INDIANA UNIVERSITY
INDIANA GEOLOGICAL SURVEY

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EXPLANATION

This map presents basic bedrock geologic information that contributes to the characterization of potential aggregate resources, characterization of bedrock aquifer systems, and analysis of the overlying predominantly glacial deposits. This map is based on data obtained from several thousand records including petroleum well drillers' logs, geophysical logs, water well drillers' logs, descriptions of cores recovered by the Indiana Geological Survey, seismic refraction records collected by the Indiana Geological Survey, natural exposures in and near the map area, and exposures in active and abandoned quarries. The map was created by modeling the bounding surfaces of mapped units using a computer gridding and contouring software. Each of the computer-modeled boundary surfaces is a 60-meter grid aligned with the U.S. Geological Survey (USGS) 1:24,000-scale, 30-meter digital elevation model grid to facilitate the development of derivative map products, such as overburden maps. The techniques used to model stratigraphic boundaries are adaptations of techniques described by Hasenmueller (1995, 1998). Subcrop lines shown on the map are computed intersections between stratigraphic unit boundaries and the bedrock surface mapped by Hasenmueller and James (2003).

The map shows the distribution of gently dipping Paleozoic sedimentary rocks subcropping and outcropping on the northeastern flank of the Illinois Basin. The simplicity of the regional structure suggests that the map can be used to make precise predictions of rock unit distribution. The remoteness of the mapped units -- subcrops are more than 300 feet below the topographic surface in some places -- presence of minor structural features that disrupt the regional trend, unconformities within the Paleozoic rock sequence that complicate boundary surfaces, and imprecisions inherent to some of the data used to construct the map make it inadvisable to regard this map product as the final authority on geologic conditions at specific sites within the map area. The map is a summary and interpretation of geologic information available in the public domain and is intended to serve as a guide to planning cost-effective site-specific evaluations of geologic conditions.

Two stratigraphic revisions have been incorporated into the map. The base of the Pleasant Mills Formation and Salina Group has been moved from the base of the Limberlost Dolomite to the base of the Waldron Shale Member of the Pleasant Mills Formation and the use of the terms Pleasant Mills Formation and Salina Group have been extended throughout the map area. These revisions simplify Silurian nomenclature in the map area and greatly increases control on the top of the Salamonie Dolomite because Waldron shale is a distinct lithology that is more frequently and reliably recorded in the records used in the construction of this map. Placing the Pleasant Mills-Salamonie boundary at the base of the Waldron is likely to facilitate subsequent hydrologic and resource assessment studies because Waldron shale most likely is an aquitard throughout the map area and is a convenient stratigraphic position for quarry benching.

The trace of the Fortville Fault, shown near the eastern edge of the map, has been slightly modified from previously published maps of the area (Gray, Ault, and Keller, 1987; Hasenmueller and James, 2002).

This map is the result of a cooperative mapping agreement between the USGS and the Indiana Geological Survey. The mapping was supported with USGS National Mapping Program STATEMAP funds and matching funds from the Indiana Geological Survey.

Explanation of Map Symbols

Pm Mansfield Formation -- Sandstone and shale with minor amounts of coal, underclay, and ironstone. The Mansfield Formation is the lowest formation in the Raccoon Creek Group, which consists of, in decending order, the Staunton, Brazil, and Mansfield Formations. The base of the Mansfield is a regional diachronous unconformity that includes networks of southwestward-trending paleo-valleys with relief in excess of 100 feet. The Mansfield rests on the West Baden and Blue River Groups in the southwestern part of the map area and rocks of the Sanders and Borden Groups in the northwestern part of the map area. The full thickness of the Mansfield is not present in map area.

Mwb West Baden Group -- Shale, sandstone, and limestone. The West Baden Group consists of five thin formations, in descending order these are the Elwren Formation, thin-bedded sandstones; Reelsville Limestone, thin-bedded gray micritic limestone; Sample Formation, shale; Beaver Bend Limestone, calcarenite; and Bethel Formation, shale and fine-grained sandstone. All West Baden formations are present in the map area but the full thickness of the group is not attained in the map area owing to erosion and the group's unconformable contact with the overlying Mansfield Formation.

Mbr Blue River Group -- Limestone, dolomite, and minor amounts of shale, calcareous sandstone, and chert.The Blue River Group consists of three formations, in descending order these are the Paoli Limestone, thin-bedded calcarenite and fine-grained limestone; Ste. Genevieve Limestone, calcarenite and calcareous sandstone; and St. Louis Limestone, fine-grained cherty limestones and dolomites. The Blue River thickens southwestward in the map area. Recorded thickness of the Blue River Group ranges from 156 to 234 feet and averages 199 feet in the map area.

