Virginia Water Resources Research Center
Annual Technical Report
FY 2005

Introduction

The Virginia Water Resources Research Center (VWRRC) at Virginia Tech is both a federally authorized program within the U.S. Department of the Interior under the U.S. Geological Survey and a state agency under the Code of Virginia. Activities and programs of the VWRRC are in accordance with the state legislative mandate and the VWRRC mission statement developed in 1995.

Mission

The mission of the VWRRC is to
1) Provide research and educational opportunities to future water scientists
2) Promote research on practical solutions to Virginia's water problems
3) Facilitate the timely transfer of water sciences information to policy and decision makers

Program Administration

Until June 2005, the Office of the Vice President for Research at Virginia Tech provided administrative oversight of the VWRRC. In July administrative oversight was delegated to the Dean of the College of Natural Resources.

The use of 104 funds is critical to the management of the VWRRC; 104 funds have been instrumental in increasing the commitment of Virginia Tech and the state to the programs of the VWRRC and are also offered (and serve) as evidence of a federal-state partnership. Overall, the VWRRC program management is based on the realities of state and federal budget prospects. The VWRRC does not completely rely on 104 base grant funding to support its programs. The VWRRC seeks project-specific external funding in collaboration with university faculty and plays a leadership role in facilitating funding from external sources.

National Affiliations

The VWRRC is affiliated with the National Institutes for Water Resources (NIWR). It is the lead member for Virginia Tech faculty on the Universities Council on Water Resources (UCOWR).

Programs of the VWRRC

The VWRRC programs in research and education serve faculty and students at all Virginia colleges and universities. The VWRRC outreach and collaborative programs are designed for policy/decision makers, local and state government agencies, and the public. Synopses of VWRRC research, education and outreach/collaborative programs are provided below.

1) Research Programs

The Research Programs of the VWRRC include:

Competitive grants (up to $20,000/year) supporting research that finds solutions to water problems in Virginia and the Mid-Atlantic region;

Competitive seed grants (up to $5,000) supporting background and preliminary research for developing large proposals for submission to external funding agencies;

Challenge grants that provide matching funds (up to $10,000) to initiate a new research partnership with a funding agency on a 1:2 (VWRRC:sponsor) basis.

In addition, the VWRRC facilitates developing interdisciplinary, multi-investigator research proposals. The VWRRC staff also prepare grant proposals to seek external funding for conducting in-house research.

2) Educational Programs

Competitive (statewide) educational programs of the VWRRC include:

The William R. Walker Graduate Research Fellowship ($2,500)

The VWRRC Undergraduate Summer Fellowships ($2,500 student stipend and $500 to faculty mentor)

Virginia Service Training for Environmental Progress, a university-community partnership (VA-STEP) summer internships ($2,500);

In addition, the VWRRC provides year-round undergraduate research opportunities to students who participate in in-house research under the supervision of VWRRC staff; coordinates the USGS internship program in Virginia; and coordinates the cross-college watershed minor program at Virginia Tech.

3) Outreach and Collaborative Programs

The VWRRC outreach and collaborative programs include:

Publication of the quarterly newsletter *Virginia Water Central*

Maintenance of the VWRRC website (www.vwrrc.vt.edu)

Facilitation of the academic expert database through the VWRRC website

Sponsorship of national, regional and statewide symposia, workshops and seminars

Publication of conference proceedings, special reports and other material (accessible on the VWRRC website)

Providing leadership to the interdisciplinary and multi-institute Academic Advisory Committee for the Virginia Department of Environmental Quality

Providing a home and administrative support to the Virginia Water Monitoring Council

Research Program

The research programs at the VWRRC can be categorized as the competitive awards program, the in-house research program and the facilitated grants program. The research program is supported through the VWRRC's Virginia state appropriation, other external funding, and overhead generated by external funding. The 104 federal funds are not allocated to support research but are used to support the outreach and information dissemination programs.

