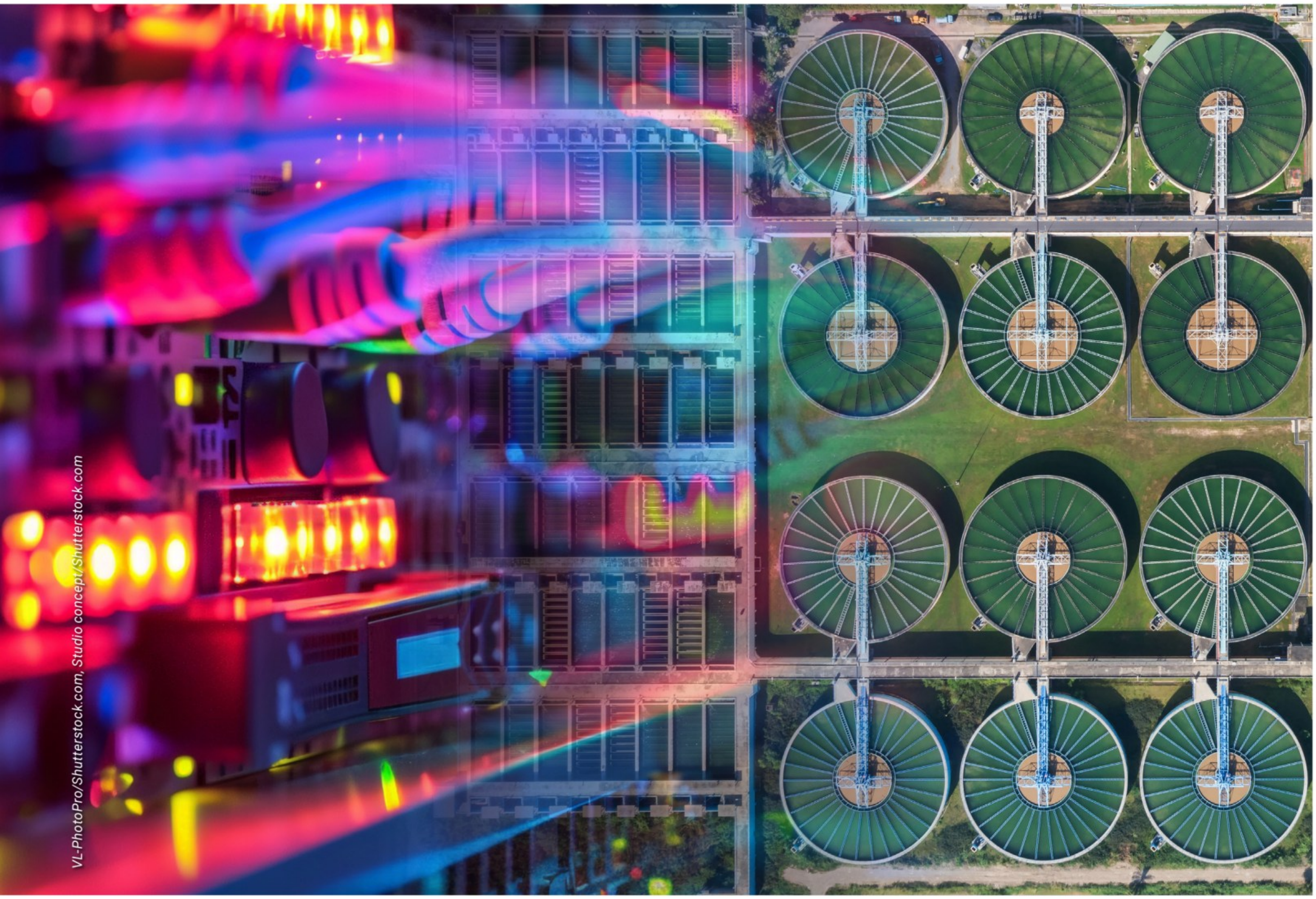
Cooling the Cloud: Water Utilities in a Data-Driven World



American Water Works Association

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Aerial photo of a data center in Nevada. Image Credit: Audio und werbung/Shutterstock.com

1. Introduction

Artificial intelligence (AI) is a rapidly growing element of the nation's economy. The physical infrastructure needed for AI is primarily housed in data centers, which are also used to meet the needs of other digital services. Data centers power these services by providing the processing, storage, and networking needed to run them. Business Insider estimates that 1,240 data centers were built or approved for construction by 2024, with Northern Virginia (329) and Maricopa County, Arizona (48) boasting the highest concentrations.[1] These areas of historic data center growth may prove to be only the beginning as more capacity is needed moving forward.

Thoughtful preparation by water systems will be essential. Data centers are anticipated to consume considerable resources and, in some instances, strain infrastructure and water supplies. A United States International Trade Commission briefing estimated that between 2010 and 2025, the technology sector would see a 146-fold increase in digital data creation.[2] Data centers provide essential infrastructure for the processing, communication, and storage of data and benefit all sectors of the economy, but they also bring significant impacts that must be addressed.[3]

As an organization serving the water utility sector, AWWA provides this report to help water utilities better understand some of the challenges, opportunities, key decision points, and other considerations involving data centers. We hope this information will also benefit many other audiences.

The proliferation of data centers is inextricably linked to AI growth because of the additional computing power necessary to train and run AI models.[4] A number of U.S. federal programs and policies have actively supported the development and growth of AI, including various executive orders issued from 2019 through 2025, funding for AI innovation, and the White House's most recent *America's AI Action Plan*, among others.[5,6,7,8] The siting of data centers is economically attractive to state and local governments, given that data centers generate considerable revenue, primarily from business personal property and real estate property taxes. Additionally, unlike most other forms of development, data centers require relatively

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[1] Hannah Beckler, "See where data center construction is booming," *Business Insider*, July 17, 2025, https://www.businessinsider.com/big-tech-ai-data-center-spending-construction-map-2025-8 .

[2] Brian Daigle, *Data Centers Around the World: A Quick Look*, Executive Briefings on Trade (United States International Trade Commission), https://www.usitc.gov/publications/332/executive_briefings/ebot_data_centers_around_the_world.pdf.

[3] Arman Shehabi, Sarah J. Smith, Alex Hubbard, Alex Newkirk, Nuoa Lei, Md Abu Bakar Siddik, Billie Holecek, Jonathan Koomey, Eric Masanet, and Dale Sartor, *2024 United States Data Center Energy Usage Report* (Energy Analysis and Environmental Impacts Division, Lawrence Berkeley National Laboratory, 2024), https://eta-publications.lbl.gov/sites/default/files/2024-12/lbnl-2024-united-states-data-center-energy-usage-report_1.pdf.

[4] Goldman Sachs, "AI to drive 165% increase in data center power demand by 2030," February 4, 2025, https://www.goldmansachs.com/insights/articles/ai-to-drive-165-increase-in-data-center-power-demand-by-2030.

[5] U.S. Department of Homeland Security, Cybersecurity & Infrastructure Security Agency, *Recent U.S. Efforts on AI Policy* (Washington, DC., n.d.), https://www.cisa.gov/ai/recent-efforts.

[6] Exec. Order No. 13960, 85 Fed. Reg. 78939-78943 (December 3, 2020), https://www.federalregister.gov/documents/2020/12/08/2020-27065/promoting-the-use-of-trustworthy-artificial-intelligence-in-the-federal-government.

[7] Exec. Order No. 14179, 90 Fed. Reg. 8741-8742 (January 23, 2025), https://www.federalregister.gov/documents/2025/01/31/2025-02172/removing-barriers-to-american-leadership-in-artificial-intelligence.

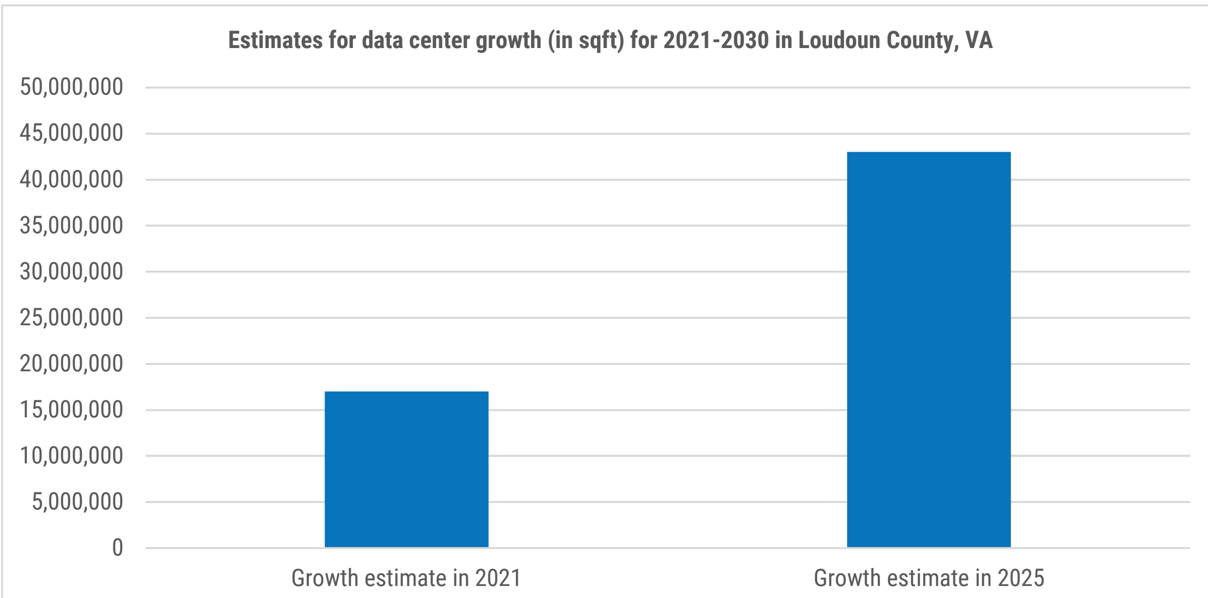
[8] Executive Office of the President of the United States, *Winning the Race: America's AI Action Plan* (Washington, DC, 2025), https://www.whitehouse.gov/wp-content/uploads/2025/07/Americas-AI-Action-Plan.pdf.

