

**The Water Information Storage and Retrieval Database
(WISARD, a.k.a, WIZARD) Web Site
User Manual**

Open File Report 2007-15



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User Manual**

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Introduction

WIZARD is an acronym for Water Information Storage and Retrieval Database (Hausberger et. al., 1998) and represents a repository of information on fresh-water wells drilled into aquifers in Kansas. It contains data on well locations, trends in depth-to-water, well construction, and casing by consolidating information maintained by several local, state, and federal agencies.

Its primary purpose is to archive water-levels measured at various times of the year for wells that are part of the statewide or local water-level observation networks. Most of these data consist of annual measurements of the depth-to-water taken over the winter months, but some wells are measured quarterly or monthly.

WIZARD contains over 52,000 well location records across Kansas with roughly 6,850 containing historic depth-to-water measurements stored in an Oracle-based relational database management system consisting of 19 related tables. Except for basic location information, data are not complete for all wells. Although water-level measurements can be found statewide, most are concentrated in the High Plains aquifer region of western and south-central Kansas. Data are updated throughout the year.

The WIZARD database evolved from the United States Geological Survey's (USGS) Ground Water Site Inventory (GWSI) in 1996. This legacy still exists in the use of the USGS_ID field, which serves as a unique identification number for a well site location. However, WIZARD is owned and maintained solely by the KGS while GWSI is operated solely by the USGS. There is no formal coordination between the two data sources.

This report will outline and explain the functions and capabilities of the WIZARD web site. This report was developed in support of the Maintenance and Enhancement of the High Plains Aquifer Information Network, funded by through the Kansas Water Research Institute, Dave Young, Principal Investigator.

Internet Browser Requirements

The WIZARD web site was developed and tested using the Netscape (version 7.0) and Internet Explorer (version 6.0) web browsers. For the WIZARD web site to function properly, the accessing browser must support frames, Java scripting, cookies, and popup windows.

Accessing the WIZARD Web Site

Most of the information in the WIZARD database (with some exceptions) is available through the WIZARD web site:

<http://www.kgs.ku.edu/Magellan/WaterLevels/index.html>

The site may also be accessed via the Kansas Geological Survey (KGS) main web page (<http://www.kgs.ku.edu/>) by clicking on the “WIZARD” hyperlink under the bullet labeled “Water”.

Well Selection Page

The WIZARD web site starts with the Well Selection Page (shown below) and allows a subset of wells to be selected from the main database. The “**Please Note**” section of the page is dynamic and serves to announce special events, such as the loading of raw field data or any downtime for database maintenance.

The screenshot shows a Mozilla Firefox browser window with the title "KGS--WIZARD Water Well Levels - Mozilla Firefox". The address bar displays the URL <http://www.kgs.ku.edu/Magellan/WaterLevels/index.html>. The page content is titled "WIZARD Water Well Levels Database". At the top left, there is a "Please Note" message: "Please Note--The 2007 KGS and DWR cooperative water level measurements have been loaded into WIZARD but are considered provisional at this time." Below this, there are several search criteria fields:

- Public Land Survey System:** Township: Any Township, Range: Any Range, Range Direction: E or W, Section: Any Section
- Lat/Long Box (NAD 83):** North Latitude, West Longitude, East Longitude, South Latitude
- County Name:** Any County, dropdown menu showing: Allen, Anderson, Atchison, Barber, Barton, Bourbon, Brown
- GMD Number:** Any GMD, dropdown menu showing: Western Kansas GMD #1, Equus Beds GMD #2, Southwest Kansas GMD #3
- Water Level Date Range:** mm/dd/yyyy format or leave blank for all records, Start Date, End Date
- State:** Kansas
- USGS_ID:** Single Entry, Load From file, Browse..., Examples on Loading Files
- KGS Local Well Number:** Single Entry, Load From file, Browse..., Examples on Loading Files

At the bottom of the search area, there are two checkboxes: "Restrict search to wells WITH water levels?" (checked) and "Pass search results to MAPPING page?". A "Select Wells" button is also present. The bottom left corner of the form area has a "Done" link.

At the top of the well selection page are links to the KGS, information related to water resources in Kansas, and WIZARD online help which is a link to this report.

WIZARD water wells can be selected by entering criteria into one or more of the text boxes and/or choosing items from the list boxes on the selection page. The well selection criteria are summarized below:

Public Land Survey System.

Public Land Survey System:

Township: **Range:** **Range Direction:** **Section:**

A Public Land Survey System (PLSS) tract may be used as a selection criterion. One simply enters the desired township, range, range direction, or section in the appropriate box or chooses these items from a list (shown above). If any of these items is not to be used as a selection criterion, the default values should be chosen.

Example: In what follows, all the wells within the township at 22S 15W are to be selected, regardless of the section number a well may be located in:

Public Land Survey System:

Township: **Range:** **Range Direction:** **Section:**

For more information on the PLSS and to view a reference map, see the KGS PLSS Public Information Circular at http://www.kgs.ku.edu/Publications/pic20/pic20_1.html

Lat/Long Box (NAD83)

This option allows the user to specify a bounding box in latitude and longitude coordinates for the well selection. Valid entries must be in decimal degrees and based on the North American Datum of 1983 (NAD1983). Both positive and negative values of longitude are valid. For the entire state of Kansas, longitude ranges from about -94.6 degrees in the east to -102 degrees in the west.

Lat/Long Box (NAD 83):

North Latitude

West Longitude East Longitude

South Latitude

In the example shown above, all of the wells within the geographic box defined by the (Longitude, Latitude) coordinates (-101.66099, 39.65031) in the northwest and (-101.15346, 39.2288) in the southeast are to be selected.

County Name:

Users may also select wells within chosen counties. One or more Kansas counties can be chosen from the list on the selection page by clicking on the county names. To choose multiple counties, hold down the CNTRL key while clicking on the name. To select a contiguous block of counties, click on the first name in the block, then hold down the SHIFT key and select the last name in the block. If Kansas counties are not to be part of the selection criterion, choose “Any County” (the default) from the list. In the example that follows, all of the wells within Finney, Ford, and Grant counties are to be selected.



GMD Number:

Wells within one or more Groundwater Management Districts (GMDs) can also be used as a selection parameter. This is done in a manner similar to selection by county. Simply choose one or more GMDs from the list on the selection page by the same procedure described above for selection by county. Choose “Any GMD” (the default) if selection is not to be done using GMD as a criterion. An example in which all wells within Southwest Kansas GMD#3 and Northwest Kansas GMD#4 are to be selected follows:



For a map of the GMDs in the state, see <http://www.kgs.ku.edu/Hydro/gmd.html>.

Water Level Date Range

In addition to the location of well sites, the selection process may be further refined based on when depth-to-water measurements were taken. For this option, enter a start date and end date in the appropriate boxes. Most standard date formats are accepted, but the mm/dd/yyyy is the default format. In the example below, all of the wells measured from January 10, 1985, to October 12, 1996, will be selected:

Water Level Date Range:

mm/dd/yyyy format or
leave blank for all records

Start Date:

End Date:

If the start and end date boxes are left blank (the defaults), these parameters will not be used as a selection criterion the entire measurement history for the selected well locations will be included.

USGS ID or KGS Local Well Number

Each of the wells in the WIZARD database can be uniquely identified by either their primary identification number (USGS_ID) or a derivative, the KGS Local Well Number (See the Appendix A for definitions of these identifiers). This option allows selection of a single well by typing either identification number in the appropriate box on the well selection page (see example below).

USGS ID or KGS Local Well Number

USGS_ID:

Single Entry:

Load From file:

KGS Local Well Number:

Single Entry:

In this example, entry of the USGS_ID and Local Well Number are demonstrated. However, only one of the identifiers is needed to select a specific well. Leave the appropriate box(es) blank if either or both of these criteria are not to be used as selection criteria.

Multiple wells may be selected by their ID numbers by creating an ASCII file (using an ASCII editor like NotePad or WordPad) containing a list of USGS_IDS or Local Well Numbers. Once the ASCII file is created, click on the browse button to navigate to its location. An example follows:

USGS_ID:

Single Entry:

Load From file:

The exact full path and file name may also be directly entered into the appropriate box if it is known. **Users are STRONGLY encouraged to use the BROWSE button to locate the file.** If a path and file

name are incorrectly typed in, the web site will, through an error message, notify you that it can not find the file. Using the navigation features of the browse button helps avoid this.

The USGS_IDs or KGS Local Well Numbers listed in the ASCII files must follow the format example shown below:

USGS_ID File Example

```
394152101525901  
394159102022201  
394409102003501  
394527102002701  
394612101323501  
394651101360001  
394856101424201  
394921101355801  
394947101283501
```

KGS LOCAL WELL File Example

```
'22S 33W 22BAA 01'  
'27S 38W 15BBB 01'  
'27S 37W 04ABB 01'  
'28S 36W 31BDD 01'  
'24S 30W 33ADD 01'  
'26S 29W 35CCC 01'  
'30S 32W 31BAB 01'  
'09S 42W 08AAA 01'  
'34S 38W 34CAA 01'
```

Note that the Local Well Numbers must be within single quotation marks since they contain embedded spaces.

