UC Berkeley Center for Law, Energy & the Environment

REGULATING DATA CENTER WATER USE *in California*

FEBRUARY 2026

Policy Report

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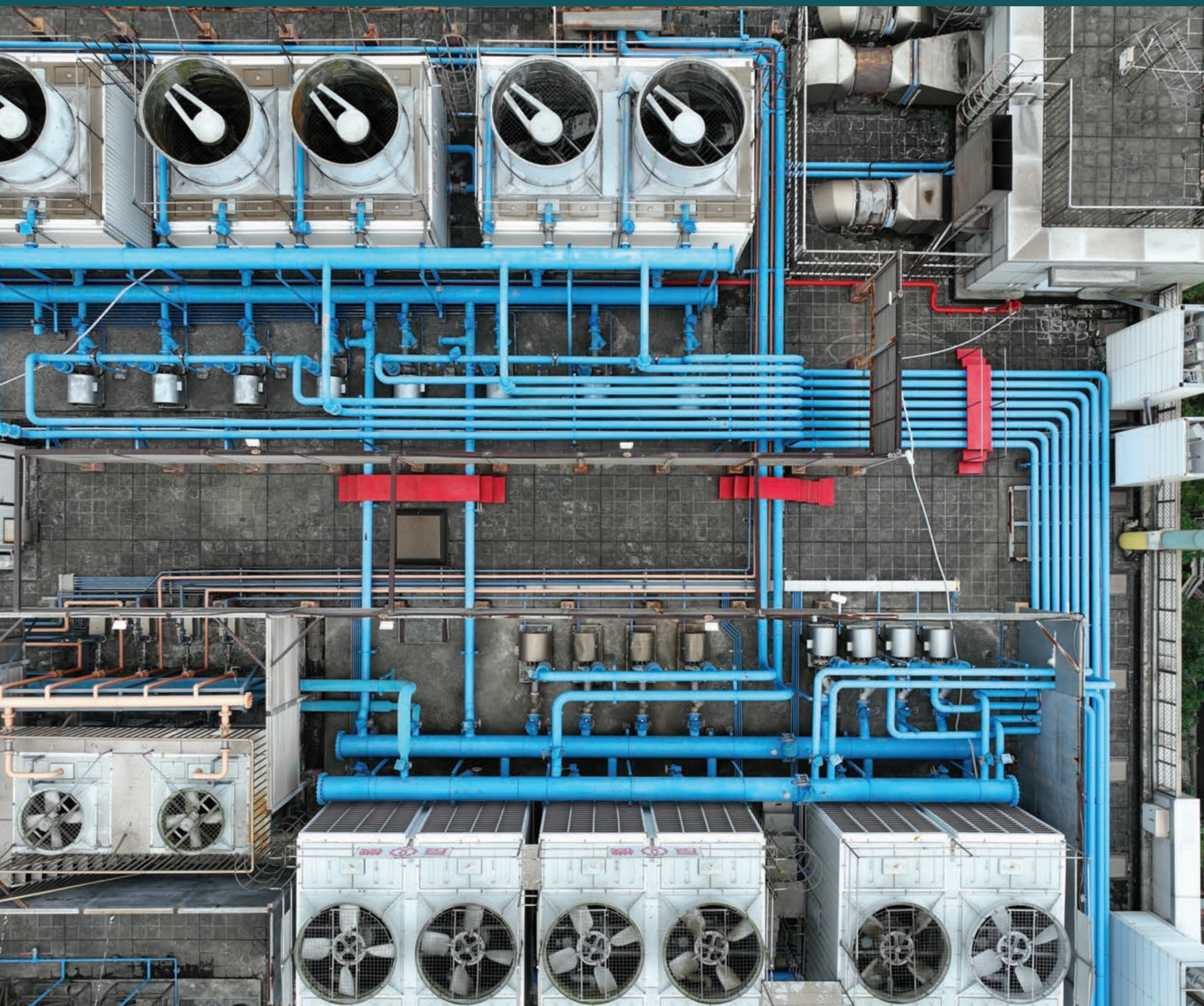

ABOUT THIS REPORT

This report is part of a larger Internet Society Foundation (ISOC) research grant in collaboration with the Environmental Law Institute (ELI) and contributes to the Digital Economy and Environment Program (DEEP), a collaboration between ELI, the Yale School of the Environment, and the Center for Law, Energy & the Environment (CLEE) at UC Berkeley. The report examines the environmental implications of data center water use in California and maps current and potential policy and regulatory responses.

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AKNOWLEDGEMENTS

The authors thank our colleagues at ELI as well as all agency staff, consultants, and industry representatives and experts for their insights and feedback to inform the analyses in this report.

We are grateful to numerous experts for sharing their insights in discussions over the course of this project. They remain anonymous in accordance with our research protocols. We solicited feedback on the report from individuals and organizations representing a range of perspectives and expertise. We thank Dave Owen, Dave Smith, Dan Farber, Kirsten Struve, Jing Wu, Reid Lifset, and Alexandria Nelson for thoughtful feedback that helped us improve a previous draft of this paper. These reviewers were not asked to endorse the final content of this report. Any views expressed in this publication are solely those of the authors.

This work was supported by the Internet Society Research Foundation (ISOC), Project "Greening the internet: Transforming useful research into used outcomes"; the Agriculture and Food Research Initiative, Project Award No. 2021-69012-35916, from the U.S. Department of Agriculture (USDA) National Institute of Food and Agriculture; and a grant from the U.S. Environmental Protection Agency's (EPA) Office of Research and Development under Assistance Agreement No. RD-84046101.

DESIGN

Template design and layout:
Jordan Rosenblum

Document design and layout:
Odd Moxie

Image credits:
Adobe Stock, for captions see page 62

SUGGESTED CITATION

Grimm, M., N. Green Nylen, and M. Kiparsky. 2026. Regulating Data Center Water Use in California. Center for Law, Energy & the Environment, UC Berkeley School of Law, Berkeley, CA. 65 pp., available at https://www.law.berkeley.edu/data-center-water-use

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REGULATING DATA CENTER WATER USE IN CALIFORNIA

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EXECUTIVE SUMMARY

The expanding use of generative AI is driving a boom in data center development, with more and bigger data centers under construction around the world. California is already home to hundreds of data centers and their numbers keep growing. One impact is growing demands on California's already stressed water resources.

Although data centers are estimated to be among the top ten water consuming industries in the United States,[1] their water use and related impacts are understudied, and approaches for managing water use and impacts have not kept pace with the industry's rapid growth.

This report examines the current state of knowledge about data center water use and what can be done to better understand and manage its impacts. We concentrate on data centers' direct on-site water use in California, a major hub for data center construction where water stress is an ongoing challenge.

In this report, we:

- summarize the current state of knowledge on direct data center water use and ways to mitigate it;
- map the policy and regulatory landscape for direct data center water use in California; and
- synthesize gaps, opportunities, and recommendations for state and local policy and decision makers and for data center developers, owners, and operators.

Our key findings include the following:

Greater transparency around data center water use is needed to improve our understanding of its scope, scale, and impacts. The state does not require all data centers to report on their water use. This leaves policy makers, state and local water and land-use decision makers, and the concerned public in the dark about the impacts data centers have on local water supplies. Researchers' estimates indicate that data centers can have significant water footprints. Yet the lack of granular information makes it hard to assess impacts of existing or planned data centers, or to develop effective strategies for managing those impacts.

Although better data are needed, "analysis paralysis" is not inevitable. Data center developers, owners, and operators have options for reducing data centers' water impacts:

- ***Strategic siting:*** Location plays a large role in determining a data center's environmental impacts. When choosing among siting possibilities, data center developers can consider factors like climate, the availability and reliability of water and energy sources, and existing water uses. For example, siting data centers in water-rich areas or close to recycled water sources can reduce competition with other water users for limited community water resources. Similarly, siting data centers in cooler climates reduces their cooling needs and, therefore, water use.
- ***Thoughtful design:*** The physical size, computational capacity, and specific cooling systems influence how much water that data center uses—and how much of that water is consumed or discharged. Cooling systems that use less water often do so at the cost of increased energy consumption, and vice versa. Closed-loop cooling systems and systems that use nonpotable water can reduce strain on local drinking water supplies. Data center developers' design decisions can consider the implications of different options for other local and regional interests.
- ***Operational measures:*** While the most significant water savings are determined by site selection and facility design, improving how a data center operates can also reduce its water use. For example, improving computational efficiency can allow the center to do the same amount of work while producing less heat. Heavy processing loads can also be planned for cooler times of day or shifted to data centers in cooler locations. Optimal operational set points such as temperature thresholds, humidity, and cooling schedules can further reduce cooling needs.

There is currently no regulatory system in California designed specifically to manage the water-related impacts of data centers. Instead, a patchwork of policies and regulations affects data center water use.

- ***Environmental review requirements:*** Data center projects must generally undergo environmental review, including of their water-related impacts. Currently, developments over a certain size or water demand threshold also require potential water suppliers to prepare a water supply assessment. Despite this disclosure of anticipated water use for some data centers, California lacks a clear understanding of data center water use.

- ***Water access and use regulation:*** Various state and local laws, regulations, and policies govern water access and use more generally. To gain access to water, a data center may require a permit, need to follow use restrictions, and/or meet specific measurement and reporting requirements. These requirements depend on its location and on whether the data center will use potable or recycled service water or draw directly from a surface-water or groundwater source. Data center owners and operators may also face water use regulations like efficiency standards and conservation requirements, or local incentives or mandates to use recycled water.