few staff for operation and utilize relatively few public services (e.g., social services that would be needed for residential development or an extensive road network needed for a commercial district).[9] Recognizing it is currently the area with the greatest density of data centers in the country, Loudoun County estimated it would receive $895 million in tax revenue from data centers in 2025, equating to 95% of the county's operating budget of $940 million.[10]

To illustrate the scale of data center impacts, the call-out box below demonstrates impacts on a single utility's planning efforts.

Example of Rapid Data Center Growth: Loudoun Water, Virginia

The pace of change associated with data center development can be dramatic. In 2020, Loudoun County officials forecasted that following a period of rapid expansion, data center development in the county would diminish after 2021. They estimated roughly 17 million additional square feet of development between 2021-30. Actual increases were roughly 20 million square feet in just four of the nine years. Subsequently, the overall forecast for 2021-30 nearly tripled to 43 million in additional square feet anticipated. These forecasts are based on development applications received by the county and may still underestimate impacts.



In Loudoun County, this degree of change in a single sector is atypical with respect to utility planning. Because Loudoun Water is a separate entity from the county, a high degree of coordination between the utility and county government is critical. Loudoun Water is also involved with development industry groups to keep abreast of new potential projects in the county. In Loudoun Water's case, the degree of planning and preparedness needed to account for this rapid pace of development calls for dedicated staff -- a key consideration for water utilities in other communities.

[9] "Data Centers in Virginia," Joint Legislative Audit & Review Commission, accessed September 15, 2025, https://jlarc.virginia.gov/landing-2024-data-centers-in-virginia.asp.
[10] Nick Minok, "Data centers helped drive down Loudoun County taxes, but new restrictions are on the way," *WJLA*, April 2, 2025, https://wjla.com/news/local/loudoun-county-virginia-taxes-data-centers-new-restrictions-budget-supervisors-board-kershner-data-center-revenue-new-positions-estimated-millions-operating-money-politics.

However, data centers can require substantial volumes of water directly due to intensive cooling systems and indirectly through water consumed for electricity generation.[11] Some large data centers are reported to directly consume up to 5 million gallons of water per day.[12] Despite this substantial water use, a 2024 white paper from a global digital infrastructure company suggests that water availability is one of the least commonly cited concerns driving the decision of where to build data centers.[13] In that paper, only 3.4% of survey respondents indicated water availability as their top concern, as compared with 41.2% who cited an electricity-related concern. Despite this, there are at least two examples of planned data center projects that were cancelled in part due to water resource concerns.[14,15] Sustainability and resource use concerns are increasingly becoming drivers for the critical digital infrastructure industry, with data centers emerging as cross-sector leaders in setting water conservation and sustainability targets.[16]

Water consumption by data centers is anticipated to increase over the coming years because of AI's computation requirements.[17] Recent construction has mostly been hyperscale (i.e., data centers typically built for a single company deploying internet services and platforms at a large scale), which use more resources, including water. The *2024 United States Data Center Energy Usage Report* demonstrates this trend, with estimates reflecting that in 2014, 64% of direct water consumption came from internal data centers (i.e., data centers run by enterprises for their own internal use).[18] By 2023, hyperscale and colocation (i.e., data centers built to serve multiple companies) were expected to account for 84% of total direct water consumption, with internal data centers accounting for just 12%.[19] This trend will likely to continue into 2028, with direct water consumption by internal data centers estimated at just 2% and hyperscale data centers increasing their consumption up to nearly 50% (33 billion gallons) of the total.[20]

To meet the needs of the communities they serve, water utilities must understand and explain the unique impacts that data centers exert on the water sector. They must also be prepared to communicate legislative and regulatory activity related to siting of data centers. Because the siting of data centers is not evenly distributed geographically, impacts faced by water systems are likely to differ by regions (Figure 1).[21] This paper provides water utilities with background information and resources to help recognize the potential impacts of data center development in their service areas.

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[11] David Mytton, "Data centre water consumption," *npj Clean Water* 4, no. 1 (2021): 11. https://doi.org/10.1038/s41545-021-00101-w.
[12] Shannon Osaka, "A new front in the water wars: Your Internet Use," *The Washington Post*, April 25, 2023, https://www.washingtonpost.com/climate-environment/2023/04/25/data-centers-drought-water-use/.
[13] Vertiv (2024). Vertiv White Paper: Rethinking Modern Data Center Design and Construction Trends. Available at https://media.datacenterdynamics.com/media/documents/Vertiv-RethinkingModernDataCenterDesign.pdf.
[14] Victor Smith, "Huge Arizona data centre axed over water use fears," *Global Water Intelligence*, August 12, 2025, https://www.globalwaterintel.com/articles/huge-arizona-data-centre-axed-over-water-use-fears.
[15] Kate Grumke, "Public opposition sinks St. Charles data center plans," *St. Louis Public Radio*, August 18, 2025, https://www.stlpr.org/news-briefs/2025-08-18/developer-controversial-data-center-st-charles.
[16] Global Water Intelligence. *Scaling Water Reuse in Industry,* (Global Water Intelligence, 2025), https://www.globalwaterintel.com/documents/scaling-reuse-in-industry.
[17] Eric Olson, Anne Grau, and Taylor Tipton, "Data centers draining resources in water-stressed communities," *The University of Tulsa*, July 19, 2024, https://utulsa.edu/news/data-centers-draining-resources-in-water-stressed-communities/.
[18] Shehabi, Smith, Hubbard, Newkirk, Lei, Siddik, Holecek, Koomey, Masanet, and Sartor, *2024 United States Data Center Energy Usage Report*.
[19] Shebabi, Smith, Hubbard, Newkirk, Lei, Siddik, Holecek, Koomey, Masanet, and Sartor, *2024 United States Data Center Energy Usage Report*.
[20] Shehabi, Smith, Hubbard, Newkirk, Lei, Siddik, Holecek, Koomey, Masanet, and Sartor, *2024 United States Data Center Energy Usage Report*.
[21] Data Center Map, "USA Data Centers."

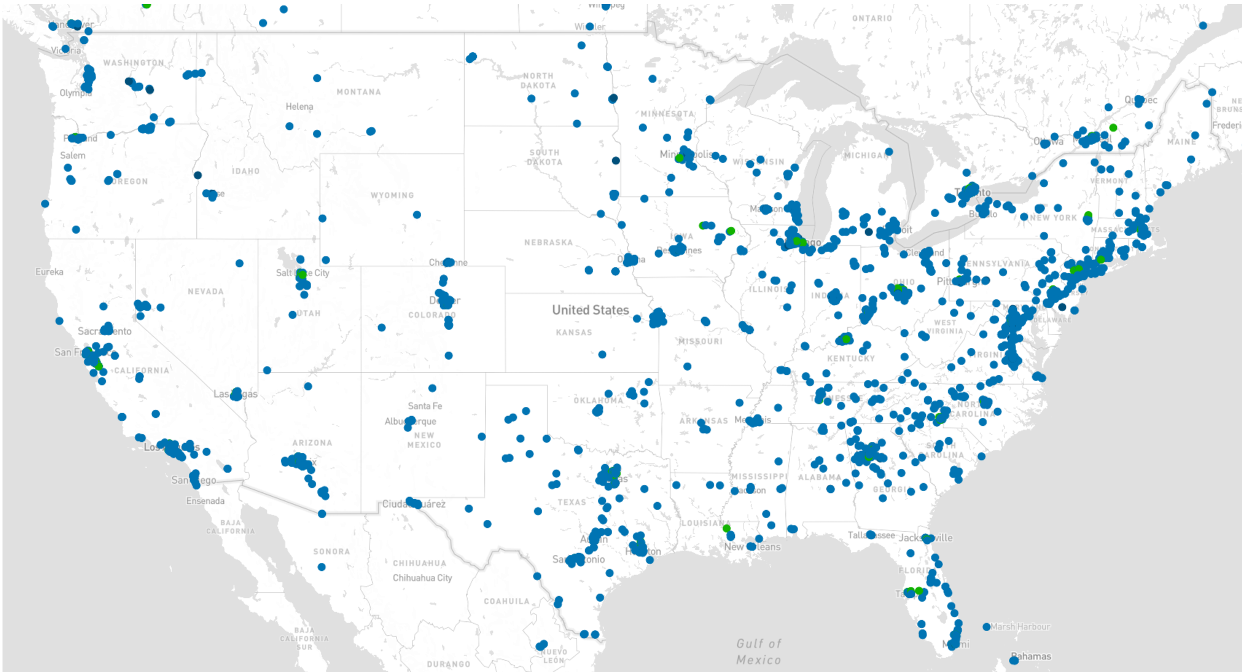

Figure 1. Distribution of Data Centers in the Continental United States[22]

2. What are data centers?

Data centers are physical facilities that house thousands of servers, digital storage equipment, and network infrastructure to support large-scale data processing and storage.[23,24] Servers hosted at data centers perform computations for data used by millions of websites and web services that make up the cloud. Despite minimal potable water needs, data center operations require substantial volumes of water overall for cooling and other operations.[25] By some accounts, up to 57% of water consumed by data centers for cooling has been sourced from potable water, with the rest coming from various other sources such groundwater, surface water, or various forms of reuse or reclaimed water[26].

