

Recommendations for Research, Management, and Protection of the Mahomet Aquifer

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Introduction

Numerous reports about the Mahomet aquifer have outlined recommendations for further research, protection, or management. From the documents in the Reference List, PRI compiled a list of these recommendations (see Appendix A). Because there is significant overlap and redundancy in this comprehensive list, PRI's Mahomet Aquifer Response Team created the following précis for consideration and discussion by the Mahomet Aquifer Protection Task Force (MAPTF). Inclusion of a recommendation in this document is not intended as an endorsement by PRI.

Funding

Stable and adequate funding from local, state, and federal governments and the private sector is essential to support recommendations about Mahomet aquifer research, management, and protection.

Understanding the Resource

Recommendations for improving the scientific understanding of the physical characteristics of the Mahomet aquifer, especially its geology and hydrogeology

1. Better define the extent of the Mahomet aquifer by:
 - a. Mapping geologic materials encountered at the land surface and in the subsurface above bedrock
 - b. Using helicopter borne, time-domain electromagnetics (HTEM) to characterize the aquifer to aid in identifying connections with other aquifers and to surface water.
 - c. Conducting seismic surveys and downhole geophysical logging studies.
2. Better define surface water and groundwater conditions:
 - a. Installing new observations wells in areas where there are major gaps in the existing network or more hydrologic information is needed.

- b. Conducting focused studies in areas with known or suspected groundwater interactions with the surface water.
 - c. Identifying and refining the delineation of higher recharge area using shallow geological mapping, soil mappings, and measurement of vertical hydraulic gradients.
 - d. Collecting geochemical data to validate groundwater flow paths and budgets.
 - e. Collecting chemical and isotopic water samples to help determine groundwater flow patterns and budgets.
 - f. Improving estimates of water use and monthly variations in use by public supplies.
 - g. Studying seasonal climate variability and collecting data during droughts and floods.
3. Integrate results of new studies into a next-generation groundwater flow model that can be used as a dynamic tool for simulation of aquifer condition and responses.

Water Quality and Protection

Recommendations to characterize, monitor, identify contamination, and maintain the water quality

1. Improve understanding of ambient water quality by:
 - a. Reviewing water quality data from public supply, domestic, and observation wells and creating summary plots and maps to show distributions of chemical constituents and identify outliers.
 - b. Determining the extent and conditions of naturally occurring arsenic contamination.
 - c. Collecting and analyze samples from existing monitoring wells and domestic wells in areas more vulnerable to contamination.
2. Improve capability and systems to identify contamination by:
 - a. Monitoring for nitrate, pesticides, and emerging contaminants.
 - b. Monitoring for road salt runoff.
3. Improve protection of water quality by:
 - a. Reviewing monitoring plans and data from landfills closed prior to the existing IEPA closure and monitoring requirements and other potential contamination sites and, if necessary, conducting sites assessments.
 - b. Promoting the sealing of unused or abandoned wells.
 - c. Conducting or updating source water protection studies.
 - d. Promoting best management practices for facilities that use, store, or handle industrial solvents.
 - e. Promoting best practices for use of road salt.

Water Quantity and Sustainability

Recommendations to better characterize, monitor, and maintain water availability and use

1. Empower a group to provide leadership, administrative structure, and processes for regional water supply planning and management of the Mahomet aquifer.
2. Ensure comprehensive water use reporting and data assessment with additional emphasis on irrigation. Consistently and fully fund the Illinois Water Inventory Program.

3. Identify key indicators relevant to water supply planning and management (e.g., population, the economy, the environment, etc.) and assess their implications for sustainable water supplies.
4. Develop local, independently reviewed water supply management plans to be in compliance with guidelines contained in a regional plan (RWSPC, 2009 and 2015).
5. Use the established regional water supply planning process to review and update regional and local water supply plans at least every five years.
6. Encourage drought preparedness.
7. Design, construct and operate water supply facilities in a manner that prevents unacceptable impacts to surface waters, wetlands and aquatic and riparian ecosystems.
8. Promote water conservation measures, including expanded use of grey water, smart lawn watering, reducing leaks in distribution systems, etc.
9. Assess the impact of new high-capacity wells on other users of the aquifer.

