New Jersey Flows

New Jersey Water Resources Research Institute

Volume III, Issue I **SPRING, 2002**

TMDLs: Identifying and Improving Impaired Waters

By Kenneth H. Reckhow, Director, North Carolina Water Resources Research Institute and Chairman, Congressional Committee to Assess the Scientific Basis of the Total Maximum Daily Load Approach to Water Pollution Reduction

Probably the most controversial recommendation in the recent National Academy of Sciences report on the Total Maximum Daily Load program concerns the identification of impaired waters. On one hand, it is widely acknowledged that the states have placed waterbodies on the 303d list of impaired waters for a range of reasons and with great variation in the strength of the scientific supporting evidence. On the other hand there is extreme resistance in some circles to adding scientific and statistical rigor to the listing process. What can be done?

In the long run, the answer is to improve the science by incorporating good monitoring design principles and statistical hypothesis testing into the listing decision, thus improving the chances for correct diagnosis of the truly impaired waters. This scientific advancement needs to be accompanied by critical review of water quality standards so that appropriate designated uses are met. To understand these recommended solutions, a review of ambient water quality standards in the United States and practices for assessing compliance, is instructive.

Water quality standards consist of two primary components: a designated use (e.g., trout waters) that specifies the desired use for the waterbody, and a criterion (e.g., chlorophyll a) that serves as a scientific measure of achievement of the designated use. Although science helps inform the decision, determining designated uses primarily involves making value judgments concerning water quality goals. While costs and benefits of compliance may be considered, selecting a criterion for determining achievement of the designated use is primarily a scientific assessment.

Assessing compliance with water quality standards is essentially a scientific task that is analogous to disease diagnosis in medicine and can be viewed from a statistical hypothesis-testing context. The doctor uses sample information from a medical examination, while the water quality scientist uses samples from a monitoring program. Fundamentally, the objective is to minimize the possibility of declaring a standard violation when the waterbody is truly in compliance or declaring compliance when the waterbody is truly in violation.

From a scientific perspective, the standards compliance diagnosis problem is best addressed using statistical hypothesis testing. To do this, samples are taken and a "null" hypothesis is established; for listing purposes the null hypothesis may be "the waterbody is in compliance," whereas for delisting the null hypothesis may be that "the waterbody is in violation." The actual hypothesis test may be based on a binomial distribution, with samples then simply expressed as dichotomous – compliance or noncompliance. Alternatively, to allow the actual magnitude of the observations to matter, a probability distribution (e.g., lognormal) could be selected to represent the criterion. Due to practical limitations for many state agencies, the binomial test is likely to be the more common choice.

(Continued on page 7)

The Director's Chair

by Joan G. Ehrenfeld, Ph.D., Director, New Jersey Water Resources Research Institute
Rutgers, The State University of New Jersey

TMDLs have become a central issue in water resource management and watershed planning. The idea of describing for each water body the maximum amount of pollution that can be tolerated without allowing the water and its ecosystems to become degraded seems logical and laudable. However the practicality of implementing this concept is problematical, and considerable confusion and controversy has engulfed the effort to develop these standards. As part of the effort of the WRRI to disseminate important information about water resources to the public, we invited Dr. Ken Reckhow, a leading scientist in the field, to come to New Jersey to share his insights with us. Over the course of two days, Dr. Reckhow met with water resource managers at the NJ DEP, water resource professionals in the private sector who are participating in the work of establishing specific TMDLs, representatives of non-profit watershed advocacy groups, and representatives of the farm community, and he also gave a well-attended public lecture. We are pleased to be able to reprint his views on the subject here. *****

New Jersey's Weather

Drought Persists in New Jersey

By Dr. David A. Robinson, New Jersey State Climatologist, Center for Environmental Prediction, Rutgers University

As this is written on the first of March, New Jersey is in the midst of one of its worst moderate-length droughts in the past century. The climatological conditions of the past 17 months have resulted in well below average precipitation, record low ground water and river levels, and surface reservoirs that are on the order of 40% of capacity, half the seasonal norm. It appears that a gubernatorial declaration of a drought emergency is inevitable and imminent (perhaps in place over all or portions of NJ by the time you read this). This note will concentrate on the climatological aspects of the drought, leaving hydrological, ecological, agricultural, economic, political, etc. perspectives to others.

