AGF Figure 1
3D Fence diagram of interpretive profiles showing aquifer material types and geological units including Quaternary = Q, Tertiary Ogallala Group = To, Tertiary White River Group Brule Formation= Tb, Tertiary Chadron Formation = Tc, Cretaceous Pierre Shale = Kp, Cretaceous Niobrara Formation = Kn, and Cretaceous Carlile Shale = Kc. From the report on the Hydrogeologic Framework of Selected Areas in The Twin Platte and Central Platte Natural Resources Districts, Nebraska 2017. The study was implemented to understand the geology for groundwater model development. The groundwater models required detailed hydrogeologic frameworks for the management scenarios being evaluated. This was a 2-year project as part of the 2016 Nebraska Project which covered several Natural Resources districts in Nebraska.
https://www.dropbox.com/s/re4rzd96e7g8t55/TPNRD-CPNRD_AEM_Hydrogeologic_Report_AGF_28Dec2017_v1.pdf?dl=0

AGF Figure 2
3D voxel image of the Quaternary materials within the Sarpy County area of Nebraska. From the report on the Hydrogeologic Framework of Selected Areas of Sarpy County, Nebraska 2017. The study was implemented to better characterize the hydrogeology and groundwater-surface water management. This was a 2-year project as part of the 2016 Nebraska Project which covered several Natural Resources districts in Nebraska.
https://www.dropbox.com/s/elomdbvxshg3w4u/P-MRNRD_AEM_Report_01Mar2017.pdf?dl=0

AGF Figure 3
Profile of Line 125100 showing a interpretive results of the AEM hydrogeologic interpretation of aquifer materials and the geological units of the Quaternary = Q, Tertiary Ogallala Group = To, Cretaceous Pierre Shale = Kp, and Cretaceous Niobrara Formation = Kn. From the report on Mapping the Hydrogeology of the Bazile Groundwater Management Area with Airborne Electromagnetics Surveys 2017. The study was implemented to understand the hydrogeology and its impact on water quality management. This was a 2-year project as part of the 2016 ENWRA Project which covered several Natural Resources districts in Nebraska.
https://www.dropbox.com/s/a3zet4pzx1tncwo/BGMA_2016_Final_v1_with_CoverPage.pdf?dl=0