Other Options on the Well Selection Page

Of the over 52,000 well records in WIZARD, only about 13% have water level measurements stored in the database. Checking the option to “Restrict search to wells WITH water levels” limits the selection to those wells that actually have depth-to-water measurements stored in WIZARD. This option is checked by default (see example below).

Restrict search to wells WITH water levels?:
Pass search results to MAPPING page?:

Given its historic legacy to GWSI, the WIZARD database may contain well records found in no other state or federal database. Although many of these well records do not contain historic depth-to-water measurements, they are still useful for understanding past ground-water well development. To access many of these site locations, the “Restrict search to wells WITH water levels?” must be turned off by clicking on the check box, which removes the check mark.

The “Pass search results to MAPPING page?” check box controls where the results of the selection criteria will be passed. Un-checking the box (the default) will pass the search results to the Well Listing Page, which itself has an option to access the mapping page. Checking the box passes the search results directly to the WIZARD mapping page. Both the Well Listing Page and the Mapping Page are discussed later in this report.

Select Wells

Select Wells

Once all the selection criteria from the Well Selection Page have been established, click the “Select Wells” button to initiate the query. The web site conducts some simple error checking, such as if an entered North Latitude value is really a number. If a problem with the selection criteria is found, an error message is displayed outlining the problem area of the query. Hitting the “Back” button on the browser will return to original selection page where the problem criteria can be adjusted.

Upon passing the error checks, the selection criteria will be run against the WIZARD database to select all the matching wells. Depending on the other options specified on the Well Selection Page, the results of the query will be displayed in either the Well Listing Page or the WIZARD Mapping Page. A message will be displayed if no well records were found to match the selection criteria.

Well Listing Page

The Well Listing Page is a listing of the selected well records (displayed 50 at a time) that match the criteria specified in the Well Selection Page. To view a specific 50-record portion of the list, click on the appropriate range at the top or bottom of the list. Just below each column label are options to sort the displayed list into ascending (asc) or descending (desc) order. For the “Date Range” column, one may sort (ascending) by the earliest date of measurement (Min Date) or (descending) by the most recent date of measurement (Max Date) for a well.

The screenshot shows a Mozilla Firefox browser window titled "WIZARD Water Well List - Mozilla Firefox". The address bar shows the URL: <http://hercules.kgs.ku.edu/geohydro/wizard/wizardwelllisting.cfm?CFID=4001516&CFTOKEN=22007316&jsessid=0>. The page header includes the Kansas Geological Survey logo, a Hydrology button, a Wizard Water Well Query button, and links for Statistics, Regional Trends, Download, Data Setup, and Create Map. A note states: "Select a well to view specific details." Below this, a message says: "804 records currently selected. Only 50 are display at one time. Records can be sorted ascending (asc) or descending (desc) which will affect ALL the records in the selection set." A note at the bottom left says: "Please Note- The 2007 KGS and DWR cooperative water level measurements have been loaded into WIZARD but are considered provisional at this time." The main content is a table with the following columns: Usgs ID, County, PLSS, Records, Date Range (Min Date Max Date), Longitude, Latitude, Use of Site, Use of Water, and Depth of Well. The table contains 10 rows of data, each representing a well record from Sedgwick county.

Usgs ID asc desc	County asc desc	PLSS asc desc	Records asc desc	Date Range Min Date Max Date	Longitude asc desc	Latitude asc desc	Use of Site asc desc	Use of Water asc desc	Depth of Well asc desc
374223097295401	Sedgwick	27S 02W 13BBB 03	48	19-DEC-1988 to 23-JUL-1996	-97.498599	37.70653	Observation	Unused	127
374223097295402	Sedgwick	27S 02W 13BBB 02	46	19-DEC-1988 to 23-JUL-1996	-97.498596	37.706534	Observation	Unused	94
374223097295403	Sedgwick	27S 02W 13BBB 01	46	19-DEC-1988 to 23-JUL-1996	-97.498589	37.706552	Observation	Unused	55
374320097284101	Sedgwick	27S 01W 07BBB 03	49	19-DEC-1988 to 23-JUL-1996	-97.478777	37.722275	Observation	Unused	180
374320097284102	Sedgwick	27S 01W 07BBB 02	46	19-DEC-1988 to 23-JUL-1996	-97.478769	37.722229	Observation	Unused	128
374320097284103	Sedgwick	27S 01W 07BBB 01	49	19-DEC-1988 to 23-JUL-1996	-97.478772	37.722272	Observation	Unused	42
									24 FEB 1900

The Well Listing Page also provides options for further computations and data displays for either the group of selected wells or individual well site locations. Clicking on an individual USGS_ID of a well from the well list will open the WIZARD Well Details Page while clicking on the processing buttons at the top of the page will perform a variety of tasks on the selection set as a whole. All of these options are discussed in the following sections of this report. On any page in the WIZARD web site, the blue button with a question mark label links the user to the site-specific help.

Well Listing Page- Well Details Page

Clicking on an individual USGS_ID from the WIZARD Well Listing page opens Wizard Well Details page. This page provides detailed information for individual wells.

The screenshot shows a Mozilla Firefox window displaying the 'Wizard Water Well Detail' page. The title bar reads 'Wizard Water Well Detail - Mozilla Firefox'. The address bar shows the URL http://hercules.kgs.ku.edu/geohydro/wizard/wizardwelldetail.cfm?usgs_id=393!. The page header includes links for 'File', 'Edit', 'View', 'History', 'Bookmarks', 'Tools', 'Help', and various system icons like Instant Message, WebMail, Calendar, Radio, People, Yellow Pages, Download, and Customize... Below the header are buttons for 'Kansas Geological Survey', 'Hydrology' (with a pie chart icon), 'Wizard Water Well Query' (with a water well icon), 'WIZARD Water Well Listing' (selected), 'FGDC Metadata', and 'Search WWC5'. A question mark icon is also present.

General Well Site Information

USGS ID:	393508101390801	KGS Local Well ID:	05S 39W 25CDA 01
County:	Cheyenne	PLSS Description:	5 39W 25 NESESW
HUC 8 Code:	10250013	GMD:	Northwest Kansas GMD #4
Longitude:	-101.649648	Lat/Long Source:	GPS (within 50 feet)
Latitude:	39.586016	Lat/Long Accuracy:	5 seconds
Surface Elevation (ft):	3533	Depth of Well (ft):	297
Geological Unit Codes:	TO	USGS Map Name:	Bird City South SW
Use of Site:	Withdrawal of Water	Use of Water:	Irrigation

Location Map

Well Remarks:

FENCE AROUND WELL GONE SEVERAL HANGS BUT NOT TOO BAD

Measuring Point Information

Note that height is listed as feet above or below land surface.

Height:	0.6
Description:	HOLE SW CORNER ON PUMPBASE

Other Well Identifiers

Well Identifier	Assignor	Date Assigned
NW	KANSAS DIST	MAR-18-1998
GWMD 4	GC KS	MAR-18-1998
NWHP	KSHPRASA	MAR-18-1998
009532	KSBA-DWR	MAR-18-1998
	NIN HP	

Water Level Measurements

393508101390801

Please Note- The 2007 KGS and DWR cooperative water level measurements have been loaded into WIZARD but are considered provisional at this time.

Note that depth to water is feet below land surface and all measurements for the well are included.

Hydrograph- Depth to Water Below Land Surface

The hydrograph displays the depth to water (feet below land surface) over time. The y-axis ranges from -125 to -139.16666667. The graph shows a highly variable depth, with significant fluctuations and a general downward trend over the period shown.

As can be seen from the figure above, the page consists of three frames, each of which can be scrolled through and resized. The top frame contains general well site information such as the longitude and latitude of the well location, the land surface elevation, the depth of the well, etc., along with a well

location map, remarks concerning the well, and in some cases, a photograph of the well. The bottom left frame contains measuring point information such as height in feet above or below land surface, other well identifiers (identifiers assigned to the well by other agencies), and in some cases, construction data and casing data for the well. The bottom right frame contains a graph of the entire depth to water measurement record for the well followed by a table listing of the depth-to-water measurement data. This table listing of depth-to-water measurements can be downloaded by clicking the “Download” button at the bottom of the table. This passes the measurement history to a new web page that, in turn, can be saved or copied and pasted into an ASCII file or spreadsheet.

At the top of the WIZARD Well Details Page is a link to the WIZARD FGDC metadata (<http://hercules.kgs.ku.edu/geohydro/wizard/wizardfgdc.html>). Discussion of FGDC metadata is beyond the scope of this manual but clicking on the “FGDC Metadata” button will provide a complete explanation and breakdown of several WIZARD tables and database fields. This metadata window will provide information about the data items listed in the file header records and on the well details page as well as other useful information regarding the WIZARD database.

The “Search WWC5” button, when clicked, presents a listing of any Water Well Completion Form Database (WWC5) records within the (PLSS) section where the well is located. The WWC5 database (<http://www.kgs.ku.edu/Magellan/WaterWell/index.html>) is a separate well repository that provides information reported from drilling companies about the lithology, location, type, use, casing, nearest source of contamination, etc., of wells drilled in Kansas since 1974. Although a single well site may be entered in both WIZARD and WWC5, there is no established link or coordination between the two databases. Associations between the two database records can be made based on common data attributes like a well’s location and its depth.