Like a factory that uses raw materials to make a product, data centers use resources (primarily electricity and water) to run computing and cooling equipment with outputs of data processing, storage, and networking, illustrated in Figure 2. The resource use is local, while the output is used globally.

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[22] "USA Data Centers," Data Center Map, accessed October 10, 2025, https://www.datacentermap.com.
[23] Siddik, Md Abu Bakar, Arman Shehabi, and Landon Marston, "The environmental footprint of data centers in the United States," *Environmental Research Letters* 16, no. 6 (2021): 064017. https://doi.org/10.1088/1748-9326/abfba1.
[24] Stephanie Susnjara and Ian Smalley, "What is a data center?," *IBM Think*, September 4, 2024, https://www.ibm.com/think/topics/data-centers.
[25] Mytton, "Data centre water consumption," 11.
[26] Mytton, "Data centre water consumption," 11.

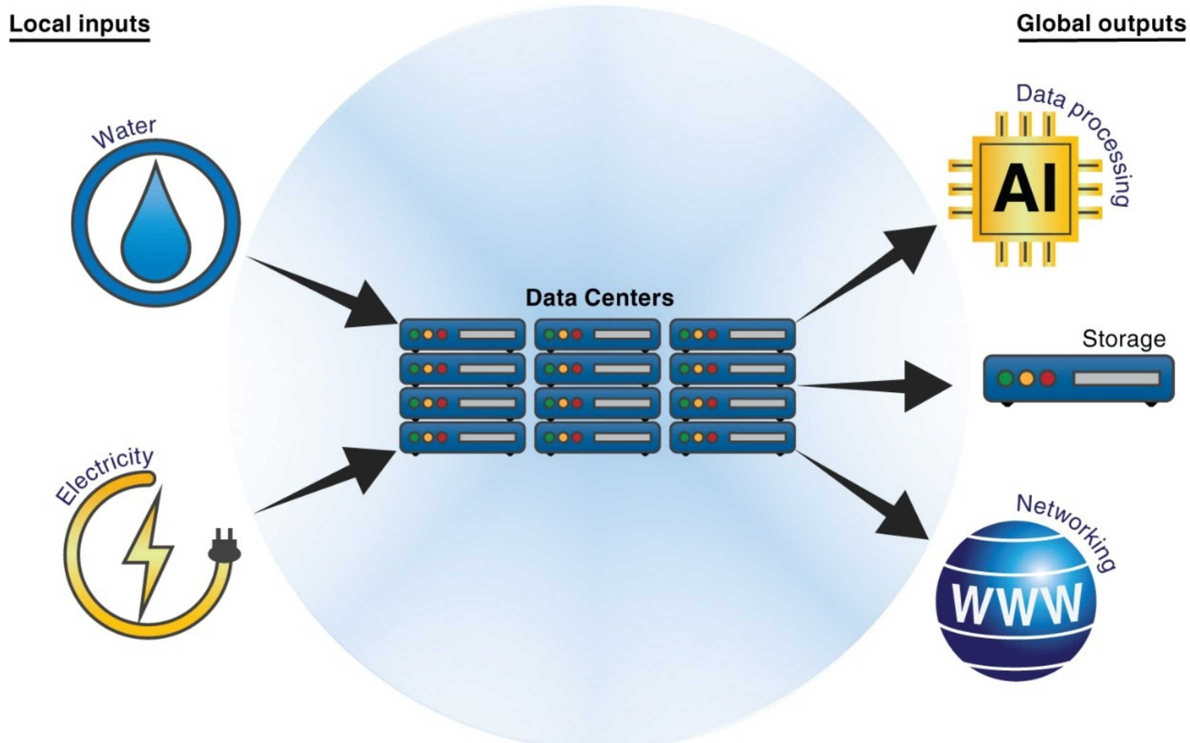

Figure 2. Diagram of Data Center Local Inputs and Global Outputs

The choice of cooling technologies employed throughout the data center, both to remove heat from the individual components and to move heat from the facility to the atmosphere, can greatly impact water and energy consumption. In recent years, liquid-cooling and free-cooling (i.e., using cool ambient temperature air or water to cool equipment) have proven to boast higher cooling effectiveness and energy efficiency. However, this increased energy efficiency may come at the cost of greater water consumption.[27,28]

Just as water utilities have adapted to other industries with significant water impacts, they are well-equipped to respond to the increased siting of data centers. That said, given the rapid pace of change associated with data center development, water utilities will need to adapt quickly to changing data center demands.

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[27] Qingxia Zhang, Zihao Meng, Xianwen Hong, Yuhao Zhan, Jia Liu, Jiabao Dong, Tian Bai, Junyu Niu, and M. Jamal Deen, "A survey on data center cooling systems: Technology, power consumption modeling and control strategy optimization," *Journal of Systems Architecture* 119 (2021): 102253. https://doi.org/10.1016/j.sysarc.2021.102253.
[28] Leila Khatib, Anh Pham, Khaled Ahmed, and Val S. Frenkel, "Data Centers and Water: Challenges and Solutions for Sustainable Cooling," *Journal-American Water Works Association* 117, no. 8 (2025): 48-53. https://doi.org/10.1002/awwa.2504.

3. What are the potential impacts data centers pose to water systems?

While the impacts posed by data centers are site-specific, the most prevalent, anticipated effects include:

- Increased water demand impacting sources or treatment capacity (Section 3.1).
- Stress on water infrastructure (Section 3.2).
- Opportunities to use alternate water supplies (Section 3.3).
- Increased costs (Section 3.4)

Cutting across these concerns is the potential for changes in data center design and operation, technology usage (such as the compression of more computing power into smaller footprints), choices in cooling strategies, and usage patterns. Taken together, these potential changes introduce substantial uncertainty to near- and long-term water and power demand forecasts. While this uncertainty makes it difficult to forecast potential impacts on a broad scale, site-specific analysis can reveal the information needed to make appropriate planning decisions.

3.1 Increased water demand and consumption

Water consumption by data centers currently makes up a small proportion of total water consumption in the United States. Data center water usage is still substantial, however, particularly for those facilities using evaporative cooling systems, and overall demand is only expected to grow. One estimate projects that annual direct water consumption attributed to cooling will have increased from 5.6 billion gallons in 2014 to 73 billion gallons by 2028.[29] But projections vary. For example, another study reported total direct water consumption in 2018 roughly 80% lower than other reports for the same year.[30] A third study examined water usage effectiveness (WUE) metrics, which utilize a ratio of the data center's water use to the electricity use of its information technology (IT) equipment, finding major variations based on which technologies were used.[31] The study demonstrates that the amount of water use for the same unit of digital output can vary by 10,000 times (1,000,000%) due to many factors, including server efficiency, server utilization, electrical grid water consumption considerations, cooling system type, data center infrastructure operating efficiency, and climatic conditions, among other factors.[32] With an enormous range of efficiency among data centers, decisions in the planning phases can have considerable impact on the ultimate resource needs. A data center industry standard metric has been introduced, which measures water use efficiency as liters of water per kilowatt hour of energy use.[33]

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[29] Shehabi, Smith, Hubbard, Newkirk, Lei, Siddik, Holecek, Koomey, Masanet, and Sartor, *2024 United States Data Center Energy Usage Report*.
[30] Siddik, Shehabi, and Marston, "The environmental footprint of data centers in the United States," 064017.
[31] Nuoa Lei, Jun Lu, Arman Shehabi, and Eric Masanet, "The water use of data center workloads: A review and assessment of key determinants," *Resources, Conservation and Recycling 219* (2025), 108310. https://doi.org/10.1016/j.resconrec.2025.108310.
[32] Lei, Lu, Shehabi, and Masanet, "The water use of data center workloads: A review and assessment of key determinants," 108310.
[33] The Green Grid. *Data Center Resource Effectiveness (DCRE) Metric*, White Paper 93 (The Green Grid, 2025), https://www.thegreengrid.org/resources/library-and-tools/wp93-data-center-resource-effectiveness-dcre-metric.

