Azadeh Bolhari, PhD, PE

University of Colorado Boulder | Civil, Environmental, Architectural Engineering Department
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EDUCATION

- **Ph.D.** in Civil Engineering, Colorado State University, Fort Collins, CO.
- **M.Sc.** in Civil Engineering, University of Colorado, Denver, CO.
- **B.Sc.** in Civil Engineering, Iran University of Science and Technology

ACADEMIC PROFESSIONAL EXPERIENCE

Associate Director for Undergraduate Education, University of Colorado Boulder 7/2022-present
Environmental Engineering Program ABET Lead

Associate Professor of Teaching, University of Colorado Boulder 1/2022-present
Environmental Engineering Program

Senior Instructor, University of Colorado Boulder 8/2020-12/2021
Environmental Engineering Program

Assistant Professor, Angelo State University 1/2017-5/2020
David L. Hirschfeld Department of Engineering, San Angelo, TX

Lecturer (full-time), University of Colorado 1/2013-12/2016
Department of Civil and Environmental Engineering, Denver, CO

Graduate Faculty, University of Colorado 1/2013-present
Department of Civil and Environmental Engineering, Denver, CO

Research Assistant, Colorado State University, Fort Collins, CO 2006-2012
Department of Civil and Environmental Engineering

Teaching Assistant, University of Colorado, Denver, CO 2005 - 2006 and 2012
Department of Civil and Environmental Engineering
Technical Engineering Advisor at M12, Byers, CO 2015 – 2016
AVID Tutor, Cherry Creek Public Schools, Denver, CO 2012-2013

GRANTS

NSF Grant: PI Bolhari, A., Co-PI Bielefeldt, A. "Research Initiation: Enhancing Engineering Students' Innovation Self-Efficacy through Design of K-12 STEM Projects" Submission to **NSF RIEF**. **Awarded**. $199,915 Aug. 2022-2024

University of Colorado Boulder College of Engineering Interdisciplinary Research Themes (IRT) Seed Grant, "Design of an AI-Augmented Learning Thread for Environmental Engineering Curriculum." Submission to Engineering Education and AI-Augmented Learning IRT, University of Colorado Boulder: **Awarded**. $16,410 Jan. 2022

University of Colorado Boulder College of Engineering Interdisciplinary Research Themes (IRT) Seed Grant, "Understanding Households' Increase in Capacity and Resiliency from Undertaking Engineering Projects." Submission to Resilient Infrastructure with Sustainability and Equity (RISE) IRT, University of Colorado Boulder: **Awarded**. $6,000 Jan. 2022

University of Georgia ProQual Institute Research Initiation Grant & CoP, **Awarded**. $6,000 2022

NSF Grant: PI Bolhari, A. "Soil and Water Degradation of LDPE Microplastics: A Coupled Experimental and Theoretical Approach." Submission to **NSF CBET**. Under preparation. $289,000

NSF Grant: PI Bolhari, A., Co-PI Castaneda, D.I. "EAGER: PPER Developing Drought-Resilient Communities by Utilizing Acrylic Concrete Structures for Rainwater Harvesting." Submission to DCL **NSF CBET** 17-055: **Awarded**. $99,997 2017

Angelo State Undergraduate Faculty-Mentored Grant, Bolhari, B., Machingura, B. "Mechanical Abrasion of Spent Plastic Shotshells and Wads." **Awarded**. $750 spring 2020

Angelo State Undergraduate Faculty-Mentored Grant, Bolhari, A., "Estimating Hickory Aquifer's Properties Using Derivative Analysis of Water Level Time Series from Active Well Fields." **Awarded**: $6,000 2018

Angelo State Undergraduate Faculty-Mentored Grant, Bolhari, A., Dusenberry, B. "Application of Phytoremediation to Improve Water Quality." **Awarded**: $750 2019

Angelo State Undergraduate Faculty-Mentored Grant, Bolhari, A., Cox, N., Freeman, S., Halfman, M., Shaffer, E. "Feasibility of Employing Rainwater Harvesting to Reduce Urban Stormwater Runoff." **Awarded**: $1,500 2017-2018

University of Colorado Faculty Development Grant, "Prairie Restoration through Snow Harvesting: A Project at The Experimental Site in Last Chance, Colorado." **Awarded:** $2,000 2015-2016

PUBLICATIONS

* Denotes undergraduate student co-author

PEER-REVIEWED ENGINEERING EDUCATION PUBLICATIONS

Castaneda, D.I.; Stewart, K., **Bolhari, A.** Exploring How Community Cultural Wealth Manifests in a Citizen Science Engineering Project (Manuscript revision*).*

Bolhari, A. "BYOE: Laboratory Exercise using Augmented Reality (AR) and Virtual Reality (VR) for Environmental Engineering Curriculum.", 2023 ASEE Annual Conference & Exposition, Boston, MA (Manuscript submitted).

