The Mahomet Aquifer of East-Central Illinois & Water Resources Planning in Illinois

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Illinois State Water Survey

May 31, 2006
The Mahomet Aquifer Region
Illinois Geology
(N-S cross-section)

North

South

<table>
<thead>
<tr>
<th>ERA</th>
<th>PERIOD</th>
<th>Millions of years ago</th>
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<tbody>
<tr>
<td>Cenozoic</td>
<td>Quaternary (Q)</td>
<td>1.6</td>
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<tr>
<td></td>
<td>Tertiary</td>
<td>66.4</td>
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<tr>
<td>Mesozoic</td>
<td>Cretaceous (K)</td>
<td>144</td>
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<tr>
<td></td>
<td>Jurassic</td>
<td>208</td>
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<tr>
<td></td>
<td>Triassic</td>
<td></td>
</tr>
<tr>
<td>Paleozoic</td>
<td>Permian</td>
<td>245</td>
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<tr>
<td></td>
<td>Pennsylvanian (P)</td>
<td>286</td>
</tr>
<tr>
<td></td>
<td>Mississippian (M)</td>
<td>320</td>
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<tr>
<td></td>
<td>Devonian (D)</td>
<td>360</td>
</tr>
<tr>
<td></td>
<td>Silurian (S)</td>
<td>408</td>
</tr>
<tr>
<td></td>
<td>Ordovician (O)</td>
<td>438</td>
</tr>
<tr>
<td></td>
<td>Cambrian (C)</td>
<td>505</td>
</tr>
<tr>
<td></td>
<td>Precambrian</td>
<td>570</td>
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</tbody>
</table>

Precambrian crystalline rock

sandstone (C)

limestone and dolomite (O)

limestone and dolomite (C, D)

sandstone (O)

shale (O)

limestone and dolomite (S, D)

sandstone (M)

siltstone (M)

interbedded shale, limestone, and sandstone (M)

coal (P)

interbedded shale, sandstone, limestone, and coal (P)

dirt, sand, and gravel (Q)
Illinois Geology
(N-S cross-section, zoomed in)
Regional Bedrock Topography

Green = higher elevations
Light violet = lower elevations
Quaternary Deposits of Illinois

Hudson and Wisconsin Episodes
Mason Group and Cahokia Fm
- Cahokia and Henry Fms; sorted sediment including waterlain river sediments and windblown silt and beach sand
- Equality Fm; fine grained sediment deposited in lakes
- Thickness of Peoria and Ruxana Sths; till deposited at least (5 ft) contour interval
- Wedron Group (Tiskilwa, Lemont, and Willard Fms) and Trafalgar Fm; diamictite deposited as till and ice-marginal sediment
- End moraine
- Ground moraine

Illinois Episode
- Wabash Fm; diamictite deposited as till and ice-marginal sediment
- Glacial Fm; diamictite deposited as till and ice-marginal sediment
- Toenichti Silt and Pearl Fm, including Hagarstown Mor; sorted sediment including river and lake deposits and wind-blown sand

Ye-Illinois Episodes
- Wolf Creek Fm; predominantly diamictite deposited as till and ice-marginal sediment

Paleozoic, Mesozoic, and Cenozoic
- Mostly Paleozoic shale, limestone, dolomite, or sandstone; exposed or covered by loess and/or residuum

Illinois State Geological Survey Bulletin 104, plate 1
Data from Willman and Frye (1970) and Limbach (1979)
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Ardith K. Hansel and W. Hilton Johnson
1996
IL Geology–glacial materials

Approximate boundary of Mahomet aquifer
Glacial depositional processes
Glacial meltwater – high energy
Geology of the Mahomet Aquifer
Land Surface, and top of Wisconsin Deposits (green)
Late Illinois Episode till
(dark purple)
Late Illinois Episode basal sand (orange)
Early Illinois Episode till (light purple)
Early Illinois Episode basal sand
(orange)
Late pre-Illinois Episode tills (brown)
Pre-Illinois Episode Mahomet Sand (yellow)
Topography of the Bedrock Surface
Pre-Illinois Episode Mahomet Sand (yellow)
Late pre-Illinois Episode tills (brown)
Early Illinois Episode basal sand
(orange)
Early Illinois Episode till
(light purple)
Late Illinois Episode basal sand (orange)
Late Illinois Episode till (dark purple)
Land Surface, and top of Wisconsin Deposits (green)
Geology of the Mahomet Aquifer
The Hydrologic Cycle
Porous Systems

Porosity = volume of pore space / total volume of porous material
Active Community Wells in Sand and Gravel Aquifers

