

Virginia Water Central

Virginia Water Resources Research Center Blacksburg, Virginia August 2002 (No. 22)

Changing the Watch at the Water Center

Leonard Shabman Departs

Leonard A. Shabman has resigned as director of the Virginia Water Resources Research Center and as a professor in Agricultural and Applied Economics at Virginia Tech. In 1972 Len came to what was then Virginia Tech's Applied Economics Department; he became director of the Water Center in 1995. On July 1, 2002, Len began work as a resident scholar with the non-profit organization Resources for the Future in Washington, D.C. In his new position, Len will continue his

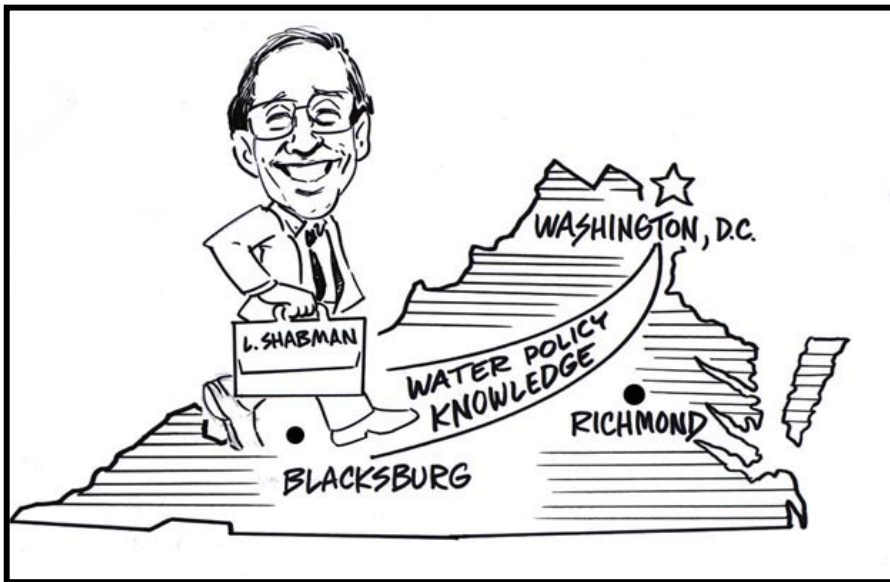
A Message from the New Interim Director of the Water Center

I was appointed Interim Director of the Water Center effective July 1, 2002. When Leonard Shabman became director in 1995, the Water Center was experiencing many difficulties, including budget cuts. Under Len's leadership the Water Center is once again recognized as a major unit for research, education, and outreach at Virginia Tech, in the state, and nationwide. We will miss Len's leadership, but fortunately we will still receive his wise council in the future.

A change in leadership causes uncertainty, but it also provides opportunities. The Water Center's greatest asset is its talented, dedicated staff. We will make every effort to maintain and strengthen our current initiatives and build on our successes, consistent with the Center's mission of research, education, and outreach. We will strive to make the Center's programs more sustainable by expanding our working relationships with state and federal agencies and developing new private-sector partnerships.

I am honored to serve the state of Virginia, Virginia Tech, other academic institutions, and Virginia citizens as the Interim Director of the Water Center. My colleagues in the Center and I are open to your constructive ideas and suggestions. Please call or e-mail to share your insights. Your advice is appreciated very much.

—Tamim Younos



research and public outreach on a broad array of water-policy topics. He will also continue to advise the Water Center, chair the Virginia Department of Environmental Quality's Academic Advisory Committee (which the Water Center coordinates), and, for Virginia Tech, both teach a class and serve as graduate advisor to students.

The Water Center staff is grateful to Len for his hard work and dedication to the Center. We wish him health, happiness, and success in his new job and home.

**"Inside This Issue"
appears on page 2.**



VIRGINIA POLYTECHNIC INSTITUTE
AND STATE UNIVERSITY

INSIDE THIS ISSUE

The Feature Article and the “Science Behind the News” section will return in the next issue. This issue devotes extra space to the large amount of news and notices that caught *Water Central’s* attention this summer, and to the program for the Water Center’s 2002 research symposium.

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IN AND OUT OF THE NEWS

Newsorthy Items You May Have Missed

The following summaries are based on information in the source(s) indicated at the end of each item. Selection of this issue’s items ended August 12, 2002. Unless otherwise noted, all localities mentioned are in Virginia and all dates are in the year 2002.

Drought-Related News

•By August 6th most of the United States suffered under drought conditions ranging from “abnormal” to “exceptional,” according to the **U. S. Drought Monitor** (produced by a collaboration of federal agencies and state climatological centers, and available on-line at www.drought.unl.edu/dm/monitor.htm). (Please see the following box for explanation of drought codes used by the Drought Monitor.) The August 6th Drought Monitor map showed 43 states with a substantial portion under some level of drought, compared to 38 states on the April 30 map. On July 3rd, *The Washington Post* reported that over 40 percent of the country was in a drought, compared to 15 percent at this point in a “typical” year and 65 percent in 1934, the worst of the “Dust Bowl” years. In the east, extreme-to-exceptional drought covered much of Virginia and North Carolina and all of South Carolina. In the west, Colorado and Wyoming were in the middle of an area of similar conditions that stretched from South Dakota to southern California.

In Virginia, the Drought Monitor map for August 6th showed almost all of the state at least abnormally dry, with a large section (most of the

Continued next page

The U. S. Drought Monitor combines several drought-rating indexes to categorize climatological drought conditions. The following descriptions were taken from the **Drought Severity Classification** table at drought.unl.edu/dm/archive/99/classify.htm (on 8/8/02):

D0—Abnormally dry: Going into drought—short-term dryness slowing planting, growth of crops or pastures; fire risk above average; Coming out of drought—some lingering water deficits; pastures or crops not fully recovered.

D1—Moderate Drought: Some damage to crops, pastures; fire risk high; streams, reservoirs, or wells low; some water shortages developing or imminent; voluntary water use restrictions requested.

D2—Severe Drought: Crop or pasture losses likely; fire risk very high; water shortages common; water restrictions imposed.

D3—Extreme Drought: Major crop/pasture losses; extreme fire danger; widespread water shortages or restrictions.

D4—Exceptional Drought: Exceptional and widespread crop/pasture losses; exceptional fire risk; water emergencies created by shortages of water in reservoirs, streams, and wells.

Continued from page 2

Piedmont and Coastal Plain) in “extreme” or “exceptional” drought. Here are the **August 6th classifications for selected areas:**

Abingdon, abnormally dry; Charlottesville, moderate drought; Danville, exceptional drought; Eastern Shore, severe drought; Richmond, exceptional drought; Roanoke, severe drought; Staunton, moderate drought; Virginia Beach, extreme drought; Washington, D.C., severe drought; and Winchester, normal.

