



CONSERVATION AND
SURVEY DIVISION

School of Natural Resources

2023

ANNUAL REPORT



Studying Nebraska and
Serving Nebraskans for 130 years

Conservation and Survey Division

of the University of Nebraska, School of Natural Resources
(Nebraska Geological Survey)

R.M. (Matt) Joeckel, *CSD Director and State Geologist*
Mark Burbach, *Human Dimensions of Natural Resource Management*
Kathleen Cameron, *Hydrogeologist*
Troy Gilmore, *Hydrologist*
Doug Hallum, *Hydrogeologist*
Paul Hansen, *Quaternary Geologist*
David Hansen, *Geological Sample Technician*
Mohamed Khalil, *Groundwater Geoscientist*
Sean Kruse, *Drilling Assistant*
Jesse Korus, *Groundwater Geologist*
Susan Olafsen Lackey, *Hydrogeologist*
Matt Marxsen, *Field Service Coordinator*
Nawaraj Shrestha, *Geospatial Science Specialist*
Colleen Steele, *Quality-Assessed Agrichemical Contaminant Database
Coordinator*
Judith Turk, *Pedologist*
Michele Waszgis, *Geological Research Specialist*
Jeffrey Westrop, *Assistant Geoscientist*
Aaron Young, *Geoscientist*

Our Mission

The Conservation and Survey Division (Nebraska Geological Survey), the natural resource survey component of the School of Natural Resources, is a unique, multi-disciplinary research, service, and data collection organization established by state statute in 1921.

The Division's mission is to investigate and record information about Nebraska's geologic history, its rock and mineral resources, the quantity and quality of its water resources, land cover and other aspects of its geography as well as the nature, distribution, and uses of its soils.

Conservation and Survey Division

Annual Report 2023

April 2024

R.M. Joeckel, Ph.D.

Director, Conservation and Survey Division
Associate Director, School of Natural Resources
Nebraska State Geologist

M.M. Waszgis, P.G.

Geological Research Specialist,
Conservation and Survey Division

University of Nebraska-Lincoln

Front Cover: Geologists examine colorful, paleosol-bearing mudstones of the lower Dakota Formation (Lower Cretaceous, Albian) in a clay pit in Jefferson County, Nebraska. These strata are an important source of raw material for brick and tile production, but they also preserve a unique record of ancient climates and terrestrial environments at the edge of an ancient seaway nearly 100 million years ago.

University of Nebraska–Lincoln

Rodney Bennett, Ph.D., Chancellor, University of Nebraska–Lincoln

Michael J. Boehm, Ph.D., NU Vice President and IANR Harlan Vice Chancellor

Larkin Powell, Ph.D., Director, School of Natural Resources

R.M. Joeckel, Ph.D., Nebraska State Geologist and Director of Conservation and Survey Division;
Senior Associate Director, School of Natural Resources

The Conservation and Survey Division of the University of Nebraska–Lincoln is the agency designated by statute to investigate and interpret the geologically related natural resources of the State, to make available to the public the results of these investigations, and to assist in the development and conservation of these resources. It consists of program areas in geology, water, soils, and remote sensing-geographic information systems.

The Division is authorized to enter into agreements with federal and state agencies to engage in cooperative surveys and investigations of the State. Publications of the Division and the cooperating agencies are available through the Conservation and Survey Division, 101 Hardin Hall, University of Nebraska–Lincoln, Lincoln, NE 68583-0961. Contact the address above, phone: (402) 472-3471, or e-mail snrsales@unl.edu. The Conservation and Survey Division web site is: <http://snr.unl.edu/csd/>.

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April 2024

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Conservation and Survey Division Annual Report 2023

Overview of Accomplishments by CSD

Extension Contacts by CSD personnel: 3,382

Outreach Contacts by CSD personnel: 4,092

Public and Private Entities served: 98+

Data and Analysis Requests fulfilled by CSD personnel: 329

Grant Award Funding involving CSD personnel: \$3,472,456

Test Hole Footage Drilled and Logged by CSD personnel: 6,500 ft

Teaching Contribution by CSD faculty:

223 University of Nebraska-Lincoln students instructed in...

20 classes in...

4 different programs listed/cross-listed, resulting in...

549 student credit hours

Students Advised by CSD faculty: 31

13 undergraduate students

18 graduate students

Students Employed and Gaining Work Experience through CSD personnel: 20

K-12 Students Engaged in Educational Outreach by CSD personnel: 360

Scientific Publications authored or coauthored by CSD personnel: 54

21 Peer-Reviewed Scientific Journal Articles

17 Published Abstracts

3 Bulletins and Technical Reports

5 Geologic (4) and Water (1) Maps

5 Open-File Reports

1 NebGuide

1 Field Guide

1 U.S. Geological Survey Data Release

Conservation and Survey Division Annual Report 2023

Overview of Accomplishments by CSD

Presentations by CSD personnel: 57

Automated Groundwater Data Entries overseen by CSD personnel: 434,277

Manual Groundwater Measurements conducted by CSD personnel: 7,555

Groundwater Quality Results processed by CSD personnel: 271

Continuing Education Units Generated by CSD Personnel for Professionals: 556

Professional Field Trip organized and conducted by CSD personnel: 1

Media Interviews by CSD personnel: 15

Page Views of CSD Website: 106,174

Digital Commons @ University of Nebraska-Lincoln CSD publication downloads:

812 CSD publications downloaded...

9,515 times by users in...