Major Sand & Gravel Aquifers
Withdrawals from Sand and Gravel Aquifers

Total use ~ 350 mgd  
+ ~200 mgd for irrigation
Mahomet Aquifer Groundwater Levels

10-foot contour
Flow direction

DeWitt Wellfield
Cisco Wellfield
Potentiometric Surface of Eastern Portion of the Mahomet Aquifer, 2005
Mahomet Aquifer Water Levels near IL River

![Graph showing water levels over time with key events labeled: Great Flood of 1993, 1988-1989 Drought]
# Regional Community Groundwater Use

<table>
<thead>
<tr>
<th>Location</th>
<th>2004 Water Use (gpd)</th>
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<tbody>
<tr>
<td>Argenta</td>
<td>57,000</td>
</tr>
<tr>
<td>Forsyth</td>
<td>400,000</td>
</tr>
<tr>
<td>Illinois-American Water Co.</td>
<td>21,000,000</td>
</tr>
<tr>
<td>Mahomet</td>
<td>500,000</td>
</tr>
<tr>
<td>Monticello</td>
<td>700,000</td>
</tr>
<tr>
<td>Normal</td>
<td>4,100,000</td>
</tr>
<tr>
<td>Rantoul</td>
<td>1,600,000</td>
</tr>
<tr>
<td>Stone Ridge Dairy (near Bellflower)</td>
<td>~1,200,000</td>
</tr>
<tr>
<td>White Heath</td>
<td>50,000</td>
</tr>
</tbody>
</table>
Water Use - Long-term trend at Champaign
Mahomet Aquifer Water Levels near Champaign

Groundwater elevation, feet

Potential for Conflict

“Whiskey is for drinking; water is for fighting over.”

*attributed to Mark Twain*

- New major users
  - Peaker power plants
  - Dairy
  - Ethanol plants
  - Municipal water users
- Well interference
Water Use - *Selected communities in the Mahomet Aquifer region*

**Groundwater**
- 2000 GROUNDWATER TOTAL = 31 MGD
- 2000 SURFACE WATER TOTAL = 71 MGD

**Surface Water Sources**

**Surfage Water**

**Groundwater**

**Pumpage, million gallons per day**

**Surface Water Sources**
- Normal
- Pekin
- Champaign-Urbana
- Danville
- Bloomington
- Springfield
- Decatur

**Mahomet Aquifer Groundwater**

**Years:** 1980, 1990, 2000
Groundwater – Stream Interaction
Groundwater – Stream Interaction
Groundwater – Stream Interaction
Groundwater – Stream Interaction
Overlapping Cones of Depression – Well Interference
Overlapping Cones of Depression – Well Interference
Overlapping Cones of Depression – Well Interference
Overlapping Cones of Depression – Well Interference
Overlapping Cones of Depression – Well Interference
Cone of Depression

Well/Aquifer Interactions
Impacts of pumping on water levels (artesian head)

Mahomet aquifer pumping head (artesian) head

Pump settings

High-capacity well

Low-capacity well

Mahomet aquifer nonpumping (artesian) head

Glacial till

Dewatered aquifer

Mahomet aquifer

P Pump settings
Impact of pumping when aquifers are hydraulically separate

- Mahomet nonpumping
- Glasford nonpumping
- Mahomet pumping
- Glasford pumping

Mahomet aquifer
Glasford aquifer
Glacial till
Impact of pumping when aquifers are hydraulically linked

- Mahomet nonpumping
- Mahomet pumping
- Glasford nonpumping
- Glasford pumping

Glacial Till

Glasford Aquifer

Dewatered aquifer

Mahomet Aquifer
Interaquifer Connections to the Sangamon below Allerton Park

- Glasford nonpumping
- Glasford pumping
- Mahomet nonpumping
- Mahomet pumping

Glacial Till

Glasford Aquifer

Mahomet Aquifer

Sangamon River

Decatur #2
Mission Statement--

...to further study the Mahomet Aquifer on a regional basis and to develop options for the management of this valuable resource.

www.MahometAquiferConsortium.org
Water Use-- Potential future demand

Population change in the Mahomet Aquifer Region

Water Use--

Selected communities in the Mahomet Aquifer region

1995 Ground-Water Total=27.9 mgd
1995 Surface Water Total=79.1 mgd

Ground-Water Sources


Surface-Water Sources

Why is this effort needed?

- Make informed decisions about meeting future water demand-- effect of projected growth and possible weather extremes
Why is this effort needed?