For explanation of some of the well characteristics displayed on the details page, see Appendix A.

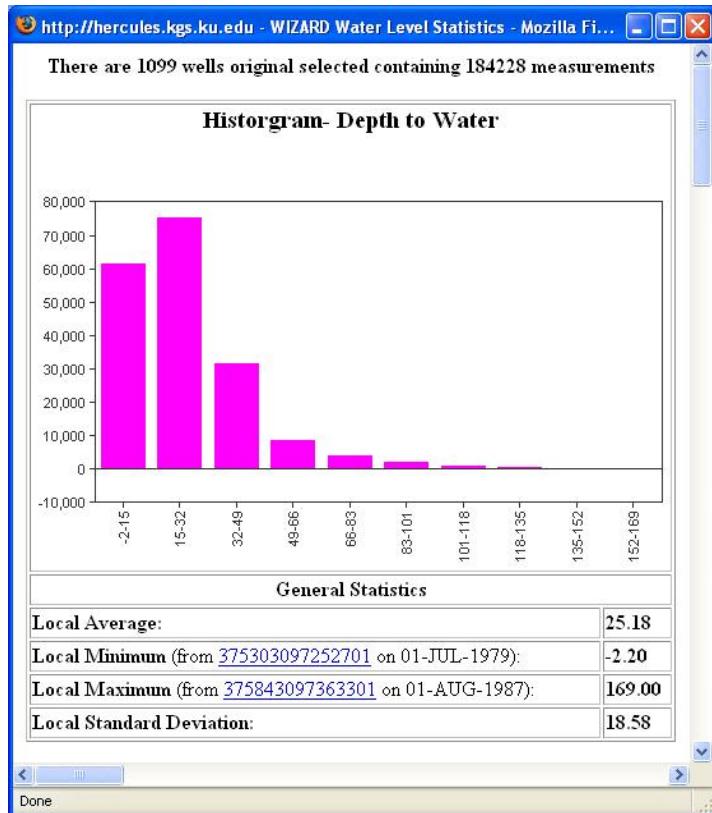
Well Listing Page- Group Processing

The group processing options at the top of the Well Listing Page provide several statistics and data processing and mapping tools that operate on the entire selected well set. These tools are useful for general investigations of the data or to further process the selection set for other applications.



Summary Statistics and Histogram

Clicking the “Statistics” button at the top of the Wizard Well Listing Page provides some summary statistics and a histogram for all depth to water measurements within the selection set:



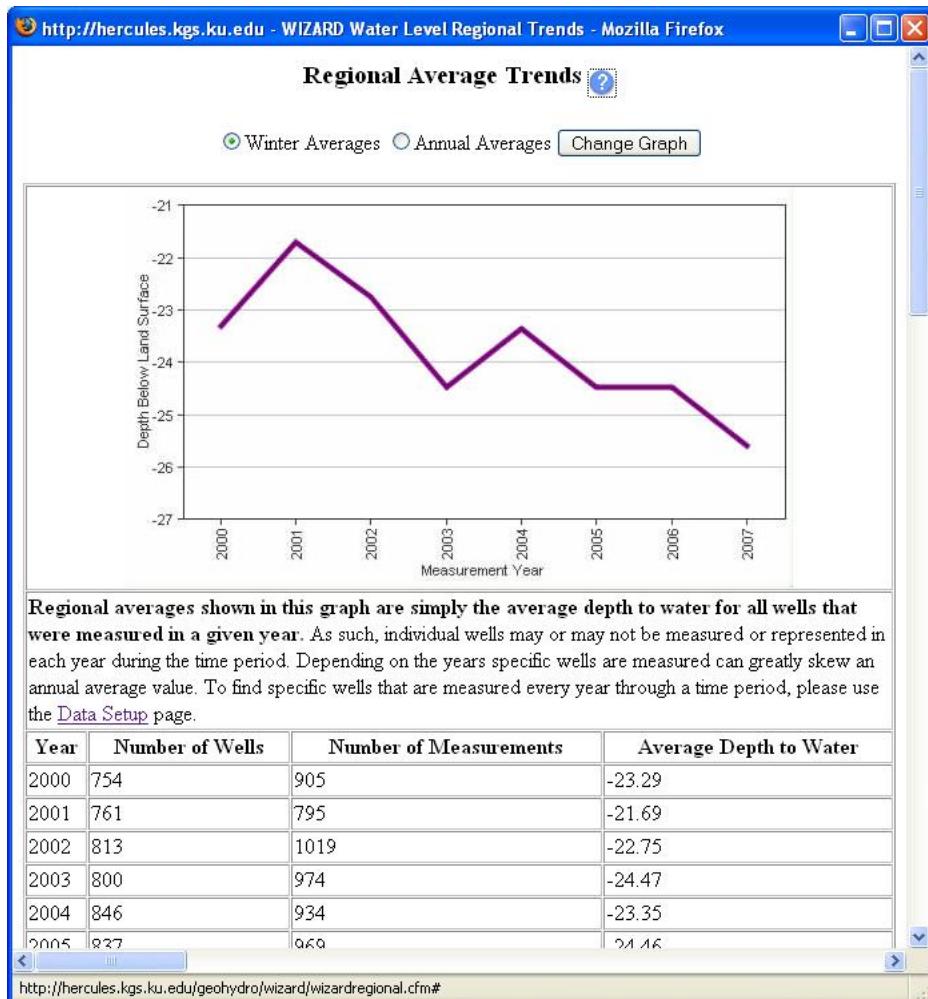
At the top of this page, the number of selected wells and the number of associated depth to water measurements are printed. The histogram depicts the distribution of depth to water values. Rolling the mouse over a histogram bar displays a message that gives the number of depth to water measurements that are within the corresponding depth to water interval along with the range of this interval. The ranges of the depth to water intervals corresponding to histogram bars are printed along the abscissa (horizontal axis) of the graph.

Following the histogram is a breakdown consisting of the local average, minimum, maximum and standard deviation of the depth to water measurements for all of the selected wells. The entries with the

labels “Local Minimum” and “Local Maximum” in the general statistics table also contain the USGS_ID of the well from which the statistic was derived and the date of its measurement. Clicking on the USGS_ID opens the WIZARD Well Details Page of this well.

Regional Trends

The Regional Trends button opens a window that displays a graph of the yearly average depth to water for the selected wells versus measurement year followed by a table containing the number of wells, the number of measurements, and the yearly average for each available measurement year.



The regional average depth to water is based on all of the selected wells measured in a given year. There are two averaging options provided at the top of the window in the form of radio buttons. Winter averages, the default option, causes the annual averaging to be computed for a period consisting of December of the previous year, January and February of the current year. For example, the winter average for the year 2000 is the average depth to water for all measurements made in December 1999, January 2000, and February, 2000. The “annual averages” option causes the averaging process to be done over the whole calendar year. Hence, the yearly average depth to water in this case would be the average of all measurements taken from January to December, 2000. If the averaging option is changed, the “Change Graph” button must be clicked to update the window.

Note that individual wells may not have been measured for every year of the time interval; hence the yearly averages can be greatly skewed. It is important to note the number of wells and measurements used to determine the yearly average. The time interval for the graph is based on the date range entered in the WIZARD Well Selection Page. If none was entered, all measurements for the selected wells are considered, hence the time interval would span a period from the earliest measurement to the most recent of any well in the selection set.

Download

This option enables both the site-specific and water level data for all of the selected wells to be downloaded. This button will open another browser window (shown below).

The screenshot shows a Mozilla Firefox browser window with the title "WIZARD Data Download - Mozilla Firefox". The address bar displays the URL <http://hercules.kgs.ku.edu/geohydro/wizard/wizarddow>. The main content area of the browser shows the "WIZARD Water Well Levels" page. At the top of this page are several navigation links: "Kansas Geological Survey", "Hydrology", "Wizard Water Well Query", "WIZARD Water Well Levels", "Data Download", "FGDC Metadata", and a question mark icon. Below these links is a large, empty text area. Underneath this area, there is descriptive text about the "Data Download" link, followed by two underlined download links: "[sites20070509111555867.txt](#)" and "[wlevel20070509111555867.txt](#)". At the bottom of the page, there is a "Disclaimer" section featuring the Kansas Geological Survey logo and text about contacting Dan Suchy or webadmin@kgs.ku.edu. A footer at the very bottom of the browser window says "WIZARD Program updated December, 2002. Data added periodically." and includes standard browser navigation buttons like back, forward, and search.

Two comma-delimited ASCII files are included with the download option-- one for well site specific information and another storing the water-level measurements for those selected sites. The data relationship between the two files is one to many in that a single well (one) may have multiple measurements (many).