For the reporting period, funding for three facilitated grants flowed through USGS, and projects were managed by the VWRRC. These projects ("Multi-Institute Bacterial Source Tracking," "Modernizing US Army Corps of Engineers Policies and Programs" and "Nutrients in Lakes and Reservoirs - Literature Review") are described in the following section.

VWRRC Competitive Grants (July 1, 2004 - June 30, 2005)

Role of sediment as a source and reservoir of fecal coliforms with regard to shellfish TMDL in Virginia. Investigator: Howard Kator, Virginia Institute of Marine Science, The College of William and Mary

Development of soluble manganese sorptive contractors for enhancing potable water treatment practices. Investigators: William R. Knocke and John C. Little, Civil and Environmental Engineering, Virginia Tech

Industrial mercury pollution of the North Fork Holston River (Virginia): New non-invasive strategies for assessing anthropogenic deterioration of freshwater ecosystems. Investigator: Michal Kowalewski, GeoSciences, Virginia Tech

Fate and transport of reproductive hormones as environmental contaminants. Investigator: Janet Herman, Environmental Sciences, University of Virginia

VWRRC Competitive Grants (July 1, 2005 - June 30, 2006)

Fate of endocrine disrupting compounds in dairy manure during storage and treatment. Investigators: Katharine Knowlton (Dairy Science), Nancy Love (Civil and Environmental Engineering), Jacton Ogejo (Biological Systems Engineering), Virginia Tech

Effect of chloramines on lead leaching, bacterial growth and non-uniform copper corrosion. Investigator: Marc Edwards, Civil and Environmental Engineering, Virginia Tech

Spatial and temporal patterns of recharge in karst agricultural watersheds. Investigator: Madeline Schreiber, Geosciences, Virginia Tech

Biomarker responses in Eastern mosquitofish (*Gambusia holbrooki*) during life-cycle exposure to biosolids. Investigator: Peter van Veld, Virginia Institute of Marine Science, The College of William and Mary

VWRRC Seed Grants (July 1, 2004 - June 30, 2005)

Discharge measurements in streams using a large-scale particle image velocimetry prototype. Investigators: Saied Mostaghimi, Kevin Brannon, and Aaron Harpold, Biological Systems Engineering, Virginia Tech

Selection and testing of primers for rRNA analysis of the microbial populations in biofilms that harbor *Legionella pneumophila*. Investigators: Hue Shen and L. Brown, Virginia State University

Grant No. 02HQGR0111 Multi-Institute Bacterial Source Tracking Project

Basic Information

Title:	Grant No. 02HQGR0111 Multi-Institute Bacterial Source Tracking Project
Project Number:	2005VA107S
Start Date:	11/29/2002
End Date:	12/31/2005
Funding Source:	Supplemental
Congressional District:	Ninth
Research Category:	Water Quality
Focus Category:	Methods, Non Point Pollution, Surface Water
Descriptors:	bacteria, water monitoring, fecal contamination
Principal Investigators:	Charles Hagedorn

Publication

1. Stoeckel, D.M., M.V. Mathes, K.E. Hyer, C. Hagedorn, H. Kator, J. Lukasis, T.L. O'Brien, M. Samadpour, K.M. Strickler, and B.A. Wiggins. 2004. Comparison of Seven Protocols to Identify Fecal Contamination Sources using *Escherichia coli*: Berkeley County, West Virginia. Environmental Science & Technology 38:6109-6117.
2. McKinney, J.M. 2004. Identifying Sources of Fecal Pollution in the Appomattox River Watershed. M.S. Thesis, Department of Crop and Soil Environmental Sciences, Virginia Tech, Blacksburg, Virginia.

This project was completed in December, 2005. Bacterial Source Tracking (BST) is a process used to identify a source of fecal contamination. The purpose of this multi-institute project was to compare four methods of BST. Methods studied under this project were: carbon source utilization of bacterial source samples; pulsed-field gel electrophoresis analysis bacterial source samples; ribotyping of bacterial source samples; and antibiotic resistance analysis of bacterial source samples.

