WEB-BASED GLACIAL AND BEDROCK GEOLOGIC MAP PRODUCTS AND DATABASES FOR ALLEN COUNTY, INDIANA

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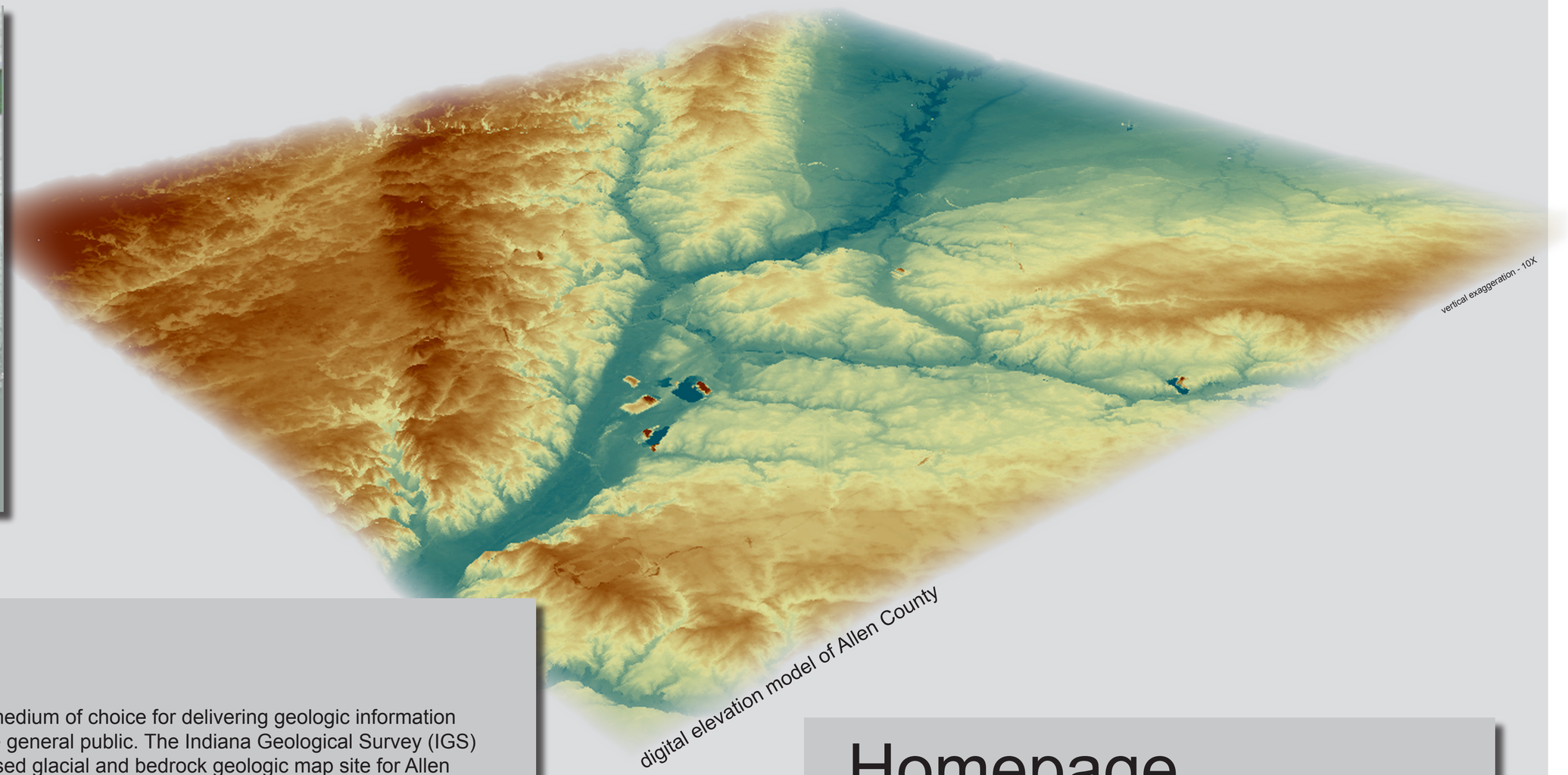