Communication

Recommendations to improve knowledge exchange

1. Improve education and outreach so that all stakeholders are better informed about water resources, water demand, and water supply planning and management, particularly when plans are made, reviewed, and updated.
2. Plan cooperative research and data collection, analysis, management, and exchange by academic institutions, units of government, the private sector, and other stakeholders. Provide education to private water and gas well owners on existing laws and potential sealing procedures.

References

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Appendix A: Mahomet Aquifer Recommendations

Category	Water Quality	Water Quantity	Recommendation	Source (identified by number from the reference list)
Contamination	x		Monitor landfill leachate	1
Contamination	x		Monitor nitrate and chloride runoff	1
Contamination	x		Monitor naturally occurring arsenic	1
Contamination	x		Monitor industrial solvent storage, transportation, and handling	1
Research		x	Study water withdrawals that change in time and space	1
Research	x	x	Study the variable distribution, spatial extent, and properties of the aquifer	1
Research	x	x	Study aquifer interactions with surface water	1
Research		x	Study seasonal weather and climate variability	1
Research		x	Define the boundaries of the Mahomet aquifer	1
Research	x	x	Identify water interactions with other aquifers	1
Research		x	Assess regional and local patterns of groundwater flow paths	1
Research		x	Address domestic and agricultural withdrawal rates	1
Research		x	Define recharge areas and processes.	1
Research		x	Study transitional areas of confined versus unconfined aquifer.	1
Research		x	Address recharge in terms of managing withdrawal.	1
Contamination	x		Properly seal decommissioned, unused, or abandoned wells.	2
Conservation		x	Fix leaky water pipes and faucets.	3
Conservation		x	Be smart about watering lawns and gardens.	3
Legislative, governmental		x	Continue to plan and manage water supplies to meet demand in compliance with existing laws, regulations and property rights, and with due consideration of acceptable and/or unacceptable impacts.	4
Legislative, governmental		x	Plan and manage water supplies with enhanced regional cooperation and coordination to address shared responsibilities and the interests of future generations.	4
Conservation		x	Manage withdrawals from the confined Mahomet aquifer so that head in any well (pumping or non-pumping) finished in the confined Mahomet aquifer does not fall below the top of the aquifer.	4

Category	Water Quality	Water Quantity	Recommendation	Source (identified by number from the reference list)
Legislative	x		Do not delay the implementation of the recommended standard to protect the confined Mahomet aquifer until other standards are developed.	4
Conservation		x	Reevaluate the earlier evaluation of the sustainability of pumping to capacity by the Illinois American Water (51.1 mgd) to include additional withdrawals from the Mahomet aquifer by other communities and industries out to 2050, with consideration of drawdown in pumping and non-pumping wells.	4
Legislative	x	x	Define the transition zone and develop an appropriate standard(s) to protect the aquifer, surface waters and ecosystems, while allowing for groundwater development.	4
Legislative	x	x	Further study to develop a standard(s) to protect shallow confined aquifers and related surface waters and ecosystems, while allowing for groundwater development.	4
Legislative		x	Develop and implement a standard(s) to limit the reduction of saturated thickness in the unconfined aquifer and protect surface waters and ecosystems, especially in summer under drought conditions, while allowing for groundwater	4
Conservation	x	x	Identify and preserve and/or restore key aquifer recharge areas, key stream reaches, and ecosystem-sensitive stream flows. Water supply planners also must understand the nature, extent, cause and trend of impacts (such as water withdrawals) on	4
Conservation	x	x	Design, construct and operate water supply facilities in a manner that prevents unacceptable impacts to surface waters, including streamflow and water levels in lakes, wetlands and aquatic and riparian ecosystems, while providing sufficient water to meet demand.	4

