Barrington Area Council
Of Governments

SHALLOW AQUIFER SYSTEM WATER LEVELS MONITORING PROGRAM
INTERIM REPORT, JULY 2016

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I. INTRODUCTION

Background / Purpose

Because the BACOG area is almost entirely reliant on the shallow aquifer system for all its water needs, there is growing concern about the sustainability of this resource. Water consumption due to growth and development has increased around and within the BACOG area and will continue. For the BACOG area, there is no alternate water supply. Lake Michigan water and river water are not available here, and even if another source of water supply were to become available, there is very little piped infrastructure to distribute such a supply. The cost to build distribution systems throughout nearly 90 square miles would be prohibitive.

Most areas have individual residential private wells or subdivision wells; over 7,800 shallow aquifer system wells provide supply for a population of approximately 35,000. A significant drop in water levels could pose a huge financial impact as private well owners might need to drill deeper or relocate wells. A threat to water levels or water quality would be a threat to public health and safety as well.

There are thousands of acres of natural areas locally, many of which are dependent on groundwater to feed them. A significant drop in water levels could also mean significant changes to those natural areas if groundwater discharge were no longer adequate to sustain rivers, streams and ponds and natural areas such as fens, woods and wetlands. If the natural areas that define the BACOG area and quality of life were to decline, property values could be negatively affected.

State studies suggest there will be a downward trend in water levels in the coming decades – by 10 to 20 feet in some BACOG communities -- so monitoring those conditions has become more critical. To address this situation, the Executive Board unanimously approved RESOLUTION #13-04 "Supporting the Establishment and Funding of a Comprehensive Groundwater Monitoring Program under the Barrington Area Council of Governments" on November 19, 2013. Establishing a baseline and then trends in water levels in the shallow aquifer system is necessary information moving forward. Water level data can provide an indication of "what we need to do" in upcoming years to protect the aquifer system that is virtually the sole water supply for the region. Under Resolution #13-04, all BACOG governments share the costs of the program due to the regional nature of this initiative and benefit to all communities.

Considerations in Monitoring

Changes in aquifer water levels reflect the dynamics between groundwater storage, recharge and discharge. If recharge exceeds discharge, the volume of water in storage will increase and water levels will rise; if discharge and extraction (pumping) exceed recharge, the volume of water in storage will decrease and water levels will fall. Water levels in wells reflect these changes, and they are the primary means of tracking changes in aquifer levels over time.

There are numerous factors that can cause water levels to rise or fall. They include: climate, regional water usage, pumping of wells in adjacent and nearby areas, varying utilization/deployment of nearby wells and their pumping rates, atmospheric pressure changes, and recharge/discharge to and from the aquifers.

Groundwater levels typically mimic seasonal changes. Higher water levels occur in late spring and summer following the snow melt and rain of the winter/spring (and the resultant recharge to the shallow aquifer system), and lower water levels occur from fall through winter following a summer of drier weather and limited precipitation, evapotranspiration, increased pumping and groundwater discharge to surface waterways. In terms of human influences, pumping from wells, especially high capacity wells, can cause water levels to decline in areas surrounding the well. This can also cause a lowering of water levels in nearby wells.

Because water levels respond daily and throughout the year to various influences, it is important to understand that a bigger picture of water levels will only emerge in a long-term analysis. Groundwater responses to climate or other influences are necessarily slow and need to be observed and evaluated on a decade (10 year) basis or longer.

When considering the long-term sustainability of groundwater, the typical range of fluctuation throughout the seasons due to climatic variables (such as precipitation, temperature, barometric pressure, and evapotranspiration) are evaluated, and then human-induced stresses such as pumping are also considered. While year-to-year changes in water levels in the short-term would likely reflect natural conditions, the BACOG monitoring program will look for long-term stability or general declines in groundwater levels that cannot be attributed to variation in the climatic variables. If water levels show a substantial decline over five to ten or more years, a likely cause might be that the rate of pumping is exceeding the rate at which that aquifer is being replenished and there is a net withdrawal from aquifer storage. This analysis would prove the trends in water levels and provide the data-based platform for taking actions that could help slow or reverse a negative trend.

Program Description

There are three components of the Comprehensive Groundwater Monitoring Program:

1. Baseline Conditions Analysis Report
2. Well Network
3. Long-term Data Analysis, Mapping, Trends and Reports

1. Baseline Conditions Analysis Report. The baseline conditions were assessed from all available information. The baseline report protocol set the data sources as follows:

- 15 Illinois State Geologic Survey (ISGS) Monitoring Wells in BACOG Area (manual measurements)

- 3 ISGS Monitoring Wells with Transducers (electronic data recorders) in BACOG Area
- Additional Monitoring Wells with Transducers in McHenry County and other Nearby Areas
- Area Stream Gages with Transducers
- 52 Municipal Pumping Wells in 13 Municipalities within and adjacent to BACOG
- Lake Level Measurements in BACOG Area

Synoptic measurements were made in summer 2014, and the primary product of the baseline conditions report was a potentiometric surface map establishing water levels in the shallow aquifer system as of that date. It also established which surface water bodies are hydraulically connected to groundwater. The report and map were completed by Kurt O. Thomsen Environmental Consulting Inc. (KOTECI) and issued in January 2015. It is available on the BACOG website at: http://www.bacog.org/images/GWL_Monitoring_Report.pdf This is the baseline information against which future measurements and water levels will be evaluated.

2. Well Network and Expansion. The well network is producing electronic measurements of groundwater levels ~~in~~ of the shallow aquifer system. BACOG worked with the United States Geological Survey (USGS) and leveraged approximately $24,000 in equipment and installation costs for three wells in the new network. BACOG executed a three-year contract with USGS where BACOG pays for operations of the three wells. Operations include collecting the data, cleaning and processing data for use, and hosting data on the USGS website for public consumption. This arrangement is anticipated to continue indefinitely, where USGS assumes responsibility for the electronic equipment including maintenance, and BACOG pays annually, on a contractual basis, for operations on the three wells.

Three equipped wells were established in the first year of the program. ISGS dedicated monitoring wells that were drilled in the BACOG area in 2005-06 were outfitted with transducers and satellite transmitters on Lake Barrington, North Barrington and Deer Park village property. Fifteen (15) other ISGS dedicated monitoring wells were developed on forest preserve property in and near BACOG. It is anticipated that more of these 15 wells can be brought into the BACOG network (by adding equipment) over time if grants are available for equipment and funding is available for annual operations.

3. Long-term Data Analysis, Trends, Mapping and Reports. This component uses the data generated from the dedicated monitoring wells and, when combined with measurements taken from all other data points (municipal wells, stream gages, etc.), can: 1) analyze trends in water-level fluctuations of the shallow aquifer system; 2) potentially identify the effect of natural phenomena and anthropogenic activities on current groundwater conditions; and 3) evaluate the interaction of groundwater with the surface water. Continued water level measurements will be used to identify detrimental changes from the baseline conditions, i.e., declining water levels. Though the program was designed to develop this reporting component annually, it was revised in 2015 to generate a comprehensive report every five years. Status reports on the program will be developed periodically in the interim by the Executive Director; status reports will not include analysis of water levels, water level mapping, or trends.

