Virginia Water Central

Virginia Water Resources Research Center Blacksburg, Virginia September 2007 (No. 42)

Photo by Steve Grieco

Children get a first-hand look at groundwater in a Giles County cave in December 2006. For recent stream flow, groundwater, and precipitation information, please see the Water Status Report.

IN THIS ISSUE

LAST *WATER CENTRAL* IN PRINT

As announced last issue, this will be the last regular print issue of *Virginia Water Central*.

Starting next issue (Issue #43), the primary distribution will be an e-mail notification when a new issue is posted at the Center's Web site, www.vwrrc.vt.edu. Readers who currently receive only the paper version of the newsletter and who wish to receive e-mail notifications *must* send an e-mail address to araflo@vt.edu; when doing so, please indicate the mailing address on your print copy. **Readers who do not have access to the Internet or a printer may ask to receive photocopies of future issues, and we will honor those requests as long as the number is manageable and affordable.** Also, Virginia state depository libraries will continue to provide public access to *Water Central*.

The Water Center asks for and appreciates your cooperation during this transition.

Alan Raflo, Water Central editor

Virginia Tech
Invent the Future

S^2 on H_2O

By Stephen Schoenholtz, Director Virginia Water Resources Research Center

It has been one of those summers when it is difficult to avoid an awareness of the importance of water to all of us in Virginia. Drought conditions, ranging from abnormally dry to exceptionally dry, have been with us for several months and continue to cover the entire state. As of late September, 15 counties had been declared primary agricultural disaster zones and were eligible to receive low-interest federal loans and other federal relief; disaster declarations were pending for 43 additional counties. The agricultural community has been hardest hit, but even suburban and urban communities have experienced a growing anxiety about water supplies with the onset of voluntary and, in some cases, mandatory water conservation measures. The "Drought Report" in this issue of *Water Central* has more information on the current drought.

After the 2002 drought, Virginia established the Drought Monitoring Task Force (DMTF), an interagency group of state and federal agencies responsible for monitoring drought conditions. A state plan guides the DMTF's drought response; the plan is available online at www.deq.virginia.gov/waterresources/pdf/droughtresponseplan.pdf. The Virginia Department of Environmental Quality monitors four indicators in comparison to long-term average conditions to evaluate when we are heading for a drought: 1) precipitation deficits, 2) streamflows, 3) groundwater levels, and 4) reservoir storage. The DMTF is activated with the first occurrence of moderate drought in the state and then continues to monitor the four indicators until the drought has passed. Depending on the four indicators, there are three generalized drought-response levels: 1) *drought watch* (promotes increased awareness), 2) *drought warning* (voluntary water conservation measures and contingency plans implemented), and 3) *drought emergency* (mandatory water conservation measures implemented).

Please See Schoenholtz, p. 15

FEATURE ARTICLE

A Sojourner Puts in and Takes in the James River

By Virginia Myers

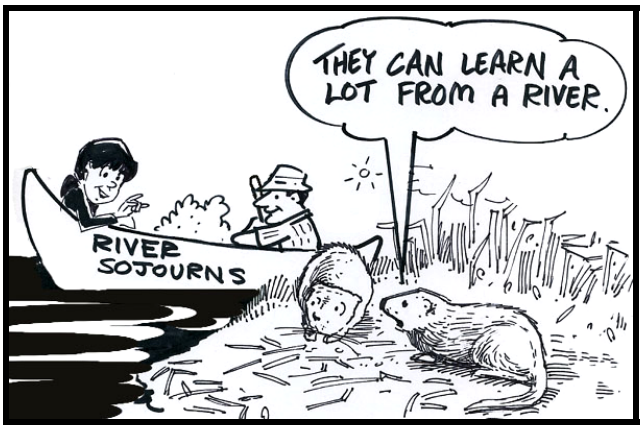
Virginia Myers is a writer and once-a-year kayaker who lives in Takoma Park, Maryland.

[Ed. note: In mid-June 2007, Virginia Myers joined several dozen other paddlers on the James River Sojourn, organized by the Alliance for the Chesapeake Bay. This year's trip began on the Rivanna above its confluence with the James at Columbia (Fluvanna County), then followed the James to Dutch Gap (Chesterfield County). *Water Central* asked Ms. Myers to write a personal account of the trip, focusing on aspects that might provide insights for readers who, like she does, live in other watersheds. Opinions expressed are not necessarily those of *Water Central* or the Virginia Water Resources Research Center.]

Paddling my kayak down the James River on a hot summer day, I look around and think I might never see the wildlife my paddling companions describe as common on this segment of the river. The flat water stretches on and on in the searing sun, and midday seems to have cooked everything lifeless. Where are the eagles I'd heard about? Weren't they supposed to be making a comeback? I see nothing—not even a grackle.

Then a couple of Canada Geese catch my eye. Hardly the exotic wildlife I'm hoping for, these common park birds don't excite me, but I am so anxious to commune with critters I paddle over to the riverbank to check them out anyway.

Lucky for me—because on closer examination, I see that the geese are protecting a clutch of goslings waddling along the shady water's edge. This surprise is a harbinger of things to come.



A James River Introduction

The James River basin is the largest river basin in Virginia, covering over 10,000 square miles (about one-fourth of Virginia's total area); a small part of the headwaters areas (about 80 square miles) is in West Virginia. As of the 2000 Census, over 2.5 million Virginians lived in the James River basin.

A 1985 Water Center publication, *Virginia's Waters*, described the river as follows: "As the river flows southeasterly to Hampton Roads, where it empties into the Chesapeake Bay, it changes from a turbulent mountain stream west of the Blue Ridge to a sluggish tidal river below Richmond." This variety results in recognition of three sub-basins: the Upper James, from the headwaters to Lynchburg; the Middle James, from Lynchburg to the Fall Line at Richmond; and the Lower James, from Richmond to the Bay.

Major James River tributaries (from upstream to downstream) include the Jackson Cowpasture, Maury, Rivanna, Appomattox, and Chickahominy rivers. The Nansemond and Elizabeth rivers join with the James at Hampton Roads.

The James River basin has enormous economic, ecological, and historical importance. It provides water supplies, wastewater treatment, natural habitats, shipping and port access, and recreational opportunities. The river and its tributaries also can cause enormous damage in floods, such as in 1969 (from Hurricane Camille), 1972 (from Hurricane Agnes), 1985 (from Tropical Storm Juan), 2003 (from Hurricane Isabel), and 2005 (from Tropical Storm Gaston).

For more information on the James River, try the following sources:

State of the James River 2007, by the James River Association (JRA), available online at www.jamesriverassociation.org; or phone (804) 730-2898. The JRA also offers James River Water Trail maps, and their Web site has links to river data, river news, and other publications.

Opportunity for Leadership: The James River in the 21st Century, published by the Water Center, available online at www.vwrrc.vt.edu/Proceedings.htm, or phone (540) 231-5624.

"Chesapeake Bay Nutrient and Sediment Reduction Strategy for the James River, Lynnhaven, and Poquoson Coastal Basins, March 2005"; by the Virginia Office of the Secretary of Natural Resources; available online at www.naturalresources.virginia.gov/Initiatives/WaterQuality/; or phone (804) 786-0044.

U. S. EPA's Chesapeake Bay Program's "Watersheds" Web site at www.chesapeakebay.net/wshed.htm.

Virginia Department of Conservation and Recreation's "Virginia's Major Watersheds" Web page, at www.dcr.virginia.gov/soil_&_water/wsheds.shtml.

Finally, don't forget to check your local library for books, reports, articles, and other resources that address the James River's history, natural history, economic importance, or cultural significance.

—By Alan Raflo

River Sojourns Are for Everybody

For someone more accustomed to a swivel chair at an office desk than the molded plastic seat of a kayak and wide vistas of a living river, paddling the James was a much-anticipated and welcome opportunity to get out, get wet, and experience nature. The Alliance for the Chesapeake Bay made it happen. Each year, this non-profit organization coordinates a series of week-long river tours open to anyone interested in paddling, nature, environmental activism, spending time with family, meeting new friends, or all of the above. Participants can choose from trips on the James and several other rivers and can go for one day or the entire week. By day, they paddle and participate in onshore programs about river resources, history, and communities; at night, they camp and often enjoy guest speakers or musicians. The Alliance's goal is to educate people about the Chesapeake Bay watershed and motivate them to protect it.

River sojourns take an everybody-pitch-in approach. Sojourners help one another haul boats in and out of the water, load up the gear truck, counsel one another on the proper way to paddle, watch one another's children, and generally develop a spirit of cooperation unparalleled in shorter ventures.

James River sojourners help empty water from a canoe, June 18, 2007.

Sojourn participants bring all levels of paddling and outdoor experience to the river, but after close, sustained contact with the river and its watershed, all leave with something new.

Looking Closely

The goslings were just my first unexpected riverbank observation. As I paddled next to a new friend, a veteran sojourner who the day before had spotted a Bald Eagle, he told me to look for any unusual movement. Sure enough, I saw something odd moving just faster than the current. We followed it until the object seemed to dive under the surface, and then watched as a muskrat scrambled through some tree roots to dry land. I'd never encountered a muskrat outside of children's storybooks.

The day of the goslings and the muskrat, I also found a discarded snake skin floating on the current and made a point of showing it off to kids on the trip (who had mixed reactions!). I continued spot birds, as well: brilliant yellow Goldfinches, the flash of Red-winged Blackbirds, and a swooping Belted Kingfisher.

But nothing beat the final day of our journey (June 23) for seeing new things. Camped out at the Dutch Gap Conservation Area (Chesterfield County), we settled in for a full day of mucking about, rather than meeting an agenda. There was a guided paddling tour of the tidal lagoon, where we saw a boat graveyard, a creative way of building up the land around rusty wrecks that sprouted Button Bush and Arrow Arum plants. As I pitched my tent, I marveled at an Osprey nest over the water just 30 yards away, in which I could see the mother bird watching me closely and protecting three chicks.

That morning I also went in search of some bird banders who were working in the neighboring woods. A wrong turn was less an inconvenience than an opportunity to see a kind of butterfly I'd never before seen. When I finally reached the bird banders, I got to see the tiny Carolina Wren they were studying; they blew on its breast to see if it had a brooding patch, an area where blood collects to keep eggs warm. They examined its wings for wear, gently pulling its delicate feathers away from its body. Then I got to hold this tiny life in my hand until it appeared to get sleepy and one of the banders urged me to let it go, quickly. Off it flew, a fitting end to a rich morning of looking closely at James River life.

A bundle of sticks atop a channel marker indicates an Osprey nest near Henricus Landing on the James River, June 22, 2007.

Outdoor Education

On Wednesday night at a park in Maidens (Goochland County). we directed our attention to a lesson on water quality, or river health. With charts and vials of river water, we learned about three determinants: turbidity, pH level, and oxygen absorption. Finally someone straightened me out on why a large amount of algae on the water's surface can be a bad thing: breakdown of large amounts of dead algae take up the oxygen that other aquatic life needs to survive. We also learned about how fish and other living things need a certain pH (or acidity) range, and that low turbidity measurements generally are a good sign (showing that not a lot of sediment is reaching the waterway).

The dinner-time lecture that day was followed by music from singer-songwriter Don Chapelle, who sings about saving the river and the Chesapeake Bay. Much to my surprise, my son and his friends—who are more frequently tuned in to rock–n-roll or rap—sang along beside me.

The whole sojourn was a similar mix of fun and education. Kids and adults played together at impromptu splashing battles, Frisbee games, and paddle races down the river. Education—besides our informal lessons while paddling and the previously described river-health presentation—included various onshore and campsite presentations. We enjoyed a lecture by the Nature Conservancy on how to fit conservation easements into "the real world," wetlands

information from the Chesapeake Bay Foundation, a talk on the history of Columbia from the Fluvanna Historical Society, a visit to the St. Francis/St. Emma site in Powhatan County and a talk about the history (beginning in 1890) of educating African Americans there, and a tour and talk at the Bosher's Dam fish ladder in Richmond. A "press event" day (June 14 at Robius Boat Landing in Chesterfield County) offered a collection of information tables, a demonstration of fish shocking (applying electric current to the water to bring fish temporarily to the surface for collection), and a cadre of press for local politicians to address, focusing on solutions to non-point source pollution on the James. Another day featured a presentation by John Page Williams, author of *Chesapeake: Exploring the Water Trail of Captain John Smith*. The sojourn's theme, "Land use then and now," helped direct the conversation that evening.

Land Use

One of my favorite lessons on the Sojourn involved a visit to Brookview Organic Farm in Goochland County. Owners Sandy and Rossie Fisher showed us various practices that helped Brookview win a land-stewardship award from American Farmland Trust. One hay-wagon ride took us to a field to see Brookview's "pastured" chickens: The birds are in a big, low, wire cage which allows them to move around, protects them from predators, and can be pulled across the field at intervals to ensure the birds have fresh grass and insects for food. Standing beside these birds has brought new meaning to standing in front of the dairy case at my local supermarket and examining "free range" claims on egg cartons; now I'm likely to ask egg suppliers exactly how the chickens are raised and base my purchases on their answer. Another wagon ride at Brookview took us to six-acre compost pile, one of the largest in the nation, according to the Fishers. Here Brookview's cattle wander through high furrows of Henrico County leaves and other vegetation, helping break down the material and adding nitrogen from their manure; after about two years and several turnings, the Fishers have marketable compost. In a world of large-scale commercial farming, these and other practices have allowed this farm to maintain its organic approach for more than 20 years, resulting in less impacts on Brookview's lands and the James River into which they drain.

Rossie (l) and Sandy Fisher describe practices at Brookview Farm in Goochland County, June 20, 2007.

Learning about a farm so close to the river—with discussions about reducing chemical use, fertilizer runoff, and planting trees to slow this runoff—was only one of my encounters with land use near the river. One day we lunched on a mid-river cluster of boulders because the riverbanks around us were property of the James River Correctional Center (at State Farm in Goochland County). On our final day we stayed at Dutch Gap Conservation Area (in Chesterfield County), where a power plant loomed over one horizon. Throughout the trip, we could see the connection of the river to transportation uses—from the remnants of the Chesapeake and Ohio Canal, to the railroad we crossed getting to and from riverside campsites, to the traffic on U.S. 522 beside our campsite at Maidens, and finally to the I-295 bridge overhead during our cruise from Richmond to Dutch Gap. In fact, the winner of the Alliance's "Spirit of the Sojourn Award" for this year was Sue Cecil, who among many other activities over the years was involved in efforts to prevent a proposed highway and protect natural areas along the river in downtown Richmond.

