

Arnold, T.L., and Warner, K.L., 2001, Creating a multi-state database from well construction records--Illinois, Indiana, and Wisconsin: 2001 Association of Ground Water Scientists and Engineers Annual Meeting and Conference, December 7-9, 2001, Nashville, Tennessee, p. 31-32.

Creating a Multi-State Data Base from Well Construction Records-- Illinois, Indiana, and Wisconsin

By T.L. Arnold and K.L. Warner, U.S. Geological Survey, Urbana, IL

ABSTRACT

A large data base consisting of 40,679 well locations and 196,687 lithologic records was created from Illinois, Indiana, and Wisconsin well-construction records for wells drilled during the period 1980-1997. The purpose of the data base is to provide information for mapping the surface, thickness, transmissivity and hydraulic conductivity of the Quaternary, Silurian/Devonian, and Cambrian/Ordovician age aquifers in the upper Illinois River Basin (UIRB). These digital maps and information will be used for the UIRB study of the National Water-Quality Assessment Program, U.S. Geological Survey (USGS), to facilitate county- or basin-wide three-dimensional (3-D) ground-water flow and transport modeling. A geographic information system (GIS) was used to create and manage the data base. Over 50 computer programs were written and utilized to compile and summarize data from various sources.

The data consists of location, lithologic, construction, and aquifer-test information for 40,679 wells (203,286 lithologies) and were obtained from Illinois State Geological Survey (ISGS), Indiana Department of Natural Resources (IDNR), and Wisconsin Department of Natural Resources (WDNR). Each agency had a different method for retrieving data. ISGS required township and range locations, IDNR required spatial polygons defining the area of interest, and WDNR required county names. Only data available in digital format were used to create this data base. Different data base layouts and formats are used by the three agencies. Data had to be reformatted, calculated from existing data, or re-ordered so that it could be uniformly compiled into one data base. The large size of this data set made it difficult to rearrange data columns and to process because each processing step took multiple days of run-time on the computer.

Summarizing the data for mapping and use in hydrogeologic models was challenging. Lithologic ages were estimated and depths to the top of the Silurian/Devonian, and Cambrian/Ordovician aquifers were identified. Various word combinations were pattern-matched to create a common descriptor for each lithology. A quality check was performed to ensure that aquifer codes were in a logical sequence. After examining hundreds of lithologies, patterns in descriptions became apparent and these patterns were used to help identify correct sequences. Ages associated with a lithology were identified after a stratigraphic table was compiled. To aid in identifying bedrock lithologies of a specific age, the uppermost bedrock was needed to provide a starting point in the identification.

To calculate the hydraulic properties (transmissivity and hydraulic conductivity), six pieces of information were required: duration of aquifer test, well discharge, drawdown during pumping, well diameter, screen length, and aquifer thickness. The thickness of permeable material in each aquifer was calculated to estimate aquifer thickness. In order to include as many wells as possible with sufficient information for calculating the hydraulic properties, the well construction information was added or corrected, if possible, based on available information about the well.

After all information was summarized, geostatistical software was used to evaluate and statistically model spatial structure, transmissivity, and hydraulic conductivity of the Silurian/Devonian and Cambrian/Ordovician aquifers and the thickness of the Quaternary and Silurian/Devonian aquifers. Most important in data base development is that the interpretation of lithologies and assumptions are made under the supervision of an experienced geologist. Well construction records are neither the most consistent nor accurate source of geologic information but they are the most geographically widespread snapshot of underlying geology. This data base has been valuable in developing maps of regional hydrogeologic characteristics of aquifers in northern Illinois, Indiana and Wisconsin.