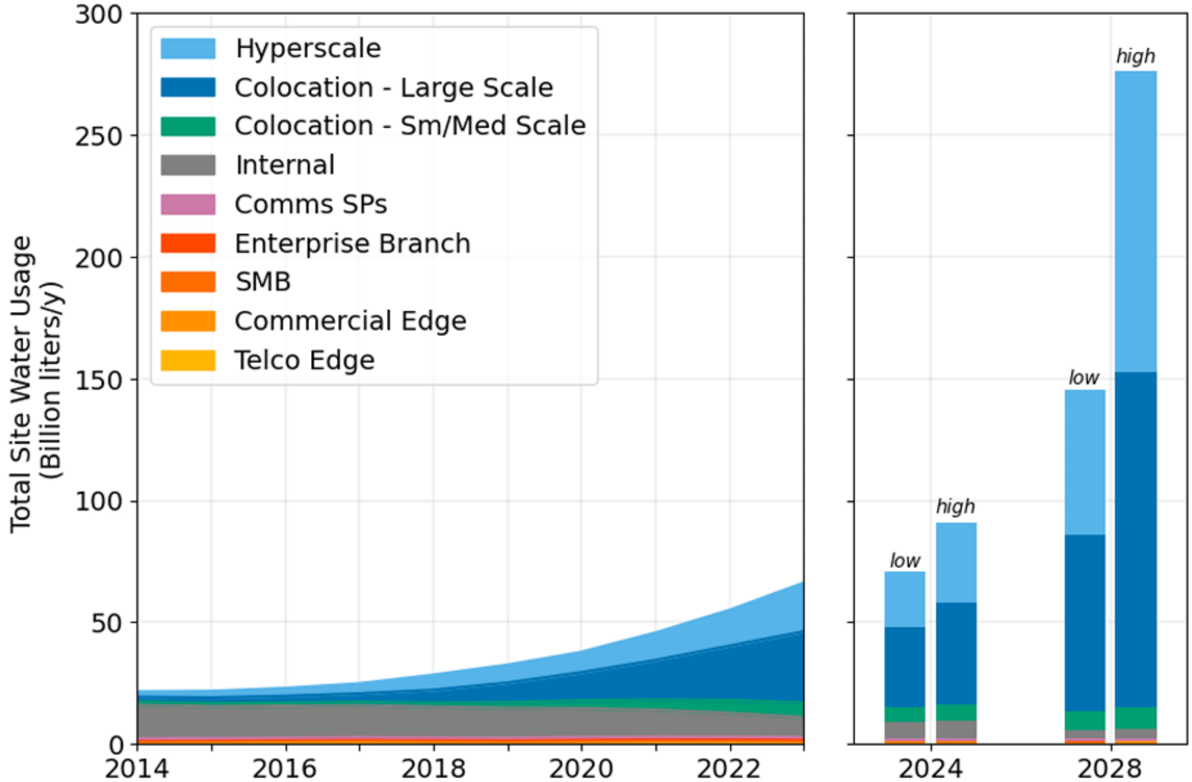

Figure 3. Historic and Anticipated Water Use by Data Center Type[34]

As Figure 3 demonstrates, substantial increases in water consumption are anticipated over time as the digital infrastructure industry continues to expand. Utilities with data centers proposed in their service territories will need to account for rapid growth in water consumption to avoid supply-related issues. For instance, an early 2025 media report suggests that Warrior River Water Authority in Bessemer, Alabama may face potential challenges supplying adequate volumes of water to a proposed hyperscale data center.[35] The utility, which is estimated to have a supply capacity around 6 million gallons per day, has stated that it would struggle to provide the requested water flow of 2 million gallons per day to the data center without "significant upgrades to the existing water system".[36]

Peak water demand from data centers can be significant and may follow different patterns of water consumption than other residential and commercial uses. This is because demand is typically tied to the level of electricity use. Clustering of data centers can exacerbate the challenge of planning for peak water demand, particularly in instances where there are concurrent demands from other sectors or limits in available supply (e.g., drought). Other environmental impacts — such as maintaining ecosystem health and baseflow to streams, impacts to nearby water bodies, and changes to groundwater levels — may also be important considerations.

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[34] Shehabi, Smith, Hubbard, Newkirk, Lei, Siddik, Holecek, Koomey, Masanet, and Sartor, *2024 United States Data Center Energy Usage Report*.
[35] Lee Hedgepeth, "Utility Says It Can't Meet Demand for Alabama Data Center Without 'Significant Upgrades'," Inside Climate News, July 12, 2025, https://insideclimatenews.org/news/12072025/bessemer-alabama-water-utility-data-center-upgrades/.
[36] Hedgepeth, "Utility Says It Can't Meet Demand for Alabama Data Center Without "Significant Upgrades'."

Water demand can impact potable water, reuse, and wastewater infrastructure depending on the existing design of the utility.[37] Examples include reaching treatment capacity or exceeding transmission capacity. Even if the utility has sufficient treatment capacity overall, the appropriate transmission and distribution infrastructure may not be in place for the needs of the data center(s) when they are first proposed for siting. These key considerations are illustrated in Figure 4.

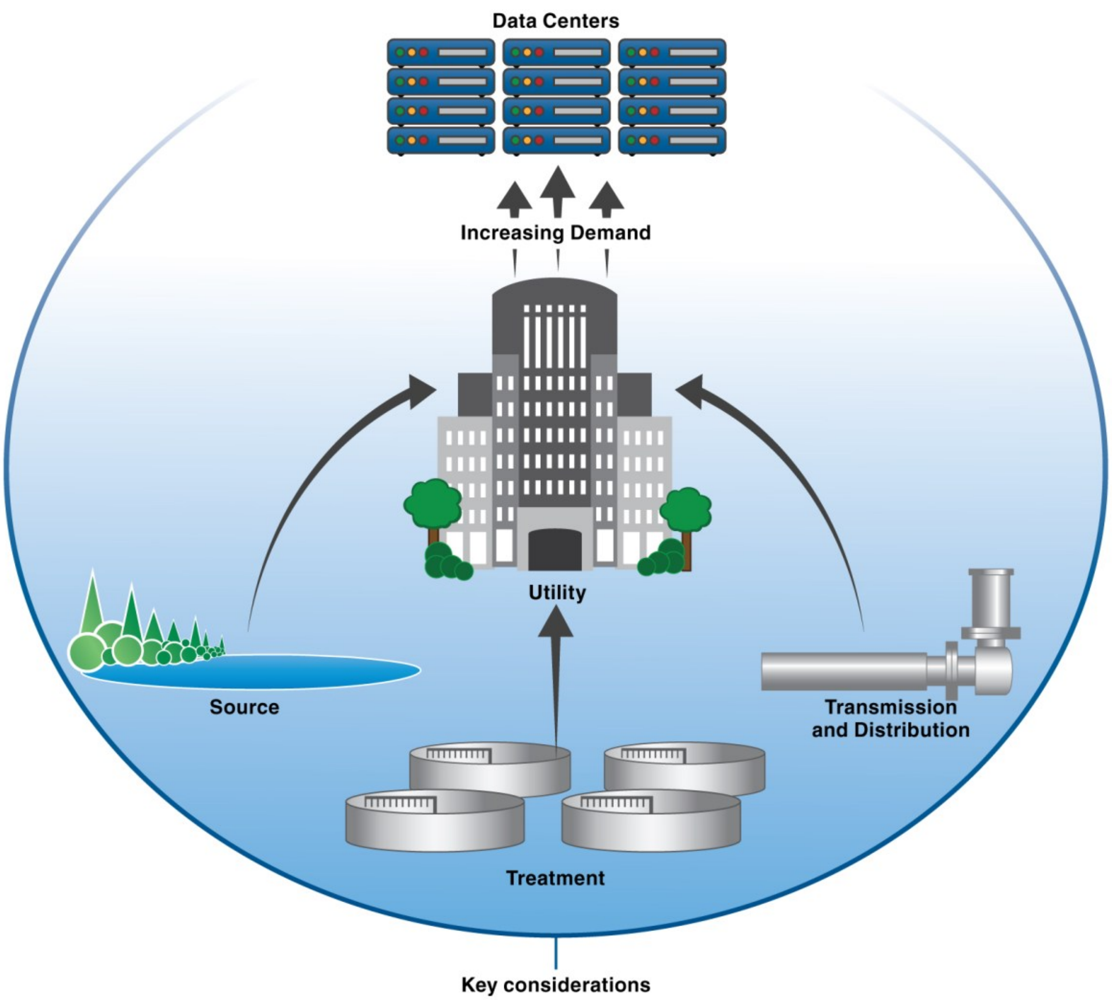

Figure 4. Key Water Utility Considerations for Data Center Demand

It is essential that data center developers and local water systems communicate early in the planning process, while also coordinating with regional water planning authorities as appropriate, to ensure sufficient capacity exists or can be created when it is needed. Ongoing coordination is also critical to addressing operational considerations.

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[37] Alex Setmajer, "How Data Centers Use Water, and How We're Working to Use Water Responsibly," *Equinix*, September 19, 2024, https://blog.equinix.com/blog/2024/09/19/how-data-centers-use-water-and-how-were-working-to-use-water-responsibly/.

With thoughtful preparation, data centers or campuses can be designed to integrate into local water infrastructure. Considerations include:

- Proximity to existing or planned recycled water production and distribution pipelines.
- Installation of on-site water storage to reduce peak demands on community infrastructure.
- Choice of cooling systems installed.
- Siting choices that use existing or planned capacity.