This past February has gone in the record books as the driest on record[1,2]. The 0.76" state-wide total is 0.16" below the previous record set in 1901. This continues a string of exceedingly dry months. Of the past 17 months, 15 have had below average precipitation, amounting to a deficit of 18.58", or 29% below average[3]. The 46.45" measured since October 2000 represents the 13th lowest 17 month total on record (there have been 1270 such intervals since January 1895). The driest observed to date was the 41.85" that fell between August 1964 and December 1965. In fact, with the exception of the most recent 17 month period, all of the top 16 had ending months in 1965 or 1966. Thus, while current climatological drought conditions have not persisted nearly as long as those of the early and middle 1960s, the present situation must certainly be considered a critical, moderate-length drought.

The past six months have been the most severe portion of the present drought. Precipitation has totaled 10.08", or 54% below average. This shatters the previous fall-winter record low of 13.96" in 1939-40. This includes the second driest fall (Sept-Nov) on record with precipitation totaling 4.76" (6.61" below average), and the driest winter (Dec-Feb) with 5.32" (-5.28"). Along with the exceedingly dry conditions of the past six months have come some warm temperatures. Statewide, the average winter temperature of 38.7°F (+5.7°F) was the second warmest on record (at 38.9°, 1931/32 retains the record)[3]. This ranking also holds for the fall-winter period, with 2001-02 temperatures averaging 3.8° above average.

Projecting a break in the current drought is a difficult, perhaps impossible task. Often when looking a month or season ahead, an outlook of persistence is best, however eventually that will fail. The National Weather Service outlooks for March and for March-May are what may be termed a "no call". They see no indication that there will be a tendency for precipitation to be in either the lower, middle or upper third compared to the past century of observations. Some recent research within our office has identified a statistically significant relationship between above normal winter sea surface temperatures (SST) off the US East Coast (which have been observed of late) and above normal precipitation in the subsequent spring. However this is far from a certainly each time such winter SSTs occur. What is certain is that it will take a series of storms over a number of months to replenish surface and ground water resources.

You are invited to visit our DroughtWatch website: **http://climate.rutgers.edu/stateclim/njdroughtwatch.html** to view updates from this office and from various state and national agencies. The Office of the NJ State Climate will continue to monitor this evolving situation. *****

[1] Values are state-wide, based on a spatially well distributed network of several dozen stations.
[2] Records are for the period 1895 to present.
[3] Averages are based on 1971-2000 observations

Conference Calls

Urban Wetlands Conference, "Sustaining Multiple Functions," May 20 - 21, 2002, Portland, OR. Hydrologic, ecological, and social forces that shape urban wetlands, preservation and protection **http://cwest.orst.edu/wetlands/conference/**

WateReuse Foundation - 2002 Annual Water Reuse Research Conference June 3-4, 2002, Manhattan Beach Marriott, Los Angeles, CA **www.watereuse.org/Pages/currents.html**

What's New

Hydrologic Primer for NJ Watershed Management now available online: **http://nj.usgs.gov/publications/WRIR/00-4140/**

NEW! **Water Infrastructure Security** EPA Homepage: **www.epa.gov/safewater/security/index.html**

USGS Report on Contaminants In U.S. Streams http://toxics.usgs.gov/regional/emc.html

Drought Understanding and Drought Response

By Thomas G. Baxter, Exec. Director, NJ Water Supply Auth.

As I experience how we communicate about droughts, I have to wonder why there doesn't seem to be a greater response from the public.