In the five-year reports, all collected data will be evaluated against the baseline maps and conditions. Changes, if any, will be identified that describe where water levels have changed, how much they have changed, and how quickly they have changed. At five years or ten years, for example, trends may emerge regarding decreases (or increases) in shallow aquifer water levels in the BACOG region.

Fact-based trend information will become the basis for planning, programs and public education to further the protection of groundwater resources.

II. FACILITIES

This section describes the points and facilities from which data is being collected for the monitoring program.

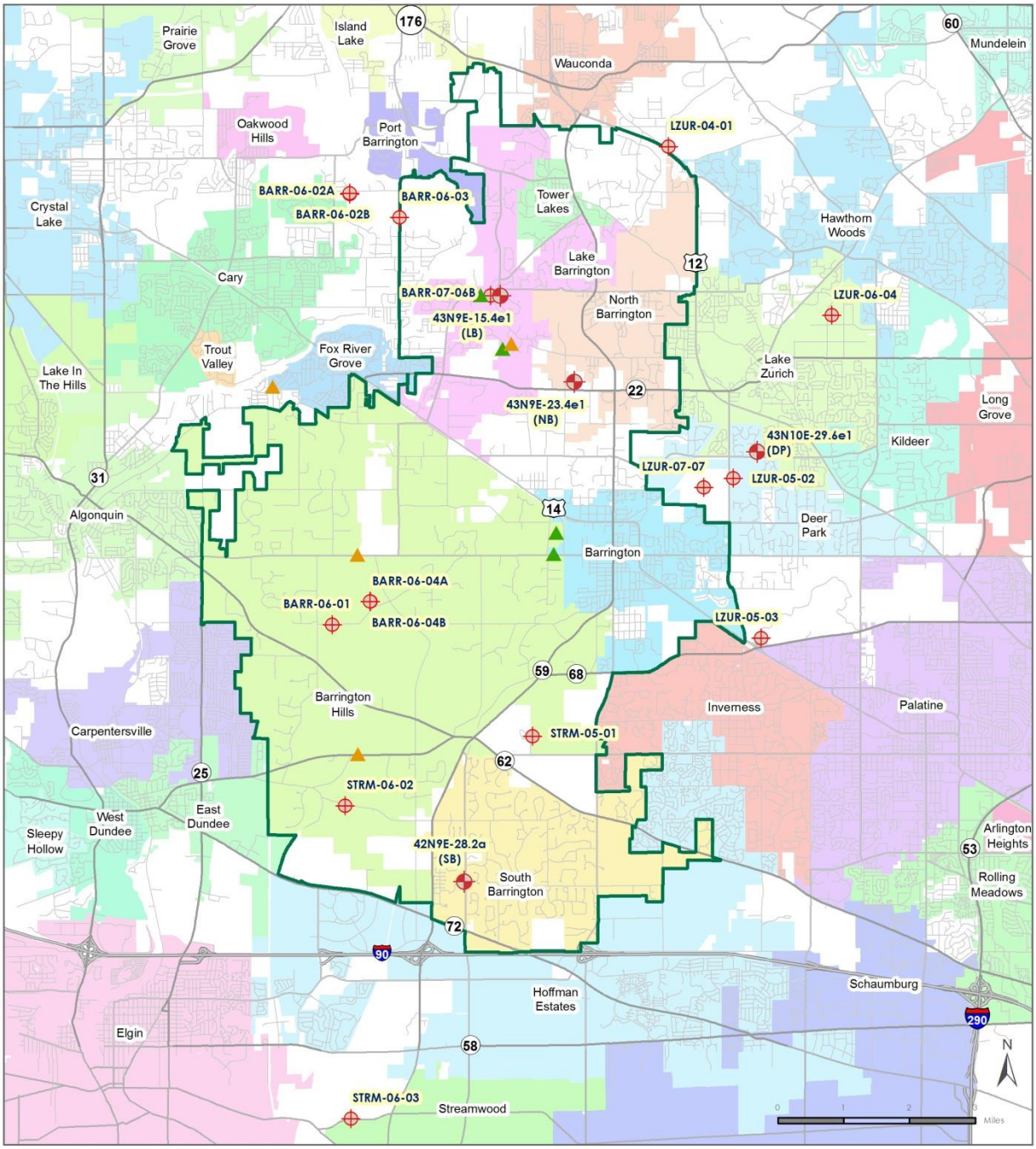
Monitoring Wells and Stream Gages

A map of the dedicated monitoring wells and stream gages, both of which take measurements of water levels, is below. Monitoring well measurements reflect groundwater levels of the shallow aquifer system. A monitoring well is drilled like a water supply well, with a borehole and casing, only it does not contain a pump or wiring for electricity; instead the well casing is left empty so that the water level can easily be measured. The map shows the 18 monitoring wells in the area that are being measured for the BACOG program. This number includes 15 monitoring wells that are not equipped with transducers and that are measured manually every year under the BACOG program. It also includes the three (3) wells that are equipped with transducers that hang in the well and satellite transmitters that take regular readings electronically.

Stream gages are located immediately adjacent to a waterway to measure the water levels in the vicinity of the stream. Stream baseflow is generally at or slightly lower than the level of the groundwater in the nearby area, as groundwater discharges into the stream. The stream gages used in the BACOG program function like shallow monitoring wells, in that a short borehole/casing is equipped with a transducer that takes water level readings in the stream on a regular basis. Data is downloaded from the transducer by cabling to a computer. The map includes locations of the four equipped stream gages in the BACOG area.

Due to the relocation of equipment from the Deer Park well to the South Barrington well at the time of this report, both locations are shown on the following map as monitoring wells funded by BACOG. In fact, only three of the four wells were equipped and monitoring water levels at any time.

Monitoring Wells and Stream Gauges



Monitoring Wells

- BACOG-Funded Monitoring Well
- Monitoring Well

Stream Gauges

- Installed and Recording
- Planned

- Interstate Highways
- State Routes
- Other Roads
- BACOG Boundary

Disclaimer of Liability:
This data has been derived partially from the Barrington Area Geographic Information System (BAGIS). This data is provided "AS-IS" without warranty of any kind, expressed or implied. BACOG and its member governments make no warranties, guarantees, or representations as to the suitability of this information for user's purposes or that the operation of the files/maps will be without defect.

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This map was produced by BACOG on 8/11/2016
Source: BAGIS, Baseline Water-Level Conditions Report, KOT Environmental Consulting, Inc., 2014
IDOT, Cook, Kane, Lake and McHenry County

The water levels in the 15 wells without transducers have been measured by hand in the field under the BACOG program since summer 2014. Since these wells were drilled by the Illinois State Geological Survey in 2005-06, a limited number of manual measurements were taken by the ISGS in the following years; measurements in these wells were discontinued in 2012 due to discontinuation of funding for this program at ISGS. Measuring the wells involved opening the well cap, inserting a chlorinated electronic tape measure to determine the water level, and calculating the water-level elevation from the reference elevation at land surface. The first BACOG water level measurements were taken by Kurt O. Thomsen Environmental Consulting Inc. (KOTECI) for the Baseline Conditions Analysis Report, issued in January 2015. The 2015 and 2016 water level readings were taken by USGS staff as a donated services contribution to BACOG.