State and local officials could improve transparency and push developers to consider and reduce water use during siting and design. Today, these opportunities remain largely untapped. In service of greater clarity and more effective management of data centers' water-related impacts, we recommend that state and local governments and industry take the following actions:

- ***Improve water use data collection and transparency:*** The state can expand requirements for data center developers and operators to transparently report water use, regardless of water source. The speed and scale of data center development warrant a swift coordination of data collection, availability, and analysis—before development outpaces oversight and creates irreversible impacts. Requiring water use estimates during the planning phase allows local decision makers to evaluate a data center's long-term impact before its resource use becomes permanent. The state can explore options for centrally collecting and analyzing data from water supply assessments or mandating additional reporting. It can also establish requirements for regular reporting of actual usage once the data center is operational to enable tracking of demands on water supplies. The resulting data would form a basis for developing performance metrics and standards, inform local governments' development decisions, and support further policy and regulatory actions.
- ***Build local capacity to evaluate and address the water impacts of proposed data center projects*:** In the absence of a comprehensive regulatory and policy framework for data center water use at the state level, initiative and oversight often fall to local entities (like cities, counties, and water suppliers). Local communities bear the brunt of the impacts and make decisions on data center development. However, they lack guidance on how to evaluate water use in the context of regional water sustainability, potential economic benefits, and energy use. The state needs to support local capacity building to help communities understand and address these things. For example, the state could provide guidance for evaluating proposed data centers' water impacts, trainings, and model regulations and performance standards that local governments can tailor to their own needs. Support for individualized technical assistance would also be useful.
- ***Establish requirements and incentives for data center water efficiency and recycled water use:*** Local governments can use land use, planning, and zoning tools and incentives to foster or require efficient data center water use, co-location of data centers with recycled water facilities, or the use of recycled water more generally. Also, state and local policymakers and regulators could explore the potential of requiring or incentivizing on-site reuse of water at data centers under certain conditions. Water service

providers could include the marginal cost of higher water use in water rates to recoup the real costs of additional data center water use and to incentivize reducing water use.

- ***Consider local water-related impacts when making data center siting and design decisions:*** The data center industry can more transparently and explicitly consider local water impacts, along with other important considerations, when deciding where and how to build data centers.
- ***Include site-specific water use data in corporate sustainability reports*:** The data center industry can improve transparency by integrating site-specific data into corporate sustainability reports. Providing water use data in context will make water and energy trade-offs explicit and help regulators and communities understand data centers' true impacts. Companies that show they are investing in technologies that reduce both water and energy consumption will not only build operational resilience but also improve their social license to operate.

Now is the time to address concerns over the data center industry's rapidly expanding water footprint. State policy makers, local government leaders, and the tech industry itself can take actions to improve transparency and reduce data centers' impacts. By acting on the recommendations in this report, they can collectively enable the continued use of data centers to support digital solutions, while safeguarding local water resources, ecosystems, and communities.

1. INTRODUCTION

1.1 BACKGROUND AND AIM

For decades, data centers have been the digital backbone of modern society. They house servers, digital storage systems, and network infrastructure—supporting large-scale data storage, management, and processing.[2] They provide and support a wide range of services, including cloud solutions for data storage and management, that are critical to governments, research institutions, and businesses.[3]

However, the recent boom in the use of generative Artificial Intelligence (AI) models and hyperscale computing is driving a rapid expansion in demand for new and larger data centers.[4] Several thousand data centers are currently operating in the United States,[5] but several thousand more have already been announced, and at least 600 are estimated to be actively under construction.[6] California is home to at least 270 data centers.[7] Industry forecasts suggest these numbers will continue their precipitous rise.[8]

With data centers multiplying, concerns about the amount of water they use—and the impacts of that water use—are growing.[9] The scale of the industry's future growth and impacts is uncertain,[10] but data centers are already estimated to be among the top ten water-consuming industries in the United States.[11] Demand for data centers to support the digital economy is expected to rise, while many parts of California already experience water scarcity in most years, and water scarcity is increasing with ongoing climate change.[12] One forecast suggests that that hyperscale data centers, alone, will use roughly 150 billion gallons of water from 2025 to 2030—as much as 4.6 million U.S. households use in one year.[13] However, the details of data centers' water use and its local and regional implications remain fuzzy. Research and regulatory approaches needed to understand and manage the water-related impacts of rapid data center expansion are just beginning to emerge.

Two major questions motivated this report: (1) what is known about data centers' water use and related impacts, and (2) how are these impacts being managed? To address these questions, we synthesize the current state of knowledge about data center water use and examine emerging policy and regulatory approaches for reducing negative impacts. In particular, we analyze the policy and regulatory landscape for data centers' direct water use in California (a major hub for data center construction that also faces increasing water stress[14]) and offer recommendations for more effectively assessing and addressing California data centers' water impacts. California has historically been a leader in environmental regulation, and improvements here could provide lessons and models for other states facing increased data center development.

This report presents (a) a high-level summary of current knowledge about data centers' direct water use and ways to limit or mitigate it, (b) a map of relevant policy and regulatory systems in California that may affect data centers' direct water use, and (c) a synthesis of open questions, challenges, and recommendations for improving the policy and regulatory landscape in California.

The report includes actionable insights for state, regional, and local policy and decision makers—including legislators, regulators, local governments, and data center developers, owners, and operators—to inform decisions about data center siting, design, and regulation in California. Further, the regulatory map can help data center developers navigate and comply with the existing web of regulations in California. We also distill broader insights for policy and decision makers in other states.

1.2 METHODS AND SCOPE

We first conducted a literature review to inform (a) a synthesis of the state of knowledge about direct data center water use[15], consumption, and impacts and (b) a high-level analysis of the regulatory framework that governs direct data center water use in California. Our review encompassed peer-reviewed literature, technical and policy reports, government planning and environmental review documents,[16] government agency and water utility websites, corporate sustainability reports, and other publicly accessible online sources.

The following questions guided the high-level regulatory analysis:

- Which policies, laws, and regulations at the federal, state, and local levels currently govern water use by data centers in California?[17]
- What water sources do data centers use or plan to use, and what regulatory requirements are relevant to those sources in particular?
- What are the goals and functions of these policies, laws, and regulations (e.g., guide siting, limit water use, etc.), and what gaps exist?

We concentrated our analysis of local policy and regulatory responses on the three California cities with the most data centers: Los Angeles, Santa Clara, and San José.[18] Insights from these cities regarding data center water use issues, impacts, and governance will likely be relevant for many other parts of California, and beyond. However, we note that the impacts of data center water use and feasible options for regulating them may differ significantly from place to place. Small rural communities, in particular, may have more limited data center water supply options and face unique or heightened water use impacts and governance challenges.

To confirm and supplement our literature review-based findings and analysis, we spoke to consultants, data center operators and owners, water suppliers, and regulators.

Our goal was to produce a broad, issue-oriented map of the current regulatory framework for direct data center water use in California, rather than an exhaustive inventory of all potentially relevant policies, laws, and regulatory requirements.

Although indirect water use is beyond the scope of this report, we acknowledge that a data center's overall water footprint also includes indirect water use, such as water use during data center construction, for electricity generation, and embedded in a data center's supply chains. Water and energy use are inextricably linked, and water use should be considered in the context of the water-energy nexus (see Box 1.).

BOX 1: THE WATER-ENERGY NEXUS

Data center water and energy use are intertwined and often present trade-offs. At the most basic level, data centers require cooling, and energy-efficient cooling technologies generally use more water, while water-saving cooling technologies often use more energy (see Section 2.1). Indirect water-use considerations further complicate water-energy trade-offs.[19] For example, data centers depend on power plants for electricity, and power plants require water. Also, more energy may be required to access, treat, and transport one potential water source than another. Similarly, the water intensity of different energy sources can vary significantly. Siting data centers in areas with wind and solar energy can reduce their indirect energy and water footprints.[20]

A data center's overall water footprint is also shaped by factors such as the water used during construction,[21] the regional infrastructure needed to support construction and operation,[22] the water demands of its supply chains (e.g., semiconductor manufacturing), and the water and energy footprints of wastewater collection and treatment.[23]

We suspect that, in many places, short-term economic incentives—driven by higher real or perceived costs and better data availability for electricity than for water—may lead data center developers and regulators to prioritize energy efficiency over water efficiency and sustainability.[24] However, joint consideration of the longer-term energy and water implications of data center siting and design options can produce more sustainable outcomes. Although an analysis of such trade-offs is beyond the scope of this report, we acknowledge they are inevitable and manifest at different scales: While water use can be a primarily local concern, energy generation is generally a regional concern. Water and energy resources are managed by different entities, with no central unifying authority. Therefore, further research could explore opportunities to better integrate consideration of both sectors.

2. DATA CENTER WATER USE

Data centers have both direct and indirect environmental impacts.[25] They often have large land footprints, and operating a data center requires ongoing use of energy and water.[26] These features have implications for water security and sustainability, terrestrial and aquatic ecosystems, energy use, climate impacts, and more. However, the bulk of the literature on data centers' environmental effects focuses on energy use and related climate impacts.[27] Fewer studies have considered data centers' water-related impacts.[28]

Water use by data centers can strain local and regional water supplies and adversely impact ecosystems.[29] Siddik et al. (2021) estimated that about one-fifth of U.S. data centers used water from water-stressed watersheds in 2021.[30] A Bloomberg study estimated that two-thirds of the data centers built since 2022 are located in areas of high water stress.[31] Some of the fastest-growing data center hubs in the United States are in the semi-arid West—often in areas that experience frequent droughts or chronic water scarcity.[32] An increase in the number or size of data centers in an area increases its data center water demand,[33] intensifying competition with municipal, agricultural, ecosystem, and other industrial water uses.[34] A recent Ceres study estimates that direct and indirect water use by planned (announced) data centers will increase annual water stress in the already severely water-stressed Phoenix region by up to 17% relative to current levels.[35]

Understanding water use and consumption (see Box 2), its impact on water resources and communities, and mitigation options is important, especially in drier regions.[36] This includes understanding in what local contexts data center water use is likely to have the most—and least—impacts.

BOX 2: UNDERSTANDING WATER USE, CONSUMPTION, AND EFFICIENCY

We define ***direct water use*** as the amount of water a data center takes in, including water that is later returned to the original water source.[37] Data centers also use water indirectly, such as water use during data center construction, for electricity generation, and embedded in a data center's supply chains. While ***indirect water use*** is an important part of a data center's overall water footprint, it is not our focus in this report.

Water consumption is the fraction of water use that is not returned to the original water source and is no longer available for ***reuse***.[38] Water that is not consumed can be discharged or reused, e.g., by recirculating cooling water. Water that is returned to a water source is typically treated before discharge to reduce water quality impacts.

Water usage effectiveness (***WUE***) compares the amount of water used to cool data center equipment to the energy needed to run that equipment, measured in cubic meters per megawatt hour.[39] Sustainability reports often report WUE or ***water use intensity***—a measure of how much water a building or facility consumes relative to its size or other relevant activity metrics.[40]

2.1 HOW DATA CENTERS USE WATER

The primary direct use of water at data centers is for cooling.[41] Cooling is needed to remove the heat servers create and maintain operational conditions that ensure adequate performance, reliability, and longevity. The amount of water a data center directly uses for cooling depends on factors such as cooling system type, outside temperature, humidity, data center type, and facility size.