(The Drought Monitor cautions that conditions in specific local areas may differ from these broad classifications.)

On July 19th, the **Virginia Drought Monitoring Task Force**, released the seventh in its series of drought status reports (available on-line through the DEQ Web-site at www.deq.state.va.us). Included in that report are the **precipitation departures** (deviations from long-term averages) for each part of the state. The three-year departures indicate both the long-term nature and the regional variation of the current drought:

Area	3-year departure (inches)	Percent of normal
Tidewater	4.33	103%
E. Piedmont	-14.41	89%
W. Piedmont	-20.07	85%
Northern	-8.57	93%
Cent. Mts.	-12.15	90%
Southwestern	-14.32	89%
Statewide	-11.01	91%

The overview in the Task Force’s July 19th report made the following additional points:

- **Streamflows** in July were “well below levels expected” for that month;
- Near normal precipitation from March to May “slowed the decline in **groundwater** levels” but it [was] “unlikely that significant recharge [would] occur during the summer.”
- Levels of large **reservoirs** continued to drop;
- In **forests**, “wildfire occurrence, rate of spread, and intensity [were] much greater than would normally be expected” in July, and there is concern about a “severe” fall fire season;
- On **farms**, impacts included lack of pasture and hay, stunted or dying corn and soybean crops, and drying wells and springs;
- Mandatory **water restrictions** were in place in Amherst, Appomattox, Chesapeake, Craigsville (Augusta County) Fredericksburg, Portsmouth, Roanoke, Spotsylvania County, and parts of

Caroline County. Voluntary conservation measures were in place in 23 localities, including Richmond;

- Private **well failures** and increases in new well drilling had been reported from several areas.

On the positive side, *The Baltimore Sun* (7/24/02) reported that the area of ecologically important **submerged aquatic plants** in the Chesapeake Bay has increased, because the drought has reduced the amount of sediments and pollutants being transported by Bay tributaries.

In Congress, the **National Drought Preparedness Act of 2002** (S.2528 and H.R.4754) was in committees in the Senate and House, as of July 30th. As introduced, the bill would establish a National Drought Council within the Federal Emergency Management Agency (FEMA). The Council would develop a national drought action plan, evaluate federal drought-related programs, coordinate the national drought-monitoring network, and provide for increased delivery of drought information. The bill would also establish a Drought Assistance Fund within FEMA.

What’s the chance that the drought will end in a month, three months, or six months?

Drought Termination and Amelioration maps produced by the National Climatic Data Center (available at lwf.ncdc.noaa.gov/oa/climate/research/drought/current.html), show the probabilities of the drought either ending or improving within a given time (from one to six months). According to the maps available in early August, 18 to 30 inches of rainfall were needed from July to September to end the drought in eastern and central Virginia; this would be 175—200 percent of normal for the period, based on precipitation data from 1961—90.

But do data from the last 40 years or so tell the whole story of “normal” vs. dry? Researchers at Lamont-Doherty Earth Observatory in New York will try to find out by examining **tree rings** from two species of long-lived trees. The three-year study, funded by the National Science Foundation, hopes to reveal the drought history of the eastern United States over the past 500—1000 years. (*Natural Hazards Observer*, May 2002)

A **long-term perspective** has been a source of reassurance for some people in **North Carolina**, where most of the state’s counties have been declared agricultural disaster areas. “This is not uncharted waters for us. It’s not the signs of the apocalypse or anything. It’s all very cyclical,” said Donald Buysee, a statistician for the state Department of Agriculture, in *The Charlotte Observer* (7/24/02)

Other News in Virginia...

• **Richmond** has nearly completed the second of three phases of a **project to reduce overflows of untreated sewage** during storms. City officials reported at the May meeting of the State Water Control Board that storm-related sewage overflows into the James River have been reduced by 40 percent since the mid-1980s. Richmond has spent about \$219 million on the work, with about \$200 million coming from sewer fees paid by city residents. After the meeting, the director of the Richmond regional office of the Va. Dept. of Environmental Quality (DEQ) said that use of city money had enabled Richmond to reduce sewage overflows faster than many other U.S. cities that face the same problem. The third phase of Richmond's project is estimated to cost another \$213 million, which the city hopes to acquire through grants rather than from sewer fees. (*Richmond Times-Dispatch*, 5/7/02)

• In June, the Va. Dept. of Housing and Community Development (DHCD) announced four **Community Development Block Grants for local water projects**. The locations, amounts, and projects are as follows: Buchanan County, \$1 million to connect 500 people to public water; Carroll County, \$800,000 to connect 200 people; Dickenson County, \$1 million to connect 400 people; and the town of Columbia (Fluvanna County), \$718,000 to replace a substandard private system with a new public system. (DHCD Web-site, www.dhcd.state.va.us, 6/4/02)

• Since April 2001, the city of **Roanoke has reduced the amount of unaccounted for water by half**. Municipal water systems routinely lose 10–15 percent of their water through leaks or other infrastructure problems. In April 2001, however, Roanoke's utilities director reported to the city council that billing records did not account for over *30 percent* of the water leaving the city's main treatment plant. The city raised water rates to generate \$1 million that has been used to repair over 400 leaks. (*Roanoke Times*, 6/18/02)

• In June, the first of two **artificial oyster reefs** was completed in the **Southern Branch of the Elizabeth River**, which flows between Chesapeake and Portsmouth. The Southern Branch has some of the most polluted sediments of any water body in the Chesapeake Bay watershed, having for many years received wastes from shipyards and factories. According to the director of the state's oyster restoration effort (the Va. Oyster Heritage Program), oyster growth in

the Elizabeth River is limited not by such contamination but rather by lack of habitat. The state began constructing artificial reefs in the river and its tributaries in 1993; eight reefs, including the two in the Southern Branch, are to be in place by the end of 2002. Statewide, 18 new reefs are being added this year, which will bring the total to 40. (*Virginian-Pilot*, 6/18/02)

• **A record number of marine mammals and sea turtles became stranded** on Virginia beaches in 2001. The Va. Marine Science Museum's (VMSM) Stranding Center reported 128 stranded marine mammals (up from 64 in 2000) and 331 stranded sea turtles (up from 189 in 2000). ("Stranding" refers to an instance when a sea turtle or marine mammal—normally found only at sea—is found on land, whether alive or dead.) No definite explanation for the increases is yet available, according to the curator of the Stranding Center. For sea turtles, October is one of the peak stranding times. People who find a live or dead sea turtle are requested to report the finding by calling (757) 437-6159 (if found on the Eastern Shore or south of the James River) or (804) 684-7313 (if found north of the James River). (Va. Coastal Management Program newsletter, Spring/Summer 2002; *Virginia Marine Resource Bulletin*, Summer 2002; and VMSM Web-site, www.vmsm.com/rescue.html, 8/15/02)