The site-specific data file name always contains the “sites” prefix followed by a time stamp. The file contains information relative to the individual well sites, such as PLSS location data, land surface elevation, well depth, and screened aquifer codes to name a few. The water levels data file name always contains the “wlevels” prefix followed by a time stamp. This file contains the depth-to-water measurements for the wells listed in the site file. The date range of the measurements is based either on the “Date Range” from the Well Selection Page or the entire period of record if no date range was specified.

Both downloaded file options preserve the original data and field names stored in the WIZARD database. Some of these values are decoded throughout certain sections of the WIZARD website. For example, the WIZARD database stores the name of the county a well is located in by its FIPS code whereas the WIZARD Well Detail Page converts this to its actual name (e.g., Cheyenne County’s fips code is 23). The download page provide a link to the FGDC metadata that lists the exact values for every field in the WIZARD database. Similarly, Appendix A of this report provides code listings used in the WIZARD website.

Left-clicking on the file name causes the file to be displayed in a new window; right-clicking on it enables the user to save the file to a disk. On MacIntosh computers, the mouse button is held down and a pop-up menu appears. Once downloaded, each file can be imported into a spreadsheet or database and a data link or relate can be created via the USGS_ID fields.

Data Setup

For each well record in the WIZARD database, there may be zero or more depth to water measurements. The relationship between a well site and its measurement data is generally one-to-many. Furthermore, a well may be measured more than once in a given year. This can present a challenge if an analysis goal to review or interpolate water-level surfaces over time and space for multiple years. The “Data Setup” option provides one way of processing the data for these types of applications. The final result from the Data Setup page is a simplified data set where each well has a single measurement per year.

The screenshot shows the "WIZARD Water Well Data Processing" page. At the top, there are links for the Kansas Geological Survey, Hydrology, and Wizard Water Well Query. The main title is "WIZARD Water Well Data Processing". Below it, a message says "Select a processing option." A note explains the purpose of the data setup page: "The purpose of this data setup page is to simplify the one to many data relationship between annual water levels in individual wells with multiple measurements by assigning a unique depth to water measurement value for each well for each year. This simplified data set is useful primarily for yearly trend analysis. For more information, please click on the help button in the upper right corner of the page." A warning message states: "Please note this procedure can be process intensive and may take a few minutes." Below this, instructions say: "All wells retrieved from the initial selection and match the criteria identified below are used in this process." The main form area contains four sections:

For each well, identify the:	Over the following months: (no selection is the same as selecting all the months)	For each of the following target years:	Apply a moving selection window around each target year of:
<input checked="" type="radio"/> Average Value <input type="radio"/> Most Recovered Value <input type="radio"/> Least Recovered Value	<input type="checkbox"/> AUG <input type="checkbox"/> JUL <input type="checkbox"/> JUN <input type="checkbox"/> SEP <input type="checkbox"/> MAY <input type="checkbox"/> OCT <input type="checkbox"/> APR <input type="checkbox"/> NOV <input type="checkbox"/> MAR <input type="checkbox"/> DEC <input type="checkbox"/> JAN <input type="checkbox"/> FEB	2000 2001 2002 2003 2004 2005 2006 2007	+ and - <input type="text"/> year(s) <input type="button" value="Submit Request"/>

At the bottom left is the Kansas Geological Survey logo. A "Disclaimer" section includes contact information for Dan Suchy and webadmin@kgs.ku.edu, and notes that the WIZARD Program was updated in December 2002. A "Done" button is at the bottom left.

The Data Setup page provides options for methods of determining a single yearly depth-to-water value, defining the time period (within a year) over which a single yearly depth to water value is to be determined, choosing “target” years of interest, and an option to apply a moving selection window around each target year. These options are discussed below.

Determination of a Single Yearly Depth to Water Value

The choices of determination method are in the form of three radio buttons that enable users to choose between the average, most recovered, and least recovered depth to water values for a yearly measurement value for a well over a chosen period(s) within the year.

For each well, identify the:	Over the following months: (no selection is the same as selecting all the months)	For each of the following target years:	Apply a moving selection window around each target year of:
<input checked="" type="radio"/> Average Value <input type="radio"/> Most Recovered Value <input type="radio"/> Least Recovered Value	<input type="checkbox"/> AUG <input type="checkbox"/> JUL <input type="checkbox"/> JUN <input type="checkbox"/> SEP <input type="checkbox"/> MAY <input type="checkbox"/> OCT <input type="checkbox"/> APR <input type="checkbox"/> NOV <input type="checkbox"/> MAR <input type="checkbox"/> DEC <input type="checkbox"/> JAN <input type="checkbox"/> FEB	<input type="checkbox"/> 2000 <input type="checkbox"/> 2001 <input type="checkbox"/> 2002 <input type="checkbox"/> 2003 <input type="checkbox"/> 2004 <input type="checkbox"/> 2005 <input type="checkbox"/> 2006 <input checked="" type="checkbox"/> 2007	+ and - 0 year(s) <input type="button" value="Submit Request"/>

The “most recovered value” is the shallowest (smallest) depth to water value, the “least recovered value” is the deepest (largest) depth to water value, while the “average value” (the default) option is the average depth to water over the chosen time period.

Choosing the Time Period(s)

Time periods within each target year that the average, most or least recovered depth-to-water values can be further restricted to the month of the measurements.

For each well, identify the:	Over the following months: (no selection is the same as selecting all the months)	For each of the following target years:	Apply a moving selection window around each target year of:
<input checked="" type="radio"/> Average Value <input type="radio"/> Most Recovered Value <input type="radio"/> Least Recovered Value	<input type="checkbox"/> AUG <input type="checkbox"/> JUL <input type="checkbox"/> JUN <input type="checkbox"/> SEP <input type="checkbox"/> MAY <input type="checkbox"/> OCT <input type="checkbox"/> APR <input type="checkbox"/> NOV <input type="checkbox"/> MAR <input type="checkbox"/> DEC <input type="checkbox"/> JAN <input type="checkbox"/> FEB	<input type="checkbox"/> 2000 <input type="checkbox"/> 2001 <input type="checkbox"/> 2002 <input type="checkbox"/> 2003 <input type="checkbox"/> 2004 <input type="checkbox"/> 2005 <input type="checkbox"/> 2006 <input checked="" type="checkbox"/> 2007	+ and - 0 year(s) <input type="button" value="Submit Request"/>

In the example above, if a single period consisting of the contiguous months of December, January, and February is chosen, the period will be treated as the “winter” months. For “winter” month periods, the December measurements of the PREVIOUS year, in association with the January and February measurements of the CURRENT year, are considered for computations. For example, for the year 1995, the measurements in December 1994, January 1995, and February 1995 will be selected and processed (averaged, etc.) to represent a single 1995 depth to water value. Non-contiguous sequences, such as (January, February), (August, September) may also be chosen, yielding more than one (in this case two) time periods within the year. If no months are chosen, the time period for determining a yearly representative depth to water value for a given well will be the entire year.

Choosing Target Years of Interest

The target years of interest are those years for which the average, most, or least recovered depth-to-water values within the specified months are to be computed.

For each well, identify the:	Over the following months: (no selection is the same as selecting all the months)	For each of the following target years:	Apply a moving selection window around each target year of:
<input checked="" type="radio"/> Average Value <input type="radio"/> Most Recovered Value <input type="radio"/> Least Recovered Value	<input type="checkbox"/> AUG <input type="checkbox"/> JUL <input type="checkbox"/> JUN <input type="checkbox"/> SEP <input type="checkbox"/> MAY <input type="checkbox"/> OCT <input type="checkbox"/> APR <input type="checkbox"/> NOV <input type="checkbox"/> MAR <input type="checkbox"/> DEC <input type="checkbox"/> JAN <input type="checkbox"/> FEB	<div style="border: 1px solid #ccc; padding: 5px; width: 150px;"><ul style="list-style-type: none">20002001200220032004200520062007</div>	+ and - <input type="text" value="0"/> year(s) <input type="button" value="Submit Request"/>

To select multiple years, hold down the CNTRL key while clicking on the years in the list. To choose a block of years, as shown above, click the earliest year in the block, then hold down the SHIFT key while clicking the latest year in the block. All of the available years may be chosen in this manner as depicted in the image above. The available years are determined from the date range entered in the WIZARD Well Selection Page or, if no date range was specified, every year present in the database for the well selection will be available.

Applying a Moving Selection Window Around Each Target Year

This option allows the consideration of a larger selection window around the target years to determine a representative yearly depth-to-water value. The number of years before and after the target year increases the size of the window of processing. For example, users may choose a one-year window around each target year to represent a 3-year moving average around the target years.