digital elevation model of Allen County

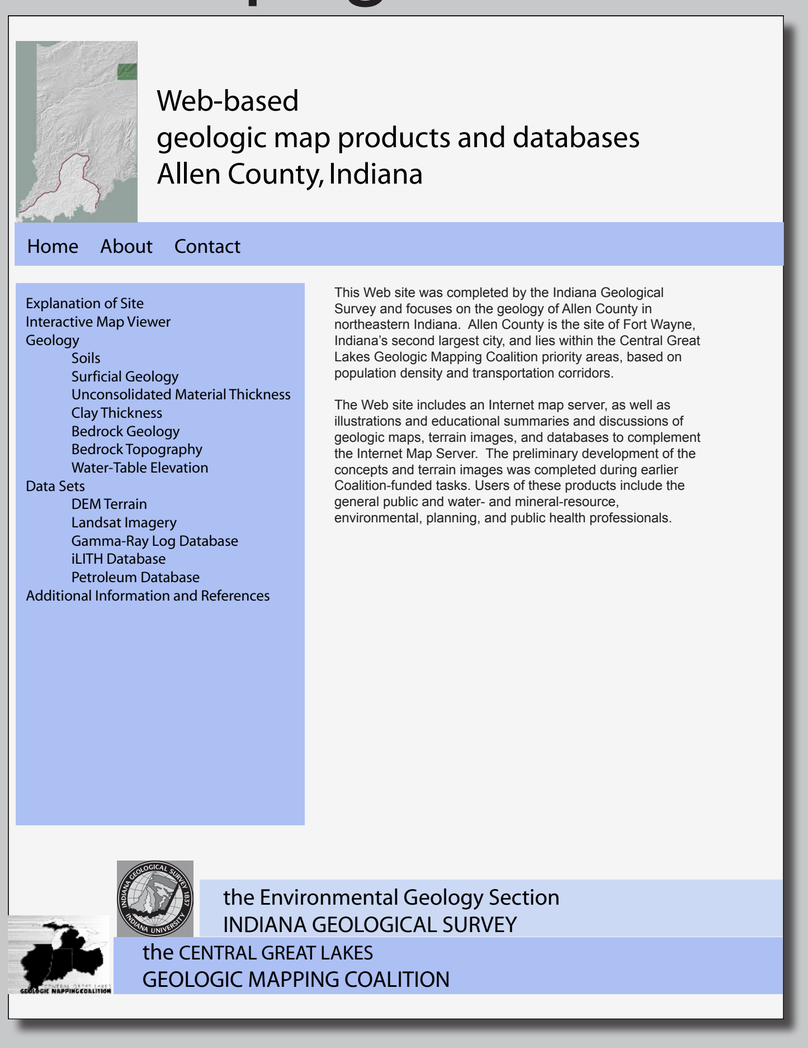
Abstract

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.

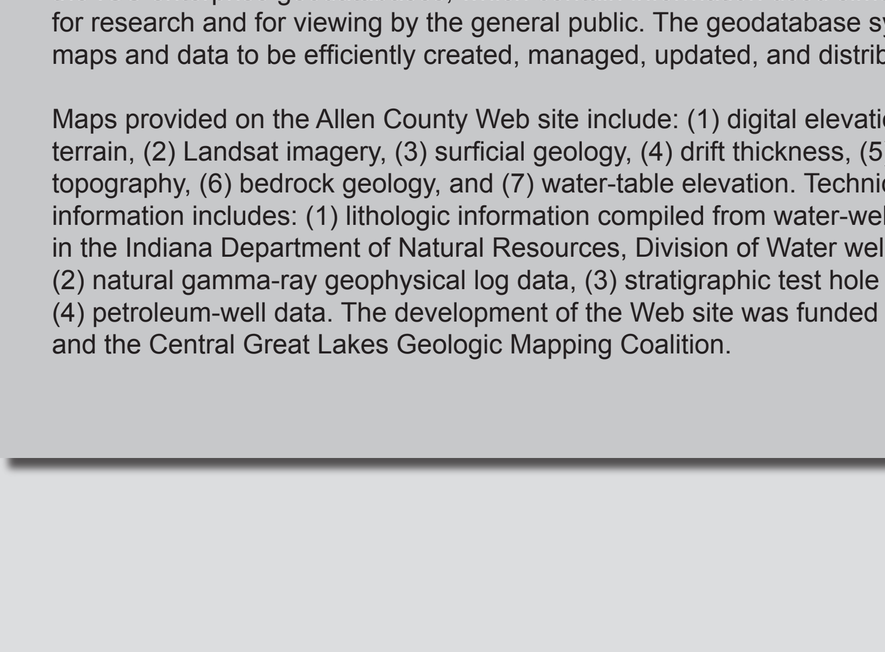
The Allen County Web site includes an Internet map server (IMS), as well as illustrations, educational summaries, and discussions of geologic maps, terrain images, and databases that complement the IMS. The site provides a front-end to the IGS enterprise geodatabases, which contain information used simultaneously 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.