Each week we, the water supply professionals, review the effect of the recent **drought declarations**. Some of the parameters that we review are precipitation, system demands, and reservoir levels. Precipitation is a measurement of a natural phenomenon, rainfall, over which we have no control. System demands are a measurement of human activity, the usage of water. Reservoir levels are a measure of the response to the natural phenomenon of rainfall but also a measure of **human activity,** not only the use of water but also the response to the restrictions put in place under drought emergency declarations.

In reviewing system demands, it is hard to see that there has been a response to the declarations. Demands did not go down after the **watch declaration** in October. Demands did not decline appreciably after the **emergency declaration** on March 4, 2002, nor did they go down significantly after the **drought emergency restrictions** were announced on declaration in March 11, 2002. In August of 1999 the declaration of a warning saw demands go up significantly followed by a **sharp and significant decline** when the emergency was declared and nonessential usage was restricted.

We need to be curious about why, in a drought that some people are saying is worse than the drought of the 1960's - ***the current drought of record*** - that we are not seeing a clearly discernable reduction in demand. To be sure this drought is occurring at a time when demands are typically at their yearly seasonal lows and great reductions were not expected, but a general downward trend rather than a scattering of both increased and deceased demands was expected.

People who access the State's web page can look at the reservoir levels (see **www.state.nj.us/dep/drought/**). But what does it mean to the average person to see that the reservoirs in the northeast are at forty percent (more of less) of capacity, or even that the reservoirs are forty percent more or less below long-term average, or that precipitation is twelve inches below average. ***Perhaps the statistic that needs to be added to the present array is the "number of days of water supply remaining."*** This concept, clearly explained along with the array of other graphics that we have, would communicate to the people

For additional drought information see:
NJ Drought Information page: **www.njdrought.org**/
Nat'l Drought Mitigation Ctr. **http://drought.unl.edu/ndmc/**
Rain barrels, diverters, **www.composters.com/main.shtml**

Federal Funding Eliminated for the Nation's Water Institutes

New Jersey Water Resources Research Institute (NJWRRI) federal funding has been *eliminated* under proposed changes in the 2003 Congressional Budget, which deletes funds for the *entire* system of National Institutes for Water Resources. NJWRRI ***is dependent*** on funding from the USGS, Department of Interior and ***matches each Federal dollar received with at least $2 from non-Federal sources***.

Too, New Jersey currently ranks 48th in the nation in terms of tax dollars returned to benefit our state. Funding of the Water Resources Research Institutes programs ensures that some tax dollars **do** return to address the real and current water problems of our state.

NJWRRI provides for critical research targeted at problems in New Jersey, transfer of important water information to the water community, as well as training of our state's future water professionals through supportive grant funding.

Led by New Jersey congressional representatives, advocacy efforts are underway on the state and national levels to restore full funding for Water Resources Research Institute programs. **New Jersey's waters, their users, and their ecosystems will be the beneficiaries! ***

Contact information for comments in support of NJWRRI funding restoration is available at ***www.house.gov/writerep/***

TMDL Committee Recommendations Presented to Congress

A committee appointed by the National Academy of Sciences (NAS) to study the scientific basis of EPA's Total Maximum Daily Load (TMDL) program has made its report to Congress, and the report has been published by the National Research Council. Under the 1972 Clean Water Act, each state must identify polluted waters, put them on its so-called 303d list, and establish TMDLs, which determine the amount by which sources of pollution would need to be reduced to meet the state's standards.

The report, ***"Assessing the TMDL Approach to Water Quality Management"*** calls on EPA to implement a two-step process that puts certain waters on a preliminary list before moving them to the final 303d list of those that require cleanup. This approach would give states time to study those bodies of water for which scant data exist while concentrating efforts on sites found to be in greatest need. If no legal mechanism exists for states to move waters from the 303d list to a preliminary list, Congress should create one, the committee said.

The report may be read on the NAS website or purchased in book form at: **www.nap.edu/catalog/10146.html**

The TMDL committee was chaired by North Carolina WRRI Director Kenneth H. Reckhow (excerpted from WRRI News).

