

Overview of Work

The Illinois State Water Survey (ISWS) received funding to perform necessary maintenance on monitoring wells for the National Ground-Water Monitoring Network (NGWMN). As an existing data provider, for this project the ISWS was tasked with identifying priority wells to receive maintenance from existing monitoring wells, either as new additions to the NGWMN network or existing NGWMN wells. Most of these wells had not been regularly visited in the last 10 to 20 years; they required redevelopment and slug testing to ensure good hydraulic connection with the aquifer. When one of the proposed wells was unavailable, a nearby well was sought out as a replacement. Available lithology, well completion, and water level data were added to the existing services provided to the NGWMN, along with documentation in the well registry. The ISWS successfully completed these tasks in summer of 2018; including the original, a total of 67 water level sites have been added to the NGWMN Portal.

Procedure

For each well receiving maintenance, water level prior to development was recorded, the well was then developed, slug tested, and the water level was remeasured. The development was accomplished by pumping the well for 20-30 minutes with either with a 2” submersible Grundfos pump or with a compressed air hose. Developing wells with a submersible pump can be problematic if there are fine sand or rust particles in the well. Unfortunately, during the development of Rockford well #4, the portable pump was ruined by rust particles getting in the bearing so necessary to develop some of the wells with air before a replacement pump could be secured.

For the 2” diameter wells, slug tests were performed by pouring 3L of water into the well and monitoring the recovery with a transducer. For many of the wells, especially those in highly-transmissive sand and gravel aquifers, the water level changed caused by the slug dissipated too quickly to analyze. The quick dissipation of a slug provided assurance that the well is in good connection to the aquifer. For the larger diameter wells (>5”), the connectivity to the aquifer was judged by its response current transducer data to seasonal changes or nearby pumpage (Elwood #8). One well, Rockford #4, did not have existing data for comparison and will require further study.

Site Selection

Generally, wells were identified for rehabilitation if they were part of existing monitoring networks, either within the NGWMN or ISWS, that had not received maintenance in many years, or if they were wells not actively being monitored, but filled spatial data gaps and could be reactivated with maintenance. Priority was given to sites falling within one of the principle aquifers (USGS, 2003) that could be outfitted with real-time monitoring for conversion to trend wells in the near future. Generally, three aquifers were targeted, as described below:

- Cambrian-Ordovician Aquifer System: Monitoring focuses chiefly on the sandstone aquifers which have been the subject of continued research due to historic drawdown in northeast Illinois (Abrams et al., 2014). However, this system is utilized throughout northern Illinois and drawdown has been observed in areas throughout the region. Some of the proposed sites are in minor aquifers within the Cambrian-Ordovician, including the Galena-Platteville Dolomite and New Richmond Sandstone.

- Alluvial Sand and Gravel Aquifers: Including the addition of monitoring in some of the minor aquifers throughout Illinois, expansion of monitoring was proposed in both the Mahomet Aquifer System in central Illinois, an existing network part of the original NGWMN pilot, and the Green River Lowlands in northwest Illinois. The latter is a multi-aquifer system in consisting of the unconfined Tampico Sand and confined Sankoty Sand. These aquifers are subjected to increasing agricultural irrigation, heads in some cases approaching the top of the Sankoty Sand during peak irrigation. This is an existing monitoring network (Burch, 2004) that is increasingly being outfitted with real-time monitoring and thus a good candidate for incorporation into the NGMWN.
- Silurian Dolomite: This is an aquifer system that has very little active monitoring in Illinois so priority has been given to reactivating legacy monitoring sites, particularly in the Kankakee region which is subject to increasing irrigation.

In total, 19 sites were identified, including 4 Surveillance wells monitored by the USGS, summarized in Table 1 and pictured in Figures 1 through 21. Of these proposed sites, 6 were unable to be accommodated at this time. This is partly due to changing monitoring and funding priorities at the ISWS, and in the case of Chenoa 1 agreements are currently being negotiated for conversion to a monitoring well. Joliet Prison Well #3 changed ownership from the State of Illinois to the City of Joliet who is in the process of contracting with a driller to have the old high-capacity pump removed. The Iroquois Conservation Area well has a steel plate top that will need to be removed for pump access, as the existing opening is too small.

