One of two related presentations on the Kentucky Interagency Groundwater Monitoring Network presented at the 2014 9th National Monitoring Conference in Cincinnati. This presentation focused on the history of how the Network was created and retrieving Network data online; the other presentation by Rob Blair of DOW focused on the mechanics of the Network and DOW’s extended sampling programs.
Geologic map of the United States, showing that Kentucky is situated between two large basins, the Illinois Basin and the Appalachian Basin. Between the basins is the uplifted Cincinnati Arch.
Kentucky’s Eastern Coal Field is located within the Appalachian Basin and the Western Coal Field is located within the Illinois Basin. The Bluegrass Region and eastern Mississippian Plateaus (or eastern Pennyroyal) are situated on the Cincinnati Arch. Because of the arch, surface rocks were eroded away and the Bluegrass Region therefore has the oldest rocks in the state (see cross section A – A’). Kentucky does not have a single homogenous aquifer as do some other states, but rather several heterogeneous aquifers.
The current 60 Network sites are shown on this physiographic region map, which closely resembles the previous geology map because geology controls topography and physiography.
This general aquifer type map was generated by Rob Blair, and shows the range of aquifers in the state, from fracture flow to granular, depending on location.
Robert Blair of KDOY provided four pictures of Network sample locations. Nada Tunnel Spring in the Eastern Kentucky Coal Field and Dyer Spring in the Western Pennyroyal are shown here.
The City of Vanceburg’s public water supply well is a Network site in the Eastern Pennyroyal region, and Slough’s (pronounced “Slew”) Wildlife Management Area well is in the Western Kentucky Coal Field near the Ohio River.
The Network website, showing sample locations and ID numbers, along with all annual reports of the Network and other articles of interest.
Before proceeding further about the Network, the Kentucky Groundwater Data Repository (another mandated program connected with the Network) was introduced, which is the interface for obtaining Network data.
History of the Network

• Prior to 1992, there was little systematic effort to describe groundwater quality and make that information widely available to the public.

• In 1993 the secretary of the Ky. Natural Resources and Env. Protection Cabinet convened a Groundwater Consensus Committee to draft groundwater protection regulations. DOW, KWRRI and KGS participated.

• Between 1993 and 1994, KGS and KWRRI worked jointly on proposed legislation to create a groundwater monitoring network.
History of the Network, Continued

• An ad hoc Interagency Technical Advisory Committee (ITAC) met through 1995 and 1996, and drafted a framework document for the Network. About 10 agencies were represented at these meetings.

• The proposed legislation did not pass in either the 1994 or 1996 Legislature

• In 1998, the Kentucky General Assembly passed two important, but unfunded, statutes:
  1. KRS 151.625 established the Groundwater Monitoring Network
  2. KRS 151.629 established the KY Interagency Technical Advisory Committee
I debated putting the actual legislation wording in my talk, but thought there may be people in the audience who are trying to develop a network for their state who may be interested in seeing exactly how the law is worded. This slide and the two following contain the exact wording of the Kentucky Revised Statute that established the Network.
3. The KGS shall utilize collected data to support research efforts that develop models for groundwater systems, and to determine and monitor trends of groundwater movement, water quality, and quantity.

4. The KGS shall provide data from the network to the Kentucky Groundwater Data Repository and make the data readily available to the public, government agencies, industry, and other entities that request access. Analyzed data maybe made available in the form of maps, charts, bulletins, and reports.

5. The KGS shall solicit input from federal, state, and local agencies, and industry, agriculture, universities, and the public to determine priority monitoring locations based on water quality and quantity concerns as the network is developed.
KRS 151.625, Continued.
6. Within ninety (90) days of the end of each state fiscal year, the KGS shall provide to the Governor and the Legislative Research Commission a summary of the groundwater monitoring network data collection and analysis activities.

Effective: July 15, 1998

State Capitol, Frankfort

Legislation for the Network, slide 3.
This is the legislation that establishes the Interagency Technical Advisory Committee, which works in conjunction with the Survey to oversee Network design and activities.
KRS 151.629, Continued.

2. The committee shall have two (2) nonvoting legislative liaisons who shall be members of the General Assembly. One (1) liaison shall be a House member appointed by the Speaker of the House of Representatives and one (1) liaison shall be a Senate member appointed by the President of the Senate. The chair of the committee shall be the director of the University of Kentucky Water Resources Research Institute. The duties and responsibilities of the committee shall include:
   (a) Developing a plan to coordinate agencies for the overall characterization of the state's groundwater, including occurrence, flow systems, water quantity, and water quality;
   (b) Reviewing the data entry process to ensure that all data collected is placed into the Kentucky Groundwater Data Repository;
   (c) Establishing a long-term groundwater monitoring plan for the Commonwealth;
   (d) Making recommendations for prioritization of the state's groundwater research needs; and
   (e) Annually reviewing and evaluating groundwater data collection and analysis.
KRS 151.629, Continued.

3. In addition to the members identified in subsection (1) or (2) of this section, the committee may have, as one (1) of its members, one (1) nonvoting representative from the United States Geological Survey, appointed by that agency.

**Effective:** June 20, 2005


**Legislative Research Commission Note** (6/20/2005). This section was amended by 2005 Ky. Acts chs. 99 and 123, which do not appear to be in conflict and have been codified together.

**Legislative Research Commission Note** (6/20/2005). 2005 Ky. Acts chs. 11, 85, 95, 97, 98, 99, 123, and 181 instruct the Reviser of Statutes to correct statutory references to agencies and officers whose names have been changed in 2005 legislation confirming the reorganization.
The ad hoc ITAC committee (prior to legislation being enacted for the committee) completed a framework document outlining the design and function of the Network in 1996.
Goals of the Network as outlined by the ad hoc ITAC committee in 1996.