For each well, identify the: <input checked="" type="radio"/> Average Value <input type="radio"/> Most Recovered Value <input type="radio"/> Least Recovered Value	Over the following months: (no selection is the same as selecting all the months) <input type="checkbox"/> AUG <input type="checkbox"/> JUL <input type="checkbox"/> JUN <input type="checkbox"/> SEP <input type="checkbox"/> MAY <input type="checkbox"/> OCT <input type="checkbox"/> APR <input type="checkbox"/> NOV <input type="checkbox"/> MAR <input type="checkbox"/> DEC <input type="checkbox"/> JAN <input type="checkbox"/> FEB	For each of the following target years: <div style="border: 1px solid #ccc; padding: 5px; width: 150px; height: 150px; display: flex; align-items: center; justify-content: center;">2000 2001 2002 2003 2004 2005 2006 2007</div>	Apply a moving selection window around each target year of: + and - <input type="text" value="0"/> year(s)
Submit Request			

By applying a value for the moving selection (or averaging) window, all the measurements for a given well for a time interval centered on the target year will be processed. For example, a moving selection window of 1 year centered on the target year of 1995 will allow all measurements that were taken in 1994, 1995, and 1996 for a well to be selected and then the average, most recovered, or least recovered depth-to-water measurement determined for each well. The resulting single values will then be assigned to the selected wells to represent the year 1995.

The principal use of this moving selection is to maintain a larger well count for long-term trend reviews. In many cases, a well may not have been measured for a variety of reasons (e.g., the well was being pumped) that would cause a target year to be missing from a trend analysis. Applying a moving window allows that missing year of water-level data to be based on the surrounding years where successful measurements were taken.

Submit Request

Once the data setup options have been specified, clicking on the “Submit Request” button produces a link (near the bottom of the data setup window) to a comma-delimited text file containing the representative depth-to-water values determined for each chosen year for each well. The measurement selection or averaging process may take several minutes, depending on the number of selected wells, the number of years chosen, and the yearly measurement determination method. Right-clicking on the link and choosing “Save Link As ...” from the context menu will enable users to save the file to a disk. Left clicking on the link will cause the text file to be displayed in a new window.

For each well, identify the:	Over the following months: (no selection is the same as selecting all the months)	For each of the following target years:	Apply a moving selection window around each target year of:
<input checked="" type="radio"/> Average Value <input type="radio"/> Most Recovered Value <input type="radio"/> Least Recovered Value	<input type="checkbox"/> AUG <input type="checkbox"/> JUL <input type="checkbox"/> JUN <input type="checkbox"/> SEP <input type="checkbox"/> MAY <input type="checkbox"/> OCT <input type="checkbox"/> APR <input type="checkbox"/> NOV <input type="checkbox"/> MAR <input type="checkbox"/> DEC <input type="checkbox"/> JAN <input type="checkbox"/> FEB	<div style="border: 1px solid #ccc; padding: 2px; width: 60px;"> 2000 2001 2002 2003 2004 2005 2006 2007 </div>	+ and - <input type="text" value="0"/> year(s) <input style="border: 1px solid #ccc; padding: 2px; width: 100px; height: 20px;" type="button" value="Submit Request"/>

This linked file contains a single record per well. Each record consists of the well's USGS_ID followed by the representative depth-to-water values determined for each chosen year. If no depth-to-water values could be determined for a well for a given year (due to lack of measurements), the depth-to-water for that year is assigned the value -9999.99. A header record consisting of the item names is present at the top of the file.

Mozilla Firefox

File Edit View History Bookmarks Tools Help

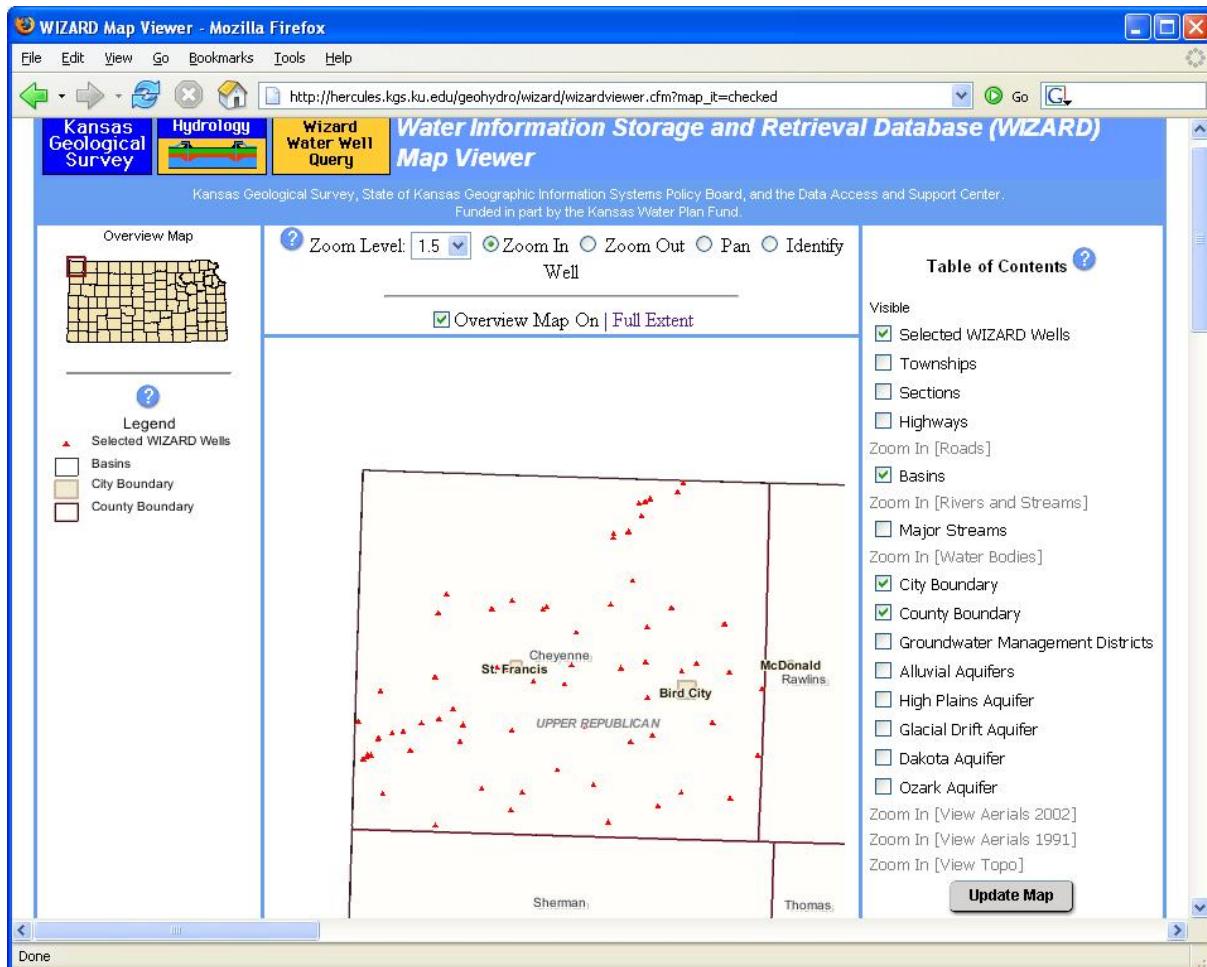
Instant Message WebMail Calendar Radio People Yellow Pages Download Customize...

USGS_ID,Avg2000,Avg2001,Avg2002,Avg2003,Avg2004,Avg2005,Avg2006,Avg2007

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 393547101481501, 211.86, 212.50, 213.93, 216.03, 217.58, 217.99, 218.33, 218.37
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 393712101470601, 227.14, 228.24, 229.35, 230.72, 231.62, 232.33, 233.08, 233.57
 393719101505501, 235.46, 233.61, 234.84, 233.40, 235.80, 236.85, 237.35, 237.38
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 393849101440101, 216.20, 216.55, 217.28, 218.08, 218.71, 218.97, 219.45, 219.48
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 393955101574301, 98.80,-9999.99,-9999.99,-9999.99,-9999.99,-9999.99,-9999.99
 394020101250801, 156.72, 157.05, 157.77, 158.42, 159.10, 160.09, 160.49, 160.67
 394047101525102, 145.52, 145.86, 146.12, 146.43, 147.01, 147.32, 147.42, 147.53
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 394152101525901, 123.68, 123.76, 123.78, 124.06, 124.29, 124.36, 124.27, 124.21
 394159102022201, 91.54, 91.63, 92.16, 92.64, 93.47, 93.77, 93.88, 93.89
 394205101413101, 142.67, 142.87, 143.39, 144.21, 144.73, 145.02, 145.21, 145.18
 394218101551201, 16.37, 16.67, 16.91, 17.15, 17.22, 17.12, 16.67, 16.50
 394237101292901, 201.12, 201.22, 201.96, 201.44, 202.38, 202.46, 202.38, 202.09
 394409102003501, 213.10, 213.51, 214.31, 214.80, 215.06, 214.67, 214.24, 214.03
 394421101354501, 223.14, 223.46, 224.16, 224.79, 225.55, 226.18, 226.37, 226.91
 394507101245701, 207.43, 208.12, 209.83, 210.85, 211.96, 212.46, 213.05, 213.43
 394507101433401, 154.73, 155.14, 155.69, 156.12, 156.62, 156.73, 156.73, 156.65
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 Done