Bolhari, A., Bielefeldt, A. "Work in Progress: Exploring Innovation Self-Efficacy of Neurodiverse Engineering Students." 2023 ASEE Annual Conference & Exposition, Boston, MA (Abstract accepted, manuscript under preparation).

Bolhari, A., Bielefeldt, A. "Work-in-Progress: Exploring the Role of Mentorship in Enhancing Engineering Students' Innovation Self-Efficacy.", 2023 ASEE Annual Conference & Exposition, Boston, MA (Abstract accepted, manuscript under preparation).

Bolhari, A., Stewart, K., Castaneda, D. "Work in Progress: Surveying Cultural Assets of Engineering Students: An Exploratory Study."2023 ASEE Annual Conference & Exposition, Boston, MA (Manuscript submitted).

Bolhari, A., Stewart, K., Flaska, E.*, Singh, B.* "Engagement in Practice: Role of Community Engagement in Disaster Recovery."2023 ASEE Annual Conference & Exposition, Boston, MA (Manuscript under preparation).

Bolhari, A., Tillema, S.* (2022), *Enhancing Engineering Students' Innovation Self-Efficacy through Design of K-12 STEM Projects* Paper presented at 2022 ASEE Annual Conference & Exposition, Minneapolis, MN. https://peer.asee.org/40763

- **Download Count: 77**

Bolhari, A.; Castaneda, D.I.; Stewart, K. (2020). Work in Progress: An Exploratory Study of the Sustainability Mindset through a Citizen Science Project in a Vulnerable Latinx Community presented at 2020 ASEE Annual Conference & Exposition, Virtual Conference. DOI: 10.18260/1-2--35609

- **Download Count: 312**

Stewart, K., Castaneda, D.I.; **Bolhari, A.** (2020). Work in Progress: Citizen Scientists' Description of an Engineer presented at 2020 ASEE Annual Conference & Exposition, Virtual Conference. DOI: 10.18260/1-2--35620

- **Download Count: 252**

Bolhari, AR., **Bolhari, A.** (2018). IT Ethics and the Role of Perceived Possibility of Disclosure: An Interventional Research. American Society for Engineering Education. ASEE Annual Conference Proceedings, Salt Lake City, Utah. DOI: 10.18260/1-2—30738

- **Download Count: 225**

BOOK CHAPTER:

Bolhari, A. & Baker, Claire (2018). Ecological Fence: Snow Harvesting. In M. Handwerker, J. Garrett-Davis, C. Sauter, R. Saxton (Eds.) *Future Rural Archive* (pp.74-115). Netherlands: Jap Sam Books & Last Chance, Colorado: Last Chance Press.

PEER-REVIEWED ENGINEERING PUBLICATIONS

Bolhari, A., T. Sale. Effects of Alkaline-activated Persulfate on Contaminants Stored in Low Permeability Zones: A box Models and Direct Spectrometry. (Manuscript under revision).

Albright, E. A., Crow, D. A., Dickinson, K., Devoss, R., Rumbach, A., Bolhari, A. (2023). CWC: The Politics of Multilevel Disasters, Recovery and Rebuilding. Southern Political Science Association Annual Meeting, January 11-14, 2023 - St. Pete Beach, Florida focused on disasters and recovery.

Bolhari, A., Castaneda, D.I., Arehart, J., Tillema[*], S. (2022). Performance Analysis and Life Cycle Assessment of Acrylic Concrete Structures for Rainwater Harvesting. *RCR Advances* 13 (2022) 200063 https://doi.org/10.1016/j.rcradv.2022.200063

Dickinson, S., Devoss, K., Albright, R., Crow, E., Rumbach, D., Bean, A., Fraser, H., Reid, T., **Bolhari, A.,** Welton-Mitchell, Andre, C. Aldrich, D., Morss, R. Whelton, Javernick-Will, A., Irvine, L., du Bray, M., Rubenfeld, S.[*], Tillema, S.[*] (2022). "Marshall Fire Unified Survey", in RAPID: Can Big Ideas About Resilience Survive the Reality of a Disaster? Built Environment Policy and Recovery After the Marshall Fire. *DesignSafe-CI*. DOI: 10.17603/ds2-0yc8-4h27

Flood, W.[*], La Rue-Lovett, M.[*], Schade, K.[*], Wager, E.[*], & **Bolhari, A.** (2022). Utilizing Cryogenic CO_2 Spray process for Removal of Lunar Regolith Dust Adhered to Spacesuits. In *2022 Waste-management Education Research Conference (WERC)* (Vol. 3, pp. 1-4). IEEE. doi: 10.1109/WERC54916.2022.9851240.