Mrs. Cecil was introduced and honored during a river cruise from Richmond to Dutch Gap, a trip that afforded paddlers a new perspective of the river and an opportunity to discuss waterways in urban settings.

Taking In the River

A sojourn is by definition a temporary stay, a visit, or—archaically—a tarry. What results when one tarries on a river for several days?

Like a riverbank, my James River sojourn held many unexpected treasures. More than just a kayaking trip, it was a tour of local geography

and history, a lesson in land use and river health, and most importantly an inspiration to preserve the river and all it offers. An equally vital aspect was family time. On this year's sojourn, as in the past two years, I was joined by my teenage son, giving me the chance to interact with him in a healthy, active environment and to watch the experience instill a deep sense of stewardship in the next generation.

As my stay on the James River wound to a close, I had much to bring back with me: my snakeskin; photos of kids teaching one another to skip rocks across the water's surface; business cards from a handful of intriguing characters who shared hours on the river and along its banks; and memories of other people whose business or careers never came up, such as a re-enactor dressed in colonial garb from the nearby James River Batteaux Festival, a white-haired woman who gamely took her turn on a rope swing at the swimming hole, and a young man committed to paddling the length of the James, from the headwaters to the Chesapeake Bay.

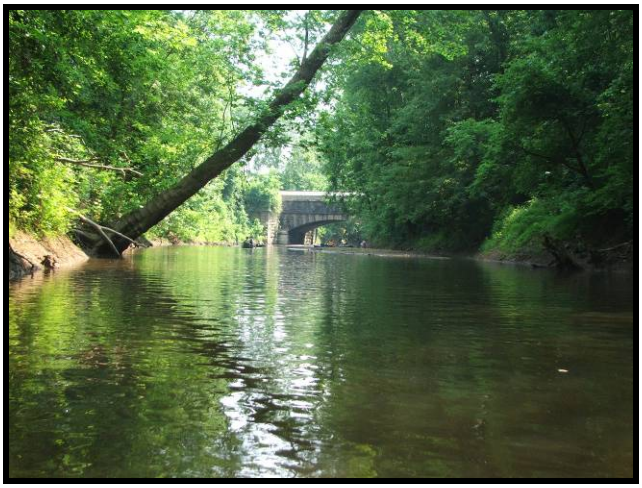
What else did I take away? New inspiration for my garden, where I now make an extra effort to go organic—if Brookview Farm could make it work on a large scale, surely I could go beyond my no-fertilizer approach and buy organic seeds and plants for my tiny yard plot. Motivation to start a thistle feeder and plant native flowers to attract more birds at home. A grocery list that now has a "farmer's market" category, prompted by a sojourn presentation on the importance of locally grown foods. I read with new insight articles about fish kills and green building. Mostly I take home a connection to the river and its sister Bay tributaries. I live in the Anacostia watershed, but I now understand that the entire area surrounding the Chesapeake Bay is intricately webbed together.

In my neighborhood park, a redesign just "daylighted" an underground stream, and the staffer in charge of the project told me he expects it will attract dragonflies, just like ones I saw all over the James. As we spoke, a Goldfinch flitted by—something else I've been noticing more often since I saw them on the river. A greater awareness of and appreciation for such local treasures, and the waterways they require, was definitely the most valuable "souvenir" from my time on one of Virginia's greatest waterways.

For more information about Alliance for the Chesapeake Bay river sojourns, phone (410) 277-6270, e-mail mail@acb-online.org, or visit the or the Alliance's Web site at www.acb-online.org/project.cfm?vid=99. To contact the Alliance's Virginia office in Richmond, phone (804) 775-0951.

Below and on the following page are additional photos from the June 2007 James River Sojourn.

Hazy sunrise over the James River at Columbia (Fluvanna County), June 17, 2007.



An aqueduct on the James River between Columbia and Westview (Goochland County), June 18, 2007.

Swimmers in the James River at Belmead (Powhatan County), June 19, 2007.

Looking down the James near Dutch Gap Conservation Area (Chesterfield County), June 22, 2007.

James River sojourners arrive at Robius Landing (Chesterfield County), June 21, 2007.

Dominion's Chesterfield Power Station (Chesterfield County), June 22, 2007.

TEACHING WATER
Especially for Virginia's K-12 teachers

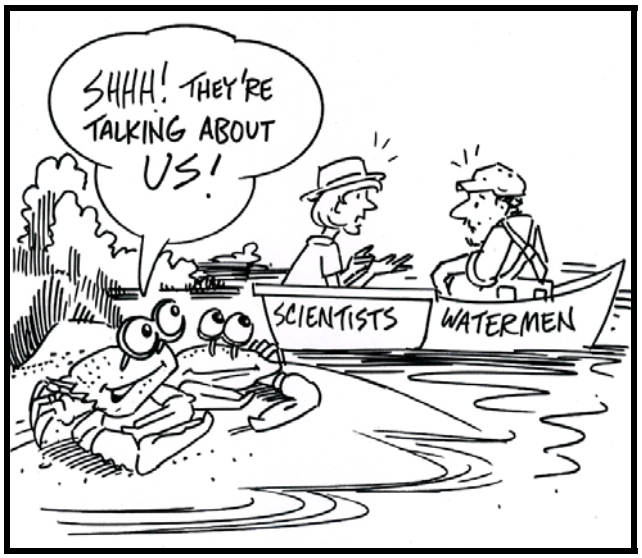
This Issue and the Virginia Standards of Learning

Below are suggestions for Virginia Standards of Learning (SOLs) that may be supported by this issue's Feature article, Science article, Water Status Report, and For the Record section. The SOLs listed below are from Virginia's 2003 Science SOLs and 2001 Social Studies SOLs. Abbreviations: BIO = biology; CE = civics and economics; ES=earth science; GOVT = Va. and U.S. government; LS=life science; VS = Virginia studies; WG = world geography.

Newsletter Section	Science SOLs	Social Studies SOLs
Feature (James River Sojourn)	4.5, 4.8, 6.5, 6.7, 6.9, LS.10, LS.12, ES.7, ES.9, BIO.9	VS.2, WG.2, WG.7, WG.12, GOVT.16
Science (Blue Crab Dialogue)	4.5, 4.8, 5.5, 6.7, 6.9, LS.5, LS.7, LS.8, LS.9, LS.10, LS.12, BIO.7, BIO.9	VS.10, CE.7, WG.7, GOVT.16
Water Status Report (Precipitation, Groundwater, and Stream Flow)	4.6, 4.8, 6.5, 6.7, LS.7, LS.12, ES.7, ES.9, ES.13	WG.2
Drought Report	4.5, 4.8, 6.5, 6.7, LS.7, LS.12, ES.7, ES. 9, ES.13	WG.2, WG.12

A Blue Crab Dialogue

[Ed. note: The following article originally ran in the July 5-11, 2007, issue of *Bay Weekly*, an independent newspaper of the Annapolis capital region, available in print and online at www.bayweekly.com. The article is by Lynn Teo Simarksi and Guy Guthridge, columnists for *Bay Weekly*, who are gathering material for a book about Chesapeake science while living aboard a trawler on the Bay. *Water Central* thanks *Bay Weekly* for permission to reprint this article. *Water Central* added the cartoon and the "Blue Crab Introduction."]



The temperature rose to simmer. At issue at this forum was a proposal to increase the minimum size of blue crabs legally harvested in Maryland. Scientists showed tables and charts of mind-numbing data on the crab population in Chesapeake Bay.

Finally, a waterman lost patience. He stood up and shouted, "You can't understand a crab by counting!"

A hundred other watermen in the room burst into cheers and applause.

That interaction at the Bi-State Blue Crab Advisory Committee meeting a few years back was a turning point for Michael Paolisso, a University of Maryland anthropologist who studies Chesapeake culture and environmental discourse.

A year later, 23 scientists, watermen and resource managers—all working on the blue crab—met in a more relaxed setting. This time they came eager to understand different viewpoints. With Paolisso moderating, they shared their diverse perspectives and knowledge. Scientists then joined the watermen on their boats, helping cull crabs, while watermen visited laboratories and offices.

Paolisso structured the exchange to improve relationships among people who care about the Bay.

Paolisso's blue crab dialogue highlighted what the anthropologist calls the cultural models through which scientists and watermen perceive the Bay environment. All of us have models to help us deal with the world's complexity. They come from our beliefs about religion, nature, work and more, along with our ecological and economic knowledge born of experience. We hate changing our models, anthropologists say.

The second time around, scientists and watermen found they stood on common ground: both did competitive work; both had to provide for families.

By the third session, says Paolisso, they were beginning to get to know one another. Later, biologist Tuck Hines said, "There's as big a range of watermen as there is a range of scientists." Hines directs the Smithsonian Environmental Research Center.

Another crab biologist, Tom Miller of the Chesapeake Biological Laboratory, was "very skeptical going in," but once inside found the dialogue "groundbreaking." Scientist or not, he hadn't even known he was using a cultural model.

Miller learned a lesson in how to explain his research. Scientists seek to understand nature well enough to predict what it will do in the future. Watermen, on the other hand, don't believe nature can be predicted.

"If I use the word predict, watermen switch off," Miller says. "They believe in divine providence."

They're more likely to listen if Miller says something like, "If this exists, then this will likely happen."

Scientists and watermen also learn differently. Watermen know the Bay through their heritage, and scientists know it through their instruments.

Watermen and scientists also work for different goals. Scientists want to understand and preserve nature, while watermen want to earn a living from the water. Their different

motives can muddy their understanding of one another.

For instance: Every year, scientists in Maryland and Virginia try to anticipate the next year's crab harvest through a winter survey made by dredging the Bay bottom. Watermen who've watched told Paolisso that scientists know a lot about crabs, but they don't know how to catch a crab. Scientists inexplicably dredge for crabs where there aren't any, said Daniel Webster, a Deal Island waterman.

Scientists say they know the crab hotspots, such as Tangier Sound, but they randomly sample the entire Bay to survey the whole population.

"We're not trying to catch crabs," says Miller. "We're trying to estimate numbers of crabs. If I was a waterman, I'd want to go where crabs are abundant, but I'd miss all the other places where there are crabs."

Biologists and watermen also work in different universes—though they both chase the same creature. Scientists study the entire Chesapeake Bay, even beyond, while watermen know the Bay bottom they work in intimate detail. Paolisso reckons a waterman skimming along in a workboat is not looking at the surface but is seeing all the familiar features of the bottom in his mind's-eye.

Watermen intuitively know where to put their pots, moving them around to anticipate the crabs' movements.

"The watermen are making all these subtle calculations," Paolisso says. "They know a lot about what crabs do but not a lot about why they do it."

Says Hines, "Watermen make correct observations but the wrong conclusion." For example, watermen (as well as some scientists) used to think that crabs came up the Bay in the spring.

"I think we've convinced the watermen now that it's really just a wave of crabs coming out of the sediment," Miller says.

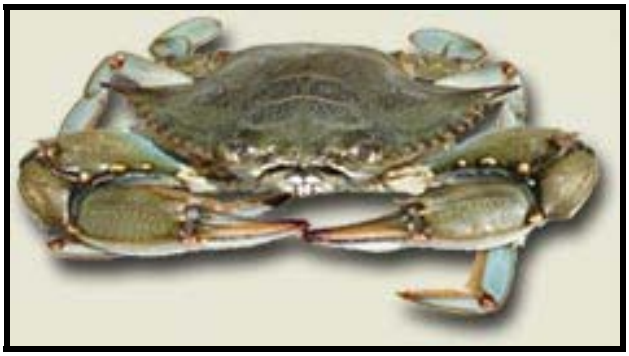
The blue crab dialogue suggests that Chesapeake Bay is more than an ecosystem, Paolisso says. It is also an idea that encompasses the cultural models of watermen and scientists. Where Chesapeake watermen are coming from has been mostly ignored, he maintains, and this ignorance has contributed to the Bay's degradation.

Many Chesapeake problems are rooted in human behavior, Paolisso says. So the Bay's future needs social scientists to work alongside watermen and biologists.

A Blue Crab Introduction

By Alan Raflo

The Blue Crab (scientific name *Callinectes sapidus*) is found in Atlantic, Caribbean, and Gulf coastal waters and estuaries, and particularly in the Chesapeake Bay, where this animal has enormous historical, cultural, commercial, and environmental significance.



A male Blue Crab. (Photo: Chesapeake Bay Program, www.chesapeakebay.net/info/blue_crab.cfm, 9/5/07.)

The Blue Crab is one of several thousand crab species found worldwide. Crabs are classified in a large group (called a phylum) of animals known as **arthropods**, which share the key features of segmented bodies, jointed appendages (legs, etc.), and an external skeleton (called an exoskeleton). This phylum also includes insects, spiders, centipedes, millipedes, and some other groups. Crabs are further classified in the class of **crustaceans**, along with lobsters, shrimp, and many other animals. Most crustaceans are aquatic or semi-aquatic, but some crustaceans live on land and some are parasites, living on or in other animals.

In the Chesapeake Bay, Blue Crabs occupy various habitats, including bottom sediments, shallow waters, or deep water, depending on their life stage and time of year. Submerged aquatic plants (or "Bay grasses") are particularly important to Blue Crabs for feeding and for cover, especially during development of juveniles and after the crabs **molt** (that is, shed their external skeleton, which is necessary for growth). The following passage from the U. S. EPA's *Chesapeake Bay: Introduction to an Ecosystem* (p. 22) describes this habitat variety and the basic Blue Crab life cycle:

> "The first life stage of a blue crab, called the zoea, is microscopic and lives a planktonic free-floating existence. After several molts the zoea reaches its second larval stage: the megalops.

> Another molt, and a tiny crab form is apparent. Both juvenile and adult crabs forage on the bottom and hibernate there through the winter. In spring, the crab quickly begins migrating from the southern part of the Chesapeake to tidal rivers and northern portions of the Bay. During the rest of the year, adult blue crabs are dispersed throughout the Bay, swimming considerable distances using their powerful paddle-like back fins."

The process of becoming an adult Blue Crab takes about 12 to 18 months. The animal's life span is generally about three years, although some may live up to five or even eight years. Mating season in the Chesapeake is generally May to September.

