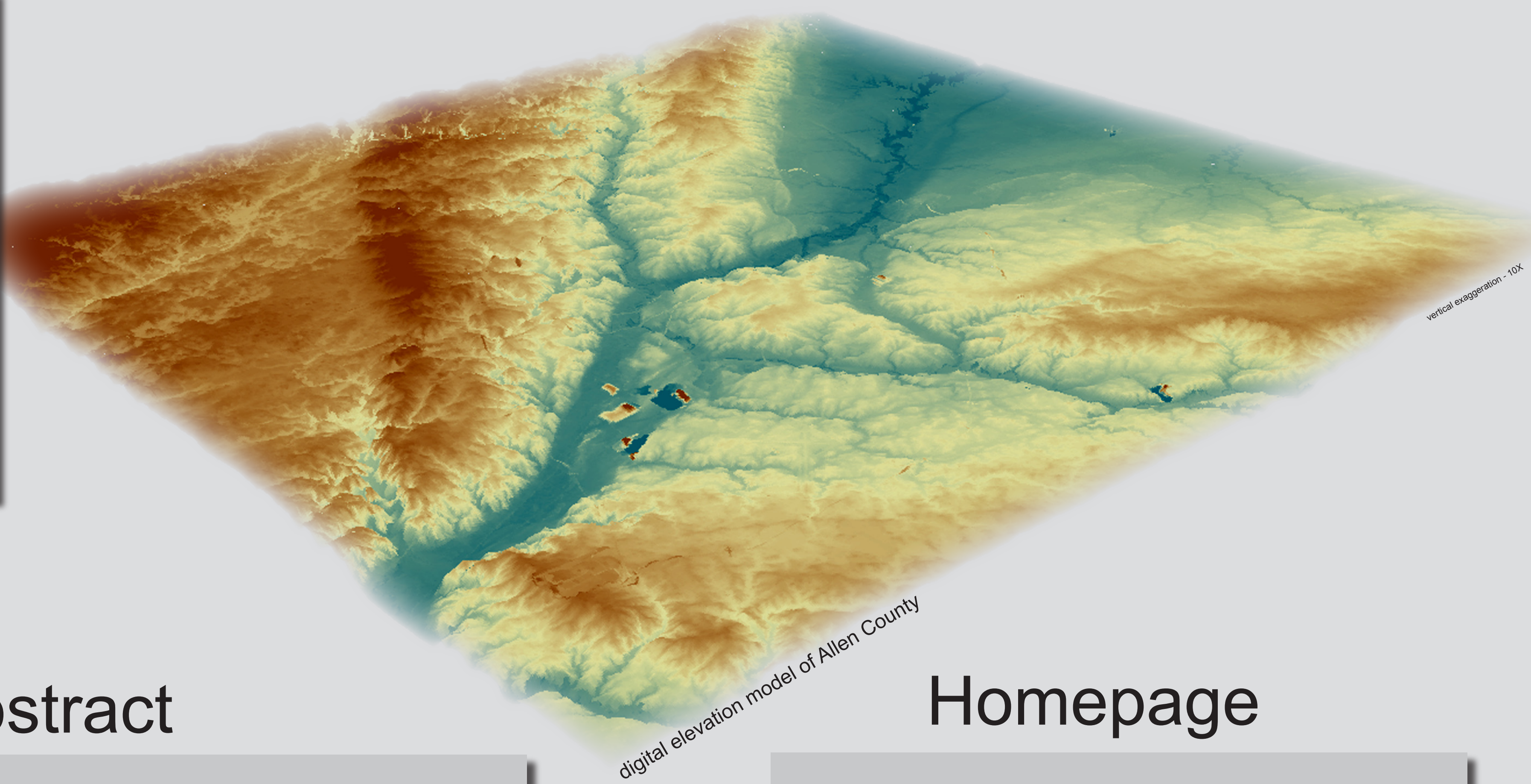


Developing a Web Site to Provide Geologic Data and Map Products for Allen County, Indiana

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Abstract

The Internet is becoming the medium of choice for delivering geologic information to both technical users and the general public. The Indiana Geological Survey (IGS) is currently creating a Web-based glacial and bedrock geologic map site for Allen County in northeastern Indiana. Allen County is the site of Fort Wayne, Indiana's second largest city, and lies within IGS mapping and outreach priority areas based on population density and transportation corridors. This Web site provides detailed geologic information in an area that continues to experience pressure on natural resources by a large population and expanding transportation network. It is anticipated that the information from the Web site will be widely used by the general public and by industry and government entities.

The Allen County Web site includes an Internet map server (IMS), as well as illustrations, educational summaries, and discussions of geologic maps, terrain images, and databases that complement the IMS. The site provides a front-end to the IGS enterprise geodatabases, which contain information used simultaneously for research and for viewing by the general public. The geodatabase systems allow maps and data to be efficiently created, managed, updated, and distributed.

Maps provided on the Allen County Web site include: (1) digital elevation model terrain, (2) Landsat imagery, (3) surficial geology, (4) drift thickness, (5) bedrock topography, (6) bedrock geology, and (7) water-table elevation. Technical database information includes: (1) lithologic information compiled from water-well information in the Indiana Department of Natural Resources, Division of Water well records, (2) natural gamma-ray geophysical log data, (3) stratigraphic test hole data, and (4) petroleum-well data. The development of the Web site was funded by the IGS and the Central Great Lakes Geologic Mapping Coalition.

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This Web site was completed by the Indiana Geological Survey and focuses on the geology of Allen County in northeastern Indiana. Allen County is the site of Fort Wayne, Indiana's second largest city, and lies within the Central Great Lakes Geologic Mapping Coalition priority areas, based on population density and transportation corridors.