Bolhari, A., Tillema, S. (2022). Exploring a New Model for Engineering Capacity and Resiliency: Households in the Aftermath of the 2021 Marshall Fire. Poster Presentation at Association of Environmental Engineering and Science Professors, St. Louis MO: AEESP June 28-30, 2022.

Butler, B.[*], Engelken, J.[*], Hill, M., Tillema, S.[*], Trick, R.[*], **Bolhari, A**., (2021). Utilization of Municipal Solid Waste Derived Biochar for Thermal Destruction of PFOA and PFOS. Colorado Rocky Mountain SWANA Annual Conference. Boulder, Colorado. November 1-3, 2021.

Dusenberry, B.[*] & **Bolhari, A.** (2019) Feasibility of Avicennia Marina (Grey Mangroves) in Salt Removal from Water. Texas. Digital Library Repository. https://hdl.handle.net/2346.1/35862

Bolhari, A., T. Sale (2018). Treatment of Trichloroethene (TCE) in Low Permeability Zones of Aquifers Using Carbon Sequestration. USBI Biochar Conference. Wilmington, Delaware.

Freeman, S.*, Cox, N.*, Halfman, M.*, Shaffer, E.*, **Bolhari, A.** (2018). On-campus Engineering Solutions to Reduce Stormwater Runoff on a Marginalized Community. Texas Digital Library Repository. http://hdl.handle.net/2346.1/30816

Bolhari, A. (2012). Feasibility of treating chlorinated solvents stored in low permeability zones in sandy aquifers. Dissertation Abstract International 74(01), 134B. (UMI No. AAT 3523626) Retrieved December 16, 2012, from Dissertations and Theses database.

Bolhari, A., T. Sale (2012). Temporal partitioning of a chlorinated solvent release between DNAPL, aqueous, and sorbed phases in transmissive and low permeability zones. Hydrology Days, 32nd Annual American Geophysical Union, Fort Collins, Colorado, March 21-23, 2012.

Wahlberg, J., S. Farhat, **A. Bolhari**, J. Martin, T. Sale, C. Newell, D. Dandy, (2012). Decision support system for modeling matrix diffusion processes, Fort Collins, Colorado, July 24-26, 2012.

Sale, T., **A. Bolhari** (2012). Temporal partitioning of a chlorinated solvent release between DNAPL, aqueous, and sorbed phases in transmissive and low permeability zones, American Geophysical Union, San Francisco, California, December 5-9, 2011.

Sale, T., **A. Bolhari** (2011). Improving Our Understanding of the Impact of Contaminants Stored in Low Permeability, SERDP/ESTCP Partner meeting, Washington D.C., November 29th, 2011.

Bolhari, A., T. Sale (2010), Resolving the Feasibility of Treating Chlorinated Solvents Stored in Plumes in Heterogeneous Sandy Aquifers, Eos Trans. AGU, 91(26), West. Pac. Geophys. Meet. Suppl., Abstract H33B1-83

Zimbron, J., **A. Bolhari**, T. Sale (2010). Updates on Treatment of Contaminants in Low Permeability Zones, Hydrology Days, 30th Annual American Geophysical Union, Fort Collins, Colorado, March 22-24 2010.

Bolhari, A., T. Sale (2008). Resolving the Feasibility of Treating Contaminants Stored in Plumes, Hydrology Days, 28th Annual American Geophysical Union, Fort Collins, Colorado, March 26-28 2008.

Bolhari, A., T. Sale (2008). Resolving the Feasibility of Treating Contaminants Stored in Plumes, University Consortium for Field-Focused Groundwater Contamination Research, Annual Progress Meeting, Orangeville, Ontario, May 05-08 2008.

Bolhari, A., T. Sale (2007). Resolving the Feasibility of Treating Contaminants Stored in Plumes, University Consortium for Field-Focused Groundwater Contamination Research, Annual Progress Meeting, Orangeville, Ontario, April 17-19 2007.

Bolhari, A., T. Sale (2007). Resolving the Feasibility of Treating Contaminants Stored in Plumes, Hydrology Days, 27th Annual American Geophysical Union, Fort Collins, Colorado, March 19-21 2007.

Bolhari, A., T. Sale (2009). Resolving the Feasibility of Treating Contaminants Stored in Plumes, Hydrology Days, 29th Annual American Geophysical Union, Fort Collins, Colorado, March 25-27 2009 (poster presentation).

TECHNICAL REPORTS:

Bolhari, A., Castaneda, D. "EAGER: PPER Developing Drought-Resilient Communities by Utilizing Acrylic Concrete Structures for Rainwater Harvesting." Final Report to the National Science Foundation, Alexandria, VA, 22314. December 2019.

Dusenberry, B.*, **A. Bolhari**. "Feasibility of *Avicennia Marina* (Grey Mangroves) in Salt Removal from Water." Angelo State University. December 2019.