127 countries

Awards Received by CSD Personnel:

Susan Olafsen Lackey, CSD Hydrogeologist

Wayne Madsen Award, Nebraska Well Drillers Association

Judith Turk, CSD Pedologist and UNL Soil Judging Team Coach

Region 5 Soil Judging Contest Sturgis, SD

1st Place Overall

2nd Place Group

Individual Student Awards 1st, 2nd, 8th, and 10th places

Publications by CSD Personnel

Peer-Reviewed Journal Articles

- Abbas, M., El Qady, G., Mesbah, H., Massoud, U., Lethy, A., El Emam, A., **Khalil, M.**, Vickers, R., Martinez, K., and Hawass, Z., 2023, [Integrated Geophysical Surveys for Locating Cleopatra's Tomb at Tap- Osiris Magna Temple, Borg El-Arab, Alexandria, Egypt](#). *Fast Times*, August 2023. [<https://www.eegs.org/fasttimes>].
- Baker, T.J., Kaiser, M., **Turk, J.**, 2023. [Predicting soil organic carbon from loss-on-ignition across four regions of Nebraska](#). *Communications in Soil Science and Plant Analysis*. 54:16, 2301-2312. [doi: 10.1080/00103624.2023.2217841].
- Burbach, M.E.**, Eaton, W.M., Delozier, J., 2023. [Boundary spanning in the context of stakeholder engagement in collaborative water management](#). *Socio-Ecological Practice Research*, 5, 79-92. [doi.org/10.1007/s42532-023-00138-w].
- Burbach, M.E.**, Kennedy, S., Eaton, W.M., Brasier, K.J., 2023. [Foundational conditions enabling participatory river management in watersheds of two regulatorily disparate states: A mixed methods study](#). *River Research and Applications*, Early view, January 23, 2023. [doi.org/10.1002/rra.4108].
- Burbach, M.E.**, Kennedy, S.M., & Kunert, S.J., 2023. [The influence of place attachment on farmers' succession plans: A mixed methods Study](#). *Sustainable Agriculture Research*, 12(2), 34-44. [doi.org/10.5539/sar.v12n2p34].
- Chaffee, M., Mittelstet, A.R., Comfort, S., Messer, T., **Shrestha, N.**, Eskridge, K., McCoy, J., 2023. [Monitoring temporal chlorophyll-a using Sentinel-2 imagery in urban retention ponds receiving a biological-chemical treatment](#). *Ecological Engineering*, Volume 197, 107123, ISSN 0925-8574. [doi.org/10.1016/j.ecoleng.2023.107123].
- Chavez-Jimenez, C.M., Salazar-Lopez, L.A., Chapman, K., **Gilmore, T.**, Sanchez-Ante, G., 2023. [Feature Analysis and Selection for Water Stream Modeling](#). In A.Y. Rodríguez-González, H. Pérez- Espinosa, J.F. Martínez-Trinidad, J.A. Carrasco-Ochoa, & J. A. Olvera-López (Eds.), *Pattern Recognition* (pp. 3–12). Cham: Springer Nature Switzerland. [doi.org/10.1007/978-3-031- 33783-3_1].
- Eaton, W.M., Brasier, K.J., **Burbach, M.E.**, Kennedy, S., Delozier, J.L., Bonilla Anariba, S.E., Whitley, H.T., Whitmer, W., Santangelo, N., 2023. [A new approach for studying social, behavioral, and environmental change through stakeholder engagement in water resource management](#). *Journal of Environmental Studies and Sciences*, 13, 389-403. [doi.org/10.1007/s13412-023- 00835-8].
- Jensen, C.R., Genereux, D.P., **Gilmore, T.E.**, Solomon, D.K., 2023. [Modified Tracer Gas Injection for Measuring Stream Gas Exchange Velocity in the Presence of Significant Temperature Variation](#). *Water Resources Research*, 59(6), e2023WR034495. [doi.org/10.1029/2023WR034495].
- Joeckel, R.M.**, Suarez, C.A., McLean, N.M., Möller, A., Ludvigson, G.A., Suarez, M.B., Kirkland, J.I., Andrew, J., Kiessling, S., Hatzell, G., 2023. [Berriasian–Valanginian geochronology and carbon-isotope stratigraphy of the Yellow Cat Member, Cedar Mountain Formation, eastern Utah, USA](#). *Geosciences*, 13(2), 18. [doi.org/10.3390/geosciences13020032].
- Kawo, N.S., **Korus, J.T.**, Gulbrandsen, M.L., 2023. [Multiple-Point Statistical \(MPS\) modeling of 3D glacial aquifer heterogeneity for improved groundwater management](#). *Hydrogeology Journal*. [doi.org/10.1007/s10040-023-02658-x].