Homepage



INTERACTIVE MAP VIEWER



Digital elevation model of Allen County

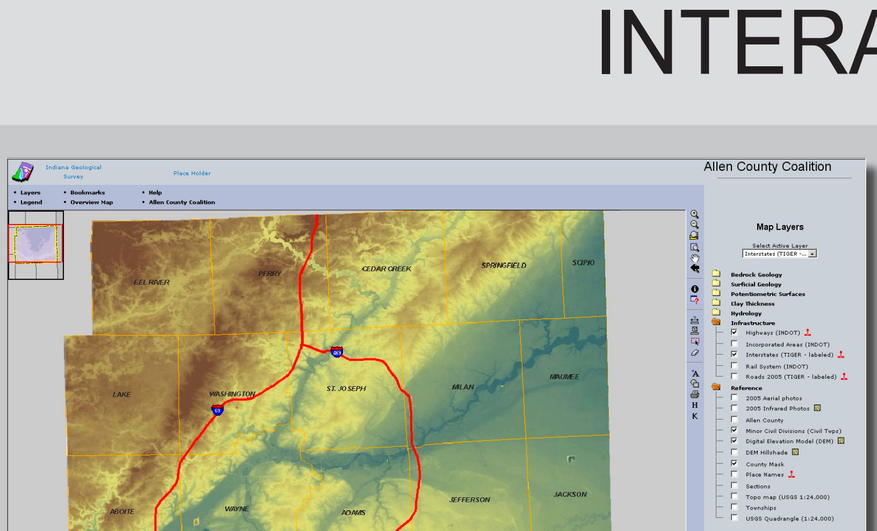
The digital elevation model (DEM) is the homepage for the interactive map. Layers contained in the site can be turned on and off using the Map Layers palette to the right of the view. Legends for each layer can be viewed by clicking the Legend dialog box in the top left corner of the map view.

Digital elevation models of the United States have been available through the U.S. Geological Survey since the early 1990s. Since then, resolution has continued to improve; the Allen County DEM on this Web site has a resolution of 1.5 feet to the pixel. The hillshade made from this raster allows for shadowing, making variations in the elevation changes appear more realistic.

Aerial photos of the Three Rivers area in Fort Wayne

The aerial photos of Allen County on this Web site have a resolution of 1 foot (each pixel represents 1 foot on the ground). These very detailed images can be used for mapping landforms or for observing changes to the landscape over time.

The photos were made available by the National Aerial Photography Program, which was coordinated by the U.S. Geological Survey (USGS). The original purpose of this program was to provide the USGS with accurate and cloud-free photographs to assist in the creation and revision of topographic maps. These photos are usually taken during the winter months to minimize the leaf cover.