An example of a forward-thinking utility planning process addressing data centers is discussed in the call-out box below.

Planning for the Future: Aurora Water, Colorado

Aurora Water in Colorado has developed a *Large Water User Guide*, which specifically addresses high-demand developments such as data centers.[38] The guide establishes criteria for both volumetric water use and non-recoverable consumption, setting thresholds between 500 and 3,000 gallons per acre per day based on a project's recoverable water volume. These guidelines serve a dual purpose: not only do they help evaluate potential strain on the city's water infrastructure, but they also ensure that extremely high water use applications are discouraged in Aurora's arid climate, where long-term water availability is a critical concern. By aligning water demand with the city's sustainable supply and growth projections, the guide supports responsible development that protects current and future water customers. In 2025, these standards were formally codified in the Aurora City Code, reinforcing their role in the city's long-range planning framework.

3.2 Strains to infrastructure and resiliency

In instances where the total amount of water use from data centers does not cause strain on the source or treatment capacity, other infrastructure and resilience concerns could still exist. Data centers are often built in places where land can be acquired affordably, well outside the core of a water system's transmission system, which can create transmission and distribution challenges. The potential for rapid development compounds this issue. The time needed to build a data center can be shorter than the time needed to create water infrastructure to support it (e.g., planning, permitting, design, and construction). Similar challenges can arise when securing electrical generation and transmission infrastructure. Uncertainty regarding whether and when data center development will occur also presents challenges for securing financing for infrastructure upgrades.

Utilities will need to approach long-term planning thoughtfully to provide sufficient treatment, transmission, and distribution to handle increases in water demand, ensuring resilient, uninterrupted water supply to support current and future operations. At the same time, utilities should be sure not to overbuild new infrastructure in response to this demand, which can ultimately result in stranded assets, if, for example, data centers move to technologies that require significantly less water.

In their long-term planning processes, water utilities should recognize that rapid changes in technology could impact data centers and thus water demand. For instance, changes in hardware used at data

[38] Aurora Water, *Appendix F: Large Water Users Guide* (Aurora Water, 2025), https://cdnsm5-hosted.civiclive.com/UserFiles/Servers/Server_1881137/File/Business%20Services/Development%20Center/Water%20&%20Other%20Utilities/2025/2025%20Water%20Sewer%20Drainage%20Standards/Appendix%20F%20Large%20Water%20Users%20Guide.pdf.

centers may generate less heat, requiring less cooling and therefore less water and electricity consumption. Changes in cooling technologies could have a similar impact. Conversely, technology also may change to allow more equipment in the same space, which could increase cooling needs and thus water demand.

3.3 Water supply alternative opportunities

Data centers may use community potable water for cooling; they may also provide their own water through groundwater wells or a nearby surface water source, requiring them to comply with state and local regulations. In other situations, utilization of centralized water reuse has proven to be a useful alternative to potable water to meet data centers' water needs. For example, Loudoun Water employs a reuse loop using treated wastewater effluent to deliver to nearby data centers.[39] Despite this success, the growth in requests for Loudoun Water's reuse water is expected to exceed supply. While the use of reclaimed water can help reduce potable water demand, data center development may still outpace capacity, resulting in additional potable demand.

Successful reuse implementation requires appropriate infrastructure, supply, and management of quality concerns. However, alternative sources may be of limited benefit in arid regions of the country where reclaimed supplies are already needed to help sustain or offset potable uses.

While data centers require certain water quality parameters, these expectations are generally achievable by water utilities. For incoming water to data centers, water with low scaling corrosion — typical for cooling systems — is ideal. More specifically, the following water quality conditions are typically required:

- Low hardness (100 mg/L as $CaCO_3$ or less)
- Moderate alkalinity (50-100 mg/L as $CaCO_3$ or less)
- Slightly elevated pH to reduce corrosivity (7.5-9)
- Chlorides < 50 mg/L
- Phosphates for corrosion control and sequestration[40]

While these parameters are typical, water quality needs may vary depending on data center facility design. For instance, cooling assets with higher grade materials will accommodate greater chloride concentrations. Data centers may include their own pretreatment systems to maximize water use efficiency, guarantee consistent quality from a source prone to variation, or meet more stringent needs for advanced cooling methods. Those incorporating on-site reuse may also tolerate higher source water concentrations when blending with recycled water of greater purity.

Water discharged from data centers typically exhibits high conductivity, elevated total dissolved solids (TDS), and increased concentrations of salts such as sodium and chloride. As data centers increasingly adopt internal water reuse practices to reduce consumption, the concentration of TDS in the resulting

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[39] "Reclaimed Water Program," Loudoun Water, accessed September 15, 2025, https://www.loudounwater.org/commercial-customers/reclaimed-water-program.

[40] American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) Technical Committee 9.9, Mission Critical Facilities, Data Centers, Technology Spaces and Electronic Equipment, *Water-Cooled Servers: Common Designs, Components, and Processes* (ASHRAE, 2019), https://www.ashrae.org/file%20library/technical%20resources/bookstore/whitepaper_tc099-watercooledservers.pdf.

effluent often rises, posing additional challenges for wastewater treatment processes.[41] However, salinity is not solely a wastewater treatment concern. Across the United States, rising salinity in both surface and groundwater supplies is emerging as a significant long-term issue, complicating drinking water treatment, reducing agricultural usability, and accelerating infrastructure corrosion. As such, any activity — including data center operations — that contributes additional salinity to water systems should be carefully evaluated for its cumulative and long-term impacts on regional water quality and treatment capacity. Elevated salinity and temperature of discharged water should also be taken into consideration from an ecosystem health perspective, as high salinity and thermal pollution may pose risks to receiving aquatic ecosystems.[42]

3.4 Increased costs

With increasing water consumption from data centers, residential customers and advocates may be concerned that their water bills will rise. Fortunately, rate-setting practices at water systems have adjusted to the unique characteristics of different industries in their service areas for a long time. In the flagship AWWA manual of practice *Principles of Water Rates, Fees and Charges* (known as "M1"), there are detailed explanations about creating different customer classes for water users with unique needs and allocating costs based upon their characteristics (chapters III.1-III.2).[43] Likewise, methods for calculating connection charges and system development charges (i.e., costs to account for the impacts to the system the connection has) are also presented (chapters VII.1-VII.2). Although data centers may present unique challenges in some respects, much of the knowledge regarding rate-setting practices already exists, although it will need to be applied in differently and more quickly than in cases of typical water system growth.

However, rates are only one part of the equation. For high-demand users like data centers, tap fees and system development charges must be structured to fully recover the true cost of service**,** both in terms of infrastructure capacity and water resource acquisition. These fees are intended to ensure equity among customer classes by requiring new developments to pay the share of the cost burden they introduce. Yet, in the pursuit of economic development, municipalities may be tempted to offer incentives — such as reduced or waived tap fees — to attract data center investment. While such incentives may appear to offer short-term economic gains, they risk shifting costs onto other users, disproportionately impacting lower-volume residential and commercial customers. In regions like Colorado, where water rights are scarce and expensive — sometimes accounting for up to 80% of a tap fee — this issue becomes even more critical. Allowing data centers to acquire their own water rights outside of utility-controlled planning frameworks may offer an appealing workaround on paper, but it can drive up the market cost of water for municipalities and districts, as private industry is often able to outbid public entities. In the long term, this can undermine coordinated water supply planning and increase the financial burden on existing ratepayers. Ensuring that data centers equitably participate in covering both capacity and resource costs is essential for preserving the financial and hydrological sustainability of water systems.

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[41] Rasheed Ahmad, "Engineers often need a lot of water to keep data centers cool," Civil Engineering, March 4, 2024, https://www.asce.org/publications-and-news/civil-engineering-source/civil-engineering-magazine/issues/magazine-issue/article/2024/03/engineers-often-need-a-lot-of-water-to-keep-data-centers-cool.

[42] Khatib, Pham, Ahmed, and Frenkel. "Data Centers and Water: Challenges and Solutions for Sustainable Cooling," 48-53.

[43] Woodcock, C, R. Giardina, T. Cristiano. 2017. M1, principles of water rates, fees, and charges, seventh edition. American Water Works Association. ISBN 9781625761910. https://store.awwa.org/M1-Principles-of-Water-Rates-Fees-and-Charges-Seventh-Edition.

4. What are the energy-related impacts?

In addition to their direct impacts to water utilities, data centers can also have indirect impacts to the water sector because of their substantial electricity demand. Challenges that can result include:

- Grid instability.
- Increased electricity costs borne by water utilities.
- Risks to resiliency and long-term planning.

