

USGS National Ground-Water Monitoring Network Cooperative Agreement

Final Technical Report.

A. Project Information Summary

1. Award Number: G21AS00008
2. Agency Name: University of Nebraska-Lincoln, School of Natural Resources,
Conservation & Survey Division
3. Title: UNL proposal to support persistent data services and video log
15 antiquated wells.
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5. Award Term: July 15th, 2021-July 14th, 2022 (Objective 2 and Objective 4)
6. Final Report Date: September 12, 2022

Overview of work planned and accomplished during the project

The Conservation and Survey Division at the University of Nebraska-Lincoln (CSD) has been a data provider to the National Ground Water Monitoring Network (NGWMN) since 2017. Currently, the CSD is serving data for 5,371 sites, of which 5,236 wells are active. Under Objective 2, well metadata and associated water level data currently served to the NGWMN were individually reviewed. The well registry was edited to reflect changes in the network. Hydrographs for all 5,371 wells were reviewed, and any changes to well classifications were noted. Under Objective 4, fifteen antiquated wells were video logged, and the condition of the well was assessed.

Detailed description of work accomplished under each objective

Under Objective 2, the CSD performed the following tasks to keep the well information in the NGWMN registry current. These tasks include:

1. Task one included locating wells that are no longer being measured. To achieve this task, a copy of the Nebraska Water Well Registration Database was obtained from the Nebraska Department of Natural Resources. The Database was queried for wells that were decommissioned between July 1st 2021, and July 15st 2022. The query results were compared against the wells currently being served to the NGWMN, and any decommissioned wells were disabled in the registry. Furthermore, wells that data providers noted as discontinued for any reason were disabled in the registry. A list of wells disabled in the NGWMN registry is included in Appendix A.
2. Task two located new wells added to the CSD Water-Level Database since 7/14/2021. Wells in the Database that are constructed in the High Plains Aquifer (HPA) and have associated construction and lithology information were added to the NGWMN. All wells were classified as Special Studies wells with Suspected/Anticipated Changes characteristics. None of the wells met the requirements to be background wells. A list of the new wells added to the NGWMN are included in Appendix B.
3. The final task involved reviewing hydrographs and associated well data for all 5,371 wells, and making any needed adjustments to the well classifications as described in the framework document. At this time, all wells were properly classified.

Under Objective 4, fifteen wells were video logged using a CSD owned Vision Systems Unlimited well bore camera, equipped with a fish-eye down-view camera lens. Two separate videos were recorded for each well, one on the trip down the well, and one on the trip up the well. Final descriptions were made from the down video, as turbidity in the water generally had less of an impact on video quality. Where sections of the well casing were not clear, findings were verified using the up video. As videos were being recorded in the field, limited field notes were taken. Recordings were reviewed in detail off site, and detailed descriptions were recorded for each well. Detailed observations and recommendations for future actions are included in Appendix C. Videos are retained by CSD, and are available upon request by contacting:

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As in-kind match for Objective 4, a Monsoon pump manufactured by Proactive Pumps was purchased to gently pump wells before or during video logging to clear water or observe turbidity to assess well casing integrity. Due to the debris that has passed through this pump, it has reached the end of its life after pumping these fifteen wells. This pump has only been used as part of this agreement. Additionally, three Sutron Satlink 3 datalogger/transmitters were purchased using CSD funds, and installed at NGWMN monitoring sites to replace outdated or failed equipment. The sites and equipment are described in Appendix D

Appendix A: Wells Disabled in the NGWMN Registry.