• **It was *not* "the biggest catfish [they'd] ever seen" in the James River in Richmond**. Rather, it was a **manatee**—an aquatic mammal usually found in Florida that can reach 10 feet long and 1000 pounds—that Va. Commonwealth University students and their teacher spotted in the river on June 22nd. Manatees are known to venture into North Carolina and Virginia waters—including the James River—in warm weather. But this was the first known sighting of one as far upstream as Richmond, according to a research scientist at the Va. Marine Science Museum. (Associated Press, 6/24/02)

• **The number of U. S. households lacking indoor plumbing has decreased to 671,000** (0.64 percent of all households), according to the 2000 U.S. Census. This is the first time that number of such households has been less than one percent of all U.S. households. When the Census Bureau began keeping indoor-plumbing records in 1940, about half of all households lacked indoor plumbing. Among Virginia counties, Bath County showed the sharpest decrease from 1990 to 2000: 349 households lacked complete indoor plumbing in 1990, while the number in 2000 was only 31. Since the 1980s, Bath County has spent about \$15

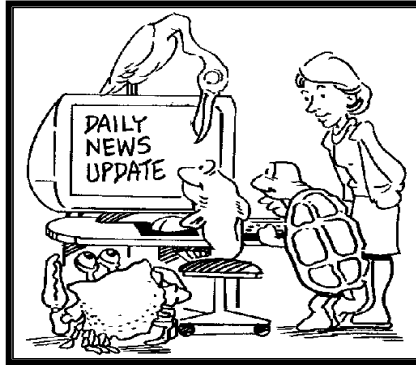
million of federal, state, and local money for 80 miles of water and sewer lines. (*Roanoke Times* reprint from *The New York Times*, 7/1/02)

•Virginia policy makers and water-resources professionals have been examining **reclamation and reuse of wastewater** as ways to conserve water and to reduce the amount of wastewater discharged to the state's waters. The 2000 Virginia General Assembly passed a bill (HB1282) requiring the State Water Control Board "to promote and establish requirements for the reclamation and reuse of wastewater that are protective of state waters and public health as an alternative to directly discharging pollutants into waters of the state."¹ Two recent projects by the Hampton Roads Sanitation District (HRS D) are examples of the potential for wastewater reuse. In the first, HRS D is collaborating with Virginia Tech scientists to evaluate use of reclaimed wastewater for irrigation of turf grass and of landscaping plants. In the second, the BP Amoco Yorktown Refinery is using 500,000 gallons per day of treated wastewater from HRS D's York River Treatment Plant. (*AWWA-Va. Section Newsletter*, July 2002)

•This election day (November 5, 2002), Virginians will vote on a proposed **\$119 million bond referendum for parks and natural areas**. The funds would be used to purchase new land for new parks and natural areas (\$30 million), to add land to existing parks (\$6.5 million), to protect parkland from shoreline erosion (\$4.5 million), and for construction and repair projects at existing parks (\$78 million). A list of the proposed projects, along with other bond information, is available at the Va. Dept. of Conservation and Recreation Web-site (see address at the end of this item) or by calling (800) 933-7275. (DCR Web-site, www.dcr.state.va.us/bond/, 7/3/02)

•In June, **snorkeling scientists surveyed the mussel population in the Clinch River** in Russell County. The Clinch, Holston, and Powell rivers, Virginia tributaries of the Tennessee River, contain one of the world's most diverse collections

¹ In the language of HB1282, "reclaimed water" means "water resulting from the treatment of domestic, municipal or industrial wastewater that is suitable for a direct beneficial or controlled use that would not otherwise occur."



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Daily News Update at
www.vwrrc.vt.edu.

of freshwater mussel species—about 50 species, with 32 very rare species. State game officials planned to release hatchery-raised juvenile mussels this summer as part of a restoration effort, and the June survey will provide a baseline of information to evaluate the results of the release. (*Richmond Times-Dispatch*, 7/11/02)

•On July 10th, the Va. DEQ released for public comment its **two major, biennial water-quality reports**: the 305(b) Water Quality Assessment and the 303(d) Report on Impaired Waters.² For the next two years or more, these reports will be the basis for discussions and decisions about the quality of Virginia's surface waters, including what waters require Total Maximum Daily Loads (TMDLs). Three public information meetings on the reports were held July 29th—August 1st, and the public comment period ended August 16th. (Va. DEQ Notice of Availability and Public Comment, 7/10/02)

•In July, the State Water Control Board gave **authority to the DEQ to nominate qualified state streams as "exceptional waters."** The federal Clean Water Act requires states to have an exceptional-waters program, under which the highest-quality water bodies receive special protection (for example, no new discharges may be added to an exceptional water). Under Virginia regulations, eligible waters must have "exceptional environmental settings and either exceptional recreational aquatic communities or exceptional recreational opportunities." Before the Board's action, nominations were allowed from "any person" but not a state agency. A public comment period and Board approval are required for nominated streams actually to receive the exceptional-waters designation. (*Roanoke Times*, 7/10/02, and Va. DEQ Web-site, www.deq.state.va.us/wqs/T2guid.html, 8/14/02)

•What's **six feet long, three feet around, and likes to eat crabs?**—the **104-pound Cobia** caught from the Chesapeake Bay by Steve Hasynik of Norfolk on July 7th. The catch is a state record. Cobia (*Rachycentron canadum*) have commercial as well as recreational value. In 2000, some 7500 pounds of Cobia were landed from the Bay;

² 305[b] and 303[d] refer to the sections of the federal Clean Water Act that require the reports.

nationwide in 2000, 3.9 million pounds were caught, valued at \$6.3 million. Cobia are also of interest for aquaculture, and the Va. Institute of Marine Science (VIMS) is working with other southeastern institutions to develop Cobia-culturing procedures. (*Richmond Times-Dispatch*, 7/12/02; VIMS Web-site, www.fisheries.vims.edu, 7/12/02; and VIMS' *The Crest*, Summer 2002)

•As of July 2002, **eight marinas had earned the Virginia Clean Marina designation** through voluntary pollution-prevention measures. Seventeen other marinas have pledged to work toward earning the designation. The Va. DEQ coordinates the Clean Marina program. (Clean Marina Program Web-site, www.deq.state.va.us/vacleanmarina/, 7/26/02)

•In July, the **Nature Conservancy** announced the first **purchase of logging rights** under its new Forestry Conservation Program. The organization, known for purchasing land outright to preserve natural areas, bought from a private landowner the timber rights on 6000 acres near Abingdon (in Washington and Russell counties). The Conservancy will harvest some of the timber to help cover the purchase. The Conservancy is seeking eventually to purchase rights to hundreds of thousands of acres to support its watershed- and habitat-protection goals. (*Roanoke Times*, 7/26/02)

