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Award Number: G19AC00180

New Mexico Bureau of Geology and Mineral Resources (NMBGMR), at New Mexico Tech
New Mexico Bureau of Geology and Mineral Resources groundwater level monitoring network
Year 3

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Major Goals 2019-2020: To support persistent data services as an existing data provider for the National Groundwater Monitoring Network (NGWMN) and to fill missing minimum data requirements for NGWMN wells using well camera surveys.

Project Summary:

New Mexico Bureau of Geology and Mineral Resources was awarded Grant No. G19AC00180 to support persistent data services and to fill missing minimum data requirements using a well camera. The period of work is between September 15, 2019 and December 14, 2020, which included a 3 month no-cost extension due to COVID-related field work delays. Work included selecting additional sites for network inclusion, maintaining existing NGWMN sites, and using a well camera to gather missing data at NGWMN sites.

Work done to support the NGWMN as a data provider:

For the year 2019-2020, our team focused on Objective 2; supporting persistent data service, and Objective 3; filling gaps in information at NGWMN sites. For Objective 2, our team consists of a staff hydrogeologist, data manager, field technician, and program manager. With USGS funds, the hydrogeologist and data manager worked with our in-house Aquifer Mapping Program (AMP) database to keep the NGWMN sites up to date. The data manager executed QA/QC procedures on all data and the project manager helped review all data and determined any additional well site selections. Their time was supported by the NMBGMR cost share fund. This team structure proved effective in maintaining a high quality standard of data submitted to the NGWMN.

We added one new site within the Rio Grande Aquifer System to the monitoring network this year and removed two sites (Figure 1). Well HS-002 was removed from the network because it was plugged in 2019 (Table 1). Nearby well HS-039 was added to the network to replace HS-002 well. It is a monitoring well and has a similar depth to well HS-002. We were able to obtain and verify historical water level data, and add it to our two years of measurements to meet the 5 years of data required to classify the site into a subnetwork. Well TB-0203 was removed as a result of the deteriorated state of the well casing discovered by well camera imaging undertaken under Objective 3 (Table 1). As a result of reaching 5 years of depth-to-water measurements, we were able to classify four additional NGWMN sites into subnetworks and turn them “on” in the NGWMN portal (Table 1).

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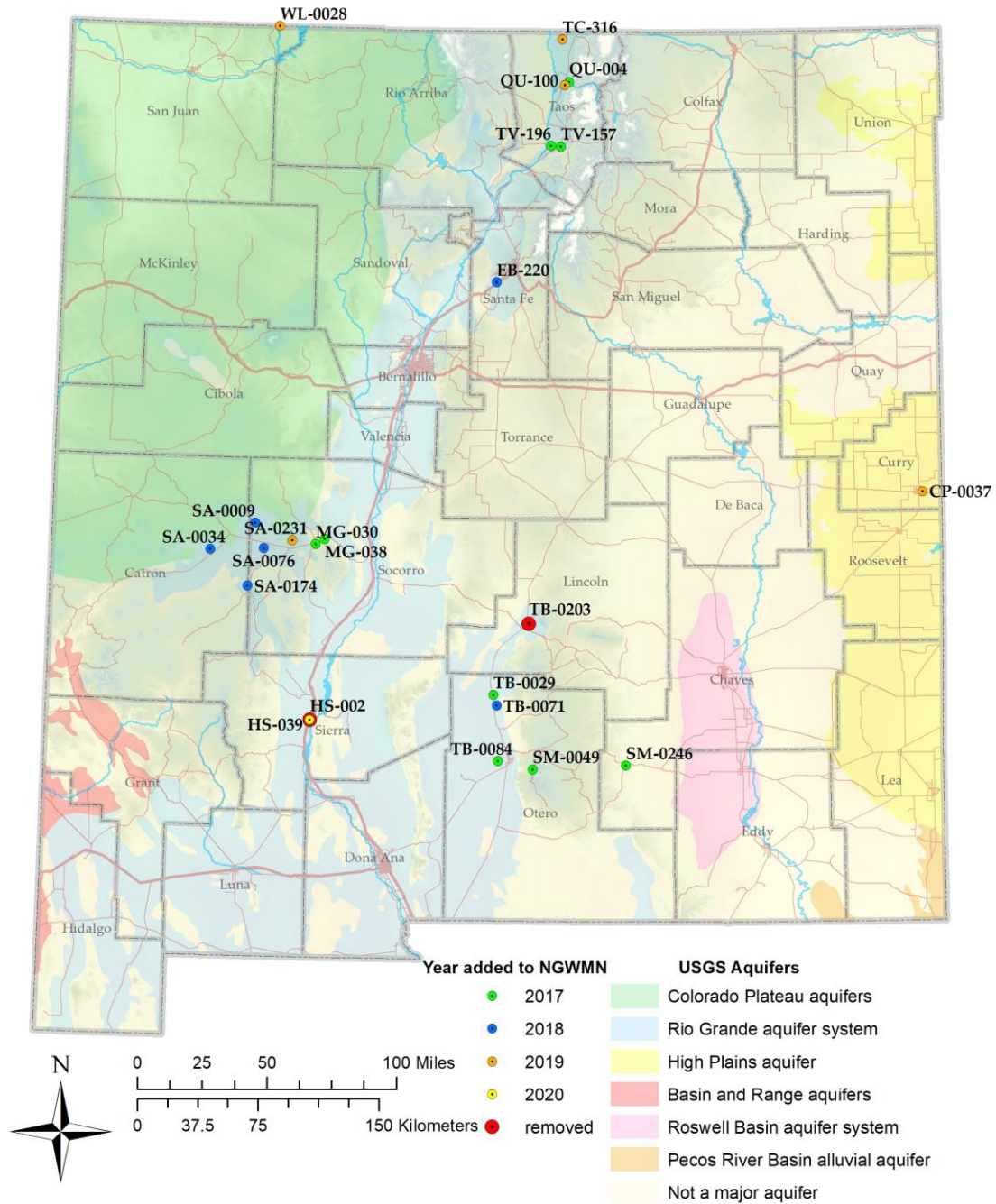