1. Collect groundwater data
2. Characterize groundwater quality
3. Distribute groundwater information
4. Improve coordination between agencies that collect groundwater data
5. Facilitate sharing of groundwater data
Proposed monitoring strategy summary of the Network as outlined by the ad hoc ITAC committee in 1996.

Proposed Monitoring Strategies

1. Past and ongoing groundwater projects were identified by physiographic region

2. Separate monitoring strategies were proposed for each of seven major physiographic/geologic regions

3. Three sampling teams proposed taking total of 800 samples per year, using standard methods

4. Analyses were to include field measurements, nutrients, pesticides, major ions, inorganics, radio-metrics, metals
Subgroups of the ad hoc ITAC committee worked on individual monitoring strategies for each of the seven major physiographic/geologic regions of Kentucky. Two are shown here.
This data transmission flow chart was included in the Framework Document of 1996, and reasonably approximates how the data are transmitted today. The ultimate goal was to ensure that Network data was compiled in and disseminated by the Kentucky Groundwater Data Repository, which is indeed the case today.
Recommendations by the ad hoc ITAC committee in the 1996 Framework document for design of the Network. At the time, major funding was thought to be achievable to support such a robust Network. The current Network represents about 10 percent of the original planned Network.

Framework Document Recommendations

1. All current groundwater data and all groundwater data to be collected in the future should be put into a standard format for entry into the Repository
2. 641 sampling sites should be installed across the state for annual sampling
3. One-time sampling for 120 locations (one per county)
4. Areas requiring more intense study should be identified and monitored as “Intense Study Areas”
The Framework Document recommended about 60 analytes in 7 categories for the sampling regime.

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<th>Field Measurements</th>
<th>Major Ions</th>
<th>Nutrients</th>
<th>Pesticides</th>
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<td>Nitrite-Nitrogen</td>
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<th>Inorganics</th>
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The analytes sampled for today in the current Network are not too different from those suggested in 1996. Volatile organic compounds (VOC’s) and caffeine have been added.
The Current Network

1. 60 sites sampled at differing intervals, about 200 samples per year (about half wells and half springs)
2. Division of Water does the sampling, funded by General Funds; Certified Well Drillers’ Fees; Federal Insecticide, Fungicide and Rodenticide Act; Section 319 of the Clean Water Act
3. KGS is developing additional sites for water-level monitoring and supplemental quality sampling using internal funding
4. ITAC meets biannually
5. KGS & DOW have compiled detailed groundwater-quality reports for all 5 BMU’s, KGS compiles Network Annual Reports

Relevant information about the current Network.
Several reports have been generated by the Network under the auspice of the ITAC committee – this is the title and content page of last year’s annual report, which summarizes the activities of the Network in general, and of the water-related activities of the agencies who are members of ITAC.
Detailed Basin Management Unit (called BMUs, of which there are 5) reports were generated by KGS and DOW between 2004 and 2008. These reports used well and spring data from the entire Groundwater Data Repository, not just the Network. Additional BMU reports were generated by DOW which specifically targeted about 30 Network-only sites within each BMU. These BMU reports are available on the KGS and KDOW websites respectively, but will also be posted on the Network website by June of 2014.
Current ITAC members

- Kentucky Division of Water, Department for Environmental Protection, Energy and Environment Cabinet
- Kentucky Geological Survey, University of Kentucky
- Kentucky Water Resources Research Institute, University of Kentucky
- University of Kentucky College of Agriculture
- Kentucky Division of Waste Management
- Kentucky Division of Forestry
- Kentucky Division of Conservation
- Kentucky Division of Pesticides, Department of Agriculture
- Kentucky Department for Natural Resources

Current roster of the Interagency Technical Advisory Committee for the Kentucky Interagency Groundwater Monitoring Network.
Accessing Network Data via the Kentucky Groundwater Data Repository

The slides to follow will show how to access Network data via the Repository.
On the Kentucky Geological Survey's front page, select “Data” then “Groundwater”.

From the KGS front page (www.uky.edu/kgs):
Select “Data”, then “Groundwater”
This is the Repository's primary website. There are 3 blue tabs for the Water Well and Spring Search Engine, the Groundwater-Quality Search Engine, and General Water Information. To access Network quality data, the Groundwater Quality tab is selected.
Select the “Search for Groundwater-Quality Data” link for tabular data. Users may also perform simple statistics on quality data, or view data on various base maps, such as geology, topography and aerial photography.
The Groundwater-quality search engine page.
At least one of the analytes in the 14 blue categories must be selected to run a search. Retrieving all analytes for multiple sites can potentially be a massive amount of data and may time-out on the user, so retrieving all available analyses can only be performed for individual sites, or for a few sites within a small radius search.
Summary range-of-value maps are available for about 38 of the most-requested analytes.
Two Ways to Access Network Data

1. By individual ID number (AGKWA), thereby obtaining all Network data for that site only

2. By user-specified analyte, thereby obtaining data for all Network sites for that specific analyte
How to retrieve all Network data for an individual Network site.
Selecting site of interest on Network map by copying AKGWA number to place in “Method” box on previous slide.
Selecting ALL Network data for a single analyte, in this case, arsenic.
Groundwater-quality data results for ALL Network data available for arsenic. Note that many more arsenic records are available through the Repository – this search was restricted to arsenic data for the Network only.
Results from any groundwater-quality search can be displayed spatially on either a topographic or aerial photography base map.
View from top of the Carew Tower in downtown Cincinnati, along with Contact information for authors, and the Network URL.