



Water Sustainability in the Era of Data Centers

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What is the concern?

What can we do?

- Consumptive use of water or water transfers decreases local water sustainability
- Need tools to evaluate impacts of water uses on watersheds and aquifers
- Tools are needed to evaluate future scenarios like data center withdrawals, inter-basin transfers, or increased demand from climate change



Data Center Water Use

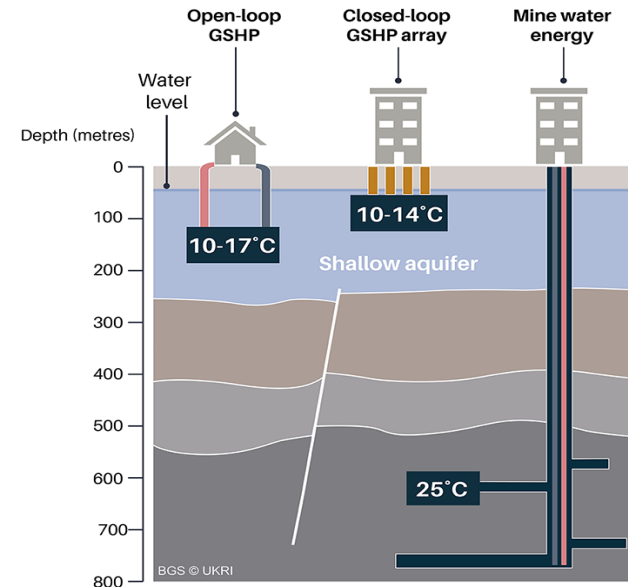
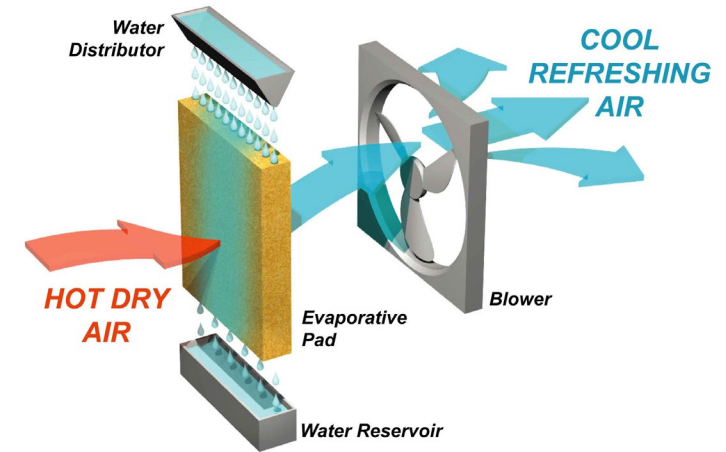
- Power generation
 - Data centers need large quantities of energy to power the electronics
 - Projected to increase 7-12% over current
 - Energy production consumes water
- Cooling
 - Energy use creates heat which must be dissipated via cooling
 - Many cooling systems consume water



(image from Brent Beste, MN DNR)