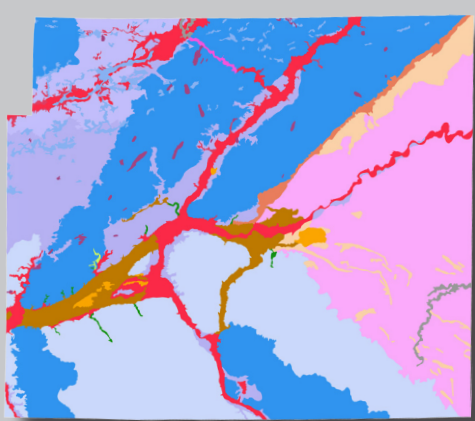
The Web site includes an Internet map server, as well as illustrations and educational summaries and discussions of geologic maps, terrain images, and databases to complement the Internet Map Server. The preliminary development of the concepts and terrain images was completed during earlier Coalition-funded tasks. Users of these products include the general public and water- and mineral-resource, environmental, planning, and public health professionals.

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Interpreted Geology and Primary Data

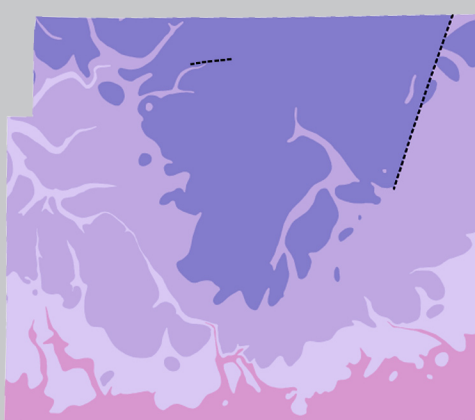
providing geologic interpretation

Surficial Geology



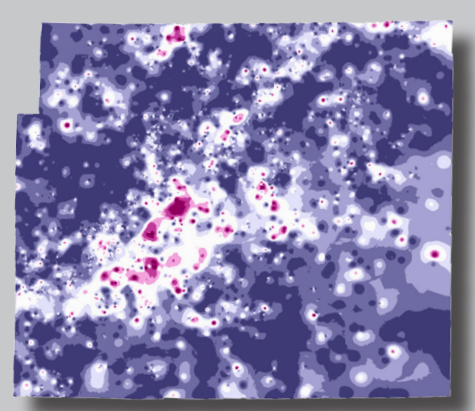
The surficial geology map of Allen County depicts local glacial terrains. These terrains characterize regions of distinct landscapes whose morphologies reflect a series of glacial and postglacial events and processes, and which are underlain by a sequence of near-surface sediments that are distinctly related to those processes. These landscapes include lake plains, end moraines, till plains, and meltwater channels. The glacial terrains of Allen County represent processes that occurred during the most recent glacial period, the late Wisconsin.

Bedrock Geology



The bedrock units in Allen County are composed of Paleozoic limestone, dolomite, and shale, ranging in age from Silurian to Devonian. Nowhere is bedrock exposed at the land surface. In northwestern Allen County, the bedrock is covered by as much as 300 ft of glacial material. The glacial materials thin southward and the bedrock lies 60 to 80 ft below the surface in the southeastern part of the county. The bedrock surface is erosional in origin and the buried surface more or less represents the land surface that existed prior to the ice age (Fleming, 1994).

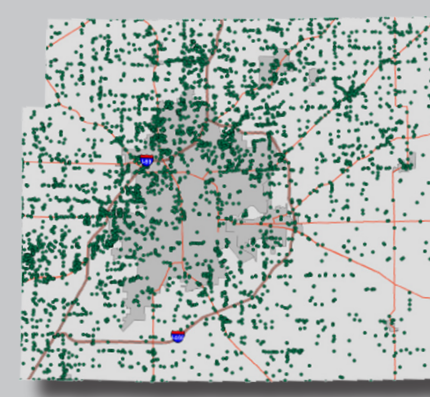
Clay Thickness



The clay thickness "surface" depicts the amount of clay in the upper 50 ft of unconsolidated sediment. It was created using an auto-mapping technique and the data from the iLITH database. A series of queries were made to extract the appropriate intervals of clay from each water well. The color ramp of the surface emphasizes the end members, which are mostly clay-rich sediments (in blue) versus mostly granular sediments (in red). The white areas equate to sediments that contain a more or less equal mixture of clay, silt, sand, and gravel.

