

▶ DIRECT FROM CDC ENVIRONMENTAL HEALTH SERVICES



Samantha Dye, MSEH, REHS  
Gaston County Department of Health and Human Services



Max Zarate-Bermudez, MSc, MPH, PhD  
Centers for Disease Control and Prevention

## Benefits of Collaboration Between a County Health Department and a Local University in North Carolina

**Editor’s Note:** NEHA strives to provide up-to-date and relevant information on environmental health and to build partnerships in the profession. In pursuit of these goals, we feature this column on environmental health services from the Centers for Disease Control and Prevention (CDC) in every issue of the *Journal*.

In these columns, authors from CDC’s Water, Food, and Environmental Health Services Branch, as well as guest authors, will share insights and information about environmental health programs, trends, issues, and resources. The conclusions in these columns are those of the author(s) and do not necessarily represent the official position of CDC.

Samantha Dye has been with Gaston County Department of Health and Human Services for 19 years, where she has served as the assistant environmental health administrator since 2013. Max Zarate-Bermudez has been an environmental epidemiologist at CDC’s National Center for Environmental Health since 2008. He works with 7 of the 19 grantees in the Safe Water for Community Health Program.

Groundwater quality is of great importance in the U.S. to protect public health. In Gaston County, North Carolina, more than 8,000 households use private wells for their drinking water supplies. The county’s 220,000 inhabitants (U.S. Census Bureau, 2017a) face economic challenges with a median household income lower than the neighboring city of Charlotte (Figure 1) (U.S. Census Bureau, 2017b).

The Gaston County Department of Health and Human Services (GCDHHS) implements and enforces state rules and regulations on private wells. Its environmental health staff

issue permits for the construction of private wells, ensure well drillers are licensed, inspect wells before issuing certificates of completion, collect water samples for mandatory testing, and assure that wells are repaired and abandoned properly.

To address resource constraints, GCDHHS is working with partners to evaluate groundwater quality and protect human health. Through a funding opportunity from the Centers for Disease Control and Prevention’s (CDC) Safe Water for Community Health (Safe WATCH) Program, GCDHHS is working with the University of North Carolina at Charlotte (UNCC)

to enhance its ability to assess and manage groundwater issues (CDC, 2018). The goal is to help private well users reduce exposures to potential contaminants in their water.

### Challenges

#### Data on Existing Wells

Environmental health staff at GCDHHS have completed and filed paper forms with data on private wells since the county assumed responsibility of the well program in 1989. Recognizing that paper forms were difficult to search and lacked durability, GCDHHS planned to convert them to a more usable and durable form by digitizing data and maintaining records online. A limited workforce and lack of funds to contract the work were barriers to implementing the plan.

#### Groundwater Contamination: Past and Present

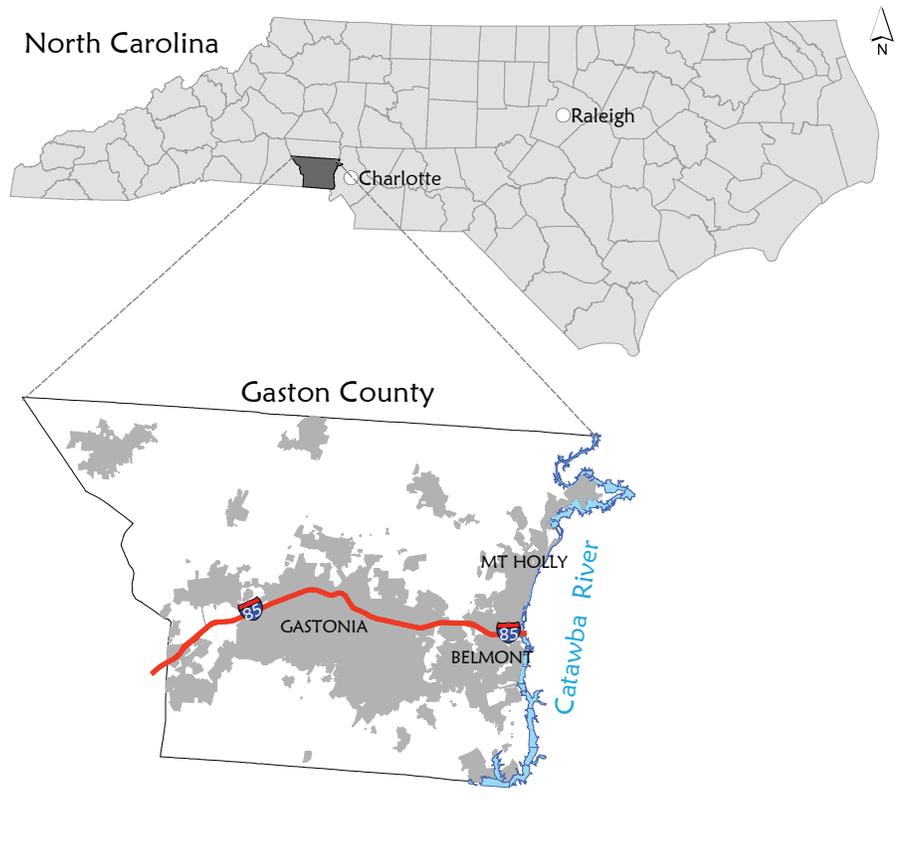
GCDHHS staff know about groundwater contamination issues caused by six active Superfund sites in the county (U.S. Environmental Protection Agency, 2018). Additionally, the North Carolina Department of Environmental Quality (NC DEQ) lists 55 sites as hazardous waste generators in Gaston County (NC DEQ, 2018a).

