



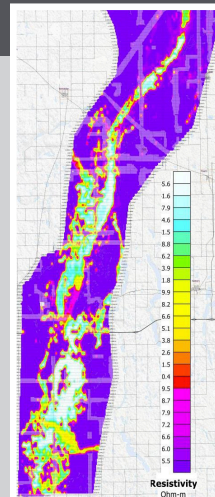
Geotech helicopter with data collection equipment in tow.

# Preliminary Results of Spiritwood Aquifer Airborne Electromagnetic Survey Exceed Expectations

During the fall of 2016, the State Water Commission's (SWC) Appropriations Division contracted with Geotech Ltd. to conduct a cutting-edge survey of the Spiritwood aquifer east of Jamestown, ND – from the air.

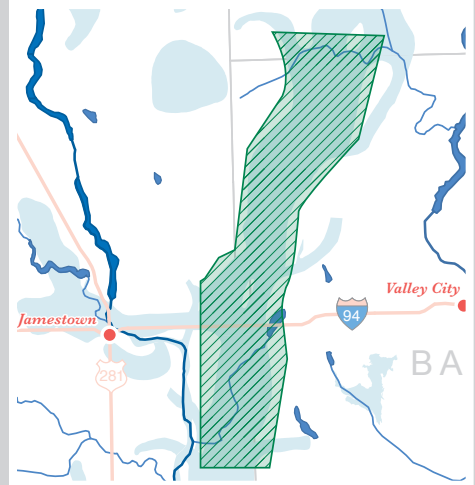
The survey, using a technology known as Airborne Electromagnetics (AEM), took place October 4-22 and covered an area from Montpelier to Walum. AEM utilizes a helicopter, towing an antenna about 100 feet above the ground. This antenna sends and receives electromagnetic signals that characterize the conductivity of materials below land surface. The survey consisted of 1,212 miles of flight lines flown east and west, perpendicular to the Spiritwood channel. East and west lines were spaced every 400 meters, with north and south lines spaced at 5,000 meters. The benefits of AEM are its non-invasive approach to data collection and its ability to collect data over large areas in a very short period of time.

The Spiritwood aquifer was chosen based on recent demands for ground water and its high density of hydrogeologic data consisting of lithologic logs, observation wells, and aquifer tests that have been collected by the SWC for decades and could be used to help validate data from the AEM survey.



This image shows the resistivity of the earth at 90 meters depth throughout the survey area.

The extent of the survey covered an area approximately 5 miles wide, extending from Walum in the north to Montpelier in the south. In total, the survey involved 288 sq. miles.



Darker colors, such as purples, represent clays and shales. Brighter colors represent sands and gravels. Finding the location and geometry of the deep channel of the Spiritwood aquifer, shown in this image, was the main goal of the study.

Jon Patch, Water Appropriations Division Director, compares it to “getting an MRI of the earth,” he explained. “The data allows us to see the deepest and most transmissive part of the aquifer and really identify the geometry of the glacial environment.”

The cost of the contract with Geotech was \$236,000. Because of the expertise of Water Appropriations Division staff, the agency has an in-house ability to analyze and interpret the data. Therefore, the SWC’s contract was about half of the original cost estimate to conduct this project.

The results were highly effective at mapping the geometry of the Spiritwood aquifer, and identified locations of additional aquifer channels that branched off of it. The data also confirmed the extent of the aquifer’s boundaries.

“The AEM survey was a huge success,” says David Hisz, a Water Commission Ground Water Hydrologist. “The

results from this survey will be extremely valuable to the State Water Commission and the citizens of North Dakota.”

Early analysis of the data is showing agreement between the AEM survey data and geologic information from test holes and observation wells that have been installed by the agency in the past. During the 2017 drilling season, the SWC Appropriations Division and their well drilling crew will install a number of additional ground water observation wells to confirm and validate data obtained from this survey.

The Spiritwood aquifer AEM survey will help the SWC with the management of the aquifer by understanding its storage capacity, aquifer depth, and recovery properties. The information gleaned from this survey will also help staff make scientifically-backed decisions in the management and appropriation of the important ground water resources of the state. Results from this work suggest this technology would work well in a number of North Dakota’s buried aquifer systems.

