

**Virginia Water Resources Research Center  
Annual Technical Report  
FY 2014**

# Introduction

## *Introduction*

The Virginia Water Resources Research Center (VWRRC) was established at Virginia Tech in 1965 as a federally authorized program. In 1982, the Virginia General Assembly authorized the VWRRC as a state agency under the Code of Virginia (§23-135.7:8).

## *Mission*

The VWRRC provides research and educational opportunities to future water scientists; promotes research on practical solutions to water resources problems; and facilitates timely transfer of water resources information to policy- and decision-makers and the general public.

## *Mission Elements*

### *Research*

- Assisting university researchers in securing research support funds from public and private sources to address water resources issues.
- Assisting university researchers in initiating and executing water resources research.
- Conducting research on water resources issues appropriate for expertise of personnel affiliated with the VWRRC.

### *Education*

Advancing educational opportunities for students in water resources fields by

- Helping university researchers provide undergraduate and graduate research experiences in water resources.
- Coordinating an undergraduate minor and graduate certificate in water resources at Virginia Tech.

### *Outreach*

- Maintaining and frequently updating the VWRRC website and social media outlets to provide access to information on water resources science, engineering, and policy.
- Publishing *Virginia Water Central*, a newsletter featuring articles on water-related policy and law, summaries of water conditions in Virginia, and news briefs about water issues.
- Producing *Virginia Water Radio*, a weekly radio show and podcast featuring unique perspectives on water sounds and news and information involving Virginia's waters.
- Securing academic advisors to work in an advisory capacity with public and private sectors as requested.
- Initiating and participating in development and execution of conferences and symposia on Virginia, regional, and national water issues.

### *Program Administration*

Administrative oversight of the VWRRC is provided by the Dean of the College of Natural Resources and Environment. A Statewide Advisory Board appointed by the Governor advises the VWRRC director on state water research and information priorities. Because of its multiple legislative authorities and administrative

responsibilities, the VWRRC has a number of reporting responsibilities. In addition to the annual reporting requirements to the USGS and the National Institutes for Water Resources (NIWR), it presents an annual report to the Virginia Tech administration and the College of Natural Resources and Environment. Five-year reports and reviews are presented to the USGS and the State Council on Higher Education for Virginia (SCHEV).

### *National Affiliations*

The VWRRC is affiliated with NIWR and the Universities Council on Water Resources (UCOWR).

### ***Programs of the VWRRC***

#### *Introduction*

Programs are structured to meet strategic goals of the VWRRC and are consistent with the VWRRC mission as authorized by the U.S. Congress through the Water Resources Research Act of 1984 (Public Law 98-242), and Code of Virginia (§23-135.7:8). Programs in research and education are available to students and faculty at all Virginia colleges and universities. Outreach and collaborative programs include information transfer to policy/decision makers and citizens, and collaborative partnerships with state and federal agencies and other water-interest groups.

#### *A. Research Programs*

1. The VWRRC's statewide competitive grants program provides research funds to find practical solutions to water problems in Virginia and the region. The grant period begins July 1 and ends June 30 of the following year. The review criteria include (a) technical merit of the proposed project, (b) relevance to Virginia and the region, (c) relevance to contemporary water issues, and (d) ability to provide research opportunities for graduate and undergraduate students. A priority listing of water research needs for this competitive grants program is updated annually in consultation with the VWRRC State Advisory Board. These grants are designed to support research efforts with a high potential for expanded funding from additional sources.
2. The VWRRC applies for external grants and conducts in-house research.
3. The VWRRC facilitates research team building and interdisciplinary, multi-institute collaborative research.
4. The VWRRC facilitates research opportunities to other university faculty and external contractors through a partnership with federal agencies that provides targeted funding from the USGS.