The three (3) wells initially equipped with transducers on Lake Barrington, North Barrington and Deer Park village property have taken water level readings multiple times a day, every day, since installation at the end of June 2014. The data is transmitted once an hour to satellites, which then send it to the USGS for processing. This data is hosted on the USGS National Water Information System site, Groundwater Conditions for Illinois, at: http://waterdata.usgs.gov/il/nwis/current/?type=gw&group_key=county_cd. There, the data generated from the three BACOG wells can be viewed, manipulated and downloaded.

Note: Since removal of the equipment on the Deer Park monitoring well on July 5th, the data collected for the previous two year period has been archived and can be viewed at: http://waterdata.usgs.gov/nwis/uv/?site_no=421036088054501&agency_cd=USGS

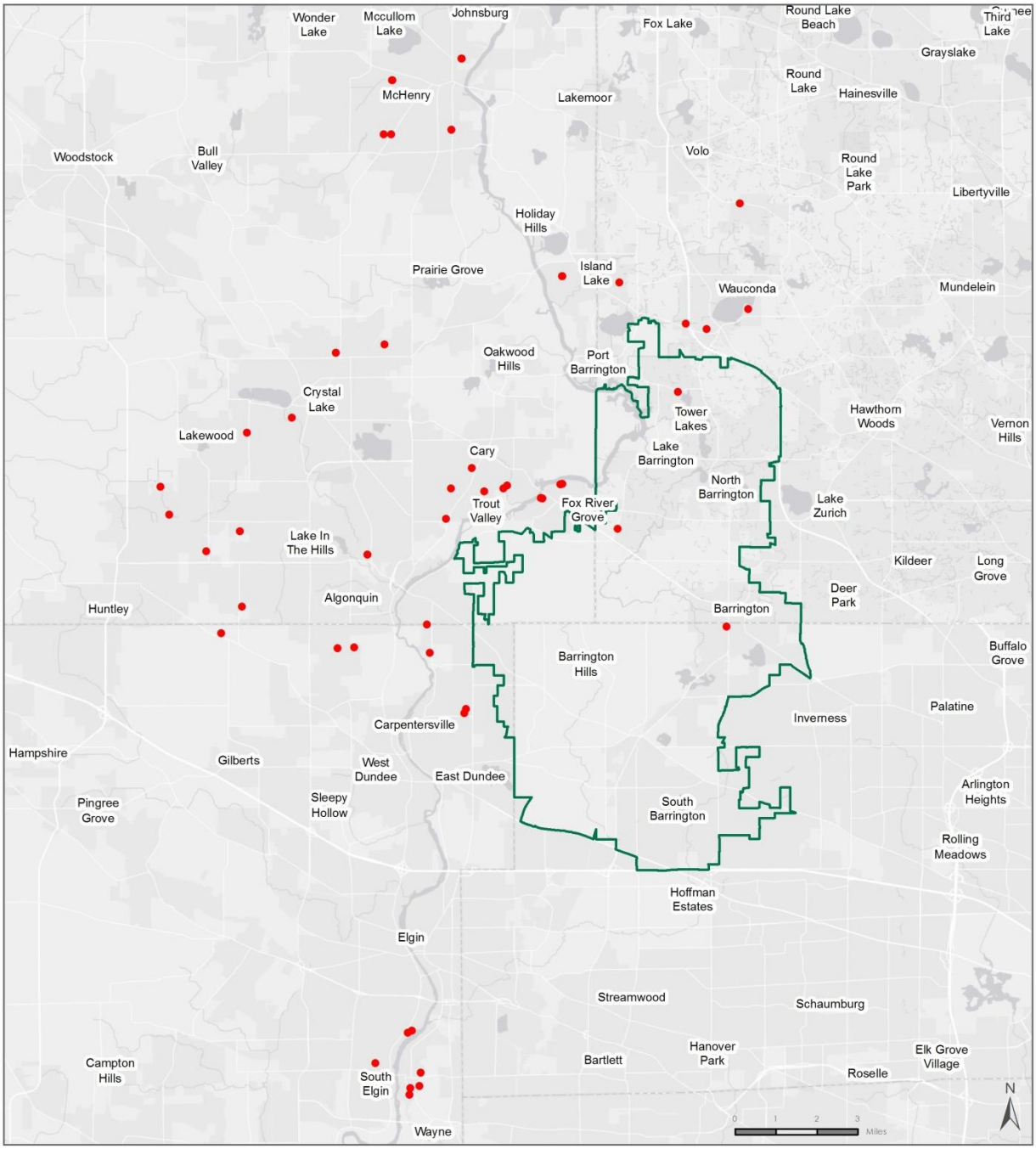
Change to BACOG Network Well Locations

The Village of South Barrington contracted for the drilling and development of a new monitoring well on village-owned property in the Conservancy in December 2015. The well was completed in June 2016. The transducer and satellite equipment in the Village of Deer Park well were moved to the South Barrington well on July 5th. This change was made due to Deer Park no longer being a member of BACOG.

Municipal Wells

Readings have been taken from municipal pumping wells in and adjacent to the BACOG area. Information including well location and elevation, pumping rate, and water levels were collected by the collaborating municipalities and sent to BACOG for the monitoring program. Wells included in the program are primarily those to the west because shallow aquifer system groundwater flows from west to east into the BACOG area. A map of the municipal pumping wells from which data is reported annually is below.

Municipal Pumping Wells



Municipal Pumping Wells
BACOG Boundary

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This map was produced by BACOG on 8/11/2016
Source: BAGIS, Baseline Water-Level Conditions Report, KOT Environmental Consulting, Inc., 2014 IDOT, Cook, Kane, Lake and McHenry County

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III. DATA COLLECTION AND ILLUSTRATION

Following are the measurements collected from each data source. Please note this is a compilation of data, not an analysis of the data. It is intended that the five-year 2019 report will utilize this data, along with data collected from the same sources through 2019, and perform the analysis of changes in water levels and conditions.