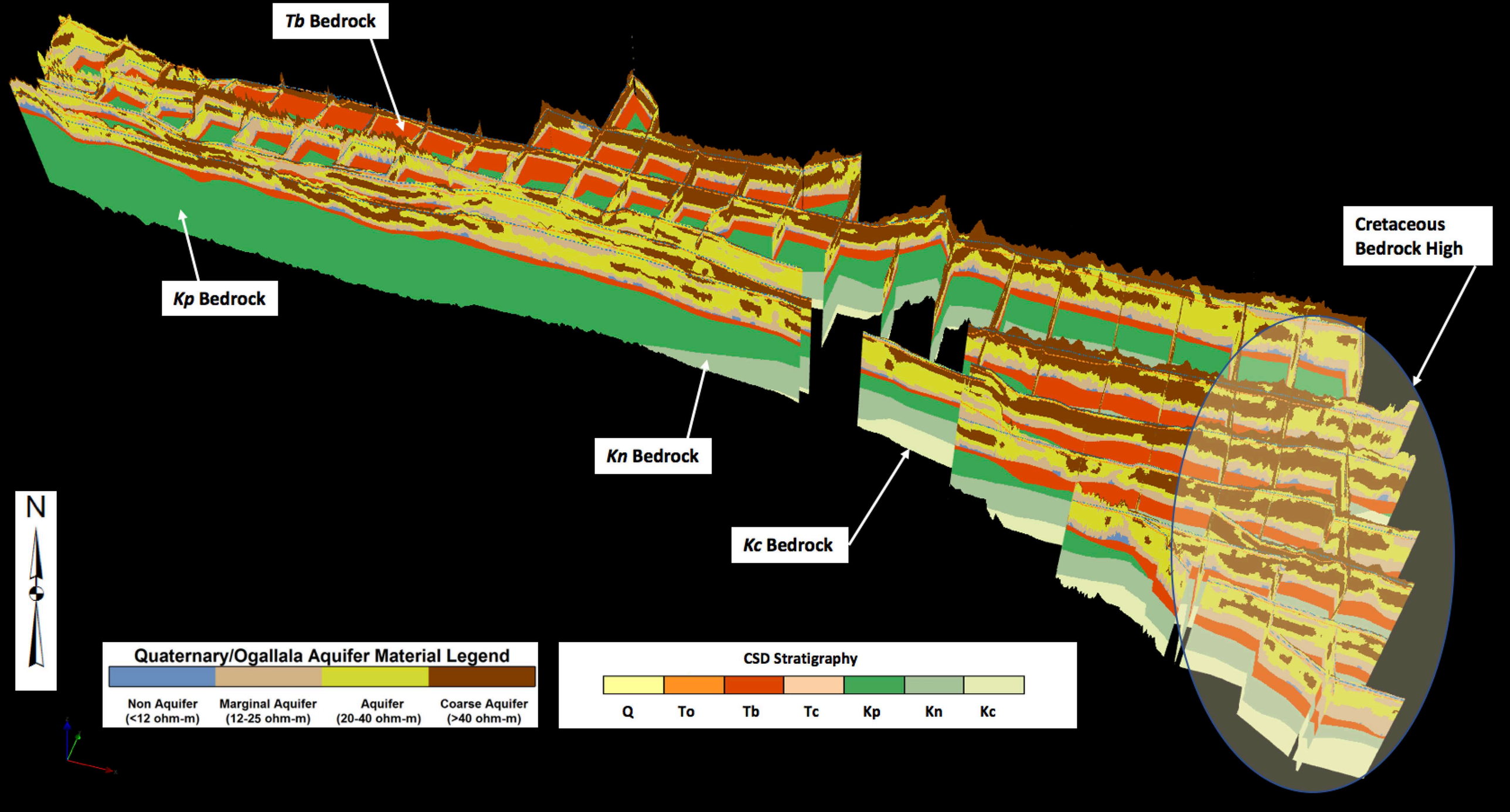
AGF Figure 4
Eastern Nebraska Water Resources Assessment (ENWRA) Web page highlighting Airborne Electromagnetic surveys. AGF has partnered with ENWRA from 2016-2020. This work is part of a multi-year eastern Nebraska project utilizing AEM mapping for identifying and delineating the aquifers for groundwater management purposes. AEM surveys provided data to create hydrogeologic frameworks across the area. AGF was responsible for survey design, QA/QC, processing, inversion, interpretation, reporting, and program management. These projects totaled 12,713 line-miles and covered 13,352 square miles. Staff from AGF were also partnered with the ENWRA while at Exploration Resources International (XRI) from 2013-2015 these projects totaled 3,830 line-miles and covered 11,690 square miles. Staff from AGF were also with the U.S. Geological Survey during the initial pilot AEM surveys for ENWRA from 2007-2009 that totaled 1,608 line-miles over an area of 262 square miles https://www.enwra.org/