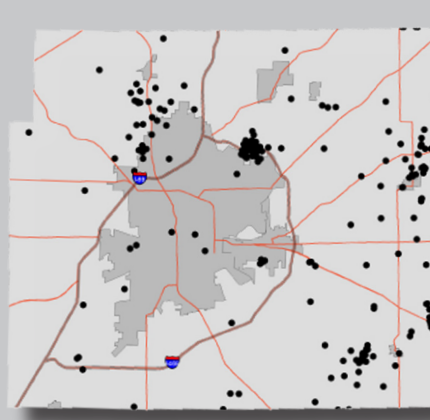
providing access to primary data

iLITH Database



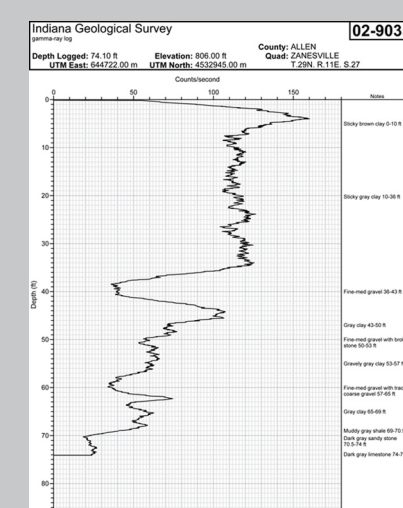
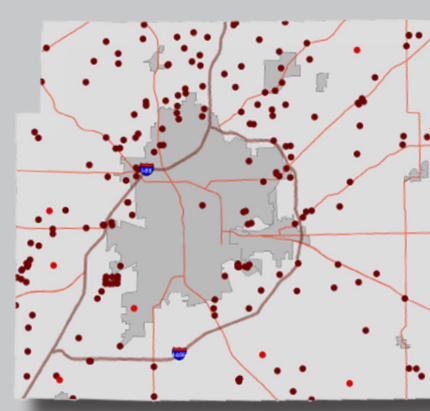
iLITH is a database containing water-well records from the Indiana Department of Natural Resources. These records were edited by the Indiana Geological Survey (IGS) for locational accuracy and the lithologic data were standardized in a series of tables (Brown and others, 2000). The graphical interface on the iLITH CD-ROM (available from the IGS) provides utilities for viewing and adding data, constructing queries, and interpreting lithologic descriptions. The Web site displays the water wells in Allen County that are contained in the iLITH database. It is possible to view these records in report form.

Petroleum Database



The Petroleum Database Management System is a Web application designed to distribute petroleum-related information from the IGS. The entire database contains information on more than 70,000 petroleum-related wells drilled in Indiana and surrounding states. The Map Viewer is an interface that displays interactive maps of petroleum well data. The database contains more than 200 records in Allen County, and these records can be viewed from this Web site.

Gamma-Ray Log Database



The gamma-ray log data set of Allen County, contains 208 records collected from water wells within the county. These records are geophysical logs, which provide reliable lithologic information (Bleuer, 2004). The locations of these data are shown in point form on the map. This Web site allows one to click on each point and bring up the plotted digital data in PDF or LAS format. These PDF and LAS files can be printed or downloaded from the site.