Of the remaining 13 sites, maintenance was performed on 8, with an additional 5 replacement sites, resulting in a total of 16 wells receiving maintenance (three nested sites). One of the

replacement sites, Elwood 8, was recently active as a production well and maintenance was not necessary. At one of the sites (Campton Hills) the shallow well is not appropriate for inclusion in the NGWMN due to poor communication with the aquifer. Though slug testing was performed on wells both shallow enough to accommodate the equipment and small enough diameter to respond to a slug, in general response curves were too rapid to yield meaningful data, indicating good connection with the aquifers. Field notes for these site visits are summarized in Appendix 1.

Network Status and Data Elements

Table 1 summarizes the status of wells identified for maintenance both in terms of whether they are currently active in the NGWMN portal and contain geology and casing data. In general, wells were added to the registry if they were not currently part of the network, though many of the new wells have minimal baseline data aside from the measurements taken during the well development processes. Several of the wells are still missing geology and casing data and will need to be added in the future. As of this writing, the ISWS is still finalizing a procedure for streaming real-time water level data into the ISWS Groundwater database, upon completion of this processes all trend wells will be updated in real time. In some cases wells are not currently displayed in the NGWMN portal pending data being finalized and entered into the ISWS groundwater database. All of the recently added wells in the network show a good connection to the aquifer and a representative water level with the exception of Rockford #4 and the Lena well which both warrant further examination.

References

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- Subcommittee on Ground Water (2013). A national framework for ground water monitoring in the United States: Prepared by The Subcommittee on Ground Water of The Advisory Committee on Water Information. http://acwi.gov/sogw/ngwmn_framework_report_july2013.pdf
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Figure 1. Bartelso