The evaluation and comparison of BST methods provide information that will help investigators across the U.S. choose appropriate techniques for determining sources of bacteria in natural waters. The project results advance field and analytical methods of bacteria source tracking methods.

Grant No. 02HQGR0122 Modernizing U.S. Army Corps of Engineers Policies and Program

Basic Information

Title:	Grant No. 02HQGR0122 Modernizing U.S. Army Corps of Engineers Policies and Program
Project Number:	2005VA108S
Start Date:	3/1/2002
End Date:	2/28/2007
Funding Source:	Supplemental
Congressional District:	Ninth
Research Category:	Engineering
Focus Category:	Law, Institutions, and Policy, None, None
Descriptors:	
Principal Investigators:	Tamim Younos

Publication

1. Holliday, W.C. 2006. Policy Studies: Supporting and Advancing Civil Works Missions and Programs. IWR Draft Report (March 2006). 28 pp.
2. Segal, D. 2005. Mitigation Options in the Lake Ontario - St. Lawrence River Study" (September 2005), 211 pp. Unpublished IWR Report).
3. Nyc, R. 2005. National Shoreline Management Study Environment: International Literature Review, 28 pp. (Unpublished IWR Report).
4. Holliday, W.C. 2004. Reconciliation of Federal Flood Hazard Mitigation Programs. U.S. Army Corps of Engineers. 56 pp. plus Appendix.
5. Holliday, W.C. 2003. Revitalization of Corps of Engineers Projects. IWR Report 03-SP-1. 60 pp.

U.S. Army Corps of Engineers policies, programs and budget have been under increased review by the public, U.S. Congress and the administration. Policy and planning for civil works projects are perceived as confusing and needing modernization to reflect the current state-of-the-art planning practices. The VWRRC coordinates policy reviews and applied research on planning for the following efforts:

- Produce background documents that can be used to develop a uniform rationale and procedure for monetary and non-monetary evaluation of ecosystem benefits and costs.
- Review the Corps' environmental project reports to identify types of data available, the level of detail and excerpt information related to economic evaluations of environmental features, benefits and costs of projects.
- Determine how the effects of project-induced sequestration or release of carbon might be accounted for in the process of project evaluation according to the planning framework established by the economic and environmental principles and guidelines for water-related land resources implementation studies.
- Review and update the 1971 National Shoreline Study Report.

Grant No. 06HQGR0021 Nutrients in Lakes and Reservoirs Literature Review

Basic Information

Title:	Grant No. 06HQGR0021 Nutrients in Lakes and Reservoirs Literature Review
Project Number:	2005VA109S
Start Date:	12/1/2005
End Date:	10/31/2006
Funding Source:	Supplemental
Congressional District:	Ninth
Research Category:	Water Quality
Focus Category:	Nitrate Contamination, Surface Water, Methods
Descriptors:	Lakes and reservoirs, criteria development, nutrient enrichment
Principal Investigators:	Tamim Younos

Publication

Nutrients entering lakes and reservoirs may cause nutrient over-enrichment of waters, sometimes with severe consequences to the water environment. Cultural eutrophication – caused by anthropogenic activities – is a major manifestation of nutrient pollution. It is a condition where excess amounts of dissolved nutrients in water contribute to the growth of undesirable levels of aquatic plants, especially algae. Nutrient over-enrichment can cause hypoxic conditions in lakes and reservoirs.

The goal of this study is to conduct a comprehensive review of literature pertinent to the dynamics of nutrients in lakes and reservoirs. The ultimate objective would be to provide nutrient criteria developers (states and territories) sufficient information that can be used to establish scientifically defensible nutrient criteria for lakes and reservoirs.

Information Transfer Program

The outreach programs of the VWRRC are supported through 104 funds. Outreach programs of the VWRRC include the following: The VWRRC website; the VWRRC newsletter; organizing symposia, seminars and workshops; publication and dissemination of the VWRRC supported research results and technical/educational reports prepared by the VWRRC staff; and establishing collaborative links with federal, state, and other groups to facilitate the transfer of science-based knowledge to policy- and decision-makers and other interest entities. An overview of the outreach and service programs is given below.