The planktonic zoea and megalops forms of Blue Crabs feed on floating plants and animals. Adults eat a variety of things, including other crustaceans, shellfish (such as clams and mussels), fish, worms, plants, dead organisms, and even other Blue Crabs.

According to Howard Ernst's 2003 book *Chesapeake Bay Blues* (p. 89), "Crabs from the Chesapeake have been contributing to the cultural, economic, and culinary richness of the region for well over a century." In 2007, the EPA's Chesapeake Bay Program reported that an estimated one-third of the nation's Blue Crab harvest comes from the Chesapeake. Harvests from 1968 to 2005 averaged about 73 million pounds, but more recent annual harvests have been about 60 million pounds, according to the Bay Program. The economic return on crab harvests, according to a 1999 Chesapeake Bay Commission estimate, is on the order of $150 million annually for licensed commercial crabbers, processing plants, restaurants, gear providers, boat manufacturers, and others involved in the crab industry.

According to the Bay Program, the Chesapeake population of Blue Crabs was estimated in 2006 to be about 130 million, 57 percent of an interim restoration target of 232 million (the target is believed to be the level that would preserve 20 percent of the species' spawning potential after harvest). Population surveys, harvest management (catch-size restrictions and harvest limits), water-quality improvements, and habitat restoration (such as increasing wetlands and areas of submerged aquatic vegetation) are all part of the effort to increase Blue Crab numbers.

Five Other Things You Might Not Know about Blue Crabs

1. Blue Crabs are an important food item for Kemp's Ridley Sea Turtle, a federally listed endangered species found, among other places, along Virginia's Atlantic coast and in the lower Chesapeake Bay.
2. At different life stages, Blue Crabs are also food for various fish, including Striped Bass (rockfish), American Eel, Atlantic Croaker, some sharks, and others.
3. A "soft-shell" crab is one that has recently molted (within a matter of hours). Females can mate only when in the soft-shell state after the final molt of their lives.
4. A crab's length (important in harvest regulations) is measured *across* the top of the shell, between the two outermost spines.
5. In the winter, Chesapeake Bay Blue Crabs move from the upper Bay (and its tributaries) to deeper waters. The movement seems to be triggered by high-wind storms from the northwest (in connection with other seasonal signals).

References and Further Reading

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VIRGINIA WATER STATUS REPORT

This section (next three pages) of *Water Central* presents recent and historical data on Virginia's precipitation, groundwater levels, and stream flow.

Precipitation in Virginia, September 2006-August 2007

The chart below shows precipitation (in inches) over the last 12 months at seven National Weather Service observation sites in Virginia. The upper number for each entry is the **total precipitation** for the respective site and month (with yearly total at the bottom of the chart), including the equivalent amount of water contained in any snowfall or other frozen precipitation. These values were found (on 9/18/07) at the "Climate" sections of National Weather Service Web sites, as follows: www.weather.gov/climate/index.php?wfo=rnk, for Blacksburg, Lynchburg, and Roanoke; www.weather.gov/climate/index.php?wfo=lwx, for Charlottesville and Washington-Dulles; and http://mi.nws.noaa.gov/climate/index.php?wfo=akq, for Norfolk and Richmond. The lower number in each entry (in parenthesis) is the **average precipitation** for the respective site month (again, with the average yearly total at the bottom of the chart), over the period 1971—2000, according to the National Climatic Data Center, *Climatography of the United States No. 81* (accessed at http://www5.ncdc.noaa.gov/climatenormals/clim81/VAnorm.pdf on 9/18/07). RL and RH mean record low or high, respectively, for that month. The recent monthly amounts (but not the long-term averages) are classified by the Weather Service as *preliminary* data and are subject to revision; the National Climatic Data Center maintains any edited and *certified* data that are available.

More Virginia climate information and data are available from the Virginia State Climatology Office, online at http://climate.virginia.edu. To reach the State Climatologist's office in Charlottesville, phone (434) 924-0548 or send e-mail to climate@virginia.edu.

	Blacks-burg (Station #012)	Charlottes-ville (Station #023)	Lynchburg (Municipal Airport)	Norfolk (Internat. Airport)	Richmond (Byrd Intern. Airport)	Roanoke (Woodrum Airport)	Wash.-Dulles Airport
Sep. 2006	3.16 (3.39)	5.76 (4.85)	7.73 (3.88)	11.64 (4.06)	9.52 (3.98)	3.21 (3.85)	7.12 (3.82)
Oct. 2006	4.91 (3.19)	7.35 (4.22)	6.76 (3.39)	3.54 (3.47)	6.12 (3.60)	5.33 (3.15)	4.82 (3.37)
Nov. 2006	3.71 (2.96)	5.37 (3.74)	4.77 (3.18)	6.46 (2.98)	6.67 (3.06)	4.22 (3.21)	5.31 (3.31)
Dec. 2006	1.83 (2.87)	1.71 (3.26)	1.66 (3.23)	2.06 (3.03)	1.42 (3.12)	1.98 (2.86)	1.74 (3.07)
Jan. 2007	2.83 (3.37)	1.90 (3.71)	3.33 (3.54)	2.71 (3.93)	3.46 (3.55)	2.40 (3.23)	2.11 (3.05)
Feb. 2007	1.85 (3.02)	1.91 (3.30)	2.00 (3.10)	2.09 (3.34)	2.06 (2.98)	2.23 (3.08)	2.54 (2.77)
Mar. 2007	6.64 (3.83)	1.57 (4.05)	3.95 (3.83)	1.84 (4.08)	2.66 (4.09)	3.32 (3.84)	2.93 (3.55)
Apr. 2007	3.63 (3.83)	2.22 (3.34)	3.10 (3.46)	3.19 (3.38)	3.62 (3.18)	2.60 (3.61)	3.38 (3.22)
May 2007	2.93 (4.39)	2.53 (4.86)	3.37 (4.11)	2.06 (3.74)	3.69 (3.96)	2.59 (4.24)	0.34 RL (4.22)
Jun. 2007	3.07 (3.93)	4.47 (4.46)	3.06 (3.79)	3.87 (3.77)	5.22 (3.54)	2.62 (3.68)	2.92 (4.07)
Jul. 2007	2.83 (4.17)	0.89 (4.94)	7.19 (4.39)	4.77 (5.17)	1.69 (4.67)	3.22 (4.00)	1.75 (3.57)
Aug. 2007	1.75 (3.68)	4.21 (4.14)	1.49 (3.41)	3.71 (4.79)	6.81 (4.18)	1.50 (3.74)	1.67 (3.78)
Total for Period	39.1 (42.63)	39.9 (48.87)	48.4 (43.31)	47.9 (45.74)	52.9 (43.91)	35.2 (42.49)	36.6 (41.80)

Groundwater Levels at Selected Virginia Wells, September 2007

As of September 18, 2007, *real-time data* (updated every 5 to 60 minutes) were being recorded from 63 observation wells in 27 Virginia localities and were available online at the U. S. Geological Survey's (USGS) Web site at http://waterdata.usgs.gov/va/nwis/current/?type=gw. The table below shows one September 18 measurement (at about 1 p.m.) from each of 19 real-time observation wells. All measurements are in **feet below the land surface**, rounded to the nearest 0.1 foot; **a smaller value means wetter conditions, while a larger value means drier conditions.** The table also shows the level reported in the last issue of *Water Central* (from 5/14/07) plus the deepest (driest) and shallowest (wettest) values recorded for each well during the well's period of record (as of the Water Year 2005 report mentioned above, which ended with September 2005). All September 2007 readings are *provisional* (i.e., subject to revision).

The USGS also publishes annual reports of data from several hundred observation wells in Virginia. The most recent annual report (as of September 2007) is *Water Resources Data-Virginia-Water Year 2005, Volume 2* (available in libraries and online at http://pubs.usgs.gov/wdr/2005/wdr-va-05-2/).

Well (Local #)	9/18/07 Level	5/14/07 Level	Record Deepest (Driest)	Record Shallowest (Wettest)	Period of Record
Accomack (66M 19 SOW 110S)	10.2	8.6	11.3 (Nov. 1981)	7.4 (Apr. and Aug. 2004)	Since Sep. 1978
Buckingham (41H 3)	22.7	18.7	36.4 (Oct. 2002)	7.3 (Apr. 1973)	Since Mar. 1970
Clarke (46W 175)	41.2	35.8	45.7 (Sep. 2002)	22.9 (Sep. 2003)	Since Jul. 1987
Fairfax (52V 2D)	17.6	12.5	24.9 (Dec. 1998)	6.5 (Mar. 1984)	Since Oct. 1976
Frederick (46X 110)	43.9	37.4	44.4 (Nov. 2002)	18.0 (June 2003)	Since Nov. 2002
Hanover (53K 19 SOW 080)	20.5	16.4	22.9 (Aug. 1984)	3.8 (Aug. 2004)	Since Jan. 1978
Loudoun (49Y 1 SOW 022)	60.5	58.1	62.0 (Jan. 2002)	48.0 (June 1972)	Since Aug. 1969
Montgomery (27F 2 SOW 019)	6.2	4.0	7.3 (Dec. 1969)	0.0 (Mar. 1993)	Jul. 1953, then since Apr. 1969
Northampton (63H 6 SOW 103A)	7.1	5.5	10.0 (Oct. 2002)	0.6 (Aug. 2004)	Since Oct. 1977
Orange (45P 1 SOW 030)	31.9	22.5	39.0 (Aug. 2002)	11.8 (Apr. 1973)	Since Feb. 1965
Prince William (49V 1)	11.2	9.4	13.1 (Sep. 1991)	6.6 (Dec. 2003)	Since Nov. 1968
Roanoke City (31G 1 SOW 008)	18.9	18.8	19.3 (Jun. 1987)	12.4 (Feb. 1986)	Since Aug. 1966
Rockbridge (35K 1 SOW 063)	27.2	22.5	30.4 (Sep. 2002)	14.3 (Apr. 1987)	Since Jun. 1972
Rockingham (41Q 1)	76.4	66.0	99.0 (Oct. 2002)	57.7 (Feb. 1998)	Since Aug. 1970
Suffolk (58B 13)	12.4	8.8	13.4 (Jan. 1981)	0.6 (Sep. 1999)	Since Mar. 1975
Surry (57E 13 SOW 094C)	10.0	7.5	11.2 (Dec. 1981)	3.9 (May 1980)	Since Jul. 1978
Virginia Beach (62B 1 SOW 098A)	7.1	3.6	12.0 (Sep. 1980)	0.8 (Aug. 2004)	Since Jun. 1979
Westmoreland (55P 9)	9.2	1.0	12.8 (Dec. 1998)	0.8 (Aug. 2004)	Since Jul. 1977
York (59F 74 SOW 184C)	10.1	2.4	13.4 (Jan. 2002)	2.0 (Feb. 1994)	Since Jun. 1990

Stream Flow in Virginia, August-September 2007

The graphs on this page, taken from the U.S. Geological Survey's (USGS) Internet site, "WaterWatch—Current Water Resources Conditions" (http://water.usgs.gov/waterwatch/?m=real&r=va&w=real%2Cplot, 9/19/06) compare recent Virginia stream flow to historical records.

The data in the graphs come from 97 sites that have at least 30 years of records. The left graph covers August 4 to September 18, 2007; the right graph covers July 1999 through mid-September 2007. Each graph uses a "**stream flow index**," which measures how a site's average stream flow *over 24 hours* (the **average daily stream flow**) compares to the historical average stream flow *for that same site and date*. The graphs show a further average: the stream flow index averaged *over all 97 monitoring stations*.

Index values (1-7 on the vertical axis in the graphs) mean the following:

Values indicating dry conditions:

1 = average daily flow is record low for that date;
2 = average daily flow is in the lowest 10 percent of historical values for that date;
3 = average daily flow is in the lowest 25 percent of historical values for that date, but exceeds the lowest 10 percent.

Value indicating "normal" flow:

4 = average daily flow exceeds the lowest 25 percent of historical values for that date, but is less that the highest 25 percent of values.

Values indicating wet conditions:

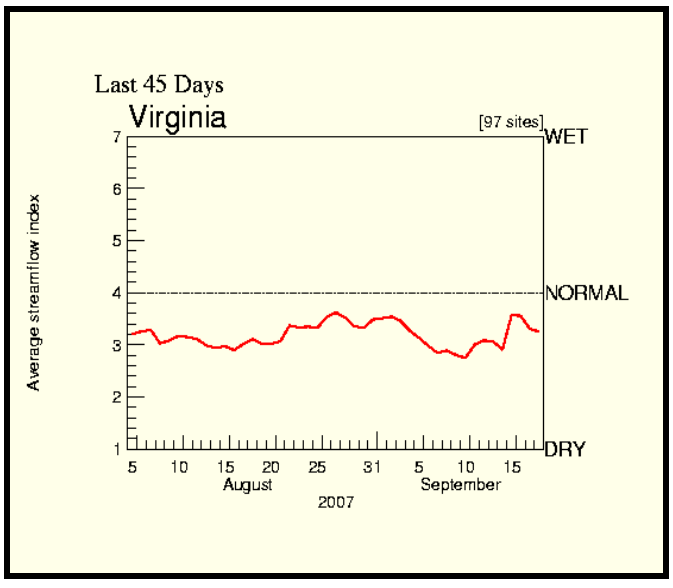
5 = average daily flow exceeds 75 of historical values for the date, but is lower than the highest 10 percent of values.
6 = average daily flow exceeds 90 percent of historical values for that date;
7 = average daily flow for the graphed date is record high for that date.

Gaps in the data: Data are not plotted for days when fewer than two-thirds of the sites report data (due to equipment or weather problems), because a statewide average on those days may misrepresent actual conditions.

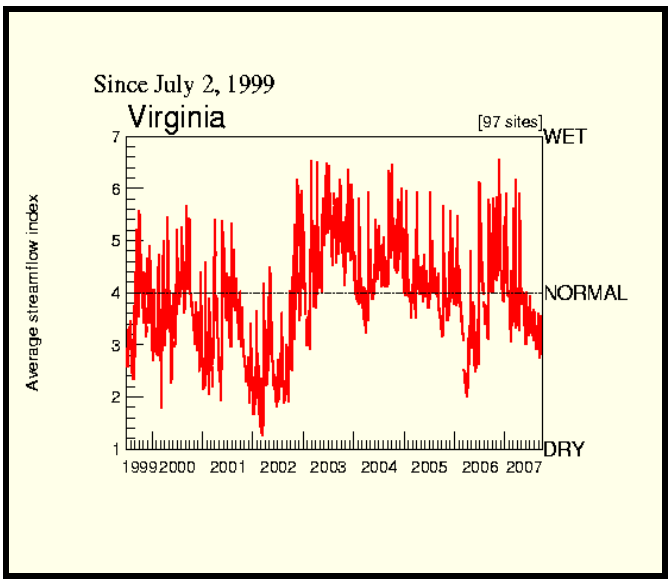
A USGS **map of current stream flow conditions** (with links providing access to details for each measuring station) is available online at http://water.usgs.gov/waterwatch/?m=real&w=map&r=va.

