

# **Revitalization of the IGS' Cretaceous well network; phase 1**

5 October 2023

Funded by the  
U.S. Geological Survey – Award # G22AC00125  
01 August 2022 – 31 July 2023

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## INTRODUCTION

The National Ground-Water Monitoring Network (NGWMN) provides a unique opportunity to collect and share water-level and water-quality data from different states and agencies. The Iowa Geological Survey (IGS) at the University of Iowa joined the NGWMN in 2017. The IGS contributes data from 40 wells, completed in the Cambrian-Ordovician (USGS national code S300CAMORD), Cretaceous (N300ILCRTCS), Mississippian (N500MSSPPI), and Silurian-Devonian (N400SLRDVN) aquifers, where quarterly static water-level measurements are collected to the NGWMN.

Activities associated with prior NGWMN awards documented that many of the IGS wells in the Lower Cretaceous (Dakota) Aquifer are non-functional. Through U.S. Geological Survey (USGS) Award # G22AC00125, the IGS received funding to drill a replacement well for one of these non-functional Dakota wells and install continuous monitoring equipment in two Dakota wells. This report describes the work performed and results obtained under this award.

### Objective 5: Well Drilling

The IGS has been systematically testing its NGWMN wells to verify they remain in hydrologic contact with the aquifer from which they draw. This testing demonstrated that D-32 (NGWMN ID 25593) lacked good connection with its aquifer. IGS staff discovered an obstruction in D-32 roughly 70 feet below the surface that could not be cleared. This obstruction is believed to be the reason two attempts to airlift the well were unsuccessful. Additionally, IGS staff discovered two holes in the casing of the well. The IGS proposed to drill a replacement well for D-32 under this award.

The IGS obtained permission from Woodbury County Conservation to construct a replacement well for ID 25593 at Midway Park. The park is located ~3 miles northeast of ID 25593 (figure 1) and was expected to have similar geology to 25593. The selected site is in a little used but accessible area of the park, which should help prevent accidental damage to the well. Table 1 contains information about the well.

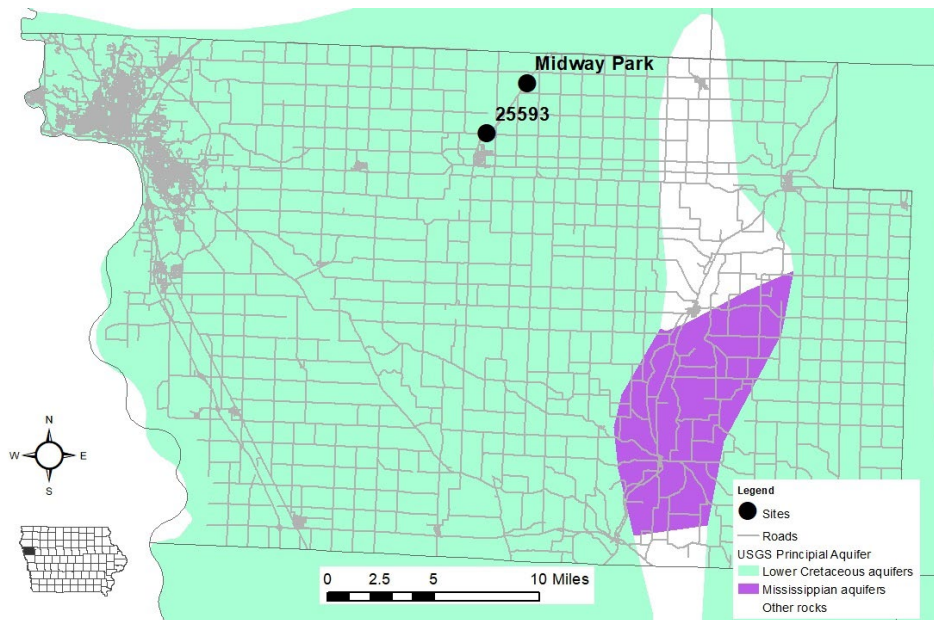
**Table 1.** General information for the new Midway Park well in Woodbury County, Iowa

Name	NGWMN ID	Principal Aquifer	Well Depth (feet)	Replaces NGWMN ID
Midway Park	100700	Lower Cretaceous (Dakota)	301	25593

The IGS contracted with Wernimont Well, an Iowa Department. of Natural Resources Certified Well Contractor, to construct the well to Iowa nonpublic water supply well standards, which are detailed in Iowa Administrative Code [567], Chapter 49 (<https://www.legis.iowa.gov/docs/ACO/chapter/10-19-2011.567.49.pdf>). Rotary drilling methods and standard materials (PVC casing and stainless steel screen) were used to construct the well. Details of the well construction are found at <https://www.iihr.uiowa.edu/igs/geosam/well/100700/logs> and are shown in Appendix A. A

locking well cap was installed to prevent unauthorized access to the well. Well construction was completed on June 1, 2023. Figure 2 shows the completed well.