Bolhari, A., Castaneda, D. "EAGER: PPER Developing Drought-Resilient Communities by Utilizing Acrylic Concrete Structures for Rainwater Harvesting." Annual Report to the National Science Foundation, Alexandria, VA, 22314. August 2018.

Freeman, S., N. Cox, M. Halfman, E. Shaffer, **A. Bolhari**. "On-campus Engineering Solutions to Reduce Stormwater Runoff on a Marginalized Community in San Angelo", Angelo State University. May 2018.

Baker, C., **A. Bolhari** "Snow Harvesting to Restore Prairie Restoration in Last Chance Experimental Site". Technical report to M12 STUDIO, CO, Byers. April 2017.

Bolhari, A., T. Sale "Management of Contaminants Stored in Plumes." White Paper to DuPont, Philadelphia, PA and GE GLOBAL RESEARCH, ALBANY, NY, 12309. January 2011.

Sale, T., B.L. Parker, C.J. Newell, J.F. Devlin, J. Zimbron, **A. Bolhari**, Saller, K., "Basic Research Addressing Contaminants in Low Permeability Zones." Proposal Submitted to Strategic Environmental Research Development Program (SERDP), Funded Project No. ER-1740, August 2010.

TEACHING *(*Denotes courses both developed and taught)*

University of Colorado-Boulder, CO:

CVEN/EVEN 4434/5434 Capstone Design spring 2021, 2022, 2023
Designed a module on utilizing Artificial Intelligence (augmented and virtual reality) in Environmental Engineering to facilitate design communication with clients.

*EVEN 4944/4830 Contaminant Fate & transport** fall, spring 2020-2023
Developed a lab-based course to meet ABET's SO6 on experimentation. In this senior-level course students design labs on processing that govern transport of contaminants in the environment.

CVEN/EVEN 4404 Water Chemistry fall 2020-2022

*CVEN/EVEN 4414 Water Chemistry Lab** fall 2021-2022
Developed 2 new labs to introduce applications of Artificial Intelligence (augmented and virtual reality) in Environmental Engineering.

Angelo State University, TX:

CVEN 4380 Senior Design* fall 2018, spring & fall 2019, spring 2020
CVEN 4315 Water and Wastewater Treatment* spring 2018-2020
CVEN 4091 Stormwater Design* fall 2017, spring 2018
CVEN 4091 Phytoremediation* spring 2019
CVEN 4091 Environmental Processes* spring 2020
ENGR 2308 Economics and Sustainability of Infrastructures* spring 2017-2020
CVEN 3351 Introduction to Environmental Engineering* fall 2017-2019
CVEN 3404 Fluid Mechanics* spring 2017
ENGR 1201 Introduction to Engineering* fall 2017-2018

University of Colorado-Denver, CO:

CVEN-5402 Environmental Modeling* spring 2013, 2014, 2015, 2016
CVEN-5404 Physical/Chemical Processes in Water Treatment* fall 2013, 2014, 2015, 2016
CVEN-5401 Introduction to Environmental Engineering* fall 2013, spring 2014
CVEN-3401 Introduction to Environmental Engineering fall 2013, spring 2014
ENGR 3400 Technology & Culture* fall 2015, spring 2016, fall 2016
ENGR 3600 International Dimensions of Technology & Culture* fall 2015, spring 2016

CVEN 3121 Mechanics/Strength of Materials* summer 2015
CVEN 5434 Field Methods for Sustainable Development: Colombia* May 2016
CVEN-5401 Introduction to Environmental Engineering (TA) spring 2006

AWARDS and HONORS

ADDITIONAL RELEVANT ACADEMIC LEADERSHIP EXPERIENCE

Journal of Engineering Education (JEE) Mentored Reviewer Program Participant spring 2022
Goal: to investigate the criteria that reviewers use to evaluate Engineering Education Research manuscripts and grant proposals through an NSF-funded Peer Reviewer Training Program (PERT)

NSF RIEF community of practice for 2020-2022 NSF RIEF awardees fall 2022-present
Goal: to facilitate training and networking for RIEF awardees
ProQual Institute Community of Practice Leadership award, University of Georgia, $3,000 2022
National WERC Environmental Design Contest, Judges' Choice Award. *Monitoring Virus Removal by Membrane Bioreactors during Water Reuse*. Faculty advisor for: Cole Pragides, Eva Thoresen, Florisel Rodriguez, Lindsey Benkelman, Meghan Holland May 2022
President's Research Award, Angelo State University 2020
Certificate of Appreciation for Outstanding Leadership; Vision and Development of the Future P4 Joint Emergency Training Facility Site Plan, Tom Green County, The State of Texas 2019
ASCE ExCEED Teaching Fellow 2018
Member-NSF Grant "Sustainable STEM Learning Program (S_2LP): *Promoting Systems Thinking to Aid Holistic Undergraduate Education."* University of Colorado 2016-2017
NSF-sponsored ASSIST Travel Grant to ALWE Program 2017
NSF-sponsored Parflow Hydrologic Model Short Course, Colorado School of Mines 2016
Office of Global Education Travel Grant to Colombia, University of Colorado 2016
NSF-sponsored "Fast Track to Work Scholarship", Colorado State University 2006-2008
"Arthur T. Corey Scholarship", Colorado State University 2007
Top Student Award- Iran University of Science and Technology 2001 & 2003