Average Daily Stream Flow Index, Compared to the Historical Average for the Date

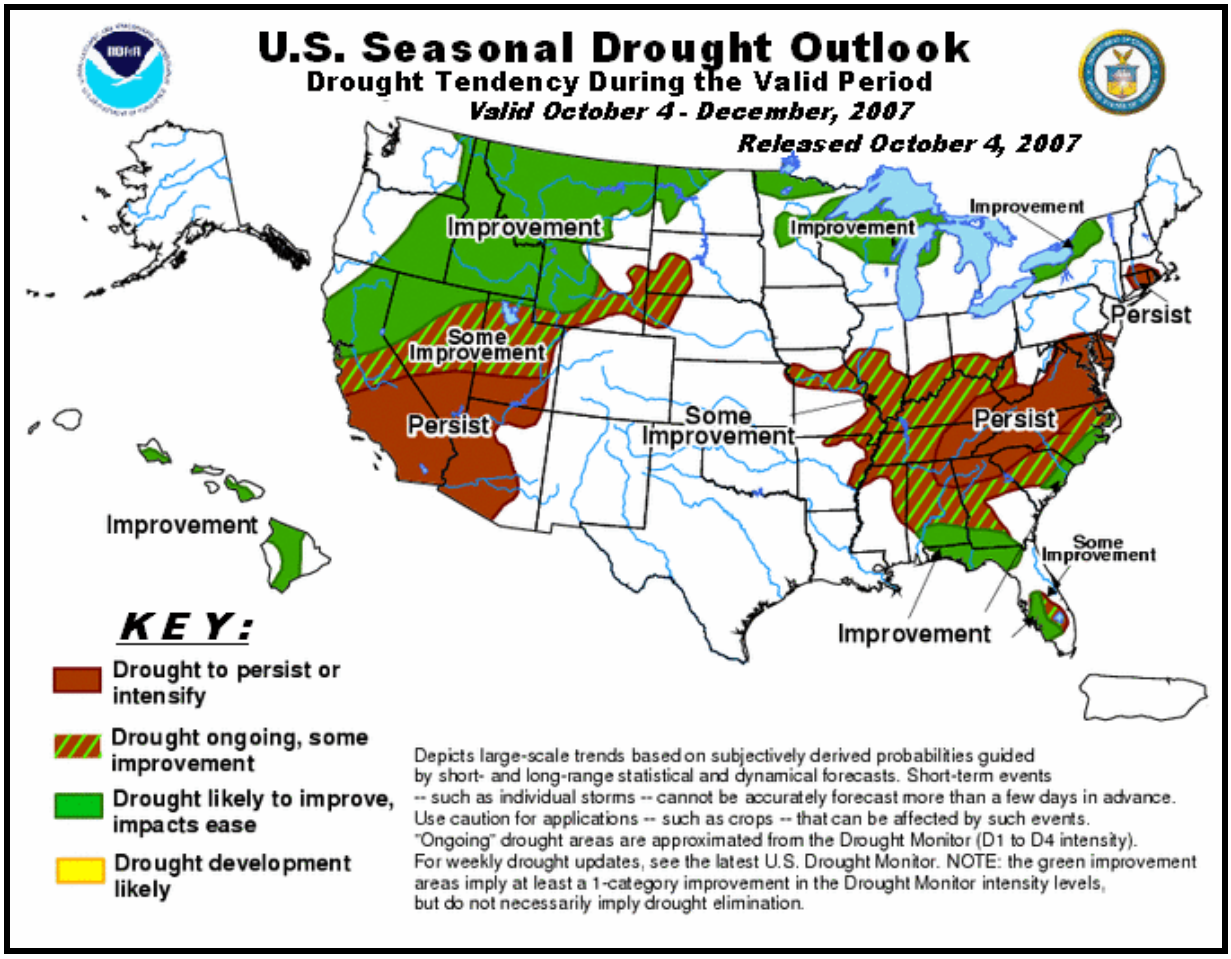
For August 4—September 18, 2007



For July 1999—Mid-September 2007



THE SUMMER 2007 DROUGHT: FUTURE, PRESENT, and PAST



The national drought outlook for October-December 2007, according to the NOAA Climate Prediction Center Web site, www.cpc.ncep.noaa.gov/products/expert_assessment/seasonal_drought.html, 10/4/07.

The map above shows the NOAA Climate Prediction Center's best estimate (as of 10/4/07) of what will happen to drought conditions over the next three months. In the rest of this section, we take a look the latest assessment of the drought in Virginia and then look back at the progress of drought conditions over Summer 2007.

Virginia Drought Monitoring Task Force Current Assessment

Responding to the Summer 2007 drought, the Virginia Drought Monitoring Task Force began issuing monthly Drought Status Reports in July. Partners on the Virginia Task Force include the following state agencies: Climatology Office, Department of Agriculture and Consumer Services, Department of Emergency Management, Department of Environmental Quality, Department of Forestry, Department of Game and Inland Fisheries, and Virginia Cooperative Extension. Federal partners include the U.S. Department of Agriculture's Farm Service Agency, the National Weather Service, and the U.S. Geological Survey. The Task Force's Drought Status Reports (issued as conditions warrant) and much more information about drought conditions (including links to Web sites of the partners) are available online at www.deq.virginia.gov/waterresources/drought.php. As of this writing, the most recent report was issued on September 24. Following are excerpts from that report.

Precipitation

The table shows **observed precipitation as a percentage of the long-term average** (over the period of record) for the indicated regions and time periods; the percentages are based on *preliminary* precipitation data. According to the Task Force report, precipitation greater than 85 percent of the long-term average is considered to be in the normal *range*. As the table shows, rainfall compared to the long-term average has been below this range throughout the state during 2007.

Region	7/1/07 to 9/20/07	1/1/07 to 9/20/07	10/1/06 to 9/20/07
Big Sandy	64%	67%	74%
New River	61%	72%	83%
Roanoke	56%	69%	84%
Upper James	59%	78%	91%
Middle James	53%	71%	89%
Shenandoah	66%	77%	87%
No. Virginia	50%	65%	79%
No. Piedmont	42%	59%	77%
Chowan	51%	66%	90%
No. Coastal Plain	37%	62%	78%
York/James	58%	59%	79%
S.E. Virginia	57%	69%	87%
Eastern Shore	59%	79%	97%
STATEWIDE	54%	68%	89%

Stream Flows, Groundwater, and Lake Levels

Stream flows in mid-September were "lowest along the Blue Ridge Mountains from Bristol to Culpeper with additional dry areas in the Rappahannock, York, and Chowan River Basins. Additionally, flows in some smaller basins in the Potomac River Basin [had] fallen to levels well below the normal range of flows." Groundwater levels were "well below normal" in water-table wells in the Valley and Ridge, Blue Ridge, and northern Piedmont regions, but generally in the normal range for September in central and eastern regions. Levels of large reservoirs (Moomaw, Smith Mountain Lake, Kerr, Philpott, and those in the Rivanna Water and Sewer Authority system) were "[continuing] to decline due to low inflows."

Public Water Supplies

As of the report date, the Department of Health had "not reported any impacts to public water supplies that have compromised their ability to provide the needs of their customers [but] several systems [over 20] in the Commonwealth have initiated voluntary [or] mandatory water conservation requirements." Voluntary restrictions were in place for major supply systems in south Hampton Roads, the Richmond area, and the area served by the Appomattox River Water Authority.

Agricultural Disaster Area Declarations

As of September 26, federal disaster declarations for drought and high temperatures had been approved by the U. S. Department of Agriculture for 15 Virginia counties: Bedford, Bland, Brunswick, Caroline, Culpeper, King George, Lancaster, Lee, Loudoun, Orange, Russell, Scott, Smyth, Washington, and Wise. Another 56 localities had been designated as "contiguous disaster areas."

On October 1, Gov. Kaine requested a federal agricultural disaster declaration for the entire state.

Drought Progression through the Lens of the U.S. Drought Monitor

The U.S. Drought Monitor, available online at www.drought.unl.edu/dm/monitor.html, is a weekly nationwide drought assessment by federal agencies and state climatological centers. The Drought Monitor's ratings, starting from the driest, are as follows: D4 = exceptional drought; D3 = extreme drought; D2 = severe drought; D1 = moderate drought; and D0 = abnormally dry.

The following table shows how much of the country and of Virginia received different Drought Monitor ratings between at four times between June 19 and September 18, 2007.

Drought Monitor Report Date	Percentage of area rated D0* or worse	Percentage of area rated D2* or worse
6/19/07	U.S. = 50% Va. = 59%	U.S. = 16% Va. = 6%
7/17/07	U.S. = 54% Va. = 100%	U.S. = 17% Va. = 15%
8/14/07	U.S. = 59% Va. = 100%	U.S. = 27% Va. = 29%
9/18/07	U.S. = 52% Va. = 99%	U.S. = 27% Va. = 39%

*D0 = "abnormally dry"; D2 = "severe drought"

Throughout this period, several states saw particularly serious, persistent, and widespread drought. In almost every weekly report from June 26 to September 18, the following states had over 50 percent of their area in severe, extreme, or exceptional drought: Alabama, Arizona, California, Georgia, Kentucky, Nevada, and Tennessee. Starting in late July and August, such conditions took hold in Idaho, Montana, North Carolina, South Carolina, and Utah, as well.

Schoenholtz, cont., from page 2

Another response to the 2002 drought was the 2003 Virginia General Assembly's mandate of a statewide water-supply planning process (SB 1221, now Section 62.1-44.38:1 of the *Virginia Code*). One of the goals of the process is to develop effective water conservation and contingency plans that account for the wide variety of water supplies and uses across the state. The process also seeks to assure that proper water-conservation activities are instituted at appropriate times. This statewide approach, when combined with actions by local governments, individual water suppliers, and individual citizens, is essential to assuring adequate water supplies for Virginia's current and future needs. And there's nothing like a drought to remind everyone why such planning and stewardship are needed.

WATER QUALITY and YOU

In this section, *Water Central* offers suggestions for how individuals can help maintain and improve the condition of Virginia's waters and aquatic habitats. We plan to repeat this or print similar information frequently. You are welcome to reproduce and distribute this page, but please retain the credits to the original source(s). All Web sites listed were functional as of 10/4/07.

Preventing Urban and Residential NPS Pollution[1]

(**Source:** U. S. Environmental Protection Agency, "What You Can Do to Prevent NPS Pollution," www.epa.gov/owow/nps/whatudo.html, 8/7/07.)

- Keep litter, pet wastes, leaves, and debris out of street gutters and storm drains. These outlets drain to lakes, streams, rivers, and wetlands.
- Apply lawn and garden chemicals sparingly and according to directions.
- Dispose of used oil, antifreeze, paints, and other household chemicals properly, not in storm sewers or drains. If your community does not already have a program for collecting household hazardous wastes, ask your local government to establish one.
- Clean up spilled brake fluid, oil, grease, and antifreeze. Do not hose them into the street.
- Control soil erosion on your property by planting ground cover and stabilizing erosion-prone areas.
- Encourage local government officials to develop construction erosion/sediment control ordinances in your community.
- Have your septic system inspected and pumped at least every 3-5 years.
- Purchase household detergents and cleaners that are low in phosphorous to reduce the amount of nutrients discharged into our lakes, streams, and coastal waters.

Additional Tips for Home Landscapes

(**Source:** Appendix A, "Water Quality Protection Tips: Ways to Improve Water Quality for Everyone's Benefit," from *Rain Gardens: A Landscape Tool to Improve Water Quality*, Virginia Department of Forestry Technical Guide, 2005).

- Select landscape plants wisely.—Select native plants that need little water and fertilizer. Use mulch to help retain moisture in dry months. If watering is necessary, then water only in the early morning or late evening.
- Integrate storm water management features into your home and yard.—Create a rain garden, install a rain barrel, or divert your downspouts to your lawn so that you may use the storm water runoff for your benefit.
- Promote natural revegetation.—Leave an unmowed buffer along the edge of the woods or along a waterway. This will provide habitat in addition to improving water quality.
- Plant trees.—Trees provide many natural benefits such as cycling nutrients in water and air, providing wind and sun blocks, providing food for wildlife, and helping control erosion.

Virginia's Voluntary Pollution Prevention Programs

For information about the following programs, visit the Virginia Department of Environmental Quality's Pollution Prevention Office Web site at www.deq.virginia.gov/p2/programs.html (as of 8/7/07) or phone the office at (804) 698-4344.

Environmental Excellence Program (for businesses, manufacturers, government agencies, and other organizations).

Hospitals for a Healthy Environment.

Businesses for the Bay (for businesses within the Chesapeake Bay watershed).

Regional Environmental Management System (a partnership of federal, state, and local public and private organizations collaborating on regional community and environmental issues).

Mercury-use reduction and proper management.

Green Lodging Program (for the tourism and hospitality industry).

Clean Marinas Program.

E-Cycling, for computer and electronics recycling.

Reporting Water-quality Problems

To report a pollution incident or suspected violation of state environmental law, contact the Virginia Department of Environmental Quality (DEQ) Pollution Response Program. During normal work hours, phone your local DEQ Regional Office; regional contact information is in the state government pages of local phone books and online at www.deq.virginia.gov/prep/contacts.html. At other times, phone (800) 468-8892 (in-state) or (804) 674-2400 (out-of-state).

[1] NPS stands for "nonpoint source pollution." As defined by the U.S. EPA, "nonpoint source pollution…comes from many diffuse sources [and] is caused by rainfall or snowmelt moving over and through the ground" (www.epa.gov/owow/nps/qa.html, 8/7/07).