Spotlight on Watersheds: Upper Hackensack River

Bergen SWAN

By Mark Becker, Co-Director, Bergen SWAN

Bergen Save the Watershed Action Network (Bergen SWAN) was established in early 1988 in response to mounting public opposition to plans by our water company's subsidiary, Rivervale Realty, to develop many of the wooded areas bordering the reservoirs in Bergen County. As directed by a 1984 order of the Board of Public Utilities, some 700 acres of this previously protected reservoir buffer land had been allowed to be transferred from the regulated Hackensack Water Company (HWC) to the unregulated River Vale Reality (RVR).

In 1989, having attained representation by the Environmental Defense Fund, Bergen SWAN engaged in several successful legal battles, culminating in the 1993 negotiated settlement with HWC/RVR which resulted in the return of approximately 390 of the original 700 acres to non-developable status and the placing of permanent deed restrictions enforcing maximum impervious cover and other environmental controls on three golf courses totaling 300 acres.

Since 1993 we have been working to preserve the some of the lands not saved under the settlement agreement. In 1998 we joined with the Sierra Club, New Jersey Conservation Foundation, the Hackensack Riverkeeper and other environmental groups to establish the Bergen County Open Space Trust Fund to assist with funding the purchase of these and other important open space parcels in the county. Recent preservation successes include 8.5 acres in Old Tappan, 14.5 Acres in Harworth and most recently 19.5 acres in Emerson. We are now devoted to the preservation of 44 acres in River Vale located along Lake Tappan and the Hackensack River.

Bergen SWAN has also been active in promoting watershed education through organizing workshops on stream back restoration and land stewardship and working with schools to develop watershed based education curriculum. Bergen SWAN Co-directors are playing an active role in many of the on-going state and regional watershed and open space preservation efforts. Lori Charkey was recently elected as the Chair of the Bergen County Open Space Trust Fund, and is the vice Chair of the WMA 5 Open Space committee. Mark Becker is a Trustee of the Meadowlands Conservation Trust and Chair of the Technical Advisory Committee of the WMA 5. For more information on Bergen SWAN please visit our web site at **www.bergenswan.org** or contact us at 201-666-1877.

(*Note: Mark Becker, together with Bergen SWAN Co-Director Lori Charkey, was named 2001 Bergen County Environmentalist of the Year).* ******

Spotlight on Watersheds: Lower Hackensack River

Ignorance

By Capt. Bill Sheehan, The Hackensack Riverkeeper

Like all urban waterways, there are numerous threats to the Hackensack River, its watershed and its people. Nonpoint source pollution, combined sewer outfalls and improper development all pose ongoing threats. Most people are aware of the more egregious threats to the ecosystem such as the ill-conceived "Meadowlands Mills" proposal. Some are less well-known. They are the remnants of the "bad old days" when environmental laws were nonexistent and unregulated dumping and discharges were the order of the day.

A swath of riverbank in Kearney remains sterile, contaminated by chromium slag. Thirty-three uncapped landfills continue to pour leachate into the lower Hackensack every time it rains. Fish carry a burden of toxins that seriously threatens the health and well being of the needy families who eat them. One could go on but if you were to distill all of the threats posed to the Hackensack River into one you would discover that they all come down to one thing: ignorance.

Ignorance doesn't tell you that the river is full of fish; or that sixty-three species of birds nest in the Meadowlands; or that two hundred more species follow the Hackensack River watershed as a migratory corridor; or that an entire ecosystem is evolving right before our eyes.