Website

The VWRRC website (www.vwrrc.vt.edu) serves as a window to VWRRC's programs and facilitates several significant functions to serve academia, state and other regulatory agencies, and interested citizens.

The website contains an inventory of VWRRC publications. New reports are posted immediately on the website. Old research reports are systematically being scanned and posted. There is a great demand for several hundred Water Center publications dating back to 1965. Access to these publications on the website will reduce printing and mailing costs and assure availability of the VWRRC's publications.

The website facilitates an expertise database that will be helpful to regulatory agencies and others seeking experts and to potential graduate students in water research areas seeking research advisors in Virginias colleges and universities.

The website provides linkage to federal and state agencies and professional organizations.

The website provides a home to other organizations and activities such as the Virginia Water Monitoring Council.

Newsletter

The publication *Virginia Water News*, a longtime newsletter of the VWRRC, was terminated in the early 1990s because of budget cuts. In June 1998, the VWRRC restored the publication of its newsletter under a new name, *Virginia Water Central*. The newsletter is published four to five times per year. The page length varies from 16 to 20 pages. All issues are posted on the Centers website: www.vwrrc.vt.edu/central/virginia.htm.

Virginia Water Central focuses on water-related issues in Virginia. The main elements of the newsletter (a given issue typically includes all elements) are a feature article on water policy or law; an article on scientific concepts related to current news; short summaries of recent water-related news items; notices of events, publications; a guide to finding information on water-related topics; guidance on the Virginia K-12 Standards of Learning; legislative information. As of June 2006, the newsletter mailing list included approximately 2,300 recipients of hard copies (free of charge) and 350 recipients of electronic copies. An e-mail notice is sent to subscribers once a new issue is posted.

Symposia, Workshops and Seminars

Each year the VWRRC organizes research symposia, workshops and seminars.

Academic Advisory Committee

In 1999, the VWRRC established a working relationship with the leadership and staff of the Virginia Department of Environmental Quality (DEQ). As a result, the VWRRC was asked to lead a statewide Academic Advisory Committee (AAC) that has provided scientific advice to the agency on its water quality improvement programs. This advisory role has been instrumental in gaining U.S. Environmental Protection Agency (EPA) approval of Virginias water monitoring programs and water quality data interpretation procedures. During the evaluation period, VWRRC staff provided leadership and coordinated the activities of the AAC for the sixth consecutive year and submitted reports and recommendations to DEQ. The work of the AAC has been used in discussions affecting changes in national water quality policy and programs administered by the EPA.

The Virginia Water Monitoring Council

In 1999, VWRRC staff coordinated discussions with personnel from the Virginia Department of Environmental Quality (DEQ) and the USGS Regional Office about the concept and realization of the Virginia Water Monitoring Council (VWMC), an organization to coordinate governmental and non-governmental water monitoring activities in Virginia. The VWRRC staff provided leadership and co-hosted several organizational meetings with the DEQ and USGS in Charlottesville and Richmond. As a result, the VWMC, representing many diverse interests in water monitoring in Virginia, was formed, the VWMC charter was developed, and a VWMC Steering Committee was established. At present, approximately 250 members belong to the VWMC and represent more than 100 different organizations. The VWRRC provides support for the VWMC through the assignment of a VWRRC staff member as the VWMC administrative assistant. Details about the VWMC are on the website hosted by the VWRRC: http://www.vwrrc.vt.edu/vwmc/

Information Dissemination

Basic Information

Title:	Information Dissemination
Project Number:	2003VA28B
Start Date:	3/1/2005
End Date:	2/28/2006
Funding Source:	104B
Congressional District:	Ninth
Research Category:	Not Applicable
Focus Category:	Education, None, None
Descriptors:	Outreach, collaborative programs
Principal Investigators:	Tamim Younos