There are several main categories of cooling systems,[42] some of which overlap with one another. These include air cooling (using air conditioning and fans to remove heat), liquid cooling (circulating a coolant through pipes or immersing components in coolant to absorb heat), evaporative cooling (exposing warm air to water to draw heat away through evaporation), and free cooling (using cooler outside conditions to reduce or eliminate mechanical cooling). Many data centers use a combination of cooling technologies and components.[43]

The various cooling options have different trade-offs between energy and water use. Cooling systems that use less water often do so at the cost of increased energy consumption, and vice versa.[44] Evaporative cooling uses the most water, followed by liquid cooling, although liquid cooling can rely on other fluids and be quite water efficient when closed-loop systems are used.[45] Air cooling systems generally use less water but require more energy.[46] Free cooling with outside air uses no water in the cooling process and little energy, whereas indirect free cooling that uses outside air to cool water has moderate water use and low energy use.[47] Alternative cooling systems that use less water may be possible in some locations. Examples include geothermal cooling, deep lake underwater cooling, and aquifer thermal energy storage.[48]

2.2 DATA CENTER WATER USE, CONSUMPTION, AND IMPACTS

Data centers likely use large amounts of water, but the exact dimensions and site-specific details remain opaque. Most available figures are estimates that need refinement. However, the magnitude of these estimates indicates a significant water footprint that warrants serious consideration.

This section first briefly summarizes current estimates of the amount of water data centers directly use—and consume—on site (versus indirectly, such as water use related to energy production). We then highlight key information gaps that make it harder for policymakers and regulators to understand the actual impacts of data center water use or formulate appropriate policy and regulatory responses.

2.2.1 Knowledge of direct water consumption and use

A data center's on-site water use depends on its location, the cooling technologies it employs, its operational water usage efficiency, and more. How much of data centers' total water consumption and use take place on-site can vary widely.[49] For example, the IEA recently estimated that approximately 40% of global data center water consumption happens on site.[50] Other estimates of on-site consumption in the United States and Europe range from roughly 17% to 50%.[51] Some sources provide combined estimates of water use that encompass aspects of both direct and indirect use.[52]

Available corporate data indicate that data center operations frequently consume most of the water they use on site. Equinix reports that roughly 76% of the water used on-site across its global data center operations is consumed, while the remaining 24% is discharged into municipal sewers or surface waters.[53] Similarly, Google reports that its data centers consume roughly 79% of the water they withdraw globally.[54]

Estimates for direct on-site water consumption vary by facility type and size. These estimates range from about 18,000 gallons per day for smaller wholesale and retail data centers to approximately 300,000 gallons per day for a mid-sized data center[55] and around 550,000 gallons per day for a hyperscale data center.[56]

However, specific local-level data are rarely available. Corporate sustainability reports are voluntary, and those companies that do prepare them often provide only aggregate water consumption and use data across their operations.[57] More precise information can be difficult to find because many data center owners and operators view their operational data, including cooling system details and water use data, as proprietary business information they want to keep private to protect their competitiveness.[58] Some corporations do share more detailed information at times. For example, according to Google, its data center locations in the United States use on the order of 56 million gallons annually in Ashburn, Virginia, and more than 1 billion gallons annually in Council Bluffs, Iowa[59]—equivalent to the estimated annual water use of 390 four-person households and 7,000 four-person households, respectively.[60] Research studies, too, generally focus on state, national, or global-level estimates of data center water use.[61] For example, researchers at UC Riverside estimate that statewide on-site data center water consumption in California will balloon from 351 million gallons in 2019 to between 1.12 and 1.75 billion gallons by 2028.[62]

Due to the rapid pace of change in the industry (e.g., the trend toward larger data centers, energy-efficiency improvements, new cooling technologies[63]) estimates of data center water use can quickly become outdated.[64]

2.2.2 Knowledge of impacts

The basic fact that data center water use may have negative impacts on other water users and ecosystems is clear. Yet, limited availability of local-level data—or the lack of important context for interpreting it—can obscure the nature and scale of data centers' individual and cumulative water impacts.[65] These impacts will depend on the size, design, and water-use characteristics of local data centers; the nature and characteristics of their water sources; and other details of the specific local social, environmental, and hydrological contexts within which they operate. Unfortunately, neither current corporate reports nor research studies tend to capture this information.

Although some data center operators and owners publish sustainability reports with water-related goals and data, very few report locally relevant specifics about the water sources they use or how their water use affects other water users or ecosystems.[66]

The water data centers use can come from many different sources with different characteristics and vulnerabilities. Many data centers access water through third parties, often municipal potable water providers,[67] but some divert surface water directly from local waterways or directly pump local groundwater to supply their needs. Some data centers use alternative sources like recycled water, which, in the United States, often consists of treated municipal wastewater.[68]

Most of the readily accessible information about data centers' water sources is very high level. For example, Equinix reported that 94% of the water used at its facilities *worldwide* in 2024 came from municipal sources while 6% came directly from groundwater sources.[69] Equinix described 37% of its total 2024 water use as coming from nonpotable sources, such as recycled water.[70]

It can be politically and practically difficult to craft appropriate policy and regulatory responses without a basic grasp of how much water local data centers *actually* use (and from what sources), how that level of use compares to other local demands, what numbers represent efficient water use (based on a data center's size, computing power, cooling system characteristics, etc.), and where and under what conditions data center water use is likely to cause significant negative impacts.[71]

Greater transparency, reporting, and data analysis would improve our understanding of local data center water use and its impacts.[72] While this report focuses primarily on impacts related to the volume of water data centers use, data centers can affect water resources in other ways, such as by discharging wastewater that contains concentrated minerals, chemical additives, and other pollutants into surface water or groundwater supplies.[73]

2.3 WAYS TO REDUCE DATA CENTER WATER USE AND IMPACTS

Strategic siting, thoughtful design, operational efficiency measures, and actions to offset water use can reduce the amount of water a data center uses or otherwise mitigate its water impacts. When deciding where to locate a data center and what cooling technologies to use, data center owners and developers can assess local conditions and the potential impacts and trade-offs of different siting and technology possibilities.[74]

2.3.1 Strategic siting

Because location is an important determinant of environmental impacts, strategic siting is key to reducing data centers' water use impacts.[75] Key considerations for data center developers should include local climate, the availability and reliability of water and energy sources, and existing local water uses.[76] For instance, siting a data center in an area with lower ambient air temperatures can reduce its cooling needs and therefore its direct and indirect water consumption.[77] Meanwhile, siting a data center in a warmer, water-stressed area can create a direct conflict between the data center's water use and other local water needs. Siting data centers in areas of low water stress or close to alternative water sources, such as a wastewater treatment plant that can provide recycled water, can reduce their water-related impacts.[78]

In practice, many additional factors may affect data center siting decisions (see Box 3).

BOX 3: WHAT DRIVES DATA CENTER SITING DECISIONS?

Data center siting is often influenced by factors such as the location of existing energy and water infrastructure and supply, the cost of energy and water, and proximity to customers and computing demand.[79] Depending on the application being hosted, proximity to a data center's users may reduce delays in data transfer, which is especially desirable for applications like finance and gaming.[80] Regulatory and tax considerations also matter.[81] For example, many new data centers are proposed to be built near Reno, Nevada, and Phoenix, Arizona.[82] Both areas have high water stress, but their lower land and energy prices, lower taxes, proximity to California's computing demand, and less stringent regulatory environment have led to high rates of data center development.[83] Many states and local governments provide tax credits and other incentives to attract data centers and other development.[84] This highlights a tension for local and state governments between potential economic development and sustainably managing water for current and future users.[85] Therefore, it is vital to improve the information base available to local officials, who must often act without a clear view of long-term resource implications.

2.3.2 Thoughtful design

Once a data center is operational, there are few options for significantly reducing its water use.[86] This is because, for a given data center size (physical size and compute load), the key factor determining data center water and energy use is cooling system selection and design.[87]

As discussed above, some types of cooling systems are generally more water intensive than others.[88] A detailed discussion of how much water needs vary among different cooling technologies and designs is beyond the scope of this report. However, various cooling systems can be designed to recover and repurpose waste heat, which can reduce cooling and water needs.[89] Furthermore, design-phase decisions can set a data center up for circular water use (e.g., closed loop cooling systems and wastewater recycling[90]) or for using alternative water sources. For instance, depending on its location and the type of cooling system, a data center might be able to use desalinated sea water, rainwater harvested on-site, on-site stormwater capture and reuse, or recycled municipal or industrial wastewater.[91] Water from alternative sources may need additional treatment before it can be used for data center cooling, depending on its physical, chemical, and biological water-quality characteristics.[92]

2.3.3 Operational efficiency measures

While opportunities to reduce water use after a data center is constructed are limited, operators can still reduce operational water use in various ways. For example, data centers can optimize operational set points such as temperature thresholds, humidity, cooling schedules, and activation points for different cooling components.[93] The latter refers to adjusting the cooling system mix based on factors like ambient temperature to enable free cooling when conditions allow. Additionally, operators can decrease cooling needs by choosing more energy-efficient servers, addressing coding inefficiencies and otherwise optimizing data processing algorithms, or taking other steps to improve computational efficiency.[94] These measures can reduce the heat produced by servers and reduce both energy and water use. Heavy processing loads can also be planned for cooler times of day or shifted to data centers in cooler locations.

2.3.4 Offsetting water use and consumption impacts

Some technology companies elect to set 'water positive goals'[95] in their sustainability strategies and reports.[96] To help achieve these goals, some companies invest in activities meant to offset the impacts of their water use and consumption,[97] such as managed aquifer recharge projects or efforts to restore aquatic ecosystems.[98] However, corporations often do not disclose where, when, or how these offsets are implemented, so it is difficult to assess the extent to which, in practice, they actually mitigate the spatial and temporal impacts of any particular data center's water use.

2.4 REGULATING DATA CENTER WATER USE

Government policies, laws, and regulatory oversight have not kept pace with the rapid expansion of AI that is triggering a surge in data center construction.[99] At the federal level, “America’s AI Action Plan” purports to accelerate data center development—in part by reducing “regulatory barriers”—but does nothing to address data centers’ environmental and community impacts.[100] Although some states are moving toward regulating data centers to manage their resource use and associated impacts, President Trump’s recent executive order, “Ensuring a National Policy Framework for Artificial Intelligence,” seeks to preempt and challenge state-level regulations to “ensure that there is a minimally burdensome national standard—not 50 discordant State ones.”[101] The executive order directs agencies to identify state laws that may conflict with the administration’s policy, restrict federal funding to states with “onerous AI laws,” and draft legislative recommendations for a federal policy framework. However, the order is a policy statement, not a binding law, and any actual preemption of state or local laws and regulations will depend on new legislation and future legal challenges by the U.S. Department of Justice.