PROFESSIONAL DEVELOPMENT

Office of Faculty Affairs (OFA), Across CU Mentoring (ACUMent) program 2022-23
ASEE Annual Conference 2022
NAE (The National Academies of Sciences, Engineering, and Medicine), Board on Science Education, "Exploring and Mapping the System of Undergraduate STEM Education" 2022
APA-ENG Networking, Ideation and Collaboration Workshop for Engineering Educators (NIC) to increase the capacity of higher education faculty to produce competitive manuscripts for refereed journals and other publication in SoTL within the context of innovation and entrepreneurship. 2022
CUBoulder ASEE workshop 2022
ProQual Institute Qualitative Research Incubator, University of Georgia 2022
Performance Management Essentials for Academic Leaders course, UCBoulder 2022
Collaborator with Invention Education Research Group, Indiana University 2022
NSF Pride in STEM: A Conversation about Research, Mentorship and Advocacy, Jun 24 2021
Engineering Education and AI-Augmented Learning IRT Workshop, UC-Boulder, August 21 2021
NCFDD: 14-day writing challenge - March, June, October 2020-2022
KEEN National Conference 2021
ASEE Annual Virtual Conference 2020
KSU NSF-CAREER Proposal Writing Workshop 2019
Professional Engineer - Colorado 2018-present
40-Hour OSHA HAZWOPER Certification 2015-present

NSF-CAREER Proposal Writing Workshop, Texas A&M	2018
NSF-CAREER Proposal Webinar, CBET Directorate	2018
Biochar Conference	
NSF Grants Conference	2017
ASEE Annual Conference	2017 & 2018
ASEE Gulf Southwest Annual Conference	2017
Lilly Teaching Conference nominated participant	2018
ESW Annual Conference	2017
ABET Symposium: IDEAL & Fundamentals of Program Assessment	2017 & 2018
Overcoming Implicit Bias in Higher Education, University of Colorado Denver	2016

Languages**:** English (professional), Persian (native), German (limited), Arabic (limited)

DEPARTMENT AND UNIVERSITY SERVICE

ABET Lead EVEN Program, UCB	2022-present
Associate Director for Undergraduate Education, EVEN Program, UCB	2022-present
Chair, EVEN Undergraduate Curriculum Committee, UCB	2022-present
Member, EVEN Undergraduate Curriculum Committee, UCB	2020-present
SEVEN/AWWA Faculty Advisor, UCB	2020-present
EVEN's Internship Coordinator - COEN 3930-755 Engineering Internship/Co-op summer	2022
Environmental Engineering Career Fair organizer, UCB	2020-present
Panelist on OFA workshop: Maintaining an active research agenda	2022
Faculty Advisor for Video Game Association, ASU	2020
Academic Faculty Advisor, ASU	2018-2020
Retention Faculty Mentor, ASU	2018-2020
Faculty advisor for Women in Engineering, ASU	2017-2020
Graduate Faculty, University of Colorado	2013-present
Environmental Engineering Lab Director, ASU	2017-2020
Chair, Faculty Search Committee- Structural Engineering, ASU	2018-2019
Chair of Assessment & Accreditation Committee, ASU	2017-2018
Member, Faculty Search Committee – Structural Engineering, ASU	2017
Member, Faculty Search Committee – Water Resources Engineering, ASU	2017
Member, Faculty Search Committee – Transportation Engineering, ASU	2017
Member, Instructional Technology Committee, ASU	2017
Library Liaison for the Engineering Department, ASU	2017
Faculty Advisor, University of Colorado ESW Chapter	2016

SERVICE TO THE COMMUNITY

NSF panelist, National Science Foundation	2017-2023
External evaluator, Promotion Review Committee, Civil & Construction Engineering, Oregon State University	2021
School Accountability Committee member, Boulder Valley School District	2021-present
ASEE reviewer: Civil & Environmental Engineering Divisions	2017-present
ASEE CED division, video competition committee	2020-2021
ASEE-CoNECD Conference: assessment committee member	2017-2018
Science Fair Judge and outreach, Santa Rita Elementary, San Angelo, TX	2017-2018
Volunteer, 9News Health Fair, Denver, Colorado	2008 & 2009