•On July 30th, attorneys argued a lawsuit by 11 farmers challenging **Appomattox County's ordinance regarding application of biosolids** to farmland. (Biosolids, or sewage sludge, are the solid material remaining after wastewater treatment.) The farmers had received Va. Dept. of Health permits to apply the material, but the plaintiffs claimed that zoning ordinances enacted by the county in February 2002 prohibited its application. The plaintiffs argued that the locality overstepped its authority in an area subject to state and federal regulation; in response, the county argued the matter fell under traditional local authority to regulate land use. U. S. District Court Judge Norman K. Moon heard the case and was to issue a ruling sometime later. (*Lynchburg News & Advance*, 7/31/02)

Meanwhile, the General Assembly's Commission on the Future of the Environment's **Biosolids Subcommittee** was to meet on August 28 and tour a Hanover County farm where biosolids are applied. The subcommittee chair is Sen. William Bolling (4th District) of Mechanicsville. (Notification letter from the Virginia Senate, 8/12/02)

•Two scientific papers published in early August—one by researchers at VIMS—presented **evidence that *Pfiesteria*³ does not kill fish by means of a toxin**. The results imply that *Pfiesteria* may not be harmful to humans. That conclusion was disputed by JoAnn Burkholder, the North Carolina State scientist who first reported (in 1990) that *Pfiesteria* can be harmful to fish and humans. In 1997 and 1998, fish kills in Maryland, Virginia, and North Carolina that appeared to have been caused by *Pfiesteria* led to widespread concern over the alleged toxicity of the organism. (*Washington Times*, 8/6/02) [Please see the following issues of *Water Central* for *Pfiesteria* news in 1997 and 1998: June 1998, p. 9; Aug. 1998, p. 11; Oct. 1998, p. 13; and Dec. 1998, p. 13.]

•On August 6th, the **Virginia Beach** city council approved an agreement with the federal government on how to pay for **replenishing (adding sand to) the Sandbridge area**. The area stretches about five miles northward from Back Bay National Wildlife Refuge. Until at least 2048, the cost to add about 300,000 cubic yards of sand every two or three years will be shared by the federal government (65 percent) and local residents and renters (35 percent). The goal of the replenishment project is a beach 170 feet wide at mid-tide. (Associated Press, 8/8/02)

•In August, the Va. Dept. of Conservation and Recreation (DCR) signed an agreement with a Grayson County couple to let the DCR manage **five New River islands as part of a canoe trail, or "blueway."** Under the agreement, the islands may be used as stopping points for river users and will have campsites and picnic grounds. Otherwise, no development will be allowed on the islands or along the corresponding 12-mile stretch of the river. DCR officials hope eventually to have a 218-mile New River canoe trail. (*Roanoke Times*, 8/8/02)

...and Outside of Virginia

•By some estimates, **nylon, monofilament fishing line** is strong enough to last 600 years—under water anyway. That longevity, combined with evidence that marine life such as turtles, manatees, and pelicans are hurt or killed when they becoming entangled or consume discarded lengths of fishing line, is sparking a **fishing-line recycling effort**. Florida (where discarded fishing line is the number-one cause of manatee

³ The full scientific name of the organism, a kind of algae, is *Pfiesteria piscicida*.

injuries) is leading the way. Its Monofilament Recycling Project is managed by Florida Sea Grant and funded by individuals and groups who sponsor recycling stations. Florida hopes to have as many as 100 of the stations in place by the end of the year, at both freshwater and saltwater marinas and other popular fishing sites in eight counties. Signs at the stations encourage anglers not to abandon tangled line in nearby waters but to place it in collection boxes. Nylon nets, nylon rope, and fishing line spools are also accepted. The collected material is then used to manufacture fishing-related products such as lures and tackle boxes. (*Coastlines*, newsletter of the Univ. of Massachusetts' Urban Harbors Institute, April 2002)

•**Fats, oil, and grease (FOG)** are becoming major problems in North Carolina's urban sewer systems. Since 1998, 23 to 28 percent of all sewer system overflows in the state—leading to spills of more than 19 million gallons of untreated sewage—have been blamed on line blockages caused by FOG. Some systems report these blockages have increased as much as 50 percent in that time. The state is paying more attention to these blockages, because wastewater-collection systems (sewer lines) are now regulated by the Environmental Management Commission and the Department of Environment and Natural Resources. (Until 1999, only wastewater-treatment plants were regulated by these agencies.)

In June, a state task force on the issue published its recommendations in the "FOG Management Manual," which is available on-line at the N.C. Division of Pollution Prevention and Environmental Assistance's Web-site, www.p2pays.org. Not everyone is happy with the recommendations; some people in the restaurant industry, for example, have refused to endorse the recommendations. The controversy may grow as more municipalities are required to seek permits for their wastewater-collection systems under the new law. (*N.C. Water Resources Research Institute News*, June 2002)

•On May 30th, the **Pennsylvania Supreme Court** decided that any **action that causes water pollution is a "public nuisance"** under the state's common law and therefore does not qualify for compensation under the "takings" clause of the Fifth Amendment of the U. S. Constitution. The case concerned the state's prohibition of the Machipongo Land & Coal Company from mining 373 acres because of the potential for contaminating nearby streams and

groundwater. Under takings rules, a government must provide monetary compensation to individuals or businesses when it interferes with legal ventures on privately owned land. The U. S. Supreme Court has ruled, however, that a takings claim is not permitted for an activity that constitutes a public nuisance. The ruling could conceivably be used by other states in the future to deny takings claims in similar circumstances. (Inside EPA's *Water Policy Report*, 6/17/02)

•"Totally Mired in Debate and Litigation" might be the feeling of the staff members of the U. S. EPA who are in the process (again) of developing a new **regulation for TMDLs** (Total Maximum Daily Loads). In July 2000, EPA issued a broad new regulation on the TMDL (or "impaired waters") program, which is mandated by the federal Clean Water Act. [Please see the December 2001 issue of *Water Central*, p. 1, for a review of the TMDL story in Virginia.] In July 2001, however, EPA Administrator Christine Todd Whitman suspended the TMDL rule for 18 months for further study and revision. The rule had received strong criticism from many sides and was headed for litigation that might have kept it from being enforced for years to come. EPA has been working on a revision, but it appears likely that the revised rule will meet with nearly as much resistance as the first attempt.