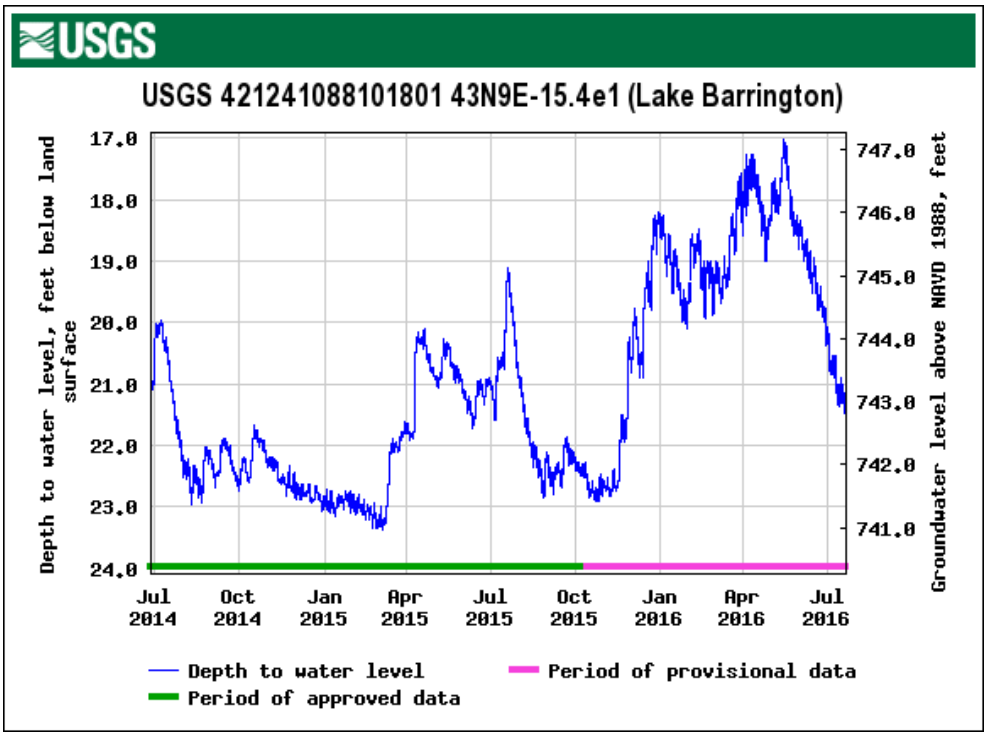
Please note the different types of data that are being collected and their uses. In the transducer-equipped stream gages and monitoring wells, the continuous data collected for surface water and groundwater will allow for several types of analyses which include, but are not limited to: estimations of recharge quantities, drawdown evaluations, barometric response function analysis, and water-budget component quantification and assessment. The measurements collected annually from the non-equipped monitoring wells and municipal pumping wells will provide a synoptic picture of groundwater levels and flow paths, as well as providing a more complete network of wells for evaluating groundwater conditions and trends. All data will ultimately be used for trend evaluation.

Equipped Dedicated Monitoring Wells

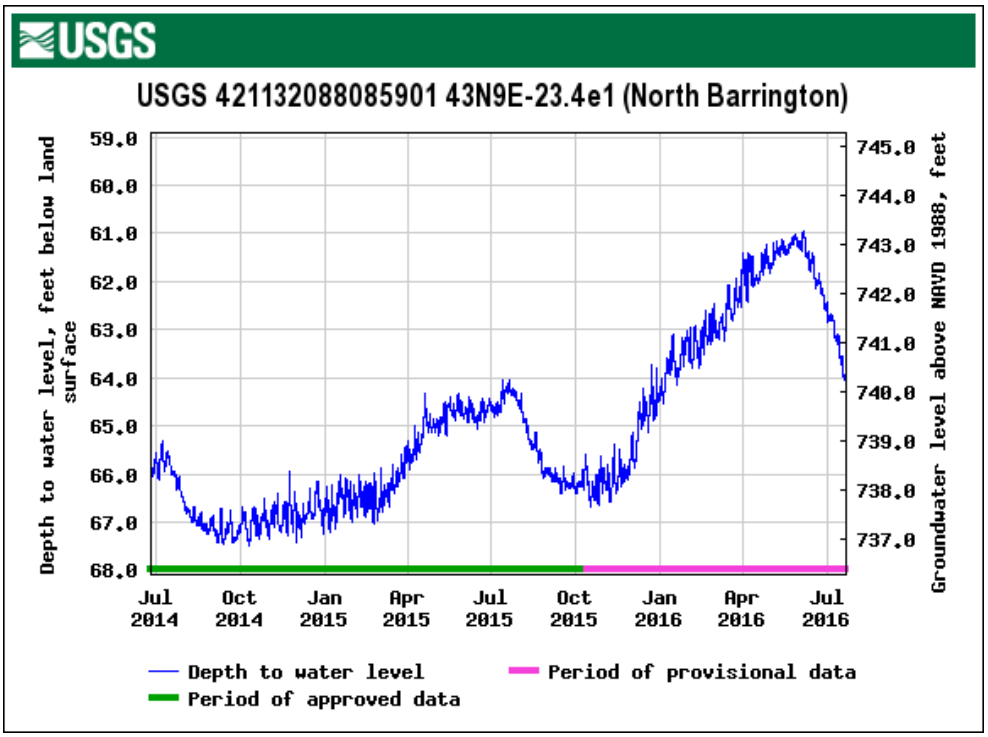
The charts below show the continuous water levels in each of the Lake Barrington, North Barrington and Deer Park equipped wells from the end of June 2014 through the first week of July 2016. The source of the graphs is USGS National Water Information – Current Conditions for Illinois Groundwater, where the BACOG monitoring well information is hosted:
http://waterdata.usgs.gov/il/nwis/current/?type=gw&group_key=county_cd

Because the South Barrington monitoring well had been collecting data only for a few weeks at the time of preparation of this report, its data is not presented here; however, the water level elevation in the South Barrington monitoring well ranged from 768.97 to 769.0 feet from July 5 to July 21, 2016.

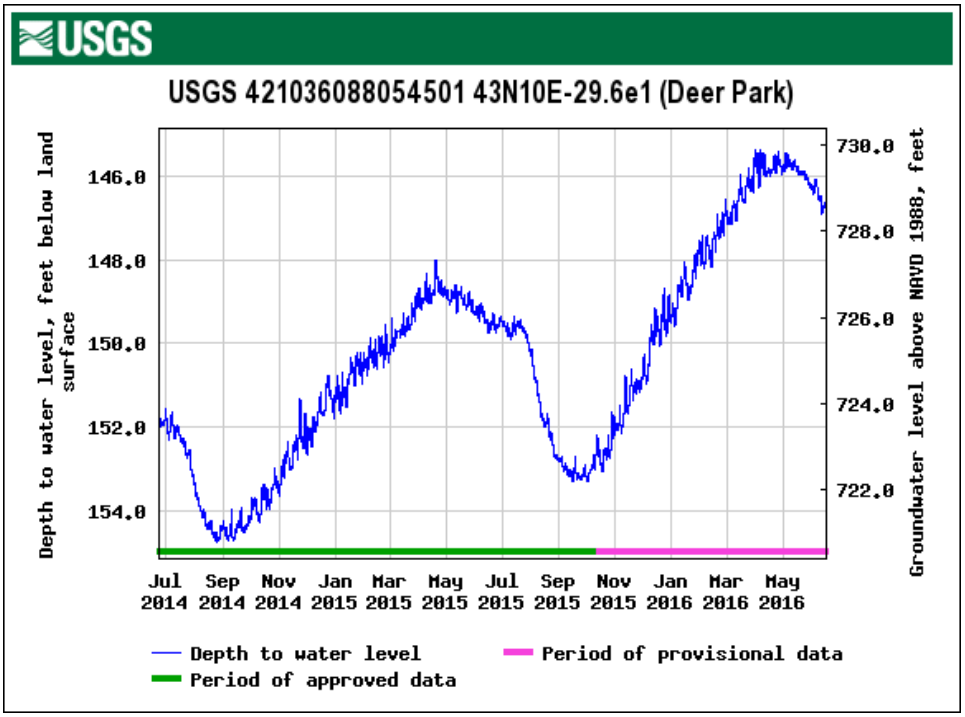
Lake Barrington Monitoring Well: 2 year period