Create Map

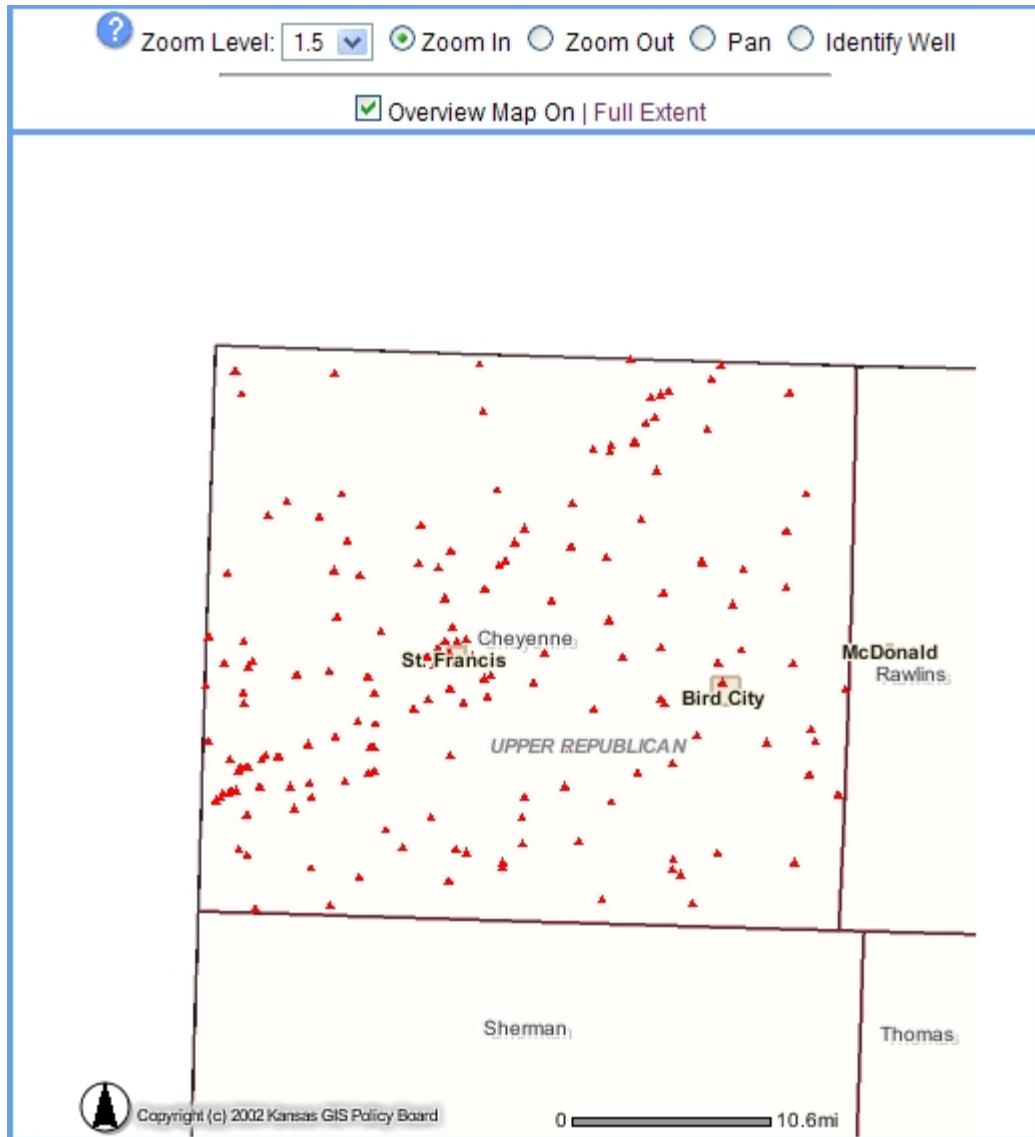
Clicking on the “Create Map” button on the WIZARD Well Listing Page or selecting the “Pass search results to MAPPING page” check box on the Well Selection Page enables selected wells to be displayed on an interactive map. A typical display is shown below:



In this figure, wells selected in Cheyenne County are displayed. The wells are displayed as small red triangles. In the rightmost panel of the map, options are provided to display the selected wells and various supporting base map components such as county boundaries, townships, sections, highways, major streams, Groundwater Management Districts, aquifers, etc. In the leftmost panel is an “overview” or “locator” map followed by the map legend. In lower center panel is the map display area and in the top center panel are tools with which the user may control and interact with the map display area. These components are discussed in detail below:

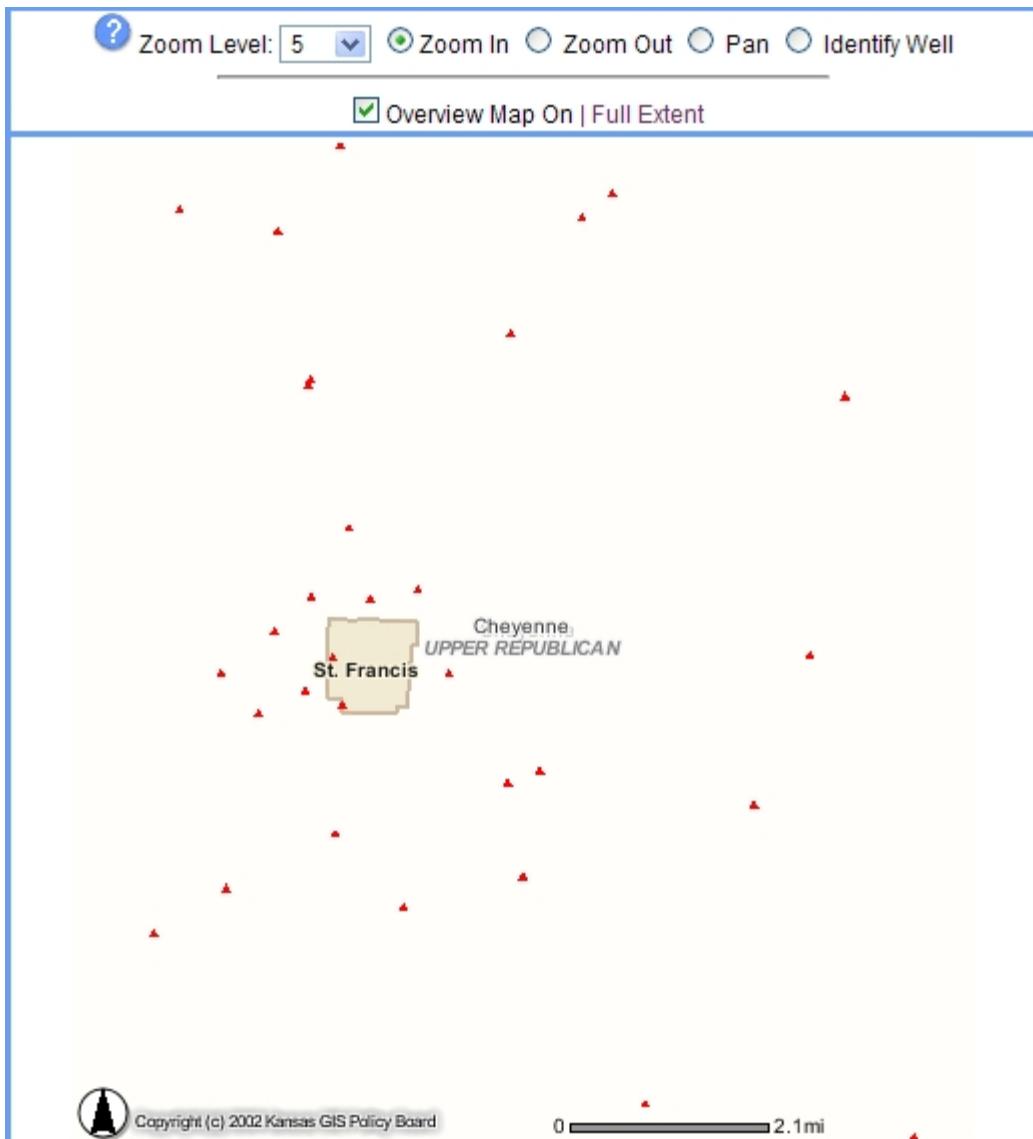
Map Tools and Map Display Area

The lower central panel of the Mapping Page is a map display area that can be interacted with through the use of the map tools in the top panel.



The zooming tools are in the form of radio buttons in the top panel. A tool is activated by clicking the appropriate radio button, and then applied by clicking within the Map Display Area.

The **Zoom In** tool allows users to zoom in closer on the map by clicking once on the map display. The map display will be centered on the clicked location and the entire display will zoom in depending on the **Zoom Level** (see below). If one zooms in far enough, there may be changes in the categories of map features that are displayed. Finer map resolution allows more map details to be observed.



In this example the “Zoom In” tool was used to click near the center of the original map display above (when the zoom level was set to 5). Comparison of the maximum distances on the scale bars (lower right corner of map) of the two maps (2.1miles in zoomed map vs. 10.6 miles in original) indicates that the map scale was increased by a factor of roughly 5.

The **Zoom Out** tool enables one to “zoom out” farther away on the map display, thus decreasing the scale of the map and, depending on the map resolution, causing less map detail to be observed. The use of the “Zoom Out” tool is the same as that of the “Zoom In” tool. When zooming out, there may be changes in the base map layers available for display on the map.

