Carolyn B. Voter, PhD

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RESEARCH INTERESTS

- Hydrologic feedbacks: surface water-groundwater interactions, land-atmosphere interactions
- Integrated hydrologic modeling, high throughput/performance computing
- Urban ecohydrology, green stormwater infrastructure, stormwater management
- Sustainable and resilient communities, coupled human-natural systems

EMPLOYMENT AND EDUCATION

Professional Appointments

2022 - present **Assistant Professor**, University of Delaware
Departments of Civil & Environmental Engineering and Earth Sciences
Affiliations: Water Science & Policy Program, Delaware Environmental Institute, Data Science Institute, Data Science Institute

2019 – 2021 **Wisconsin Water Resources Science-Policy Fellow**, University of Wisconsin-Madison
Water Use Section, WI Department of Natural Resources, Madison, WI

Education

2019 **Ph.D.**, Civil Engineering, University of Wisconsin-Madison

2012 **B.S.**, Civil Engineering, Bucknell University

PUBLICATIONS

Peer-Reviewed Papers

6. Alexander, G.A. [gs]*, **C.B. Voter**, D.B. Wright, S.P. Loheide II. 2024. Urban Ecohydrology: Resolving Sub-Grid Surface Lateral Water and Energy Transfers in a Land Surface Model. *Water Resources Research.* https://doi.org/10.1029/2023WR035511

5. Oswald, C.J., C. Kelleher, S.H. Ledford, K.G. Hopkins, A. Sytsma, D. Tetzlaff, L. Toran, **C.B. Voter**. 2023. Moving beyond impervious surface cover: the need for integrated process understanding of water flow in cities. *Journal of Hydrology.* https://doi.org/10.1016/j.jhydrol.2023.129188

4. **Voter, C.B.**, F.J. Guerrero-Bolaño, A.W. Latzka, B.M. Maitland, and J. Hauxwell. 2021. Adaptable University-Agency Early-Career Fellowship Program Creates a Win-Win-Win for Wisconsin's Waters. *Journal of Contemporary Water Research & Education,* 174:139-154. https://doi.org/10.1111/j.1936-704X.2021.3365.x

3. **Voter, C.B.** and S.P. Loheide II. 2021. Climatic controls on the hydrologic effects of urban low impact development practices. *Environmental Research Letters,* 16(6): 064021. https://iopscience.iop.org/article/10.1088/1748-9326/abfc06

2. **Voter, C.B.** and S.P. Loheide II. 2020. Where and When Soil Amendment is Most Effective as a Low Impact Development Practice in Residential Areas. *Journal of the American Water Resources Association,* 56(5):776-789. https://doi.org/10.1111/1752-1688.12870

1. **Voter, C.B.** and S.P. Loheide II. 2018. Urban Residential Surface and Subsurface Hydrology: Synergistic Effects of Low-Impact Features at the Parcel-Scale. *Water Resources Research, 54*. https://doi.org/10.1029/2018WR022534

Refereed Conference Papers

1. Mayo, L. and **C.B. Voter.** 2019. Introducing Students to Engineering by Helping Them RePicture Their World. ASEE Annual Conference & Exposition, Tampa, FL. https://peer.asee.org/32265. (17p.)

Technical Reports

2. **Voter, C.B**, C. Hein, J. Chenevert, I. Anderson, R. Smail, M. Gibson, K. Doyle, S. Bunde. 2021. Appendix B: Central Sands Lakes Study Technical Report: Lake Ecosystem Characterization and Response. Wisconsin Department of Natural Resources. https://doi.org/10.5281/zenodo.5708751

1. **Voter, C.B.** and E. Verbeten. February 2017. "Groundwater: Powering Wisconsin's Economy." *Wisconsin Natural Resources*. Wisconsin Department of Natural Resources. http://dnr.wi.gov/wnrmag/2017/02/Insert1.pdf

FUNDING

Grants

2024 – 2026 **An investigation of green infrastructure to enhance resilient stormwater management in the City of Wilmington** ($115,00)
Funding: Delaware Sea Grant
Voter Role: Co-PI
Collaborators: Rebecca Nixon (UD, lead PI), Victor Perez (UD)