Category	Water Quality	Water Quantity	Recommendation	Source (identified by number from the reference list)
Conservation		x	Manage public water supplies to provide dependable and adequate supplies of water during, at a minimum, recurrence of the multi-year droughts-of-record, similar to those that occurred in the 1930s and 1950s. A 90% confidence level should be used for yields.	4
Conservation		x	Increase efficiencies of water withdrawal, treatment, distribution and use, and use of water from alternative sources (such as reused water, detained stormwater, and conjunctive use of surface water and groundwater).	4
Management		x	Design water supply facilities for staged or incremental construction, where feasible, to permit maximum flexibility to accommodate changes in population and economic growth, changes in technology for water supply management, new scientific understanding, and possible new or revised management standards.	4
Management		x	Reevaluate criteria and standards to protect the aquifers when criteria and a standard(s) are developed to protect surface waters and aquatic and riparian ecosystems from possible unacceptable impacts of groundwater withdrawals.	4
Management		x	Establish a continuous process for water supply planning and continually review and update regional and local water supply plans by stakeholders at least every five years.	4
Communication; Management		x	Encourage all water supply managers and other stakeholders in the region to review a regional plan, suggest modifications, and become partners in regional water supply planning and management.	4
Legislative, governmental; Management; Communication		x	Develop local water supply management plans to be in compliance with guidelines contained in a regional plan, and that the local plans be reviewed independently.	4

Category	Water Quality	Water Quantity	Recommendation	Source (identified by number from the reference list)
Research; Communication	x	x	Plan cooperative research and data collection, analysis, management and exchange by academic institutions, appropriate units of government, the private sector, and other	4
Communication	x	x	Increase public knowledge of water resources, water demand, and water supply planning and management, particularly when plans are made, reviewed, and updated.	4
Communication	x	x	Articulate the need for and benefits of regional water supply planning and management.	4
Communication	x	x	Improve education and outreach so that local decision makers and the public are better informed about regional water supply	4
Communication	x	x	Coordinate voluntary participation in regional water supply planning and management and integrate diverse opinions	4
Communication	x	x	Encourage and facilitate all water supply operators to participate in a review of the plan and, with guidance, have an opportunity to modify the plan, including the water demand	4
Education		x	Encourage, facilitate and provide technical assistance to water supply operators in the preparation of local water supply and management plans that are consistent with the guidelines in a regional plan. Review of the local plans will result in a collective regional plan	4
Management	x	x	Recommend best management practices for water supply management	4
Management	x	x	Coordinate implementation of a regional plan - with monitoring and reporting of progress to establish accountability	4
Management	x	x	Identify key indicators relevant to water supply planning and management (e.g., population, the economy, the environment, water withdrawals and uses, streamflow, groundwater levels, climate and land-use changes, regulations etc.), monitor and report changes, and assess their implications for sustainable water supplies	4

Category	Water Quality	Water Quantity	Recommendation	Source (identified by number from the reference list)
Communication	x	x	Continuously engage in regional water supply planning and update the regional plan on a periodic basis, at least every five	4
Research; Management	x	x	Consider incorporating in future plans subjects not addressed in the current plan, e.g., water quality, instream and riparian water needs, ecosystems, infrastructure, land-use, water pricing etc.	4
Management; Research	x	x	Coordinate the identification of technical objectives and requirements for major data collection, analysis and distribution efforts and continue to receive technical assistance in water supply planning and management	4
Communication; Management; Education	x	x	Retool the Mahomet Aquifer Consortium to provide leadership, administrative structure and process to fulfill and expanded role for regional water supply planning and management in East-Central Illinois.	4
Communication; Management; Education	x	x	Broaden the mission to include leadership and coordination of regional water supply planning and management activities – for surface water as well as groundwater – in the 15- county region	4
Communication; Management; Education	x	x	Broaden membership of the Board of Directors and its Technical Advisors to include the type of stakeholder and geographical diversity represented on the Regional Water Supply Planning Committee	4
Management	x	x	Establish an appropriate committee structure to implement the regional plan	4
Management	x	x	Engage in a continuous process of regional water supply planning and management and facilitate implementation a	4
Communication	x	x	Encourage broader participation in Members’ meetings and rotate the meetings throughout the region	4
Communication; Education	x	x	Continue and improve a website to provide information to the public	4
Management	x	x	To be effective, the Mahomet Aquifer Consortium will need a permanent staff and appropriate financial and operating	4