Publication

1. Brown, B. L., A. D. Slaughter, and M. E. Schreiber. 2005. Controls on arsenic transport within agricultural watersheds. Applied Geochemistry 20(1): 123-133.
2. Brown, M.E., Kowalewski, M., Neves, R.J., Cherry, D.S., and Schreiber, M.E., 2005. Freshwater mussel shells as environmental chronicles: Geochemical and taphonomic signatures of mercury-related extirpations in the North Fork Holston River, Virginia: Environmental Science and Technology 39: 1455-1462.
3. Choi, J.W. and J. A. Smith. 2005. Geoenvironmental factors affecting organic vapor advection and diffusion fluxes from the unsaturated zone to the atmospheric under natural conditions. Environmental Engineering Science 22(1):95-108.
4. Younos, T. 2005. Emerging Threats to Drinking Water Quality. Renewable Resources Journal, Vol. 25, No. 2, p. 1-5.
5. Younos, T. 2005. Desalination: Supplementing Freshwater Supplies Approaches and Challenges. In: Desalination A Primer. Journal of Contemporary Water Research & Education. Issue No. 132, Universities Council on Water Resources (UCOWR), Southern Illinois University. P. 1-2.
6. Younos, T. and K. E. Tulou. 2005. Overview of Desalination Techniques. In: Desalination A Primer. Journal of Contemporary Water Research & Education. Issue No. 132, Universities Council on Water Resources (UCOWR), Southern Illinois University. P. 3-10.
7. Younos, T. 2005. Environmental Issues of Desalination. In: Desalination A Primer. Journal of Contemporary Water Research & Education. Issue No. 132, Universities Council on Water Resources (UCOWR), Southern Illinois University. P. 11-18.
8. Younos, T. 2005. Desalination: Permits and Regulatory Requirements. In: Desalination A Primer. Journal of Contemporary Water Research & Education. Issue No. 132, Universities Council on Water