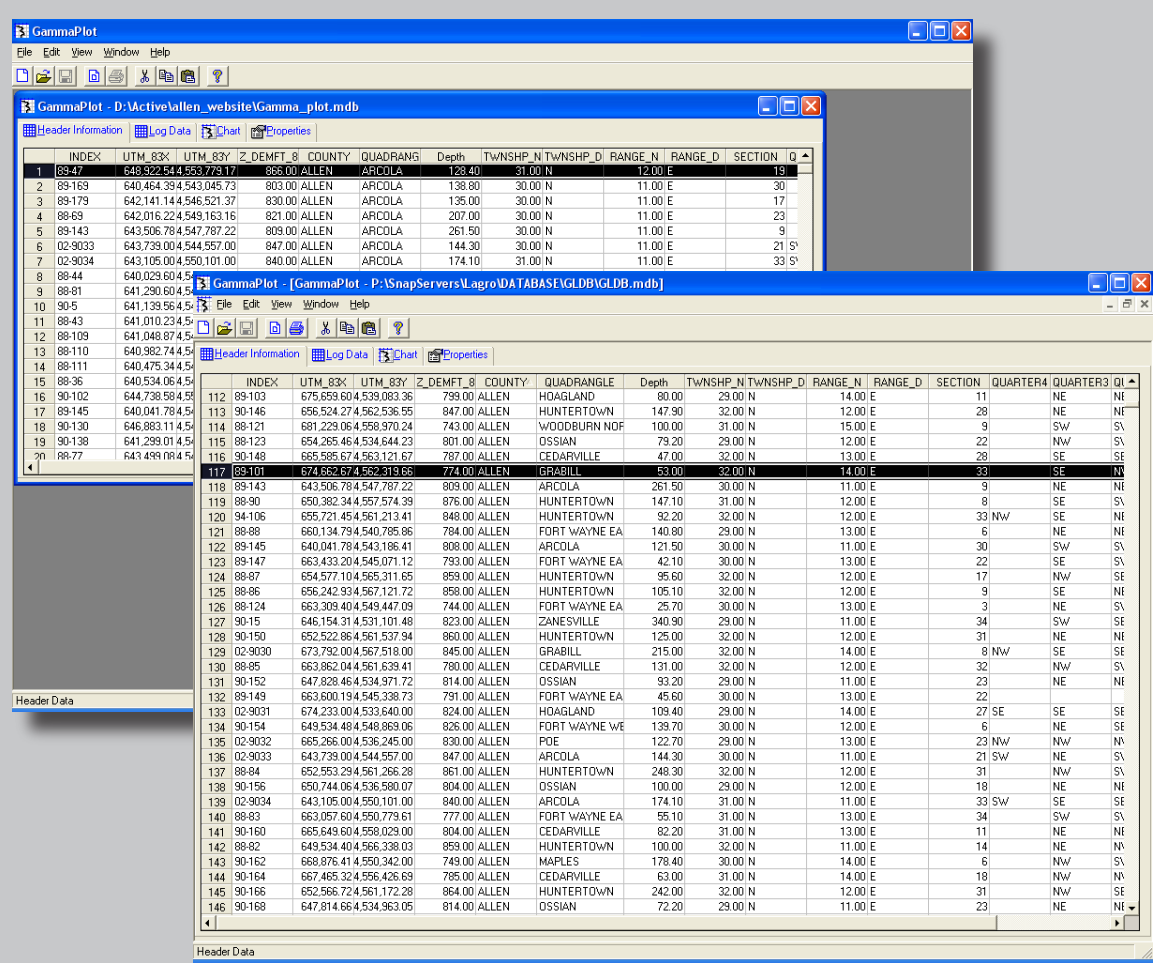


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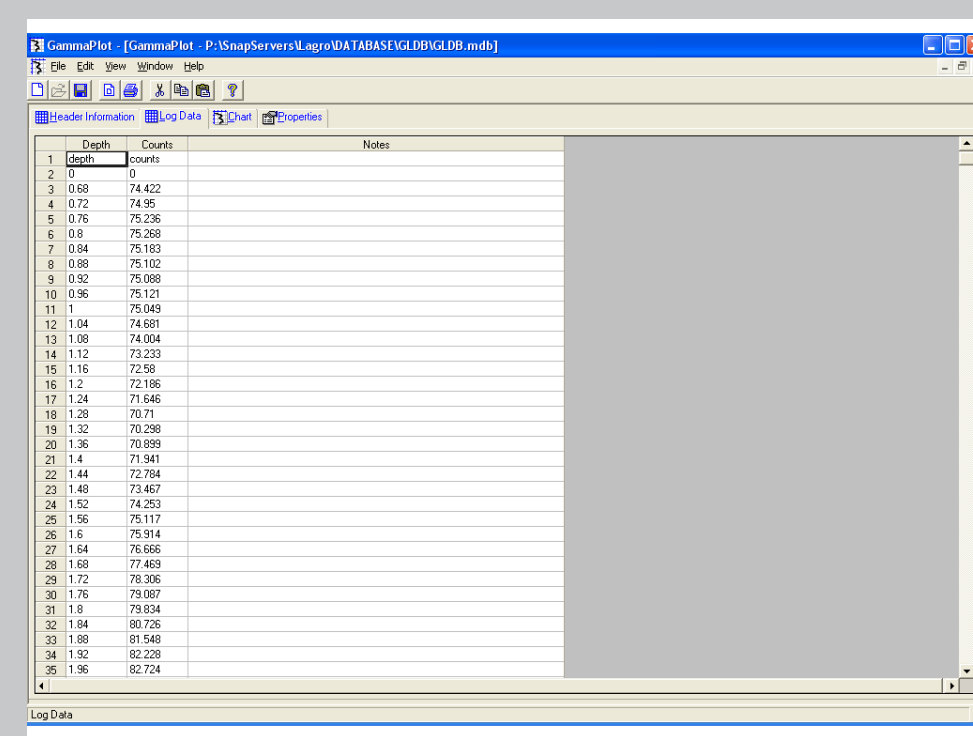
the CENTRAL GREAT LAKES
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Making PDFs from Digital Gamma-Ray Logs

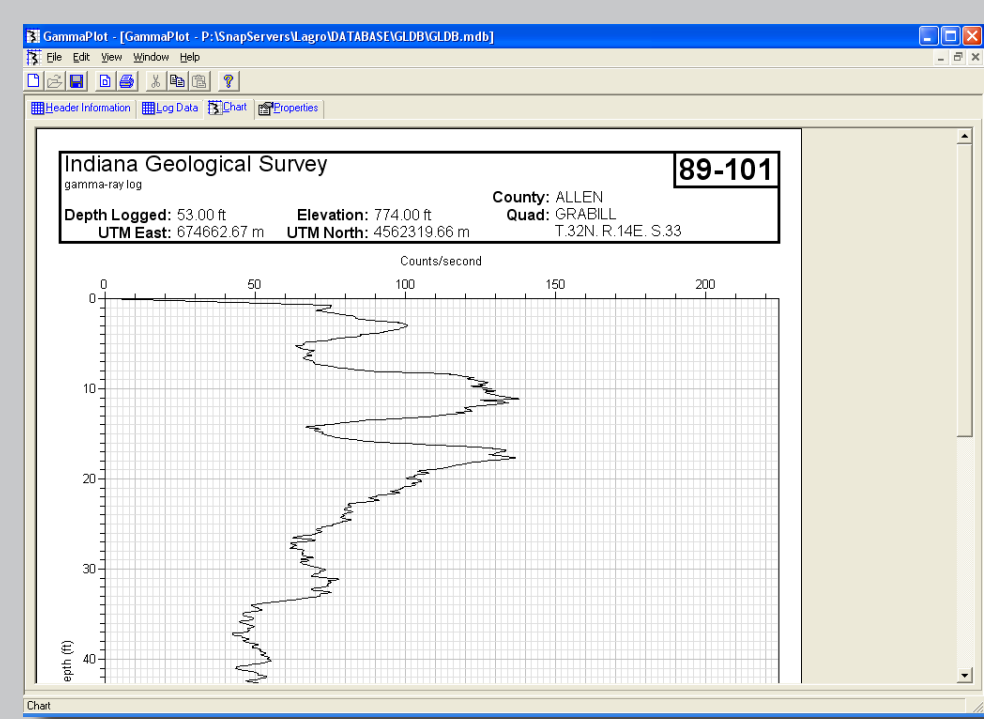


| Depth (m) | Counts | Other Parameters |
|-----------|--------|------------------|
| 1.00 | 100 | ... |
| 1.10 | 110 | ... |
| 1.20 | 120 | ... |
| 1.30 | 130 | ... |
| 1.40 | 140 | ... |
| 1.50 | 150 | ... |
| 1.60 | 160 | ... |
| 1.70 | 170 | ... |
| 1.80 | 180 | ... |
| 1.90 | 190 | ... |
| 2.00 | 200 | ... |

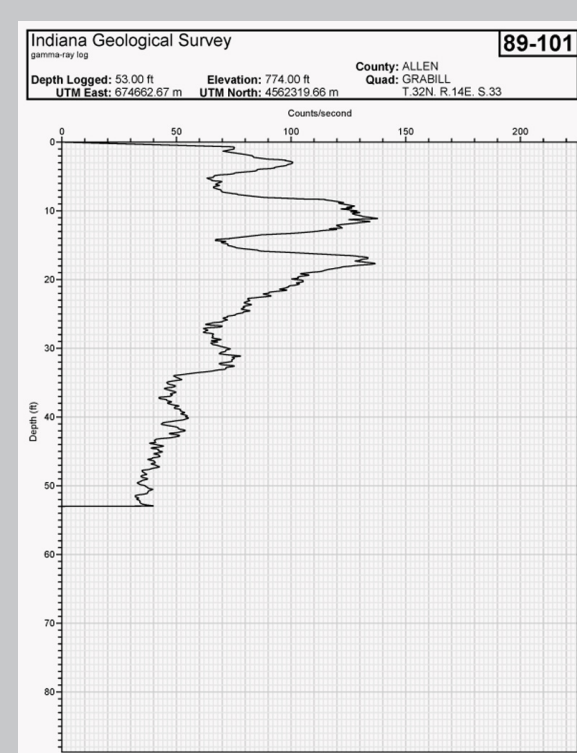
1 Gamma-ray log curves are plotted using an IGS-created program, Gammplot. This program uses tabbed spreadsheets to graph the numeric data and retrieve header information from the gamma-ray log database. This database is an internal IGS relational database that stores location and description information.