IN AND *OUT OF* THE NEWS
Newsworthy Items You May Have Missed

The items in this section are based on information in the source(s) indicated in parentheses at the end of each item. Most of this issue's items were originally reported from May to September 2007. Except as otherwise noted, the localities mentioned are in Virginia and the dates are in 2007. All Web sites listed were functional as of October 2, 2007. Frequently used abbreviations include the following: DCR = Va. Dept. of Conservation and Recreation; DEQ = Va. Dept. of Environmental Quality; EPA = U.S. Environmental Protection Agency; SWCB = Va. State Water Control Board; VMRC = Va. Marine Resources Commission.

Starting Point

•What might you find **on the bottom of a pond**? Blacksburg residents found out this summer when the Virginia Tech Duck Pond was drained for about a week as part of the Virginia State Police's investigation of the April 16 campus shootings. As the July 3 photo below shows, the pond basin held barrels, other litter, and lots of sediment collected over the nearly 20 years since the pond was last drained and dredged. One state trooper assisting in the exhausting job of searching the pond noted, "It would be good to take some pictures to show kids what happens to litter."

State Regulation Items

•The **Virginia Marine Resources Commission** (VMRC) held regular monthly meetings on May 22, June 26, July 24-25, August 28, and September 25. VMRC meeting minutes are available at www.mrc.virginia.gov/calendar.shtm. Some news-making actions at these meetings were the following:

••(June) The VMRC levied a **$100,000 civil charge** against VA Timberline LLC of Ashland for **wetlands damages** resulting from non-permitted mowing of several dozen wetland acres in the Lawnes Point development in Isle of Wight County. The fine was the largest ever imposed by the VMRC for a violation of this kind. (*Daily Press*, 6/27/07; *Richmond Times-Dispatch*, 7/3/07)

••(August) The VMRC endorsed an **oyster-management plan** developed over the past year by the Blue Ribbon Oyster Panel. Key plan elements are the following: requesting $2.5 million in 2008 in state funds for native oyster restoration ($1.3 million was provided for 2007); rotating oyster areas between sanctuary protection and harvest; tougher penalties for violations; and paying commercial fisherman to transport large adult oysters (assumed to be disease-resistant) to sanctuary areas. (*Virginian-Pilot*, 8/1 and 8/29/07)

••(September) In accordance with the Blue Ribbon Oyster Panel plan, the VMRC approved oyster harvesting in areas of the **Rappahannock River** where harvesting has been prohibited for over ten years, a two-zone rotational harvest area near Tangier Island, and a four-month seaside Eastern Shore season. (*Daily Press,* 9/27/07; VMRC meeting minutes)

••(September) The VMRC changed restrictions on **Striped Bass** fishing to reduce that harvest, which has exceeded limits set by the Atlantic States Marine Fisheries Council every year from 2001 to 2006. (*Daily Press*, 9/24 and 9/26/07)

•The **State Water Control Board (SWCB)** held regular quarterly meetings on June 27 and September 25. SWCB meeting minutes are available (for 180 days) through the Virginia Regulatory Town Hall Web site, www.townhall.state.va.us. Some news-making actions at these meetings were the following:

••(June) The Board approved for public review several proposed **changes to water quality standards**, as part of the triennial review required by the federal Clean Water Act. One proposal is to change the **bacterial criterion** for recreational waters (except coastal beaches). The current criterion is 126 colony forming units (CFU)/100 milliliters of water, which is based on an *illness rate risk level* of 0.8 percent (8 out of 1000 swimmers may get gastrointestinal illness). The proposed criterion is 206 CFU, based on an illness rate risk level of 1.0 percent (10 out of 1000 swimmers may get gastrointestinal illness). Another proposal would address state waters that have **naturally lower dissolved oxygen and pH values** than are required in existing regulations. As of late September, the public comment period for the water-quality standards proposals had not begun. More information is online at www.deq.state.va.us/wqs/rule.html#TR. (SWCB meeting minutes for 6/27/07)

••(September) The Board began transferring regulatory oversight of **biosolids** (treated sewage sludge) from the Department of Health (VDH) to the Department of Environmental Quality (DEQ) (*Lynchburg News & Advance*, 9/25/07).

•On July 27, the U. S. Environmental Protection Agency (EPA) approved amendments to Virginia's surface water-quality regulation (9 VAC 25-260 in the *Virginia Administrative Code*) adding **nutrient criteria for 116 man-made lakes and reservoirs and the two natural lakes** in Virginia. EPA is requiring all states to develop nutrient criteria for various types of surface water bodies. More information is online at www.deq.state.va.us/wqs/rule.html#NUT2. For more information contact Jean Gregory at (800) 592-5482 ext. 4113; e-mail: jwgregory@deq.virginia.gov. (Text provided by Jean Gregory, Virginia DEQ, 8/13/07)

•The SWCB is considering a regulation to create shellfish "**aquaculture enhancement zones**" on the Eastern Shore. The regulation would require applicants for wastewater discharge permits to show that they have evaluated alternatives to the discharge and that the discharge is the option with the least environmental impact. A public comment period on the regulation was scheduled to close October 24. In September, the Accomack County Board of Supervisors, concerned about the potential impact of the regulation on providing central sewer in the county, asked the SWCB to extend the comment period and to form an advisory committee to study the proposal. (*Daily Times* [Salisbury, Md.], 9/27/07]

Water Supply Items

•At the state, regional, and local levels, Virginia's **water-supply planning process** continues.[2] In July the Virginia DEQ announced **grant awards** totaling $300,000 to 13 government authorities to assist local and regional water supply plans development; grants totaling $1 million have been awarded since 2006. The regional and local plans, which are due between 2008 and 2011, are to lead ultimately to a statewide plan for water needs and potential alternatives for at least 30 years. DEQ's water-supply planning Web site is www.deq.virginia.gov/watersupplyplanning/homepage.html. (DEQ Press Release, 7/17/07)

•In May, the **Town of Appomattox banned copper water pipes** in all new buildings (except for limited use to connect appliances). The ban is part of Appomattox' response to a DEQ order to reduce copper in the town's wastewater (high copper levels can harm aquatic life). The ban is apparently the only one in Virginia. (*Lynchburg News & Advance*, 5/14/07)

•**Albemarle County and Charlottesville** are "behind the eight ball" in their need to improve water supply infrastructure, according to Thomas Frederick, the head of the Rivanna Water and Sewer Authority. Mr. Frederick wrote in a September memo that a severe drought could have "catastrophic consequences" for the area until progress is made on the Authority's $142-million plan for water supply for the next 50 years. (*Charlottesville Daily Progress*, 9/25/07)

•In August, construction began on a **new reservoir in Stafford County**, on Rocky Pen Run (Rappahannock River basin). Completion of the $77-million project is not expected until 2010; pumping in water from the Rappahannock would follow, with actual withdrawals not likely before 2011. (*Fredericksburg Free Lance-Star*, 5/17 and 8/19/07. For a previous *Water Central* item: June 2006, p. 22.)

•In September the SWCB approved a DEQ permit for construction of the Cobbs Creek **reservoir in Cumberland County** and an intake on the James River to supply the reservoir. The $175-million, 1,100-acre, 14.8-billion-gallon reservoir is to serve Cumberland, Goochland, Henrico, and Powhatan counties. A U.S. Army Corps of Engineers permit is still needed before construction may start. (*Richmond Times-Dispatch*, 9/30/07)

Wastewater Items

•Besides the aquaculture enhancement zone issue mentioned above, other wastewater issues have been making news in several **Accomack County** localities. Near Greenbackville, developers of the proposed 4,800-home **Captain's Cove subdivision** appealed the September 2006 denial by the SWCB of a wastewater system permit. On July 30, the SWCB heard the appeal, and based on the Virginia Department of Health's (VDH) determination that the project would result in condemnation of shellfish grounds, again denied the permit. In **Parksley**, local officials in May were seeking $312,000 from Accomack County to help fund a $1.2-million sewage-treatment project in the town's central district. The town already had received almost $1 million in a loan and grant from the U.S. Department of Agriculture. And in **Chincoteague**, the town council in July began reviewing a consultant's report on various options for collecting town sewage and disposing of the treated effluent. (www.delmarvanow.com, 5/19, 6/14, and 7/12/07; and minutes of SWCB July 30 hearing)

•In May, the Virginia Resources Authority (VRA) announced **$244 million in Clean Water State Revolving Fund Revenue Bonds** to finance nutrient-removal improvements at wastewater treatment plants in nine localities. The transaction is the largest in the history of VRA. According to VRA Executive Director Sheryl Bailey, in recent years the Authority has "pumped up the volume" of its low-interest loans to localities to help the state's efforts to reduce nutrients in Virginia's Chesapeake Bay tributaries. (*Richmond Times-Dispatch*, 6/3/07; VRA press release)

•**Sewage overflows and leaks** are not a pleasant topic but they were news-makers in Summer 2007.

••From November 2006 to May 2007, over 60 sewer overflows from manholes led to sewage reaching **Massaponax Creek in Spotsylvania County**. In August, the Virginia DEQ fined the county $16,000, most of which will fund water-quality monitoring and pollution prevention on the creek. A $50-million project is planned to replace an interceptor line that is considered the cause of the problem. (*Fredericksburg Free Lance-Star*, 6/13 and 8/21/07)

••In July, the **Richmond** (City) Department of Public Utilities began a new **e-mail system to alert residents** when stormwater causes overflows to the city's combined stormwater and sanitary sewer system. (*Richmond Times-Dispatch*, 7/17/07)

••In August, the Virginia DEQ announced a proposed agreement with the **Hampton Roads Sanitation District** (HRSD) and 13 localities to complete wastewater-system improvements to reduce

[2] The process began when the General Assembly, following droughts between 1999 and 2002, passed legislation in 2003 (SB 1221) requiring a comprehensive water supply planning process. For more on this history, please see the November 2005 *Water Central*, p. 1.

sewer overflows during storms. The HRSD executive director estimated that the work would cost $100 million and take 15 years. (*Virginian-Pilot*, 8/7/07)

••On September 12, a 13-hour, **400,000-gallon sewage spill** from an accidentally ruptured pipe occurred in **York County**, leading to a shellfishing ban on the Poquoson River. (*Daily Press*, 9/25/07)

•Regulations considered by Gloucester County in August would break new ground in **oversight of alternative onsite sewage systems** (alternatives to traditional septic tank/drainfield systems). Gloucester would be the first locality to require new systems to reduce nitrogen releases by 50 percent and system owners to participate in an Internet-based monitoring system. (*Daily Press*, 7/16/07)

•In July, **Philip Morris USA** announced plans to construct 48 acres of **wetlands and ponds to absorb nutrients** from wastewater at the Park 500 tobacco plant in Chester. The $6-million system would divert 1.8 million gallons of treated wastewater through the wetland/pond complex, reducing nitrogen by an estimated 13 percent and phosphorus by 34 percent. (*Virginian-Pilot*, 7/18/07)

•In the world of wastewater, what does **Chesterfield County, Virginia**, have in common with **Charles County, Maryland**? In both counties, local officials are working with power companies to s**end treated wastewater to power plants for cooling and other operations**. Using the wastewater this way would reduce the need for surface or groundwater use by the power plants as well as discharges from wastewater-treatment plants. (*Washington Post*, 8/19/07; *Richmond Times-Dispatch*, 8/25/07)

•In Rockingham County in August, the Town of Broadway was the highest bidder for the **SIL Clean Water wastewater-treatment plant**, the subject of a lawsuit filed in October 2006 by the Virginia attorney general over alleged violations of the plant's nitrogen and phosphorus discharge allowances. The plant went to auction after SIL filed for bankruptcy early in 2007. Broadway will pay $2.4 million for the plant, which SIL parent company Shaeffer International (based in Illinois) bought for $11 million in 2001. By March 15, 2008, Broadway must submit to DEQ a plan for correcting the plant's problems and meeting permit requirements. (*Harrisonburg Daily News-Record*, 8/27 and 9/21/07. For a previous *Water Central* item: January 2007, p. 18.)

Fish Kills, Spills, Monitoring, and Other Water-quality Items

•In mid-June, the **Shenandoah River Fish Kill** Task Force reported that large kills seen in the spring on the Shenandoah, along with smaller kills in the James River basin (a new development in 2007), had apparently abated. The Shenandoah developments match a pattern seen in that basin since 2004. In July the Task Force reported that it planned to analyze waste from poultry and cattle and compare the results to analyses of fish tissue, water, and sediments from the Shenandoah; the results could provide direction for further testing. The Task Force is investigating many possible causes for the kills, including bacteria, viruses, agricultural runoff, sediments, temperature, and others. (*Northern Virginia Daily*, 7/12/07; *Harrisonburg Daily News-Record*, 8/20/07; Task Force's June 15 report, available at www.deq.virginia.gov/info/srfishkill.html.)

•A fish kill resulting from **a fungicide spill at a Montgomery County country club** in August teaches the importance of knowing where drain pipes go. Over 10,300 fish—including 169 Roanoke Logperch, a federal and state endangered species—were killed after the fungicide chlorothalonil spilled during mixing, was improperly washed from the concrete mixing area, and flowed through a drain pipe leading directly to the river. Among other post-spill actions, the drain pipe was sealed. (*Roanoke Times*, 8/17/07)

•In August, the DEQ reported that fish samples from the **Staunton River** (a section of the Roanoke River) showed high **mercury** levels. On August 31, the Virginia Department of Health (VDH) issued a mercury fish-consumption advisory for the Staunton River; a PCB (polychlorinated biphenyls) advisory has been in place on the Staunton since 1999. The August advisory also included **new or modified mercury and PCB advisories** for Mott Run Reservoir and Chandlers Mill Pond in the Rappahannock River basin, the Nottoway River, the Blackwater River, Kerr Reservoir, Dan River, and Lake Anna. (*Brookneal Union Star*, 8/14/07; VDH press release, 8/31/07. Information on VDH fish-consumption advisories is available online at www.vdh.virginia.gov/epidemiology/publichealthtoxicology/advisories/.)

•*Karlodinium* and *Cochlodinium* were two types of **algae causing blooms** in Virginia in Summer 2007. The Virginia DEQ reported that blooms of *Karlodinium*, which can produce toxins, were associated with fish kills in various parts of the **Potomac River** basin in June and July, including a July kill of about 300,000 fish in Westmoreland County's Mattox Creek. Meanwhile, a bloom of a species of *Cochlodinium* in August on the **Elizabeth and Lafayette rivers** (in Chesapeake, Norfolk, and Portsmouth) created a reddish-brown water color known as a "**mahogany tide**"; as of August 30, no fish kills had been associated with that bloom. (Va. DEQ reports 8/21 and 8/30/07, at www.deq.virginia.gov/info/Potomacalgalbloom.html and www.deq.virginia.gov/info/elizabethalgalbloom.html.)