North Barrington Monitoring Well: 2 year period

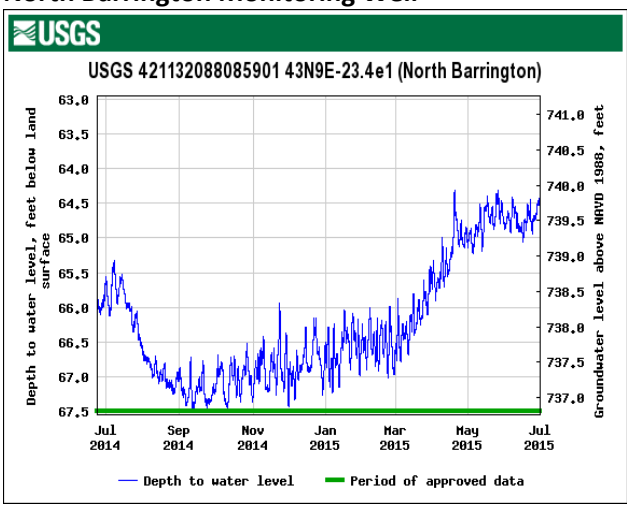


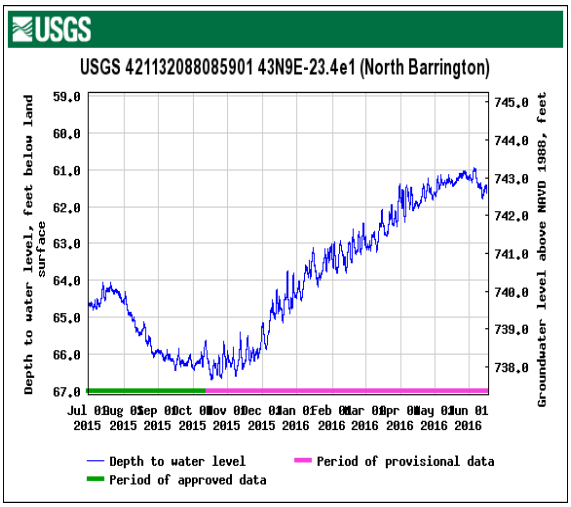
Deer Park Monitoring Well: 2 year period



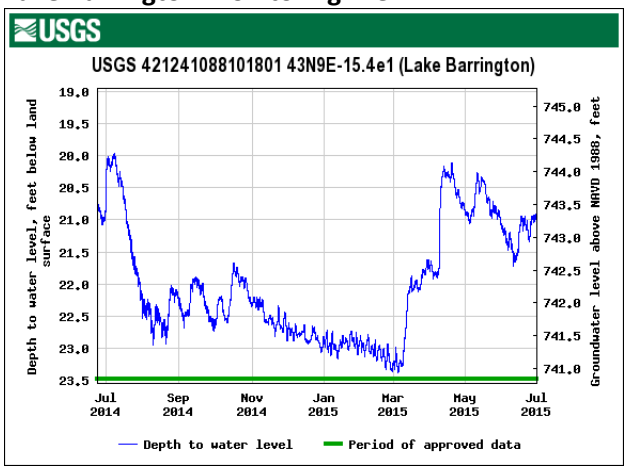
The charts that follow show continuous water levels in each of the three equipped wells for two 12-month periods, side by side, comparing the period June 2014-June 2015 to June 2015-June 2016. Please note the range of measurements on the graphs is not exactly the same for the two time periods.

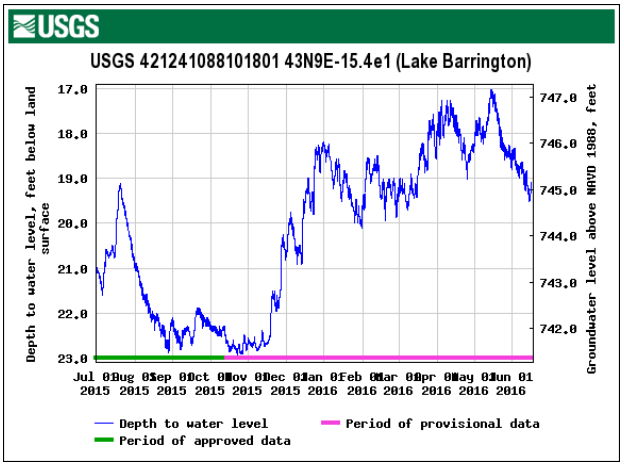
North Barrington Monitoring Well



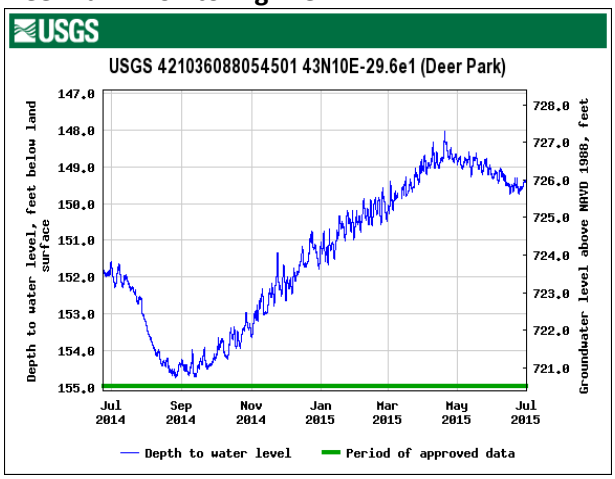


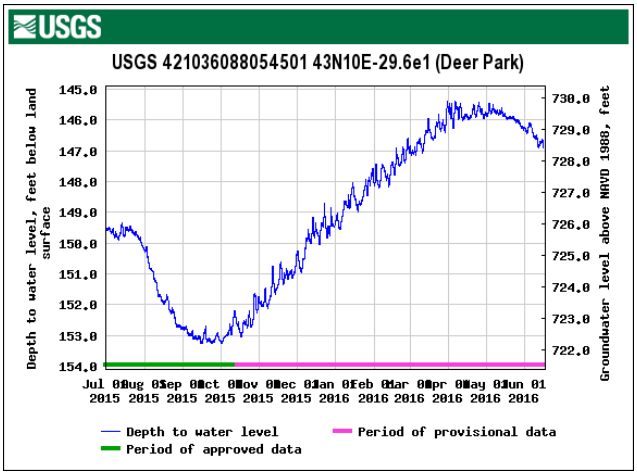
Lake Barrington Monitoring Well





Deer Park Monitoring Well





Manually-Measured Dedicated Monitoring Wells

Water levels in the 15 dedicated monitoring wells drilled by ISGS are now being measured annually at a single point-in-time. The first chart below shows measurements collected by KOTECI with BACOG staff on July 10, 2014, by USGS staff on July 28, 2015, and by USGS staff on July 7, 2016. In the second chart, data from the electronic measurements in the equipped wells has been extracted to show the water levels on the dates of measurement of the other 15 wells.