INVITED TALK & MODERATOR

UC-BOUlder ASEE fall "enhancing innovation self-efficacy of engineering students." 2022
Environmental Justice in Environmental Engineering Curriculum, UCB September 2020
ASEE Conference, Session Moderator June 2020
Bolhari, A., Castaneda, D. "From Evolution of Plumes to Evolution of a Scientist: Drought-Resilient Communities." University of Arkansas, Fayetteville 2018

PROFESSIONAL MEMBERSHIP

American Society of Civil Engineers (ASCE) 2018-present
Society of Women Engineers (SWE) 2017-present
Association of Environmental Engineering and Science Professors (AEESP) 2014-present
American Society of Engineering Education (ASEE) 2017-present
The Gamma Beta Phi Society 2011-present
The National Scholars Honor Society 2009-present
Order of the Engineer 2011-present
American Geophysical Union 2006-present

GRADUATE FACULTY ADVISOR University of Colorado Denver

Dubinsky, Jonathan. **PhD Dissertation** 2016
"Sustainability modeling for regional systems, case study: San Luis Basin, Colorado"
Zelinka, David. **MSc Thesis** 2016
"A comparative environmental impact assessment of hydraulic fracturing chemicals for oil and gas versus coal-bed methane wells"
Adams, Mathew. **MSc Thesis** 2016
"Vertical Drop Structures in Series and Multiple Flow Weir Design"
Baker, Clair, **Independent Study** 2016
"Last Chance, Colorado Prairie Restoration"
Mehrkesh, Amirhossein. **PhD Dissertation** 2015
"Optimization-based design and analysis of tailor-made ionic liquids"
Mousavi, Bahador. **MSc Thesis** 2015
"Mathematical programming model for optimal design of sustainable vaccine supply chain in developing countries"
Jones, Mathew. **MSc Thesis** 2014
"Chaotic advection from stretching and folding in a Hele-Shaw cell"
Nelson, Derek. **MSc Thesis** 2014
"Environmental fate and transport of methanol in West Virginia's Elk River"
Elalem, Shada. **MSc Thesis** 2014
"Understanding spatio-temporal patterns of losses due to flooding disasters: mapping the vulnerability of Hindu-Kush Himalaya region from socio-economic and natural angles"
Martens, Joshua. **MSc Thesis** 2014
"Does the multi-functionality of smartphones justify their environmental impacts?"
Stout, Sherry. **MSc Thesis** 2014
"Sustainable design for increased resiliency"
Serrano, Adriana. **MSc Thesis** 2014
"Agave fiber biofilter hybrid system on the denitrification-nitrification processes in wastewater treatment"

UNDERGRADUATE RESEARCH ADVISOR

Donal Madden, Assessing the Wealth of Engineering Students 2022
University of Colorado Boulder Summer SPUR

Machingura, B. "Mechanical Abrasion of Spent Plastic Shotshells and Wads." Submission to Angelo State Undergraduate Faculty-Mentored Grant: **Awarded**. $750 2020

Dusenberry, B. "Application of Phytoremediation to Improve Water Quality." Submission to Angelo State Undergraduate Faculty-Mentored Grant: **Awarded**. $750 2019

Cox, N., S. Freeman, J. Gravell, M. Halfman. "Feasibility of Employing Rainwater Harvesting to Reduce Urban Stormwater Runoff." **Awarded**. $750 2018

Freeman, S., N. Cox, M. Halfman, E. Shaffer. "On-campus Engineering Solutions to Reduce Stormwater Runoff on a Marginalized Community." **Awarded**. $750.00 2017

STUDENT MENTORSHIP

Graduate Research Students, UC-Boulder:

- Bisman Singh: Applied Math MSc student, 2022-present
- Nihal Thirunakarasu: 2022 Computer Science MSc student
- Tejas Kaushik: 2022 Computer Science MSc student

Undergraduate EVEN Research Students, UC-Boulder:

- Eric Flaska: Applied Math, 2022-present
- Shelby Tillema: 2021-2022 now PhD student at Northwestern University
- Connor Ellertson: 2022 now MSc student at University of Colorado Denver
- Joe Ning: 2022 now MSc student at University of Colorado Boulder
- Donal Madden: 2022 CU Boulder Summer SPUR student
- Sasha Rubenfeld, 2022
- Rita Trick, 2021
- Calvin Malloski, 2021

Undergraduate Student Support, UC-Boulder:

- Kiersten Maxwell on GRFP, under review
- Shelby Tillema on GRFP: awarded in 2022
- Nominated Claire Butler for Terry McManus Outstanding Student Award ($1,000), awarded. WERC Environmental Design Contest (April 11-14, 2021)
- Nominated Cassidy Cortright for Outstanding Undergraduate of College Award, 2021, awarded.
- Nominated Abigail Weeks for the Silver Medal, 2021, awarded.