Site ID	Site Name
405241100132201	11N 25W 31CB:G-005152X
411404097182601	15N 1E 34BBA:G-047754
405007099524701	10N 22W 18CB:G-002317
420049103555502	24N 57W 33AAAD:G-088543 Mid
415400103580001	22N 57W 8BBBB:G-093230
412105102080401	16N 42W 21AABB:G-086018
411426098093701	15N 7W 30DB:G-021002
420049103555503	24N 57W 33AAAD:G-088543
412911096283101	18N 8E 36CBBC:G-001994
405228098325001	11N 11W 34CBC:G-012411
412243097461001	16N 4W 10BB:G-023505
415717097080301	23N 3E 19BC:G-001814
412111097102501	16N 2E 14CCAC:G-047402
420006104004402	23N 58W 2AABB:G-094678
404600099515601	9N 22W 7AD:G-014112
405059099510401	10N 22W 8D:G-062213
405742097203001	12N 1E 32CC:G-025020
404321099494901	9N 22W 28AC:G-013586
412405100101701	17N 25W 35BC:A-006298
410610098221101	13N 9W 17B:G-009185
404605097211901	9N 1E 7ABDD:G-027978
414146097050201	20N 3E 21ABDD:G-030942
403442097181801	7N 1E 15BAC:G-008826
402460098206701	5N 9W 9DCC:A-004331
404203098112201	9N 8W 35DDBB:G-006273
414235097372200	20N 3W 14ADBB:G-042070
424038096484301	25N 5E 2ABBB:G-052995
401721097442801	4N 4W 26BB:G-014871
402753097303201	6N 2W 26ABBC:G-012315
404212097104801	9N 2E 34DA:G-024049
403620098002201	7N 6W 4BD:G-004382
410442097130601	13N 2E 20DDB:G-007031
402925097471901	6N 4W 17ADAA:G-004726
413093097476201	18N 4W 20DA:G-012376
402836098230701	6N 10W 24A:G-035031
425018099534801	33N 22W 10AC:G-042193
401811097035501	4N 3E 23BBC:G-021197
403030097272001	6N 1W 8BA:G-018288
403020098245301	6N 10W 11BC:G-024493
402846097410101	6N 3W 20BDBA:G-004557
404429099282801	9N 19W 22BA:G-013683
404411097345101	9N 2W 19AD:G-004962

402240098335401 5N 11W 28BA:G-031573
401823097573001 4N 6W 23ABA:G-039146
401501097374101 3N 3W 2CCA:G-024699
424315101563201 32N 39W 30CA:G-042352
403024097400101 6N 3W 9B:G-033931
415637103443302 23N 55W 19DCDD:G-094674 (Shallow)
415637103443301 23N 55W 19DCDD:G-094674 (Deep)
402951097315801 6N 2W 10CCAA:G-004905
420417096484200 24N 5E 11A:G-054080
404750098135601 10N 8W 33AB:G-040484
402124099201601 5N 18W 35CB
401823097463601 4N 4W 21BA:G-002363
402740097370201 6N 3W 26ADDB:G-017620X
402040100183901 4N 27W 1AD:G-037775
405840098553101 12N 14W 29CDBB:G-038366
415233096502600 22N 5E 15CACC:G-042034
402635097475301 6N 4W 32CBAA:G-009021
415221097220000 22N 1E 19BBBD:G-035060
404025097170501 8N 1E 11CA:G-021996
403419097320201 7N 3W 13D:G-014222
405503097383401 11N 3W 15DC:G-003795
404257099281401 9N 19W 27DC:G-011681
403544097294101 7N 2W 12BA:G-021934
415120097372900 22N 3W 26AACC:G-042439
410000099144101 12N 17W 22ABCC:G-037095
425455100132001 34N 25W 14DBD:G-042684

Appendix B: New wells added to the NGWMN Registry.

All sites are screened in the High Plains Aquifer, and classified as Special Studies with Suspected/Anticipated Changes characteristics.

Site ID	Site Name
414825102005201	21N 41W 12BD:51668
414733099463601	21N 21W 17DB:189774
415139101253401	22N 36W 24DD:80004
415340101564801	22N 40W 10CB:133139
414848100075901	21N 24W 6DD:63687
414557101314901	21N 36W 30CA:61723
412954100181701	18N 26W 27DC:30752
412652100461701	17N 30W 15BB:50051
412349100152201	G-088679:100647
413745100403201	19N 29W 8AD:222881
412428100292901	17N 28W 36AB:169862
412758100283201	17N 27W 6AB:36373
G-184615	24N 6W 24BC:251240
G-169344	2N 3E 30BB:227516
G-157880	17N 44W 29DAAA:208196
421112101084801	26N 33W 34CA:72626
420638099432601	25N 21W26AD 1:58796
420232100094101	24N 25W 24AB:46191
420030100590501	24N 32W 35BD:7527
G-039310	28N 19W 4BBD:46516
G-038996	9N 3W 6CB:46193
G-037169	25N 10W 23CBA:44314
G-025631	8N 2W 25AA:32185
G-021829	14N 1W 17AC:28156
G-017810	10N 6W 9AC:23754
G-006665	6N 4W 10CC:10874
420548099421201	25N 21W 36DA:222877
420217100483201	24N 30W 20DA:22188
G-074059	11N 1E 15CD:82399
G-060157	24N 6W 8DA:67922
G-057566	29N 16W 24B:65242
G-055416	28N 7W 25BA:63024
G-051000	26N 5W 9C:58525
G-050903	28N 5W 11CA:58427
G-135999	29N 1E 34CD:165524
G-125875	28N 9W 3CB:156096