State approaches to governing the environmental impacts of data centers are emerging. To date, most focus on data centers’ greenhouse gas emissions and energy use.[102] However, some states are also starting to respond to concerns about data center water use.[103] For example, Arizona legislators introduced a bill to reevaluate water allocation for industrial users, including data centers.[104] States actors are also beginning to try to address the knowledge gaps about data centers’ resource use and environmental impacts that make developing appropriate responses more challenging.[105] Legislators in New Jersey recently passed a bill that requires data centers to report electricity and water use quarterly.[106] The State of California almost took its first steps towards improving understanding of how much water data centers use with Assembly Bill 93. Although the legislature passed the bill, the governor vetoed it, citing his “reluctan[ce] to impose rigid reporting requirements about operational details on this sector without understanding the full impact on businesses and the consumers of their technology.”[107] The bill would have required a planned data center’s proponents to provide an initial estimate of expected water use to their water supplier when applying for a city or county permit, business license, or equivalent approval and to provide a report of actual annual water use to their water supplier when seeking any subsequent renewals.[108]

Local governments, too, are beginning to develop responses to data center water use. For example, some local governments have adopted, or are considering, zoning ordinances and water use ordinances.[109] We discuss several examples of local responses in Section 3.

Policy-related research is also playing catch up. Although some research studies offer policy recommendations for reducing data centers’ energy use and pollutant emissions,[110] few provide water-related governance recommendations.[111] Fewer studies have examined policy, law, and regulatory responses to the resource demands and impacts of data centers in any detail.[112]

3. THE POLICY AND REGULATORY FRAMEWORK FOR DATA CENTER WATER USE IN CALIFORNIA

Oversight of data center water use in California relies on a patchwork of policies and regulations that were not designed with data centers in mind. There is no comprehensive policy, legal, or regulatory framework specifically for data center water use. However, data center projects must generally undergo environmental review, including of their water-related impacts, and various state and local laws, regulations, and policies govern water access and use more generally. Water access and use requirements vary for different water-source types. Additionally, adjacent regulatory systems may affect data centers' water use (see Appendix 1).

This section explores how the complex regulatory context maps onto data centers' direct water use. Figure 1 provides an overview of the key components of the framework.

3.1 ENVIRONMENTAL REVIEW REQUIREMENTS

Data center projects must generally undergo some form of environmental review to assess and disclose the project's potential impacts and inform related government decisions.

Some projects may be subject to review under the National Environmental Policy Act (NEPA).[113] NEPA requires a federal agency to consider the environmental impacts of a project if there is a clear "federal nexus," such as the project being built on federal land, receiving significant federal funding, or requiring a permit from the agency. If such a project may have significant environmental impacts, the federal agency must prepare a detailed environmental impact statement (EIS).[114] NEPA review encompasses all "reasonably foreseeable environmental effects" of the project,[115] including water-related impacts. Most data center projects are unlikely to require NEPA review because

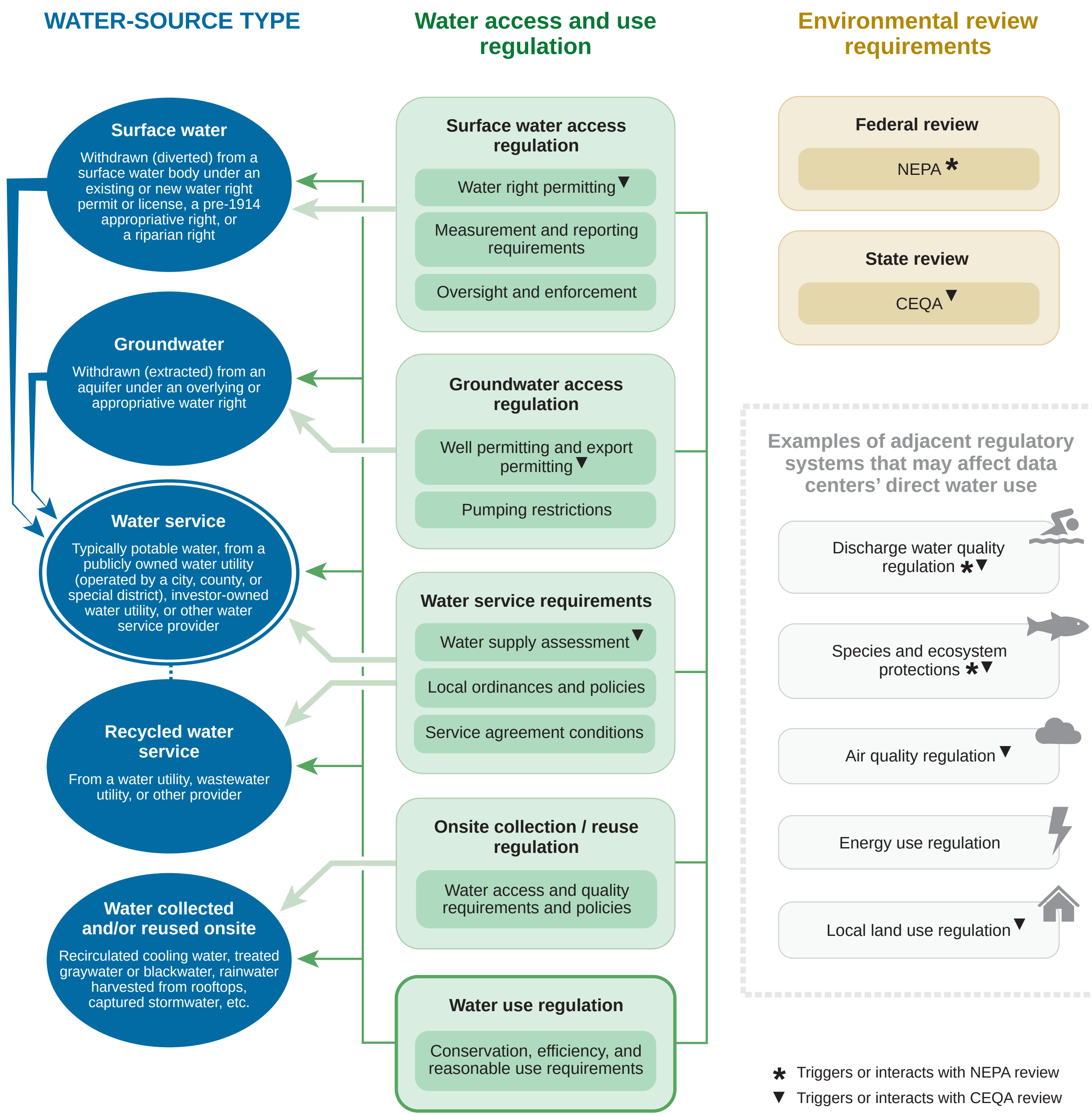


Figure 1 Simplified overview of the regulatory framework for direct data center water use in California

they are typically private (and privately funded) developments on non-federal land, and some federal permitting is delegated to the state (e.g. wastewater discharge permits, see Appendix 1). However, some projects might need NEPA review because, for example, they would require an incidental take permit for protected species (listed under the state or federal Endangered Species Acts) or a Clean Water Act Section 404 Permit from the U.S. Army Corps of Engineers (due to the potential for construction to discharge dredged or fill material into U.S. waters). Despite the already limited circumstances under which data center projects would need NEPA review, the White House's recent "AI Action Plan" calls for creating new categorical exemptions for data center related actions.[116]

California has its own environmental review requirements. Developing a data center generally necessitates environmental review under the California Environmental Quality Act (CEQA). CEQA requires local and state agencies to evaluate the environmental impacts of any project that requires their approval and to avoid or mitigate significant impacts whenever feasible.[117] The lead agency must prepare an environmental impact report (EIR) if the project would have significant negative effects on the environment.[118] This report includes an evaluation of "[d]irect and indirect significant effects of the project on the environment," both in the short-term and the long-term, including changes to "aspects of the resource base such as water."[119] Depending on a data center's specifications, CEQA review may need to include a water supply assessment by potential water suppliers.[120] For example, a water supply assessment is required for a proposed industrial development (including a data center project) with "more than 650,000 square feet of floor area" or that would use an amount of water equivalent to either a 500-unit residential development or a 10% increase in the connections of a small public water system with 5,000 or fewer connections.[121] While some data centers likely meet these thresholds, others fall below them—contributing to the current lack of data regarding the industry's water use in California. CEQA offers communities an opportunity to voice concerns during a formal public review period that requires written agency responses.

Both NEPA and CEQA include streamlined pathways for low-impact projects. If a project is subject to both NEPA and CEQA, the lead agencies may be able to streamline compliance by cooperating in different ways, potentially including developing a unified environmental review process for the project.[122]

3.2 WATER ACCESS REGULATION

The nature of the water sources a data center relies on affects what state and local laws, regulations, and policies apply to the project. Most directly, the water-source type affects what the data center must do to gain access to the water, what limits and conditions apply, and the scope and nature of monitoring and reporting requirements. In this section, we introduce the regulatory context for five types of water sources data centers are known to rely on: (1) water service from a publicly or privately owned water utility, (2) recycled water service from a water or wastewater utility, (3) surface water, (4) groundwater, and (5) water collected and/or reused onsite.[123]

3.2.1 Water service

Many data centers rely on water provided by a public water system or other water utility. In this situation, the water service provider typically withdraws water from a natural water source (see Section 3.2.3 or contracts with another entity that does so. Some water service providers also offer recycled water (treated wastewater) (see Section 3.2.2). Many different types of public and private entities can provide water service, including municipalities (cities and counties), public special districts, and private investor-owned utilities.[124]

Most regulation—and management—of data centers' use of water from water service providers occurs at the local level. The federal government does not regulate data centers' use of water from water service providers. While California does not directly regulate data centers' use of water from water service providers, it does regulate both publicly owned and privately owned water suppliers.[125]

Like other development projects, data centers must apply for water service. The water service application can include use projections, demand estimates, and connection fees.[126] In the City of Santa Clara, applicants may be required to complete a Development Impact Analysis analyzing the project's impacts on the potable water system.[127] A service agreement then outlines the terms of service, including payment obligations. Water service customers must comply with local ordinances, conservation policies, and drought restrictions (which can restrict potable water use for non-priority uses),[128] as well as with any applicable state-level water use policies and restrictions (see also Section 3.3).