Including the kills noted above, some **45 fish kills due to algae or oxygen-deprived water** occurred in the Chesapeake Bay watershed from June to August, according to *Dead Zones, Algal Blooms, and Fish Kills in the Chesapeake Bay Region in 2007*, a September report from the Chesapeake Bay Foundation.

•In August, the Natural Resources Defense Council (NRDC) released its 2007 ***Guide to Water Quality at Vacation Beaches***, covering conditions in 2006. The report identifies beach closings, advisories, and pollution sources by state. In Virginia, one percent of monitoring samples exceeded bacterial standards,

compared to two percent in 2005 and to the nationwide rate of seven percent in 2006 and eight percent in 2005. Virginia posted beach advisories (at four beaches) on 40 days in 2006, compared to 42 days in 2005. The report is available online at www.nrdc.org/oceans. (*Richmond Times-Dispatch*, 8/8/07. For more on beach water quality monitoring in Virginia: "Beaches and Bacteria," Aug. 2004 *Water Central*, p. 10.)

•The Virginia Estuarine and Coastal Observing System (VECOS), operated by the Virginia Institute of Marine Science, is expanding its system of **"real-time" water monitoring stations**. Four stations are now in place in the York River. The stations record temperature, dissolved oxygen, wave height, and several other factors every 15 minutes and post the values online at http://chsd.vims.edu/realtime/. (VIMS Web site, www.vims.edu, 10/1/07)

Clean-up and Restoration Items

•**Fairfax County** and **Harrisonburg** might want to share notes about **stream-restoration projects**. In May, the Fairfax Board of Supervisors approved a $341,000 contract with a private firm for a project to reduce erosion and improve natural habitat along 1,200 feet of a tributary to Little Hunting Creek. Harrisonburg has received a $400,000 grant from the Virginia Aquatic Resources Trust Fund for restoring bends and pools, controlling erosion, and planting vegetation along 3,000 feet of Blacks Run and Seibert Creek. (www.examiner.com, 5/22/07; *Harrisonburg Daily News-Record*, 9/18/07)

•In June, officials in **Scott County** discovered over **500 hundred metal drums** containing oil, oil filters, water, and garbage at an abandoned oil-recycling business. A U.S. EPA official coordinated a month-long removal or the drums. The county and the Virginia DEQ still face the tasks of removing solid waste, cleaning up contaminated soil, determining charges against the property owner, and attempting to recoup costs. (*Bristol Herald-Courier*, 7/12/07)

•Here are four items from some **Virginia sites on the U.S. EPA's Superfund National Priorities List (NPL)**. (All Virginia sites are listed online at www.epa.gov/reg3hwmd/super/va.htm.)

••**Decades-old contamination from military operations** remains at four bases in southeastern Virginia: Langley Air Force Base, Fort Eustis, the Naval Weapons Station Yorktown, and Cheatham Annex. The Fort Eustis, Yorktown, and Cheatham facilities are among 114 sites nationwide where the military considers the risk of human exposure "not under control." At the Virginia facilities, some work has been done and work continues, but many problem areas remain. (*Daily Press*, 6/10/07)

••The U.S. EPA will provide **$10 million for clean-up work at the former Kim-Stan landfill** in Alleghany County. The money will fund a vegetated cap to contain leachate, currently being generated at an estimated rate of 16,000 to 75,000 gallons per day. The unlined landfill was closed by court order in 1990 for environmental violations and placed on the NPL in 1999. (*Roanoke Times*, 9/14/07)

••In September, the EPA proposed addition of the **Hidden Lane landfill in Loudoun County t**o the NPL. Since 1988, tests have indicated TCE (trichloroethylene, a cancer-causing substance) in wells in the Broad Run Farms community adjacent to the landfill; testing in 2005 found contamination in 24 of 69 wells tested. (*Leesburg Today*, 9/18/07)

••At the **former Avtex plant** in Front Royal (Warren County), added to the NPL in 1986, the EPA and former owner FMC Corporation are **removing several miles of sewer lines** that could contain contaminants. (*Northern Virginia Daily*, 9/25/07)

•In June, Virginia State Police Sgt. Michael Berry organized several **dive teams to remove trash from the James River** near Scottsville (Fluvanna County). (*Daily Progress*, 7/1/07)

•In August, work began to **remove most of the 177-year-old Woolen Mills dam** on the Rivanna River, giving American Shad and other anadromous fish access to upstream spawning areas. (*Daily Progress*, 8/14/07)

•In an item from outside of Virginia: Arizona State University researchers have designed a device that **uses algae to remove nitrogen and phosphorus** from contaminated groundwater and from various types of wastewater. The "multi-stage, continuous-flow photobioreactor" is shown at the right. (*Arizona Water Resource*, Sep.-Oct. 2006. Photo by Qiang Hu; courtesy of Arizona Water Resources Research Center.)

Other Chesapeake Bay Items

•May 2008 is the new expected date for the U.S. Army Corps of Engineers' environmental impact statement on the **possible introduction of non-native oysters**. (*Daily Press*, 8/3/07. For an introduction to the non-native oyster issue: Jan. 2005 *Water Central*, p. 8.)

•A September report from the EPA's Office of Inspector General found that "**new development [in the Bay watershed] is increasing nutrient and sediment loads**…faster than restoration efforts are reducing them," and that nutrient- and sediment-reduction goals for 2010 (from the Chesapeake 2000 Agreement) will not be met. One key finding is that while watershed population increased 8 percent in the 1990s, the extent of impervious surfaces (which increase runoff carrying nutrients and sediments) increased 41 percent. The report noted that "opportunities abound" for EPA to show localities ways to reduce nutrient and sediment impacts from developed lands. The report, *Development Growth Outpacing Progress in Watershed Efforts to Restore the Chesapeake Bay*, is available at www.epa.gov/oig/reports/2007/20070910-2007-P-00031.pdf.

•In Portsmouth on the Elizabeth River, a **new $450-million, 230-acre port terminal** opened September 7. The APM Terminals facility is predicted to increase by 50 percent the number of cargo containers handled annually in Hampton Roads. More port expansion is expected in the area, including a terminal planned to open on Craney Island in 2017. (*Virginian-Pilot*, 9/5/07)

•Each year, **improperly discarded fishing line** leads to the death of many birds, fish, and other aquatic animals in the Bay area. To help reduce this problem, Maryland's state parks have started a **fishing-line recycling system**. Modeling a Florida program, Maryland's Department of Natural Resources built 52 recycling tubes (like the one at right) from PVC materials and placed them at state parks. The collected line goes to a company that recycles it into fish-habitat structures for lakes and ponds. Information from the Florida Fish and Wildlife Conservation Commission about starting such a program is available online at http://fishinglinerecycling.org, or phone Florida Sea Grant at (352) 392-5870. (*Bay Weekly*, 9/20-9/26/07; photo courtesy of Florida Sea Grant.)

Notable Achievements

•In June, **Virginia Environmental Stewardship Awards**—co-sponsored by the Virginia Secretary of Natural Resources and the Virginia Petroleum Council—were given to David Jones of Martinsville for establishing the "Trout in the Classroom" program in schools, Wayne Kirkpatrick of Stuart for volunteer water-quality monitoring work, Jennifer Weatherly of Sterling for a storm-drain marking program, and the Fort Belvoir military housing project for energy efficiency and stormwater management. (Va. DEQ Press Release, 6/26/07)

•In July, **Virginia Citizens for Water Quality awards** for outstanding service in water-quality monitoring were given to Wes Jargowski of the Roanoke Valley, Tony Pane of the Va. Department of Conservation and Recreation, Loudoun Watershed Watch, the McClure River Restoration Project in Dickenson County, and the Neighborhood Ecological Stewardship Training Program in Fairfax County. (Va. CWQ Press Release, 7/24/07)

Water, Energy, and Climate Items

•In May, Va. Gov. Tim Kaine announced that Virginia would become the 34th state to join the **Climate Registry**, an agreement by states to measure and report emissions of three greenhouse gases—carbon dioxide, methane, and nitrous oxide—in a standardized, comparable way. (*Virginian-Pilot*, 5/23/07)

•In June, the **Virginia Coastal Energy Research Consortium** (created by the 2006 General Assembly and including seven state universities) awarded $1.5 million for four research projects: three on wind energy, and one to investigate growing algae on treated sewage then extracting algal oils to produce a biofuel. (*Virginian-Pilot*, 6/30/07)

•On September 14, the Virginia Supreme Court rejected procedural challenges to the **$65-million wind-energy project proposed for Highland County**, which would be Virginia's first major wind-energy facility. The decision returned the issue to the State Corporation Commission, where a hearing examiner has recommended approval if the project developer proposes an adequate plan to limit bird and bat deaths. (*Richmond Times-Dispatch*, 9/15/07)

•The **King George County landfill** is one of some 60 sites where Waste Management, Inc. (WMI) plans to add facilities to generate **electricity from landfill-generated methane**. According to WMI, the King George landfill could provide enough electricity for 10,000 homes. (*King George Journal Press*, 5/16/07; *Richmond Times-Dispatch*, 6/27/07)

•Not only landfills but also **livestock generate methane**, and some 200 projects nationwide are seeking to use methane from swine and cattle manure to generate electricity. The electricity amounts are not necessarily large, but the systems reduce release of methane and can help reduce the amount of manure-based nutrients reaching waterways. According to the U.S. EPA, one swine operation in Virginia has a methane recovery system. (*Greenwire*, www.eenews.net, 7/18/07; and *AgStar Digest*, Winter 2006, www.epa.gov/agstar/pdf/2006digest.pdf)

•**Poultry manure** also contains energy. Foster Agblevor in Virginia Tech's Biological Systems Engineering Department is studying how to generate a biofuel—rather than electricity—on a commercial scale from poultry manure. (*Virginian-Pilot*, 9/2/07)

•**Biodiesel**—diesel fuel produced from plant oils or animal fats plus an alcohol—is an old idea (it's been used for over 100 years) that's getting lots of new attention. Currently Virginia has several relatively small biodiesel refineries, but the one proposed in Chesapeake by California-based Smiling Earth Energy LLC would possibly be the world's largest. The proposed $532-million facility would use jatropha, a tropical plant, to generate 320 million gallons of biodiesel per year (only 250 million gallons were produced nationwide in 2006). By August, however, local support for the project was decreasing because of concerns about the developers' finances and about a drug conviction by one of the company's principals. The Chesapeake City Council was scheduled to consider the project in October. (*Richmond Times-Dispatch*, 5/26/07; *Virginian-Pilot*, 5/23 and 8/25/07)

•Chesapeake is also the proposed location for another large biofuel refinery, in this case producing **ethanol** as well as biodiesel. International Bio Energy Virginia LLC has proposed a $400-million plant with the capacity to produce over 200 million gallons of ethanol per year (by comparison, the capacity of most existing

U.S. ethanol plants is on the order of 60 to 100 million gallons per year). The proposed plant would use an estimated 1.5 million gallons of water per day, making it the city's largest water consumer and requiring an estimated $20 million in new water infrastructure. Potential benefits include an estimated 150 jobs and several million dollars annually in real estate tax revenues. Concerns have been raised over potential odors, noise, traffic, chemical accidents, fires, and air pollution. The plant would be within a mile of Portsmouth residences, and in August Portsmouth City Council voted its opposition to the project (Portsmouth has no official say in the matter, though). As of late September, Chesapeake city planners had recommended some 75 changes to the project, including producing only 108 million gallons of ethanol (at least in its first year), and the city planning commission had postponed its vote on the project. (*Virginian-Pilot*, 5/19, 5/23, 7/16, 7/22, 8/15, 9/8, and 9/23/07)

Final Words

•"Certainly by no stretch am I a genius…Persistence and overcoming personal obstacles—if I had to guess if there's one thing I might deserve it for, that would be it."—Mark Edwards, Virginia Tech professor of civil and environmental engineering, commenting on being selected as a MacArthur Foundation Fellow for 2007 and receiving a $500,000 award (often referred to as a "genius grant"). Dr. Edwards was recognized for his work on drinking-water chemistry and toxicity in large American cities. (*Roanoke Times*, 9/26/07; MacArthur Foundation Web site, www.macfound.org, 10/2/07)

• "It didn't dawn on me that I could possibly be of any use…but I did find out in the White House that one individual can make a difference. That is a mighty fine place to make a difference."—Claudia Taylor (Lady Bird) Johnson, the former first lady, who died July 11, 2007 (the quote is from 1987). (*Austin American-Statesman*, 7/12/07)

Special News Item: Landmark Groundwater Rights Ruling in Virginia

By Jesse Richardson

Jesse Richardson is an associate professor in the Virginia Tech Department of Urban Affairs and Planning.

In December 2006, the Circuit Court of Louisa County, Virginia, decided an important groundwater case that demonstrated the long-standing dispute over what system of groundwater rights is in effect in Virginia.

In *Historic Green Springs, et al. v. Virginia Western Land Company, LLC, et al.,* the plaintiffs—landowners within an historic district in Louisa County—sought an injunction to stop the Louisa County Water Authority from operating three wells. The lawsuit alleged that pumping from these wells would interfere with the plaintiffs' groundwater. In addition, the landowners asked the court to clarify groundwater rights in Virginia. (Note that some zoning issues were also at issue.)

The Virginia Supreme Court has not ruled on groundwater rights in Virginia. Prior lower court rulings indicate that either the **English Rule** or the **American Rule** may apply in Virginia. The Water Authority argued that the English Rule, or Absolute Dominion Rule, should apply. This rule—also called the "law of the biggest pump" by some legal pundits—provides that a landowner may pump as much groundwater as he wishes. As long as the pumping is not malicious, the landowner is not liable for injury to other landowners (such as by drying up of wells).

The plaintiffs, on the other hand, argued that the American Rule applies in Virginia. Also known as the Reasonable Use Rule, this doctrine provides that a landowner is allowed reasonable use of groundwater beneath their property in view of the similar rights of others. This rule prohibits "lift"—that is, withdrawing groundwater and removing it to a different location, such as in public water supply. But a plaintiff must show *injury* (like a dry well) to file a successful lawsuit: If a landowner "lifts" the water and no injury occurs, no lawsuit may be maintained. In other words (to use a basketball analogy), "no harm, no foul."