- Kishawi, Y., Mittelstet, A.R., **Gilmore, T.E.**, Twidwell, D., Roy, T., **Shrestha, N.**, 2023. [Impact of Eastern Redcedar encroachment on water resources in the Nebraska Sandhills](#). Science of The Total Environment, Volume 858, Part 1. 159696, ISSN 0048-9697. [doi.org/10.1016/j.scitotenv.2022.159696].
- Korus, J.T., Joeckel, R.M.**, 2023. <https://pubs.geoscienceworld.org/gsa/geosphere/article/19/3/695/621082/Exhumed-fluvial-landforms-reveal-evolution-of-late> Geological Society of America Geosphere, 19(3), 695-718. [doi.org/10.1130/GES02587.1].
- Korus, J.T., Joeckel, R.M.**, 2023. [Telescopic megafans on the High Plains, USA were signal buffers in a major source-to-sink system](#). The Sedimentary Record 21(1). [doi.org/10.2110/001c.89096].
- Tilahun, T.A., **Korus, J.T.**, 2023. [3D hydrostratigraphic and hydraulic conductivity modeling using supervised machine learning](#). Applied Computing and Geosciences 19, 100122: [doi.org/10.1016/j.acags.2023.100122].
- Turk, J.K.**, 2023. [Literature circles promote accountability and student engagement with assigned reading in a soil science class](#). Natural Sciences Education, 52, e20103. [doi.org/10.1002/nse2.20103].
- Vituri Santarosa, L., Gastmans, D., **Gilmore, T.E.**, Boll, J., Balbin Betancur, S., Monteiro Gonçalves, V.F., 2023. [Baseflow and water resilience variability in two water management units in southeastern Brazil](#). International Journal of River Basin Management, 21:3, 387-400. [doi: 10.1080/15715124.2021.2002346].
- Westrop, J.P.**, Yadav, Pooja., Nolan, P.J., Campbell, Kate M., Singh, Rajesh., Bone, Sharon E., Chan, A.H.; Kohtz, A.J.; Pan, D.A., Healy, O., Bargar, J., Snow, D.D., Weber, K.A., 2023. [Nitrate-stimulated release of naturally occurring sedimentary uranium](#). Environmental Science and Technology. [doi: 10.1021/acs.est.2c07683].
- Young, R.A., **Turk, J.K.**, Jelinski, N.A., Anderson, A.D., Clark, K.M., Dere, A., Moorberg, C.J., Osterloh, K., Presley, D., 2023. [Jumble judging: Cognitive and affective outcomes of intercollegiate collaboration at a soil judging competition](#). Natural Sciences Education, 52, e20104. [doi.org/10.1002/nse2.20104].
- Zlotnik, V.A., Solomon, D.K., Genereux, D.P., **Gilmore, T.E.**, Humphrey, C.E., Mittelstet, A.R., Zlotnik, A.V., 2023. [Theory of an automatic seepage meter and ramifications for applications](#). Water Resources Research, 59(10), e2023WR034766. [doi.org/10.1029/2023WR034766].
- Zeyrek, C., Mittelstet, A.R., **Gilmore, T.E.**, Zlotnik, V., Solomon, D.K, Genereux, D.P., et al., 2023. [Modeling groundwater transit time distributions and means across a Nebraska watershed: Effects of heterogeneity in the aquifer, riverbed, and recharge parameters](#). Journal of Hydrology, 617, 128891. [doi.org/10.1016/j.jhydrol.2022.128891].

Published Abstracts

- Burbach, M.**, Mott, B., 2023. The role of gender, curiosity, and champion of innovation in transformational environmental leadership: A mixed methods study. 2023 IASNR Conference.
- Burberry, C., **Joeckel, R.M., Waszgis, M.**, 2023. Microscale deformation of a Proterozoic granite near the nexus of the Mid-Continent Rift and Nemaha Uplift, SE Nebraska, USA. EGU23-11375. Vienna, Austria, European Geosciences Union.
- Hanson, P.R., Reinier, C.L.**, Bruihler, J.C., **Joeckel, R.M.**, 2023. Luminescence dating and alluvial history of the Platte River in Nebraska, USA. 17th International Luminescence and Electron Spin Resonance Dating Conference, Copenhagen, Denmark. June 2023.

- Hernandez, W., **Turk, J.K.**, & Baker, T.J. Changes in particle size over 60 years of crop production in Nebraska. ASA-CSSA-SSSA International Annual Meetings. St. Louis, MO. 30 Oct. 2023.
- Katchcer, J., Jol, H.M., **Hanson, P.R.**, **Reinier, C.L.**, 2023. Stratigraphic Analysis of Paired Vegetated Linear Dunes in the Nebraska Sand Hills Using Ground Penetrating Radar. Council on Undergraduate Research Annual Meeting, Eau Claire, WI. April 2023.
- Korus, J.T.**, **Joeckel, R.M.**, 2023. Telescopic fluvial fans as signal-buffering mechanisms of late Neogene sediment storage and recycling on the High Plains in Colorado and Nebraska. Geological Society of America Abstracts with Programs 55 (6). [doi: 10.1130/abs/2023AM-395274].
- Korus, J.T.**, Tilahun, T., 2023. Application of random forest machine learning for regional 3D hydrostratigraphic modeling. 6th European Meeting on 3D Geological Modeling, Copenhagen, Denmark. May 23-26, 2023.
- Loope, H.M., **Hanson, P.R.**, Antinao, J.L., Jacobs, P.M., Grimley, D.A., 2023. Last glacial maximum and late glacial eolian sand activity, east fork White River Basin, Indiana, USA. Geological Society of America North-Central Section Meeting, Grand Rapids, MI. May 2023.
- Mahan, S.A., Mead, J.I., **Hanson, P.R.**, Wilkins, J., Holen, S.R., Jass, C.N., 2023. Age reassignment using luminescence dating for The Mammoth Site, Black Hills, South Dakota, USA. 17th International Luminescence and Electron Spin Resonance Dating Conference, Copenhagen, Denmark. June 2023.
- Schmidt, C., Halter, T., King, G., **Hanson, P.**, Kreutzer, S., 2023. Zircon luminescence as a geochronological tool for (sub-) recent sediments. 17th International Luminescence and Electron Spin Resonance Dating Conference, Copenhagen, Denmark. June 2023.
- Solberg, J., Jol, H., **Hanson, P.R.**, Ju, F., 2023. Analysis of paired linear dune stratigraphy in the Nebraska Sand Hills utilizing ground penetrating radar. Geological Society of America Annual Meeting. GSA Abstracts with Programs 55, no. 6.
- Tilahun, T., **Korus, J.T.**, 2023. A multi-event time series approach for groundwater recharge quantification and mapping. Geological Society of America Abstracts with Programs 55 (6). [doi: 10.1130/abs/2023AM-395920].
- Tilahun, T., **Korus, J.T.**, 2023. Deep learning-based groundwater recharge estimation using thematic maps and groundwater-level observation data. AGU23, San Francisco, CA, December 14, 2023.
- Rudnick, D.R., Kremen, A., Warren, J., Burr, C.A., Lo, T., Martin, T., Nakabuye, H.N., Katimbo, A., Stockton, M., Proctor, C., Foltz, M., **Burbach, M.**, Kennedy, S., Taghvaeian, S., & Sharma, S. (2023, June). Enhancing production efficiency and farm profitability through participatory research. ECPA2023 14th European Conference on Precision Agriculture, Bologna, Italy. 2-6 July 2023.
- Rutgers, M. & **Turk, J.K.** The effect of soil aggregation state on color-based predictions of soil organic carbon. ASA-CSSA-SSSA International Annual Meetings, St. Louis, MO. October 31, 2023.
- Rutgers, M. & **Turk, J.K.** Particle size distribution of deflation basin soils in Eastern Nebraska. ASA-CSSA-SSSA International Annual Meetings, St. Louis, MO. October 30, 2023.
- Turk, J.K.** & Baker, T.J. Human-induced soil change in Nebraska. ASA-CSSA-SSSA International Annual Meetings, St. Louis, MO. October 30, 2023.