Figure 2. BUR-91A and BUR-91B



Figure 3. Campton Hills Shallow Well



Figure 4. Campton Hills, foreground: shallow well, background: deep well



Figure 5. Elwood 8



Figure 6. Forsythe



Figure 7. Granite City



Figure 8. Henry - Child Park



Figure 9. Iroquois



Figure 10. Joliet Prison 3 Well House



Figure 11. Lena



Figure 12. Lena



Figure 13. Rockford 4



Figure 14. Rockford 4



Figure 15. Sand Lake



Figure 16. St. Anne

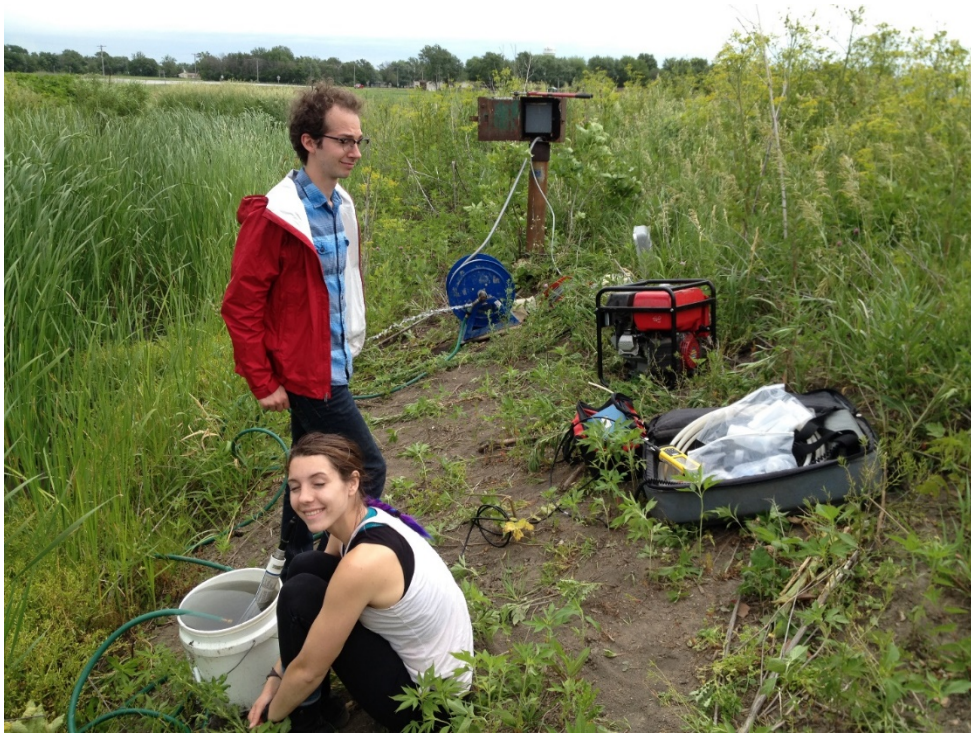


Figure 17. St. Anne



Figure 18. Starved Rock after cleaning and installation of new bolts



Figure 19. Cleaning Starved Rock



Figure 20. SWS-2 East St Louis



Figure 21. WHT-91B

Table 1. List of proposed and replacement wells. USGS-monitored sites are shown in italics with USGS site name in parentheses.

Proposed	Replacement (if applicable)	Aquifer	Active in NGWMN portal as of 10/31/18	Maintenance completed	Geology / casing data
Joliet Prison 3		Cambrian-Ordovician	No	No	Yes
Midewin 11	Elwood 8	Cambrian-Ordovician	No	Not app	Yes
Rockford 4		Cambrian-Ordovician	Yes	Yes	No
Chenoa 1		Cambrian-Ordovician	Yes	No	No
Starved Rock 5		Cambrian-Ordovician	Yes	Yes	Yes
<i>Lena (177-6-71-65)</i>		Cambrian-Ordovician	Yes	Yes	-
Campton Hills (bedrock well)		Cambrian-Ordovician	Yes	Yes	Yes
<i>West Union (023-3-12-3760 (Clark IDOA CRN))</i>		Alluvial Sand and Gravel	Yes	No	-
<i>Bartelso (027-3-18-4159 (Clinton IDOA CRN))</i>		Alluvial Sand and Gravel	Yes	No	-
Sand Lake		Alluvial Sand and Gravel	Yes	Yes	Yes
Decatur	Forsyth 1	Alluvial Sand and Gravel	Yes	Yes	Yes
East Peoria	Bradley Park	Alluvial Sand and Gravel	Yes	Yes	Yes
Henry		Alluvial Sand and Gravel	No	Yes	No
<i>E St Louis (3N9W-29.7f1)</i>	SWS-2	Alluvial Sand and Gravel	Yes	Yes	-
<i>Granite City (3N9W-8.1b1 (MESD-GCD)) (shallow and deep well)</i>		Alluvial Sand and Gravel	Yes	Yes	-
Bureau 91E	BUR-91A and BUR 91B	Alluvial Sand and Gravel	Yes	Yes	Yes
WHT-91B		Alluvial Sand and Gravel	Yes	Yes	Yes
St. Anne		Silurian Dolomite	No	Yes	Yes
Iroquois Conservation Area		Silurian Dolomite	No	No	Yes

Appendix 1: Field Notes

All water levels given as depth to water in feet

1. **Campton Hills-Bored well** 7/23/2018 12:05 pm

WL (water level) 9.46

TD (total depth) 74'

Stick up 2.3'

Diameter – 42" outside, 36" inside concrete

Pumped with Grundfos at 5 gpm for 47 mins

Time/WL

12 10.49

22 11.25

30 11.86

40 12.57

45 12.80

47 13.01 – Appears to be removing water from well bore storage as expected

Recovery

Time - wl

0 13.02

1 13.00

2 12.98

3 12.98

5 12.91

11 12.77

15 12.70

20 12.61

25 12.52

30 12.44

35 12.37

41 12.31

45 12.22

50 12.16

2. **Campton Hill – Galena-Platteville well**

WL 391.8

6" steel

3. **Sand Lake** 6/26/2018 1:50 pm

WL 11.24

TD 42'

2" PVC

Stick up 2.53'

Pumped with Grundfos for 15 min at 3 gpm, some muck on bottom, same WL afterwards (11.24)