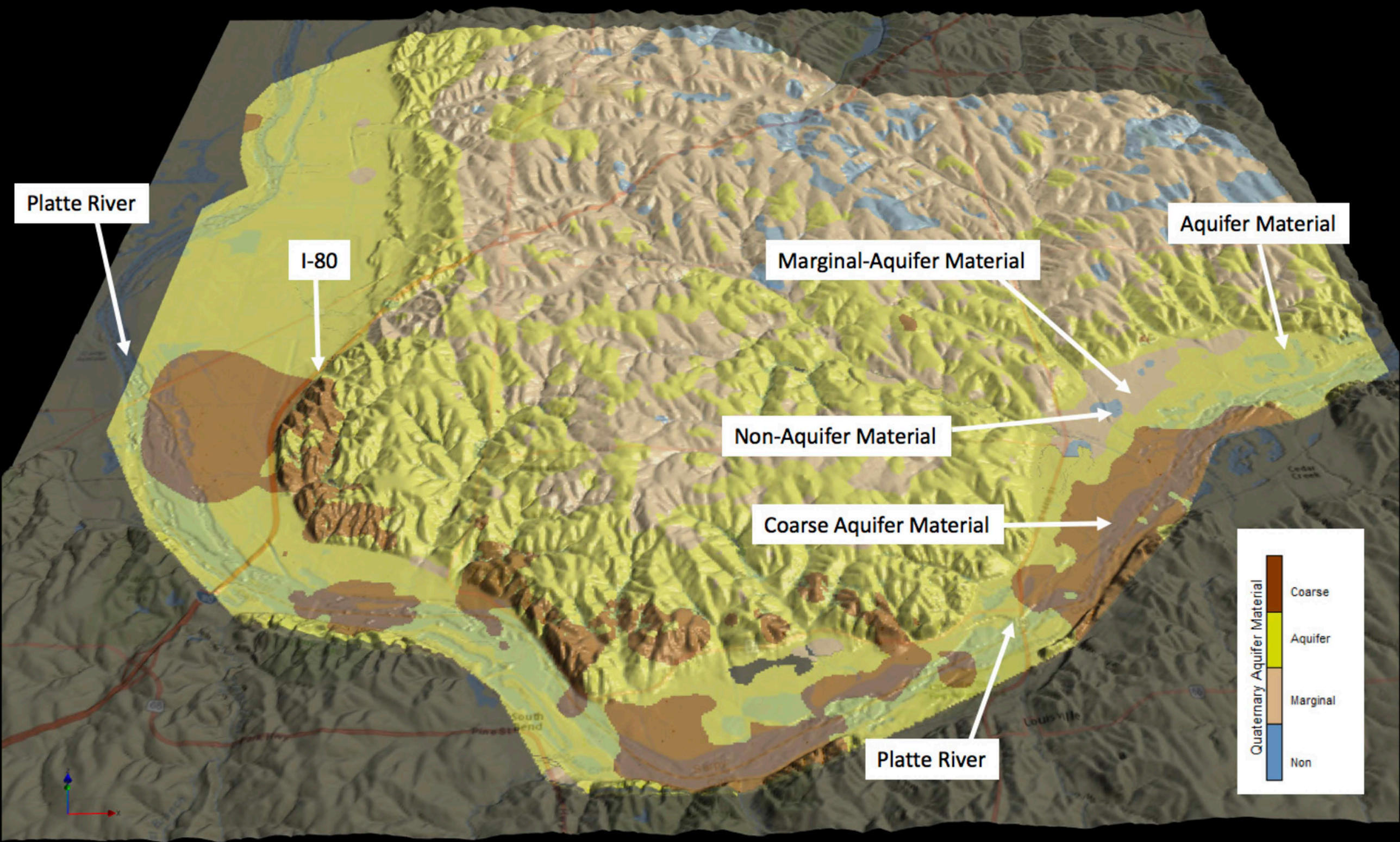
AGF Figure 5

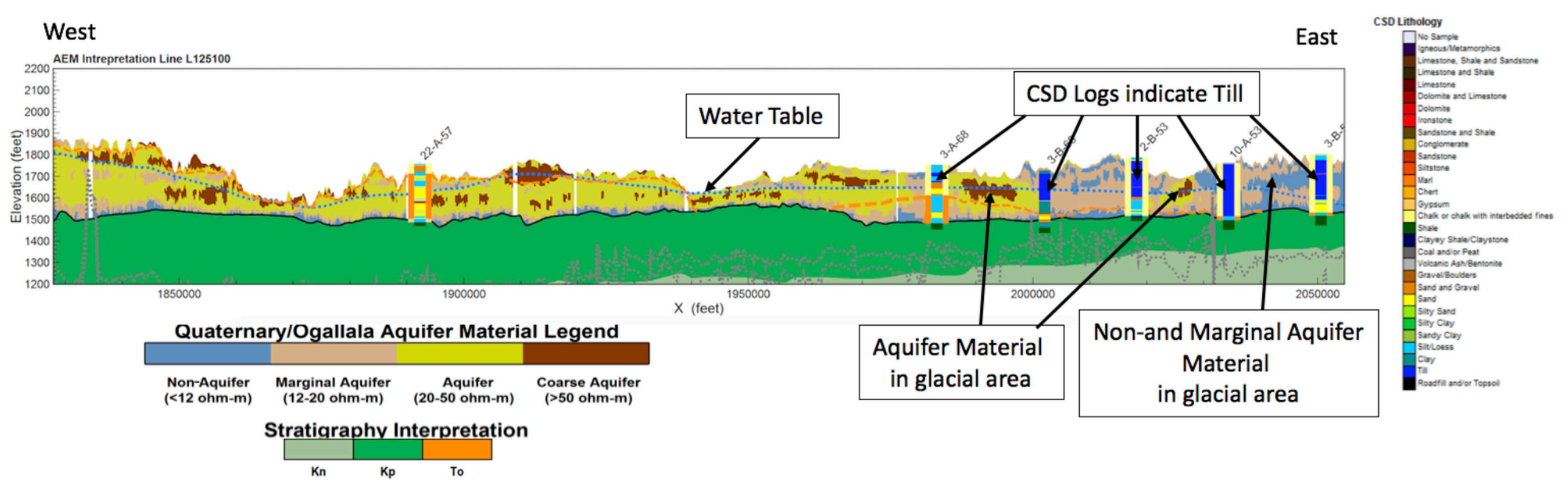
North Dakota Water Commission (NDSWC) and State Engineer web page highlighting Airborne Electromagnetic (AEM) Surveys. AGF has partnered with Geotech Ltd. for a project with the NDSWC for 4 years (2017-2020) to map several locations in North Dakota using. AEM. This work is part of a multi-year statewide project AEM mapping project for identifying the Quaternary aquifers. AEM surveys provided data to create hydrogeologic frameworks that the State utilizes for groundwater management and well permitting. AGF was responsible for survey design, QA/QC, data inversions and reporting. These projects totaled 5,025-line miles and covered 3,689 square miles.
https://www.swc.nd.gov/reg_approp/aem/