Bulletins and Technical Reports

- Bennett, D.E., Lewis, M., Mahowald, H., Collins, M., Brammer, T., Flint, H.B., Thorsness, L., Eaton, W., Hansen, K., **Burbach, M.**, Koebele, E., 2023. [Preferences for addressing water shortages among Colorado River Basin agricultural water users.](#) The Ruckelshaus Institute, Haub

Diffendal, R.F. Jr. and Swinehart, J.B., 2023. [The Broadwater Formation \(Pliocene\) of Nebraska and southeastern Wyoming, 2023](#). University of Nebraska–Lincoln, Conservation and Survey Division, Report of Investigations 13, 36 p.

Young, A.R., Burbach, M.E., Olafsen Lackey, S., Joeckel, R.M., and Westrop, J.P., 2023. [Nebraska Statewide Groundwater-Level Monitoring Report 2022](#). Nebraska Water Survey Paper 91. Conservation and Survey Division, University of Nebraska-Lincoln, 18 p.

U.S. Geological Survey Data Release

Verplanck, P.L., Lowers, H.A., Johnson, C.A., Koenig, A.E., Farmer, L., Kettler, R.M., **Joeckel, R.M.**, 2022. [Geochemical data for the Elk Creek alkaline complex, southeast Nebraska](#). U.S. Geological Survey data release. [doi: 10.5066/P9S41SV0].

Field Guide

Olafsen Lackey, S., Cameron, K.A., and Marxsen, M.J., 2023. [Hydrogeologic Field Trip of Northeast Nebraska, Guidebook No. 39](#). University of Nebraska-Lincoln, Conservation and Survey Division, 24 p.

Geologic and Hydrologic Maps

Hanson, P.R., Reinier, C.L. 2023. [Surficial geology of the Leshara 7.5 Minute Quadrangle, Nebraska](#). Conservation and Survey Division, School of Natural Resources.

Hanson, P.R., Reinier, C.L., 2023. [Surficial geology of the Richland 7.5 Minute Quadrangle, Nebraska](#). Conservation and Survey Division, School of Natural Resources.

Hanson, P.R., Reinier, C.L. 2023. [Surficial geology of the Mead 7.5 Minute Quadrangle, Nebraska](#). Conservation and Survey Division, School of Natural Resources.

Joeckel, R.M., Reinier, C.L., and Waszgis, M.M., 2023. [Surficial Geology of the Meadville 7.5 Minute Quadrangle, Nebraska](#). Conservation and Survey Division, School of Natural Resources.

Shrestha, N., Briggs, A., Young, A.R., Joeckel, R.M., 2023. Nebraska's Water. Conservation and Survey Division Water Survey Map 159. Conservation and Survey Division, School of Natural Resources, University of Nebraska-Lincoln.

NebGuide

Heeren, D., Wilkening, E., **Hallum, D.**, McCullough, C., Keshwani, J., Schellpeper, J., 2023. [Impact of irrigation technologies on water use: Clarifying water withdrawals and consumptive use](#). University of Nebraska-Lincoln, Nebraska Extension. NebGuide, January 2023. [https://extensionpubs.unl.edu/publication/g2345/html/view].

Open-File Reports

Burbach, M.E., 2023. Australia: Managing diverse ecosystems - A storybook of student research. Conservation and Survey Division, School of Natural Resources, University of Nebraska-Lincoln. Open-File Report 238.

Burbach, M.E., Joeckel, R.M., 2023. 2023 Nebraska Water Leaders Academy – Final report. School of Natural Resources, University of Nebraska-Lincoln. Open-File Report 247.

Kennedy, S.M., **Burbach, M.E.**, 2023. TAPS program evaluation – Producers. Conservation and Survey Division, School of Natural Resources, University of Nebraska-Lincoln. Open-File Report 233.