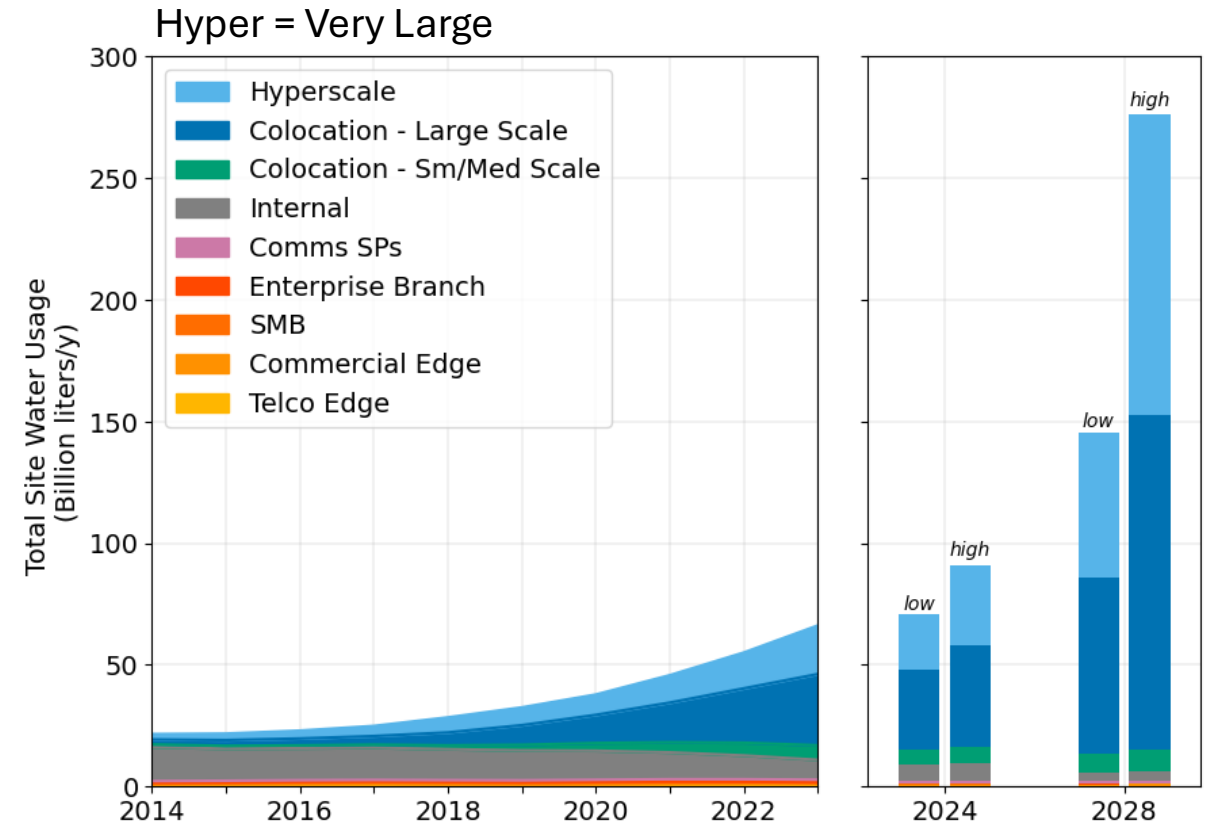
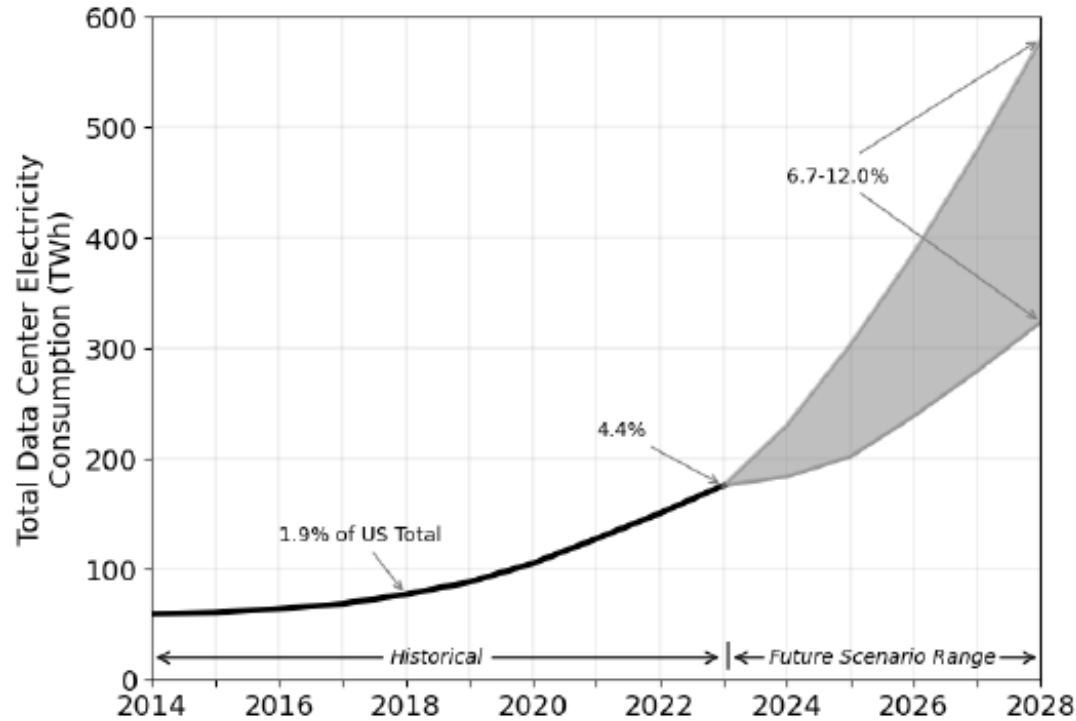
Data Center Cooling Systems