Figure 1. Principle aquifers and NMBGMR sites selected for inclusion in the NGWMN in 2019-2020 (yellow), two wells were removed from the system due to changes in well access (red).

Table 1. Updates to NGWMN sites

Point ID	National Aquifer	Well depth (ft)	Subnetwork	Monitoring Category	Monitoring Frequency	Action
HS-002	Rio Grande Aquifer System	25	Background	Trend	Removed	Plugged in 2019; removed from NGWMN
HS-039	Rio Grande Aquifer System	26	Background	Trend	Annual	Added to replace HS-002, sited turned “on”
TB-0203	Rio Grande Aquifer System	103	Background	Trend	Removed	Well camera revealed deteriorated casing, little water remaining; removed from NGWMN
SA-0174	Rio Grande Aquifer System	324	Background	Trend	Annual	Site turned “on”
SA-0231	Rio Grande Aquifer System	450	Background	Trend	Annual	Site turned “on”
TC-316	Rio Grande Aquifer System	423	Suspected changes	Trend	Annual	Site turned “on”

The NMBGMR team continued to work closely with the USGS NM Water Science Center in Albuquerque and the NM Office of the State Engineer. Together, we identified sites that overlap with existing monitoring efforts so as to avoid duplicating submissions to the NGWMN. Working with these federal and state entities ensures we ultimately achieve representative water level monitoring coverage throughout the state.

Completed data collection

As with our inaugural year (2017-2018), a variety of data collection and database maintenance tasks were performed. Field work was done to collect manual measurements using standardized methods. Field sheets and notebooks were copied or scanned upon return to the office; hard copies are stored in locked file drawers by the data manager. Within two weeks, quality checks were performed and then the data was entered into the AMP database. All well locations, well construction information, and manual water level data are maintained in the AMP database and the data fields are aligned with those in the NGWMN database. We maintained a reliable database link between the AMP database and the NGWMN database. All efforts to provide data to the NGWMN complement the NMBGMR mission to provide water level data to the public.

Under Objective 3, the NMBGMR team used down-hole cameras to fill in missing well site data in the well registry. We proposed to examine 14 wells with a rented downhole camera from vendor Environmental Equipment and Supply LLC, but ended up examining 13 wells due to the presence of pumping equipment still installed on one well. During the field campaign in March 2020, the COVID-19 pandemic temporarily halted field work. As a result, we received a no-cost extension to December 14, 2020.

The NMBGMR team consisted of two hydrogeologists, two field technicians, and a data manager. USGS funds supported well camera imaging and data collection by one hydrogeologist, one field technician and the data manager. The other hydrogeologist and field technician were supported by the NMBGMR cost share fund. Data collected included identification of casing material, screen interval and material, depth of the well and well condition. The gathered data allowed for the reconciliation of discrepancies between historic data sources and completion of missing well information. USGS funds supported the travel necessary to image 13 wells.

In the first phase of camera surveys completed before COVID interrupted field work, the field technicians, hydrogeologists, and data manager were able to camera 7 wells (Figure 2) using a Laval Underground Surveys R-Cam Model 1000 XLT rented from Environmental Equipment and Supply LLC using USGS funds. The R-Cam 1000 XLT Color Video Water Well Inspection System is equipped with two cameras in a single housing, each with a wide-angle lens, for viewing downhole and side view images in wells (for example, see Figure 3). Depth to water measurements at each site were collected at the time of imaging.