Data centers and other water service customers may need to reduce the amount of water they use during times of water shortage. For example, under state law, urban water suppliers must prepare a Water Shortage Contingency Plan identifying six progressive water shortage levels tied to shortage indicators and a suite of response actions, including water-use restrictions, for each.[129] Furthermore, during times of water shortage, the State Water Resources Control Board may implement seniority-based water right curtailments that limit affected water service providers to providing only enough water to meet minimum human health and safety needs (see also Section 3.2.3.1).

A partnership between a data center and municipal water service provider can emerge when the data center's water use makes up a large fraction of local water demand, exceeding the bounds of standard commercial water service.[130] A smaller data center that uses less water may simply need to pay a connection fee and the standard fixed and volumetric service fees. However, a hyperscale data center can use so much water that, in order to serve it, the water service provider would need to expand its water infrastructure, acquire additional water rights, and/or purchase additional water under contract from another entity, raising the service provider's costs and triggering a new rate study.[131] In that case, the data center and the water service provider may develop a partnership to collaboratively address the cost of changes necessary to support the data center's water needs.[132] If the fees the data center pays do not reflect the increased costs associated with providing it water—and water rates increase for local residents—local opposition and rate disputes may arise.[133]

3.2.2 Recycled water service

Some data centers use recycled water, mostly treated municipal wastewater.[134] To make it easier to use recycled water, data centers can be intentionally located near existing recycling facilities. However, this may require expanding existing recycled water infrastructure if the data center is not in a location with existing recycled water access. Also, if other entities already use all the recycled water a facility produces, that facility may need to expand its recycling capacity by building additional infrastructure — and data center companies should bear the financial responsibility for these expansions.

The federal government does not directly regulate recycled water use.[135] However, adjacent federal regulatory systems address the discharge of pollutants into waters under federal jurisdiction (see Appendix 1). Additionally, the National Water Reuse Action Plan and federal funding programs encourage water reuse.[136]

The State of California has established policies and regulations for recycled water[137] which vary depending on the intended purpose of use. However, these generally focus on treatment requirements, and do not regulate the volume of recycled water a party may use (see also Appendix 1). Industrial or commercial cooling is generally considered an acceptable use of recycled water in California, but recycled water used in cooling towers may need to be treated more thoroughly than recycled water used in other cooling methods.[138] In their state-mandated Urban Water Management Plans, some urban water suppliers specifically prioritize industrial cooling uses for recycled water connections.[139] A 2025 legislative proposal, Senate Bill 58, would have incentivized data centers to use more recycled water by providing partial tax exemptions for certified data centers that use recycled water for cooling (and meet other standards).[140]

Some local governments have developed recycled water policies, requirements, or incentives that are relevant to data centers. For example, some municipalities aim to shift future water use from potable water to recycled water when possible.[141] For example, the City of Santa Clara's municipal code requires the use of recycled water when available and feasible.[142] Both Santa Clara[143] and the City of San José[144] offer reduced water rates for recycled water service. More specific to data centers, San José's general plan includes a policy goal of using recycled water for building cooling where feasible.[145] In the southern San Francisco Bay Area, a regional entity (South Bay Water Recycling) produces recycled water at a regional facility, acting as a wholesale recycled water provider for San José Municipal Water, the City of Santa Clara, and two other retail water providers.[146] Currently, the recycled water is only available to commercial customers and is used primarily for irrigation.[147] However, some data centers that receive the recycled water use it for cooling purposes.[148] To use recycled water in Santa Clara or San José, the user must first obtain a recycled water permit.[149]

3.2.3 Water withdrawn directly from a natural water source

Instead of getting water through a water service provider, some data centers withdraw the water they use directly from a natural water source. Accessing water this way in California requires a water right. In California, surface water and groundwater are governed by different water rights systems and involve different types of government permissions, making the regulatory framework for withdrawing water directly from a natural source complex. Depending on its water quality characteristics, water withdrawn from a natural source may require treatment before it can be used for data center cooling. In this section, we provide a high-level overview of key aspects of California's surface water rights and groundwater rights systems (and groundwater management) that are potentially relevant to data centers.

3.2.3.1 Surface water

Some data centers obtain surface water rights to access the water they use. Due to technical and legal realities that make starting new surface water diversions challenging, we suspect that few California data centers directly divert surface water from a stream, lake, or other surface water body. Acquiring a new surface water right can be a long and expensive process that results in a water right that is junior to all pre-existing rights in the watershed during times of water shortage and, therefore, is less reliable.[150] Nevertheless, some data centers in California do directly withdraw surface water for cooling.[151]

A water right is required to divert surface water for use in California. The state has two main types of surface water rights: riparian and appropriative. Riparian rights allow the owner of land adjacent to a surface water body to take water from it for reasonable use on that land.[152] In times of water shortage, riparian users must reduce their use proportionally.[153] Appropriative rights are different. They allow water users to divert surface water for non-riparian uses on a "first-in-time, first-in-right" seniority basis, which means a water user with an older priority date has seniority over a water user with a newer one.[154] Data centers are likely to hold very junior appropriative rights, placing them at the end of the queue, so they would be among the first water-right holders to face mandatory curtailment during droughts.

In general, a data center developer must apply for a water right permit from the State Water Resources Control Board before taking water from a "lake, river, stream, or creek," or from certain underground supplies considered "subterranean streams."[155] To approve a permit application, the Board must find that the application demonstrates that unappropriated water is legally available from the proposed source and that the proposed use is in the public interest.[156] The permit specifies where, how much, and during what time periods the permittee can take water from the source, as well as other conditions.[157] Riparian rights do not require a permit, but they can only be transferred with ownership of riparian land. Both types of water right holders must follow measurement requirements that vary depending on the scale of their diversions and must submit annual water-use reports to the Board.[158]

The State Water Resources Control Board also adopts generally applicable regulations that further regulate surface water diversion and use[159] and could affect data centers (see also Section 3.3). For example, during recent droughts, it has used emergency regulations to implement water right curtailments in some watersheds when not enough water was available to meet all demands.[160] The Board has included curtailment exceptions for diversions needed to meet minimum human health and safety needs[161] and other purposes, but data center water use is unlikely to meet those exceptions.

3.2.3.2 Groundwater

Some data centers withdraw groundwater from an aquifer to support their water needs. Historically, groundwater extractions have been less regulated in California than surface water diversions.[162] Federal regulation of groundwater focuses on protecting water quality in aquifers that are used as sources of drinking water. California law defines groundwater rights and creates a framework for local groundwater management.

In California, groundwater rights law largely parallels the state's surface-water rights law, but it is less well developed and implemented. This is because California courts have defined groundwater rights in a piecemeal fashion while settling various disagreements between water users.[163] The most common types of groundwater rights are overlying rights and appropriative rights. Overlying rights are analogous to riparian surface-water rights: they allow a land owner to pump a reasonable amount of water for use on their land, and overlying users must reduce their use proportionally during times of shortage.[164] If a data center pumps and uses groundwater from a well on its property, it would likely be considered to be using groundwater under an overlying right. If there is surplus water in a groundwater basin, water users can acquire appropriative groundwater rights by pumping and using groundwater.[165] Just as for surface water, appropriative groundwater rights have a "first-in-time, first-in-right" priority system. If a data center pumps groundwater from one area and transports it to another location for use, it would likely be considered to be using groundwater under an appropriative right.[166] Cumulatively, the amount of groundwater extracted from a groundwater basin is not supposed to exceed that basin's "safe yield."[167] However, because there is no state or local permitting program for groundwater rights—and, historically, oversight of groundwater use in most areas has been patchy and scarce—many of California's groundwater basins are overdrafted (or at risk of becoming so).

Most regulation of groundwater use in California currently takes place at the local level. Counties, some cities, and some special districts require permits to install or alter water wells.[168] Some counties also require a permit to extract groundwater for export outside the county's boundaries[169] or to extract groundwater for use on a different parcel within the county.[170] The 2014 Sustainable Groundwater Management Act (SGMA)[171] adds another regulatory layer in some basins. SGMA is largely implemented locally, although two state agencies play important oversight and intervention roles.[172]

SGMA required the creation of local groundwater sustainability agencies (GSAs) to develop and implement groundwater sustainability plans to manage high- and medium-priority groundwater basins.[173] Among other tools, SGMA allows—but does not require—GSAs to limit pumping and adopt well-metering requirements.[174] GSAs can establish groundwater extraction allocations and can develop permitting systems for administering them.[175] Data centers would need to comply with any applicable requirements established under GSAs' SGMA authorities.

Nonetheless, in most parts of California, groundwater users continue to withdraw water without having clearly quantified groundwater rights (or SGMA-related extraction allocations) relative to other users in the basin—and without measuring or reporting their withdrawals.[176] Exceptions exist in some of the medium- and high-priority basins that have decided to establish groundwater extraction allocations under SGMA, in areas where groundwater management agencies were established to address local groundwater overdraft prior to SGMA, and in adjudicated areas (where groundwater use is regulated based on court decrees that have determined groundwater rights).[177] In adjudicated areas, the court ultimately decides who holds groundwater rights, how much groundwater those right holders can extract, and how the area will be managed.[178] Groundwater pumping in these areas can be highly regulated, so that a data center developer would either need to hold an existing right or acquire one from a current right holder (some adjudicated areas allow water trading[179]). In some areas, a data center pumping groundwater would need to measure and report its extractions.

Independent of SGMA and court adjudications, Los Angeles, Riverside, Ventura, and San Bernardino Counties are subject to a Groundwater Recordation Program established by the Legislature that mandates reporting of groundwater extractions[180] In these areas, large data centers with water-intensive cooling systems that exceed the threshold of extracting 10 acre-feet (3.26 million gallons) from a single source or aggregate extractions of 25 acre-feet (8.15 million gallons) would have to submit annual reports of their groundwater extractions to the State Water Resources Control Board.[181]

3.2.3.3 Water transfers

Neither our desk research nor discussions with industry experts revealed examples of data center owners directly entering water markets or engaging in transfers to secure water from surface-water or groundwater sources. Future research could investigate the extent to which such transactions occur in California to more fully understand the industry's impacts, including impacts on other water users.