- Kennedy, S.M., **Burbach, M.E.**, 2023. TAPS program evaluation – Non-Producers. School of Natural Resources, University of Nebraska-Lincoln. Open-File Report 234.
- Khalil, M.A., Hallum, D.R., Korus, J.T.**, 2023. Resistivity Survey for Locating a Well Site on the Howell Property. Conservation and Survey Division, School of Natural Resources, University of Nebraska- Lincoln. Open-File Report 239.

Presentations by CSD Personnel

- Khalil, M.**, 2023. Introduction to Applied Geophysics. Western Nebraska Community College, Scottsbluff, NE. March 1, 2023.
- Khalil, M.**, 2023. Applied Geophysics. Nebraska Roads Scholar Tour, Scottsbluff, NE. August 3, 2023.
- Khalil, M.**, 2023. Applied Geophysics in Hydrogeology. Nebraska Water Industries Trade Show, Kearney, NE. February 16, 2023.
- Khalil, M.**, 2023. Use of Geophysics in Environmental and Engineering Problems. Panhandle Research and Extension Center, Scottsbluff, NE. August 23, 2023.
- Burbach, M.E.**, 2023. Full range leadership for leaders in the water arena. Nebraska Water Leaders Academy, Lincoln, NE. January 19, 2023.
- Burbach, M.E.**, 2023. Boundary spanning skills for effective stakeholder Engagement. Nebraska Water Leaders Academy, Kearney, NE. March 24, 2023.
- Burbach, M.E.**, 2023. Personal Empowerment - Engaging Your Leadership Capacity. Indiana Watershed Leadership Academy (Virtual). May 2, 2023.
- Burbach, M.E.**, 2023. The role of gender, curiosity, and champion of innovation in transformational environmental leadership: A mixed methods study. 2023 IASNR Conference, Portland, ME. June 12, 2023.
- Rudnick, D.R., Kremen, A., Warren, J., Burr, C.A., Lo, T., Martin, T., Nakabuye, H.N., Katimbo, A., Stockton, M., Proctor, C., Foltz, M., **Burbach, M.**, Kennedy, S., Taghvaeian, S., & Sharma, S., 2023. Enhancing production efficiency and farm profitability through participatory research. ECPA2023 14th European Conference on Precision Agriculture. July 4, 2023.
- Burbach, M.E.**, 2023. Experiential learning exercises to prepare future environmental leaders for best practices associated with collaborative governance. Governance Collaborative Governance Retreat, Jackson Hole, WY. August 1, 2023.
- Burbach, M.E.**, 2023. Niobrara National Wild & Scenic River: Outstandingly remarkable values. Nebraska Water Leaders Academy. September 14, 2023.
- Burbach, M.E.**, 2023. Personal empowerment: Engaging your leadership capacity. Nebraska Water Leaders Academy. November 16, 2023.
- Cameron, K.A.**, 2023. Where is the groundwater and how do we find it?. Roehr’s Machinery Growers Meeting, Beatrice, NE. March 2, 2023.
- Cameron, K.A.**, 2023. Eastern Nebraska Water Resources Assessment (ENWRA) Update. ENWRA Spring Meeting, Wahoo, NE. April 26, 2023.
- Cameron, K.A.**, 2023. Stop 3 Dakota outcrop and Papio-Missouri River NRD test holes. Nebraska Well Drillers Association, Homer, NE. September 12, 2023.
- Cameron, K.A.**, 2023. Tools for water management II: ENWRA and Nebraska GeoCloud. Nebraska Water Center Urban Water Conference, Omaha, NE. October 3, 2023.
- Hallum, D.**, 2023. Recent upgrades to a farm and ranch water monitoring system along the North Platte River. West Central Research and Extension Center Seminar, North Platte, NE. February 20, 2023.