The **Pan Tool** enables the location on the map to be moved in any direction without changing the map scale. To use this tool, click its radio button and then click on the new map location. The new location becomes the new center of the map.

The **Identify Well** tool is a link to the WIZARD Well Details Page (see previous section above) for a specific well on the map. Clicking on a well in the map display causes the WIZARD Well Details Page to be displayed in a popup window. The page contains detailed information for the well that was clicked.

Checking/Un-checking the “**Overview Map On**” checkbox toggles the display of a locator map called the “Overview Map” at the top of the left panel. The locator map allows the user to see the position of the display area relative to the entire state. The current map extent is indicated by the red rectangle on this locator map. The overview map will update dynamically as the map display changes.

Clicking the **Full Extent** link causes the map to be displayed at its original scale.

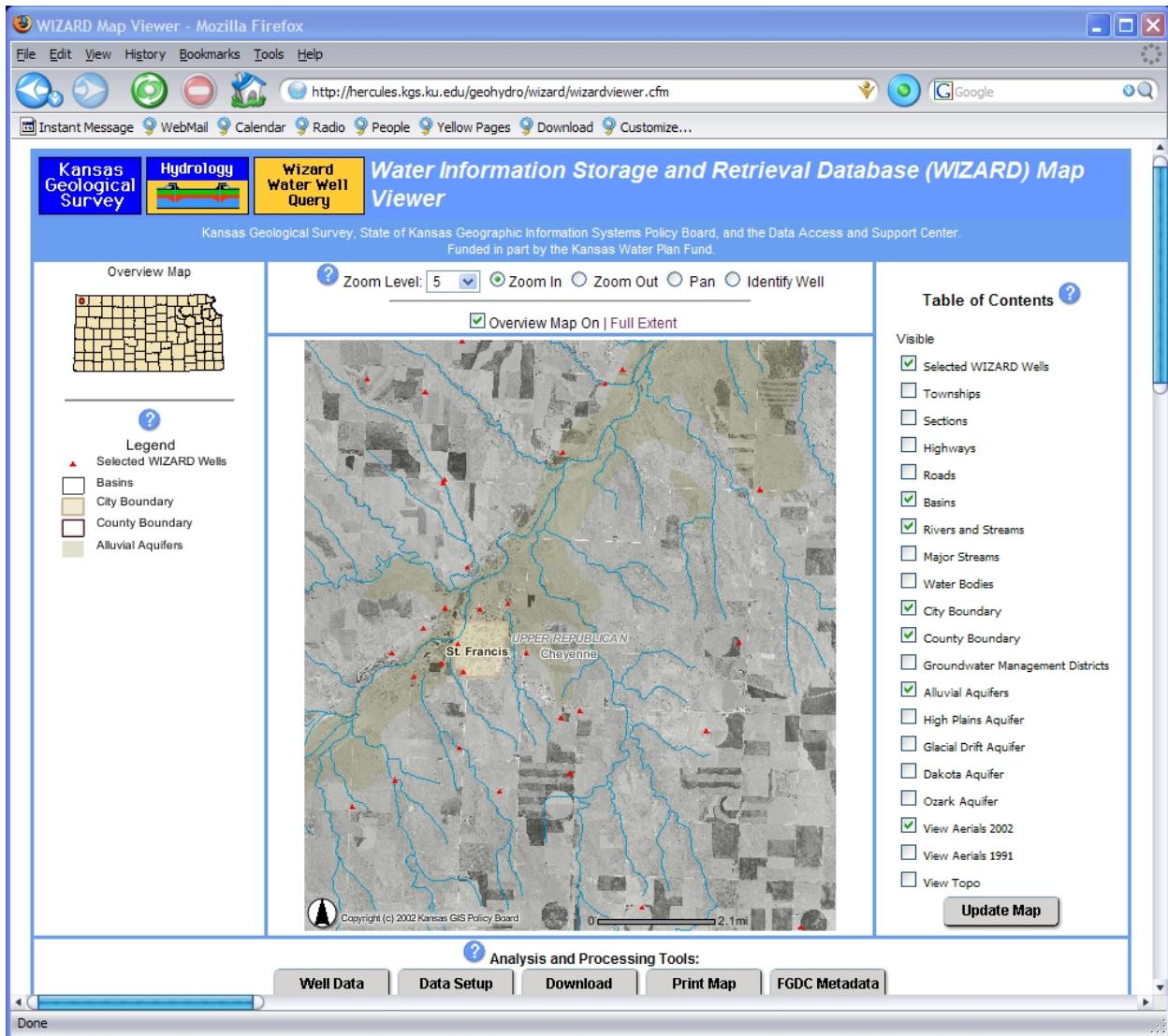
Overview Map and Legend

Below the Overview Map at the top of the leftmost panel is the map **Legend**, which denotes the symbols for all feature categories (such as roads, streams, counties, etc.) that have been made visible by checking the appropriate boxes in the table of contents. The legend enables users to distinguish categories of map features. Only those feature categories (layers) that have been checked in the table of contents have a legend symbol. The symbology for map categories is static and can not be changed.



Table of Contents

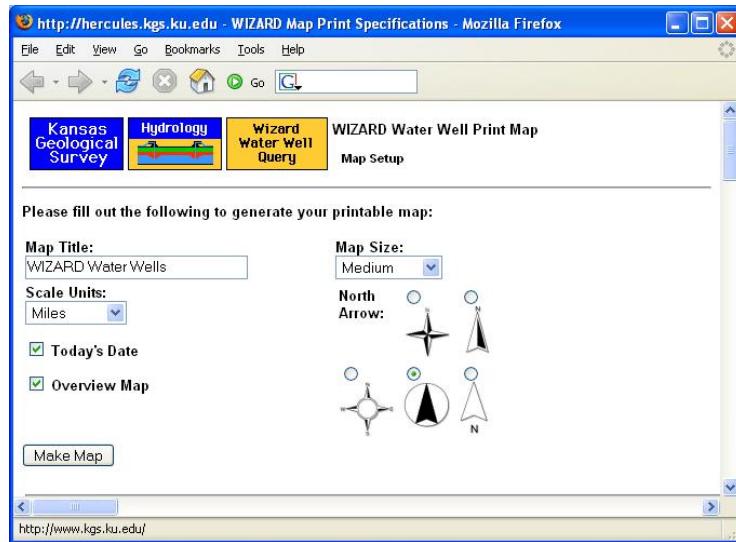
In the rightmost panel is the Table of Contents (TOC). The TOC is a list of available map layers (feature categories) preceded by checkboxes. The checkboxes toggle the layer's visibility status in the map display. Checking a layer's box turns the layer on while un-checking the box turns the layer off. Once the visibility status for the layers has been set, click the **Update Map** button at the bottom of the TOC to refresh the map display area.



Excluding aerial photos and topographic maps, the symbology of visible layers is shown in the legend portion of the map display. Several of the layers are only available at certain map scales. For example, viewing aerial photos is not an option when zoomed out to a county scale.

Other Map Options

At the bottom of the WIZARD map viewer is the **Well Data** button, which, when clicked, opens the WIZARD Well Listing Page in a separate window. Other controls at the bottom of the viewer are **the Data Setup, Download, and FGDC Metadata**, and **Print Map** buttons. The first three are discussed in previous sections of this report. The **Print Map** button allows users to create a map that is suitable for printing by providing several pre-print options (shown below).



From this page, users can choose the map title, scale units, and size of the actual map (Small, Medium, Large, or Extra Large). The style of North Arrow can also be selected and if the overview map and the current date should be displayed. Clicking the **Make Map** button causes the printer-friendly map to be displayed in a window. The map can then be printed by choosing “Print” from the file menu of the browser.

Conclusions

The WIZARD database consolidates ground-water well site locations and depth-to-water measurements from a variety of local, state, and federal sources and represents the most inclusive listing of water-level information in Kansas. The web site provides a real-time data access portal containing a host of selection, analysis, and mapping functions. WIZARD-based data facilitates scientific analysis that includes the determination of saturated thickness, depth to water, water-level trends, and water-resources predictions.

References

- Hausberger, G., Davis, J., Miller R., Look, K., Adkins-Heleson, D., Ross, G., Bennet, B., Schloss, J., Bohling, G., 1998. WISARD: Water Information Storage and Retrieval Database, Kansas Geological Survey Open File Report 1998-13.
- Woods, J. J., Schloss, J. A., and Macfarlane, P. A., 2000. January 2000 Kansas water levels and data related to water-level changes, Kansas Geological Survey, Technical Series 15, 89 p.

Appendix A: Some Item Definitions and Codes

Well Site-specific Database Items:

Below are definitions of most of the well-related items listed on the Wizard Well Details Page along with some associated fields. The labels are those used on the details page.