2 This is the numeric gamma-ray log data displayed using the log data tab. Two columns of data are used to plot the gamma-ray log curve: depth and counts. The tabbed display allows the user to switch back and forth between the location information and the numeric data.



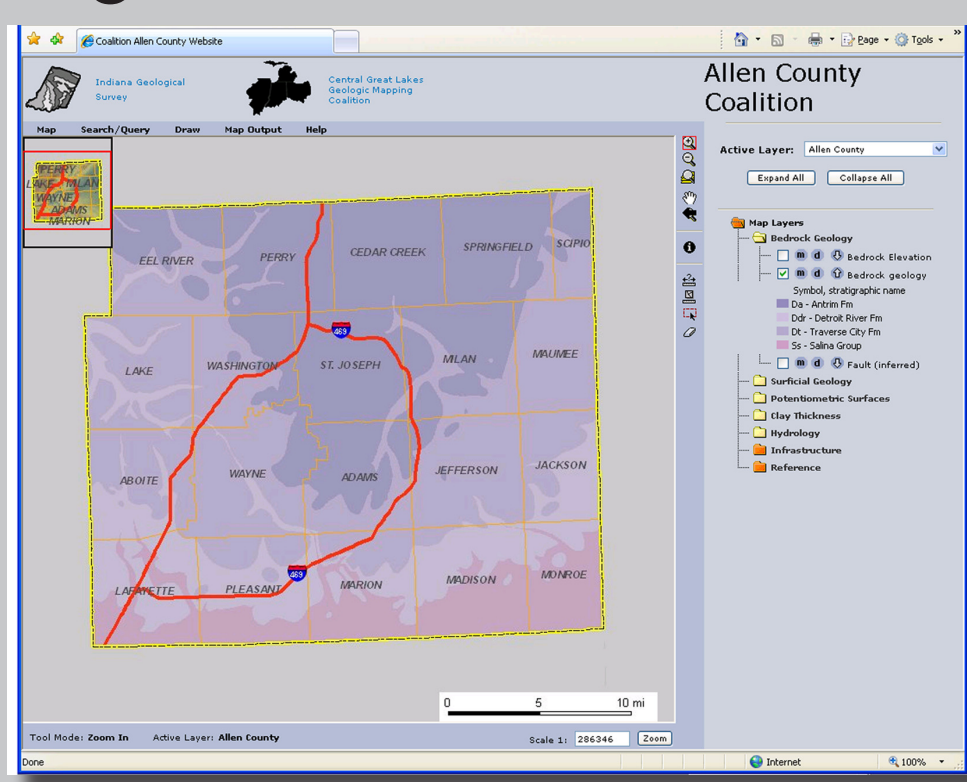
3 The PDFs provide a visual representation of the numeric gamma-ray data collected digitally in the field and stored as tab-delimited text files. Using the chart tab, a preview of the PDF can be seen before saving. The final PDF is saved by using a PDF printer driver that saves the file with the unique gamma-ray log number.



4 The final PDF can now be viewed and printed in Adobe Acrobat®. These PDFs of the gamma-ray log data can be downloaded from the Allen County Web site.