- Hallum, D.**, 2023. Water soil weather monitoring system overview. Nebraska Public Power District Seminar.
- Hallum, D.**, 2023. Presentation at NE GIS Symposium, LaVista, NE. April 11-12, 2023.
- Hanson, P.R.**, 2023. Late Holocene dune activation in the Nebraska Sand Hills, USA. Heidelberg University, Heidelberg, Germany. April 2023.
- Hanson, P.R.**, Reinier, C.L., Bruhler, J.C., **Joeckel, R.M.**, 2023. Luminescence dating and alluvial history of the Platte River in Nebraska, USA. 17th International Luminescence and Electron Spin Resonance Dating Conference, Copenhagen, Denmark. June 2023.
- Katchcer, J., Jol, H.M., **Hanson, P.R.**, Reinier, C.L., 2023. Stratigraphic Analysis of Paired Vegetated Linear Dunes in the Nebraska Sand Hills Using Ground Penetrating Radar. Council on Undergraduate Research Annual Meeting, Eau Claire, WI. April 2023.
- Loope, H.M., **Hanson, P.R.**, Antinao, J.L., Jacobs, P.M., Grimley, D.A., 2023. Last glacial maximum and late glacial eolian sand activity, east fork White River Basin, Indiana, USA. Geological Society of America North-Central Section Meeting, Grand Rapids, MI. May 2023.
- Mahan, S.A., Mead, J.I., **Hanson, P.R.**, Wilkins, J., Holen, S.R., Jass, C.N., 2023. Age reassignment using luminescence dating for The Mammoth Site, Black Hills, South Dakota, USA. 17th International Luminescence and Electron Spin Resonance Dating Conference, Copenhagen, Denmark. June 2023.
- Mason, J.A., McDowell, T.M., Miao, X., **Hanson, P.R.**, Johnson, W.C., Xu, Z., Marin-Spiotta, E., 2023. Paleosols as essential evidence in dune field and loess records of Holocene environmental change. XIV International Symposium and Field Workshop on Paleopedology, Las Cruces, NM, USA. October, 2023.
- Schmidt, C., Halter, T., King, G., **Hanson, P.**, Kreutzer, S., 2023. Zircon luminescence as a geochronological tool for (sub-) recent sediments. 17th International Luminescence and Electron Spin Resonance Dating Conference, Copenhagen, Denmark. June 2023.
- Solberg, J., Jol, H., **Hanson, P.R.**, Ju, F., 2023. Analysis of paired linear dune stratigraphy in the Nebraska Sand Hills utilizing ground penetrating radar. Geological Society of America Annual Meeting. GSA Abstracts with Programs 55, no. 6.
- Johnson, K., **Gilmore, T.**, and Harner, M., 2023. GRIME-AI: Semi-automated image classification software for image-based water level monitoring. USGS National Innovation Center (NIC)/Next Generation Water Observing System (NGWOS) External Research and Development Seminar Series, Virtual Seminar. October 5, 2023.
- Gilmore, T.E.**, Harner, M., Stranzl, J., Chapman, K., Birgand, F., Richardson, A., Johnson, K., Bajelan, J., Sánchez Ante, G., Young, S., Motlagh, M., Mittelstet. A., 2023. Overcoming challenges when using ground-based time-lapse imagery in ecohydrology. ASABE Annual International Meeting, Omaha, NE. July 10, 2023.
- Bajelan, J., Harner, M., **Gilmore, T.**, Folk, G., Chapman, K., Wetovick, K., Sikes, J., Ostrom, B., Geluso, K., Stranzl, J., Jonas-Bratten, J., Wuellner, M., Klein, A., and Wagner, C., 2023. An introduction to the Kearney Outdoor Learning Area for place-based learning and research (Talk). Nebraska Environmental Education Conference, Eugene T. Mahoney State Park, Ashland, NE. February 8, 2023.
- Gilmore, T.E.**, 2023. How (Grasslands Feed the) Groundwater (that) Feeds the Unique and Steady Sandhills Streams. Center for Grasslands Studies Seminar Series, Lincoln, NE. August 28, 2023.
- Gilmore, T.E.**, 2023. Groundwater nitrate and the red pivot project. Haskell Ag Lab Science & Ag Family Field Day, Concord, NE. August 10, 2023.
- Cherry, M., **Gilmore, T.E.**, 2023. Red Pivot Study and How Water Moves in Our Aquifer in the Central Nebraska Area. Central Plains Irrigation Association (CPIA) Conference, Kearney, NE. February 28, 2023.
- Gilmore, T.E.**, Cherry, M., 2023. Groundwater Research in the Upper Little Blue Basin. Little Blue NRD Board Meeting, Davenport, NE. February 14, 2023.

- Gilmore, T.E.**, Cherry, M., 2023. Groundwater: Local conditions, groundwater movement, and the red pivot project. Central City Extension Day, Central City, NE. February 14, 2023.
- Cherry, M., **Gilmore, T.E.**, 2023. A Pivotal New Approach to Groundwater Quality Assessment. South Central Water Conference, Holdrege, NE. January 31, 2023.
- Joeckel, R.M.**, 2023. Perspective on world (ground) water 2023 and a geological primer on groundwater in Nebraska. Nebraska Water Leaders Academy, Lincoln, NE. January 21, 2023.
- Joeckel, R.M.**, 2023. Down the river: What a brief trip down the Niobrara can show us. Nebraska Water Leaders Academy, Lincoln, NE. January 21, 2023.
- Joeckel, R.M.**, 2023. The Conservation and Survey Division (CSD): Studying Nebraska and Serving Nebraskans for 130 years. Brazilian Delegation at Daugherty Water for Food Global Institute, Lincoln, NE. May 11, 2023.
- Korus, J.T.**, 2023. A deep-time, high-resolution view of Cenozoic fluvial systems on the Great Plains using LiDAR, AEM, UAVs, and aerial imagery. University of Kansas Department of Geology Spring Colloquium, Lawrence, KS. February 16, 2023.
- Korus, J.T.**, Tilahun, T., 2023. Application of random forest machine learning for regional 3D hydrostratigraphic modeling. 6th European Meeting on 3D Geological Modeling, Copenhagen, Denmark. May 23-26, 2023.
- Korus, J.T.**, 2023. Fluvial ridges provide a deep-time, high-resolution record of Cenozoic fluvial systems on the North American Great Plains. Geological Survey of Denmark and Greenland (GEUS) Research Seminar Aarhus, Denmark. May 17, 2023.
- Korus, J.T.**, 2023. Groundwater Hydrology. Nebraska Water Leaders Academy, Lincoln, NE. January 20, 2023.
- Olafsen Lackey, S.**, 2023. Groundwater management the path forward. Lewis and Clark NRD Water Subcommittee, Hartington, NE. April 20, 2023.
- Olafsen Lackey, S.**, 2023. Groundwater Source Potential in the Lindy Area. Cedar-Knox Rural Water Project Board Meeting, Hartington, NE. June 8, 2023.
- Rutgers, M.D., **Turk, J.K.**, 2023. The effect of soil aggregation state on color-based predictions of soil organic carbon. ASA-SSSA-CSSA International Annual Meetings, St. Louis, MO. October 31, 2023.
- Hernandez, W.B., **Turk, J.K.**, Baker, T.J., 2023. Changes in particle size over 60 years of crop production in Nebraska. ASA-SSSA-CSSA International Annual Meetings, St. Louis, MO. October 30, 2023.
- Rutgers, M.D, **Turk, J.K.**, 2023. Particle size distribution of deflation basin soils in Eastern Nebraska. ASA-SSSA-CSSA International Annual Meetings, St. Louis, MO. October 30, 2023.
- Turk, J.K.**, Baker, T.J., 2023. Human-induced soil change in Nebraska. ASA-SSSA-CSSA International Annual Meetings, St. Louis, MO. October 30, 2023.
- Turk, J.K.**, and Baker, T.J., 2023. The nature of soil change across Nebraska. Nebraska Society of Professional Soil Scientists, Society for Range Management Joint Symposium. April 14, 2023.
- Vasquez, C., **Turk, J.K.**, 2023. Decomposition rates of depressional wetlands in Eastern Nebraska. Nebraska Society of Professional Soil Scientists, Society for Range Management Joint Symposium. April 14, 2023.
- Glasshoff, S., Shahbazi, K., Marzi, M., **Turk, J.K.**, Ferguson, R., Harms, D., 2023. Using mid-infrared spectrometry to assess relative accuracy of three soil organic carbon measurement methods for calcareous soils. Nebraska Society of Professional Soil Scientists, Society for Range Management Joint Symposium. April 14, 2023.
- Rutgers, M., **Turk, J.K.**, 2023. Particle size distribution of deflation basin soils of the Todd Valley, Eastern Nebraska. Nebraska Society of Professional Soil Scientists, Society for Range Management Joint Symposium. April 14, 2023.
- Westrop, J.P.**, 2023. Groundwater nitrate geochemistry and occurrence in Nebraska. Nebraska Water Industries Annual Convention and Trade Show, Kearney, NE. February 16, 2024.