Other threats to potentially contaminate the county’s groundwater include

- leachate from coal ash ponds at Duke Energy power generation plants in Mt. Holly and Belmont (NC DEQ, 2018b);
- naturally occurring arsenic in the western part of the county;

FIGURE 1

**Location of Gaston County, North Carolina**



- point and nonpoint sources of pollution along the Catawba River (recharging county aquifers);
- cycles of decreased rainfall causing groundwater depletion and compromising water quality;
- septic systems that might be malfunctioning; and
- a growing number of older wells possibly ending their functional capacity.

**Collaboration With the University of North Carolina at Charlotte**

When CDC announced Safe WATCH, the GCDHHS special projects administrator assembled a team with the GCDHHS environmental health assistant administrator and faculty members from the Department of Public Health Sciences and Department of Geography and Earth Sciences at UNCC.

The team proposed digitizing existing private well data, developing a system for future

data input in the field, and creating a database that will interface with a publicly available GIS website. The proposal integrated expertise available at both GCDHHS and UNCC and involved graduate and undergraduate students from both UNCC departments.

**Achievements of the Collaboration**

In 2017, students from UNCC scanned paper permits for more than 8,000 private wells, entered data into a digital database, and geocoded locations using state-of-the-art geospatial technologies (Owusu, Lan, Zheng, Tang, & Delmelle, 2017). As of March 2018, students have visited 3,431 homes and gathered field data on private well locations and characteristics (Table 1). Students collected 520 well water samples for total coliform and *E. coli* tests; 132 samples (25.4%) tested positive for total coliform and 6 samples (1.2%) for *E. coli*.

To date, 35 undergraduate and 6 graduate students have worked on the grant.

TABLE 1

**Data Gathered During Visits to Homes Listed as Having a Private Well in Gaston County, North Carolina**

Result of Home Visit	# of Homes Visited	%
Homes with missing data	3	0.1
Well water sampling to test for nitrogen, total coliform, and <i>E. coli</i> only	56	1.6
Getting geospatial coordinates only	7	0.2
Survey to gather private well location and characteristics only	2	0.1
Well water sampling and getting geospatial coordinates only	370	10.8
Well water sampling and survey to gather private well location and characteristics only	18	0.5
Survey to gather private well location and characteristics and getting geospatial coordinates only	5	0.1
Well water sampling, getting geospatial coordinates, and survey to gather private well location and characteristics	206	6.0
Homeowner requested a revisit at a later date	97	2.8
Homeowner declined to participate	386	11.3
Serviced by city water and only uses well water for irrigation	3	0.1
Serviced by city water and does not use well water	18	0.5
Did not enter property (i.e., no trespassing, beware of dog, or private property signs present)	805	23.5
No one home	1,235	36.0
House uses community well	8	0.2
Could not locate home	212	6.2
<b>Total</b>	<b>3,431</b>	<b>100.0</b>

TABLE 2

**Dissemination of Preliminary Findings of the Gaston County Department of Health and Human Services–University of North Carolina at Charlotte Collaboration**

Date	Author(s)	Presentation	Event Proceedings
November 20–22, 2016	Owusu, C., Delmelle, E., Tang, W., Lan, Y., Major, E., Shi, J., Silverman, G., and Dye, S.	Improving Geocoding Accuracy of Private Water Wells in Gaston County, North Carolina, Using a Context-Based Approach	2016 Annual Meeting, South Eastern Division of the Association of American Geographers, Columbia, South Carolina
March 15, 2017	Dye, S., Delmelle, E., Tang, W., and Silverman, G.	Healthy Wells Collaboration With the University of North Carolina at Charlotte (UNCC)	Water Resources Research Institute (WRRI) of the University of North Carolina System, Raleigh, North Carolina
April 5–9, 2017	Owusu, C., Delmelle, E., Tang, W., Lan, Y., Major, E., Shi, J., Silverman, G., and Dye, S.	Hybrid Geocoding and Text Matching: A Multistage Process to Improve Geocoding Accuracy and Match Rate of Historical Records	2017 Annual Meeting, Association of American Geographers, Boston, Massachusetts
June 21–24, 2017	Silverman, G., Delmelle, E., Tang, W., and Dye, S.	Protecting Rural Groundwater Quality in Gaston County, North Carolina, Through a Collaborative and Integrated GIS-Based Data Management and Educational Project	2017 Annual Conference, Association for Environmental Studies and Sciences, Tucson, Arizona
July 14, 2017	Dye, S., Delmelle, E., Tang, W., and Silverman, G.	Healthy Wells Collaboration With UNCC	2017 Annual Educational Conference & Exhibition, National Environmental Health Association (NEHA), Grand Rapids, Michigan
February 14–15, 2018	Dye, S.	Healthy Wells	Integrating Data to Empower Advancement Virtual Conference, NEHA
March 15, 2018	Delmelle, E.	A Spatially Explicit Database of Private Wells for the Monitoring of Water Quality in Gaston County, North Carolina	2018 Annual Conference, WWRI, Raleigh, North Carolina

Students have gained field experience generating useful information to enhance the GCDHHS private well program and website. This introduction to the environmental health practice has motivated some students to pursue a career in environmental health after graduation.