3.2.4 Water collected or reused on-site

Data centers may also collect and use—or reuse—certain types of water onsite. Most straightforwardly, some data centers already engage in a form of reuse by treating and recirculating their own cooling water.[182] However, in some circumstances data centers may be able to use on-site-treated blackwater, graywater, stormwater, or rainwater (harvested from the data center's rooftop[183]) for purposes like toilet flushing and landscape irrigation.

Under California law, harvesting rainwater from rooftops does not require a water right permit,[184] however, a private entity might need a surface-water right permit (see Section 3.2.3.1) to collect and use stormwater runoff.[185]

The state develops water-quality focused policies and regulations for water reuse that vary depending on what the water will be used for.[186] Currently, sections of the California plumbing code establish requirements for untreated graywater systems and untreated rainwater systems that are used for certain types of irrigation.[187] Additionally, the State Water Resources Control Board is in the process of developing risk-based water quality regulations for onsite treatment and reuse of nonpotable water that is put to nonpotable end uses.[188]

In general, reusing nonpotable water requires some form of treatment and additional precautions such as ongoing monitoring, backflow pretention devices, dual plumbing, an engineering report that explain how health and safety risks are mitigated,[189] and a trained site supervisor. Meeting these responsibilities comes at a cost and could pose financial and logistical challenges for data centers.

3.3 WATER USE REGULATION

All water use in California, whether by a water right holder or by a water service customer, may be subject to additional regulation that affects how much water can be used for what purposes. Because the California Constitution requires water use to be reasonable and "in the public interest,"[190] the Legislature sometimes makes laws restricting water uses.[191] Similarly, the State Water Resources Control Board sometimes adopts permanent or temporary regulations for water use, such as emergency conservation regulations during droughts.[192] Notably, requirements often vary depending on the type of water source and use at issue, with more stringent requirements for uses that require potable water[193] (see also Section 3.2).

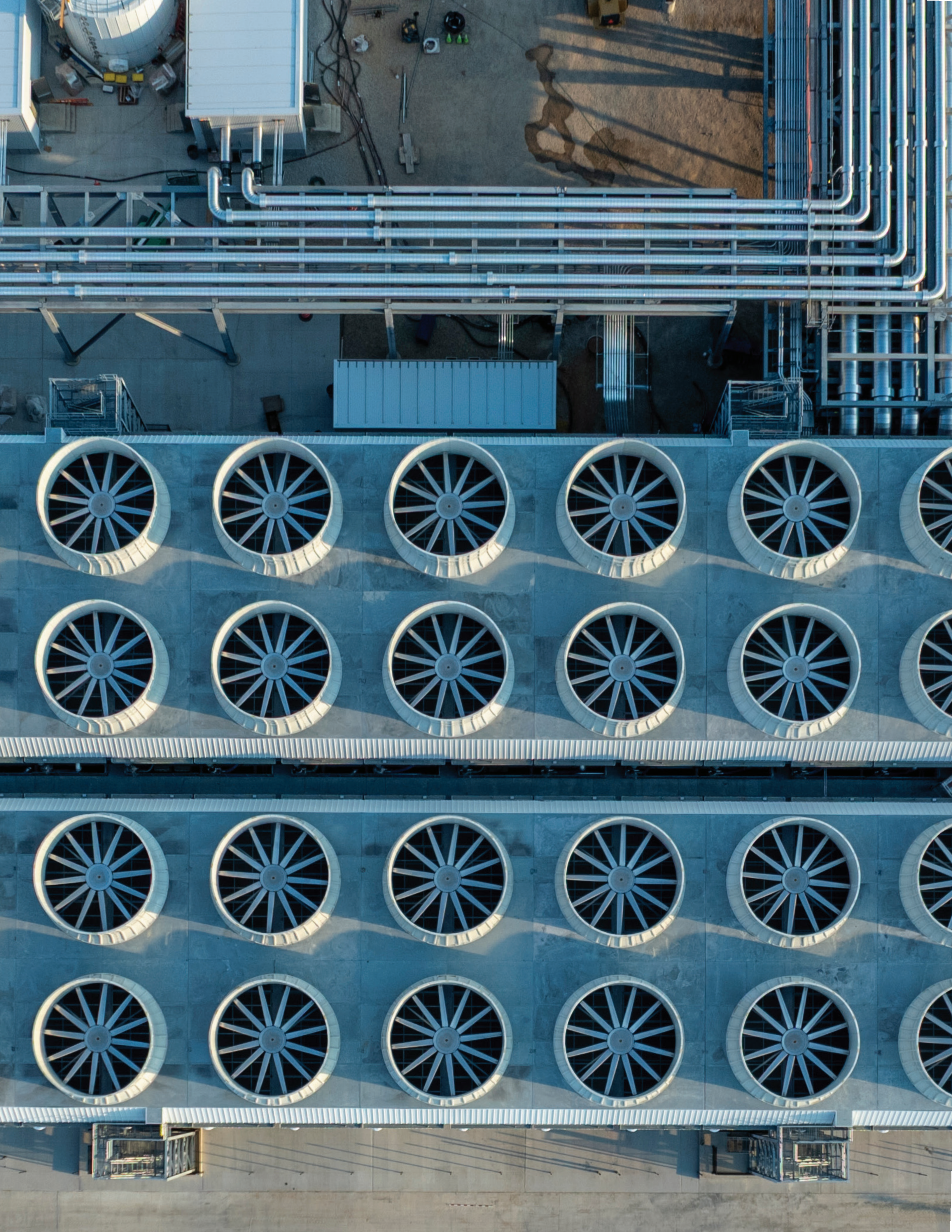
Although water efficiency and conservation requirements or incentives can originate with the state or federal[194] governments, they are often implemented primarily at the local level. For example, the state develops water efficiency standards and water conservation requirements that can be relevant to data centers—in part through state mandated local programs, such as the following:

- CALGreen is California's Green Building Standards Code (implemented by local building departments). It includes both building code requirements and voluntary measures related to water efficiency.[195] For example, new data centers may be required to install separate meters or submeters for water in cooling towers or evaporative coolers when certain thresholds are met.[196] CALGreen applies statewide to any local jurisdiction (city, county) unless that jurisdiction adopts more stringent requirements.

- Urban water suppliers must prepare Urban Water Management Plans that assess water supply reliability and drought risk, describe conservation measures to promote reasonable and efficient use of water, lay out a water shortage contingency plan, and more.[197]

- The 2025 Making Conservation a California Way of Life regulation[198] sets water use objectives for individual urban retail water suppliers and encourages suppliers to take actions to improve the water use efficiency of their distribution systems and among their customers.[199] It provides a framework for urban water suppliers to implement performance measures for commercial and industrial (and other) water uses—but notably, process water (including cooling water in data centers) is statutorily excluded.[200] The Department of Water Resources also provides recommendations to help industrial (and other) users identify water-intensive practices, and prioritize conservation.[201]

Cities, counties, and other water suppliers play an important role in establishing and implementing water efficiency and disclosure incentives and requirements. Their local plans and ordinances can set standards that require conservation or otherwise improve water use efficiency. One example is the City of Los Angeles's water efficiency requirements for cooling tower systems in the city.[202] More generally, the Los Angeles Existing Buildings Energy and Water Efficiency Program requires annual benchmarking of energy and water consumption as well as energy and water audits and operational modernization measures to improve efficiency every five years.[203] The City of San José's Energy and Water Building Performance Ordinance requires owners of commercial, industrial, institutional, and multifamily residential buildings to track their energy and water use and to meet energy and water efficiency standards.[204] Santa Clara Valley Water District offers a water efficient technology rebate that can help existing data centers and other commercial facilities with retrofits (e.g., cooling tower efficiency upgrades) that reduce water use.[205]



4. KEY FINDINGS AND RECOMMENDATIONS

Water considerations must be part of data center decision making to ensure that likely community and environmental impacts and trade-offs (e.g., between water and energy use and between local resource use and local economic benefit) are clear. However, detailed information about data centers' water use is currently in short supply. This leaves policy makers, state and local water and land-use decision makers, and the concerned public in the dark about the impacts data centers have on local water supplies.

Much of the existing regulatory framework that affects data center water use in California is general in nature and was not specifically designed with data centers in mind. Data center projects must comply with a patchwork of environmental review requirements, water-source access requirements, efficiency requirements, and more. Most of these requirements are based in state or local law and are administered by state or local government agencies. At both levels, there are gaps in the regulatory framework surrounding data center water use.

Our literature review and regulatory map reveal that clear opportunities to use regulatory and policy tools to improve transparency around data centers' water use and encourage mitigation of their water-related impacts remain largely untapped. Key opportunities to better understand or reduce data centers' water footprints include improving water use reporting, strategically siting data centers to reduce their water needs and impacts, and designing data centers with less water-intensive cooling systems. The data center industry can consider these opportunities when deciding what information to include in corporate reports and determining where and how to pursue new data center developments. Government decision makers can consider these opportunities as they craft policy and regulatory responses to data centers' impacts and make decisions about specific data center developments. Regulations could be sector-specific, focusing on data centers in particular, or be designed to apply to large-scale industrial water users more generally.

Below, we discuss key gaps and opportunities and provide several specific recommendations.

4.1 INFORMATION GAPS AND OPPORTUNITIES

In Section 2, we provided an overview of the current state of knowledge about data centers' water use and related considerations. That overview reveals how much we do not know. The lack of transparency around data center water use makes understanding its scope, scale, and impacts difficult. Much of what we know about data center water use comes from researchers' estimates and high-level summaries in corporate sustainability reports. Current water supply assessments under CEQA and other state and local water use reporting requirements have failed to provide a clear understanding of data center water use in the state. The magnitude of water use estimates indicates that data centers can have significant water footprints. Yet the lack of more granular information makes it hard to assess the true water-related impacts of existing or planned data centers, or to develop effective strategies for managing those impacts (see Box 4).

The opportunity to improve transparency through more detailed and systematic reporting is ripe and would help both data center proponents and state and local governments anticipate and address serious local impacts and community concerns.

4.2 POLICY AND REGULATORY GAPS AND OPPORTUNITIES

In Section 3 we mapped the patchy policy and regulatory framework that currently applies to data center water use in California. In absence of a comprehensive state-level framework addressing data center water use, initiative and oversight often fall to local entities such as cities, counties, and water suppliers. Box 5 summarizes the main categories of policy and regulatory tools state and local entities can use to understand and address data center water use.