Notes:

- The column titled "Change" represents the change in water level from the baseline reading in 2014 to the most recent reading (i.e., 2016) but does not address changes in the interim years.
- Reference Point Elevations for the monitoring wells are at ground surface in the data provided by USGS, ISGS and ISWS. Water level elevations are calculated from these points.

Well (quadrangle/#)	Water Level Elevation (ft AMSL)			
	2014	2015	2016	Change
BARR-06-01	781.38	783.18	786.90	5.52
BARR-06-02A	739.65	739.05	738.69	-0.96
BARR-06-02B	752.65	751.98	752.33	-0.32
BARR-06-03	NA	775.61	NA	NA
BARR-06-04A	771.55	773.33	770.65	-0.90
BARR-06-04B	NA	768.63	NA	NA
BARR-07-06B	741.24	741.28	742.84	1.60
LZUR-04-01	744.80	745.07	748.22	3.42
LZUR-05-02	786.78	780.17	777.41	-9.37
LZUR-05-03	729.39	NA	NA	NA
LZUR-06-04	714.99	714.77	NA	NA
LZUR-07-07	724.81	726.74	730.30	5.49
STRM-05-01	748.16	749.00	747.77	-0.39
STRM-06-02	809.09	809.48	NA	NA
STRM-06-03	766.21	766.46	766.13	-0.08

Well	Water Level Elevation (ft AMSL)			
	2014	2015	2016	Change
43N9E-15.4e1 (LB)	743.98	743.96	743.5	-0.48
43N9E-23.4e1 (NB)	738.34	739.85	741.48	3.14
43N10E-29.6e1 (DP)	723.16	725.48	726.82	3.66
42N9E-28.2a (SB)	NA	NA	769	NA

Historical Manually-Measured Monitoring Well Data

Manual point-in-time measurements were taken by the Illinois State Geological Survey from the date of their construction in 2005-06 to 2012. These readings were compiled by the ISGS for the BACOG Monitoring Program and are shown below. Monitoring of these wells was discontinued as of 2012 due to funding cuts at ISGS. Please note that climatic influences such as precipitation due to seasons may affect the variability of the readings from year to year, that is, some readings were taken in the summer and some were taken in the fall.

Well	Water Level Elevation (ft AMSL)					
(quadrangle/#)	7/2/2007	10/25/2007	11/5/2008	7/14/2009	6/22/2010	6/6/2012
BARR-06-01	775.06	777.04	780.74	786.59	785.63	784.57
BARR-06-02A	737.14	739.01	739.48	739.20	739.83	NA
BARR-06-02B	752.40	752.70	752.58	754.27	753.65	751.92
BARR-06-03	738.47	739.01	739.53	741.26	740.95	NA
BARR-06-04A	766.21	768.15	771.25	775.68	774.92	NA
BARR-06-04B	765.21	766.14	767.47	768.31	768.42	767.96
BARR-07-06B	737.56	738.00	739.86	NA	NA	NA
LZUR-04-01	744.95	745.72	746.73	747.4	749.22	747.44
LZUR-05-02	847.68	843.46	837.64	829.29	819.00	800.95
LZUR-05-03	714.74	719.63	725.64	724.53	730.52	NA
LZUR-06-04	702.31	710.31	714.69	711.68	717.36	715.67
LZUR-07-07	NA	719.81	723.18	726.72	729.54	727.91
STRM-05-01	736.38	741.40	746.46	745.94	749.56	746.61
STRM-06-02	807.78	810.33	810.57	813.17	811.89	810.57
STRM-06-03	763.34	763.86	766.08	766.96	766.49	764.86

Municipal Pumping Wells

Water level measurements are being taken annually in approximately 52 wells located in 13 municipalities on a synoptic basis. BACOG developed the chart below from: 1) measurements taken July 9, 2014 and collected by KOTECI; and 2) measurements taken August 10, 2015 and July 7, 2016 collected by the BACOG Executive Director.

Notes:

- A number of variables can affect the water level in a pumping well. For example, rate of pumping, barometric pressure, and the overlapping cones of depression (drawdown of aquifer water levels due to pumping) from all the other high-capacity wells in the aquifer. This data is being collected for the 2019 comprehensive report; the reader is cautioned against trying to interpret it as stand-alone information.
- The Reference Point Elevations were self-reported by the municipalities in 2014. In 2016, BACOG staff adjusted for inconsistencies in some of this data by consulting USGS topography maps and well log information from ISGS ILWATER maps if data was available. Pumping Water Levels were calculated from these points.

Operating Municipal Well	Pumping Water Level Elevation (ft AMSL)		
	2014	2015	2016
ALGONQUIN_5	762	759	767
ALGONQUIN_7	700	699	702
ALGONQUIN_8	818	832	832
ALGONQUIN_9	837	844	850
ALGONQUIN_13	835	818	817
ALGONQUIN_15	842	NA	854
BARRINGTON_1	702	726	726
BARRINGTON_4	NA	714	716
CARPENTERSVILLE_5	767	767	762
CARPENTERSVILLE_6	752	765	752
CARY_3	781	791	778
CARY_8	713	714	715
CARY_9	700	701	693
CARY_10	787	789	789
CARY_11	804	805	804
CARY_12	811	810	809
CRYSTAL_LAKE_9	755	743	747
CRYSTAL_LAKE_10	792	794	801
CRYSTAL_LAKE_11	804	805	815
CRYSTAL_LAKE_14	795	778	783
CRYSTAL_LAKE_15	875	862	861
FOX_RIVER_GROVE_1	721	NA	724
FOX_RIVER_GROVE_2	723	723	NA
FOX_RIVER_GROVE_3	NA	NA	701
FOX_RIVER_GROVE_4	NA	675	NA
ISLAND LAKE_4-6	650	641	642
ISLAND LAKE_4-10	648	642	658
ISLAND_LAKE_5	720	716	720
LAKE BARRINGTON 1	741	725	764
LAKE BARRINGTON 2	NA	744	744
LAKE_IN_THE_HILLS_6	843	846	NA
LAKE_IN_THE_HILLS_9	767	767	767
LAKE_IN_THE_HILLS_10	855	851	855
LAKE_IN_THE_HILLS_12	809	814	816
LAKE_IN_THE_HILLS_16	822	826	824
LAKE_IN_THE_HILLS_17	727	729	729
MCHENRY_2	735	735	733
MCHENRY_3	669	668	666
MCHENRY_5	711	713	711
MCHENRY_6	704	704	700