- Identify and resolve water quality issues
Why is this effort needed?

- Help ensure your water supply for the future
- Optimize your future water supply costs
- Promote planned economic development/smart growth for your community
How can you help?

- Provide data—well locations, volume of water pumped, …
- Provide funding
- Provide audiences for educational presentations (schools & businesses!)
MAC Board of Directors
Contact information

- Mel Pleines, Mackinaw Valley Water Authority, Minier, 309-392-2719
- Dorland Smith, Illinois Water Authority Assoc., Havana, 309-543-3147
- Barry Suits, Illinois-American Water Co., Champaign, 217-373-3247
- Craig Cummings, City of Bloomington, 309-434-2225
- Nancy Erickson, Illinois Farm Bureau, 309-557-3153
- Sharon Martin, Monticello, 217-687-2628
- Ellis Sanderson, Urbana, 217-328-4488
Water Supply Planning in Illinois

- Gov. Blagojevich issues Exec Order 2006-01
- The Development of State and Regional Water-Supply Plans
  - Plans should be
    - Consistent with existing laws, regs & rights
    - Based on science
    - Regional and not statewide

EXECUTIVE ORDER FOR THE DEVELOPMENT OF STATE AND REGIONAL WATER-SUPPLY PLANS

WHEREAS, the citizens of Illinois rely on surface water and groundwater for personal consumption, and industries of the State use a significant amount of that water for economic development; and

WHEREAS, the increasing demands on Illinois’ water resources and the impacts of drought may lead to conflicts between the multiple water supply users and may adversely affect the health of the State’s citizens as well as adversely impacting the environment and the economy; and

WHEREAS, the quantity of surface water and groundwater in Illinois must be properly assessed through a sound planning process as an essential part of any responsible, economically viable and secure water supply development for the citizens of the State; and

WHEREAS, the Illinois Interagency Coordinating Committee on Groundwater, the Illinois State Water Survey, and the Illinois State Water Plan Task Force have identified the Priority Water Quantity Planning Areas that are most at risk for water shortages and conflicts; and

WHEREAS, the Illinois Integrated Water Quantity Planning and Management Committee recommends the development of regional aquifer and watershed plans for managing water suppliers,

THEREFORE, BE IT ORDERED that the following actions shall be executed:

Consistent with the authority granted to the Department of Natural Resources under the Rivers, Lakes, and Streams Act, 625 ILCS 5/9-5 et seq., and the Level of Lake Michigan Act, 615 ILCS 50/1 et seq., the authority of the Department of Natural Resources’ Office of Water Resources under 20 ILCS 301/5-5, the Office of Water Resources, in coordination with the State Water Survey, shall:

1. Define a comprehensive program for state and regional water supply planning and management and develop a strategic plan for its implementation consistent with existing laws, regulations and property rights,

2. Provide for public review of the draft strategic plan for a water supply planning and management program,
Water Supply Planning in Illinois

- Two pilot committees
- Formed and working
- Develop demand projections and assess supply

Water resources planning discussed at first mtg

Nominees selected at roundtable discussions
## Water Supply Planning in Illinois

### East-Central Illinois Committee

<table>
<thead>
<tr>
<th>Interest Group</th>
<th>Representative</th>
<th>Geographic Region</th>
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<tbody>
<tr>
<td>Agriculture</td>
<td>Jeff Smith</td>
<td>West</td>
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<tr>
<td>Counties</td>
<td>Evelyn Neavear</td>
<td>West</td>
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<tr>
<td>Electric Generating Utilities</td>
<td>Thomas L. Davis</td>
<td>Central</td>
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<td>Environment</td>
<td>Dwain Berggren</td>
<td>East</td>
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<td>Industries</td>
<td>Mark Sheppard</td>
<td>Central</td>
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<td>Municipalities</td>
<td>Paul Berg</td>
<td>East</td>
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<tr>
<td>Public</td>
<td>Bradley Uken</td>
<td>East</td>
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<tr>
<td>Rural Water Districts</td>
<td>Frank Dunmire</td>
<td>Central</td>
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<td>Small Business</td>
<td>Robert Betzelberger</td>
<td>West</td>
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<td>Soil and Water Conservation</td>
<td>Shannon Allen</td>
<td>Central</td>
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<td>Water Authorities</td>
<td>Morris Bell</td>
<td>West</td>
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<tr>
<td>Water Utilities</td>
<td>Brent O’Neill</td>
<td>East</td>
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Visit us on the web!

www.isgs.uiuc.edu
www.MahometAquiferConsortium.org
www.sws.uiuc.edu