Ignorance makes people think the river is dead; makes governments believe that a marsh of common reed is a "degraded wetland" good for nothing except filling; and turns the low tide smell of biological activity into a stink. At its worst, ignorance makes it easy for people to turn their backs on their river; allows mega-malls to be proposed for wetlands, and prevents our river from getting fixed. ***The only good thing about ignorance is that it isn't terminal. ****

There are many opportunities to learn about the rich biological resources of The Hackensack watershed. Hackensack Riverkeeper offers guided boat trips, field walks and canoe rentals, for example (see their website at **http://www.HackensackRiverkeeper.org**). Other organizations, including the New Jersey Meadowlands Commission, also offer guided trips through the area (see **http://www.hmdc.state.nj.us/ec/public/events.html**). It is hoped that as people directly experience the watershed, they will help to restore and protect it.

USGS, in partnership with USEPA, has completed the National Hydrography Dataset, a geospatial database of all surface water in the conterminous United States. Available for free on the web at **http://nhd.usgs.gov/** along with demonstrations, tutorials.

New Jersey Source Water Assessment Program

By Kristin Zams, NJDEP, Bureau of Safe Drinking Water

The 1996 Amendments to the Federal Safe Drinking Water Act place a strong emphasis on public awareness and the information provided to the public concerning their quality of drinking water. As part of the 1996 Amendments, all states are required to establish a Source Water Assessment Program. Through the Source Water Assessment Program, the New Jersey Department of Environmental Protection (NJDEP) will evaluate the susceptibility of public water systems to different types of contamination. The assessments will be used as a tool in the management of treatment, monitoring, and protection of the drinking water sources. In November 1999, the U.S. Environmental Protection Agency approved NJDEP's Source Water Assessment Program Plan. The Source Water Assessment Program Plan is available at **www.state.nj.us/dep/watersupply/swap.htm** or you can contact the Bureau of Safe Drinking Water at 609-292-5550. New Jersey's Source Water Assessment Program incorporates four steps:

1. Delineate the source water assessment area of each ground and surface water source of public drinking water.
2. Inventory the potential contamination sources within the source water assessment area.
3. Determine the public water system's susceptibility to contaminants.
4. Incorporate public participation and education into the program.

The NJDEP is performing source water assessment area delineations for all public water system wells and intakes. The source water assessment area for a groundwater source is the area in which water flows to the well within a twelve year time period. The NJDEP is using two approved delineation methods: Combined Model and Calculated Fixed Radius Method. A description of these methods is in the "Guidelines for Delineations of Well Head Protection Areas in New Jersey" available at **www.state.nj.us/dep/dsr/whpadel.pdf**. The NJDEP has completed source water assessment area delineations for community public water system wells. NJDEP with the assistance of county health agencies and the New Jersey Water Association have GPS located approximately 70 percent of the noncommunity water system wells. Once the wells are GPS located and the attribute data (e.g. well depth, screen depth, pumping rate) is collected, the NJDEP will begin delineating the noncommunity water system wells using the Calculated Fixed Radius Method. The NJDEP expects the delineations for the noncommunity public water systems will be complete in 2002.

Surface water source water assessment areas are delineated slightly different than the assessment areas for wells. Surface water source water assessment areas include the entire drainage area, tributaries, and headwaters. The source water assessment area will be delineated using U.S. Geological Survey's hydrologic unit code (HUC) 14. The NJDEP anticipates the source water assessment area delineations for surface water intakes will be complete by July 2002.

Included in the New Jersey Source Water Assessment Program Plan is a list of potential contaminant sources in the eight contaminant categories that are of concern. The contaminant source can be either a nonpoint or point source. Nonpoint sources include roadway runoff, agriculture, recreational areas, storage facilities, and landfills. Contaminated sites, leaking underground storage tanks, and New Jersey Pollution Discharge Elimination System Permitted Sites (NJPDES) are examples of point sources. Potential contaminant sources within the source water assessment areas will be identified using existing Geographic Information System (GIS) data sets.

The NJDEP has contracted with the U.S. Geological Survey to develop a susceptibility model for each of the eight contaminant categories. In addition to developing the susceptibility model, the U.S. Geological Survey has agreed to fund a portion of the Source Water Assessment Program.