MCHENRY_7	711	704	705
MCHENRY_8	787	719	746
MCHENRY_9	647	658	635
MCHENRY_10	611	612	609
SOUTH_ELGIN_3	677	686	686
SOUTH_ELGIN_4	735	762	764
SOUTH_ELGIN_5	698	695	699
SOUTH_ELGIN_6	687	NA	689
SOUTH_ELGIN_10	683	684	694
SOUTH_ELGIN_11	705	704	701
SOUTH_ELGIN_12	649	641	651
TOWER_LAKES_5	693	693	693
WAUCONDA_3	650	650	653
WAUCONDA_5	751	752	753
WAUCONDA_6	717	716	717
WAUCONDA_10	707	706	718

Stream Gages

Limited streamgage data is available. Streamgage measurements were not available for the 2015 Baseline Report, which was developed from data collected in 2014. With the installation of two gages in Flint Creek near Lake Barrington in November 2014 and two additional gages in Flint Creek near New Hart Road in Barrington in May 2016, more data should be available for the next report. The stream gages take continuous readings, but the measurements below were extracted for a point-in-time for 2015 and 2016.

Stream Gauge	Water Level Elevation (ft AMSL)		
	2015	2016	Change
FC_1	NA	792.33	NA
FC_2	NA	789.00	NA
FC_3	748.83	748.75	-0.08
FC_5	740.19	740.05	-0.14

Climatic Conditions

The following climatic data was compiled by BACOG in summer 2016 from the National Oceanic and Atmospheric Administration (NOAA), U.S. Department of Commerce, Chicago Weather Forecast Office, at: http://w2.weather.gov/climate/index.php?wfo=lot. The NOAA *Annual Climate Report* contains detailed annual weather statistics, including temperature, precipitation, degree days, wind, humidity, sunrise/sunset, and record temperature data for a year period. Precipitation data includes both calendar year and water year totals, percent of normal values, and comparisons to normal.

Precipitation, Annual – Chicago IL:

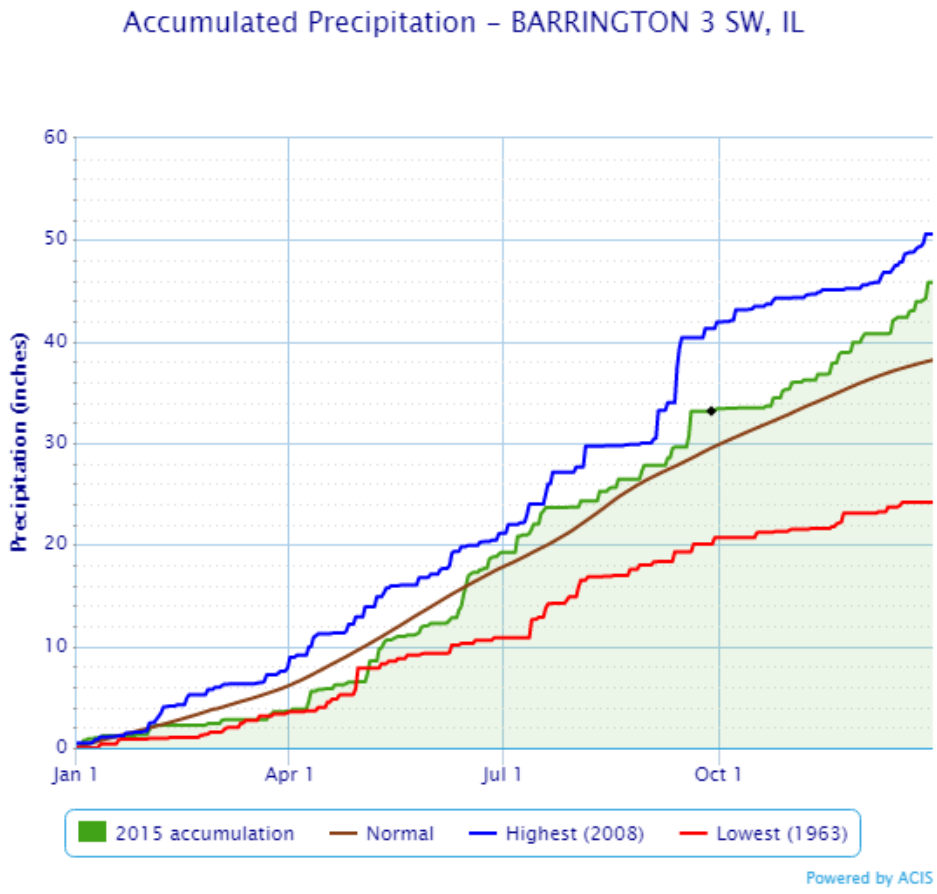
Inches, Annual	2015	2014	2013	2012	2011
	39.85	39.47	42.09	26.91	49.83
Normal*	36.89	36.89	36.89	36.89	36.89
Over/Under Normal, Inches	2.96	2.58	5.20	(9.98)	12.94
Over/Under Normal, Percent	+8%	+7%	+14%	-27%	+35%

**Normal Period: 1981 to 2010 (30-Year)*

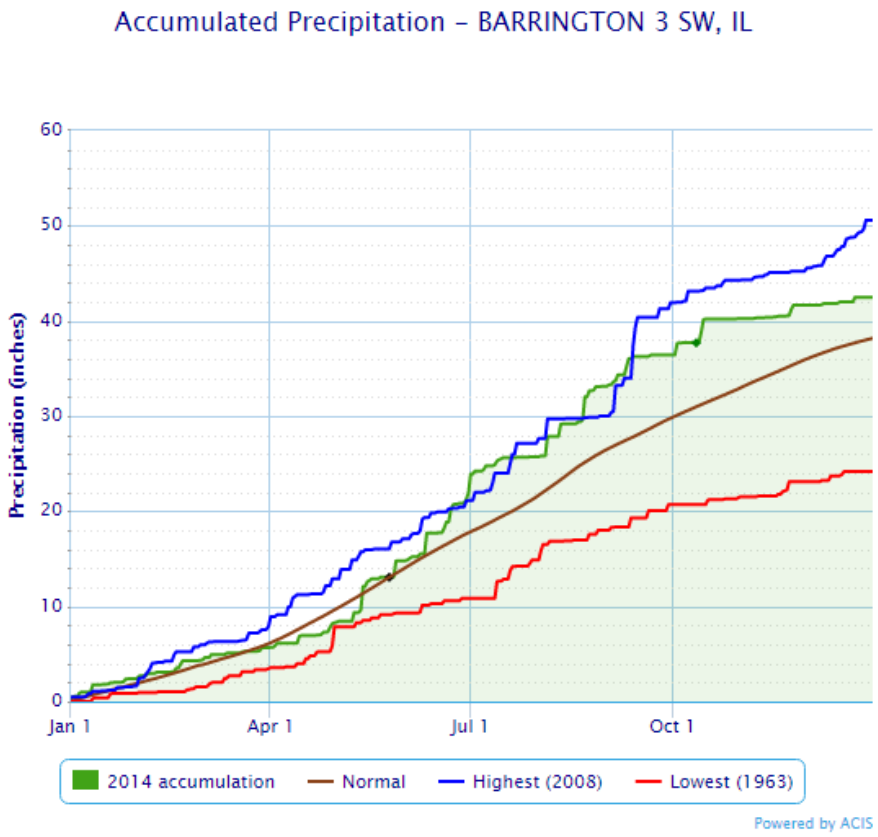
Precipitation in the Chicago metropolitan region during the years covered by the monitoring program was higher than the 30-year normal: higher by 7% in 2014, and higher by 8% in 2015 during the monitoring program.