Resources (UCOWR), Southern Illinois University. P. 19-26.
9. Younos, T. and K. E. Tulou. 2005. Desalination: Energy Needs, Consumption and Sources. In: Desalination A Primer. Journal of Contemporary Water Research & Education. Issue No. 132, Universities Council on Water Resources (UCOWR), Southern Illinois University. P. 27-38.
10. Younos, T. 2005. The Economics of Desalination. In: Desalination A Primer. Journal of Contemporary Water Research & Education. Issue No. 132, Universities Council on Water Resources (UCOWR), Southern Illinois University. P. 39-45.
11. Bogucki, M.A. 2005. Evaluation and testing of a vertical flux chamber to quantify gasoline hydrocarbon emissions from subsurface to the atmosphere under natural conditions. M.E. in Civil Engineering, University of Virginia.
12. Ji-Sun Yi. 2006. The biogeochemical processes influencing the environmental occurrence of 17â-estradiol in natural waters. M.S. in Environmental Sciences, University of Virginia.
13. Halich, G.S. 2005. Estimating Changes in Residential Water Demand for Voluntary and Mandatory Water-Use Restrictions Implemented during the 2002 Virginia Drought. Ph.D. Dissertation, Agricultural and Applied Economics, Virginia Tech.
14. Harpold, A.A. 2005. Discharge Measurements in Streams Using a Large-Scale Particle Image Velocimetry Prototype. M.S. in Biological Systems Engineering, Virginia Tech.
15. Makus, K. E. 2005. Carbon Tetrachloride Reduction by Nanoscale Magnetite. M.S. in Civil and Environmental Engineering, Virginia Tech.
16. Halich, G. and K. Stephenson. 2006. The effectiveness of drought management programs in reducing residential water-use in Virginia. VWRRC Special Report SR29-2006. 43 pp. Virginia Water Resources Research Center, Virginia Tech, Blacksburg, Virginia.
17. Walker, J., C. Zipper, L. Shabman, T. Younos. 2006. A literature review for use in nutrient criteria development for freshwater streams and rivers in Virginia. VWRRC Special Report SR28-2006. 101 pp. Virginia Water Resources Research Center, Virginia Tech, Blacksburg, Virginia.
18. Zipper, C., J. J. Ney, L. A. Smock, E.P. Smith, J.C. Little, K. Stephenson, P. A. Bukaveckas, E. R. Yagow, J. L. Walker, T. Younos. 2005. Issues related to freshwater nutrient criteria for lakes and reservoirs in Virginia. VWRRC Special Report SR27-2005. 98 pp. Virginia Water Resources Research Center, Virginia Tech, Blacksburg, Virginia.
19. Edwards, M., B. Marshall, Y. Zhang and Y. Lee. 2005. Unintended Consequences of Chloramine Hit Home. Proceedings of the WEF Disinfection Conference. Mesa, Arizona. Feb. 2005. 17 pages.
20. Triantafyllidou, S., Parks, J., and M. Edwards. Particulate Lead I n Drinking Water. To be presented at the AWWA Annual Conference and to be published in the Conference Proceedings. June 2006.
21. Younos, T. (Editor). 2005. Total Maximum Daily Load: Approaches and Challenges. PennWell Books, Tulsa, Oklahoma. 373 pp. (ISBN 1-59370-046-6).
22. Younos, T. (Issue Editor) 2006. Desalination A Primer. Journal of Contemporary Water Research & Education. Issue No. 132, Universities Council on Water Resources (UCOWR), Southern Illinois University. 52pp.
23. Younos, T. (Editor). 2005. Proceedings of Virginia Water Research Symposium: Balancing Water Law and Sciences, VWRRC P11-2005. Virginia Water Resources Research Center, Virginia Tech, Blacksburg, VA, 126 pp.
24. Mitchell, N., L. LeBarre and A. Raflo. 2006. A Practical Guide to Natural Resource Stewardship Programs in Virginia. VWRRC Educational Report ER-03-2006. 26 pp. Virginia Water Resources Research Center, Virginia Tech, Blacksburg, Virginia.
25. Raflo, A. and G. Wills. 2005. A Look Back over 35 Years of Water News in Virginia. VWRRC

Educational Report ER-02-2005. 16 pp. Virginia Water Resources Research Center, Virginia Tech, Blacksburg, Virginia.
26. Roth, R.A. 2005. Biological Integrity and Virginia's Rivers. VWRRC Educational Report ER-01-2005. 35 pp. Virginia Water Resources Research Center, Virginia Tech, Blacksburg, Virginia.
27. Virginia Water Central Feb 2006 (No. 37), 37pp. VWRRC, Virginia Tech, Blacksburg, Virginia.
28. Virginia Water Central Nov 2005 (No. 36), 35 pp. VWRRC, Virginia Tech, Blacksburg, Virginia.
29. Virginia Water Central Aug 2005 (No. 35), 35 pp. VWRRC, Virginia Tech, Blacksburg, Virginia.
30. Virginia Water Central Apr 2005 (No. 34), 28 pp. VWRRC, Virginia Tech, Blacksburg, Virginia.
31. Huntley, J.W., Romanek, C.S., Kowalewski, M., and Brown, M.E.2005. Variations in the Hg and N content of shells from freshwater mussels exposed to Hg contamination: Geological Society of America Abstracts with Programs, v. 37(7), p. 453.
32. Schwartz BF, Schreiber M. 2005. Using Time Domain Reflectometry and 2-D Differential ERT to Monitor Changes in Soil Moisture in Mantled Agricultural Sinkholes. Geological Society of America Abstracts with Programs. GSA Annual Meeting, Salt Lake City UT Oct 15-19, 2005.
33. Schwartz, BF, Schreiber ME, Orndorff, W. 2005. New applications of differential Electrical Resistivity Tomography and Time Domain Reflectometry to modeling infiltration and soil moisture in agricultural sinkholes, Tenth Multidisciplinary Conference on Sinkholes and the Engineering and Environmental Impacts of Karst, Austin TX, Sept 2005.
34. Press Coverage: "Adding mussel to environmental assessments", by B. Harder, Science News, v. 167, No. 9, p. 141, February 26, 2005
35. Press Coverage: Montgomery Countys Water Conversion Goes Smoothly http://www.eng.vt.edu/pdf/upload_files/RT%20water.pdf
36. Walker, J. and others. 2005. Water Related Regulations: Which Government Agency is Responsible. Virginia Water Monitoring Council. Virginia Tech, Blacksburg, VA. 16 pp.
37. Walker, J. 2005. Virginia Water Monitoring Council 2004-2005 Annual Report. Virginia Water Monitoring Council. Virginia Tech, Blacksburg, VA. 20 pp.