The susceptibility models will determine susceptibility based on the intake or well's sensitivity (such as confined vs. unconfined for wells) and the amount and type of potential contaminant sources within its source water assessment area. These models will be developed using a selected set of surface water monitoring stations and public water system wells throughout New Jersey. All models will be validated, and then applied to the remaining public water systems.

The 1996 Amendments to the Federal Safe Drinking Water Act place a strong emphasis on the need for public participation in the Source Water Assessment Program. Currently, the Advisory Committee consists of approximately 50 members who come from various interests including water purveyors, municipalities, health departments, and environmental organizations. The Advisory Committee is responsible for assisting the NJDEP by addressing concerns and questions that arise during the Source Water Assessment Program.

Required by the 1996 Amendments, the NJDEP must provide the source water assessments to the public in a comprehensive form. The Advisory Committee and the NJDEP will work together to ensure the summary document can be understood by the general public. The summary document will be available through the NJDEP. In addition, public water systems' Consumer Confidence Reports, which are annually mailed to all consumers, must notify their consumers of the availability of the source water assessment information and means of obtaining the material.

In addition to the Source Water Assessment Advisory Committee, the NJDEP is taking steps toward informing the general public concerning its Source Water Assessment Program. The NJDEP has developed a newsletter, a presentation, a web page, and other educational materials.

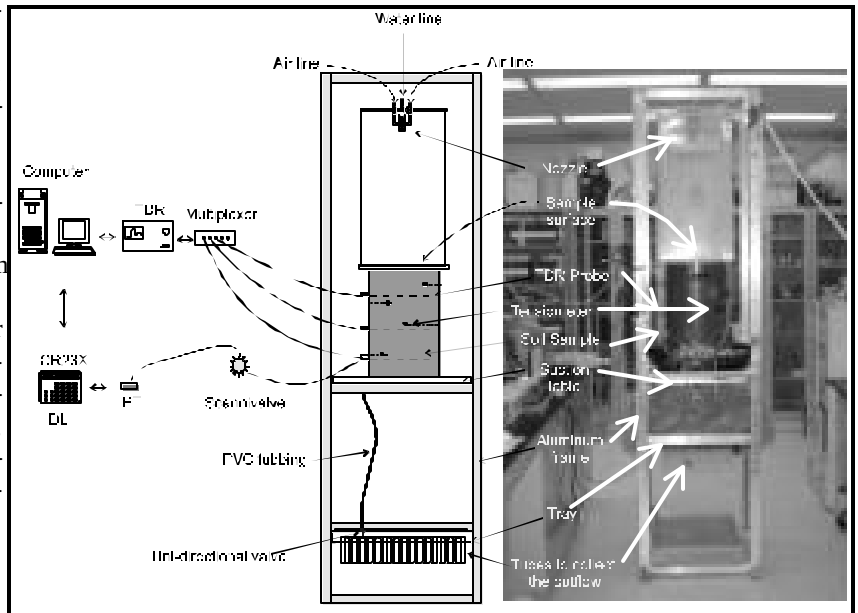
The NJDEP is anticipating the source water assessments will be complete by May 2003, in accordance with the Source Water Assessment Program Plan approval. Contact Kristin Zams of the Bureau of Safe Drinking Water at 609-292-5550 or kzams@dep.state.nj.us with any questions or comments. *****

On the Heterogeneity of Near Saturation Water Flow in Soil

By Dr. Daniel Giménez, Department of Environmental Sciences, Rutgers University

The random nature of variation in soil structure (i.e., the geometry of the variable distribution of pores and solids) has hindered progress in understanding and predicting phenomena such as groundwater contamination, carbon sequestration, and bioavailability of contaminants. Our interest is on the effect of soil structure on the variability of near saturation water flow because of its importance for analyzing and modeling water movement and chemical transport in the subsurface.