#### *B. Educational Programs*

1. The VWRRC provides research opportunities to undergraduate students and assistantships to graduate students who participate in sponsored research. Also, numerous graduate and undergraduate students are supported through the VWRRC's competitive grants program in Virginia Tech academic departments, and at Virginia's other colleges and universities.
2. In 1999, the VWRRC established the William R. Walker Graduate Research Fellowship to honor the many contributions of Dr. William R. Walker, the VWRRC's first director. The annual monetary award is intended for individuals preparing for a professional career in water resources and is provided to at least one new graduate student at Virginia Tech each year. Details of the program can be found on the VWRRC website: [http://www.vwrrc.vt.edu/walker\\_fellowship.html](http://www.vwrrc.vt.edu/walker_fellowship.html)
3. The VWRRC coordinates the interdisciplinary Watershed Management Undergraduate Minor and a Watershed Management Graduate Certificate Program in collaboration with five colleges and ten departments at Virginia Tech. The VWRRC also developed and coordinates an interdisciplinary B.S.

degree program called Water: Resources, Policy, and Management in collaboration with the Department of Forest Resources and Environmental Conservation at Virginia Tech and nine other departments across five colleges.

4. The VWRRC supports and advises the Virginia Tech Chapter of the American Water Resources Association.

### *C. Outreach and Collaborative Programs*

1. The VWRRC provides administrative support for the Virginia Water Monitoring Council.
2. The VWRRC publishes research reports, symposia proceedings and citizen education booklets. It provides funding for the publication of outreach efforts.
3. The VWRRC publishes a newsletter, Virginia Water Central, several times each year. It features scientific and educational articles, legislative information, and water news of interest. The newsletter is available to the public at <http://www.vwrrc.vt.edu/watercentral.html> and electronic copies are provided via email to more than 600 people.
4. The VWRRC sponsors or co-sponsors symposia, workshops, and seminars addressing contemporary water resources issues.
5. The VWRRC facilitates peer reviews for state programs when requested.
6. The VWRRC website (<http://www.vwrrc.vt.edu/>) serves as a repository of the Center's publications, houses an academic expert database, provides updated news and information relevant to water resources, and manages website links for several collaborative partners, including the Virginia Water Monitoring Council, the Virginia Department of Environmental Quality Stormwater BMP Clearinghouse, and the Clinch Powell Clean Rivers Initiative. A news feed from the website allows users to subscribe to VWRRC updates via email.
7. The VWRRC has Twitter and Facebook sites and a Water News Grouper blog (<http://vawatercentralnewsgrouper.wordpress.com/>) to facilitate information exchange related to water resources and related news at the VWRRC.

## Research Program Introduction

The research program of the Virginia Water Resources Research Center (VWRRC) is supported through

- its annual appropriation from the Commonwealth of Virginia,
- external funding through grants and contracts, and
- a portion of overhead generated by external funding.

The VWRRC's 104B funds are not allocated to support research, but are used to support its outreach and information dissemination programs and to provide administrative support.

The VWRRC funded four new research projects through allocation of \$5,000 seed grants to graduate students at Virginia Tech in the Departments of Civil and Environmental Engineering, and Biological Systems Engineering, at the University of Virginia in the Department of Environmental Sciences, and at the Virginia Institute of Marine Science in the Department of Physical Sciences/Chemical Oceanography.

One research project that passed through USGS to the VWRRC was administered by the VWRRC and was active during the reporting period.

## Modernizing U.S. Army Corps of Engineers Planning and Regulatory Policies and Programs Phase VI

### Basic Information

<b>Title:</b>	Modernizing U.S. Army Corps of Engineers Planning and Regulatory Policies and Programs Phase VI
<b>Project Number:</b>	2013VA162S
<b>USGS Grant Number:</b>	G13AP00007
<b>Sponsoring Agency:</b>	COE/IWR
<b>Start Date:</b>	12/12/2012
<b>End Date:</b>	9/30/2014
<b>Funding Source:</b>	Supplemental
<b>Congressional District:</b>	9th
<b>Research Category:</b>	Social Sciences
<b>Focus Category:</b>	Economics, Law, Institutions, and Policy, Economics
<b>Descriptors:</b>	
<b>Principal Investigators:</b>	Stephen H. Schoenholtz, Leonard Shabman

### Publication

1. None

All work consisted of assisting others draft numerous issue papers and reports. None were completed and are still in draft status awaiting review at various levels, and are unavailable at this time. The draft documents were mainly on alternative financing and levee safety risk analysis.

