EXECUTIVE SUMMARY

The Role of Onsite Water Systems in Advancing Water Resilience in Silicon Valley

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PACIFIC INSTITUTE

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The Pacific Institute envisions a world in which society, the economy, and the environment have the water they need to thrive now and in the future. In pursuit of this vision, the Institute creates and advances solutions to the world's most pressing water challenges, such as unsustainable water management and use; climate change; environmental degradation; food, fiber, and energy production for a growing population; and lack of access to freshwater and sanitation. Since 1987, the Pacific Institute has cut across traditional areas of study and actively collaborated with a diverse set of stakeholders, including policymakers, scientists, corporate leaders, international organizations such as the United Nations, advocacy groups, and local communities. This interdisciplinary and nonpartisan approach helps bring diverse interests together to forge effective real-world solutions. Since 2009, the Pacific Institute has also acted as co-secretariat for the UN Global Compact CEO Water Mandate, a global commitment platform that mobilizes a critical mass of business leaders to address global water challenges through corporate water stewardship.

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EXECUTIVE SUMMARY

Water is essential for the social, economic, and environmental well-being of Silicon Valley. Yet the region is facing a host of water challenges, affecting the quality and reliability of water as well as the risk of flooding. The region's water and wastewater infrastructure is aging, and in many cases, nearing the end of its useful life. Continued growth and development are putting additional strains on the region, and climate change is adding to that burden through sea level rise, more intense storms, and more severe droughts. These challenges present risks, but also an opportunity to rethink the design, configuration, and operation of water and wastewater systems.

DISTRIBUTED WATER SYSTEMS IN SILICON VALLEY

In response to the water challenges facing Silicon Valley, there is growing interest in the potential for distributed strategies to improve the performance and resilience of urban water systems. Distributed strategies in an urban context generally refer to "dispersed facilities that extend beyond the central infrastructure and are located at or near the point of use." (Johnson Foundation at Wingspread, 2014). These systems include a broad range of water supply, wastewater treatment, and stormwater management strategies, such as water efficiency, onsite stormwater capture and reuse, and onsite wastewater treatment and reuse. These distributed strategies can be implemented in residential and commercial settings at a range of scales.

Many leading companies are investing in distributed water systems at their facilities. In Silicon Valley, several big technology companies — including Facebook, Microsoft, and Google — have implemented onsite non-potable water systems (ONWS) on their campuses. These systems gather wastewater from lavatory sinks, showers, toilets, washing machines, dishwashers, and cooling towers; treat it to safe levels onsite; and then reuse that water for non-potable purposes, such as toilet flushing and outdoor irrigation. In this report, we examine the opportunities and challenges associated with scaling onsite ONWS in Silicon Valley.

REGIONAL STAKEHOLDER PERSPECTIVES

To better understand local perspectives on ONWS in Silicon Valley, we interviewed 23 stakeholders working in the region, including representatives from water utilities, academia, technology companies, engineering consultants, water technology vendors, and environmental organizations. Interviewees were asked about a range of issues related to ONWS in Silicon Valley, including its current and future role, implementation drivers and barriers, the appropriate role of the private sector, and the likely effect of new regulations. It is important to note that the views expressed in the regional perspectives section represent the opinions of those interviewed, and we make no attempt to validate these opinions.

ONWS currently play a minor role in Silicon Valley, and those interviewed had differing expectations

about the future role of these systems in the region. Some think they will play an important role in the future, whereas others think they will remain a niche technology. There is general agreement, however, that future water supply portfolios in the region will include projects at various scales (i.e., building, block, district, and regional systems), and some are excited about the opportunities for district-scale systems.

Those interviewed agree that sustainability goals are a major driver of corporate investments in ONWS, as well as long-term positive return on investment. There is broad agreement that by being sustainability leaders and innovators, Silicon Valley companies can strengthen their brand reputation both broadly and within local communities, as well as improve employee recruitment and retention in a competitive labor market. Another key driver is the desire to reduce water-related risks posed by climate change and other water challenges in California. Companies see water and sewer costs rising and want a resilient and independent water supply. While ONWS may not present a strong positive return on investment in the near term, rising water and wastewater costs indicate greater returns over longer time horizons are possible.