2024 – 2027 **Integrated Assessment of Climate Change Impacts to Groundwater, Stormwater, and Wastewater Infrastructure at Coastal Military Facilities** ($1,541,829)
Funding: Department of Defense Environmental Security Technology Certification Program
Voter Role: Lead PI
Collaborators: Paul Imhoff (UD), Holly Michael (UD), Larry Trout (Straughan Environmental)

2022 – 2024 **SAI-P: Optimizing deployment of green stormwater infrastructure for maximum benefit** ($123,556)
Funding: National Science Foundation, Strengthening American Infrastructure
Voter Role: Lead PI
Collaborators: Paul Imhoff (UD), Rebecca Nixon (UD), Yao Hu (UD)

2020 – 2022 **Mitigating flooding, extreme heat, and heavy rainfall in urban coastal communities by "greening"** ($238,582)
Funding: Wisconsin Sea Grant Institute
Voter Role: Co-Lead Author, Associate Investigator
Collaborators: Steve Loheide (Lead PI, UW-Madison), Dan Wright (UW-Madison)

Fellowships

2019 – 2021 **Wisconsin Water Resources Science-Policy Fellowship**, Wisconsin Water Resources Institute, UW-Madison ($55,000 stipend)
Voter Role: Postdoctoral Fellow

2015 – 2016 **Wisconsin Water Resources Science-Policy Fellowship**, Wisconsin Water Resources Institute, UW-Madison ($33,231 tuition, stipend, fringe benefits)
Voter Role: Student Fellow

2014 – 2015 **Weston Fellowship**, UW-Madison ($37,466 for stipend, tuition, and fringe benefits; $1,500 flexible funds)
Voter Role: Student Fellow

2008 – 2012 **Presidential Fellowship**, Bucknell University ($25,000 per year; $1,500/semester research stipend)
Voter Role: Student Fellow

AWARDS AND HONORS

2024 **Excellence in Teaching Aware**, University of Delaware

2022 **Most Valuable Professor**, Women's Volleyball Team, University of Delaware

2021 **Team of the Year**, Wisconsin Department of Natural Resources Environmental Management Division, for the Central Sands Lake Study Team

2021 **AGU 2020 Editor's Citation for Excellence in Refereeing**, Water Resources Research [link]

2019 **James R. Villemonte Excellence in Research Award**, Dept. of Civil and Environmental Engineering, UW-Madison

2019 **Outstanding Graduate Oral Presentation**, American Water Resources Association – Wisconsin Section Annual Meeting

2018 **Outstanding Student Presentation Award**, American Geophysical Union Fall Meeting

2012 **Chancellor's Opportunity Award**, UW-Madison

2012 **Peer Award of Distinction**, Dept. of Civil Engineering, Bucknell University

2012 **Michael D. LaGrega Award for Excellence in Environmental Engineering**, Bucknell University [description]

2012 **Eleanor D. Decker Prize for Women**, Bucknell University [description]

2011 **Chi Epsilon**, Civil Engineering Honor Society

2011 **Tau Beta Pi**, Engineering Honor Society

PRESENTATIONS

[us] = undergraduate student, [gs] = graduate student, [m] = mentor

Conference Abstracts (*selected*)

2024 Erukubami, O.[gs], A. Farnum [gs], **C.B. Voter**. Assessment of Sea Level Rise Impacts on Shallow Groundwater in an Urban Coastal Environment. MODFLOW and More. Princeton, NJ. Jun 2024. *Poster.*

Zobel, R.[gs], **C.B. Voter.**, R. Nixon, P. Imhoff, Y. Hu. Intersection of Maintenance, Effectiveness, and Equity in Green Stormwater Infrastructure in the Chesapeake Bay Region. ASCE EWRI Operations and Maintenance of Stormwater Systems Conference. Austin, TX. Apr 2024. *Oral.*

Alexander, G.A.[gs], **C.B. Voter**, S.P. Loheide II[m], and D.B. Wright. How Adoption of Green Infrastructure Impacts Urban Hydrologic-Atmospheric Processes. ASCE EWRI Environment & Water Resources Congress. Milwaukee, WI. May 2024. *Oral.*

Voter, C.B. Does This Matter? Lessons Learned (and Still Learning) from Connecting with Water Science Stakeholders. American Meterological Society Annual Meeting 23rd Annual Student Conference. Jan 2024. *Oral.*
>> Invited