Undergraduate Research Assistants of NSF CBET proposal:

- Dhiraj Shrestha 2/19-2020
- Geneva Gutierrez 2/19-9/19

Undergraduate Research Assistants on NSF-EAGER:

- Jesse Lee 5/18 – 8/19
- Maria Ochoa 11/17 – 11/18
- TJ Spies, 5/18 – 12/18
- Austin Poole 11/17 – 5/18
- Nicholas Menrique 11/17 – 5/18

Undergraduate Faculty-mentored Research Students, ASU:

- Brandon Machingura 1/20-2020

- Brandon Dussenbury 01/19-12/19
- Jake Gravell 08/17 – 05/18
- Mark halfman 08/17 – 05/18
- Natalie Cox 08/17 – 05/18
- Shelby Freeman 08/17 – 05/18

Scientific mentor of Texas A&M 4-H students: Guerrero, G., Trees, M.: "FLOC AND FLOW: Using Electrocoagulation and Granular Media Filtration to Improve Water Quality." *Intel International Science & Engineering Fair.* Pittsburgh. May 2018.

ENGINEERING CURRICULA DEVELOPMENT

College Level 2020-2022

Development of Experimentation Thread for EVEN Undergraduate Program at CU-Boulder: this experimentation thread aims to meet ABET Student Outcome 6 and is imbedded in a series of prescribed labs which start at EVEN 4414 Water Chemistry Lab and culminates in EVEN 4494 Contaminant Fate & Transport through a series of lab designs.

K-12 Level 2020-2023

Development of 27 curricular content for *TeachEngineering* digital library at the following grade levels: https://docs.google.com/spreadsheets/d/12bEUr11gDRG7iN8KOQubA898S68ZEv2Y9cXBApx3cXU/edit?usp=sharing

Elementary Grades

1- Oil Spill Demonstration — Activity; Grade Level: 1-3; Motor oil pollution poses a risk to soil, surface, and groundwater bodies. This lab aims to model an oil spill in Colorado sediment by layering sand and mud, then releasing an inert pollutant that behaves similarly to petroleum. Observing the pollutant transport allows students to visualize and understand the challenges associated with oil spills.

2- Contaminant Transport — Activity; Grade Level: 3-5; This experiment models the transport of a conservative pollutant (i.e., a solid material like trash) in a stream system. This will introduce students to how engineers model natural systems in a fun, conceptual matter. By creating a model stream and tracking how beads flow when water is added, students will be able to describe how contaminants flow in a stream system, discuss the effects of stream characteristics on flow, solve problems related to distance, time, and velocity, think about other modeling scenarios, and talk about the importance of modeling contaminant transport systems.

3- Oil Spill Simulation — Activity; Grade Level: 3-5; Students will use the engineering process to explore the best method of removing oil from a marine oil spill site. By making a model oil spill site with household materials, students will test using different materials like cotton balls, feathers, spoons, and dish soap to remove the oil from the water body. Through this experimentation, students will learn how engineers use experimentation to make decisions, while also learning about the pros and cons of various oil spill cleanup techniques.

4- Plant Power — Activity; Grade Level: 1-3; This experiment aims to introduce kids to how plants can take up potential contaminants using celery and food dye. This will give them a conceptual understanding of partition coefficients between plants and water that are used in real-life environmental engineering application. Students will observe how celery changes colors to match the food color they have been added to over time and will be introduced to how scientists and engineers use this concept to remove contaminants from the environment.

5- Oil Spill Simulation — Activity; Grade Level: 3-5; Students will use the engineering process to explore the best method of removing oil from a marine oil spill site. By making a model oil spill site with

household materials, students will test using different materials like cotton balls, feathers, spoons, and dish soap to remove the oil from the water body. Through this experimentation, students will learn how engineers use experimentation to make decisions, while also learning about the pros and cons of various oil spill cleanup techniques.

6- Oil Spill Remediation — Activity; Grade Level: 4-5; Students will use the engineering process to explore the best method of removing oil from a marine oil spill site. By making a model oil spill site with household materials, students will test using different materials like cotton balls, feathers, spoons, and dish soap to remove the oil from the water body. Through this experimentation, students will learn how engineers use experimentation to make decisions, while also learning about the pros and cons of various oil spill cleanup techniques.