## Information Transfer Program Introduction

The VWRRC supports timely dissemination of science-based information to policy- and decision-making entities and to citizens. The VWRRC used its USGS 104B funds to support expert personnel with responsibilities related to the VWRRC's outreach and collaborative programs. During the reporting period, the USGS 104B funds supported:

1. Preparation and electronic publication of the newsletter *Virginia Water Central*.
2. Partial administrative support for the Virginia Water Monitoring Council.
3. Partial support for production and management of the VWRRC webpage, VWRRC Facebook, VWRRC Twitter, and *Virginia Water Radio*.
4. Preparation and electronic publication of the *Virginia Water Central* Water News Grouper containing annotated links to articles and references relevant to Virginia's water resources. The Water News Grouper is accessed via the VWRRC webpage (<http://vawatercentralnewsgrouper.wordpress.com/>).

# Information Transfer

## Basic Information

<b>Title:</b>	Information Transfer
<b>Project Number:</b>	2014VA167B
<b>Start Date:</b>	3/1/2014
<b>End Date:</b>	2/28/2015
<b>Funding Source:</b>	104B
<b>Congressional District:</b>	VA-009
<b>Research Category:</b>	Not Applicable
<b>Focus Category:</b>	None, None, None
<b>Descriptors:</b>	None
<b>Principal Investigators:</b>	Stephen H. Schoenholtz

## Publications

1. Boehme, E.A., C.E. Zipper, S.H. Schoenholtz, D.J. Soucek, A.J. Timpano. Temporal dynamics of benthic macroinvertebrate communities and their response to elevated specific conductance in Appalachian Coalfield headwater streams. *Ecological Indicators*. In review.
2. Brown, K.R., K.J. McGuire, W.M. Aust, W.C. Hession, C.A. Dolloff, 2015. The effect of increasing gravel cover on forest roads for reduced sediment delivery to stream crossings, *Hydrological Processes*, 29(6): 1129–1140. DOI: 10.1002/hyp.10232.
3. Brown, K.R., K.J. McGuire, W.C. Hession, W.M. Aust, 2015. Can the Water Erosion Prediction Project (WEPP) model be used to evaluate BMP effectiveness from forest roads? *Journal of Forestry*. DOI: 10.5849/jof.14-101.
4. Chen, Y., S.D. Day, A.F. Wick, K.J. McGuire, 2014. Influence of urban land development and subsequent soil rehabilitation on soil aggregates, carbon, and hydraulic conductivity, *Science of The Total Environment*, 494-495: 329–336. 10.1016/j.scitotenv.2014.06.099. Christopher, S.F., S.H. Schoenholtz, J.E. Nettles. Water quantity implications of regional-scale switchgrass production in the southeastern U.S. *Biomass and Bioenergy*. In review.
5. Christopher, S.F., S.H. Schoenholtz, J.E. Nettles. Water quantity implications of regional-scale switchgrass production in the southeastern U.S. *Biomass and Bioenergy*. In review.
6. Evans, D.M., C.E. Zipper, E.T. Hester, and S.H. Schoenholtz, 2015. Hydrologic effects of surface coal mining in Appalachia (USA). *Journal of American Water Resources Association*. In press.
7. Evans, D.M., S.H. Schoenholtz, P.J. Wigington, Jr., S.M. Griffith, W.C. Floyd, 2014. Spatial and temporal patterns of dissolved nitrogen and phosphorus in surface waters of a multi-land use basin. *Environmental Monitoring & Assessment* 186(2):873-887. DOI: 10.1007/s10661-013-428-4.
8. Gannon, J.P., S.W. Bailey, K.J. McGuire, 2014. Organizing groundwater regimes and response thresholds by soils: A framework for understanding runoff generation in a headwater catchment, *Water Resources Research*, 50(11): 8403–8419. DOI: 10.1002/2014WR015498.
9. Gillin, C.P., S.W. Bailey, K.J. McGuire, J.P. Gannon, 2015. Mapping of hydro-pedologic spatial patterns in a steep headwater catchment, *Soil Science Society of America Journal*, 79(2): 440-453. DOI: 10.2136/sssaj2014.05.0189.
10. Gillin, C.P., S.W. Bailey, K.J. McGuire, S.P. Prisley, 2015. Evaluation of lidar-derived DEMs through terrain analysis and field comparison, *Photogrammetric Engineering & Remote Sensing*, 81(5): 387-396. DOI: 10.14358/PERS.81.5.387.
11. Little, C., J.G. Cuevas, A. Lara, M. Pinto, S.H. Schoenholtz, 2014. Buffer effects of streamside native