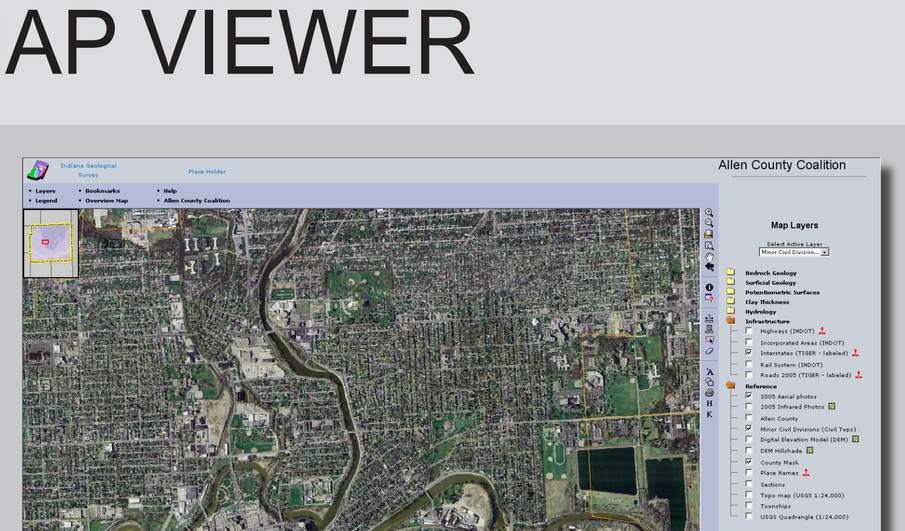


Topographic map of the Three Rivers area in Fort Wayne

This map layer of a digital raster graphic (DRG) is a scanned image of the U.S. Geological Survey's 1:24,000-scale topographic maps. The scale of these digital maps match the original paper maps.

These best-known USGS maps are also known as 7.5-minute quadrangles. More than 55,000 7.5-minute maps were made to cover the 48 conterminous states and were completed in 1992.

This image from the Web site is zoomed into the center of Allen County where the confluence of three rivers coincides with the heart of Fort Wayne. These rivers are the Maumee River, the St. Joseph River, and the St. Marys River.



Infrared image of the Three Rivers area in Fort Wayne

These infrared images of the same area in Allen County are from Landsat satellites that have been collecting images of the Earth's surface since 1972. These images can be useful in mapping sediments of various textures, which may have different moisture contents and thereby display as different colors.

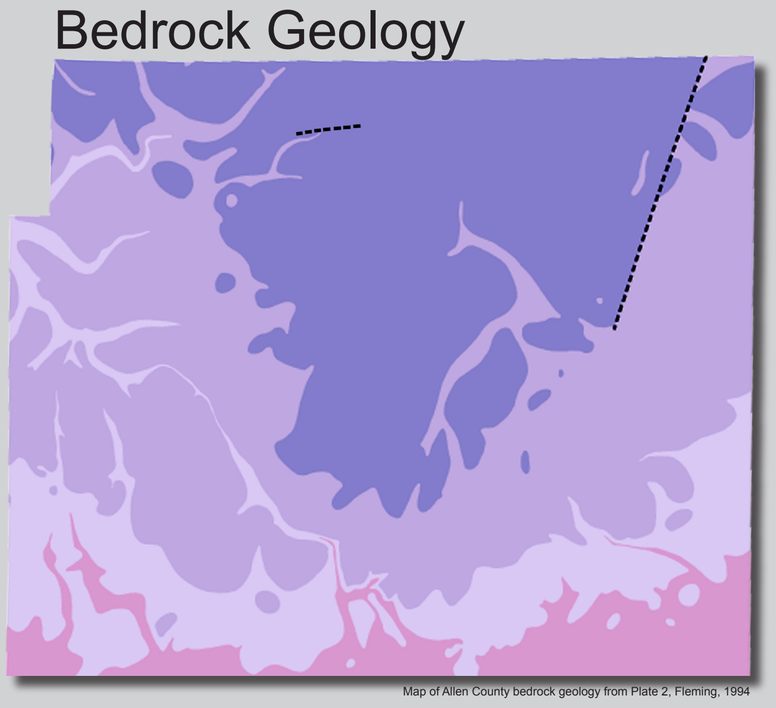
Landsat satellites detect the electromagnetic energy from the earth and record this information in seven different wavelengths in the form of an image. Different objects emit different types of electromagnetic radiation. Clear water reflects little radiation, so it looks black. Pavement and bare ground reflect a lot of radiation, so they look bright. Urban areas usually look light blue-gray. Vegetation absorbs visible light but reflects infrared, making it red in the image.

the Environmental Geology Section
INDIANA GEOLOGICAL SURVEY

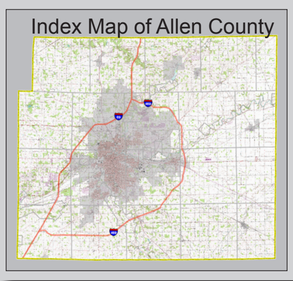
the CENTRAL GREAT LAKES
GEOLOGIC MAPPING COALITION