Appendix C: Down hole video findings and recommendations for future actions.

Aurora Well, NGWMN site ID: 404836097584101, video logged 9-28-21

The Aurora well is constructed of 6" glued PVC casing installed in 1981 to a recorded depth of 170'. Depth to water is 89' below top of casing (TOC). Top of screen is 150' below TOC to a total depth of 170' below TOC. Screen is PVC cut slot screen. Possible gas bubbles coming from the formation were observed. PVC end cap is visible at the bottom of well. No significant biofouling of the well was observed. No silt is present at the bottom of the well. All glued joints appear tight, well is in excellent condition.

Burress Deep Well, NGWMN site ID: 403356097275602, video logged 4-11-2022

The Burress Deep well is constructed with 2" glued PVC casing and was installed to a depth of 250' in 2005. Depth to water is 93.5' from TOC. This well was pumped in 2019. All glued joints appear to be tight. Top of screen is 230' from TOC. Well screen is a saw-cut PVC slotted screen. Well screen is clean and in excellent shape to a total depth of 250' from TOC. No silt is present at the bottom of the well. No significant biofouling of the well was observed. This well is in overall excellent shape.

Burress Shallow Well, NGWMN site ID: 403356097275604, video logged 4-11-2022

The Burress Shallow well is constructed with 2" glued PVC casing and was installed to a depth of 64.5' in 2005. Depth to water is 57.1' from the TOC. This well was pumped in 2019. All glued joints appear to be tight. Top of screen is 49' from TOC. Well screen is a saw-cut PVC slotted screen. Well screen is clean and in excellent shape to a total depth of 68' from TOC. No silt is present at the bottom of the well. No significant biofouling of the well was observed. This well is in overall excellent shape.

Carleton Well, NGWMN site ID: 401537097434101, video logged 10-6-21

The Carleton well is constructed of 6" heavy-wall threaded steel casing. The well was installed in 1968. Depth to water is 78.7' from TOC. All threaded joints are tight and show no signs of leakage. Beginning at 77.6', a yellow substance is observed on the sides of the well casing and is interpreted as paint from well installation or casing production. Depth to water is 105.7' TOC. A pen is lodged in the well at 130'. Below 130' there is moderate to heavy scale and biofouling on the surface of the casing, some of which is flaking off. Below 140' biofouling is heavy, with possible corrosion holes near 170'. Well is silted up to 176'. Screen is not visible. Total depth of well as constructed is 195'. Bottom 20' of well is silted in. This well could benefit from development or replacement.

Daykin Well, NGWMN site ID: 401626097210701, video logged 10-6-21

The Daykin well is constructed of 6" heavy-wall threaded steel casing. The well was installed in 1968. Depth to water is 78.7' from TOC. All threaded joints are tight and show no signs of leakage. The well has little scale and biofouling below the water level. The casing has moderate rust scale above the water level, though there is no evidence of rust holes. Top of screen is 177', the well screen consists of vertical slot screen, slot size is approximately 0.25". Screen is clean, and gravel pack can be observed through the slots. Silt is encountered at 189.3', total depth of well as constructed is 210', lower 20' of well is silted up. For its age, this well is in excellent shape. Would benefit from developing to remove silt from bottom of well.