Although local communities bear the brunt of the impacts and local governments ultimately make decisions about data center development, local government decision makers do not necessarily emphasize water sustainability in their interactions with data center proponents.[206] This gap highlights a potential opening for the state to play a role in building local decision makers' capacity to consider data centers' water impacts.

That is not to say that all local governments are ignoring the water impacts of data centers, or of development more generally. For example, some of the cities we analyzed have taken steps to incentivize or require new developments to use recycled water. Their policies and requirements can serve as models for other areas. Exploring avenues for supporting water reuse where recycled water is not already available can help to further reduce strain on potable water supplies.

BOX 4: DO DATA CENTERS USE A LITTLE WATER OR A LOT? IT'S ALL RELATIVE.

Whether data center water use is significant depends on the baseline for comparison and local vulnerabilities and priorities. For example, local decision makers may consider a data center's potential demand relative to the scale of local water supplies and competing uses of those supplies (e.g., household water needs, agricultural irrigation, other commercial and industrial uses, and environmental water needs)—and its potential economic benefits relative to alternative water-dependent activities. Due to the current lack of transparency and limited availability of relevant data, these comparisons can be highly speculative.

In comparison to California's entire agricultural sector (which used about 32 million acre-feet of water in 2019) or California overall urban water use (about 8 million acre-feet in 2019),[207] data centers likely use a much smaller amount of water in aggregate.[208] Indeed, a recent estimate suggests that data centers used only around 1,078 acre-feet (~350 million gallons) of water for on-site use in California in 2019, although the study estimated that the amount more than doubled by 2023.[209]

However, the absolute volume of water data centers use statewide is much less important than how much water a new data center development would use relative to the existing capacity of the local water system that would need to absorb the additional burden. In other words: What matters most is the scale of new local use compared to available local supply.

Policymakers and communities are also likely to be interested in the economic benefits a data center will provide relative to its resource use. For example, local decision makers may care about how the tax-revenue and job-creation impacts of a data center compared to, say, a mall or a shipping distribution center.

Ultimately, whether a data center's water use is considered to be in the public interest depends on the community's specific priorities and vulnerabilities. If decision makers are to serve their local constituents well, they must listen to community input and feedback, be transparent about the comparisons they are making, and evaluate not just how much water a proposed data center would use, but the full range of its social, environmental, and economic impacts and trade-offs.

Unfortunately, this picture is clouded by data deficiencies. Decisions about where and how to build data centers would, ideally, be grounded in data that are not currently collected or disclosed (see Section 2.2).

We suspect that most data centers in California primarily rely on public water service from a municipal or private water utility. State regulation of municipal water use primarily targets water suppliers, not data centers or other individual water users directly. Furthermore, water suppliers are responsible for maintaining reliable service over time. Therefore, enhancing our understanding of data centers' use of public water services is key to accurately characterizing and addressing data center water use in California.

Some California data centers use groundwater as a backup supply (e.g., in case their recycled water supply is interrupted) or as their main source of water. The state regulatory framework for groundwater is less extensive than the state regulatory framework for surface water. Pumping limits exist in some water-stressed areas, which may dissuade the development of data centers with water-intensive cooling systems in these areas. However, outside those areas, groundwater pumping remains largely unrestricted. This gap may need state attention.

As we noted in Section 2.3, our literature review revealed two key decision points for reducing data center water use and its impacts: siting and cooling system design. Local planning mechanisms can influence both. For example, by directing high water-use projects to areas of the city with more sustainable supplies. Yet, based on our high-level review of local regulations in the three California cities with the most data centers, we hypothesize that the potential to prioritize water considerations in siting decisions is underutilized. There appears to be untapped potential to require or encourage co-location of data centers with wastewater treatment plants that can serve as a source of recycled water,[210] siting data centers in areas with more abundant potable water supply or with existing access to recycled or desalinated water, and the use of less water-intensive cooling systems. However, some movement is happening: a new agreement between San José and Prologis authorizes the development of a data center campus on 159 acres of wastewater treatment plant buffer lands to leverage recycled water infrastructure.[211]

BOX 5. SUMMARY OF POLICY AND REGULATORY TOOLS THAT MAY AFFECT DATA CENTER WATER USE

Data center water use in California is currently shaped less by direct mandates and more by a patchwork of general environmental review requirements, water access requirements, and water efficiency and conservation requirements. Available tools range from highly prescriptive command-and-control requirements ('sticks') to incentives for voluntary action ('carrots').

The following list provides a partial overview of tools that the state and local entities are using to manage water use. Many of these tools could be tailored to more specifically address data centers' water use and related impacts.

Environmental review requirements are one way consideration of water use is incorporated into decision making. It can disclose anticipated water use and highlight potential impacts to decision makers and stakeholders, but does not directly regulate water use, although CEQA can require mitigation of significant impacts.

Permits or other approvals needed to access a source of water vary depending on the type of water source a data center plans to rely on. For example, a data center that wants to use a municipal water supply needs to apply for service and may need to negotiate a water service agreement. If a data center plans to directly access a natural water body, it needs a water right. Starting a new surface-water diversion usually requires a water right permit from the state. A local well permit is required to dig a new groundwater well, and other permits or approvals may be required in areas with active groundwater management programs. Permits and other approvals include use restrictions and other conditions that could be tailored to address the risks and information needs associated with data centers.

General plans are state-mandated plans that cities and counties update periodically to set the broad contours of future land use and development in order to meet their long-term goals. These goals can include things like shifting water use from potable to recycled water when feasible.

State statutes and regulations and local ordinances can be used to establish broad policies and specific requirements of various types. For example, local ordinances might require new data centers to use recycled water when it is available, use zoning or other rules to direct new high-water-use activities to areas where recycled water is available, or give large industrial water users priority access to recycled water. Building codes can incorporate water efficiency standards.

Reporting requirements can be built into the environmental review process and included in permits and in other approvals or established separately. Increasing transparency around data center water use was the aim of recently vetoed Assembly Bill 93. Without the bill, water-use disclosure is only triggered as part of a water supply assessment during the environmental review process if a data center exceeds specific size or consumption thresholds. While water service providers track consumption at every meter, they often lack specific data center classifications in their data, and privacy laws keep them from disclosing individual customer's usage to the public.[212] Surface water right holders must report their diversions annually, but the state's publicly accessible water rights database does not allow easy identification and tracking of data center uses. Groundwater users currently don't need to report their extractions in most parts of the state, but may need to do so in some areas with active groundwater management programs.

Financial incentives include things like lower rates for recycled water service than for potable water service and tax credits or exemptions tied to water efficiency or recycled water use.

4.3 RECOMMENDATIONS

Our synthesis of the state of knowledge on data center water use and our regulatory mapping supports a set of recommendations geared toward enhancing understanding of data center water use and addressing its impacts. State policymakers and regulatory agencies, local government decision makers, and data center providers each have a role to play in ensuring that data centers support California's economic and technological advancement while respecting local community and environmental needs and priorities.

4.3.1 Improve information about data center water use and its impacts

Improving data collection and transparency is necessary if state and local decision makers are to understand data center water use and its impacts. The expansion of data centers represents a permanent commitment of resources once approved. Existing reporting requirements have failed to provide a clear understanding of data center water use in California. The scale and speed of development and high density of data center water use warrants swift coordination of data collection, availability, and analysis—to ensure that oversight keeps pace with industry growth and protects long-term water sustainability.

Improved data disclosure and reporting could help clarify what water sources data centers draw from, how water use varies depending on factors like data center size and cooling system. Such data could provide a basis for developing policies and regulations, performance metrics,[213] and benchmarks for water-efficient data center performance.

Therefore, our first recommendation is for the state to ***improve water use data collection and transparency.*** Disclosing water use estimates during the planning phase enables local decision makers to evaluate a data center's impact before its resource use becomes permanent. Also, regularly reporting actual usage once the data center is operational could enable the state to track demands on water supply.

Currently, data centers may be required to disclose anticipated water use through water supply assessments conducted during the environmental review process—but only when a data center meets certain size or water-use thresholds (see Section 3.1). To close the remaining information gap, the state could explore options to extend reporting of anticipated water use, such as centrally collecting and analyzing data that is already being provided, or mandating additional reporting of anticipated water use.

Assembly Bill 93 would have been a first step in expanding data collection by requiring data centers to provide an initial estimate or report of actual water use to their local water supplier when applying for an initial business license or when seeking renewal. In the absence of this bill, Health and Safety Code section 116530 may provide a basis for collecting more information about data center water use from public water systems. This statutory provision gives the State Water Resources Control Board broad authority to require reports from public water systems regarding their capacity, sustainability, and service connections,[214] potentially including information on data center water use. If it were to exercise this authority, the Board would likely need to undertake a formal rulemaking process. The resulting regulation could, among other things, direct water service providers to refine their data collection categories to distinguish data centers from broad industrial classifications.

However, reporting requirements would ideally capture ongoing water use and apply to all data centers, not just those reliant on public water system service. To meet this goal, the California legislature could pass a law directing the State Water Resources Control Board to develop reporting requirements that apply to data center operators, regardless of the sources of water they use. Requirements could be tiered so that data centers that use more water must provide more detailed information about the nature and timing of their water use and their cooling systems.[215] Policymakers could consider whether it might be beneficial to extend reporting requirements to other categories of commercial and industrial facilities that are known to be large water users to support comparative analysis. Such data could lay the groundwork to include process water in Making Conservation a California Way of Life urban water use objectives and performance measures.

For a state concerned with data center water use, reporting is a necessary component of oversight. However, we acknowledge that such transparency is not without costs. For this information to be actionable, the state needs to build capacity to collect and analyze data. For example, the legislature could fund the State Water Resources Control Board to ensure staff have the capacity to absorb and distill this technical information into meaningful state- and local-level insights. Also, while basic water use reporting might not be a significant financial burden for data center companies, it would add to the cumulative regulatory burden for both the industry and regulatory agencies. While an economic analysis of this cumulative burden is beyond the scope of this report, it is a factor policymakers should weigh when considering what measures to take to address concerns about data centers' water impacts.

The state could augment data center water use reporting information with support for research to better understand the impacts of data center water use. Water use data are critical, but analyzing those data in context to understand how water use translates into community and environmental impacts would be necessary to provide decision-relevant information to audiences interested in data center siting, design, and operations. Impacts are often determined by place-specific factors: for example, small rural communities may have fewer water supply options and face heightened water use impacts and governance challenges. Analytical support would be particularly important for local communities without the capacity to conduct such analysis on their own.

