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EPA Completes Drinking Water Infrastructure Needs Survey and Assessment

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As a nation, we depend on a safe and secure supply of drinking water for our public health and our economic prosperity. Advances in water treatment throughout the last century have had a tremendous effect on improving public health in the United States. Local communities have made serious financial investments to provide household access to drinking water and sanitation. However, our nation's water infrastructure is aging and may need to be replaced or upgraded. Population growth and shifts may also create a need for new and improved infrastructure.

The U.S. Environmental Protection Agency's third *Drinking Water Infrastructure Needs Survey and Assessment*, issued in June 2005, reports that the nation's water systems need to invest $276.8 billion over the next 20 years in order to continue to provide clean, safe drinking water.

The assessment, conducted in 2003, covers costs for repairs and replacement of transmission pipes, storage, and source and treatment projects for public water systems eligible to receive funding from the Drinking Water State Revolving Fund (DWSRF) programs—approximately 53,000 community water systems and 21,400 not-for-profit noncommunity water systems, including schools and churches. The Safe Drinking Water Act (SDWA) requires that the EPA use the assessment results to allocate DWSRF funds.

The total need of $276.8 billion is significantly greater than the $167.4 and $165.5 billion needs reported in the 1995 and 1999 assessments, respectively. The EPA believes that the 2003 assessment more accurately captured needs that were underreported in earlier assessments, particularly costs to address critical rehabilitation and replacement of deteriorating infrastructure. This enormous national need reflects the challenges confronting water utilities as they deal with an infrastructure network that has aged considerably since systems were constructed, in many cases, 50 to 100 years ago.

The nation's largest water systems (serving more than 50,000 people) comprise 44%, or $123 billion, of the total need. However, medium and small systems also have substantial needs of $103 billion and $34.2 billion, respectively. Not-for-profit and noncommunity water systems have $3.4 billion in needs. Although the total small system need is modest compared to larger systems, the costs borne on a per-household basis by small systems are significantly higher than those of larger systems. Because they lack the economies of scale available to larger systems, small water systems face significant challenges to continue to provide safe drinking water to consumers.

Close to two-thirds, or $184 billion, of the needs are associated with infrastructure to deliver water-transmission pipes from a river to a treatment plant and distribution pipes from the treatment plant to customer homes. At $53.2 billion, projects to install treatment represent the second largest category of needs. The needs categories are closed out by $24.8 billion for storage projects, $12.8 billion for projects needed to secure safe sources of water, including installation and rehabilitation of drilled wells, and $2.3 billion in other needs.

Although all of the projects in the assessment promote public health objectives, approximately $45.1 billion (16.3%) of the total national need is directly attributable to specific SDWA regulations. Most of the needs, $35.2 billion, address existing SDWA regulations,

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Students' Corner

Emporia State University's On-Campus Hydrogeology Field Station: A Multiuse Facility for Teaching and Research

by Dr. Marcia Schulmeister, Emporia State University

College students enrolled in traditional hydrogeology programs often receive minimal exposure to the basic tools and skills used by government and industry practitioners. Emporia State University's (ESU) new environmental geoscience curriculum prepares students for applied hydrogeology careers by incorporating practical field experience, laboratory methods, computer modeling, and geographic information systems (GIS) analyses in hydrogeology and soil science courses. Traditional lecture and online courses are augmented with field-based exercises designed to introduce techniques commonly used in environmental site assessment and decision-making. ESU's small class sizes and integrated Physical Sciences Department enable courses that fulfill traditional curricular needs, while also including environmental information from the field.

The centerpiece of the new program is a floodplain-aquifer research site located on alluvial deposits of the Neosho River. In the heart of the ESU campus, the new research station is a five-minute walk from the Physical Sciences Department. Given the wide range of daily campus activities that take place at the site (athletic team training, marching band practice, and physical education activities), class exercises attract many curious onlookers—thus advertising the program to a broad, on-campus population of potential new majors.

Students enrolled in the hydrogeology series are introduced to data collection and site characterization through field- and lab-based exercises. In on-campus sections of the introductory course, students determine hydraulic gradients and flow directions in a network of monitoring wells. Homework problems in on-campus and online sections of the class are based on field tests performed in the second course of the sequence, Environmental Field Methods. In the methods course, geophysical, ground water and soil sampling, and GPS and transit methods are introduced through a series of field investigations. This course also provides exposure to monitoring well and multilevel sampler installation and direct-push methods through collaboration with industry partners. Data validation and the advantages and limitations of each method are scrutinized in biweekly field reports, which are prepared in professional report-writing format. Because these reports typically require presentation of spatial data, students apply skills obtained in GIS and remote-sensing courses taught as part of the existing earth science and geospatial analysis curriculum. Water samples obtained in the class are analyzed as class exercises in water analysis and analytical methods courses taught in the chemistry curriculum. In the final course of the sequence, Contaminant Hydrogeology, data obtained in the previous classes are used to construct site models using software commonly used by environmental practitioners. Assignment of model parameters and difficult aspects of sensitivity analysis are made tangible as students work with information they obtained and evaluated firsthand.

Learning and discovery that occur in this familiar setting seem to intrigue students and instill in them a sense of contribution to our ongoing research on alluvial aquifers. Given the novelty of this new facility, most of the data obtained in class exercises is original, allowing students to become the regional experts for the types of aquifers they will frequently encounter while working as hydrogeologists in the midwestern United States.

For information about ESU's on-campus or online hydrogeology curriculum, see *http://hydrogeology.emporia.edu* or contact Marcia Schulmeister by phone at (620) 341-5983 or by e-mail at *schulmem @emporia.edu*.

Students hold a screen point in place as probe rods are retracted during a direct-push slug testing exercise. Tools and direct-push unit were provided by Geoprobe Systems in Salina, Kansas.

Soil samples are obtained in Environmental Field Methods class using direct-push tools. Forty feet of continuous core were laid out in the foreground for description and sampling, while monitoring wells are installed in the background. Soil sampling and well drilling activities were made possible through collaboration with Larsen and Associates Inc. and Hydrologic Inc. The interaction with local professionals provides students with exposure to career options in hydrogeology.

Ground water sampling to the tune of "Fight on Emporia." Field chemical parameters are measured in monitoring wells (behind the vehicle) during an aquifer test. The nearby floodplain margin (tree-covered terrace in background), allows for evaluation of boundary effects during data interpretation.