## Take a Closer Look

Image A

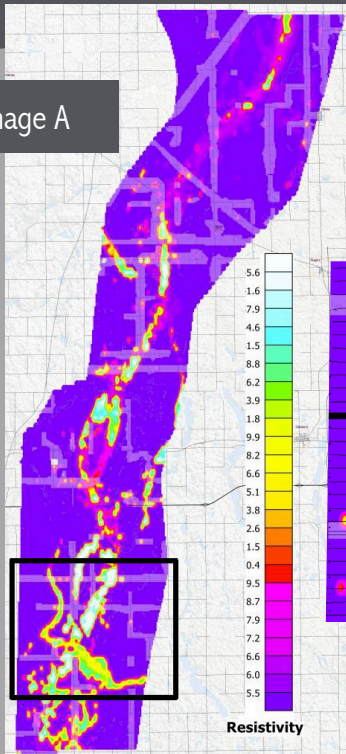
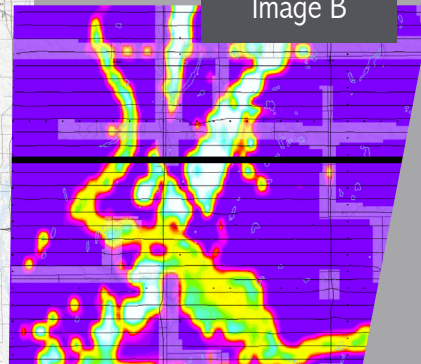


Image B

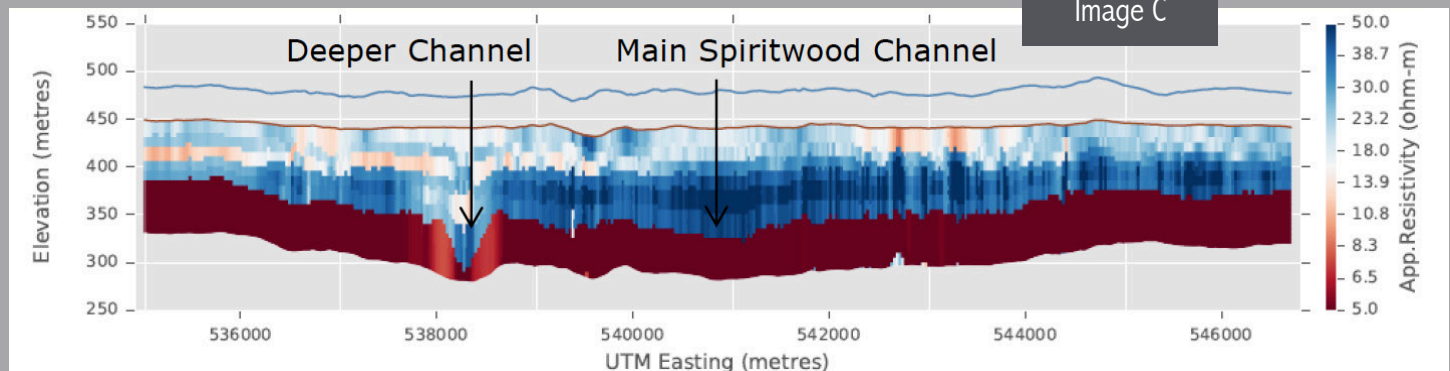


Preliminary results of the survey indicate that there may be a previously unknown aquifer channel in the southern portion of the survey area. The Spiritwood aquifer generally runs in a north and south direction. However, within the bold box in **Image A**, you can see an area of bright yellow and green that runs in a northwest to southeast direction.

The black line in **Image B** represents an individual flight line that was flown during data collection. **Image C** is the cross-section of data from that flight line. This cross-section shows the much deeper channel that may be older than the main Spiritwood channel.

As stated in the main article, the SWC Appropriations Division and their well drilling crew will install ground water observation wells to validate the AEM survey. If validated, this would help improve our understanding of the hydraulics of the system.

Image C



# Commission Approves Significant Funding For Water Projects

At their March 29 meeting, the Water Commission approved over \$32.7 million in cost-share grants for a variety of projects. Among the approvals was funding for ongoing large-scale flood protection efforts in Lisbon and Minot.

## Lisbon Flood Protection

Although the City of Lisbon's emergency levees were successful at preventing significant damages during the record flood of 2009, the risk of catastrophic failure prompted the city to pursue flood mitigation sufficient to provide protection from a 1% flood event.

The Lisbon project is broken into two phases, with a total of ten sections of levee. Water Commission funding allowed construction, which began in 2014, of levees A, B, and C. Levee D was approved for up to \$3.6 million at the Water Commission's March meeting.

The Water Commission has agreed to fund a greater cost-share percentage of this project due to increased Sheyenne River flows resulting from the Devils Lake outlets. Levee D construction is expected to start in October 2017. Once Levee D is complete, all that will be remaining of Phase 1 will be Levee E, before the city can start on Phase 2.