AGF Figure 6

Website that highlights the Stanford Groundwater Architecture Project (GAP). The 3D fence diagram to the left is from the AGF Butte county report. AGF Has partnered with Stanford University for five years (2015-2019) to map several locations in California. These locations were part of the GAP project (Butte County) and two were for groundwater management investigations (Kaweah and Tulare). These AEM Surveys provided practical experience in using data From AEM to create hydrogeologic frameworks. AGF was responsible for survey design, QA/QC, interpretation, reporting and program management. These projects totaled 1,056-line miles and covered 1,292 square miles.
https://mapwater.stanford.edu


Tb Bedrock
Kp Bedrock
Kn Bedrock
Kc Bedrock
Cretaceous Bedrock High
N
Quaternary/Ogallala Aquifer Material Legend
Non Aquifer (<12 ohm-m)
Marginal Aquifer (12-25 ohm-m)
Aquifer (20-40 ohm-m)
Coarse Aquifer (>40 ohm-m)
CSD Stratigraphy
Q
To
Tb
Tc
Kp
Kn
Kc


Platte River
I-80
Marginal-Aquifer Material
Aquifer Material
Non-Aquifer Material
Coarse Aquifer Material
Platte River
Quaternary Aquifer Material
Coarse
Aquifer
Marginal
Non


West
East
AEM Intrepretation Line L125100
Elevation (feet)
2200
2100
2000
1900
1800
1700
1600
1500
1400
1300
1200
1850000
1900000
1950000
2000000
2050000
X (feet)
22-A-57
3-A-68
3-B-65
2-B-53
10-A-53
3-B-
Water Table
CSD Logs indicate Till
Aquifer Material in glacial area
Non-and Marginal Aquifer Material in glacial area
CSD Lithology
No Sample
Igneous/Metamorphics
Limestone, Shale and Sandstone
Limestone and Shale
Limestone
Dolomite and Limestone
Dolomite
Ironstone
Sandstone and Shale
Conglomerate
Sandstone
Siltstone
Marl
Chert
Gypsum
Chalk or chalk with interbedded fines
Shale
Clayey Shale/Claystone
Coal and/or Peat
Volcanic Ash/Bentonite
Gravel/Boulders
Sand and Gravel
Sand
Silty Sand
Silty Clay
Sandy Clay
Silt/Loess
Clay
Till
Roadfill and/or Topsoil
Quaternary/Ogallala Aquifer Material Legend
Non-Aquifer (<12 ohm-m)
Marginal Aquifer (12-20 ohm-m)
Aquifer (20-50 ohm-m)
Coarse Aquifer (>50 ohm-m)
Stratigraphy Interpretation
Kn
Kp
To

ENWRA

Eastern Nebraska Water Resources Assessment

About Us

The Eastern Nebraska Water Resources Assessment (ENWRA) project was formed in 2006. The long-term goal of the project is to develop a geologic framework and water budget for the previously glaciated portion of eastern Nebraska...

More

Projects

ENWRA is using a variety of techniques, including cutting-edge "AEM" (Airborne Electromagnetic Survey), to map the hydrogeology of eastern Nebraska...