GEOLOGY
providing geologic interpretation

Bedrock Geology



Index Map of Allen County



Explanation

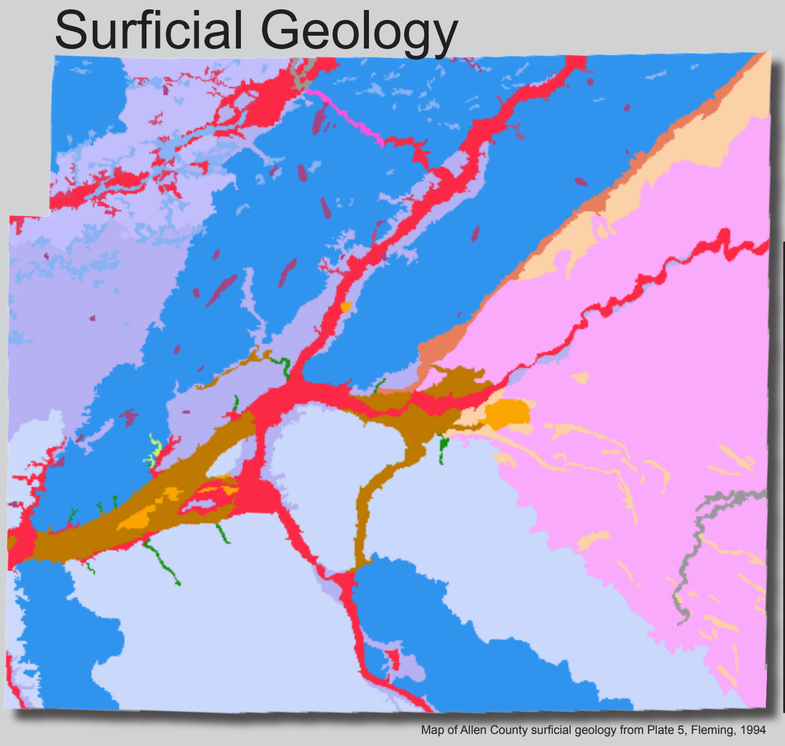
- Antrim Shale (Devonian)
- Traverse City Fm. (Devonian)
- Detroit River Fm. (Devonian)
- Salina Group (Silurian)
- Fault (inferred)

Map of Allen County bedrock geology from Plate 2, Fleming, 1994

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 feet of glacial material. The glacial materials thin southward and the bedrock lies 60 to 80 feet 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) made the following inferences about the bedrock surface. The topography of the surface underlain by the shale forms a broad north-to northeast-sloping lowland. The parts of the bedrock surface underlain by limestone and dolomite of the Traverse City Formation, Detroit River Formation, and Salina Group generally form a north-sloping dissected karst plain.

Surficial Geology



Explanation

- alluvial valley
- depressions and abandoned sluiceways
- sand dunes
- ancestral channel
- spits, bars, and small beach ridges
- beach ridges
- outwash valley, includes alluvium
- tunnel valley
- eskers and outwash bodies
- till plain
- end moraine
- water-washed till plain
- hummocks of ice-contact drift
- lacustrine plain
- irregular ice-contact drift
- buried till plain
- meltwater channel

Map of Allen County surficial geology from Plate 5, Fleming, 1994

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. These terrains include silt- and clay-rich lake plains, silty-clay to clay loam till plains and end moraines, and stratified sand and gravel meltwater channels.

Clay Thickness (0-50 ft)

Explanation

- 0-5 ft
- 5.1-10 ft
- 10.1-15 ft
- 15.1-20 ft
- 20.1-25 ft
- 25.1-30 ft
- 30.1-35 ft
- 35.1-40 ft
- 40.1-45 ft
- 45.1-50 ft

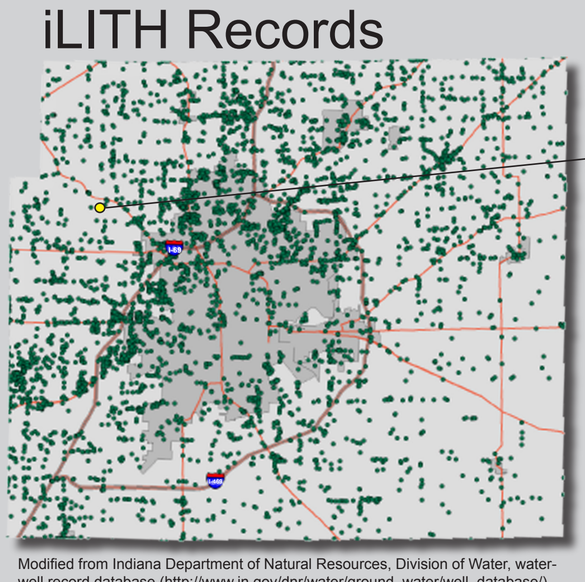
Map of Allen County thickness of clay within the upper 50 feet