2023 **Voter, C.B.**, P. Imhoff, H. Michael, L. Trout, O. Erukubami[gs], A. Farnum[gs]. Integrated Assessment of Climate Change Impacts to Groundwater, Stormwater, and Wastewater Infrastructure at Coastal Military Facilities. DoD Energy and Environment Innovation Symposium. Dec 2023. *Oral.*
>> Invited

Zobel, R.[gs], **C.B. Voter**. Identifying the Current State of Stormwater Management and Green Stormwater Infrastructure on Public University Campuses in the Chesapeake Bay Region. CUAHSI Biennial Meeting. Lake Tahoe, CA. Jun 2023. *Poster.*

Erukubami, O.[gs], **C.B. Voter**. Assessment of Sea Level Rise Impacts on Aquifer Systems in Coastal Environments: A Case Study of Bowers Beach, Delaware. CUAHSI Biennial Meeting. Lake Tahoe, CA. Jun 2023. *Poster.*

Alexander, G.A.[gs], **C.B. Voter**, S.P. Loheide II[m], and D.B. Wright. Better representation of urban hydrologic processes alters surface water and temperature cycles in regional coupled climate models. Consortium for the Advancement of Hydrologic Sciences, Inc. (CUAHSI) Biennial Meeting. Lake Tahoe, CA. Jun 2023. *Poster & Lightning Talk.*

Alexander, G.A.[gs], **C.B. Voter**, S.P. Loheide II[m], and D.B. Wright. Resolving Fine-Scale Lateral Water Transfers in Urban Environments Alters Regional Climate Simulations. American Meteorological Society Annual Meeting. Denver, CO. Jan 2023. *Poster.*

2022 Alexander, G.A.[gs], **C.B. Voter**, S.P. Loheide II[m], and D.B. Wright. Better Representation of Urban Hydrologic Processes Alters How Heat Responds to Urban Vegetation in Regional Climate Models. American Geophysical Union Fall Meeting. Chicago, IL. Dec 2022. *Poster.*

Voter, C.B., G.A. Alexcander[gs], S.P. Loheide II[m], D.B. Wright. Consider the Climate: Understanding What to Expect from Urban Hydrology Interventions Depending on Where You Are. American Geophysical Union Frontiers in Hydrology Meeting. San Juan, PR. Jun 2022. *Oral.*
>> Invited

2021 **Voter, C.B.**, C. Hein[m], J. Chenevert, I. Anderson. A Framework for Describing the Hydrologic Regime of Lakes for Improved Water Quantity Management. American Geophysical Union Fall Meeting. New Orleans, LA. Dec 2021. *Oral.*

Alexander, G.A.[gs], **C.B. Voter**, S.P. Loheide II[m], and D.B. Wright. Incorporating Impacts of Green Infrastructure into a Large-Scale Land Surface Model. American Geophysical Union Fall Meeting. New Orleans, LA. Dec 2021. *Oral.*

Alexander, G.A.[gs], **C.B. Voter**, S.P. Loheide II[m], and D.B. Wright. Incorporating the Hydrologic Impacts of Low Impact Development in a Large-Scale Land Surface Model. American Water Resources Association-Wisconsin Section Annual Meeting. Online. Mar 2021. *Oral.*
>> *WI AWRA Outstanding Graduate Oral Presentation*

Parsen, M., **C.B. Voter**, C. Hein[m], and A.H. Pruitt. Lake-Groundwater Interactions of Plainfield, Long, and Pleasant Lakes in the Central Sands of Wisconsin. American Water Resources Association-Wisconsin Section Annual Meeting. Online. Mar 2021. *Oral.*

2020 **Voter, C.B.**, C. Hein[m], J. Chenevert, I. Anderson, A.H. Pruitt, M.N. Fienen, M.J. Haserodt, A. Leaf, and S. Westenbroek. Impacts of groundwater withdrawals on lake hydrology and ecology in a water-rich region: what matters most? American Geophysical Union Fall Meeting. Online. Dec 2020. *Poster.*

Avery, W.A., S.P. Loheide II[m], W.R. Selbig, H. Barker, K. Rabeler, D.M. Ciruzzi, and **C.B. Voter**. The role of urban canopy architecture in precipitation redistribution. American Geophysical Union Fall Meeting. Online. Dec 2020. *eLightning.*