Ms Sanders Group -- Limestone, cherty limestone, dolomite, and impure carbonate.The Sanders Group consists of three formations, in descending order these are the Salem Limestone, massive and cross-bedded coarse-grained calcarenite; Harrodsburg Limestone, gray cherty calcarenite and fine-grained limestone; and Ramp Creek Formation, predominantly fine-grained cherty limestone and dolomite interbedded with shale. The Sanders thickens southwestward in the map area. Recorded thickness of the Sanders ranges from 76 to 175 feet and averages 126 feet in the map area.

Mske Edwardsville and Spickert Knob Formations undifferentiated -- Thin-, medium-, and thick-bedded siltstone, shale and fine-grained sandstone with minor amounts of limestone.The Edwardsville and Spickert Knob Formations are the uppermost formations in the Borden Group, which consists of the Edwardsville Formation, Spickert Knob Formation, and New Providence Shale, in descending order. The Edwardsville is difficult to distinguish from the uppermost beds of the underlying Spickert Knob where the basal member of the Edwardsville, the Floyds Knob Limestone Member, is missing. Such is the case in much of the map area. For that reason the Edwardsville and Spickert Knob are mapped as an undifferentiated unit. Recorded thickness of the undifferentiated Edwardsville/Spickert Knob ranges from 521 to 643 feet and averages 585 feet in the map area. The base of the Spickert Knob is typically a sharp contact between porous sandstones or siltstones at the base of the Spickert Knob to the New Providence shale in the map area. The contact between the top of the Edwardsville and overlying Ramp Creek Limestone is gradational.

Mnp New Providence Shale -- Clay shale and silty shale. The New Providence Shale is the lowest formation in the Borden Group. The New Providence thins westward in the map area. Recorded thickness of the New Providence ranges from 23 to 227 feet and averages 142 feet in the map area. The contact between the New Providence and the overlying Spickert Knob Formation is typically an abrupt transition from shale to porous sandstone or siltstone in the map area. The contact between the New Providence and underlying Rockford Limestone or New Albany Shale typically is abrupt.

DMnar Rockford Limestone and New Albany Shale undifferentiated -- Organic-rich shale and minor amounts of impure limestone. The Rockford Limestone is a thin, persistent, impure limestone that rests conformably on the New Albany Shale. The Rockford and New Albany are not differentiated because the Rockford, which is rarely more than 10 feet thick, is too thin to map as a separate unit. The New Albany consists of brownish-black, carbon-rich shale, greenish-gray shale, and minor amounts of carbonate and quartz sandstone. The New Albany is divided into six irregularly developed members, in descending order these are the Ellsworth, Clegg Creek, Camp Run, Morgan Trail, Selmier, and Blocher Members. The undifferentiated Rockford/New Albany is thickest in the south-central part of the map area. Recorded thickness of the undifferentiated Rockford/New Albany range from 97 to 155 feet and averages 127 feet thick in the map area.

Dm Muscatatuck Group -- Limestone and dolomite. The Muscatatuck Group consists of two formations; these are, in descending order, the North Vernon Limestone and Jeffersonville Limestone. Muscatatuck formations were not mapped because they are thin and not well documented in the map area. Drillers' logs, especially older drillers' logs in the northeastern part of the map area refer to the Muscatatuck as the "Corniferous Limestone" and do not differentiate units within the Muscatatuck. The contact between the Muscatatuck and overlying New Albany Shale is an abrupt and possibly unconformable transition from limestone to black, organic-rich shale (Droste and Shaver, in Shaver and others, 1986, p. 99) that is well documented in drilling records in the map area. The contact between the Muscatatuck and underlying Silurian rocks is a diachronous regional unconformity. The Muscatatuck rests on the Wabash Formation throughout the map area. The Muscatatuck thickens southward in the map area. Recorded thickness of the Muscatatuck ranges from 86 to 155 feet and averages 115 feet thick in the map area.

Sw Wabash Formation -- Limestone, dolomite, and argillaceous or silty dolomite. The Wabash Formation is subdivided into two irregularly developed named members; these are, in descending order, Liston Creek Limestone and Mississinewa Shale Members. The upper contact of the Wabash Formation is a regional unconformity between Devonian and Silurian rocks. The Wabash thickens westward in the map area. Recorded thickness of the Wabash Formation ranges from 16 to 210 feet and averages 89 feet in the map area. The contact between the Wabash Formation and underlying Pleasant Mills Formation is conformable and gradational. The gradation from the Mississinewa Shale Member of the Wabash Formation to the Louisville Limestone Member of the Pleasant Mills Formation is generally an interval of several feet. Wabash boundaries are extrapolations where reef facies replace the above-mentioned members.