Middle School Grades 6-8

1- Groundwater Remediation — Activity; Grade Level: 6-8; Students will use food coloring to visualize how a pollutant will move through groundwater demonstrating how a pollutant might interact with the various filter materials and allow them to visualize the performance of their filter. Then the students will design a filter for the pollutant within the groundwater flow. The activity will utilize a clear acrylic box that the students can fill with soil and various filter materials and then dyed water will be allowed to flow through it and the students will be able to observe the variations in flow. Then the students will come up with ideas in groups and design a filter from the materials provided (Activated Charcoal, Mulch, etc.) to fit within a cylindrical cross section and what type of filter materials and arrangement work best to slow the movement of a groundwater pollutant.

2- Water Cycle and Pollutants — Activity; Grade Level: 5-7; To create an understanding of contaminant transport using the earth's natural mechanisms, students will conduct various experiments examining different transport mechanisms of both water and a benign contaminant. To deepen the students' comprehension of transport phenomena, contaminants such as food dye can be utilized to provide a helpful visual aid. Working in teams of 2-3, students will conduct these experiments and bring their research to the class to encourage students to both work and think cooperatively. During this process students will learn a basic introduction to contaminant partitioning, sorption, and the three main methods of mechanical contaminant transport: advection, dispersion, and diffusion.

3- Partitioning of Pollutants between Water and Vegetables — Activity; Grade Level: 6-8; Various root vegetables are submerged in dyed water (done with food coloring) to show contaminant transport from water into the organic matter through transpiration. This experiment visually displays the absorbance and transport of dye via the vegetables' roots, transpiration streams, and leaves over the span of three to five days - roughly the time it will take for the systems to reach equilibrium.

4- Water Hardness — Activity; Grade Level: 5-7; Water hardness is a naturally occurring phenomenon in groundwater and surface water bodies commonly used for drinking water. While not detrimental to human health, water treatment plants often reduce water hardness to prevent scaling in water pipes. This experiment will show students how hard water reacts with soap, showing them how bubbly the water can become as a result. The following is a video demonstrating how to conduct this experiment: https://drive.google.com/file/d/1fhgROZovIt-kRZAC_6fJmTlcu0cViOvB/view?usp=sharing. The experiment will overall introduce students to the concept of water hardness and give them awareness of how engineers are constantly experimenting with different ways to soften water.

5- Ocean Acidification — Activity; Grade Level: 7; Ocean acidification is a key issue facing our environment today. This experiment demonstrates how changes in pH effect ocean ecosystem health while introducing them to basic pH concepts and teaching them vocabulary used to describe ocean

acidification. Seashells are placed in soda, and changes in pH and qualitative observations are recorded daily to demonstrate how the shells change over time in different pH's.

6- Desalination — Activity; Grade Level: 7; Seawater desalination is an important solution to increase supply of clean water from seawater worldwide. This experiment allows students to design devices to desalinate water while emphasizing the engineering design process. Students are given one day to design their "plant" from everyday materials, another day to build it, and a third day to rework a failed design.

7- Exploding Chalk — Activity; Grade Level: 6-8; This experiment introduces students to the nature of acid-base reactions, specifically that of vinegar and baking soda, to show them how to things can combine and form something else from an engineering standpoint. Two experiments are proposed: combining the materials in a bag and watching it explode and painting a design on the sidewalk with one material and spraying it with the other to show their art coming to life.

8- Coin Chemistry — Activity; Grade Level: 6-8; This experiment introduces students to the concept of acids and bases while using these materials to explain the chemistry of cleaning a penny. Students will be able to analyze and predict the effects of common household liquids on old copper pennies, while also exploring the chemical makeups of these household liquids and identifying the relationship between copper and pH. Pennies are placed in various household cleaning products to observe how well they are cleaned. Through qualitative relationships and researching common pH's of household materials, students will gain a conceptual understanding of pH.

High School Grades 9-12

1- Contaminant Transport— Activity; Grade Level: 8-12; Chemical contamination in the natural environment is a growing concern and this lab aims to educate students on how contaminants move through the environment, particularly in water. This activity will allow students to work as engineers to design an experiment which models groundwater contamination and encourages them to consider how this relates to their environment. This experiment will take two 1-hour sessions.

2- Phytoremediation — Activity; Grade Level: 9-11; Phytoremediation has different levels of effectiveness for remediating environmental contaminants based on the plants used. This experiment explores the different uptake food dye contaminant of different plants. By placing plants in the dye-filled water and measuring the amount of dye present over time via adsorbance, a calibration curve can be created that will allow students to calculate the amount of dye remaining in each water sample due to the uptake of each plant. Students will be introduced to methods of calculating remediation's effectiveness in application.

3- How do Pollutants move? Advection, Dispersion, Diffusion— Activity; Grade Level: 9-11; This experiment will allow students to construct theoretical models of a riverine and lake environment using common household materials to investigate the physical transport of a contaminant in a real fluvial ecosystem. Students will learn about the different types of physical transport (advection, diffusion, and dispersion) and apply their knowledge, investigating their system(s) within the context of these processes.