The Louisa circuit court judge made two significant rulings. First, the judge held that groundwater rights are property rights. As a property right, groundwater rights receive constitutional and other protections. If a landowner can show unlawful interference with this right, the court may order that the offender cease the pumping activity. Second, the judge agreed with the plaintiffs that the American Rule applies in Virginia. This ruling augments two other trial court rulings of the same vein. Although no certainty exists until the Virginia Supreme Court rules, a growing unanimity exists that the American Rule will apply.

Unfortunately for the plaintiffs in this case, they were unable to show damages from the pumping. Therefore, the Water Authority may continue the activity.

Because the Water Authority vigorously argued for the English Rule, some observers thought the Authority would appeal the judge's ruling applying the American Rule in Virginia. An appeal would give the Virginia Supreme Court an opportunity to settle the question of which groundwater rule applies in Virginia. As of September 2007, however, no appeal had been filed, so apparently Virginia's system of groundwater rights will stay unsettled for some time to come.

[*Ed. note:* For a previous *Water Central* item by Mr. Richardson on groundwater law, please see the December 2002 issue, p. 20.]

THE COMMONWEALTH'S WATER—ISSUES ON THE STATE WATER AGENDA

This section (previously the "State Meeting Review" in the Notices section of *Water Central*) lists water issues under current consideration (study or regulation) by state boards, commissions, or agencies in Virginia. The first part identifies areas undergoing current Total Maximum Daily Load (TMDL) processes. The second part covers other water-related topics currently being considered. The final part gives schedule and contact information for key water-related boards and commissions. Information in this issue is based on public meetings listed **between May 1 and September 24, 2007**, on the **Virginia Regulatory Town Hall** Web site, at www.townhall.state.va.us. The Town Hall site posts agendas of upcoming meetings and minutes of past meetings held by Virginia's boards, commissions, and departments. Unless otherwise noted, all contact people listed in this section are Virginia state employees. To find the e-mail address any state employee, go online to www.employees.state.va.us/directory-search.cfm. You can also request state employee phone numbers by calling (800) 422-2319.

Ongoing Total Maximum Daily Load (TMDL) Processes

Under the federal Clean Water, when a water body fails (with a certain frequency) to meet state water-quality standards, the water is to be designated as "impaired," requiring development of a total maximum daily load (TMDL). A TMDL *study* identifies the pollutant source(s) causing the impairment and determines how much of the pollutant(s) the water can receive (the "load") and still meet standards. A TMDL *implementation plan* (required by Virginia law) maps a process for reducing the pollutant load to the TMDL level. Many Virginia TMDLs are underway, each involving many public meetings. Information on the status of all TMDLs in Virginia is available online at www.deq.state.va.us/tmdl/.

Location	Water(s) & Impairment	Larger Watershed(s)	Contact
Accomack County	Shellfish waters in Assawoman, Little Mosquito, and Parker creeks for bacteria	Coastal bays	Jennifer Howell
Accomack County	Shellfish waters in Bagwell Creek, Chesconessex Creek. Deep Creek, Folly Creek, Hunting Creek, Swans Gut, and Greenbackville Harbor for bacteria	Most to Chesapeake Bay; Folly Creek to Coastal bays	Chester Bigelow
Accomack and Northampton counties	Messongo Creek (Accomack) and Hungars Creek (Northampton) for bacteria	Chesapeake Bay	Jennifer Howell
Albemarle and Buckingham counties	James River tributaries	James River	Robert Brent
Amelia and Nottoway counties	Deep Creek, Flat Creek, Nibbs Creek, and West Creek for bacteria	Appomattox River/James River	Chris French
Amherst, Bedford, and Campbell counties and City of Lynchburg	James River, Blackwater Creek Burton Creek, Fishing Creek, Ivy Creek, Judith Creek, and Tomahawk Creek for bacteria	Chesapeake Bay	Amanda Gray
Augusta County	Long Glade Run, Mossy Creek, and Naked Creek for bacteria	South River/ Shenandoah River	Tara Sieber
Augusta and Rockbridge counties	Hays Creek, Moffatts Creek, Otts Creek, and Walker Creek for bacteria	James River	Robert Brent
Buchanan County	Knox Creek for bacteria and aquatic life impairment and Pawpaw Creek for aquatic life impairment	Levisa Fork/Big Sandy River	Shelley Williams
Caroline, King George, Spotsylvania, and Stafford counties and City of Fredericksburg	Tidal freshwater portions of Rappahannock River for bacteria	Chesapeake Bay	Katie Conaway

Location	Water(s) & Impairment	Larger Watershed(s)	Contact
Dickenson, Russell, and Wise counties	Lick Creek for bacteria and benthic impairment	Clinch River	Shelley Williams
Essex County	Hoskins Creek and tributaries for bacteria	Rappahannock River	Chris French
Fairfax County and City of Fairfax	Accotink Creek and Difficult Run for bacteria and aquatic-life impairment	Potomac River	Katie Conaway
Frederick County	Hogue Creek for bacteria	Potomac River (confluence in West Virginia)	Robert Brent
Gloucester County	Shellfish waters for bacteria	York River	Chester Bigelow
Halifax and Pittsylvania counties	Banister River watershed for bacteria	Dan River/Roanoke River	Amanda Gray
Halifax and Pittsylvania counties	Dan River and several tributaries for bacteria	Roanoke River	Amanda Gray
Henry and Patrick counties and City of Martinsville	North Fork and South Fork of Mayo River for bacteria; Smith River for bacteria and aquatic-life impairment	Dan River/Roanoke River	Mary Dail
Isle of Wight County	Jones Creek and Pagan River for bacteria	James River	Jennifer Howell
James City County	Mill Creek and Powhatan Creek watersheds for bacteria	James River	Jennifer Howell
Lancaster County	12 shellfish propagation waters for bacteria	Rappahannock River	Chester Bigelow
Lee County	Straight Creek and tributaries for bacteria	Powell River/Tennessee River	Shelley D. Williams
Mathews County	East River and Put-in Creek shellfish waters for bacteria	Mobjack Bay	Chester Bigelow
Mathews County	Billups Creek, David Creek, Doctors Creek, Edwards Creek, Horn Harbor, Morris Creek, Queens Creek, and Stutts Creek shellfish areas for bacteria	Chesapeake Bay	Chester Bigelow
City of Newport News	Baptist Run, Deep Creek, Skiffes Creek, Warwick River, and James River for bacteria	James River	Jennifer Howell
Northumberland County	Cockrell Creek for bacteria	Wicomico River	Chris French
Page County	Hawksbill Creek and Mill Creek for bacteria	Shenandoah River	Nesha Mizel
Prince William County	Neabsco Creek for bacteria	Potomac River	Katie Conaway
City of Suffolk	Lower Nansemond River shellfish waters for bacteria	Chesapeake Bay	Jennifer Howell
Tazewell County	Indian Creek for bacteria	Clinch River	Shelley Williams
Tazewell County	Upper Clinch River for sediment	Tennessee River	Theresa Carter Buckles
City of Virginia Beach	Middle West Neck Creek, Milldam Creek, and Nawney Creek, all for bacteria	Back Bay and North Landing River	Jennifer Howell
York County	Felgates, King, and Queen creeks shellfish waters for bacteria and dissolved-oxygen impairment	York River	Jennifer Howell
Several Virginia localities plus parts of Maryland and D.C.	Tidal Potomac River and tributaries for PCBs (polychlorinated biphenyls)	Chesapeake Bay	Mark Richards

Other Topics Under Current Statewide Consideration

Items are listed alphabetically by topic, followed by the agency or group coordinating state study or action and then a contact name. Minutes of meetings noted are available at the Virginia Regulatory Town Hall Web site, www.townhall.state.va.us, Agency Abbreviations: DCR = Dept. Conservation and Recreation; DEQ = Dept. Environmental Quality; DGIF = Dept. Game and Inland Fisheries; DMME = Dept. Mines, Minerals and Energy; SWCB = State Water Control Board; VDH = Department of Health.

Biosolids—A SWCB panel is studying biosolids in Virginia. The panel's first meeting was Sep. 18. More information: Jeff Corbin.
Invasive Species—DCR's working group met May 15 and Jul. 25. More information: David Dowling.
Mined Land Reclamation Permitting—DMME's work group met on Jun. 28. More information: Les Vincent.
Natural Preserve System—Conservation and Recreation Board's subcommittee met Jun. 11 and Jul. 26. More information: David Dowling.
Recycling—DEQ's Recycling Markets Development Council met Jun. 14. More information: Thomas Smith, Prince William County Public Works, tsmith@pwcgov.org or (703) 792-6252.
Sewage Handling and Disposal Regulations—VDH's advisory committee met on May 18. More information: Donald Alexander.
Small Municipal Separate Storm Sewer System (MS4) General Permit Regulation—DCR's technical advisory committee met Jun. 19, Jul. 26 and Aug. 22. More information: David Dowling.
Solid Waste Management Regulation Amendment 5, including provisions regarding protection of water resources—A DEQ/Waste Management Board public hearing was held Aug. 13. More information: Allen Brockman.
(Possible) State Park along Mayo River—DCR is studying the feasibility of establishing a new state park along the Mayo River in Henry County. More information: John Davy.
Stormwater Best Management Practices—DCR's Stormwater BMP Clearinghouse Committee met May 30, Jun. 21, and Sep. 11. More information: David Dowling.
Stormwater Management Regulations—DCR's technical advisory committee met May 22, Jun. 14, Jun. 26, Jun. 29, and Aug. 21. More information: David Dowling.
Water-quality standards triennial review—SWCB advisory committee met May 9. More information: Elleanore Daub.
Wastewater discharges from water-treatment plants (proposed general permit)—SWCB advisory committee met May 23. More information: George Cosby.
Water reclamation and reuse regulation (9 VAC 25-740)—SWCB held public hearings on this proposed regulation on Sep. 17, 21, and 24. More information: Valerie Rourke.
Underground Storage Tank Technical Standards and Corrective Action Requirements Regulation (9 VAC 25-580)—The SWCB is considering whether to amend this regulation. More information: Russell P. Ellison.

Regular Meetings of Statewide Boards and Commissions

Chesapeake Bay Local Assistance Board—meets March, June, September, and December. More information: (800) CHESBAY; www.cblad.state.va.us.
Game and Inland Fisheries Board—meets bimonthly. More information: www.dgif.virginia.gov.
Groundwater Protection Steering Committee—meets third Tuesday of odd-numbered months. More information: www.deq.virginia.gov/gwpsc/.
Land Conservation Foundation—meets about three times per year. More information: Dept. of Conservation and Recreation (DCR), (804) 786-3218; www.dcr.virginia.gov/virginia_land_conservation_foundation/index.shtml.
Licensing and Regulation Boards for engineers, soil scientists, waterworks and wastewater works operators, and wetland delineators, under the Dept. of Professional and Occupational Regulation, (804) 367-8500, TDD (804) 367-9753; www.dpor.virginia.gov/dporweb/boards.cfm.
Marine Resources Commission—meets monthly. More information: (757) 247-2200, TDD (757) 247-2292; www.mrc.state.va.us.
Soil and Water Conservation Board—meets bimonthly. More information: DCR, (804) 786-1712; www.dcr.virginia.gov/soil_&_water/vs&wcb.shtml.
State Water Control Board—meets March, June, September, and December. More information: Dept. of Environmental Quality (DEQ), (800) 592-5482; www.deq.virginia.gov/cboards/homepage.html#water.
Waste Management Board—meets about three times per year. More information: DEQ, (800) 592-5482; www.deq.virginia.gov/cboards/homepage.html#waste.

N O T I C E S

If you would like to receive a weekly e-mail notification about *upcoming meetings, conferences, and other events related to water quality*, you may do so by joining the Virginia Water Monitoring Council; contact Jane Walker at the Water Center at (540) 231-4159 or janewalk@vt.edu.

All Web sites listed in this section were functional as of September 24, 2007.

Editor's Note

The "State Meeting Review" that formerly opened "Notices" has been replaced by a new, separate section, "Virginia Government Water Issues Overview." The new section immediately precedes the Notices section.

Reports on Climate Change and Energy Developments

If you're trying to keep up with the water-resource implications of climate change and related developments in energy sources and uses, the following reports and resources may help:

●The U.S. Supreme Court's April 2, 2007, ruling in *Massachusetts v. EPA*, in which the Court held that the U.S. Environmental Protection Agency has authority under the Clean Air Act to regulate greenhouse gas emissions, is available online at www.supremecourtus.gov/opinions/06slipopinion.html.

●*Report from the Greenhouse Gas Working Group of the [Virginia] State Advisory Board on Air Pollution* (a January 2007 overview of issues regarding greenhouse gases and their emissions in Virginia and nationwide) is available online at www.deq.state.va.us/air/sabrpts.html.

●The U. S. Environmental Protection Agency's "U.S. Greenhouse Gas Inventory" Web page is www.epa.gov/climatechange/emissions/usgginventory.html.

●*Energy Market and Economic Impacts of a Proposal to Reduce Greenhouse Gas Intensity with a Cap and Trade System*, a January 2007 report by the U. S. Energy Information Administration (SR/OIAF/2007-01), is available online at http://tonto.eia.doe.gov/FTPROOT/service/sroiaf(2007)01.pdf; or phone (202) 586-8800.

●The Intergovernmental Panel on Climate Change (IPCC) is publishing four reports as part of its "Fourth Assessment Report—Climate Change 2007." Reports from three working groups—on the physical science of climate change, impacts, and mitigation—were issued in February, April, and May, respectively. A synthesis report is due in November. All are available online at www.ipcc.ch.

●*National Security and the Threat of Climate Change*, published in April 2007 by the CNA Corporation, is available online at http://securityandclimate.cna.org.

●The *Carbon Sequestration Atlas of the U.S. and Canada*, from the U. S. Department of Energy, is available online at www.netl.doe.gov/technologies/carbon_seq/refshelf/atlas/. ("Carbon sequestration" refers to the capture of carbon gas emissions from fossil fuel use, particularly in burning fossil fuels to generate electricity.)

●*Atlas of Climate Change: Mapping the Worlds Greatest Challenge* is available for sale from University of California Press, (800) 777-4726, www.ucpress.edu.