The new rule, called the "watershed rule," is expected to differ from the July 2000 version in at least three significant ways. First, it would offer wastewater dischargers the opportunity to buy and sell water-pollution credits. Second, instead of being able only to designate waters as either impaired or not impaired, states would have five categories for designating waters, including a category of "more information needed." (Inadequate data has been identified as a major problem with the TMDL program overall.) Third, it would revise a provision requiring states to submit TMDL-implementation plans to EPA (there was considerable opposition to this part of the July 2000 rule). But the new rule, like the original, still would require states to submit TMDLs to EPA for approval, and this provision would likely be challenged in court by parties who feel it exceeds EPA's authority under the Clean Water Act. Challenges are also likely to come from environmental groups that may consider the rule not strong enough or may object particularly to the provision allowing buying and selling of water-pollution credits. (Inside EPA's *Water Policy Report*, 6/17/02 and 7/15/02)

•It may or may not affect the current drought, but the cyclical **El Nino phenomenon** has returned. In July, the National Weather Service reported the El Nino conditions in the tropical Pacific Ocean: above-average sea-surface temperatures over several months. Not expected to be as strong as the one in 1997—98, this El Nino may begin affecting North American weather in Fall 2002, including a possible reduction in Atlantic Ocean hurricanes. (*NOAA News Online*, www.noaanews.noaa.gov, 7/11/02)

•**Finally**, here's a significant point in the **economics of water and gasoline**. In the last year, U.S. sales of bottled water increased 30 percent (due at least in part to \$85 million spent on advertising the product), while demand for gasoline has risen 2—5 percent per year for the past five years. The large demand for bottled water is part of the reason that bottled water typically sells for over \$1 per liter, while gasoline goes for about \$1.25 to \$1.50 per gallon in the United States (equivalent to about 35 cents per liter). (*Christian Science Monitor*, 8/5/02)

—By Alan Raflo and David Mudd

Special News Item: Monitoring for Exotic Forest Pests at Virginia's Ports

Virginia's ports handle tens of millions of tons of imported goods each year (see accompanying box). Unfortunately, those goods sometimes harbor unwelcome visitors, including exotic (nonnative) insects. Exotic longhorned beetles and bark beetles are one such group of potential stowaways in the wooden shipping material, such as pallets, arriving at Virginia's ports. These insects are wood borers that can damage and destroy landscape and forest trees, resulting in costly management programs.

Established in North Carolina and other states but not yet established in Virginia, this group of insects is the focus of a special survey at Virginia's ports by Virginia Tech, the U. S. Dept. of Agriculture, and the Va. Dept. of Agriculture and Consumer Services. In Summer 2002, traps were placed at several locations in Virginia that receive wooden shipping material from overseas. Results from monitoring the traps are expected in October. The accompanying photos are from the project's trap-sampling trip in June.



In a warehouse at Norfolk International Terminal, Eric Day of Virginia Tech checks one of the funnel traps used for this survey.



Container ship at Norfolk International Terminal.

Virginia's Ports

Newport News Marine Terminal
Norfolk International Terminals
Port of Richmond
Portsmouth Marine Terminal
Virginia Inland Port, Front Royal

In 1999, Virginia ranked second among U. S. East Coast ports in market share. In 2001, the Hampton Roads ports (Newport News, Norfolk, and Portsmouth) handled over 37.4 million tons of cargo (15 million tons import) with a net value of over \$27.6 billion; the Richmond port handled 530,000 tons (276,000 tons import). (Figures for 2001 for the Inland Port were not available.)

(Information from the Virginia Port Authority and the Port of Richmond, 8/20/02)

N O T I C E S

On the DEQ Public Calendar

The Va. Dept. of Environmental Quality's "Public Calendar" is located at www.deq.state.va.us/info/. The phone number for the DEQ's Central Office in Richmond is (800) 592-5482 (toll-free in Virginia).

- Sept. 26**—Public meeting on notice of intent to amend aboveground storage tank regulation and underground storage tank financial and technical regulations; DEQ Piedmont Regional Office, Richmond, 10 a.m. For more information, contact Cindy Berndt, e-mail: cmberndt@deq.state.va.us, or by phone at the number listed above.
- Sept. 27**—Public hearing on proposed amendments to the general VPDES permit regulation for petroleum-contaminated sites; DEQ Piedmont Regional Office, Richmond, 10 a.m. For more information contact Jon VanSoestbergen, e-mail: jvansoest@deq.state.va.us, or by phone at the number listed above.
- Sept. 27**—Public hearing on proposed amendments to general VPDES permit regulation for cooling water discharges; DEQ Piedmont Regional Office, Richmond, 10 a.m. For more information contact Jon VanSoestbergen, e-mail: jvansoest@deq.state.va.us, or by phone at number listed above.
- Oct. 10**—Meeting of the water impact study group; DEQ Piedmont Regional Office, Richmond, 10 a.m. For more information contact Allan Brockenbrough, e-mail: abrockenb@deq.state.va.us, or by phone at number listed above.

Conferences and Other Events

- The ninth annual **Virginia Watershed Management Conference** will be held Sept. 25—27, 2002, Roanoke. For more information, see the Va. Dept. of Conservation and Recreation Web-site, www.dcr.state.va.us/watershed/, or phone Jackie Miller at (804) 786-0237.
- Virginia Water Monitoring Council 3rd Annual Meeting**, Sept. 27, 2002, Roanoke, 1:30 p.m. (at the end of the Virginia Watershed Management Conference). To learn more about the VWMC, visit www.vwrrc.vt.edu/vwmc, or phone Jane Walker at (540) 231-4159.
- Estuaries Day 2002**, Sept. 28, 2002, York River State Park, noon-4 p.m. This event is part of National Estuaries Day. Activities include boat

and canoe trips, marsh hikes, and habitat exhibits. For more information, contact the Chesapeake Bay National Estuarine Reserve at (804) 684-7135, or e-mail: cbnerr@vims.edu.

•**National Water Monitoring Day**, Oct. 18, 2002 (the 30th anniversary of the signing of the federal Clean Water Act). Volunteers nationwide will sample water and contribute data to a national database. For more information, visit www.yearofcleanwater.org, or phone America's Clean Water Foundation at (202) 898-0908.

•**Environmental Alliance for Senior Involvement (EASI) International Conference and Watershed Summit**, Oct. 28—30, 2002, North East, Md. *Registration closes September 27*. For more information, phone EASI at (540) 788-3274, or visit www.easi.org.

•**Virginia Water Environment Association Education Seminar**, Nov. 13, 2002, Richmond. This year's seminar is "Mission Impossible?—Strategies to Meet Future Nutrient and Toxicity Requirements." For more information, phone Tom Broderick at (703) 771-1095 or Teresa Moore at (804) 330-2917, or visit www.vwea.org.

•**American Water Resources Association Annual Conference**, Nov. 3—7, 2002, Philadelphia. For more information, visit www.awra.org, or contact Janet Bowers at (610) 344-5400, or e-mail: jbowers@chesco.org.