Category	Water Quality	Water Quantity	Recommendation	Source (identified by number from the reference list)
Management	x	x	A critical early step is for the Mahomet Aquifer Consortium to identify its resource needs and to take action to secure them. Stable and adequate funding from state government through the Illinois Department of Natural Resources and local entities is essential to support efforts to implement a regional plan. Federal funds also should be pursued as a possible source	4
Communication; Management; Education	x	x	Establish an <i>ad hoc</i> group to investigate opportunities for creating incentives to water supply operators to participate in implementing the regional plan and in funding some of the	4
Communication; Management; Education	x	x	Encourage the University of Illinois at Urbana-Champaign to consolidate and strengthen its important role as a partner with local entities and state agencies, especially the Department of Natural Resources, in regional water supply planning and management,	4
Communication; Management; Education	x	x	Encourage the University of Illinois at Urbana-Champaign to use a small amount of core state resources to keep the groundwater flow model operational and to conduct and report on assessment of the impacts of new high capacity wells, in coordination with Soil and Water Conservation Districts, if additional state funds are not available. This would implement for the region the increasingly important, but unfunded 1983 Water Use Act mandate to conduct and report on impact	4
Research; Management	x	x	All divisions of the Prairie Research Institute, in coordination with the Mahomet Aquifer Consortium, should develop a plan to assist the Mahomet Aquifer Consortium.	4
Management	x	x	Actively seek stable and adequate funding from local, state, and federal governmental entities along with the private sector to implement action items.	5
Research; Education	x	x	Work with small water operators through existing partnerships on education and data collection.	5

Category	Water Quality	Water Quantity	Recommendation	Source (identified by number from the reference list)
Communication; Education		x	Continue discussion regarding ways to build stakeholder involvement throughout the region.	5
Management		x	Encourage the planning of water supply/drought preparedness, utilizing among other things, the existing plan.	5
Management		x	Continue periodic reviews and full updates of preceding reports: water withdrawals and water demand estimates in 2017; conduct a full update to the <i>Plan to Improve the Planning and Management of Water Supplies in East-Central Illinois</i> in 2022.	5
Education	x		Provide education to private well, water or gas, owners on existing laws and potential sealing procedures.	5
Research	x	x	Strive to close the data gaps that hinder our better understanding of the aquifer and surface water sources and that, at times, impede planning efforts. Some of the data gaps that need to be addressed were identified by INTERA and include: a) All water demand sectors should report water withdrawals; b) Reporting should be mandatory; c) All water withdrawals should be made public; d) Withdrawals should be accurately reported as withdrawals, not total water produced or used; e) Monthly withdrawals should be reported. Population served should be accurately reported annually; f) Resident population estimates should be projected for the entire water supply planning period; g) Employment populations should be projected for the entire water supply planning period; h) Public water suppliers should report price annually; i) Significant changes (large increases or decreases in annual average) in	5
Management; Education		x	Encourage per property water metering/tracking within municipalities and in the rural areas of the region.	5
Management; Education		x	Investigate opportunities for sub-metering at multi-occupied properties such as apartment buildings.	5
Education		x	Promote water conservation on all levels through education, fact sheets and water audits.	5

Category	Water Quality	Water Quantity	Recommendation	Source (identified by number from the reference list)
Management	x	x	Stimulate the expanded use of grey water.	5
Management	x	x	Encourage more Best Management Practices (BMPs) in infrastructure design.	5
Communication	x	x	Continue to work with all current partners while fostering new relationships in water planning efforts.	5
Research	x	x	Install new wells in Iroquois, Vermilion, DeWitt, Logan, south-central McLean, northern Tazewell, Woodford and eastern Mason Counties to fill in gaps in the observation well network.	6
Research	x	x	Install additional observation wells in the shallow aquifer.	6
Research		x	Equip more observation wells with pressure transducers to digitally record water levels.	6
Research		x	Collect additional water withdrawal data to improve estimates of irrigation water use in the eastern portion of the aquifer as well as commercial and industrial withdrawals across the aquifer as a whole.	6
Research	x		Collect more chemical and isotopic data to better understand the interactions of the Mahomet aquifer with the land surface, overlying shallow aquifers, and underlying bedrock units.	6
Research		x	Research to more accurately predict the impact of pumpage from the Mahomet aquifer on private wells constructed in the shallower aquifers.	6
Research		x	New observation wells and streamflow measurements sites need to be developed where there may be significant groundwater/surface water interactions to quantify impacts by groundwater pumpage on streamflow	6
Research		x	Water supply systems should plan for the climatic conditions similar to those experienced in the early- to mid-1900s, with specific focus on the <i>drought of record</i> ,	6