- Evaporative cooling
 - 100% consumptive
- Water cooling open loop
 - transfers water
- Water cooling closed loop
 - very low use
- Runoff capture and reuse
 - lowers net use
- Air conditioning/air heat pumps
 - no water use but high energy
- Air cooling
 - only possible in the winter



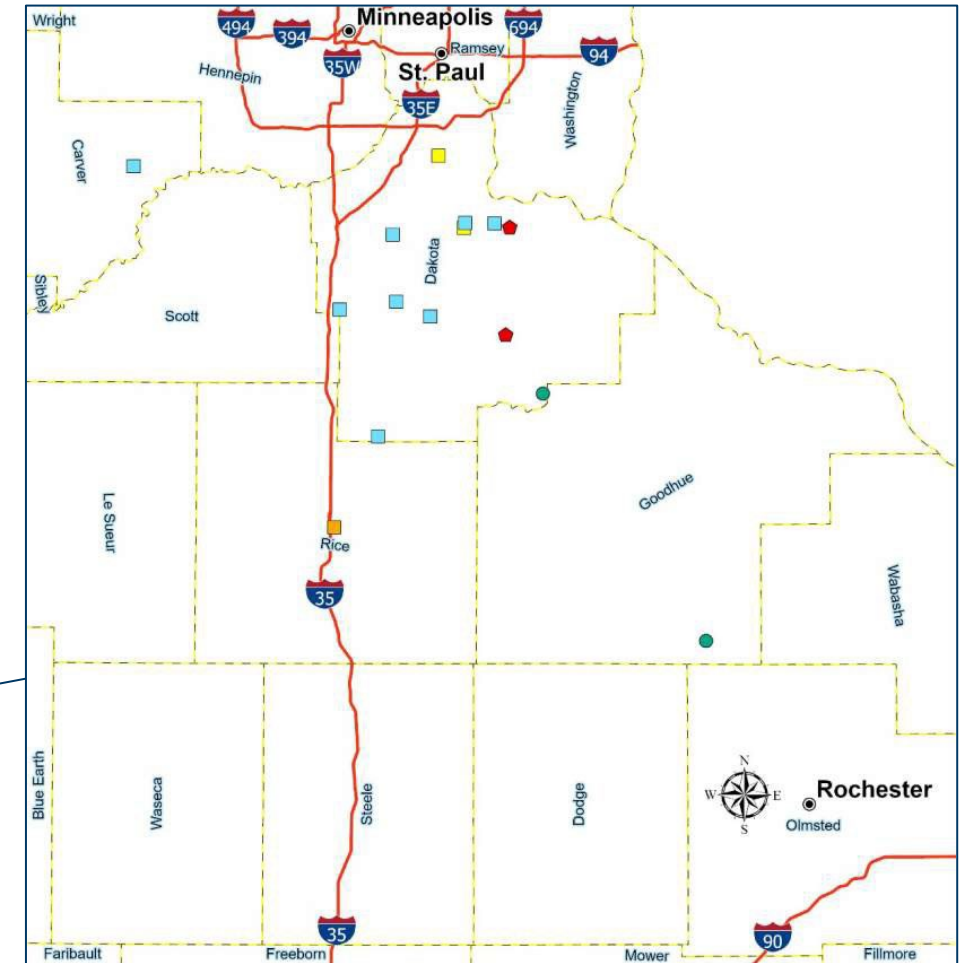
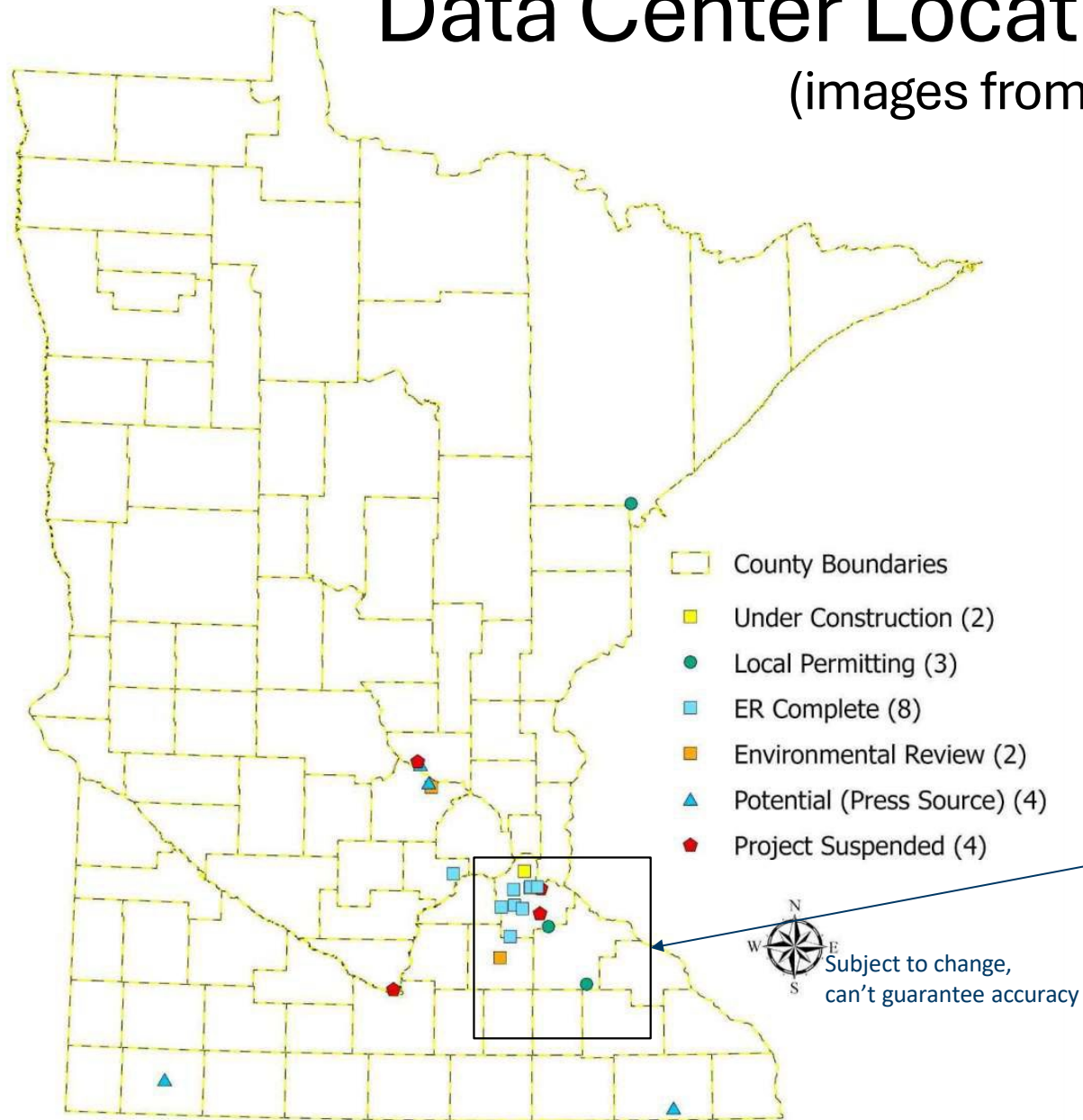
Projected Power & Water Use by Data Centers