New Guide to Aquatic Invertebrates

A Guide to Common Freshwater Invertebrates of North America is a new book by Reese Voshell, professor in the Virginia Tech Department of Entomology. The 442-page book, with over 200 color and B/W illustrations, covers about 100 of the invertebrates most likely to be found in North America. The book is available from retailers, or directly from the McDonald and Woodward Publishing Company at (800) 233-8787.

State of Virginia's Coast 2001

Prepared by the Va. Institute of Marine Science, this report summarizes the current conditions and uses of the coastal zone. The report is available on-line only, at www.deq.state.va.us/coastal/documents/state.pdf. The opening ocean photo is spectacular! If you need assistance getting access to the report, phone (804) 698-4051.

Chesapeake Bay Gateways Map and Guide

For those who want to explore places like Battle Creek Cypress Swamp and Schooner Sultana, this brochure includes addresses, phone numbers, map locations, and checklists of services for 111 sites, information centers, and water and land trails in the Bay watershed. To order a copy on-line, visit www.baygateways.net. To order a copy by phone, call (toll-free) (888) 824-5877 in Virginia, (866) 229-9297 in Maryland.

Also Out There...

From the many water-related publications that arrive in the Water Center's mail, here's a list of some recent, in-depth articles on various subjects:

- “Floyd Follies: What We've Learned” (developments in hurricane-evacuation practices resulting from Hurricane Floyd in 1999). *Coastal Heritage*, Summer 2002, S.C. Sea Grant Consortium, Charleston, (843) 727-2078.
- “Superfund's Future.” *The Environmental Forum*, March/April 2002, Environmental Law Institute, Washington, (800) 433-5120; e-mail: forum@eli.org.
- “Addressing Phase II NPDES Problems Before They Become a Headache.” *Land and Water*, May/June 2002, Land and Water, Inc., Fort Dodge, Iowa, (515) 576-3191.
- “Virginia's State Fish Hatcheries.” *Virginia Wildlife*, July 2002, Va. Dept. of Game and Inland Fisheries, Richmond, (804) 367-1000.
- “How Safe is Our Drinking Water?” *On Tap*, Winter 2002, National Drinking Water Clearinghouse, Morgantown, W.Va., (800) 642-8301; available on-line at www.nesc.wvu.edu/ndwc/ndwc_publications.htm.
- “Does Sprawl Cost Us All? Isolating the Effects of Housing Patterns on Public Water and Sewer Costs.” *Journal of the American Planning Association*, Winter 2002 (Vol. 68, No. 1), pp. 56—70; look for this in a larger library.
- “Urban Lake Management”—A special issue of *Watershed Protection Techniques* (Dec. 2001), Center for Watershed Protection, Ellicott City, Md., (410) 461-8323; e-mail: center@cwpp.org.

At the Water Center

•**Water Security in the 21st Century**, July 30—August 1, 2003, in Washington, D.C. For those wishing to present a paper, the *abstract deadline is October 15, 2002*. For more information, visit the Water Center Web-site, www.vwrrc.vt.edu.

Water Center Awards for 2002 **Competitive Grants—One-year awards of \$25,000 each**

“Fate and transport of reproductive hormones as environmental contaminants.” Janet Herman, Dept. of Environ. Sciences, University of Virginia.

“Quantifying the effects of land use change and population on pollutant delivery from an urbanizing watershed in northern Virginia.” Randy Dymond, Dept. of Civil & Environ. Engineering, Virginia Tech.

“Nutritional factors promoting algal blooms in the lower Chesapeake Bay.” Margaret Mulholland, Dept. of Ocean, Earth, and Atmospheric Sciences, Old Dominion University.

Seed Grants—Awards of \$5,000 each to help researchers develop proposals for larger grants

“Effects of plant lipid content on the transfer of pollutants from plant to air.” James Smith, Dept. of Civil Engineering, University of Virginia.

“Statistical analysis of the antibiotic resistance analysis BST method for use in fecal coliform TMDL/TMDL implementation plan development.” Eric P. Smith, Dept. of Statistics, Virginia Tech.

“Applications of neural networks for watershed management.” Darrell Bosch, Dept. of Agricultural and Applied Economics, Virginia Tech.

“Impact of *Morone spp.* on water quality management of reservoirs.” Thomas Shahady, Dept. of Biol. & Environ. Science, Lynchburg College.

William R. Walker Graduate Fellow Award

Michele Lynn Peterie, Doctoral Student, Dept. of Biological Systems Engineering, Virginia Tech.

Undergraduate Summer Research Award

Heather Renee Shannon, Dept. of Geological Sciences, Virginia Tech.

CORRECTION FROM THE PREVIOUS ISSUE OF WATER CENTRAL

The April-June 2002 issue, page 21, incorrectly listed the Web-site address for the Northern Virginia Soil and Water Conservation District. The correct address is www.fairfaxcounty.gov/nvswcd.



VIRGINIA WATER RESEARCH SYMPOSIUM 2002
DRINKING WATER SUPPLIES ASSESSMENT AND
MANAGEMENT STRATEGIES FOR THE 21st CENTURY

Sheraton Richmond West, Richmond Virginia
November 6-7, 2002

Wednesday, November 6, 2002

7:30 – 8:30 a.m. **REGISTRATION**

8:30 – 8:45 a.m. **OPENING:** Tamim Younos, Interim Director, Va. Water Resources Research Center

8:45 – 9:00 a.m. **WELCOME:** Tayloe Murphy, Secretary of Natural Resources

9:00 – 9:30 a.m. **KEYNOTE ADDRESS:** Governor Mark Warner (invited)

9:30 – 10:15 a.m. **Session 1: Virginia's Source Water Protection Concepts, Approach, and Methodology**

Virginia's Approach to Source Water Protection: Christopher D. Adkins, Va. Department of Health (VDH)

Utilizing VDH's Digital Source Water Assessment Data Toward Source Water Protection: David L. Bradshaw, Olver Incorporated and Douglas F. Canody, Washington County Service Authority

A Usable and Affordable Product: A Plea for Consultant-Derived Geologic Delineations of Drinking Water Sources in Karst Terrain That Do Not Gather Dust: Josh Rubinstein, Virginia Rural Water Association

10:15 – 10:45 **BREAK**

10:45 – 11:30 **Continuation of Session 1**

GIS Applied to Virginia's Source Water Assessment Program: Steve Sedlock, Keane, Inc., VDH

Watershed Protection for Drinking Water Supplies: A Regional Tool: Scott R. Emry and Shonia M. Holloway, Hampton Roads Planning District Commission

Hydrogeologic Assessment of the Mechums River and Ivy Creek Basins, Albemarle County, Virginia: David J. Hirschman, Albemarle County Engineering Dept., Michael C. Collins, ENSAT Corporation, Nick Evans, Virginia Groundwater Associates, Vincent Day, ENSAT Corporation, and John Rice (formerly ENSAT Corporation)