2019 **Voter, C.B.** and S.P. Loheide II[m]. Advancing understanding of single family parcel hydrology to improve the hydroecologic outcomes of low impact practices. American Geophysical Union Fall Meeting. San Francisco, CA. Dec 2019. *eLightning.*
>> *Invited*

Voter, C.B. and S.P. Loheide II[m]. Restoring urban ecohydrologic fluxes on a lot-by-lot basis: Which doors to knock on first? American Geophysical Union Fall Meeting. San Francisco, CA. Dec 2019. *Oral.*

Voter, C.B. and S.P. Loheide II[m]. Soil amendment as a green infrastructure practice in residential areas. American Water Resources Association-Wisconsin Section Annual Meeting. Delavan, WI. Mar 2019. *Oral.*
>> *WI AWRA Outstanding Graduate Oral Presentation*

Nohr, K.[ug], **C.B. Voter** and S.P. Loheide II[m]. Comparing soil infiltration capacity among and within residential parcels in Milwaukee. American Water Resources Association-Wisconsin Section Annual Meeting. Delavan, WI. Mar 2019. *Poster.*
>> *WI AWRA Outstanding Undergraduate Presentation*

earlier **Voter, C.B** and S.P. Loheide II[m]. Quantifying weather-driven differences in the hydrologic outcomes of low-impact practices. American Geophysical Union Fall Meeting. Washington D.C. Dec 2018. *Oral.*
>> *AGU Outstanding Student Presentation Award*

Voter, C.B. and S.P. Loheide II[m]. Climate- and development-driven heterogeneity in hydrologic fluxes from urban residential parcels. Long Term Ecological Research Network – All-Scientists Meeting. Monterey Bay, CA. Oct 2018. *Poster.*

Voter, C.B. and S.P. Loheide II[m]. Introducing a real-world design problem to an intro water resources engineering course: effects on cognitive skills, confidence, and perception of value. UW-Madison Teaching and Learning Symposium. Madison, WI. May 2017. *Poster.*

Stieve, J.[ug], **C.B. Voter** and S.P. Loheide II[m]. Particle Size Analysis of Milwaukee Soils. UW-Madison Undergraduate Research Symposium. Madison, WI. Apr 2017. *Poster.*

Voter, C.B. and S.P. Loheide II[m]. Effect of weather patterns in cities across the United States on surface runoff, deep drainage, and evapotranspiration from a residential parcel. American Geophysical Union Fall Meeting. San Francisco, CA. Dec 2016. *Oral.*

[ug]Calderon, M., **C.B. Voter** and S.P. Loheide II[m]. Soil Particle Size Analysis in Milwaukee. UW-Madison Undergraduate Research Symposium. Madison, WI. Apr 2016. *Poster.*

Invited Seminars, Symposia and Panels (*selected*)

2023 Connecting Science, Management, and Community in the Central Sands and Beyond. Water@UW-Madison Symposium. Apr 2023. *Oral + Panel.*

2022 Urban ecohydrology: Processes that matter, ways to model them, and implications for sustainable management. Georgia State University. Nov 2022. *Oral.*

Scaling up: Accounting for key fine-scale urban hydrologic processes at city and larger scales. UMBC Center for Urban Environmental Research and Education Seminar. Online. Feb 2022. *Oral.*

What matters most? Tracking down key ecohydrologic processes in urban and agricultural landscapes to inform management strategies. University of Delaware Earth Sciences Seminar. Feb 2022. *Oral.*

2021 Using Co-productive Science to Address Wicked Water Problems in the Highly-irrigated Wisconsin Central Sands. University of Delaware Project WiCCED Seminar. Online. Oct 2021. *Oral.*

Advancing Science and Management through the Central Sands Lakes Study. UW-Madison Environmental Chemistry and Technology Seminar. Online. Oct 2021. *Oral.*

The Central Sands Lakes Study: Findings & Recommendations Overview. Wisconsin Department of Natural Resources. Online. May 2021. *Oral*. dnr.wisconsin.gov/topic/Wells/HighCap/CSLStudy.html

Tackling Wisconsin's Water Challenges through UW Water Science-Policy Fellowships and Agency Partnerships. *Panel*. At:

- Wisconsin Water Week, plenary session with panel discussion. Online. Mar 2021.
- University of Wisconsin-Madison 5th Annual Symposium for Research Administrators, panel discussion. Online. Sep 2020.