## Mouse River Flood Protection

The Mouse River basin was devastated by record flooding in 2011. After the flood, the Mouse River Enhanced Flood Protection Project (MREFPP) was developed to provide flood mitigation measures to reduce the chances of the basin being flooded again in the future from a similar event.

At the March meeting, the Water Commission approved nearly \$21 million in funding for several portions of the flood mitigation project in the City of Minot. Included in the approvals was: the Broadway Pump Station, to pump up to 178,000 gallons per minute from the dry side of the levee into the Mouse River; the Peterson Coulee Outlet, to block interior drainage from reaching the Mouse River from adjacent land; property acquisitions for buildings that will be displaced by flood mitigation structures; and also for a federally required peer review of structures previously funded by the Water Commission.



The completed floodwall in Sandager Park in Lisbon.

Photo Credit:  
Moore Engineering

## MARCH 29 WATER COMMISSION COST-SHARE APPROVALS

Grand Forks Co. Legal Drain No. 58	\$1,481,850
GCDC Mile Marker 15 Irrigation	\$321,781
Wells Co. Hurdsfield Legal Drain	\$644,292
Richland-Sargent Co. Legal Drain No. 7, Phase II	\$378,000
Walsh Co. Drain No. 30-1	\$282,307
Walsh Co. Drain No. 87/McLeod	\$3,369,820
Williams Co. Epping Dam Safety Repair	\$127,089
Cass Co. Drain No. 14 Channel Improvements	\$741,562
Cass Co. Sheyenne-Maple Flood Control District No. 2	\$1,035,358
Lisbon Permanent Flood Control Project Levee D	\$3,600,000
<b>Minot (MREFPP)</b>	
Broadway Pump Station	\$15,197,000
Peterson Coulee Outlet	\$1,427,022
Independent Peer Review-Phases BU-1 and BU-5	\$171,909
Minot Property Acquisitions	\$3,979,656
<b>TOTAL FUNDING APPROVED</b>	<b>\$32,757,646</b>



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# Discover Today's SOURIS RIVER watershed institute



For More Info &  
Registration Visit  
[www.swc.nd.gov](http://www.swc.nd.gov)

## JULY 9-14, 2017

### About the institute...

Join us in Bottineau for an opportunity to experience current watershed management and water resource issues on the Souris River. While exploring the issues and identifying solutions, participants will receive real world, user friendly and classroom ready instruction from specially trained Project WET facilitators, resource professionals, and scientists.

Participants will experience hands-on, minds-on learning through a balance of presentations, discussions, activities, field tours, and environmental investigations and will be able to transfer the institute's field studies to practical classroom applications.

**Discover, explore, and experience** some of the region's unique water resource sites in the Souris River watershed.

**See, hear, live, and feel** the pulse of the Souris River watershed through some of the region's foremost experts on water resources, watershed science, and social issues.

**Complete** several environmental investigations to understand methods for determining overall watershed quality.

- Biological, Chemical & Physical Assessments.
- Streamflow & Cross-Section Assessments.
- Stream Habitat Assessment.

**Learn** about and complete hands-on activities from Project WET Guides.

"A lot of time, effort, planning, and energy went into planning this institute. All of the instructors and presenters were dedicated to making this a wonderful learning experience for us all with the hopes that we can influence our students to understand and enjoy aspects of nature." *Mari Baldwin, 3rd Grade Elementary Education, Minot, ND*

"To know that North Dakota has the people with the knowledge and expertise to address the water issues facing North Dakota was more than I could ever have expected. It is up to us as teachers to use these assets to make sure our students can help to make the best decisions we can to address the questions our state faces." *Scott Erickson, 7-12 Grade Life Science, Earth Science & Biology, Tolley, ND*

**NEED  
GRADUATE  
CREDIT?**

### Credit, Costs, Scholarships

Participants can receive four semester graduate credits (upon approval) through **MISU, UND, or NDSU**. There is a \$50 per credit fee payable to the preferred institution. Online registration is available.

Registration must be done on-line at [www.swc.nd.gov/info\\_edu/water\\_education/education/](http://www.swc.nd.gov/info_edu/water_education/education/). The registration fee covers room, board, materials, instructors, and resources.

Your local water resource district, school staff development funds, or local soil conservation district may offer full scholarships. Participants are responsible for contacting their local districts. To find your local district, [www.swc.nd.gov/info\\_edu/water\\_links/](http://www.swc.nd.gov/info_edu/water_links/).

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