11:30 – 12:30 a.m. **Session 2: Models and Case Studies of Source Water Protection in Virginia**
Source Water Protection Through Local Programs, Policies, and Comprehensive Planning: Terri Brown, Terrane Environmental Company

Source Water Protection Case Study: The Town of Kenbridge: Albert Crigger, Virginia Rural Water Association

Cap It – A Private Well Abandonment Program: Lisa Meddin, James City Service Authority

Source Water Assessment for Five Towns in Shenandoah County: Michael C. Collins and John Rice, (formerly ENSAT Corporation)

12:30 – 2:00 p.m. **LUNCHEON;** Presentation of the William R. Walker Fellowship Award
Speaker: Robert Burnley, Director, Va. Department of Environmental Quality

2:00 – 3:30 p.m.	<u>Session 3: Collaborative Water Supply Planning: A Shared Vision Approach for the Rappahannock Basin:</u> Bill Cox, Civil and Environmental Engineering, Va. Tech, Jeffrey Connor, Engineering Fundamentals, Va. Tech, Lauren Cartwright, Corp- IWR, Kurt Stephenson, Agricultural and Applied Economics, Va. Tech, Eldon James, Rappahannock River Basin Commission, and Bill Werick, Corp-IWR
3:30 – 4:00 pm.	BREAK; Visit with exhibitors
4:00 – 6:00 p.m.	<u>Session 4: Securing Virginia's Water Infrastructure-A shift in Priorities:</u> Mark Anderson, VDH
6:00 – 7:30	EXHIBITOR RECEPTION

Thursday, November 7, 2002

7:30 – 8:30 a.m. **REGISTRATION**

8:30 – 10:00 a.m. **CONCURRENT SESSIONS**

Session 5: Land Use Growth and its Effect on Drinking Water Supplies

Evaluation of Land Use and Population change on Nutrient Delivery from an Urbanizing Watershed in Northern Virginia: Randel L. Dymond and Mark Dougherty, Civil and Environmental Engineering, Va. Tech, Carl E. Zipper, Corp and Soil Environmental Sciences, Va. Tech, and Adil N. Godrej and Thomas J. Grizzard, Jr. Occoquan Monitoring Lab, Va. Tech

Water Resource Issues of Developing Country Communities: Isai T. Urasa, Chemistry Dept., Hampton University

Impact of Construction Site Run-off on Water Quality and Macroinvertebrate Composition in Virginia Piedmont Streams: Thomas D. Shahady and Cheryl Swackhammer, Lynchburg College

Limitations of GIS Elevation Data for Watershed Modeling: Marco Caiado and Conrad Heatwole, Biological Systems Engineering, Va. Tech

Session 6: Drinking Water Assessment Technologies

Distance and Travel Time Estimates to Define Pollution Risk for Source Water Protection: Conrad Heatwole, Biological Systems Engineering, Va. Tech, and David Bradshaw, Oliver, Inc.

Comparison of Seven Methods for Source-Tracking *Escherichia coli*: Kenneth E. Hyer, Melvin V. Mathes, and Donald M. Stoeckel, USGS, Richmond, Charleston, WVA, Columbus, OH

Decision Support System for Surface Water Quality Protection in Morocco: Muriel Bouzinac, Stephen H. Blair, and Wadie Kawar, Ecology and Environment, Inc, Buffalo, NY and Arlington, VA

Anthropogenic Sources of Arsenic and Copper to Sediments of a Suburban Lake in Northern Virginia: Karen C. Rice, USGS, Charlottesville

10:00 – 10:30 BREAK

10:30 – 12:00 noon. **CONCURRENT SESSIONS**

Session 7: Rural and Urban Drinking Water Resources and Wastewater Management

Withdrawals of Water from Domestic Wells in the Virginia Coastal Plain: J. P. Pope, E. R. McFarland, and R. B. Banks, USGS, Richmond

Smart Infrastructure? Alternative Wastewater Treatment for Charles City County, Virginia: Michael C. Collins, ENSAT Corp., Bernard Proctor, Berkley-Howell & Assoc, Jack Miniclear, Charles City County Public Works, John Bragg, Charles City County Planning, and Anish Jantrania, VDH

Determining the Economic Value of a Water Resource Project: An Application of the Concepts of Capital Budgeting to the Process of Water Resource Management: James P. Savage, Water Resource Advisors

Cooperative Infrastructures for Small Water Systems: A Case Study: Micki M. Young, Dixie Reaves, and Eluned Jones, Agricultural and Applied Economics, Va. Tech, and Tamim Younos, Va. Water Resources Research Center

Winter Management of Constructed Wetland Treatment Systems: E. Smith, R. Gordon, A. Madani, and G. Stratton, Nova Scotia Agricultural College, Nova Scotia, Canada

Session 8: Drinking Water Contaminants and Source Water Protection Programs

Regional Fluoride Mitigation Strategy for 57 Community Water Systems: Shonia Holloway and Scott Emry, Hampton Roads Planning District Commission

The Effects of the Drought on Smith Mountain Lake and Claytor Lake Water Quality: Carolyn L. Thomas and David M. Johnson, Ferrum College

Examining the Potential for Biotransformation and Sorption of Roxarsone, An Organoarsenic Animal Feed Additive: Brenda L. Brown and Madeline E. Schreiber, Geological Sciences, Va. Tech

Everyday Decisions Affect Groundwater Quality: A Multimedia Teaching Tool: Phyllis L. Newbill and Parvinder S. Sethi, Geology Dept., Radford University

Well Aware: Watershed Pollution Prevention Program: Rob Arner, Southeast Rural Community Assistance Project, Inc.,

Water Quality and Water Quantity Research Activities in Nova Scotia Canada: A. Madani, R. Gordon, and G. Stratton, Engineering Dept., Nova Scotia Agricultural College

12:00 – 2:00 p.m. Luncheon

Speaker: Robert Hirsch, Chief Hydrologist, Water Resources Division, U.S. Geological Survey: **Science for Sustainable and Safe Drinking Water Supplies: USGS Perspectives.**

2:00 – 3:15 p.m. **CONCURRENT SESSIONS**

Session 9: Corrosion: Chemical Causes: Economic, Aesthetic and Health Effects – Sponsored by the National Science Foundation

Complex Problems Need Interdisciplinary Solutions: Andrea M. Dietrich, Civil and Environmental Engineering, Va. Tech

Chemical Causes of Corrosion: Marc Edwards, Civil and Environmental Engineering, Va. Tech

Health Issues of Copper in Drinking Water: Sharon Dwyer, Institute for Community Health School of Public and International Affairs

Aesthetic Issues and Consumer Concerns with Water Pipes: Susan Duncan, Food Science and Technology, Va. Tech

Economic Impacts of Corroding Pipes: G. V. Loganathan, Civil Engineering, Va. Tech