2020 Defining a "significant" reduction in "average seasonal lake levels" in the Wisconsin Central Sands. *Oral.* At:

- Wisconsin Potato and Vegetable Growers Association. Online. Mar 2020.
- Water@UW-Madison Spring Symposium. Online. May 2020.
- Wisconsin Lakes and Rivers Partnership. Online. Oct 2020.

2019 Wisconsin and Great Lakes Fellowships: Connecting Science, Policy, and Management. Water@UW-Madison Fall Poster Session. Madison, WI. Nov 2019. *Poster.*

Improving the quality of my research on urban residential hydrology by increasing the quantity of simulations using HTCondor. HTCondor Week. Madison, WI. May 2019. *Oral.*

Protecting our Urban Waters. Wisconsin Chapter of the Society for Conservation Biology, presentation and panel discussion. Madison, WI. Feb 2019. *Oral.*

earlier Delta Future Faculty Panel. Center for Integration of Research, Teaching, and Learning Fall In-Person Meeting, panel discussion. Madison, WI. Oct 2018. *Panel.*

Low-impact practices in residential areas: how interactions among practices and with climate alter urban hydrology. Marquette University Environmental and Water Resources Engineering Seminar. Milwaukee, WI. Oct 2018. *Oral.*

Low-impact practices on residential parcels: How and where they cause the biggest (hydrologic) bang. Nelson Institute Brown Bag Series. Madison, WI. Apr 2018. *Oral.*

Variability in deep drainage from urban residential parcels: what interventions have the greatest potential impact? Wisconsin Groundwater Association Speaker Series. Madison, WI. Sep 2017. *Oral.*

The Wisconsin Groundwater Coordinating Council: 2016 Updates and the Fellowship Experience. Water@UW-Madison Fall Poster Session. Madison, WI. Oct 2016. *Poster*.

TEACHING

University of Delaware

2024 Spring **GEOL 467/667: Ecohydrology** 3 credits, 28 students (undergrad + grad)

2023 Fall **CIEG 305: Fluid Mechanics** 3 credits (2 sections), 104 students

2023 Spring **GEOL 467/667: Ecohydrology** 3 credits, 14 students (undergrad + grad)

2022 Fall **CIEG 305: Fluid Mechanics** 3 credits (1 section), 109 students

Guest Teaching

Spring 2022 **CIEG 403: Sustainable Applications in Infrastructure** (UD)
Topic: Green Stormwater Infrastructure

Fall 2019, Fall 2016 **CEE 311: Hydroscience** (UW-Madison)
Topic: Urban Hydrology

Fall 2014 **CEE 411: Open Channel Hydraulics** (UW-Madison)
Topic: Flow Routing

Professional Development (*selected*)

2023 **Course Design Institute**
Host: Center for Teaching and Learning, University of Delaware
4-day workshop

2022 **Excellence in Civil Engineering Education (ExCEEd) Workshop**
Host: American Society of Civil Engineers, Westpoint, NY

6-day workshop that provides engineering educators with theory, examples, practice, and feedback to improve their teaching abilities

2018 **Delta Certificate in Teaching, Research and Learning**
Host: Delta Program, UW-Madison
Committee: Dr. Trina McMahon (chair), Dr. Steve Loheide, Dr. Daniel Wright, Dr. Amber Smith, Dr. Rosemary Russ
Certificate awarded after successful defense of a teaching portfolio following science education coursework and a teaching-as-research internship

2017 **Research Mentor Training**
Host: Delta Program, UW-Madison
Semester-long seminar (1 credit) exploring strategies to become a more effective, culturally responsive mentor and discuss mentoring challenges as they arise

2016 **Delta Internship Program**
Host: Delta Program, UW-Madison
Semester-long seminar (3 credit) in which each participant develops their own teaching-as-research project, implements it in a classroom, and presents findings

2015 **Teaching in the College Classroom**
Host: Delta Program, UW-Madison
Semester-long course (3 credit) that provides a deep foundational knowledge of evidence-based teaching practices with opportunities to practice new teaching approaches