(Lawrence Berkeley National Laboratory (2024), <https://escholarship.org/uc/item/32d6m0d1>)



Data Center Locations in MN under Review

(images from Brent Beste, MN DNR)

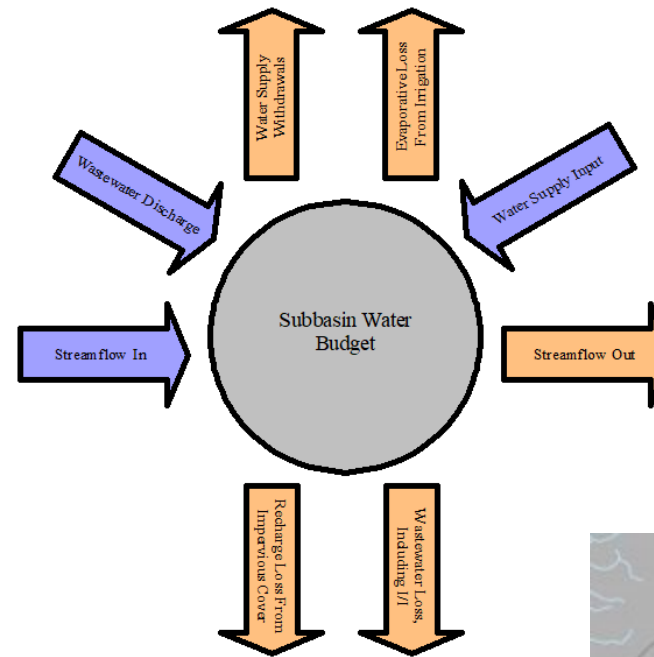


Existing Versus Proposed Project

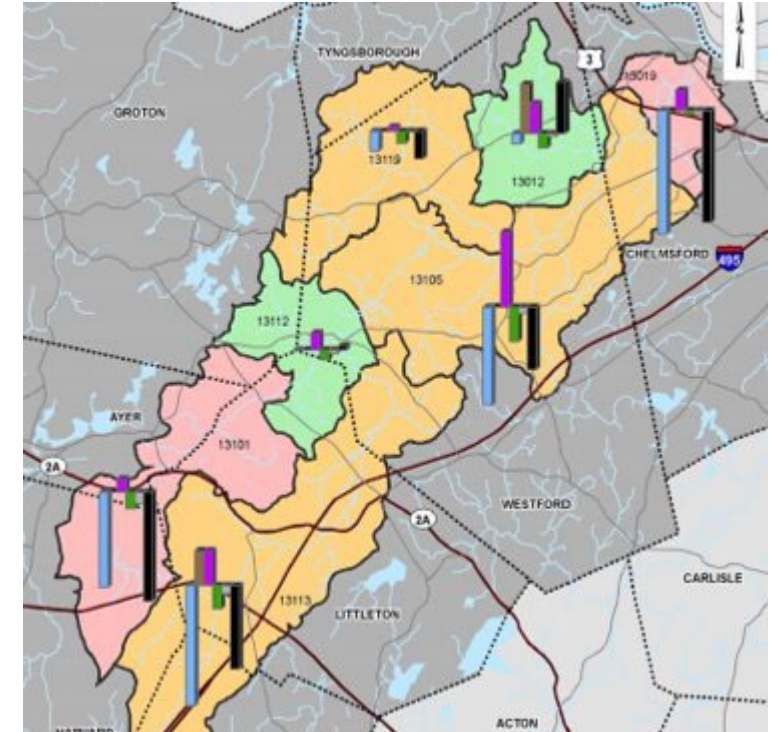
- **Funded Project (July 2025 to June 2026) – Budget \$198,000**
 - Pilot water budget framework for managing water withdrawals
 - Establishment of local data contacts and local data sources
 - Simple water budget development using local data
 - Testing on 3 watersheds and 3 groundwater areas
 - Our full intention was to take this pilot project statewide
- **Proposed Project (July 2026 to June 2028) – Budget \$335,867**
 - Statewide water budget framework for managing water withdrawals
 - New data center water demands have increased urgency
 - Typical LCCMR path will be too slow to help (earliest start would be July 2027)
 - Proposed project will include geographical water sustainability tool

Proposed Work

- Test established water balance models
 - USGS, UNH and others
- Collect and process statewide data
 - Geographical information
 - Water withdrawals, inputs, outputs
 - Water use by data centers
 - Climate conditions
- Focus effort on locations with proposed new data centers
- Statewide application with geographical tool
 - Current conditions versus near-natural conditions
 - Climate change scenarios (e.g., drier dry seasons)
 - Data centers assessments (local or statewide)
- Workshops for teaching/training of use of the model for water sustainability assessments



MA water budgets (2005)



MA water budgets graphical output (2005)

Who will do the work?

- U of M Key Staff
 - John Nieber, PI, hydrology skills, project management
 - Post-doctoral researcher
 - hydrology and water use management skills
 - computer modeling and data analysis skills
 - Extension staff
- Geosyntec Key Staff
 - Nigel Pickering, water resources engineering skills, project management
 - Prior experience with MA Sustainable Water Management Initiative (SWMI)
 - Geosyntec Advisors – data center experts
 - GIS Analyst – mapping skills, data automation
 - Data Analyst – data analysis, data automation
 - Web Developer – interface skills, tool interface development
 - Hydrologist – hydrological modeling skills for water budget
- Advised by a TAC
 - DNR, MPCA, MDA, MDH, LGUs

Questions?

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