More

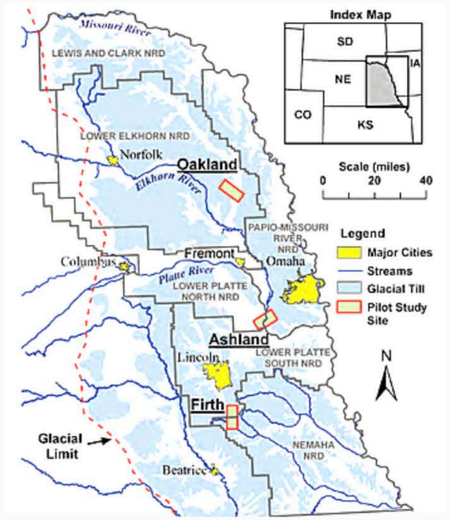
Media/Downloads

Learn more about our goals and projects with these PDFs and videos...

More

Contact Us

Contact ENWRA or any of our cooperating agencies here.



ENWRA PILOT STUDY SITES

3125 Portia St
PO Box 83581
Lincoln, NE 68501
402.476.2729

kcameron_enwra@lpsnrd.org

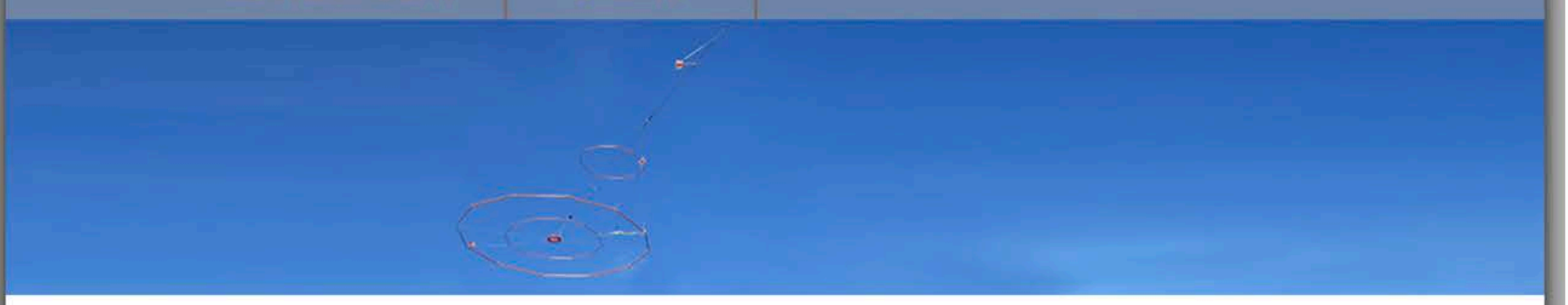
News

The 2018 Airborne Electromagnetic Survey (AEM) Flights and associated reports are complete! The Lower Elkhorn, Nemaha, Papio-Missouri River, Lower Platte South, and Lower Platte North NRD chapter reports are now **available**. You can also click **here** for an updated location map of the eastern Nebraska 2007 to 2018 flight locations. Be sure to visit our other AEM tabs for additional AEM results and project descriptions.

Groundwater elevation, weather station data and sampling results for ENWRA's 3 pilot study sites are now available under the Media/Downloads Tab. Click **here** for a link to download the 2008 to 2018 compiled datasets and graphs (168 MB).

Calendar

ENWRA's last meeting (Long Range Plan update meeting) was held December 11, 2019 at the Papio-Missouri River NRD in Omaha, NE. Click **here** for the minutes. A copy of the AEM-themed ENWRA presentation from the 2020 NRD Legislative Conference is also available for download **here**.



AIRBORNE ELECTROMAGNETIC SURVEYS (AEM)

Airborne Electromagnetic Surveys (AEM) have been conducted in several areas in the state. These surveys provide high resolution maps of aquifers that help water managers identify and optimize local sources of available groundwater.

AEM implements a helicopter that tows an antenna about 100 feet above the ground, which sends and receives electromagnetic signals to characterize the geology beneath the surface. Geophysical data is collected by the helicopter that flies in a grid pattern. The data identifies the deepest and most transmissive part of the aquifer and determines the geometry of the glacial environment – including depth and extent of the aquifers.

Press Releases

Water Commission Press Releases

AEM Projects & Reports

Project 1 – Spiritwood - JT

Project 2 – Warwick

Project 3 (Geotech) – Wahpeton Buried Valley

Project 3 (Aqua Geo Framworks) – Wahpeton Buried Valley

Projects 4 & 5 – (Geotech) - Spiritwood South & Tolna

Projects 4 & 5 – (Aqua Geo Framworks) - Spiritwood South & Tolna

AEM Results Via MapService

The results of the AEM surveys conducted in North Dakota are available via the agency's MapService. Or click on a project below to display the survey area. Additional data layers are available under the Airborne Electromagnetic Survey layer.