Session 10: Virginia's Water Intake Design Criteria and Resource Protection

Design Criteria for Fish Screens in Virginia: Recommendations based on a Review of the Literature: Charles Gowan, Randolph Macon College, and Greg Garman, Va. Commonwealth University

Implementing Guidelines of Water Intake Design Criteria in Virginia: The Triumphs and Hurdles: Tom Wilcox, Va. Department of Game and Inland Fisheries (VDGIF)

Instream Flow for Riverine Stewardship: John Kauffman, VDGIF

3:15

EVALUATION AND ADJOURN

SYMPOSIUM REGISTRATION FORM

Virginia Water Research Symposium

November 6-7, 2002

Please type or print. Complete a separate form for each participant. Return the form by October 15 along with a check or credit card information to the Conference Registrar, Division of Continuing Education, 810 University City Blvd, Suite D, Mail Code 0272, Virginia Tech, Blacksburg, VA 24061; phone 540-231-5182; Fax 540-231-3306 (for credit card registration only).

Name _____ SSI # _____

Title _____ Organization _____

Org. FID # _____ Address _____

Daytime phone number _____ Fax number _____

Email _____

-
- \$130 Registration fee (includes all meals, breaks, reception, proceedings) (after October 15, \$150)
- \$80 One-day registration November 6 (includes continental breakfast, breaks, luncheon, reception, proceedings) (after October 15, \$90)
- \$70 One-day registration November 7 (includes continental breakfast, break, luncheon, proceedings) (after October 15, \$80)
- \$80 Student registration (includes continental breakfasts, breaks, luncheons, reception, and proceedings) (must be currently enrolled as a student and present student identification at registration)
- I would like vegetarian meals
- I will be attending the reception (included in registration fee)

Method of Payment (no staples, tape, or paper clips, please)

- check (make checks payable to Treasurer, Virginia Tech, CE)
- Credit Card Master Card VISA Amex

Card Number _____ Expiration Date _____

Name on Card _____

Signature _____

If you would like to register as an exhibitor, please log on the VWRRC's website, www.vwrre.vt.edu.

Booth space is still available. For more information, contact Judy Poff, jupoff@vt.edu or 540-231-8030.

Don't forget to make lodging reservations! Sheraton Hotel-Richmond West (formerly the Hyatt), 6624 West Broad St., Richmond, VA 23230. \$77/single or double. Reservations must be made by October 15 to receive the symposium room rate. Indicate that you will be attending the Va. Water Research Symposium. Contact information: phone 1-800-325-3535; direct number 804-285-2000; Fax 804-288-3961.

FOR THE RECORD

Sources for Selected Water Resources Topics

Weather and Climate Information Sources

(This topic was covered in the April 1999 *Water Central*, p. 15. Except as noted below, the information in that issue was still correct as of 8/19/02.)

Useful Publications

•*Thunderstorms Across the Nation: An Atlas of Storms, Hail and Their Damages in the 20th Century*. The Univ. of Colorado's *Natural Hazards Observer* calls this book the "first-ever atlas on thunderstorms and hail (that) describes all aspects of the climatology of both phenomena in the United States...." The book has maps of storm activity and damage, chronicles of storm losses with insurance records, and an array of statistics relating to storm activity. Written in 2001 by Stanley A. Changnon; 94 pages; \$5.00. Available from the Midwestern Regional Climate Center, 2204 Griffith Street, Champaign, IL 61820; e-mail: mcc@sws.uiuc.edu. It can also be ordered from the National Climatic Data Center, on-line at www.nndc.noaa.gov/onlinestore.html.

•"Water Resources and Climate Change" is a special issue of the *Journal of the American Water Resources Association*. It offers 20 overlapping U.S. regional assessments and five sector assessments (agriculture, water, forestry, coastal areas, and human health) that explore current conditions and possible changes. Published in 1999, and available from the American Water Resources Association, P. O. Box 1626, Middleburg, VA 20118-1626; phone (540) 687-8390; Web-site: www.awra.org.

Agencies

•The National Weather Service's **Hydrometeorological Prediction Center** produces a map, available on-line at www.hpc.ncep.noaa.gov/nationalfloodoutlook, that gives a five-day outlook for flooding in the contiguous 48 states. It is updated daily at 4:00 p.m. Official flood warnings and forecasts, however, are still issued by the Weather Service's regional River Forecast Centers and Weather Forecast Offices; those products are available on-line at weather.noaa.gov/pd/.

•The **Integrated Flood Observing and Warning System** has up-to-the-minute precipitation data for Virginia as well as for Massachusetts, Connecticut, New York, New Jersey, Pennsylvania, Maryland, West Virginia, Ohio, Kentucky, Tennessee, North Carolina, and South Carolina. Available on-line at www.afws.net.

•The **Center for Ocean-Atmospheric Prediction Studies** at Florida State University has extensive information on-line about the **El Nino and La Nina phenomena**. The site, www.coaps.fsu.edu/lib/elninolinks/, includes links to books, technical articles, popular articles, and even cartoons. The phone number for the Center library is (850) 644-6931.

•The **National Oceanic and Atmospheric Agency's Climate Information Project** offers summaries—near-daily and weekly—of climatological changes and impacts around the world. Available on-line at www.cip.ogp.noaa.gov.

Updated Information

•**Virginia State Climatology Office**. This office is now at P. O. Box 400123, Charlottesville, VA 22904; e-mail: climate@virginia.edu. Its Web-site address is www.climate.virginia.edu.

•**Southeast Regional Climate Center**. The contact information has changed to the following: 2221 Devine Street, Suite 222, Columbia, SC 29205; phone (866) 845-1553.

•**Dial-A-Buoy**. This service provides coastal wind and wave information by phone (228-688-1948). It now has a companion Web-site that explains how to use the system: www.ndbc.noaa.gov/dial.shtml.

–By David Mudd

Upcoming "For the Record" Schedule

Oct. 2002: Water Use
Dec. 2002: Wetlands
Feb. 2003: Water Law and Rights
Apr. 2003: State Water Regulations
Aug. 2003: Federal Water Regulations

Schedule subject to change

Virginia Water Central

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Water Central staff: Alan Raflo, editor; David Mudd, writer; George Wills, illustrator.

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Web-crawlers aren't just in the movies...

Water Central is available on the Water Center's Web-site, www.vwrrc.vt.edu. If you prefer to read the newsletter there, *instead of* receiving a paper copy, please send your e-mail address to water@vt.edu, and we will notify you whenever a new issue is posted.

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1. Would you rate the content of this issue as good, fair, or poor?
2. Would you rate the appearance as good, fair, or poor?
3. Would you rate the readability of the articles as good, fair, or poor?
4. Is the newsletter too long, too short, or about right?
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