The GCDHHS–UNCC collaboration has improved the practice of environmental health in Gaston County and led to dissemination of findings at many professional events (Table 2). The experience has been mutually beneficial for faculty, students, and GCDHHS environmental health staff while serving the county and enhancing a program aimed to protect the quality of local groundwater.

**What’s Next**

Students will continue entering data in the database and working in the field to physically visit and verify well coordinates

using GPS. They will continue to educate well owners on the importance of testing well water, provide educational materials, administer a survey, and collect samples to test for total coliform and *E. coli* at no cost to residents.

The collaborators will continue to create maps of private wells and display them on the GCDHHS website. A data layer in the website will include well attributes such as depth, flow, static water level, type of casing, name of well driller, and test results for well water. Information will be accessible to the public and GCDHHS environmental health staff working in the field.

GCDHHS and UNCC collaborators will analyze the database to determine potential health hazards that water from private wells might pose to users. This analysis will allow GCDHHS environmental health staff to better target educational outreach, recommend corrective

actions, and propose revisions to county and state private well rules and regulations. 🚧

**Acknowledgements:** We would like to acknowledge Alexandra Alcorn, a recent Master of Public Health graduate from UNCC for her meaningful contribution summarizing the data presented in Table 1. Alcorn has collaborated with field and data analyses work since the beginning of this project. Also, we would like to acknowledge the contributions of the staff at GCDHHS and faculty and students at UNCC in planning, conducting, analyzing, and disseminating findings of this project.

**Corresponding Author:** Samantha Dye, Assistant Environmental Health Administrator, Gaston County Department of Health and Human Services, 991 West Hudson Boulevard, Gastonia, NC 28052. E-mail: samantha.dye@gastongov.com.

## References

Centers for Disease Control and Prevention. (2018). *Safe Water for Community Health (Safe WATCH)*. Retrieved from <https://www.cdc.gov/nceh/ehs/safe-watch/index.html>

North Carolina Department of Environmental Quality. (2018a). *Hazardous waste sites map*. Retrieved from <https://deq.nc.gov/about/divisions/waste-management/waste-management-rules-data/waste-management-gis-maps/tsd-map-viewer>

North Carolina Department of Environmental Quality. (2018b). *Well test information for residents near Duke Energy coal ash impoundments*. Retrieved from <https://deq.nc.gov/about/divisions/water-resources/>

water-resources-hot-topics/dwr-coal-ash-regulation/well-test-information-for-residents-near-duke-energy-coal-ash-impoundments

Owusu, C., Lan, Y., Zheng, M., Tang, W., & Delmelle, E. (2017). Geocoding fundamentals and associated challenges. In H.A. Karimi & B. Karimi (Eds.), *Geospatial Data Science Techniques and Applications*, (pp. 41–62). Boca Raton, LA: Taylor and Francis Group.

U.S. Census Bureau. (2017a). *QuickFacts, Gaston County, North Carolina*. Retrieved from <https://www.census.gov/quickfacts/fact/table/gastoncountynorthcarolina/PST045217>

U.S. Census Bureau. (2017b). *QuickFacts, Gaston County, North Carolina; Charlotte city, North Carolina; North Carolina*. Retrieved from <https://www.census.gov/quickfacts/fact/table/gastoncountynorthcarolina,charlottecitynorthcarolina,NC/PST045217>

U.S. Environmental Protection Agency. (2018). *Superfund sites in reuse in North Carolina*. Retrieved from <https://www.epa.gov/superfund-redevelopment-initiative/superfund-sites-reuse-north-carolina>

## Did You Know?

NEHA's new membership structure will be introduced on October 1. The new structure will include five different membership categories—Professional, Emerging Professional, Retired Professional, International, and Life. All members within these categories will continue to receive the electronic version of the *Journal*. Members based in the U.S. also have the option to purchase a print subscription of the *Journal* for just \$35. Learn more about NEHA's membership and its benefits at [www.neha.org/membership-communities](http://www.neha.org/membership-communities).



Employers increasingly require a professional credential to verify that you are qualified and trained to perform your job duties. Credentials improve the visibility and credibility of our profession, and they can result in raises or promotions for the holder. For 80 years, NEHA has fostered dedication, competency, and capability through professional credentialing. We provide a path to those who want to challenge themselves, and keep learning every day. Earning a credential is a personal commitment to excellence and achievement.

Learn more at [neha.org/professional-development/credentials](http://neha.org/professional-development/credentials).



**A credential today can improve all your tomorrows.**