An infiltrometer suited for investigating water movement at near saturation was designed and built (Fig. 1). Large undisturbed soil columns (0.32 m in diameter and 0.5 m long) were sampled from the Rutgers Plant Sciences and Extension Farm (Adelphia, NJ). A nozzle located 0.70 m above the soil surface, uniformly delivered water to the soil surface at predetermined rates. Soil water was monitored using Time Domain Reflectometry (TDR) probes installed at three depths (0.10, 0.25 and 0.45 m). Pressure potential was monitored using small (0.8-cm diameter and 1.5-cm long) tensiometers installed at four depths (0.10, 0.20, 0.30, and 0.40 m). The lower boundary was controlled with a tension table composed by 110 individual cells uniformly distributed over the area and used to collect the flow. Tension at the table was regulated by the length of the hanging columns (PVC tubes filled with water at end of each cell). The flux in each cell was collected and weighted to assess flow variability at several inflow rates.



System available at the Department of Environmental Sciences (Rutgers University) to

Flow variability in soil is influenced by the texture and structure of the various soil horizons, flow rate, and probably by the initial soil water content. The soil used in this study belongs to the Freehold series and is characterized by a clay layer that starts at about 0.4 m below the surface. The continuity of the clay layer is interrupted by macropores that were visible at the bottom of the columns. An increase in total outflow rate from 6 μm/s to 24 μm/s resulted in a 7% increase in the proportion of cells active in the flow process (see Fig. 2), and in a more uniform distribution of cell outflow rates. (When the outflow rate increased from 6 μm/s to 24 μm/s the ratio between the average flow of the upper and lower quartiles of the outflow distributions decreased from 277 to 23, respectively.) From tensiometer measurements we know that the increase in outflow rate was caused by the incorporation to the flow process of pores with diameters between 0.2 to 0.32 mm, but cannot explain the decrease in outflow variability with an increase in outflow rate.

Changes in flow pattern observed in the Freehold series soil are significant and likely to influence a suite of soil processes. Furthermore, they could not be inferred from average measurements of soil properties. For instance, throughout the experiments average soil water content along the column increased by less than 1%. We are presently expanding this research to: 1) quantify the spatial structure of outflow rate, 2) correlate soil structural features with flow variability, and 3) compare the spatial structure of chemical and water flow. This information will be used to develop models linking soil structure with flow rate and variability. *****

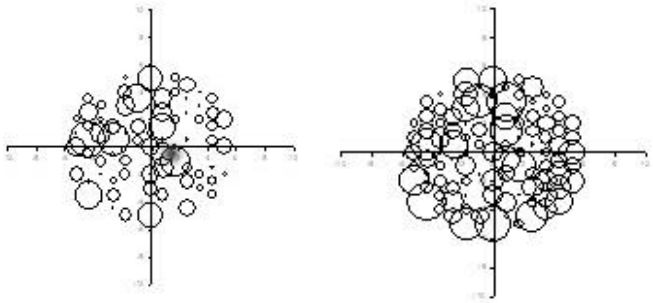


Figure 1: Spatial pattern of outflow collected at the bottom of a soil column. Outflow rates were a) 6 mm/s, and b) 24 mm/s. The magnitude of the flow is represented by the diameter of the circles.

TMDLs

(Continued from page 1)

Contrast that rigorous analytical strategy to the approaches currently employed to assess standard violations and list impaired waters. Available water quality data and visual assessments have been combined for judgment calls by the states for most of the current 303d lists. Not knowing the implications of 303d listing decisions, states often placed waterbodies on the 303d list with little or no actual water quality data. For example, most of the evaluated waters in Mississippi are on the state's 303d list; they were placed there in many instances based on windshield surveys undertaken by the county soil and water conservation districts in the belief that this would increase the amount of federal funds allocated to Mississippi under the EPA 319 program. Mississippi now has over 2,000 TMDLs to develop in the next eight years, with apparently little water quality data to either confirm noncompliance or prioritize the needs.