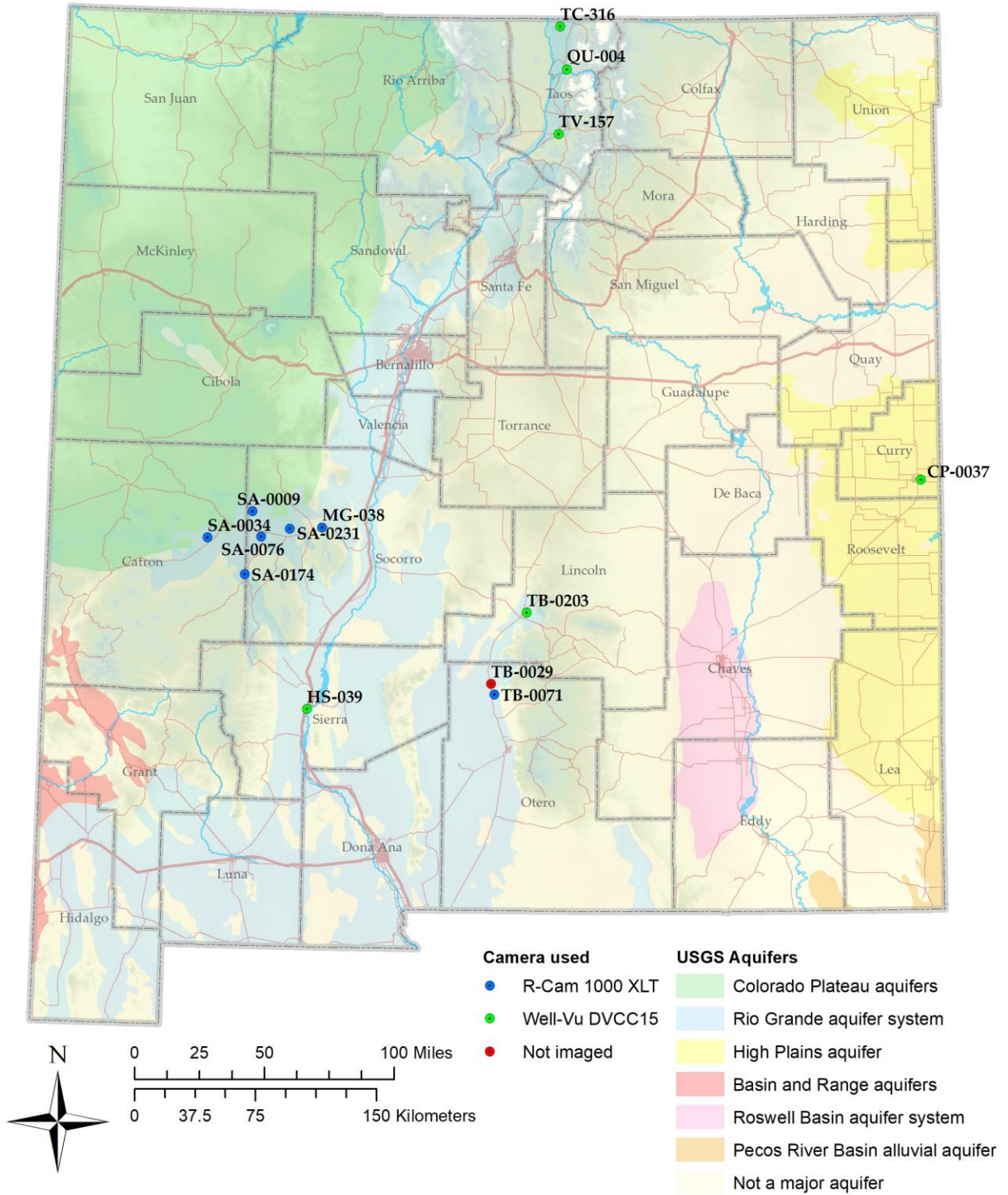


Figure 2. NGWMN sites surveyed using down-hole cameras to fill in missing minimum data requirements.

The second phase of the well camera work commenced from July 30, 2020 to September 11, 2020. During this phase, NMBGMR staff rented a Well-Vu DVCC15 equipped with a single wide-angle Fisheye camera with a 184 degree hemispherical view (for example, see Figure 3). The team used this second well camera to image the remaining 6 wells (Figure 2). The decision was made to not use the camera on one of the initially proposed wells, TB-0029, because, although unused, it is still equipped and the team did not want to risk getting the rented camera stuck in the well. See Table 2 for the results of the well camera surveys.