Data center growth projections show continued increases in demand on electric transmission systems, with one source estimating that data centers account for roughly 4.5% of total electricity consumption in the United States.[44] The *2024 United States Data Center Energy Usage Report* developed a range of scenarios of future data center energy demand through 2028, which indicate energy consumption estimates for data centers ranging from 325 to 580 terawatt-hours (TWh) in 2028.[45] The report estimates that, based on the assumption of an average capacity utilization rate of 50%, the annual energy use range would translate to a total power demand between 74 and 132 GW, representing 6.7% to 12% of total U.S. electricity consumption forecasted for 2028.[46] Estimated national consumption of electricity from data centers is projected to rise from 4% in 2024 to 4.6-9.1% by 2030, per an Electric Power Research Institute (EPRI) paper.[47]

Because their operations require such considerable amounts of electricity, data centers in high concentrations can cause electrical grid instability. For example, a series of publicized incidents in Virginia occurred where routine fault-protection actions by the grid operator caused dozens of data centers to simultaneously switch to backup power despite the grid remaining online.[48] Though electric service was not interrupted, the rapid drop in electricity demand resulted in overvoltage and nearly triggered widespread outages in the area.[49] Electricity interruptions can have major impacts on water utilities, and if the disruptions were to be widespread, recovery might take longer than expected. Thus, water utilities should regularly evaluate how their operations would be impacted from grid interruptions and take action to reduce risks, regardless of the level of data center activity.[50] Actions could include dual-feeds or dedicated protected lines for electricity supply, on-site backup generation, and increased storage.

Data centers also have considerable indirect water use associated with power generation. Water consumption for electric generation can vary considerably based on several factors, including fuel type,

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44 Neil Kolwey and Howard Geller, *Data centers: Power needs and clean energy challenges* (Southwest Energy Efficiency Project, 2025), https://www.swenergy.org/directory/data-centers-power-needs-and-clean-energy-challenges/.
45 Shehabi, Smith, Hubbard, Newkirk, Lei, Siddik, Holecek, Koomey, Masanet, and Sartor, *2024 United States Data Center Energy Usage Report*.
46 Shehabi, Smith, Hubbard, Newkirk, Lei, Siddik, Holecek, Koomey, Masanet, and Sartor, *2024 United States Data Center Energy Usage Report*.
47 EPRI, *Powering Intelligence: Analyzing Artificial Intelligence and Data Center Energy Consumption*, Report 000000003002028905 (EPRI, 2024), https://www.epri.com/research/products/3002028905.
48 Tim McLaughlin, "Big Tech's data center boom poses new risk to US grid operators," *Reuters,* March 19, 2025, https://www.reuters.com/technology/big-techs-data-center-boom-poses-new-risk-us-grid-operators-2025-03-19/.
49 McLaughlin, "Big Tech's data center boom poses new risk to US grid operators."
50 There are many resources available to assist utilities with this issue. One example is AWWA's "Emergency Power Source Planning for Water and Wastewater" at https://store.awwa.org/Emergency-Power-Source-Planning-for-Water-and-Wastewater.

technology, location, and plant efficiency. One source estimates the total indirect water footprint of data centers in the United States at nearly 211 billion gallons in 2023.[51] Another source estimates that in 2018, indirect water consumption attributed to electricity demand was roughly 101 billion gallons.[52] The same study indicates that about 75% of data centers' water footprint is indirect water consumption, which includes both electricity generation and electricity consumption of utilities servicing data centers.[53] Sourcing electricity from less water-intensive energy sources, including wind and solar, can help data centers reduce their indirect consumption.[54] The impacts felt locally from data center indirect water use can range from none to significant, depending on whether the indirect use does or does not impact the local sources.

Additionally, electric infrastructure costs can adversely impact the rates of both residential and commercial/industrial electrical customers, including water utilities themselves. This is especially relevant for electrical load peaking, as it may require considerable new infrastructure whose cost may be distributed across other types of customers. Some states have adopted more stringent requirements for data centers to source power supply in response to concerns that the additional load may result in rate increases for other customers.[55] For instance, in March 2025, the Utah Senate passed S.B. 132, which includes provisions intended to prevent incremental costs of large energy load requirements to be paid by the consumer, requiring instead that the large user address those costs.[56]

The energy-related challenges posed by the rapid growth of data centers cannot be overstated. Some of those challenges are beyond the scope of what water utilities will likely encounter, but it is nevertheless beneficial to remain aware of these issues as some will have direct and indirect impacts on water utilities and the management of water resources.

5. How are data centers regulated?

There is no overarching regulator of data centers in the United States. Rather, data center developers and operators must, like other industries, comply with an array of regulations covering different aspects of their design, construction, and operation. For siting, design, and construction, data centers must be responsive to state and local zoning, land-use planning, building codes, fire codes, noise limitations, and similar requirements, some of which apply to all industrial entities and some which may be unique to this sector.[57,58] The formality of such requirements is not standardized. In other parts of the world, there are

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[51] Shehabi, Smith, Hubbard, Newkirk, Lei, Siddik, Holecek, Koomey, Masanet, and Sartor, *2024 United States Data Center Energy Usage Report*.
[52] Siddik, Shehabi, and Marston, "The environmental footprint of data centers in the United States," 064017.
[53] Siddik, Shehabi, and Marston, "The environmental footprint of data centers in the United States," 064017.
[54] Khatib, Pham, Ahmed, and Frenkel. "Data Centers and Water: Challenges and Solutions for Sustainable Cooling," 48-53.
[55] Gibson Dunn, "When Data Center Developers Have Options, State Regulatory Treatment Is Key to Success," March 17, 2025, https://www.gibsondunn.com/when-data-center-developers-have-options-state-regulatory-treatment-is-key-to-success/.
[56] Gibson Dunn, "When Data Center Developers Have Options, State Regulatory Treatment Is Key to Success."
[57] Bill Kosik, John Peterson, Brian Rener, Mike Starr, Tarek G. Tousson, Saahil Tumber, and John Gregory Williams, "Data centers achieve a new level of high-tech: Codes and standards," *Consulting – Specifying Engineer,* April 27, 2020, https://www.csemag.com/data-centers-achieve-a-new-level-of-high-tech-codes-and-standards/.
[58] Christopher Tozzi, "Land Barriers: How Zoning Regulations Could Stall Data Center Industry Expansion," *Data Center Knowledge*, January 10, 2025, https://www.datacenterknowledge.com/regulations/land-barriers-how-zoning-regulations-could-stall-data-center-industry-expansion.

emerging national frameworks. The European Union, for example, intends to protect against water shortages by proposing minimum performance standards for data centers by the end of 2026.[59]

For the operation of the data center itself, there are an array of requirements for how the data center processes, stores, and transmits data, impacting information security and privacy protection. These are imposed by regulation, customer requirements, and/or industry standards.[60] Although compliance is not likely to meaningfully alter how data centers expend their resources, addressing these requirements is likely to be paramount to the data center operator. Additionally, data centers are increasingly becoming targets for cyberattacks. As such, taking measures to protect against such attacks is likely to become a driver for the industry.[61]

At least 17 U.S. states have proposed or adopted laws or regulations that apply to data centers; these policies primarily focus on such areas as utility regulation, energy efficiency, energy standards, zoning and permitting, and rate structures.[62] By contrast, fewer states have proposed or adopted laws or regulations with impacts to reporting and/or optimization of water consumption at data centers. Examples of state policies that have sought to regulate water usage at data centers include the following:

- The New York Senate introduced S.B. S6394A during its 2025-26 session, which would require data centers to disclose the amount of water projected to be used on an annual basis.[63]
- The New Jersey Senate introduced S.B. S4143 during its 2024-25 session, which would require data centers to optimize water usage to minimize impacts to drinking water and the environment.[64]
- Minnesota's H.F. 16 was signed into law in June 2025. It requires a pre-application evaluation for projects that propose to consume in excess of 100 million gallons per year and stipulates water use permit conditions.[65]

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[59] John Ainger, "EU will work on setting water use caps for thirsty data centers," *Bloomberg*, May 15, 2025, https://www.bloomberg.com/news/articles/2025-05-15/eu-will-work-on-setting-water-use-caps-for-thirsty-data-centers.

[60] Kostic, N. 17 December 2024. Data Center Compliance and Regulations Explained. PhoenixNAP. https://phoenixnap.com/blog/data-center-compliance.

[61] *Broadband Breakfast,* "Dateline Ashburn: How to Break the Internet," September 5, 2025, https://chat.broadbandbreakfast.com/c/news/dateline-ashburn-how-to-break-the-internet-d8343d04-5123-49ac-a1c3-d0c632f555c3.

[62] North Dakota Legislative Council, "State-by-State Data Center Regulation," accessed September 19, 2025, https://ndlegis.gov/sites/default/files/resource/research-document/state-by-state-data-center-regulation-january-2025.pdf.

[63] New York State Legislature, Senate, Senate Bill S6394A, 2025-2026 Legislative Session, introduced in Senate March 13, 2025, https://www.nysenate.gov/legislation/bills/2025/S6394/amendment/A.

[64] New Jersey Legislature, Senate, Bill S4143, Session 2024-2025, introduced in Senate March 17, 2025, https://www.njleg.state.nj.us/bill-search/2024/S4143/bill-text?f=S4500&n=4143_S1.

[65] Minnesota Legislature, House, HF 16, 94th Legislature, 2025 1st Special Session, introduced in House June 17, 2025, https://www.revisor.mn.gov/bills/text.php?number=HF16&version=latest&session=ls94&session_year=2025&session_number=1.