4. **Bradley Park** 6/26/2018 5:30 pm

WL 62.35

TD 159' (~100' stand water ~150 gals)

Stick up 3.60'

6" steel

Removed Stevens recorder, float, and wire

Pumped with Grundfos at 3 gpm for 62 mins

After 30 mins WL was 62.60, after 46 mins WL was 62.60

Pumped clear till the pump was lowered to the bottom – lots of black manganese particles

5. **Rockford #4 Beatie Park** 8/24/2018 11:00 am

WL 7.22 TOC, 9.26 top of manhole cover that is flush with land surface (area is flat till drop off at river)

Stick up -2.04

Well has a 2" galvanized pipe cemented into large diameter well (12"??). Length of 2" pipe unknown and may be affect the water level response to the pumping.

Pumped with Grundfos at 5 gpm for 30 mins

WL dropped from 9.26 to 14.20 after 10 mins and to 14.45 after 30 mins

Water was rusty red and turned to brown after 10 mins

Could not get steel tape past 65', got Solinst dropline down to 800' and could still drop. Solinst went down slowly

Bring ISWS video camera or have real downhole video done.

6. **Lena** 8/24/2018 2:30 pm

WL 31.61 TOC, 32.23 top of flush mount

Stick up 0.62'

TD 58

2" PVC

Pumped ~ 3 gals of water out with Grundfos before running out of water

WL 50.97 3:48 pm and 50.85 at 3:53 pm

7. **Henry – Child Park** 8/24/2018 6:30 pm

WL 49.98 TOC

Stick up 2.6'

TD 65'

2" PVC

Pumped at 4.8 gpm for 12 mins when pump failed, small amount of sediment, water very clear, WL the same 49.98 after pumping.

WL on 2/25/1997 = 50.02, 12/12/1996 = 50.76

Drilled on 11/27/1996 with ISWS rig

Log

- 0-3 Top soil
- 3-15 Fine sand, dry
- 15-37 Medium sand and gravel
- 37-39 Medium sand and ¼" gravel
- 42-62.5 Medium sand

Well set with bottom of 5' screen at 62.5'

8. **Forsyth Well** – School Rd and Brush College Rd – 8/29/2018

WL 107.16

Stick up 2.4

2" PVC

Pumped with Grundfos at 3 gpm for 10 mins before pump failed, WL 107.83

9. **Granite City – Deep well** 8/30/2018 11:00 am

WL 17.33 TOC

Stick up 2.8'

Depth 101' TOC

Pumped with air at 3 pgm for 15 mins using 25' hose (8' water in well), pumped clear, same WL of 17.33 afterwards

10. **Granite City – Water table well** 8/30/2018 11:00 am

WL 16.55

Stick up 2.0'

TD= 47'

Pumped with air, dirty for 5 mins, then clear of next 5 mins, WL 16.47 at end (??)

11. **SWS-2 E St Louis** 8/30/2018 2:00 pm

WL 13.82

Pumped with air for 30 mins at 5 gpm, WL dropped to 39' afterwards recovered at 0.3 ft/min

Well has telemetry

12. **Bartelso** – 8/30/2018 4:30 pm

WL 11.04

Stick up 3.5'

Pumped with air at 2.5 gpm for 20 mins, some mud, WL 11.01 at end.

13. **Starved Rock 5** – 7/18/2018 12:30 PM

WL 169.05

Cleared mouse nest with vacuum, placed 2 inch pvc in casing for easier dropline access

Pumped for 20 minutes, not measurable difference in WL after pumping

14. **BUR-91A** – 7/18/2018 2:48 PM

WL 37.03

Stick up 2.25'

2 inch diameter

Pumped for 20 minutes, WL after umping 37.05 ft

15. **BUR 91B** – 7/18/2018 2:50 PM

WL 8.97

Stick up 2.7'

2 inch diameter

Pumped for 20 minutes, WL after pumping 8.99 feet

16. **WHT-91B** – 7/18/2018 4:19 PM

WL 10.04

Stick up 2.7'

5.25 inch diameter

Pumped for approximately 30 minutes, water was extremely dark and did not clear after pumping

Pumping water level of 10.37