Spm Pleasant Mills Formation -- Dolomite, limestone, and argillaceous dolomite. The Pleasant Mills Formation was proposed by Droste and Shaver (1982, p. 11-17) to include, in descending order, the Louisville Limestone, Waldron Shale, and Limberlost Dolomite Members. It rarely is possible to differentiate the Limberlost Dolomite and underlying Salamonie Dolomite carbonates in the map area. The lithologic change that marks the base of the Waldron Shale Member of the Pleasant Mills Formation is distinct and commonly noted in drillers' logs and other geologic records from the map area; therefore, the Pleasant Mills Formation is herein restricted to the rocks from the top of the Louisville Limestone Member to the base of the Waldron Shale Member and the Limberlost Dolomite is assigned to the Salamonie Dolomite. Both the upper and lower contacts of the Pleasant Mills Formation, as herein defined, are conformable. The Pleasant Mills thickens northwestward in the map area. Recorded thickness of the Pleasant Mills ranges from 28 to 88 feet and averages 53 feet in the map area. Pleasant Mills boundaries are extrapolations where reef facies replace the above-mentioned members.

Correlation of Map Units

MAP UNIT	SERIES	SYSTEM
Pm	Morrowan	Pennsylvanian
unconformity		
Mwb	Chesterian	Mississippian
Mbr	Valmeyeran	
Ms		
Mske		
Mnp		
DMnar	Kinderhookian	
	Chautauquan	Devonian
	Senecan	
Dm	Erian	
unconformity		
Sw	Ulsterian	
	Cayugan	Silurian
Spm	Niagaran	