- The Connecticut General Assembly introduced S.B. 1292 and H.B. 5076 during its 2025 session, which would require data centers to report information on water usage and establish water efficiency performance standards.[66,67]
- The California Senate introduced A.B. 93 during its 2025-26 session, which would require data centers to provide an estimate of expected water use.[68]
- Virginia's Joint Legislative Audit and Review Commission issued recommendations that the General Assembly consider amending state code to authorize local governments to require data center developments to provide water use estimates and consider water use when making rezoning and special use permit decisions.[69]

Some states lack policies that explicitly regulate data centers but have water management laws or regulations that may apply to data centers. For instance, in Missouri, major water users (i.e., entities capable of producing 100,000 gallons per day, or about 70 gallons per minute, including all wells or surface intakes) are legally required to register and report water usage to the Missouri Department of Natural Resources.[70] Similarly, Iowa law stipulates that any user withdrawing more than 25,000 gallons of water per day from any groundwater or surface water source must obtain a water use permit.[71] Massachusetts also regulates large water users (i.e., entities withdrawing more than 100,000 gallons) under the Massachusetts Water Management Act.[72] These laws would likely result in registration and reporting for a data center only if the facility was obtaining water directly from a groundwater or surface water source, as opposed to indirectly through a water utility. In Arizona, several large municipalities have passed ordinances to regulate large water users. Notably, the town of Marana, Arizona has an ordinance that stipulates that the water department will not deliver potable water to data centers for their cooling, humidity control, or other similar operational uses; in these cases, the developer must identify an alternative water source.[73] Southern Nevada Water Authority instituted a ban on new installations of evaporative cooling in industrial and commercial settings in 2021, which includes data centers[74].

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66 State of Connecticut General Assembly, Senate, *An Act Concerning Energy and Water Efficiency Requirements for Artificial Intelligence Data Centers*, Raised Bill No. 1292, January Session, 2025, introduced in Senate April 7, 2025, https://www.cga.ct.gov/2025/TOB/S/PDF/2025SB-01292-R00-SB.PDF.

67 State of Connecticut General Assembly, House, *An Act Concerning Energy and Water Efficiency Requirements for Artificial Intelligence Data Centers*, Proposed Bill No. 5076, January Session, 2025, introduced in House January 10, 2025, https://www.cga.ct.gov/2025/TOB/H/PDF/2025HB-05076-R00-HB.PDF.

68 California Legislature, Assembly, 2025 CA A 93, 2025-2026 Regular Session, introduced in Assembly January 7, 2025, https://custom.statenet.com/public/resources.cgi?mode=show_text&id=ID:bill:CA2025000A93&verid=CA2025000A93_20250709_0_A&.

69 Joint Legislative Audit & Review Commission, "Data Centers in Virginia."

70 "Major Water User Registration," Missouri Department of Natural Resources, accessed September 17, 2025, https://dnr.mo.gov/water/business-industry-other-entities/reporting/major-water-users/registration.

71 "Water Allocation & Use," Iowa Department of Natural Resources, accessed September 17, 2025, https://www.iowadnr.gov/environmental-protection/water-quality/water-supply-engineering/water-allocation-use.

72 *Massachusetts Water Management Act*, MA Gen L ch 21g § 1 (2022). https://malegislature.gov/Laws/GeneralLaws/PartI/TitleII/Chapter21G.

73 Arizona State University (ASU) Kyl Center for Water Policy at Morrison Institute, *How Arizona Municipal Water Providers are Regulating Large-Volume Water Users* (ASU, 2025), https://morrisoninstitute.asu.edu/sites/g/files/litvpz841/files/2025-09/Large-Volume%20Water%20User%20Ordinances%20090525_revised2.pdf.

74 "Understand laws and ordinances" Southern Nevada Water Authority, accessed October 1, 2025. https://www.snwa.com/conservation/understand-laws-ordinances/index.html.

Many states, including 36 that offer some form of tax incentive, actively promote new data center development.[75] These laws differ in the type of tax exemption offered, period of time covered by the incentive, eligible entities, investment thresholds, and the types of expenditures or other items covered by the legislation. In addition to covering construction and IT equipment, tax exemptions in some states also cover electricity, cooling infrastructure, and data center end-users.[76]

6. What can utilities do if expecting data center development?

Utilities should prepare for data center development through rigorous assessment, early engagement, and careful follow-through. In all instances, understanding the local conditions is essential and may warrant different or additional considerations than those suggested here.

First, remember that as the local water utility, you know the capabilities and limitations of your system, although you may not immediately have the answer to every possible question. To address potential challenges and take advantage of the benefits of data centers in your service territory, advanced planning is critical.

The following considerations can help guide a planning process around potential development of data centers in your area:

1. *Consider coordinating in your region*: Coordinate with state and regional water planners and other utilities in your watershed to discuss regional water capacity limits and holistic impacts to your watershed. Ask your community economic development team to consult with your utility early in the process when evaluating data center siting options. There are a number of potential policies that can ensure that water resource concerns are heard early in the development process, and by being looped in early in the process, the developer will be much more likely to be able to make meaningful design changes (such as adding non-evaporative cooling systems) should a concern be identified.
2. *Consider your source:* Whether groundwater, surface water, nontraditional sources or any combination of waters, every source has capacity limits. Limitations may derive from regulatory requirements, pure availability, or some other reason. For states with complex water rights and/or withdrawal permit limits, even if the source can theoretically support additional capacity, there may be other limitations. Always account for other anticipated changes in demand. Consider future water use needs, accounting for potential growth and permit allocations.
3. *Consider your treatment capacity:* For either drinking water or reuse water, there will be limits on how much additional treatment can be added. In some systems, there may be considerable reserve treatment capacity or a built-in ability to increase it in the future, whereas other systems may already

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[75] Jake Remington and Rod Carter, "An Overview of State Data Center-Related Tax Incentives," *Development*, Winter 2024/2025 Issue, https://www.naiop.org/research-and-publications/magazine/2024/Winter-2024-2025/development-ownership/an-overview-of-state-data-center-related-tax-incentives/.
[76] Farney, "Incentivizing the Digital Future: Inside America's Face to Attract Data Centers," *Data Center Frontier,* August 5, 2025, https://www.datacenterfrontier.com/site-selection/article/55307797/incentivizing-the-digital-future-inside-americas-race-to-attract-data-centers.

be approaching limits. Adding additional treatment capacity is usually a long-term process that involves considerable capital investment.

4. *Consider your transmission and distribution:* Even if the source and treatment infrastructure are adequate, data centers will likely seek land that is affordable. Transmission and distribution systems may not be in place or be sufficient to meet the needs at the chosen location. Proactively identify areas in your distribution system that can support demand from data center development and be prepared to explain limitations and challenges with less ideal locations.

5. *Consider impacts on other customers*: Changes to one area of the system can have positive and/or negative effects on other areas. Consider whether addressing a data center's needs may improve resilience or capacity for others, or whether doing so may indirectly limit future growth to other parts of the system or impose new costs to existing customers. What can be done to limit adverse impacts?

6. *Consider the financials:* Addressing these challenges will be complex and involve considerable resources. Unlike overall incremental system growth where costs are relatively evenly spread across the customer base, if upgrades are needed to accommodate a single customer or cluster of customers, the responsibility to pay may fall to that much smaller customer group.

7. *Consider alternatives:* If any aspect of a possible plan seems overly difficult, expensive, or time-consuming, are there different approaches by which to accomplish the same goal? Consider requiring alternative lower/zero water-use cooling systems, a variety of sources (including reuse), and different approaches that the customer might employ (internal reuse, for example, to lower total demand).

8. *Consider contingencies:* Even given the best laid plans, things can go wrong. Consider various contingencies such as drought, power outages, and other disruptions. Do these events potentially change the plan, or do you need to develop new procedures to address them? What should you do if key information, such as the data center's water and electricity use, is unknown until a later stage in the development process?

Ideally, these many questions are addressed ahead of any formal announcements or commitments to construct a data center. However, these considerations can also be examined after a decision has been made. In such cases, the timeline is likely to be compressed, but the process will be better informed in terms of where the data center will be built and the anticipated water consumption. The call-out box below presents potential ideas for facilitating information exchange between the utility and data center developers. Exchanging this information will allow for a more specific assessment of potential impacts to source, treatment, infrastructure, finances, and other aspects of utility operation, and builds trust through collaboration. The utility can then work with the data center developer to ensure that concerns are adequately addressed and that the developer and operator are able to pay for any necessary upgrades to address their needs. If the data center's needs exceed the utility's ability to meet them, necessary modifications can be discussed to ensure all parties have appropriate expectations and only feasible service commitments are made. Figure 5 illustrates these eight considerations.