MENTORING

Graduate Mentees

2024 – present Emma Ruggiero, PhD student, Water Science and Policy, University of Delaware
2023 – present Austin Farnum, PhD student, Water Resources Engineering, University of Delaware
2022 – present Omowumi Erukubami, MS student, Geological Sciences, University of Delaware
2022 – present Rachel Zobel, PhD student, Water Science and Policy, University of Delaware
2020 – present Aaron Alexander, PhD candidate, Civil and Environmental Engineering, UW-Madison

Undergraduate Mentees

2024 – present Nicole Mnych, B.S. in Environmental Engineering, University of Delaware
2024 – present Chloe Gerstenbacher, B.S. in Environmental Engineering, University of Delaware
2022 – 2023 Abigail Pierson, B.S. in Environmental Engineering, University of Delaware
2018 – 2019 Katlyn Nohr, B.S. in Geological Engineering, UW-Madison
2018 Aaron Canton, B.S. in Civil and Environmental Engineering, UW-Madison
2017 – 2018 Jared Stieve, B.S. in Civil and Environmental Engineering, UW-Madison
2016 Alex Bauch, B.S. in Environmental Sciences, UW-Madison
2015 – 2016 Martin Calderon, B.S. in Civil and Environmental Engineering, UW-Madison

Committees

2024 – present K.J. Olsen, MS student, Structural Engineering, University of Delaware

2024	Nana Abena Osei Tutu, MS student, Water Resources Engineering, University of Delaware
2023 – present	Dannielle Pratt, PhD student, Water Resources Engineering, University of Delaware
2023	Lauren Donati, MS student, Water Science and Policy, University of Delaware

SERVICE

University of Delaware

2023-present **Member**, Department of Civil & Environmental Engineering Leadership Team

2023-2024 **Member**, Environmental Engineering Faculty Search Committee

2022-2023 **Member**, Department of Civil & Environmental Engineering Graduate Committee

2022 **Member**, Coastal Geotechnical Faculty Search Committee

Reviewer Activities

Manuscript Reviewer for: Science of the Total Environment, Environmental Research Letters, Journal of Hydrology, Water Resources Research, Ecohydrology, Journal of the American Water Resources Association, Journal of Sustainable Water in the Built Environment, Journal of Hydrologic Engineering, Journal of Water Resources Engineering, Journal of Contemporary Water Research and Education

Proposal Reviewer for: National Science Foundation Hydrologic Sciences (4x ad hoc, 1x panel), Washington Sea Grant (1x ad hoc), Department of Energy (1x panel)

Professional

2022-present **University Representative**, Consortium for the Advancement of Hydrologic Sciences, Inc.

2023 **Session Organizer**, Effective and Equitable Green Stormwater Infrastructure in the Chesapeake Bay. *Bay-wide Stormwater Partners Retreat.*

Panelist, Using Carbon to Achieve Chesapeake Bay (and Watershed) Water Quality Goals and Climate Resiliency: The Science, Gaps, Implementation Activities and Opportunities. *Chesapeake Bay Science Technical Advisory Committee Workshop*.

2016-present **Founding Contributor**, RePicture Engineering
Contributions: support summer program, Role Model profile, review grant proposals and papers, beta test new features

PUBLIC ENGAGEMENT

Professional Development

2018 **Green Infrastructure and Stormwater Management**: A workshop to explore decision support tools to support community resiliency workshop. Sea Grant Extension, Milwaukee, WI. 3-day workshop.

2017 **Community-Engaged Research Institute**, Sea Grant Extension, Lansing, MI. 5-day workshop.

Professional Development

2021 Can green infrastructure influence the weather in Milwaukee? [link]

2020 UW-Madison College of Engineering. A green scene: Engineers take a comprehensive approach to mitigating urban heat islands. [link]

2019 Wisconsin Water Resources Institute. Voter Returns as Water Resources Science-Policy Fellow to Shed Light on Central Sands Lakes. [link]

2019 EOS Research Spotlight. Strategies to Improve Urban Hydrology. [link]

2017 UW-Madison News. A Data Tool for Homeowners to Make Rain Gardens More Effective. [link]

2015 Wisconsin Water Resources Institute. Voter Elects to Become Debut WRI Fellow. [link]

2012 Wisconsin Water Resources Institute. A Little from a Lot. [link]