An aquifer recovery test was conducted to establish the well's baseline hydraulic conductivity. A manual static water-level measurement was made with an e-line. An In-Situ Level TROLL 700 transducer was placed in the well. The transducers reference level was set to the manual static water-level and collection interval was set to every second. The well was pumped at 30 GPM. After an initial draw down, the water-level in the well fluctuated over the same interval for roughly two hours. Pumping was terminated 2.25 hours after the initial start and the water-level allowed to recover.



**Figure 1.** Map of Woodbury County, Iowa showing the location of the new Midway Park well in relation to the previous NGWMN ID 25593.

Data from the recovery test was downloaded from the transducer, processed in Microsoft Excel, and analyzed using AquiferTest 10.0 software (Waterloo Hydrogeologic). Using the Theis Recovery method (Theis, 1935), the hydraulic conductivity (K) was estimated at 13.6 ft/day. The raw data and analysis results of the recovery tests were entered into IGS Pump Test (<https://www.iuhr.uiowa.edu/igs/pump-test/>) to allow public access.

The information for this new well is available on the NGWMN Data Portal as NGWMN ID 100700. The well was added to the Well Registry, populated with all required elements. Triggers in GeoSam, the IGS' well database, were enabled that allow IGS web services to transfer the well's construction and water-level measurements data to the NGWMN.



**Figure 2:** Photograph of the completed Midway Park well (NGWMN ID 100700).

The IGS is currently monitoring both ID 25593 and the new site (100700) to establish a correlation between the water levels, if any, at these sites.

#### **Objective 5: Purchase equipment....**

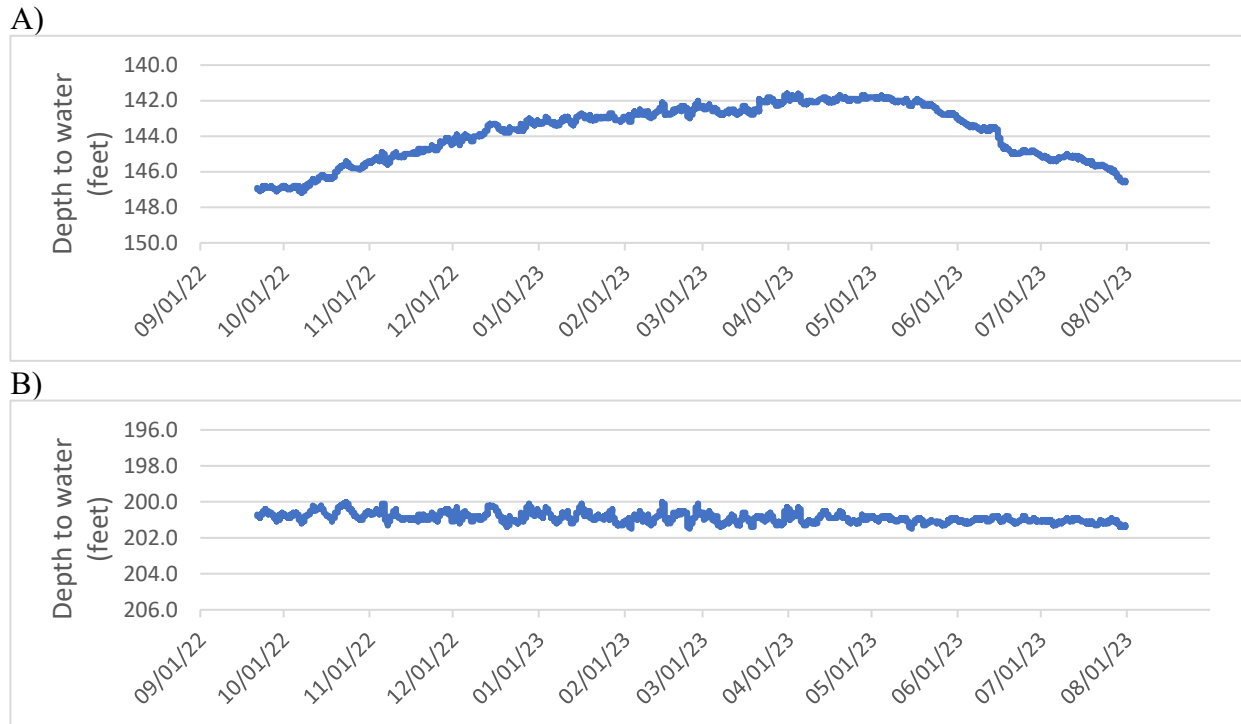
The IGS does not have a good understanding of fine scale water-level fluctuations in the Dakota Aquifer. Most of IGS' water-level data for the Dakota Aquifer is derived from single measurements associated with the construction of new water wells. The IGS proposed to purchase and install pressure transducers in two NGWMN well sites, IDs 24556 and 64073, to allow for the continuous collection of water-level data under this award.