●*Biofuels and the Bay*, published in September 2007 by the Chesapeake Bay Commission, is available online at www.chesbay.state.va.us/recent.htm; or phone (410) 263-3420 to request a printed copy.

●*The Virginia Energy Plan*, a ten-year plan required by the 2006 General Assembly, was released in September 2007; available online at www.dmme.virginia.gov/vaenergyplan.shtml, or phone the Va. Department of Mines, Minerals and Energy at (804) 692-0007.

Water-quality Monitoring Training

Through December 2007, the Alliance for the Chesapeake Bay is providing free chemical/physical water-quality monitoring training to watershed and monitoring groups. For more information, phone Laurel Woodworth at (804) 775-0951.

Check that Estuary's Progress—STAT! BayStat, That Is

Announced in February 2007, BayStat is an initiative by Maryland Gov. Martin O'Malley to track the progress of Maryland's Chesapeake Bay restoration efforts. The BayStat Web site at www.baystat.maryland.gov has information on the status of Bay habitat and water quality (overall and by watersheds), sources of problems, current restoration efforts, and how citizens can get involved.

Have Expertise, Will Travel?

Do you have skills or materials to share (either as a volunteer of for compensation) in water, sanitation, or related areas in developing countries? Or, are you looking for such assistance? If so, help is available from a database being developed by the National Ground Water Association's Developing Countries Interest Group. The Web site for the database is http://info.ngwa.org/dcig/index.aspx.

The Next Decade for the USGS

In April 2007, the U. S. Geological Survey (USGS) published a strategy to guide its scientific investigations through 2017. Six "science directions" are identified, covering ecosystems, climate change, energy and minerals, hazards, wildlife, and water. *Facing Tomorrow's Challenges—U. S. Geological Survey Science in the Decade 2007-2017* is available online at http://pubs.usgs.gov/circ/2007/1309/index.html. To purchase a print copy, phone (toll-free) (888) ASK-USGS (request Circular 1309).

Upcoming Conferences and Workshops

(A regularly updated list of Virginia conferences and workshops is available at the Water Center's Web site, at www.vwrrc.vt.edu/VAConfQuickGuide.htm.)

Events In Virginia

Oct. 28-Nov. 2, 2007, Williamsburg: **26th Annual International Submerged Lands Management Conference.** Organized by the Virginia Marine Resources Commission. More information: Tony Watkinson, (757) 247-2255 or tony.watkinson@mrc.virginia.gov; Web site: www.submergedlands2007.com/index.html.

Oct. 30, 2007, Farmville: **Rain Barrel Workshop-Train the Trainer.** Organized by Clean Virginia Waterways, Virginia Water Monitoring Council, and Piedmont Soil and Water Conservation District. More information: cleanva@longwood.edu; Web site: www.longwood.edu/cleanva/rainbarrels.htm

Nov. 13-17, 2007, Virginia Beach: **North American Association for Environmental Education's Annual Conference**. More information: (202) 419-0412; Web site: www.naaee.org/conference.

Nov. 29, 2007, Abingdon: **Females Advancing the Sciences and Technology.** Organized by the Southwest Virginia Higher Education Center. More information: Peggy McCallum, (276) 619-4311 or pmccal5@vt.edu.

Dec. 6-7, Portsmouth: **Virginia Coastal Zone Management Partners Workshop.** Organized by the Virginia Coastal Zone Management Program (Virginia Department of Environmental Quality). More information: Virginia Witmer at (804) 698-4320 or Virginia.Witmer@deq.virginia.gov; Web site: www.deq.virginia.gov/coastal.

Mar. 9-11, 2008, Richmond: **Virginia Water Conference 2008.** Organized by the Virginia Lakes and Watersheds Association. Deadline to submit presentation abstracts is Nov. 15. More information: Stuart Stein, sstein@gky.com; Web site: www.vlwa.org.

Events Elsewhere

Nov. 28-30, 2007, Denver, Colo: **Groundwater Foundation Annual Conference.** More information: (800) 858-4844; Web site: www.groundwater.org

Dec. 4-7, 2007, Orlando, Fla.: **National Ground Water Association Expo and Annual Meeting.** More information: (800) 551-7379; Web site: www.ngwa.org/2007expo/index.aspx.

Jan. 16-18, 2008, Washington, D.C.: **Climate Change: Science and Solutions.** Organized by the National Council for Science and the Environment. More information: (202) 530-5810 or info@ncseonline.org; Web site: http://ncseonline.org.

Feb. 27-28, 2008, Gainesville, Fla.: **Sustainable Water Resources—Florida Challenges, Global Solutions.** Organized by the University of Florida Water Institute. More information: Lisette Staal, (352) 392-5893 x2116; Web site: www.treeo.ufl.edu/conferences/water.

Also Out There…

From the many water-related publications that arrive at the Water Center, here's a brief description of some recent detailed articles:

•**"Knocking Back Biological Invaders"**—This article and companion pieces discuss pathways, issues, and impacts of non-native, invasive aquatic species. *Coastal Heritage*, Spring 2007. South Carolina Sea Grant Consortium, Charleston, S.C.; (843) 727-2078 or annette.dunmeyer@scseagrant.org; available online at www.scseagrant.org/Sections/?cid=82.

•"**Bag It—Will Fewer Plastic Bags Make the World More Sustainable?**"—This article looks at the manufacture, use, costs, and benefits of plastic grocery bags, as Annapolis, Md., considers banning them, partly to reduce the number of bags reaching streams and the Bay. *Bay Weekly*, Vol. 15/Issue 37 (Sept. 13-19, 2007). Published in Annapolis, Md., phone (410) 626-9888; available online at www.bayweekly.com/archives/2007.html.

AT THE VIRGINIA WATER CENTER

To reach the Virginia Water Resources Research Center: phone (540) 231-5624; FAX (540) 231-6673; e-mail water@vt.edu; Web site www.vwrrc.vt.edu.

2007 Virginia / West Virginia Water Research Symposium
November 26-30, 2007
Blacksburg. Virginia

Please see the full-page notice on the following page. For online symposium information and registration, please visit http://www.vwrrc.vt.edu/symposium2007/default.html.

New Reports

The following new reports are available online at www.vwrrc.vt.edu/publications/recent.htm

- *Nutrients in Lakes and Reservoirs - A Literature Review for Use in Nutrient Criteria Development*, by J. L. Walker, T. Younos, and C. E. Zipper (SR34-2007).
- *Urban Stream Daylighting: Case Study Evaluations*, by T. Buchholz and T. Younos (SR35-2007).
- *Urban Stream Daylighting: Design Application to Stroubles Creek, Blacksburg, Virginia*, by T. Buchholz, D. Bork and T. Younos (SR36-2007).

Pathogen Symposium Video Online

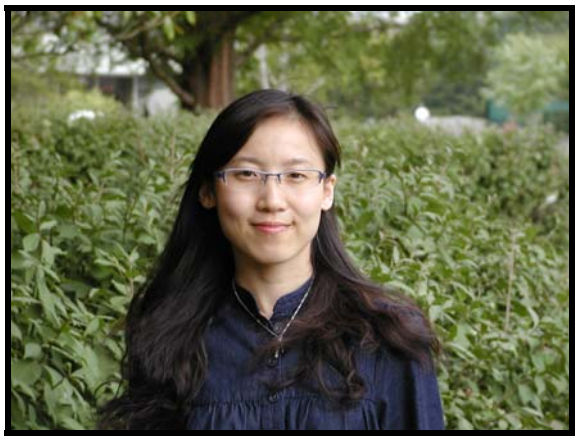
Video of the Water Center's November 2006 Pathogen Research Symposium is now available online at www.vwrrc.vt.edu/Proceedings.htm.

Bun venit la Water Center, Ana!

That's "Welcome to the Water Center, Ana!" in Romanian. Ana Constantinescu, a Romanian native, joined the Water Center staff in May 2007 as manager for public relations and marketing activities. Ms. Constantinescu has a bachelor's degree in Journalism from the University of Bucharest and a master's degree in Communications from Virginia Tech. Her professional background includes public relations and strategic communication planning at the Romanian branch of BBDO Worldwide, a U.S. advertising agency. Ms. Constantinescu also works for the Virginia Tech Center for Geospatial Information Technology and is a contributing author to "The Expansion Election" which focuses on the 2004 European Union parliamentary elections.

欢迎 (Welcome) to Yanling Jiang

Yanling Jiang from the Chinese Academy of Sciences in Beijing spent September 2007 at the Water Center as a visiting scientist. Ms. Jiang, hosted by Tamim Younos, studied watershed management and the TMDL program in Virginia along with watershed research at Virginia Tech.



2007 Virginia / West Virginia Water Research Symposium

"*Connecting Management to Aquatic Communities*"

Join us!
November 26-30, 2007
The Inn at Virginia Tech and Skelton Conference Center
Virginia Tech
Blacksburg, VA
Website: www.vwrrc.vt.edu/symposium2007

The **2007 Virginia / West Virginia Water Research Symposium** provides an opportunity to present and learn about recent water research relevant to Virginia and West Virginia.

Workshops [more information: http://www.vwrrc.vt.edu/symposium2007/workshops.html]

Five **workshops** have been scheduled:

- **Introduction to Fluvial Geomorphology** (Nov. 26-27) - Tess Wynn, Assistant Professor • W. Cully Hession, Associate Professor, *Virginia Tech*
- **An Overview of the TMDL Process** (Nov. 27) - Panel of experts moderated by David Gruber, President, *Biological Monitoring, Inc.*
- **Mixing Zones Analyses for TMDLs** (Nov. 27) - Wu-Seng (Winston) Lung, Professor, *University of Virginia*
- **Building Consensus for Revitalization of River, Land and Community** (Nov. 27) - Frank Dukes, Director, *Institute for Environmental Negotiation, University of Virginia* • Phoebe Crisman, Urbanist and Associate Professor, *University of Virginia*
- **Tools for Watershed Modeling and Assessment** (Nov. 30) - Jerald J. Fletcher, Director, *Natural Resource Analysis Center, West Virginia University*

Plenary session [more information: http://www.vwrrc.vt.edu/symposium2007/highlight.html]

Dr. Don J. Orth, Professor of Fisheries and Wildlife Sciences at Virginia Tech, will host the symposium's plenary session, **"Water for Wildlife: Emerging Issues in Virginia and West Virginia Waters."**

Dr. Orth will moderate a panel of experts from Virginia and West Virginia universities, state agencies and private companies. The panel will present research findings, case studies, and overviews of the issues that affect aquatic communities.

Oral presentations

More than **80 oral presentations** on a wide range of water quality and water supply issues such as research findings, technical innovations, regulations and guidelines, watershed management, monitoring, reporting, and a broad range of other water-related topics.

More information about the presentations, including abstracts, will be made available on the symposium's website, at www.vwrrc.vt.edu/symposium2007.

Registration information will be available soon online at:
www.vwrrc.vt.edu/symposium2007

For more information, please contact:

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[Ed. note: On-line readers, please note that the Web addresses on this page are *not* hyperlinked.]

Guide to *Water Central* Article Topics, June 1998—May 2007

The following two pages list topics in *Water Central* issues from June 1998 (the first issue) through May 2007 (issue #41). The list does not include items from the "In and Out of the News" or "Notices" sections of the newsletter. All issues of *Water Central* are available online at www.vwrrc.vt.edu; page numbers below refer to the *two*-column versions of each issue (a *one*-column version is also available online for issues since December 2001 [issue #19]). If you have questions or wish to request a paper copy of any issue, please phone (540) 231-5463or e-mail araflo@vt.edu.

Feature Articles

Bill Walker Tribute—May 2007, p. 3
Clean Water Act Jurisdiction (waters of the United States)—Jan. 2007, p. 1
Coastal Conditions—Aug. 2004, p. 8
Desalination—Jan. 2005, p. 1
Disaster Preparedness and Response—Aug.-Sep. 2001, p. 2
Drinking Water (including Safe Drinking Water Act and treatment issues)—Dec. 1998, p. 1; Feb. 1999, p. 1; Jan. 2001, p. 1
Environmental Laboratory Certification Program—Aug. 2005, p. 1
Flood Hazard Mitigation in Grundy, Va.—June 2006, p. 1
Groundwater—Oct. 2002, p. 1
Impaired Waters and TMDLs—Oct. 1998, p. 1; Oct. 1999, p. 1; Dec. 1999, p. 1; Dec. 2001, p. 1
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Market-based Water Quality Management—Aug. 2003, p. 2
Non-tidal Wetlands—Nov. 2000, p. 1
Nutrients—Jun. 2003, p. 2; Jan. 2004, p. 7
Oceans—Aug. 2004, p. 1 (report of Oceans Commission)
Off-shore Gas and Oil Exploration Reports—Feb. 2006, p. 14; Sep. 2006, p. 1
Rappahannock River Water Resources Planning—Feb. 2002, p. 1
Regional Water Authority (Roanoke area)—Aug. 2005, p. 7
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Virginia General Assembly Water-related Legislation: Annual Inventory and Perspectives–Jun. 1998, p. 3; Aug. 1998, p. 1; Apr. 1999, p. 1; Jun. 1999, p. 1; Apr. 2000, p. 1; Jun.-Aug. 2000, p. 2; Jun. 2001, p. 1; Apr.-June. 2002, p. 1; Mar. 2003, p. 1; Apr. 2004, p. 1; Apr. 2005, p. 1; Feb. 2006, p. 1; May 2007, p. 8
Virginia State Budget Related to Water—Apr. 2001, p. 1
Water Quality Overview by Virginia Secretary of Natural Resources—Nov. 2005, p. 9
Water Quality Reports—Dec. 2002, p. 1
Water Supply Policy and Planning—Jan. 2004, p. 2; Jan. 2004, p. 13 (Report of Water Supply Technical Advisory Committee); Nov. 2004, p. 1; Nov. 2005, pp. 1 and 4 (two articles)

Science Behind the News

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Bacteria—Aug. 1998, p. 5; Oct. 1999, p. 8; Aug. 2004, p. 10 (at beaches)
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Benthic Macroinvertebrates—Apr.-Jun. 2002, p. 11
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Sources of Information ("For the Record" Section)

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Teaching Resources

Virginia Water Research

Water Center Programs

Water Status Reports

As of the January 2007 issue, all three topics are covered in each issue.

Miscellaneous Short Items

Virginia Water Central

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Thank you!

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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?

5. Do the issues come too frequently, too seldom, or about right?

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