- Young, A.R.**, 2023. UNL-CSD Involvement in the NGWMN. National Groundwater Monitoring Network Data Providers Conference, Denver CO.
- Young, A.R.**, 2023. An overview of groundwater level monitoring in Nebraska. Brazilian Delegation at Daugherty Water for Food Global Institute, Lincoln, NE. May 11, 2023.
- Young, A.R.**, 2023. Groundwater Level Trends in Nebraska. Climate Assessment Response Committee, Lincoln, NE. November 17, 2023.

Public and Private Entities Served by CSD

Air Force Center for Engineering and the Environment
Alfs Well Drilling Company
American Association of Petroleum Geologist, Mid-Continent Section (AAPG-MCS)
Aqua Geo Frameworks
Argonne National Laboratory
AWS Well Company
Boyd Jones Construction
Buffalo Bill Farm Expo
Cedar-Knox Rural Water Project
Central Platte NRD
Daugherty Water for Food Global Institute
Department of Earth and Atmospheric Sciences, University of Nebraska-Lincoln
Duck Creek Ranch
EA Engineering
East Campus Discovery Days & Farmers Market
Eastern Nebraska Water Resources Assessment
Entropy, Inc.
Geological Society of Minnesota
H2Options Engineering
HDR
Heine Well Drilling
IANR Roads Scholar Tour
Johnson, Mirmiran and Thompson, Inc.
Kansas Geological Survey
Lewis and Clark NRD
Lancaster County Health Department
Lincoln Garden Club
Little Blue NRD
Lower Big Blue NRD
Lower Elkhorn NRD
Lower Loup NRD
Lower Platte Modeling Group
Lower Platte North NRD
Lower Platte South NRD
LRE Water (Water Consultation Services)

Middle Niobrara NRD
Moser Well Drilling
National Park Service
National Groundwater Monitoring Network Program Board
Nebraska Association of County Officials
Nebraska Corn Board
Nebraska Department of Agriculture
Nebraska Department of Energy and Environment
Nebraska Department of Natural Resources
Nebraska Energy Office
Nebraska Extension, Institute of Agriculture and Natural Resources
Nebraska Forest Service
Nebraska Game and Parks Commission
Nebraska GeoCloud users
Nebraska Geological Society
Nebraska Ground Water Monitoring Advisory Committee
Nebraska GIS/LIS Association
Nebraska Legislature
Nebraska State Irrigation Association
Nebraska Water Science Center, U.S. Geological Survey
Nebraska Water Well Standards Board
Nebraska Well Drillers Association
Nemaha NRD
New York Times
Nemaha NRD
Norfolk Public Water System
North Central Region Water Network
Northdale Sanitary District, South Dakota
Olsson Associates
Omaha Northwest High School
Onsite Wastewater Advisory Committee
Panhandle Research, Extension and Education Center
Papio-Missouri River NRD
Prairie Valley Farms
Rieschick Drilling
Sarpy County Public Works Department
Seward County Zoning Board

Soil and Plant Sciences Research Advisory Team
South Platte NRD
Steve Comfort, Soil Environmental Chemist, University of Nebraska-Lincoln
Testing Ag Performance Solutions (TAPS) program
Twin Platte NRD
U.S. Department of Agriculture, National Institute of Food and Agriculture
U.S. Geological Survey Earth MRI Program
U.S. Geological Survey National Ground Water Monitoring Network
U.S. Geological Survey Nebraska Water Science Center
University of Nebraska System, University Architect
University of Texas-Dallas
University of Utah
University of Wyoming
Upper Big Blue NRD
Upper Loup NRD
Upper Niobrara-White NRD
Upper Republican NRD
Upper Republican NRD
U.S. Army Engineering Support Center
Virginia Tech University
Waite & McWha, Attorneys at Law
Water Planning Division, Nebraska Department of Natural Resources
Water Riches Field Day
West Central Research, Extension and Education Center
Western Nebraska Community College
Western Science Fair