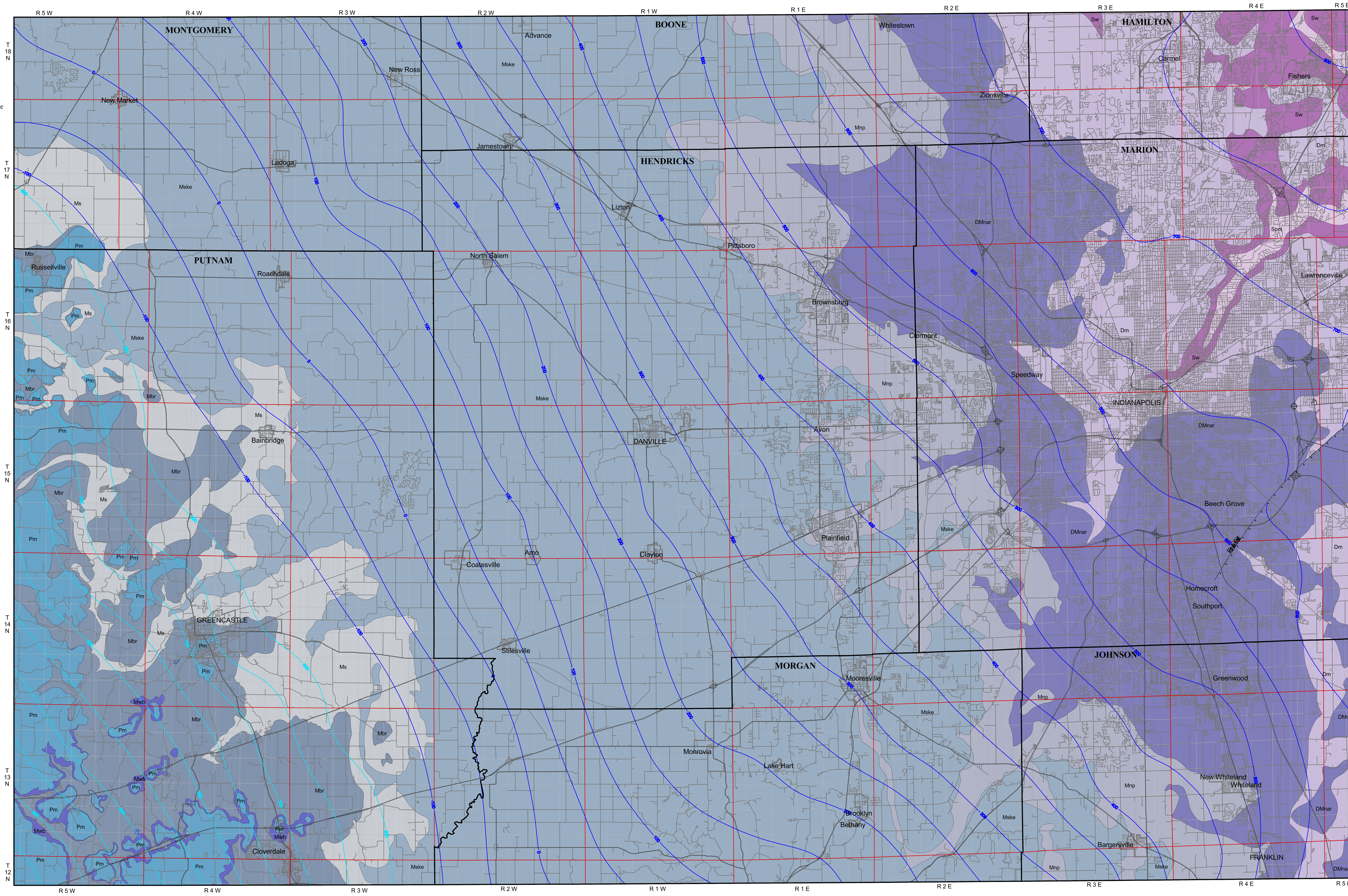
Explanation of Map Line Symbols

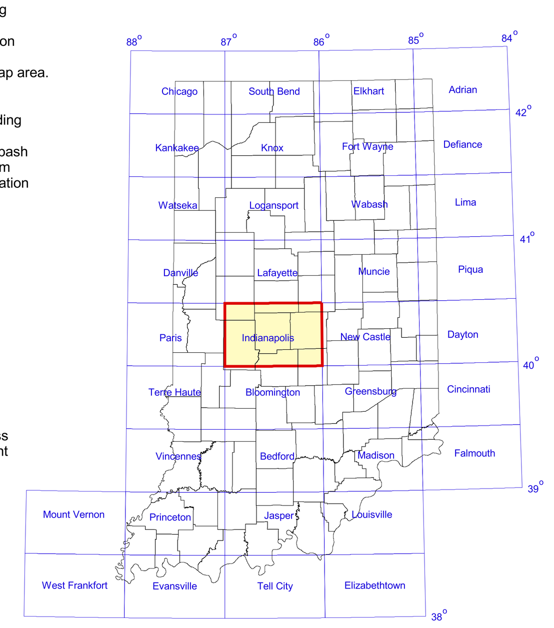
Contact -- Approximately located.

Fault -- Approximately located. Bar and ball on downthrown side. Polyline representing fault trace was treated as a breakline when computing structure.

—700— Structure contour -- Approximately located. Drawn on the top of the Sanders Group using computer gridding and contouring software. Contour interval is 50 feet (about 16 meters). The computations were carried out on 60-meter grids that extend more than one mile beyond the map area on all sides.

—100— Structure contour -- Approximately located. Drawn on the top of the Muscatatuck Group using computer gridding and contouring software. Contour interval is 50 feet (about 16 meters). The computations were carried out on 60-meter grids that extend more than one mile beyond the map area on all sides.





Index map of Indiana counties showing the location of the study area; red line indicates the extent of the Indianapolis 30 x 60 minute quadrangle.

Scale 1:100,000

5 0 5 10 Miles

5 0 5 10 15 Kilometers

REFERENCES CITED

Droste, J. B., and Shaver, R. H., 1982, The Salina Group (Middle and Upper Silurian) of Indiana: Indiana Geological Survey Special Report 24, 41 p.

Droste, J. B. and Shaver, R. H., 1986, Muscatatuck Group, in Shaver, R. H., Ault, C. H., Burger, A. M., Carr, D. D., Droste, J. B., Eggert, D. L., Gray, H. H., Harper, D. Hasenmueller, N. R., Hasenmueller, W. A., Horowitz, A. S., Hutchison, H. C., Keith, B. D., Keller, S. J., Patton, J. B., Rexroad, C. B., and Weir, C. E., Compendium of Paleozoic rock-unit stratigraphy in Indiana -- A revision: Indiana Geological Survey Bulletin 59, p. 99-100.

Gray, H. H., Ault, C. H., and Keller, S. J., 1987, Bedrock geologic map of Indiana: Indiana Geological Survey Miscellaneous Map 48.

Hasenmueller, W. A., 1995, Developing an estimate of crushed stone resources in the Blue River Group in Putnam County, Indiana: Indiana Academy of Science 111th Annual Meeting, Programs and Abstracts, November 2-3, 1995, Indiana University Purdue University, Indianapolis, Indiana, p. 69.

Hasenmueller, W. A., 1998, Building digital geologic maps with a contouring program, in Soller, D. R., ed., Digital Mapping Techniques '98 -- Workshop Proceedings: U.S. Geological Survey Open-File Report 98-487, p. 67-71.

Hasenmueller, W. A., and James, C. L., 2002, Map showing structure on top of the Trenton Limestone in the Indiana Heartland: Indiana Geological Survey Open-File Study 02-06.

Hasenmueller, W. A., and James, C. L., 2003, Map showing elevation of the bedrock surface in the Indianapolis 30 x 60 minute quadrangle, central Indiana: Indiana Geological Survey Open-File Study 03-03.

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Base map taken from
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Digital compilation and cartography
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Bedrock Geologic Map of the Indianapolis 30 x 60 Minute Quadrangle, Central Indiana

by
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2003