Glenvil Well, NGWMN site ID: 402806098132501, video logged 10-25-2021

The Glenvil Well is constructed of heavy-wall 6" threaded steel casing. All threaded joints are tight and show no signs of leakage. Possible rust hole in casing at 60.1', though no signs of water entering hole. Water level is 106.5' below TOC. Below water line, there is minimal buildup on the casing. The top of the screen is visible at 189'. The screen is a staggered vertical slot steel screen. Slot size is large, probably 1/4" or larger slot size. Silt observed at 193'. Depth recorded from construction log is 205', bottom 12' of well is silted up. This well could benefit from development to remove silt. Overall, this well is in good shape.

Hastings Well, NGWMN site ID: 403403098244001, video logged 4-11-2022

The Hastings wells is cased with 8" heavy-wall threaded pipe and was installed in 1934. Water level is 118.0' from TOC. Water in casing is generally clear. Well casing is significantly off vertical in the borehole. There is a possible perforation of the casing at 93'. The perforation does not appear to have a significant amount of seepage. A high water-rust mark begins about 100'. Slight biofouling begins at about 117'. All joints appear to be tight, up to 130'. The joint at 132' may have a crack or separation on one-half of the casing diameter. An unknown object is protruding into the side of the well casing at 139' and catching the camera on the way up, possibly a bolt or louver? Bottom of the well is 147', TD is listed as 155' in records, well contains 8' of silt/debris. No screen is visible. Due to the age and condition of the well, this well would be a good candidate for future replacement.

Kronberg Well, NGWMN site ID: 405921097514701, video logged 9-29-21

The Kronberg well is constructed of 6" heavy-wall threaded steel casing. Water level is 82.40' from TOC. All threaded joints above the water line are tight and have no evidence of leakage. Below the water line, the well is heavily bio-fouled, and the well casing is not visible. At 128.5 and 137', there is a large rust scale that is flaking off. It is possible that the casing could be corroded through at this depth. At 143', the well is heavily corroded, with buildup blocking roughly one third of the well. At 167.7', the well was bridged or plugged with an unknown object or heavy encrustation. The camera punched through the blockage, and cloudy water was encountered. The screened section of the well was not visible due to water quality and casing fouling. Silt and debris was encountered at a depth of 184'. The well was pumped for 20 minutes at approximately 1.3 gallons per minute to reduce turbidity and increase visibility. During pumping, fresh water entering at the bottom of the well could be observed. After 20 minutes of pumping, visibility improved minimally, and one louver was visible. After pumping, water quality did not improve enough to make further observations on the way up. There was little drawdown while pumping at 1.3 gpm. Total depth from well log is 189', 184 observed. There is 5' of buildup in the bottom of the well. This well would be a good candidate for future replacement.

Murphy Well, NGWMN site ID: 405648098064201, video logged 6-7-2022

The Murphy well is cased with 6" glue-Joint PVC pipe, has a recorded depth of 180' and was installed in 1979. Depth to water is 82.5' from TOC. Top of screen is 89.5'. Well screen is PVC saw cut slotted screen, Slots are likely 0.08-0.1 inch. Well is in excellent shape, all glued joints are tight. Well screen shows no significant signs of biofouling. Observed depth is 165.2' from TOC, with approximately 20' of silt and dead insects in the bottom of the well. From the condition of the well protector, most of the silt is likely from wind-blown dust. This well could benefit from development and a better protector.

Osceola Well, NGWMN site ID: 411012097325201, video logged 9-28-21

The Osceola well is constructed of 4" thin wall casing installed in 1959 to a depth of 180'. Water level is 45.9' below TOC. There is a significant bulge in the wall of the casing at 10.6'. Beginning at 11.5', there is a vertical bulge in the casing that extends about 8" down the casing. Possible rust holes can be observed in the casing at 30.7', 31.7', 33.2', 49.8', 50.3', 54', 155.1'. Threaded joints at the following depth show signs of damage and possible leakage- 33.8', 44.9', 56.1', 61.8', 101', 109', 118', 126.3'. Below 77' visibility is poor, and well is heavily bio-fouled. Silt and debris were encountered at 161'. No screen is visible. Construction information for the well has a total depth of 180'; either the screen failed or the bottom 19' of the well is silted in. To improve visibility, the well was pumped at a rate of 1.6 gpm. Water level was lowered approximately 35' in 4 minutes and the pump lost flow. After 4 minutes of recovery, the well was able to be pumped again for an additional 1 minute before losing flow. There was some movement observed at 161' while pumping, zones of cloudy water were observed on the way up with the camera, suggesting that water is being pumped through holes in the casing in addition to through the screen/silt at the bottom of the well. This well is in poor shape, and may be impacted by leakage from higher aquifer units. This well should be replaced.