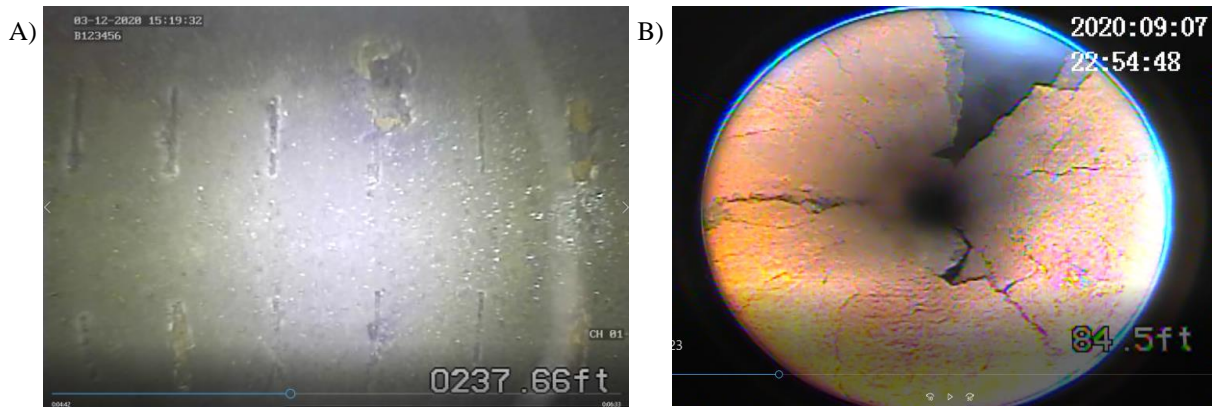


Figure 3. Examples of well images and data captured with down-hole cameras. A) Small (about 0.2 feet in length) slots in well screen in SA-0174 (side-view camera) imaged using the Laval Underground Surveys R-Cam Model 1000 XLT. B) Holes and cracks in TB-0203 casing imaged using a Well-Vu DVCC15 equipped with a single wide-angle Fisheye camera. The deteriorated state of the casing and low amount of water remaining in the well lead to its removal from the NGWMN.

Updates made to web services:

The database link between the AMP and NGWMN databases enables relevant data tables to relate directly to the NGWMN tables. This information smoothly relates to the data requirements in the NGWMN database. Three full-time staff are dedicated to providing support for core IT infrastructure for the NMBGMR. As a result of well camera work, we added new fields for screen and casing material into our web service. IT staff worked with the AMP team on the NGWMN thanks to financial support provided by the USGS.

Problems encountered in serving data to the NGWMN data portal:

None

Notice of changes in databases or web services that would impact future integration with data portal:

None

Conclusions

The NMBGMR is successfully connected to the USGS NGWMN, and is now showing 19 sites on the USGS website. Well camera inspections gathered missing site data for 13 of these NGWMN sites and improved data quality. The NMBGMR will continue to grow and add new

sites, as well as improve data quality at existing sites. We look forward to continuing to work with the USGS toward this important endeavor for a national coverage of groundwater monitoring.

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Table 2. Minimum data requirements collected by well camera surveys at NGWMN sites.

Point ID	Principal Aquifer	Monitoring category	Monitoring frequency	Well depth (ft)	Casing Description	Screened interval (ft)	Screen Description
CP-0037	High Plains Aquifer	<5 years data	Annual	356	Steel	232-356	Steel with torch cut slots
HS-039	Rio Grande Aquifer System	Trend	Annual	26	PVC	16-26	PVC with slots
MG-038	Rio Grande Aquifer System	Trend	Annual	135	Steel	115-130; 135-141	Steel with torch cut slots; Open uncased hole with fractured rock
QU-004	Rio Grande Aquifer System	Trend	Annual	449	Steel	135-160; 200-210; 215-230; 245-295; 295-500	Mineralization prevented identification of screen intervals, material
SA-0009	Rio Grande Aquifer System	Trend	Annual	297	Steel	268-297	Steel with torch cut slots
SA-0034	Rio Grande Aquifer System	Trend	Annual	234	Steel	218-234	Steel with torch cut slots
SA-0076	Rio Grande Aquifer System	Trend	Annual	284	Steel	267-282	Steel with torch cut slots
SA-0174	Rio Grande Aquifer System	Trend	Annual	324	Steel	240-324	Steel with torch cut slots
SA-0231	Rio Grande Aquifer System	Trend	Annual	450	Steel	30-450	Steel with torch cut slots
TB-0029	Rio Grande Aquifer System	Trend	Annual	724	Not imaged		
TB-0071	Rio Grande Aquifer System	Trend	Annual	651	PVC	320-418; 539-638	PVC with horizontal slots; PVC with horizontal slots
TB-0203	Rio Grande Aquifer System	Trend	Removed	103	Steel; intense rusting		Degraded state and low remaining water level led to removal from the network
TC-316	Rio Grande Aquifer System	Trend	Annual	423	Steel	267-422	Steel with torch cut slots
TV-157	Rio Grande Aquifer System	Trend	Annual	217	PVC	162-217	PVC with slots