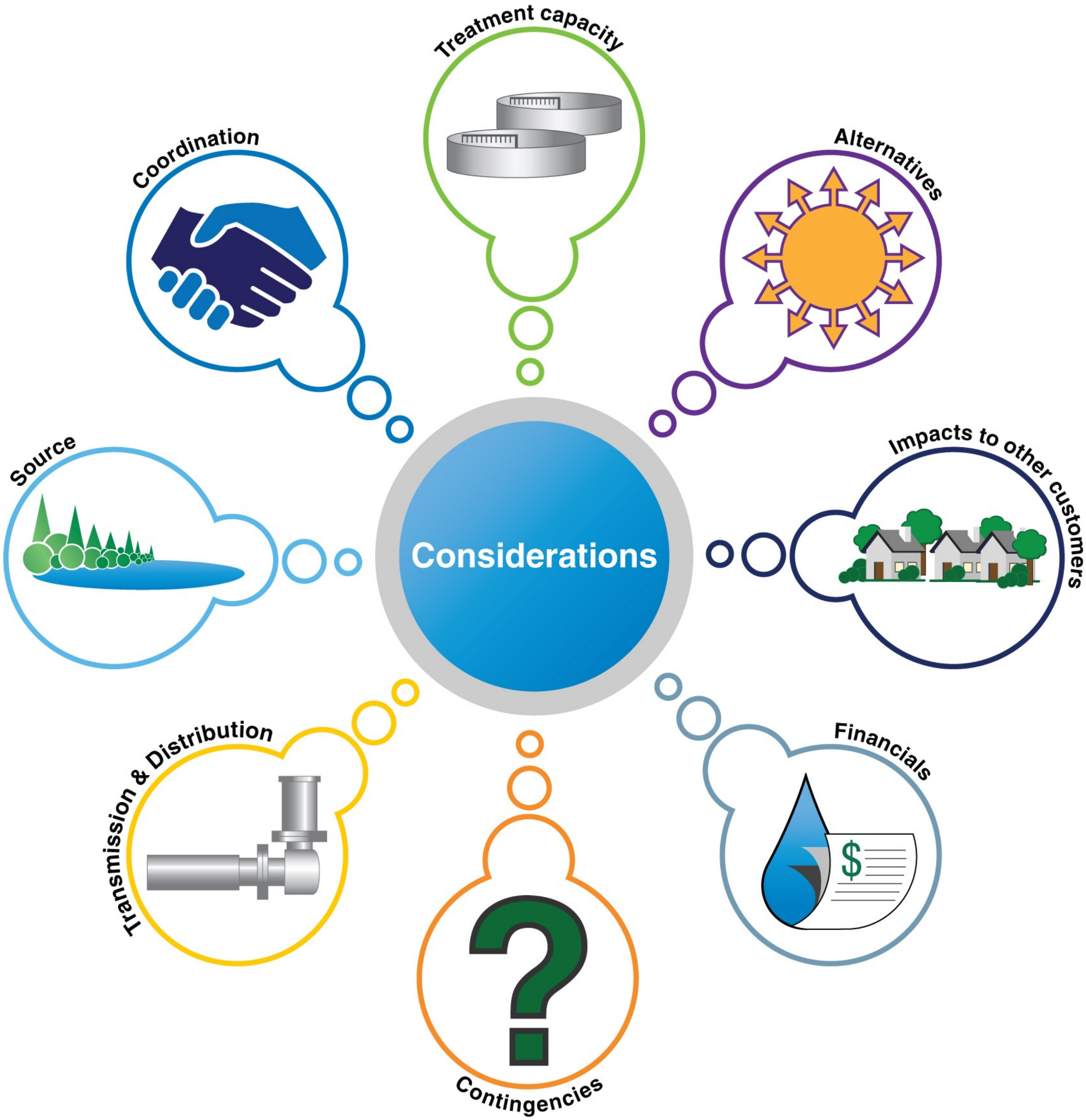


Figure 5. Water Utility Planning Considerations for Data Center Development

Ideas for Utility and Data Center Developer Information Exchange

Information the utility should be ready to provide:
• Maps showing distance to available infrastructure from the proposed site(s) as well as pipe sizes, available pressures, and capacities. • System's total available capacity. • Relevant future upgrades already anticipated by the system regardless of the data center development. • Upgrades that may be required to the system because of the anticipated data center development.
Information the utility should request:
• What is the cooling strategy for the data center? • What is the anticipated maximum day demand and average day flow? • What is the anticipated instantaneous demand? • What is the anticipated monthly use profile? • What is the estimated commissioning date? • What is the estimated ramp up/buildout schedule?

To effectively integrate data centers into areas with existing water systems, utilities may need to establish or update clear and predictable review processes for new, large service connections. These processes ideally would require potential new large water users to submit comprehensive information upfront, prior to approval to begin construction. This includes detailed projections of water demand — both average and peak usage — with expected variability over time (e.g., daily or seasonal maximum and minimum usage), anticipated discharge volumes, and water quality characteristics of any returned flow. Understanding these parameters early allows utilities to assess infrastructure impacts, resource availability, and treatment needs more accurately. Moreover, a standardized review framework ensures transparency, supports equitable decision-making, and enables utilities to plan for long-term system resilience as high-demand users like data centers emerge.

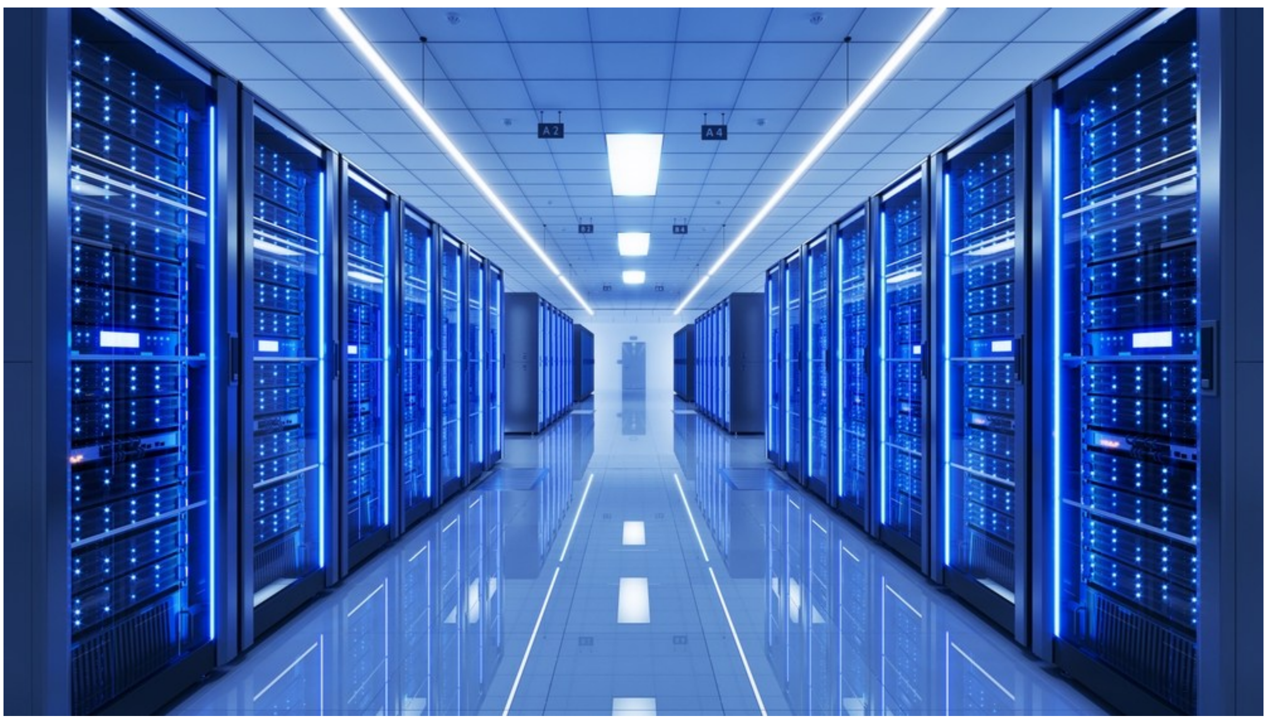
Public interest in data centers is growing, and you may receive customer and media inquiries. In responding to such requests, in all cases, honesty and transparency is the best policy. Truthfully reporting to your customers and residents what you know about potential data center development and its impacts to the water system and supplies is essential, as is faithfully acknowledging anything that is not known. Utilities may be privacy concerns: for example, if it is not possible to disclose how much water a data center uses, particularly in cases where nondisclosure agreements are in place, utilities should refer questions to the facility itself. Talk about efforts to work collaboratively with the sector to prevent and solve problems. If there are concerns, be consistent and be prepared to answer follow-up questions.

Through careful analysis, meaningful information exchange, and careful decision-making, utilities can minimize the adverse impacts to their operations from data centers and contribute towards long-term system sustainability.

Recognizing that many decisions are made during planning and construction, ongoing coordination with data center operators after the facilities are functioning is critical. Regular communication provides an opportunity to identify any operational challenges and address them, just as would be the case for other customers.

7. Conclusion

AI technology is contributing to the rapid proliferation of data centers in communities across North America. Data centers use large volumes of water and may introduce challenges with respect to managing water resources and infrastructure. Recognizing and proactively addressing these challenges is critical for water utilities. Fortunately, water utilities have a great deal of experience working with a wide range of industrial customers. Although data centers present unique concerns, the water sector possesses the technical expertise and strategic foresight to meet the moment. Each proposed data center development will require weighing trade-offs to determine what is right for the community, electric and water utilities, the regional water supply, and data center developers and operators. Water utilities can engage with many partners to ensure data centers are assessed and integrated as appropriate into their communities. Water utilities can provide critical insights during the community planning process and should remain engaged after data centers are constructed and operational.



Server racks in a data center. Image credit: Sashkin/Shutterstock.com

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