Rising City Deep Well, NGWMN site ID: 411410097173003, video logged 12-14-2021

The Rising City Deep well is constructed of 6" glued joint PVC casing and was installed in 1979. Depth to water was 95.2' from TOC. Water in casing is clear. Minimal buildup on well casing below 150'. All glued joints are tight. Well bore is generally straight. Well screen begins at 197.5'. Well screen consists of three vertical rows of saw cut slots in PVC casing. Probably 0.020-0.030 slot. Screen is generally clean. There is no buildup of silt at the bottom of the well, the PVC end cap is visible in camera image. Possible piece of electrical tape observed at bottom of well. TD is 207' from TOC. Well is in remarkably good shape. No holes or casing damaged recorded. This well is in excellent condition.

Rising City Shallow Well, NGWMN site ID: 411410097173004, video logged 12-14-2021

The Rising City Shallow well is constructed of 6" glued joint PVC casing and was installed in 1979. Water level is 78.7' from TOC. Small plastic debris was observed floating on top of water. Well casing below water is clean and the well bore is remarkably straight. Top of well screen is 121.4' well screen is saw-slotted PVC, with three vertical rows of slots. Probably 0.020-0.030 slot. Inside of casing is clean. Bottom encountered at 130.5', minimal amount of silt accumulated at bottom of well. Well is in remarkably good shape. No holes or casing damaged recorded. All joints are tight. This well is in excellent condition.

Roseland Well, NGWMN site ID: 402910098352101, video logged 10-5-2021

Video mislabeled Kronberg. The Roseland well is constructed of 6" heavy-wall threaded steel casing. There is a small hole in the casing visible at 32.6'. There is no evidence of water entering the well through the hole. The hole may be a remnant from the installation of the well. Water level is 93.4' from TOC. Minimal bio-fouling on well casing below 165'. There is a large red unidentified buildup at 173.5'. This could possibly be a hole in the casing, though it is likely minor. The well is silted in, or full of rust scale up to 191', total depth is 210' from construction log. no screen is visible. This well could benefit from development to remove the 19' of debris and silt. Overall, this well is in good shape but would benefit from development to clear silt.

York Deep Well, NGWMN site ID: 405305097351504, video logged 6-8-2022

The York Deep Well is cased with 6" glue-joint PVC and has a recorded depth of 280'. This well was drilled in 1983. Depth to water is approximately 107.8' from TOC. All glued joints appear to be tight. There is heavy biofouling and possibly a hole in the casing at a joint located at 269'. Reddish growth at this depth is blocking roughly half the diameter of the well. Well screen is horizontal slot PVC and begins at 269'. There is a round object approximately 3/4 inch in diameter bridging the well at a depth of 272'. There is more heavy growth at a depth of 274', obstructing roughly half the diameter of the casing. Silt and debris is reached at 275'. The well appears to have 5' of silt at the bottom. There is a slight buildup of silt or biologic matter on the walls of the casing and screen. This well could benefit from development to clear buildup of silt and biofouling.

York Shallow Well, NGWMN site ID: 405305097351503, video logged 6-8-2022

The York shallow well was installed to a recorded depth of 165' in 1969. The well is constructed of 6' steel casing with welded joints. Depth to water is 81.6' from TOC. The well has mild biofouling below the water level. Cloudy water was encountered at 189'. Beginning at 195', the well is heavily encrusted. Top of the screen may begin at 200'. The well is silted up to a depth of 200.4'. The total depth of the well recorded in CSD records is 165'. The total depth of the well is unknown. This well would be a good candidate for future replacement.

Appendix D: New equipment installed as in-kind service.

Equipment at each site consists of a new Ott Hydromet / Sutron Satlink model SL3-1 logger transmitter.

Site ID	Site Name	Date Replaced	Satlink SN
10	North Lincoln County	5/18/2022	21120628
40	SE Cherry County	6/17/2022	21111252
39	SW Cherry County	6/17/2022	21110429