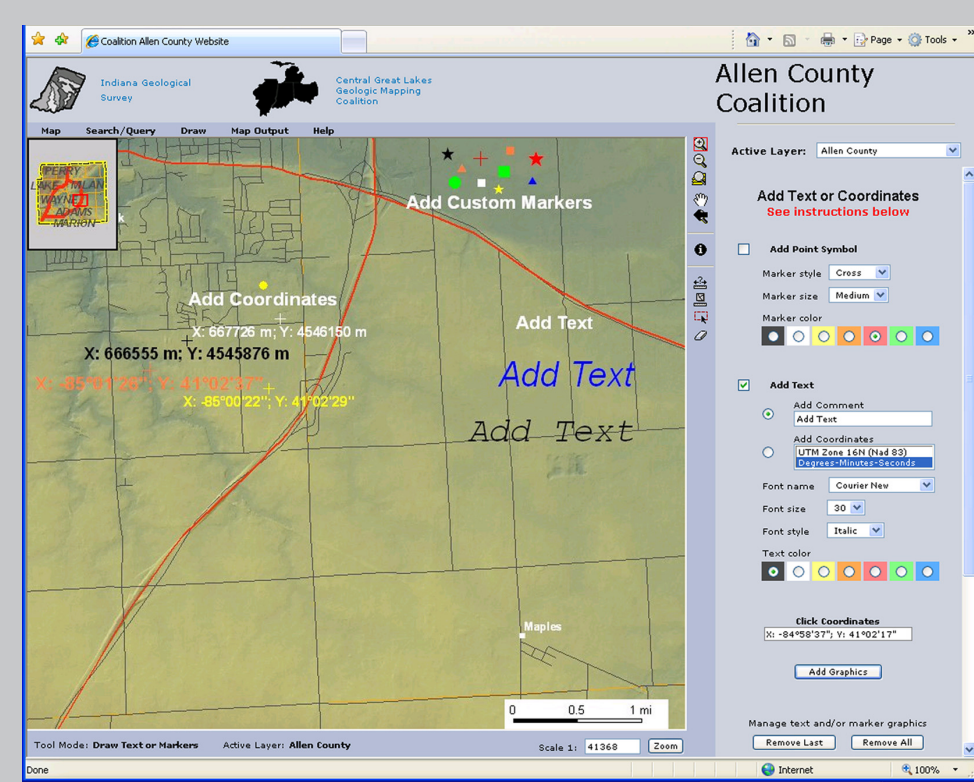
Customizing the Web Site

Legends



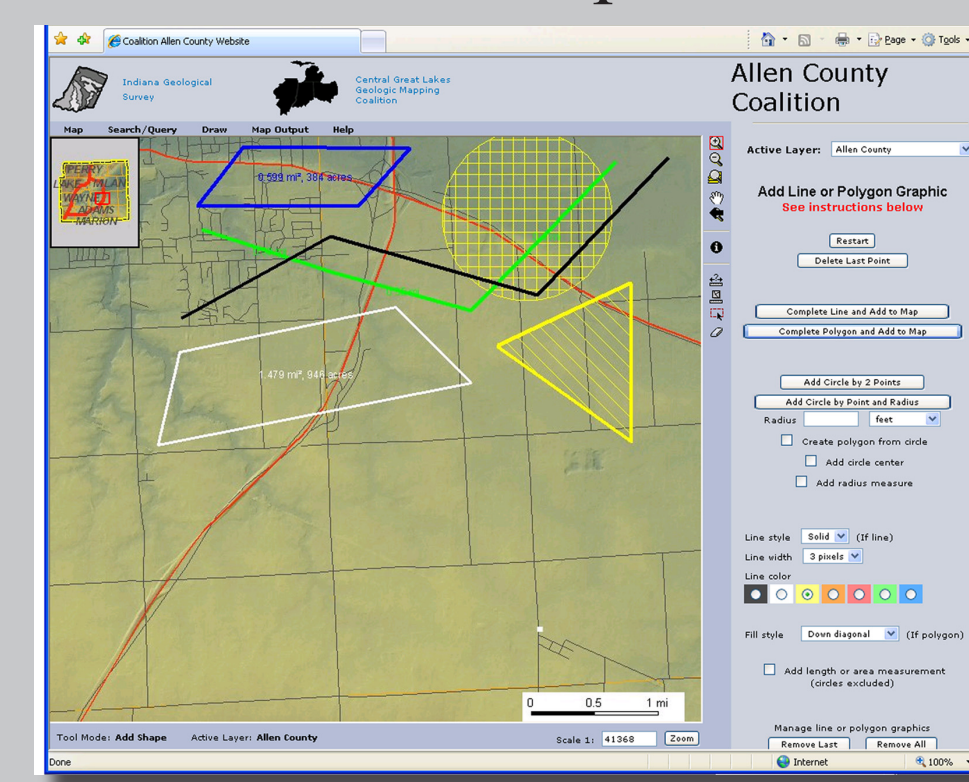
The legends in the interactive viewer are customized to allow viewing of individual layer symbology in the table of contents (TOC) rather than having to toggle between a specific layer and the TOC. The layer symbology is represented by GIF images linked to the associated layer in the TOC. This also allows the user to choose the legend elements to be included in the final map layout.

Draw Tools - Text



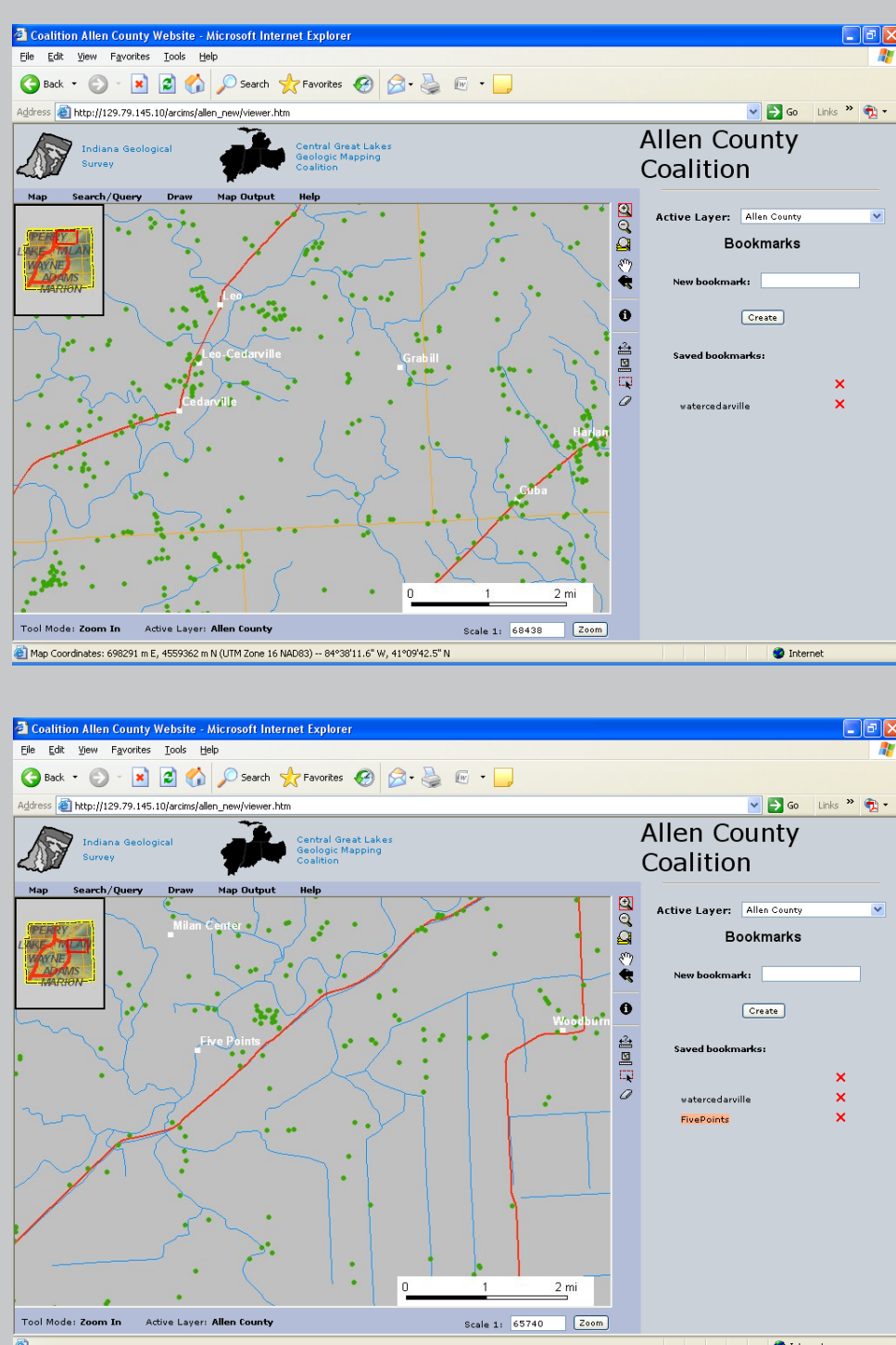
The Draw menu contains tools that enable users to add custom text and geometric shapes to the map view for labeling and analyzing specific cross sections or areas of interest. The text tool adds points to the map and associates text or coordinates to that point.