So, given this 303d listing dilemma, why is the improvement in scientific practice through statistical hypothesis testing being resisted? In all likelihood, the resistance reflects an understandable concern that, given the haphazard basis for the current 303d list, rigorous statistical testing would result in a number of waterbodies being removed from the current list. This may indeed happen, although additional water quality monitoring is also likely to lead to currently unlisted waterbodies being identified as impaired. Still, how should we respond to those who feel that the requirement for hypothesis testing will shrink the list of impaired waters?

The answer is clear. Improvements in science enhance the TMDL program. In this case, they help identify the truly impaired waterbodies, thus directing resources appropriately. If the result of statistical hypothesis testing incorrectly leads to removal from the 303d list of waterbodies that truly do not meet their designated use, then does this mean that the requirement for hypothesis testing was a bad decision? No! It means that the water quality standard is inadequate, most likely because the criterion does not adequately reflect the designated use, or the criterion level is not stringent enough, or the hypothesis test error rate needs adjustment. All of these corrective measures are appropriately addressed at improvement of the criterion to properly and accurately reflect the designated use.

It makes little sense to oppose the proposed scientific improvements in the listing process. Rejecting improved listing may keep current 303d lists intact, but flawed lists will likely result in state resources being directed toward developing TMDLs for some waterbodies which are actually in compliance. Further, without scientific and statistical improvements in the listing process, misdiagnosis will continue at a needlessly high rate. The potential for seeing actually impaired streams dropped from 303d lists can and should be addressed by properly revising the standard to best represent the designated uses.

We should encourage improvements in the science, as we should encourage the accurate reflection of values in water quality standards; both of these are essential to the primary goal of attainment of the designated use. *****

Article reprinted, with permission, from the WRRI News of the North Carolina WRRI. Other articles by Dr. Reckhow on the subject of TMDL's, Adaptive Management, and more can be found at ***www2.ncsu.edu/ncsu/wrri/reckhow.html***

NJWRRI Funded Grants Announcement

New Jersey Water Resources Research Institute is pleased to announce the following grant funds awarded for the year 2002-2003:

Senior Researcher Grant Awards:

Dr. Daniel Giménez, Dept. Environmental Sciences, Rutgers University: "Measurement and Prediction of Hydraulic Properties Needed to Model Groundwater Quality in Southern New Jersey"

Dr. Kenneth Y. Lee, Civil & Envir. Engineering, Rutgers University: "Destruction of Volatile Organic Compounds Using the Photochemical Remediation Reactor"

Ph. D. Candidate Researcher Grant Awards:

Heather Bowman Cutway, Ecology & Evolution, Rutgers University: "Human Components of Exotic Species Invasion in Urban Forested Wetlands"

Dawen Kou, Dept. Chemistry & Env. Science, NJ Institute of Technology: "Continuous, On-Line Monitoring of Haloacetic Acids in Water Using Analytical Membrane Extraction"

Steven Y. Litvin, New Jersey Marine Sciences Consortium: "Effects of the Biopollutant, *Phragmites australis,* On the Nutritional Status (Biochemical Condition) of Juvenile Weakfish, New Directions Incorporating Otolith Chemical Signature Analysis"

B. W. Ravit, Environmental Sciences Rutgers University: "Salt Marsh Macrophyte Rhizosphere Effects on Sediment Microbial Community Catabolic Response Profiles"

Piyapawn Somsamuk, Dept. Biochemistry & Microbiology, Rutgers University: "Anaerobic biodegradation of MTBE under different anoxic conditions"

Undergraduate Student Research Grant Awards:

William J. Cromartie, Richard Stockton College of New Jersey: "Development of improved biomonitoring protocol for the Great Egg Harbor River."

Colleen Hatfield, Cook College, Rutgers University: "Effects of mixed land use on riparian plant community characteristics of headwater streams."

Joseph Orlins, Rowan University (2 projects): "Hydrologic and Hydraulic Studies of South Jersey Dams," "Streambank Stabilization of Chestnut Branch of Mantua Creek" *****

Features

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