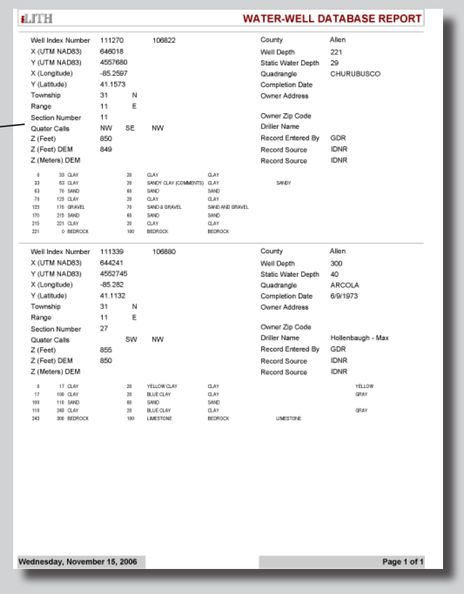
The clay thickness “surface” depicts the amount of clay in the upper 50 feet of unconsolidated sediment. It was created using an auto-mapping technique and data from the iLITH database. A series of queries were made to extract the appropriate intervals of clay from each water well. The surface was constructed in ArcView 3.3, with the Spatial Analyst Extension using inverse distance weighted statistics.

The map depicts the average clay thickness originating from a series of data points with know values. 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.

IGS DATA SETS
providing access to primary data

iLITH Records





WATER-WELL DATABASE REPORT

Well Index Number	111270		106822	County	Allen
X (UTM NAD83)	646018			Well Depth	221
Y (UTM NAD83)	4557680			Static Water Depth	29
X (Longitude)	-85.2597			Quadrangle	CHURUBUSCO
Y (Latitude)	41.1573			Completion Date	
Township	31	N		Owner Address	
Range	11	E			
Section Number	11			Owner Zip Code	
Quater Calls	NW	SE	NW	Driller Name	
Z (Feet)	850			Record Entered By	GDR
Z (Feet) DEM	849			Record Source	IDNR
Z (Meters) DEM				Record Source	IDNR

0	33	CLAY	20	CLAY	CLAY	
33	63	CLAY	20	SANDY CLAY (COMMENTS)	CLAY	SANDY
63	70	SAND	60	SAND	SAND	
70	123	CLAY	20	CLAY	CLAY	
123	170	GRAVEL	70	SAND & GRAVEL	SAND AND GRAVEL	
170	215	SAND	60	SAND	SAND	
215	221	CLAY	20	CLAY	CLAY	
221	0	BEDROCK	160	BEDROCK	BEDROCK	

Well Index Number	111339		106880	County	Allen
X (UTM NAD83)	644241			Well Depth	300
Y (UTM NAD83)	4552745			Static Water Depth	40
X (Longitude)	-85.282			Quadrangle	ARCOLA
Y (Latitude)	41.1132			Completion Date	6/9/1973
Township	31	N		Owner Address	
Range	11	E			
Section Number	27			Owner Zip Code	
Quater Calls		SW	NW	Driller Name	Hollenbaugh - Max
Z (Feet)	855			Record Entered By	GDR
Z (Feet) DEM	850			Record Source	IDNR
Z (Meters) DEM				Record Source	IDNR

0	17	CLAY	20	YELLOW CLAY	CLAY	YELLOW
17	106	CLAY	20	BLUE CLAY	CLAY	GRAY
106	110	SAND	60	SAND	SAND	
110	240	CLAY	20	BLUE CLAY	CLAY	GRAY
240	306	BEDROCK	160	LIMESTONE	BEDROCK	LIMESTONE