Draw Tools - Shapes



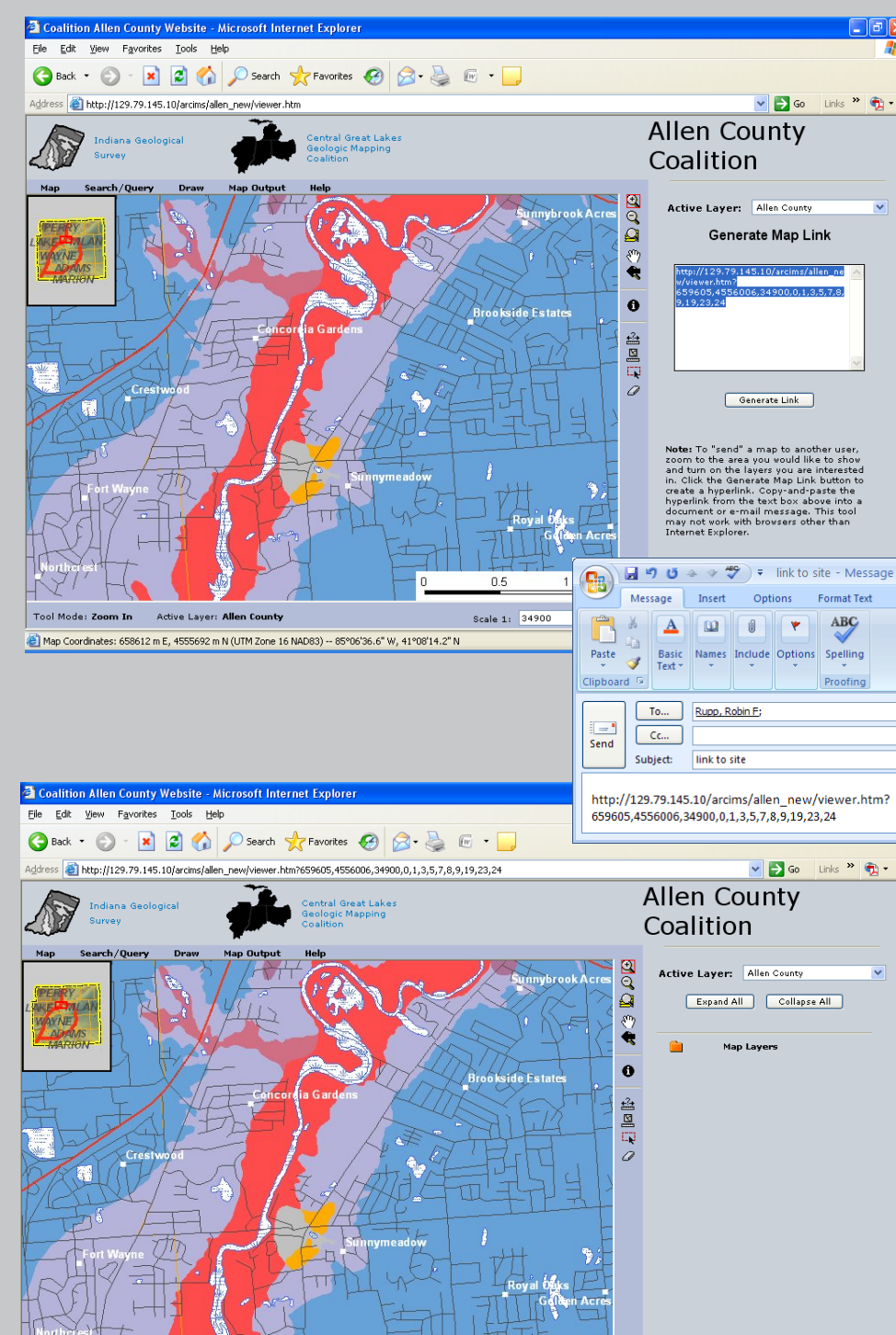
Using the Add Line or Polygon Graphic function under the Draw menu, lines, polygons, and circles can be drawn on-screen with predefined measurements or simply by pointing and clicking on the map.