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- forests on water provision in watersheds dominated by exotic forest plantations. *Ecohydrology*. DOI: 10.1002/eco.1575.
12. Slesak, R.A., S.H. Schoenholtz, D.M. Evans, 2015. Hillslope erosion from high-risk sites following wildfire and salvage logging in southern Oregon, USA. *Forest Ecology and Management* 342: 1-7. DOI: 10.1016/j.foreco.2015.01.007.
  13. Tetzlaff, D., J. Buttle, S.K. Carey, K. McGuire, H. Laudon, C. Soulsby, 2015. Tracer-based assessment of flow paths, storage and runoff generation in northern catchments: a review, *Hydrological Processes*. DOI: 10.1002/hyp.10412.
  14. Timpano, A.J., S.H. Schoenholtz, D.J. Soucek, C.E. Zipper, 2015. Salinity as a limiting factor for biological condition in mining-influenced Central Appalachian headwater streams. *Journal of American Water Resources Association*. DOI: 10.1111/jawr.12247.
  15. Wexler, S.K., C.L. Goodale, K.J. McGuire, S.W. Bailey, P.M. Groffman, 2014. Isotopic signals of summer denitrification in a northern hardwood forested catchment, *Proceedings of the National Academy of Sciences*, 111(46): 16413–16418. DOI: 10.1073/pnas.1404321111.
  16. Garey, A.L., G.C. Garman, L.A. Smock, 2014. Development of Aquatic Life Use Assessment Protocols for Class VII Waters in Virginia: 2014 Report of the Academic Advisory Committee for Virginia Department of Environmental Quality. SR55-2014. Virginia Water Resources Research Center, Blacksburg, Va., 27 pp.
  17. Shabman, L.A., K. Stephenson, F. Nearhoof, 2014. Lessons from Florida's Experience Developing Numeric Nutrient Standards for Flowing Waters: 2014 Report of the Academic Advisory Committee for Virginia Department of Environmental Quality. SR54-2014. Virginia Water Resources Research Center, Blacksburg, Va., 14 pp.
  18. Virginia Water Central, November 2014 (No. 63), 40 pp.

## **Outreach and Information Transfer Accomplishments**

### **Newsletter *Virginia Water Central***

Email distribution to 620 recipients and announcement/availability on VWRRC Web site.

### **Notifications to *Virginia Water Monitoring Council List Servs***

The VWRRC provides administrative support to the Virginia Water Monitoring Council (VWMC). The VWMC was formed to promote and facilitate coordination of water monitoring programs throughout the Commonwealth of Virginia. Membership in the VWMC is open to any person or organization with responsibility for or interest in water monitoring in Virginia. Weekly water-related announcements via list serve are provided to 620 members (representing more than 250 different organizations) of the VWMC. Announcements include information about conferences, workshops, total maximum daily load (TMDL) public meetings in Virginia, job openings, newly published reports, information posted on Web sites, and other pertinent information.