While the preceding measurements were for the Chicago area, the following climatic information is specific to Barrington.

Precipitation, Barrington IL: January 1-December 31 2015
(from NOAA website: http://w2.weather.gov/climate/xmacis.php?wfo=lot)



Precipitation, Barrington IL: January 1-December 31 2014



Precipitation Monthly - January to December, Barrington 3 SW, IL:

2015	1.29	1.10	1.20	2.91	5.75	6.99	4.46	4.10	5.58	1.99	4.55	5.90	**TOTAL 45.82**

2014	2.39	1.91	1.35	2.63	6.51	7.11	3.82	7.41	3.28	3.82	1.43	0.83	**TOTAL 42.49**

Compilation of Data

BACOG developed a structure to store all measurements described in this Section III, using Excel spreadsheets and geodatabases. The information is maintained and backed up in the BACOG office. The data structure is designed to hold the readings collected from the start of the monitoring program in 2014 through future years. All data can be used for reporting, and it will be analyzed collectively for the 2019 comprehensive report.

IV. TRENDS OR INDICATIONS

As a courtesy to BACOG, two individuals from the ISGS and the USGS have provided comments on the data presented in this Interim Report.

Comments provided by David R. Larson, Hydrogeologist (retired), Illinois State Geological Survey; former Section Head, Geologic Mapping and Hydrogeology Center:
Because the water-level record is so short and with little stage-level data for surface water, discussion of trends would be inappropriate. A discussion of possible indicators might include the overall similarity of the North Barrington and Deep Park hydrographs between the two periods. Another feature is the hydrographs of the first period show less fluctuation of water level than the hydrographs of the second period. A third feature is the different shape of the Lake Barrington hydrographs, but this would need a word of explanation as to why they are different. The hydrographs show minor changes over time, and this may be all that is needed to be said. Adding a weather monitoring station (precipitation, temperature, etc.) within BACOG but some distance from the Barrington NOAA site would be beneficial. The data provided would enhance evaluating the trends in water-level fluctuations, for example. Cooperative programs, such as Mesonet, may help provide the resources to accomplish this, one of which involves schools.

Comments provided by Amy M. Gahala, Hydrologist, U.S. Geological Survey, DeKalb Office:
As previously noted, the required time period necessary to observe and evaluate trends in water levels is generally five years to a decade or more. For the 2019 BACOG report, the data available will include the historical ISGS measurements from 2007-12, which when evaluated together with all data collected through 2019, should provide an adequate time period to establish trends. With the exception of the LZUR-05-02 monitoring well, all the other water level data are indicating a stable trend. The Lake Zurich quadrangle well, LZUR-05-02, has shown a 70 foot decrease in water levels from 2007 to 2016. Water levels have dropped consistently on a year-to-year basis, and this is not likely to be caused by natural fluctuations.

V. PROGRAM COSTS

Component 1, the Baseline Conditions Analysis Report issued in January 2015, was entirely funded from BACOG cash reserves in 2014 in the amount of $19,565. This was a one-time expense.

Component 2, the Well Network, was funded in 2014 by: 1) a ~$24,000 grant from USGS for equipment on three wells, and 2) BACOG cash reserves in the amount of $6,150 for operations by USGS on the same three wells. In the two years since, operations have been funded by BACOG government member assessments, on a proportional basis based on the Dues Policy, in the total annual amount of $6,150. This is an on-going expense of the program; the well operational costs are likely to be raised slightly by USGS in the next 3-year contract.

Component 3, Long-term Data Analysis and Reporting, is being funded by BACOG government member assessments, on a proportional basis based on the Dues Policy. The annual amounts assessed to date are $4,242 total in 2014-15 and $4,581 total in 2015-16. The annual assessments are being collected toward the cost of the second comprehensive report of shallow aquifer system conditions, to be conducted in 2019. Over the five-year period, the assessments will increase somewhat each year for a goal amount of $25,000 to fund the 2019 report. These funds are held in a restricted account.

Component 1 and 2 together resulted in an annual assessment to members of $10,392 in 2015 (cost shared proportionately among members) to a little over $12,000 by the year 2019. There are no other costs -- other than staff time -- of the Comprehensive Groundwater Monitoring Program. This Interim Report is not a funded activity of the program.

VI. DIRECTIONS FOR THE FUTURE

No changes in program scope or directions for the upcoming 1-2 years are recommended at this time. After consultation with the Illinois State Water Survey, the date for the synoptic monitoring well and pumping well measurements likely will be moved to the month of June (from July or August) in 2017 and thereafter.

VII. ACKNOWLEDGMENTS

BACOG wishes to acknowledge collaborating agencies for their contributions to the Aquifer Water Levels Monitoring Program. Thank you to Doug Yeskis, State Director of the USGS Illinois Water Science Center, for the offer in 2013 to grant the monitoring/satellite equipment, which opened the door to launching the BACOG program. Thank you to Jon Hortness, Field Office Chief at the U.S. Geological Survey--DeKalb Office, and Supervisory Hydrologist Jon Lageman and Hydrologist Amy Gahala for guidance and technical assistance for this 2016 Interim Report. Special thanks go to the USGS DeKalb Field Office for providing staff to manually measure the 15 dedicated monitoring wells in 2015 and 2016, and to the 13 area municipalities that are collaboratively providing measurements from municipal wells: Algonquin, Barrington, Carpentersville, Cary, Crystal Lake, Fox River Grove, Island Lake, Lake Barrington, Lake in the Hills, McHenry, South Elgin, Tower Lakes, and Wauconda.

Our gratitude is also shared to staff of the Illinois State Water Survey (ISWS) and Illinois State Geological Survey (ISGS), including Scott Meyer, Steve Wilson, Walt Kelly, David Larson and Jason Thomason, for their advice, support and involvement over many years regarding the development/design of the BACOG Aquifer Water Levels Monitoring Program. Exceptional mention and appreciation goes to hydrogeologist Kurt Thomsen, KOTECI, who developed the initial protocol for this program as part of the Baseline Conditions Analysis Report and has served as professional advisor to BACOG for more than a decade. Thank you to BACOG GIS Analyst Tomasz Szczuka for his unwavering attention to accuracy in compiling the data for this report.

Report prepared by:
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