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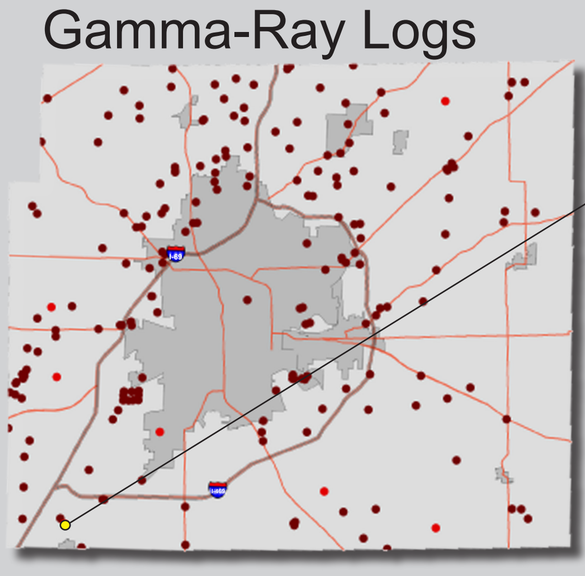
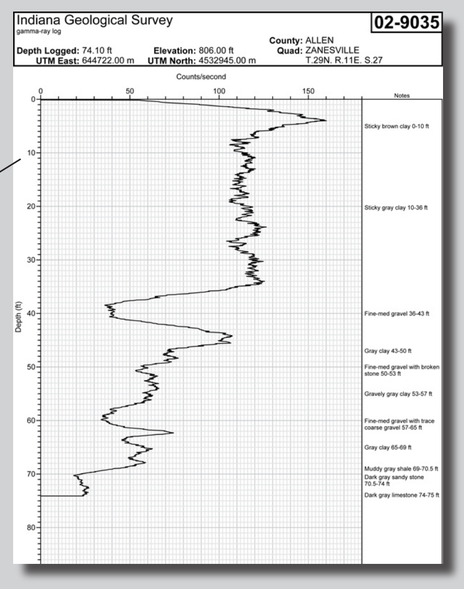
Modified from Indiana Department of Natural Resources, Division of Water, water-well record database (http://www.in.gov/dnr/water/ground_water/well_database/)

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. The locational data and the lithology data are made available for each record by clicking on any water-well point in the Web viewer.

Gamma-Ray Logs





Indiana Geological Survey — 02-9035
gamma-ray log
Depth Logged: 74.10 ft — Elevation: 806.00 ft — County: ALLEN
UTM East: 644722.00 m — UTM North: 4532945.00 m — Quad: ZANESVILLE
T.29N. R.11E. S.27

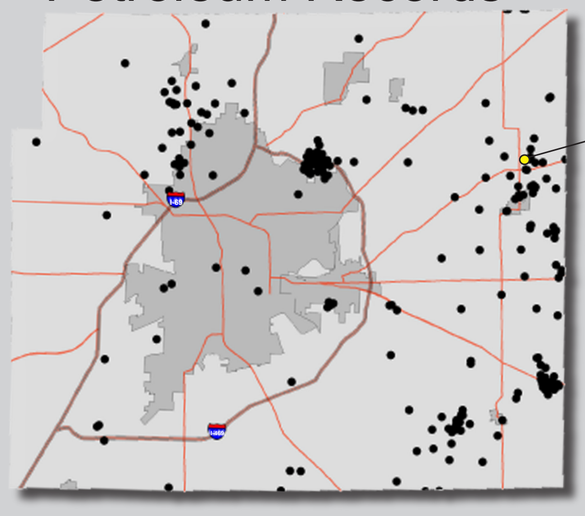
Counts/second: 0, 50, 100, 150 — Depth (ft): 0, 10, 20, 30, 40, 50, 60, 70, 80

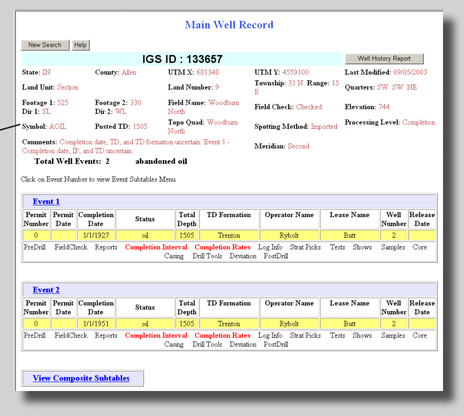
Notes:
- Sticky brown clay 0-10 ft
- Sticky gray clay 10-36 ft
- Fine-med gravel 36-43 ft
- Gray clay 43-50 ft
- Fine-med gravel with broken stone 50-53 ft
- Gravely gray clay 53-57 ft
- Fine-med gravel with trace coarse gravel 57-65 ft
- Gray clay 65-69 ft
- Muddy gray shale 69-70.5 ft
- Dark gray sandy stone 70.5-74 ft
- Dark gray limestone 74-75 ft

The gamma-ray log data set of Allen County, Indiana, contains 208 records collected from water wells within the county. These records are geo-physical 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 format. These PDFs can be printed or downloaded from the site.