1. Distributed 33 sets of general announcements as e-mail messages to the VWMC membership; each message contained at least a dozen informational announcements, including: calls for papers, conference announcements, job openings, training opportunities, recently published reports, etc.
2. Developed 12 sets of special announcements and distributed these as e-mail messages to the VWMC membership for a total of 197 special announcements; these announcements pertained to VWMC-sponsored activities, information about beach-monitoring and water recreation as specified in grants from the Virginia Department of Health (VDH), job opportunities, and upcoming conferences.
3. Collaborated with VDH to develop special beach monitoring announcements for distribution to the VWMC membership and beyond.
4. Weekly announcements are posted on the VWMC's website, [www.vwrcc.vt.edu/vwmc](http://www.vwrcc.vt.edu/vwmc).

## **VWRRC Website**

([www.vwrrc.vt.edu](http://www.vwrrc.vt.edu))

The VWRRC website is updated at least weekly and supports a Water News Grouper blog page, which is updated several times each week. During this reporting cycle, the webpage was completely redeveloped and now feature automated integration with a subscribeable email list and push notifications to Facebook and Twitter. The VWRRC website also serves as the portal for two other websites that the VWRRC manages:

1. Virginia Water Monitoring Council (<http://www.vwrrc.vt.edu/vwmc/default.asp>)
2. Virginia Department of Environmental Quality Stormwater BMP Clearinghouse (<http://www.vwrrc.vt.edu/swc/>)

VWRRC is on **Twitter** at <http://twitter.com/VaWaterCenter> and

**Facebook** (<http://www.facebook.com/pages/Blacksburg-VA/Virginia-Water-Resources-Research-Center/186479556264?v=wall>)

## **Virginia Water Radio**

([www.virginiawaterradio.org](http://www.virginiawaterradio.org))

The VWRRC produces and hosts a weekly 5-minute radio show featuring summaries of recent water news, upcoming water events, and water-related sounds or music. Broadcast on two campus stations: WECH at Emory & Henry College, WUVT at Virginia Tech, and WVRU at Radford University (new in 2014-15). During the past year the Water Radio Web site had about 5,220 views (about 14 per day) and 2,004 first-time visits.

A list of Virginia science and social studies standards of learning (SOLs) related to water was developed to connect SOLs to one or more related Water Radio episodes, and to compile a contact list of the science supervisors (or overall curriculum supervisors) in all of Virginia's public school divisions. In October 2014, a Montgomery County Schools science supervisor provided an assessment of Water Radio as a teaching tool, which will better position Water Radio for use in schools.

## **International Outreach Activities**

1. VWRRC Faculty serve as referees for numerous international journals.
2. The VWRRC hosted visiting international graduate students from the University of Padua, Italy.
3. Associate Director McGuire serves as Associate Editor of *Hydrological Processes*, an international journal, and *Journal of Environmental Quality*, which publishes international research.
4. Associate Director McGuire is Vice-chair for the international Gordon Research Conference on Catchment Science.
5. Director Schoenholtz serves as sub-editor of *Current Forestry Reports*, an international journal.
6. Director Schoenholtz met with water resources faculty at University of Canterbury, University of Auckland, Massey University, and Waikato University in New Zealand to discuss role of VWRRC.

# USGS Summer Intern Program

None.

<b>Student Support</b>					
<b>Category</b>	<b>Section 104 Base Grant</b>	<b>Section 104 NCGP Award</b>	<b>NIWR-USGS Internship</b>	<b>Supplemental Awards</b>	<b>Total</b>
<b>Undergraduate</b>	6	0	2	0	8
<b>Masters</b>	3	0	0	0	3
<b>Ph.D.</b>	6	0	0	0	6
<b>Post-Doc.</b>	0	0	0	0	0
<b>Total</b>	15	0	2	0	17

## Notable Awards and Achievements

New interdisciplinary B.S. degree in *Water: Resources, Policy, and Management* was approved by the Virginia Tech Board of Visitors and the State Council on Higher Education for Virginia for initial offering in August 2015. The VWRRC coordinated the four-year process of proposing and approval of this new degree. See <http://waterdegree.frec.vt.edu/> for more information.

VWRRC Director Stephen Schoenholtz was awarded a visiting senior research fellowship for January-February 2015 at Scion (New Zealand Forest Research Institute).