Project 1 – Spiritwood - JT

Project 2 – Warwick/Tolna

Project 3 – Wahpeton Buried Valley

Project 4 – Spiritwood South

Project 5 – Tolna

Photos & Videos

AEM Photos and AEM Videos

Data Available For Download

Project 1 - Google KMZ, Maps, Cross Sections

Project 2 - Google KMZ, Maps, Cross Sections

Project 3 - Google KMZ, Maps, Cross Sections (Geotech), Cross Sections (AGF)

Project 4 - Google KMZ (ZIP File), Maps (Geotech), Maps (AGF), Cross Sections (AGF)

Project 5 - Google KMZ (ZIP File), Maps (Geotech), Maps (AGF), Cross Sections (Geotech), Cross Sections (AGF)

Advanced Data Files

Advanced Data Files (available upon email request) include: Grid Files, ASCII XYZ Data, and Geodatabase Files. These surveys provide large files (Gigabytes) and need specialized software and expertise to open and view.

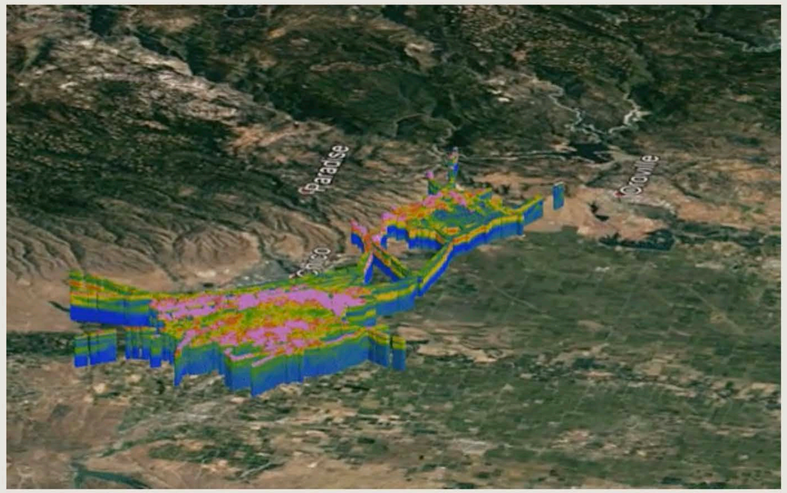
For more information please contact the Water Appropriations Division at (701) 328-2754 or by e-mail.

The Stanford Groundwater Architecture Project (GAP)

Mapping California's water resources

Using advanced geophysical imaging technologies in novel ways, we are mapping California's groundwater to enable sustainable groundwater management for the state's major agricultural areas and elsewhere. California's subsurface aquifers are being extensively pumped, especially during years of drought. In some areas, the subsidence, or compaction, caused by over-pumping means that even with abundant rain, the lost water-storage capacity may never be recovered. Negative changes in water quality are also being seen - the intrusion of saltwater into coastal aquifers and high levels of arsenic in wells in the Central Valley.

But using the airborne electromagnetic method, we can identify freshwater aquifers and manage them carefully. In the same way that medical imaging revolutionized our approach to managing human health, geophysical imaging can revolutionize our approach to managing groundwater, giving us a roadmap to the sustainable management of one of our most precious resources.



Mapping the groundwater system, ~300 m beneath the ground, in Butte and Glenn Counties.

Working with scientists from Aarhus University, Aqua Geo Frameworks, I•GIS, and Ramboll; the state of California Department of Water Resources; the State Water Resources Control Board; three regional water agencies; and the Danish Environmental Protection Agency (EPA), Stanford scientists are leading a $2 million project -- The Stanford Groundwater Architecture Project (GAP) -- to map the state's groundwater systems. Although legislation is in place requiring sustainable groundwater management, there is a critical need for data to support the development of plans. Without these data, "it's like managing a bank account and not knowing how much is going in and how much is coming out," says Stanford geophysicist Rosemary Knight, the lead scientist on the project.

Building on previous research led by Knight and other scientists the project commenced in October 2018 and will continue for two years. The purpose of the GAP is to determine the optimal workflow required to use the geophysical imaging method as the basis for sustainable groundwater management. Knight's vision: that the geophysical imaging method will be adopted for groundwater management throughout the state.