The VWRRC supports timely dissemination of science-based information to policy and decision-making bodies and citizens. The Center used its 104 funds to support skilled personnel with responsibilities related to the Center's outreach and collaborative programs.

104 funds supported

- preparation of the VWRRC newsletter *Virginia Water Central*
- Service Training for Environmental Progress (STEP) [an educational/outreach internship program]

104 funds provided

- partial support for organizing the annual Virginia Water Research Symposium
- partial administrative support for the Virginia Water Monitoring Council and
- partial support for the Center's multi-institute and interdisciplinary academic advisory committee for the Virginia Department of Environmental Quality

For details, see Information Dissemination Programs of the VWRRC.

Program Adminstration

Basic Information

Title:	Program Adminstration
Project Number:	2003VA30B
Start Date:	3/1/2005
End Date:	2/28/2006
Funding Source:	104B
Congressional District:	Ninth
Research Category:	Not Applicable
Focus Category:	None, None, None
Descriptors:	None
Principal Investigators:	Tamim Younos

Publication

Program Administration

The use of 104 funds is critical to the management of the VWRRC. 104 funds have been instrumental in increasing the university (Virginia Tech) and state commitments to the programs of the VWRRC. 104 funds are also offered and serve as evidence of federal-state partnership. This is important because less restrictive 104 funds can be used as match for fund raising efforts and marginally supplementing other funding sources. Overall, the VWRRC program management is based on the realities of state and federal budget prospects. The VWRRC does not completely rely on 104 base grant funding to support its programs. It seeks project specific external funding in collaboration with the university faculty and plays a leadership role in facilitating funding from external sources.

During the evaluation period, 104 funds were used to support skilled personnel with responsibility for activities related to program administration and the VWRRC website. These activities include:

- Updating, editing and maintaining the homepage
- Posting Daily Water News (on a daily basis, water news is extracted from the regional newspapers and posted on the VWRRC website)
- Scanning and posting of several hundred VWRRC publications dating back to 1965 (recent publications are created in PDF format and posted on the website)
- Developing a web-based inventory of all VWRRC publications

In addition, 104 funds were used to provide personnel support for the maintenance of hardware and software to ensure VWRRC website capabilities and computer capabilities are state of the art.

Student Support

Student Support					
Category	**Section 104 Base Grant**	**Section 104 NCGP Award**	**NIWR-USGS Internship**	**Supplemental Awards**	**Total**
Undergraduate	0	0	0	9	9
Masters	0	0	0	7	7
Ph.D.	0	0	0	3	3
Post-Doc.	0	0	0	1	1
Total	0	0	0	20	20

Notable Awards and Achievements

Tamim Younos, interim director, edited a book entitled "Total Maximum Daily Load: Approaches and Challenges" (373 pp)published by PennWell Books, Tulsa, Oklahoma.

Tamim Younos, interim director, served as president of the Universities Council on Water Resources (2005-2006).

Tamim Younos, interim director, was elected to the Board of Directors of the American Water Resources Association (AWRA).

The NIWR Board appointed Tamim Younos to represent academia on the National Water Monitoring Council.

Publications from Prior Projects

None