Category	Water Quality	Water Quantity	Recommendation	Source (identified by number from the reference list)
Research	x	x	Conduct pumping test of the City of Decatur well #1 to better identify aquifer properties and the nature of the connections between aquifer and the Sangamon River. This knowledge could be used to develop a better computer model of the	7
Research		x	Continue studies to improve the geologic model used to develop the flow model	8
Communication	x	x	Compile geological, geophysical, and hydrogeological information in a digital database that would be connected to a new Internet interface to serve data to the public.	8
Research	x	x	Use watershed modelling to improve our understanding of groundwater-surface water linkages in east-central Illinois.	8
Research	x		Collect and analyze groundwater samples from the 40 groundwater monitoring wells installed in McLean, Piatt, Champaign, Ford and Vermilion Counties to assist in determining flow patterns in these areas.	8
Research	x	x	Install groundwater monitoring wells to facilitate mapping the geology in six areas in the Mahomet aquifer region. The mapping will be based on geologic coring, borehole geophysics, and geochemical analysis of groundwater. The six areas are: southwest Tazewell and northwest Logan Counties; the Kenney Bedrock Valley in southwest DeWitt and eastern Logan Counties; Northern Macon County; Northern Vermilion County, including the Danville and Onarga Bedrock Valleys; the Pesotum Bedrock Valley in Champaign County; the Middlewotn Bedrock Valley in Logan and Menard Counties.	8

Category	Water Quality	Water Quantity	Recommendation	Source (identified by number from the reference list)
Research	x	x	Map geologic materials encountered at the land surface and in the subsurface above bedrock along transects crossing the Mahomet Bedrock Valley and adjacent area to define the variability in the geology and hydrogeology. Mapping will be based on geologic coring, surface and borehole geophysics, and geochemical analysis of groundwater. The five proposed areas are: Village of Kenney to the City of Clinton; Central Champaign County; Northern and central Champaign County; Allerton Park to the Village of Mansfield; Village of Burton	8
Research	x	x	Characterize groundwater and surface water interactions along select stream reaches by installing nest of groundwater monitoring well and stream gauges, and conducting electrical earth resistivity surveys along portions of each stream reach. The four proposed stream reaches are: the Sangamon River between Fisher and Mahomet; the Sangamon River from Monitcello to Friends Creek; the Middle Fork of the Vermilion River in northeastern Champaign and eastern Ford Counties;	8
Research	x	x	Further characterize the Illinois Episode deglacial-phase sediments in east-central Illinois to determine the architecture and distribution of the deposits. These deposits contain aquifer materials that are correlated to the Upper Glasford aquifer, and groundwater extracted from this unit typically supports smaller	8
Research	x	x	Conduct an airborne Time-domain EM (TEM) to characterize the aquifer to aid in identifying locations that might be more likely to have interactions between surface water and	8
Research	x	x	Conduct a 3-D seismic survey (6 miles long) to characterize the deposits of the Quaternary Period in northern Champaign	8
Research	x	x	Evaluate alternative geophysical methods for characterizing groundwater-surface water interactions. Alternative methods include ground water temperature, earth self-potential, and marine resistivity.	8

Category	Water Quality	Water Quantity	Recommendation	Source (identified by number from the reference list)
Research		x	Conduct a study to establish very accurate baseline elevation data of the land surface in Champaign County so that earth subsidence due to drawdown of groundwater in the Mahomet aquifer can be accurately measured.	8
Research	x	x	Continue downhole logging in boreholes in east-central Illinois to provide additional information on the character of aquifer materials composing the Mahomet aquifer.	8