USGS ID	The unique 15-digit well identifier. It is initially based on the latitude and longitude (degrees, minutes, seconds) of the well site, but should not be considered a locator.
County	The name of the county in which the well is located.
HUC 8 Code	The 8-digit Hydrologic Unit Code for the Office of Water Data Coordination catalog unit which the site is located in. The 8-digit code consists of four Parts: 1) Hydrographic region code; 2) Sub region code designated by the Water Resources Council; 3) Accounting unit within the National Water Data Network; and 4) Cataloging unit of the USGS's "Catalog of Information on Water Data".
Longitude	The (NAD 1983) longitude of the well location in decimal degrees.
Latitude	The (NAD 1983) latitude of the well location in decimal degrees.
Lat/Long Accuracy	Accuracy of latitude and longitude coordinates (in seconds).
Lat/Long Source	Indicates source of longitude and latitude coordinates (see code definitions below).
KGS Local Well ID	(Also referred to as the KGS Local Well Number.) This well identifier is composed of the township, range, section number, up to four levels of qualifier/subdivision (see below), and a well number (a unique ID that distinguishes different wells at the same PLSS location). For example, if a well has a local well ID of 05S 30W 23CDD 01, it is located in the township at (05S, 30W), is within section 23 at the SE quarter (D) of the SE quarter (D) of the SW quarter (C) of this section. Furthermore, among the wells at this PLSS location, it has been assigned a well number of "01". For more information on the PLSS and to see a reference map, see the KGS PLSS Public Information Circular (http://www.kgs.ku.edu/Publications/pic20/pic20_1.html).
PLSS Description	Similar to the local well ID but without the township direction and well number and with the "spot" designation (described below).
Township	The vertical (N-S) coordinate of the PLSS grid of townships. Township values range from 1 in the north to 35 in the south in Kansas.
Township Direction	Always south (S) in Kansas.
Range	The horizontal (E-W) coordinate of the PLSS grid of townships. In Kansas,

range values vary from 1 to 43 moving westward and from 1 to 25 moving eastward from the Sixth Principal Meridian.

Range Direction	All townships west of the Sixth Principal Meridian have a range direction Value of “W” (West) while all those east of this meridian have a range direction of “E” (East).
Section	Most PLSS townships are divided into 36 one square mile sections.
Subdivision	Each section can be divided into four quarter sections, and each quarter section may be divided into four quarters and so on. Within WIZARD, up to four levels of division of a section are possible. The quarters are designated A (NE), B (NW), C (SW), and D (SE). They are listed from the largest (leftmost) to the smallest (rightmost) levels of subdivision. For example, the subdivision designation of CDD, the C or SW quarter is the largest subdivision.
Spot	Alternate subdivision designation in which the subdivisions appear from the smallest to the largest. For example, the subdivision designation of CDD would have a spot designation of SESESW with the SW quarter being the largest subdivision.
Depth of Well	Depth of the completed well, in feet, below the land surface.
Surface Elevation	Altitude (in feet above sea level) of the land surface at the well site location.
Geological Unit Codes	Designate the geological units that the well is screened in. Up to three codes are assigned per well (see code definitions below and Woods et. al., 2000).
GMD	The Groundwater Management District (GMD) number in which the well site is located.
USGS Map Name	Name of 7.5 minutes (1:24000 scale) USGS topographic quadrangle map the well is located in.
Measuring Point	The spot on the well where the measuring device, such as a steel tape, is inserted to obtain a depth to water value. The height of the measuring point is the distance, in feet, above or below the land surface datum. The Measuring Point’s description is used to help locate it on well.
Use of Site	The primary or principle use of the site or the purpose for which the site was constructed. For site use codes, see “USE_OF_SITE_PRIMARY” in the WIZARD metadata (http://hercules.kgs.ku.edu/geohydro/wizard/wizardfgdc.html).
Use of Water	The primary or principal use of water from the site. For water use codes, see “USE_OF_WATER_PRIMARY” in the WIZARD metadata .
Remarks	General comments about well site.

Depth-to-Water Items:

Tape Hold	Also called the “stop depth” the tape hold is the amount of steel tape, in feet, inserted into the well and held at the measuring point.
Chalk Cut	The value on the steel tape at which the chalk was marked by the water table.
Depth To Water	The depth, in feet below the land surface, to the water table in the well. Depth to water is calculated by subtracting the Chalk Cut value and Measuring Point Height from the Tape Hold. For graphing purposes, values are shown with negative signs to indicate depth below the land surface.
Date	The date on which the depth to water measurement was taken.
Status	Water level status code indicating any special conditions at the time of the measurement.
Agency	The agency responsible for the measurement.
Method	A code indicating how the water level was measured (see code definitions below).
WL Source	Indicator of the source of the water level measurement. In particular, measurements taken by the general public. Has value “U” if unverified volunteer measurement, V if verified or reviewed volunteer measurement.
Initials	Initials of the individual responsible for the measurement.

Items Related to Measuring Points

Height	The height of the measuring point in feet above or below land surface.
Description	A short description of the measuring point to facilitate its location on the well site.

Items Related to Other Well Identifiers

Well Identifier	Identifiers or classifications that other agencies have assigned to the well.
Assignor	The assignor of the well identifier. This may be an agency, a well network, a project, etc.
Date Assigned	The date on which the assignment of the identifier was made.

Items Related to Well Construction

Date	The date on which construction of the well was completed.
Construction Method	A code that indicates the method by which the site was constructed. For code definitions, see “CONSTRUCTION_METHOD” in the WIZARD metadata .
Type of Finish	A code that indicates the method of finish or the nature of the openings that allow water to enter the well. For code definitions, see “TYPE_OF_FINISH” in the WIZARD metadata .
Surface Seal	A code indicating the type of material used to seal the well so that surface water does not enter the well. For code definitions, see TYPE_OF_SURFACE_SEAL” in the WIZARD metadata .
Depth to Bottom of Seal	The depth to the bottom of the seal in feet below land surface.
Development Method	A code indicating the well development method. See DEVELOPMENT_METHOD in the WIZARD metadata for code definitions.
Development Hours	The length of time (in hours) that the well was bailed, pumped, etc., for development.
Special Treatment	A code indicating any special treatment applied during well development. For code definitions, see”DEVELOPMENT_SPECIAL_TREAT” in the WIZARD metadata .

Items Related to Well Casing Information

Sequence 1:	This number is assigned at the time of data entry to keep data by record type in a logical order.
Sequence 2:	A unique sequence number for sites that share a common USGS_ID value. Generally caused by multiple measurements.
Depth To Top	The depth to the top of section of casing, in feet below land surface. If the casing extends above the land surface, the height of the casing above land surface is preceded by a minus sign (-).
Depth To Bottom	The depth to the bottom of section of casing, in feet below land surface.
Diameter	The inside diameter, in inches, of perforated or slotted pipe, the diameter of a screen, or the diameter of the hole, if the well is a finished open-hole.
Material	The code indicating the type of material which the screen or other open section is made. For code definitions, see “MATERIAL” in the WIZARD metadata .
Thickness	The thickness of the casing wall (in inches).

Some Code Definitions

Geological Unit Codes:

QA	Quaternary alluvium
KD	Cretaceous Dakota, Kiowa Formations, and Cheyenne Sandstone
KN	Cretaceous Niobrara Chalk
KJ	Lower Cretaceous/Upper Jurassic undifferentiated
PL	Pennsylvanian Lawrence and Stranger Formations
TO	Tertiary Ogallala Formation
QU	Quaternary undifferentiated
JM	Jurassic Morrison Formation
OU	Ordovician Undifferentiated

Lat/Long Source Codes:

GIS	Coordinates determined by plotting within a Geographic Information System.
GPS	Coordinates measured with a Global Positioning System (GPS).
GPS (within 50 ft.)	Coordinates measured with a GPS within 50 ft. of the well site.
GWSI	Coordinate values from the USGS Ground Water Site Inventory database.
LEO	Coordinates calculated from the well's legal (PLSS) location using the LEO conversion program.

Water Level Status Codes:

A	Measurement was determined to be "anomalous" by KGS statistical analysis.
B	Only the year and month were provided for the measurement date and time (defaults to first day of the month).
D	The site was dry (no water level recorded).
E	The site was flowing recently.
F	The site was flowing, but the head could not be measured (no water level recorded).
G	A nearby site that taps the same aquifer was flowing.
H	A nearby site that taps the same aquifer had been flowing recently.
I	Injector site (recharge water being injected into the aquifer).
J	Injector site monitor (a nearby site that taps the same aquifer is injecting recharge water).
M	The site was plugged.
N	The measurement was discontinued.
O	An obstruction was encountered in the well above the water surface (no water level recorded).
P	The site was being pumped.
R	The site had been pumped recently.
S	A nearby site that taps the same aquifer was being pumped.
T	A nearby site that taps the same aquifer had been pumped recently.
V	Foreign substance was present on the surface of the water.
W	The well was destroyed.
X	The water level was affected by stage in nearby surface-water

- site.
Z Other conditions that would affect the measured water level
(explain in remarks).

Measurement Method Codes:

A	Airline measurement
B	Analog or graphic recorder
C	Calibrated airline measurement
E	Estimated
G	Pressure-gage measurement
H	Calibrated pressure-gage measurement
L	Interpreted from geophysical logs
M	Manometer measurement
N	Non-recording gage
R	Reported, method not known
S	Steel-tape measurement
T	Electric-tape measurement
V	Calibrated electric-tape measurement
Z	Other