Selected Objectives for CSD in 2024

- Addressing inquiries from diverse stakeholders
- Advancing the understanding of water resources using remote sensing
- Analyses of geophysical surveys of critical hydraulic infrastructure
- Building a GIS for a local hydrostratigraphic framework to improve farm planning and interdisciplinary collaboration at West-Central Extension and Research Center
- Building models to extract hydrologic information from ground-based time-lapse imagery
- Collecting baseline geophysical data for a collaborative project with the West-Central Research and Extension Center
- Completing multiple geologic maps for the U.S. Geological Survey STATEMAP Cooperative Geologic Mapping Program
- Completing research on oriented landforms on the Great Plains
- Completing testing of phase 2 enhancements for the Nebraska Groundwater Quality Clearinghouse
- Conceptualizing and implementing research involving CSD personnel and Nebraska Extension specialists
- Conducting and evaluating the effectiveness of the Nebraska Water Leaders Academy
- Conducting and supervising research in the human dimensions of natural resources management
- Continuing geophysical research on seepage from dams, water-supply canals, and other hydraulic structures
- Continuing research on blowouts in the Nebraska Sand Hills
- Contributing to the Nebraska Climate Change Report
- Coordinating and co-leading a Nebraska Geological Society field trip to south-central Nebraska
- Creating new web apps and educational materials for airborne electromagnetics data
- Developing groundwater game concept to support data science instruction in Nebraska high schools
- Developing regional soil organic matter prediction charts
- Disseminating research results through Nebraska Extension

- Drilling test holes for Lower Elkhorn NRD and Logan East Rural Water District
- Establishing a process for adding enzyme-linked immunosorbent assay results to the clearinghouse for Nebraska Department of Agriculture
- Establishing critical enhancements to incorporate water quality results in the Nebraska Groundwater Quality Clearinghouse
- Exploring emerging models of environmental management to better prepare students to make sound decisions
- Ground research on linear dunes in the Nebraska Sand Hills along the Niobrara River
- Geological sample preservation projects
- Investigate modern and ancient sedimentary systems of the Great Plains
- K–12 educational outreach
- Monitoring well installations for National Park Service
- Producing an interactive map recommending the water quality parameters that should be tested in private wells based on their locations
- Publishing comparisons between field tracer data analysis and numerical groundwater modeling
- Publishing research on groundwater redox state
- Repository infrastructure improvements
- Researching ancient "greenhouse" climates and global C-cycle perturbations
- Studying long-term impacts of land use on soil carbon and structure
- Supporting Nebraska's fuel, mineral, and carbon-capture and storage industries
- Upgrading CSD's online mapping and databases

What's New at CSD

CSD news stories from 2023

- [Waszgis receives SNR Staff Recognition Award for Fall 2023](#)
- [The USGS and Conservation Survey Division announce low-level airplane flights in Central Great Plains](#)
- [Discussion-centered learning may spur more reading than lectures](#)
- [Huskers take 4th at national soil judging contest](#)
- [Continued below-average precipitation reduces groundwater levels, report shows](#)
- [Faculty Spotlight: Jesse Korus](#)
- [Study confirms nitrate can draw uranium into groundwater](#)
- [Spread of redcedar tree may threaten quantity, quality of Nebraska's water](#)
- [Husker analysis of ancient carbon cycle deepens understanding of modern Earth](#)
- [Repository's range of 'puzzle pieces' explain Nebraska's geologic past](#)



CONSERVATION AND SURVEY DIVISION

130 YRS
CSD
1893-2023

School of Natural Resources

2023

6,500 ft of test holes drilled and logged



54 PUBLICATIONS
21 Peer-Reviewed
17 Published Abstracts
5 Geologic & Groundwater Maps
5 Open File Reports
6 Additional Publications

\$3.47M+

Active
GRANT FUNDING



PRESENTATIONS
Local, National & International



57



274

UNL STUDENTS
31 Advised
20 Student Employees
20 Classes Taught
223 Students Enrolled
549 Credit Hours earned



7,474

Served through
EXTENSION & OUTREACH
including
360 Nebraska K-12 Students

INTERVIEWS

15



DATA & ANALYSIS
Requests Fulfilled

329



CONTINUING EDUCATION UNITS

earned by professionals through CSD accredited courses

556



FIELD TRIP



1

JUDITH TURK & UNL SOIL JUDGING TEAM
Region 5:
1st Place Overall
2nd Place Group
Students 1st, 2nd, 8th, & 10th



106,174

PAGE VIEWS

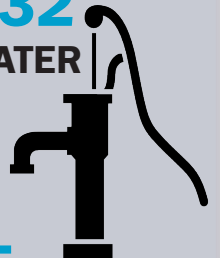


9,515

DOWNLOADS

of 812 CSD Publications from 127 Countries

441,832
GROUNDWATER LEVEL ENTRIES



271

GROUNDWATER QUALITY ENTRIES

SUSAN OLAFSEN LACKEY
Wayne Madsen Award, NWDA

Conservation and Survey Division

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Conservation and Survey Division
School of Natural Resources
University of Nebraska-Lincoln