The data center industry can also improve transparency by ***including site-specific water use data in corporate sustainability reports***. Providing water use data in context will make water and energy trade-offs explicit and help regulators and communities understand data centers' true impacts. Companies that are able to show that they are investing in technologies that reduce both water and energy consumption will not only build operational resilience but also secure a social license to operate.

An improved information base would help researchers, policymakers, regulatory agencies, and local decision makers prioritize future policy and regulatory actions. Although this report focuses on direct on-site data center water use, it is important that water considerations not be viewed in isolation. Indirect water use, such as from energy generation, and other resource impacts also need to be considered. For example, both water and energy are limited resources in California. Simply requiring dry cooling systems or limiting data centers' water use may not always be the best option, particularly where these approaches would greatly intensify other stressors, such as to energy systems. Decision makers face the challenge of considering the whole system and all relevant factors, which include, but are not limited to direct water use and its impacts. State support for building local capacity can enable local leaders to make more informed decisions about data center development.

4.3.2 Address the impacts of data center water use

Where data center water use is an issue, options for addressing water use and its impacts could include the following:

- The state could ***help local decision makers build capacity*** to factor data center water use into consideration of proposed data center projects. For example, state agencies could provide guidance for evaluating proposed data centers' potential resource use and potential economic benefits on a level playing field. They could provide trainings on local policy and regulatory options for managing data centers' water impacts and develop model water-efficiency standards and other tools local entities could use to address data center water use when necessary. Trade-off evaluation is notoriously difficult since it is ultimately based on values.[216] Therefore, the state could set up a technical assistance program or provide funding for local governments to hire expertise to help them assess data center impacts and determine appropriate controls.
- Data center developers could more ***explicitly and transparently consider local water impacts in siting and design decisions***, along with other important considerations.
- State or local governments could ***incentivize less water-intensive cooling systems or recycled water use***. Examples of such policy 'carrots' include tax breaks (as Senate Bill 58 would have provided) or streamlined permitting for data centers that use recycled water or less water-intensive cooling systems.[217] More analysis is needed to determine if such tools could be economically effective in steering behavior.
- State or local governments could ***set water usage or efficiency standards*** for data centers, such as limits on cooling water use, water-efficiency specifications, or water recycling requirements. These regulatory 'sticks' may drive innovation in cooling systems and water recycling.[218] Conditional zoning could be a useful tool for implementing such standards.[219]
- Local governments could ***employ zoning and other land-use tools*** to specifically address data center water use. We recognize that case law on local governments' land-use authorities may limit some of these options in some cases. To take advantage of locally specific opportunities, local governments could encourage co-siting of data centers and wastewater treatment plans[220] or use zoning ordinances to require siting water-intensive uses in areas with recycled water availability. However, recycled water is also a limited resource with competing demands. Therefore, local governments could encourage data centers to help fund expansions of tertiary treatment capacity that boosts recycled water supplies.
- Water service providers could ***include the marginal cost of higher water use in water rates*** to clarify and recoup the real costs of additional data

center water use.[221] Adjusting water rates to cover all associated costs can help ensure that high-intensity water users do not increase water rates for the whole community. Water service providers may be able to tier pricing for higher volume uses or require data centers to pay for expansion of a recycled water system and other infrastructure impacts needed to accommodate its usage. Any rate adjustments must remain consistent with California's requirement that charges must be based on the cost of service.[222] Tiered prices must also correlate with the actual cost of providing water at those tiered levels.[223] Based on (limited) available information, we suspect that energy costs for data centers are higher than water costs, and that subsidized recycled water is cheaper than potable utility water.[224] Higher water rates for potable water may incentivize data centers to use recycled water or reduce their overall water use.

- Depending on how much data centers draw directly from groundwater sources, ***more oversight could protect groundwater basins from unsustainable use by data centers***.[225] This is especially relevant outside of adjudicated areas and priority basins under SGMA, where there is less oversight of groundwater use.
- State and local policymakers and regulators could explore the potential utility and implications of **requiring or incentivizing on-site reuse of water at data centers** under certain conditions. Similarly, the state could investigate the conditions (e.g., roof surface area, local precipitation patterns, storage options) under which on-site rainwater harvesting or stormwater capture and use might be a feasible source of water for industrial cooling, as well as the circumstances under which a water right permit would be required.

These recommendations entail significant changes and there might be legal and other institutional challenges to implementing them. Nevertheless, each of the remains an option for exploration and implementation by all interested decision makers from the legislature to data center operators.

Development pressure, combined with public attention, creates an opportunity for policy innovation and technological advancement. California can better align data center development with community values and resource limitations. To date, data centers' energy use has received more policy and regulatory attention than their water use, when both need to be considered together to properly weigh the trade-offs between them. As data centers' collective footprint on our infrastructure landscape continues to expand, owners and operators may feel that they must prioritize either water conservation or energy efficiency. However, with careful planning, investments in technology like recycled water facilities and cooling system innovations may offer solutions that can minimize energy, water, and other impacts.

Levers discussed above are available to reduce water use, as are the actions outlined for state, local, and industry actors to improve transparency and consider water use in decision making. Our recommendations discuss how these might be implemented in practice and offer a path for California to ensure that data center development is balanced against water sustainability and community priorities.

5. CONCLUSION

This report has examined the current state of knowledge about data center water use and what can be done to better understand and manage its impacts. The current boom in data center development could have significant repercussions for local water resources. However, California's citizens and decision makers are operating at a disadvantage: lack of information hinders our understanding of the local and statewide scope and scale of water-related impacts. The speed and scale of data center development warrant a swift coordination of data collection, availability, and analysis—before development outpaces oversight and creates permanent impacts.

Furthermore, local communities bear the impacts of data centers, and their governments are the key decision makers on whether, where and under what conditions a data center can be built—but they lack guidance on how to evaluate water use in the context of regional water sustainability, energy use, and economic benefits.

Fortunately, data center developers have options. The siting phase and the design phase are key points for reducing data center water use. Locating data centers in areas with recycled water supply and using less water intensive cooling technologies can reduce water use and its impacts. To avoid missing broader resource implications, any actions to address data center water use must consider trade-offs between water and energy use.

State and local government decision makers could use regulatory and policy tools to improve transparency around data centers' water use and to require or encourage mitigation of its impacts. Today, these opportunities remain largely untapped. In service of greater clarity and more effective management of data centers' water-related impacts, we recommend that state and local governments and industry take the following actions:

Options for state government:

- The state could improve water use data collection and transparency by extending requirements for data center operators to report their anticipated and actual water use across all water sources—to help local decision makers make informed choices and state agencies track demands on water supplies. The state may need to increase its capacity to centrally collect and distill information for actionable insights.
- The state could provide clarity on its policy intent and the regulatory boundaries for data centers. This includes defining the scope of local discretion, modernizing the regulatory framework, and filling necessary gaps in authority.
- The state could support local capacity building—for example, by providing technical support, model standards and regulations—to enable local entities to evaluate both short-term gains and long-term potential impacts to best serve local communities.

Options for local governments:

- Local government entities could use incentives and land-use and zoning tools to foster or require efficient water use, co-location of data center with wastewater treatment plants, or the use of recycled water sources.

Options for data center providers:

- The data center industry could improve transparency—for example, by explicitly considering local water impacts and siting and design decisions, and by including local data into sustainability reports. By providing this information, companies can make water-energy trade-offs clear to regulators and communities and improve operational resilience.

Now is the time to address concerns over the data center industry's rapidly expanding water footprint. State- and local-government policy makers and decision makers—and the tech industry itself—can take actions to improve transparency and reduce data centers' impacts on local water resources and the ecosystems and communities that depend on them.

Ultimately, the issue is bigger than our state: if California's can lead on increasing transparency around data center water use and developing a viable regulatory framework for addressing the impacts of data centers within its own borders, improvements here can provide lessons and models for other states facing rapid data center development.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APPENDIX 1: EXAMPLES OF ADJACENT REGULATORY SYSTEMS THAT CAN AFFECT DATA CENTER WATER USE

Other regulatory systems can also affect data center water use, even if regulating water access or use falls outside the scope of their objectives. We briefly discuss several examples of these adjacent regulatory systems here:

- **Discharge water-quality regulation:** The federal Clean Water Act and state Porter-Cologne Water Quality Control Act[226] protect the quality of water in natural water bodies. Activities that may discharge pollutants into water bodies, such as data center construction[227] or discharging cooling water into a river or to an area that impacts groundwater, may require a permit under one or both legal frameworks. National Pollutant Discharge Elimination System (NPDES) permits regulate discharges of pollutants from municipal, industrial, and other point-sources to waters under federal jurisdiction,[228] while state Waste Discharge Requirements (WDRs) apply to discharges to state waters (including groundwater).[229] Requirements for cooling water intake structures designed to withdraw at least 2 million gallons per day from waters of the United States are incorporated into NPDES permits.[230]
- **Species and ecosystem protections:** Requirements meant to protect species and ecosystems may affect data centers under certain conditions. For example, if a data center's construction or operation could affect a river, stream, or lake in a way that could negatively impact fish or other wildlife, a Lake and Streambed Alteration Agreement with the California Department of Fish and Wildlife may be required.[231] If a data center could affect state or federally protected species, an incidental take permit may be required.[232] If a data center diverts water directly from a natural surface water source, it could be subject to instream flow requirements designed to protect public trust resources, such as native fish species.[233]
- **Air quality regulation:** Air quality regulations may apply to emissions from cooling systems that use evaporative cooling (and can emit particulate matter) and emissions from on-site energy generation.[234] On-site energy generation includes diesel generators, which data centers often rely on for backup power. The federal Clean Air Act and state air quality laws are implemented by the California Air Resources Board and local air quality management districts.[235] For example, the South Coast Air Quality Management District operates an emission control and reporting program.[236]
- **Energy use regulation:** The trade-offs between water and energy use for data center cooling systems mean that regulations, incentives, and requirements surrounding energy use and efficiency can have implications for data center water use. At the state level, this includes building energy efficiency standards,[237] renewable energy mandates (e.g., Senate Bill 100 encouraging a shift to more solar and wind power for electricity generation, which should reduce indirect data center water use[238]) and, potentially, reporting requirements for data center energy use.[239]
- **Local land-use regulation:** Cities and counties can use their land use authorities to influence data center water use, such as by establishing zoning ordinances that guide data center development to locations with more reliable water supplies and/or access to recycled water or by adding efficiency and other requirements to building permits.

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PHOTO CAPTIONS

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