Bookmarks

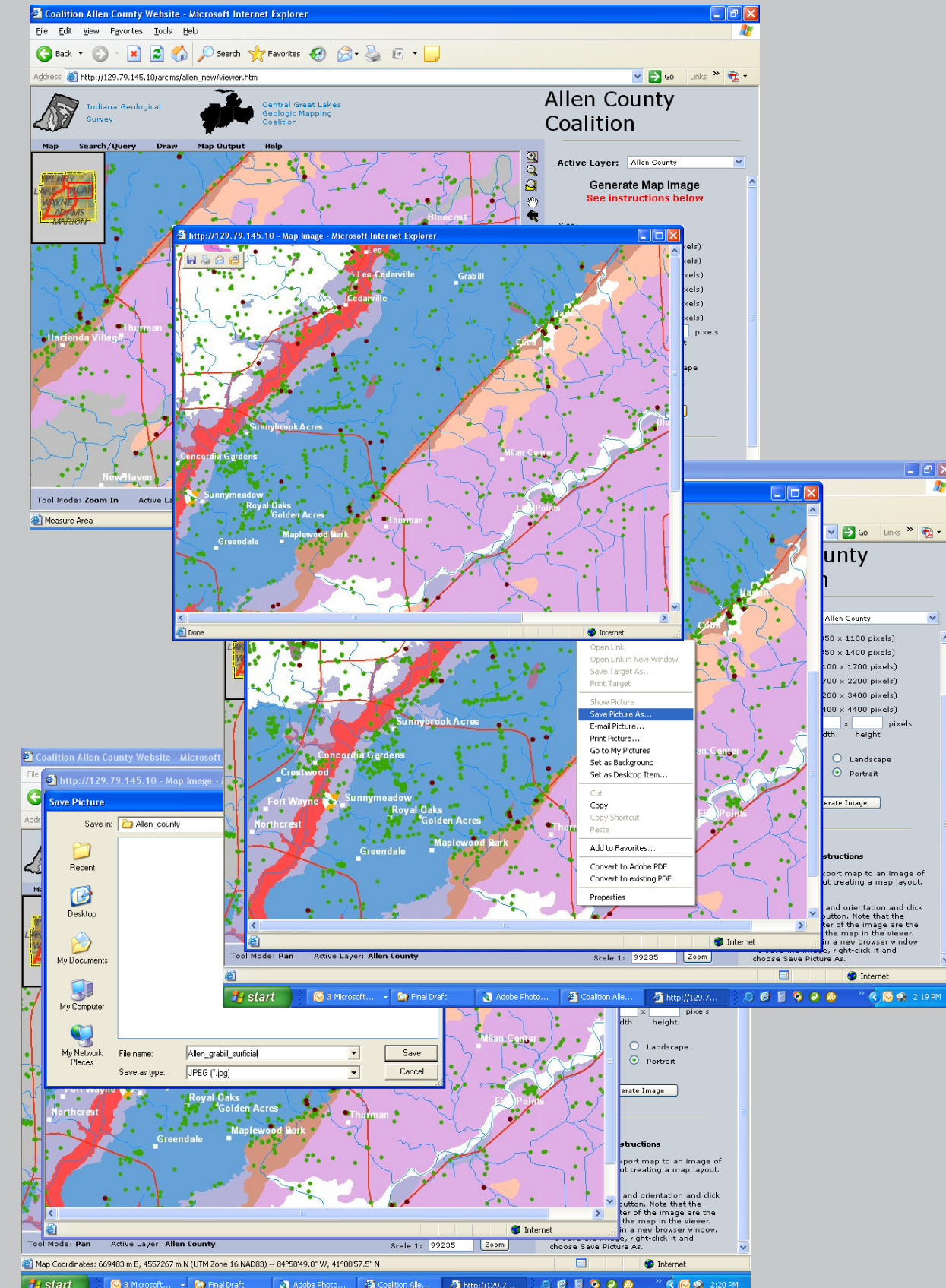


Bookmarks and hyperlinks allow map users to create, save, and restore their own custom maps, as well as share them with colleagues. Bookmarks are saved in a Web browser and stored as cookies on the local computer. Hyperlinks are created in the map view from the Map menu and can be copied and pasted into an e-mail or other document, enabling an efficient transfer of data and ideas. Both tools provide a means of "saving" a customized view of the IMS map. They allow users to return to a custom view extent, with the predetermined layers turned on for viewing.

Hyperlinks



Map Output



Users can save their custom map, including text and shapes, as a JPG file for use in other applications, such as a GIS.

Conclusions

The IGS created this Web site to provide maps, images, and databases of geologic information for Allen County, Indiana. Data included on the site are (1) digital elevation model terrain, high-resolution aerial photos, and Landsat imagery, (2) geologic and hydrogeologic maps, and (3) primary data from geophysical log, water-well, and petroleum-well records.

Using enterprise GIS and database technologies, including an Internet map server, Microsoft SQL Server, and ColdFusion, the IGS is able to present data in the form of versatile, dynamic interpreted maps along with raw "primary" geologic information to an expanded group of users. The IMS site provides a front-end to the IGS enterprise geodatabase, which contains information used simultaneously for research and general viewing. The ArcSDE geodatabase allows for the efficient creation, management, and distribution of the data and maps. Through links to ColdFusion, the site also allows direct access to other IGS enterprise database systems, containing petroleum well records, gamma-ray logs, and water well information. The combination of these spatial (geodatabase) and traditional database technologies allows users to access more information than ever before. By making primary geologic data such as well records and gamma-ray logs widely available on the Internet, the IGS is changing the paradigm for how we distribute geologic information to the public.

Acknowledgments

The development of the Allen County Web site was funded by the Indiana Geological Survey and the Central Great Lakes Geologic Mapping Coalition.

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