The IGS currently deploys In-Situ Level TROLL 700 data loggers and vented cables of standard lengths in other wells. To enable the IGS to quickly swap out equipment in the case of an emergency, the same equipment (In-Situ Level TROLL 700s and vented cables) was purchased.

The equipment was deployed to the sites in September 2022. Minor modification to the well, including installing a protective PVC casing and creating a secure hanging point, were required to install the transducers at both sites. At ID 64073, a 200-foot cable was connected to a 25-foot cable using a cable extender to allow the transducer to be deployed below the static water-level. At ID 24556, a 200-foot cable was used.

Transducer operation followed procedures established in GWPD 16 of the USGS' Groundwater Technical Procedures of the U.S. Geological Survey (Cunningham and Schalk, 2011). Water level data from both sites were downloaded on quarterly site visits. To maintain quality control, transducer readings were checked against manual static water-level measurements and the transducers were recalibrated on these quarterly visits.

The data collected provides new insights into water-levels in the Dakota Aquifer. Figure 3 compares the data at both sites and illustrates different water level dynamics within the aquifer at the two locations. While the water-levels in D-2 recover ~4.5 feet during the winter months, water-levels in D-29 slightly decline.



**Figure 3.** Water-level data from A) D-2 (NGWMN 24556) and B) D-29 (NGWMN ID 64073).

Technical limitations prevent the IGS from sharing the continuous water-level data. The IGS stored the average water-level for the first day of each month in its GeoSam database. Web services transfer this data to the NGWMN for display in the NGWMN Data Portal. The IGS is currently modifying its databases and web services to store and transfer continuous water-level data to the NGWMN.

With USGS permission, the IGS purchased another In-Situ Level TROLL 700 and a 50-foot vented cable for the new well at Midway Park (NGWMN ID 100700) with funds that remained from the drilling project. Unfortunately, the equipment arrived after the end of the grant period. The equipment is scheduled to be installed in September or October 2023.

## WEBSERVICE AND DATABASES

The IGS did not encounter any problems with its web services transferring data to the NGWMN Data Portal during the contract period of this award. No updates to existing web services were completed during the project period.

## **SUMMARY**

The IGS has achieved its project goals. Specifically, a new Dakota well was constructed at Midway Park to replace a non-functional Dakota well. The IGS obtained and installed two transducers in NGWMN IDs 24556 and 64073 to document fine-scale water-level changes in those wells. These activities start the process of revitalizing the IGS' Dakota well network with functional wells and allows for the collection of more detailed water-level data in the Dakota Aquifer.

## **References**

Cunningham, W.L., and Schalk, C.W., comps., 2011, Groundwater Technical Procedures of the U.S. Geological Survey: U.S. Geological Survey Techniques and Methods 1–A1, 151 p.

Theis, C. V. (1935), The relation between the lowering of the Piezometric surface and the rate and duration of discharge of a well using ground-water storage, *Eos Trans. AGU*, 16(2), 519–524, doi:10.1029/TR016i002p00519.

APPENDIX A  
MIDWAY PARK (NGWMN ID 100700) CONSTRUCTION DIAGRAM