Test holes drilled and logged for the Central Great Lakes Geologic Mapping Coalition project are highlighted in red. The drillers’ logs from these holes were added to the gamma-ray log records, allowing the user to view the lithologies next to the log signatures.

Petroleum Records





Main Well Record

New Search | Help | Well History Report

IGS ID : 133657

State: IN	County: Allen	UTM X: 681348	UTM Y: 4559100	Last Modified: 09/05/2003	
Land Unit: Section		Land Number: 9	Township: 31 N Range: 15 E	Quarters: SW SW NE	
Footage 1: 525 Dir 1: SL	Footage 2: 330 Dir 2: WL	Field Name: Woodburn North		Field Check: Checked	Elevation: 744
Symbol: AOIL	Posted TD: 1505	Topo Quad: Woodburn North		Spotting Method: Imported	Processing Level: Completion
Comments: Completion date, TD, and TD formation uncertain. Event 1 - Completion date, IP, and TD uncertain.				Meridian: Second	

Total Well Events: 2 — abandoned oil

Click on Event Number to view Event Subtables Menu

Event 1

Permit Number	Permit Date	Completion Date	Status	Total Depth	TD Formation	Operator Name	Lease Name	Well Number	Release Date
0		1/1/1927	oil	1505	Trenton	Rybolt	Butt	2	

PreDrill | Field/Check | Reports | Completion Interval | Completion Rates | Log Info | Strat Picks | Tests | Shows | Samples | Core | Casing | Drill Tools | Deviation | PostDrill

Event 2

Permit Number	Permit Date	Completion Date	Status	Total Depth	TD Formation	Operator Name	Lease Name	Well Number	Release Date
0		1/1/1951	oil	1505	Trenton	Rybolt	Butt	2	

PreDrill | Field/Check | Reports | Completion Interval | Completion Rates | Log Info | Strat Picks | Tests | Shows | Samples | Core | Casing | Drill Tools | Deviation | PostDrill

View Composite Subtables

The Petroleum Database Management System is a Web application designed to distribute petroleum-related information from the Indiana Geological Survey. The database contains information on more than 70,000 petroleum-related wells drilled in Indiana. 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 can be viewed from this Web site. Many of these records date back to the 1880s when the Trenton Field was one of the largest oil and gas fields. This field extended through a large portion of north-central Indiana and was largely depleted many years ago.

Summary

This Allen County Web site provides basic information on the geology of the area in an easy-to-view format and provides access to various maps and photos. The water-well, petroleum, and gamma-ray log data provide uninterpreted information of the subsurface in Allen County. More information may be found within the references cited.

Reference layers and metadata for the entire state can be downloaded from the *GIS Atlas of Indiana*, <http://129.79.145.7/arcims/statewide_mxd/index.html.> The *GIS Atlas* together with the other IGS sites had 1,423,041 visitors during 2006. The number of visits to the site continues to increase.

Acknowledgments

Funding was provided by the Central Great Lakes Geologic Mapping Coalition (<http://igs.indiana.edu/GreatLakesGeology/coalitionindex.html>).

References

Bleuer, N.K., 2004, Slow-logging subtle sequences–the gamma-ray log character of glacigenic and other unconsolidated sedimentary sequences: Indiana Geological Survey Special Report 65, 39 p.

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Indiana Geological Survey, 2007, Petroleum Database Management System: Indiana Geological Survey Web page, <http://igs.indiana.edu/pdms/index.cfm>, date accessed, January 2007.

Indiana Department of Natural Resources, Division of Water, 2007, Water Well Record Database: Indiana Department of Natural Resources Web page, <http://www.in.gov/dnr/water/ground_water/well_database/>, date accessed, January 2007.