All interviewees expressed support, and in some cases enthusiasm, for Silicon Valley companies investing in ONWS. For example, interviewees felt that corporate investments in ONWS can accelerate innovation in treatment, monitoring, project implementation (including regulation), and operation of water systems more broadly. There was also discussion about how private investments in ONWS can alleviate pressure on centralized systems, and perhaps defer, reduce, or eliminate the need for utilities to make capital investments to expand existing water networks.

However, interviewees also expressed concerns over the appropriate role of corporations in managing water resources. These included trepidation about corporate accountability for public health and safety, as well as concerns about equity when it comes to water costs and availability.

Lastly, interviewees were asked how they expect California Senate Bill 966 — which requires the State Water Resources Control Board to adopt regulations for the onsite treatment and reuse of nonpotable water — to affect the development of onsite water systems in Silicon Valley. The bill enjoys wide support, and all agreed that standard regulations for onsite water systems are an absolute necessity. There was some disagreement about whether local permitting and oversight is the appropriate approach for ONWS, but agreement that local authorities need support to effectively implement the legislation. There is confusion about what the lack of a local program means, and some interviewees had doubts about whether SB 966 will be relevant by the time it is finalized.

REALIZING BENEFITS

At scale, ONWS have the potential to fundamentally shift water use and wastewater production patterns, thereby altering water, greenhouse gas, and other resource outputs. This shift, in turn, can provide a wide range of benefits, such as enhancing water supply reliability, improving water quality, reducing local flooding, and increasing urban green space (see, for example, Johnson Foundation at Wingspread, 2014 and Kohler and Koch, 2019). These systems, however, can also create negative impacts if done poorly and without integrating planning with other water systems. They can, for example, result in stranded assets and jeopardize existing and future commitments to recycled water customers.

The outputs of ONWS can lead to an array of cascading outcomes and impacts that occur along various temporal and spatial horizons. Through interviews and a literature review, we identified 26 potential outcomes and impacts associated with ONWS, both positive and negative (Table ES1). Outcomes and impacts, both positive and negative, depend on local context and are proportional to the extent to which ONWS are implemented, such that a small number of ONWS would have no or very little effect on the water and wastewater systems and the broader community.

Table ES1. Potential Outcomes and Impacts Associated with Onsite Non-Potable Water Systems

Theme	Potential Outcomes and Impacts*
Water Quantity	Augment local water supplies (+)
	Inability to meet recycled water commitments (-)
Water Quality	Reduce discharge of wastewater pollutants (+)
	Reduce freshwater discharge into receiving waters (+/-)
Energy Use and GHG Emissions	Greater onsite energy use and associated GHG emissions (-)
	Reduced system energy use and associated GHG emissions (+)
	Reduced urban heat island effect (+)
Infrastructure	Avoided or deferred new water supply/treatment and wastewater infrastructure (+)
	Concentrated wastewater streams that can corrode wastewater collection system and/or create odor concerns (-)
	Creation of stranded assets if centralized and distributed systems are poorly integrated (-)
Finances	Increased site capital and operation and maintenance costs (-)
	Altered operation and maintenance costs for the water and/or wastewater system (+/-)
	Near-term reduction in revenue and shifting cost burden (-)
	Long-term reduction in capital costs for water and wastewater infrastructure (+)
	Greater financial flexibility (+)
Innovation	Creation of new technologies and ways of building and operating water systems (+)
	Creation of innovative shared ownership and operation models (+)
	Creation of innovative partnerships between the public and private sectors (+)
Organizational Reputation	Seen as a leader and innovator (+)
	Improvement in employee recruitment and retention (+)
Policy Goals and Regulatory Requirements	Achievement of public and private sector sustainability goals (+)
	Altered ability to meet NPDES/WDR** requirements (+/-)
Resilience	Diversified water supply portfolio (+)
	Greater operational flexibility (+)
	Reduced vulnerability to sea level rise (on coastal infrastructure and Delta supplies) (+)
	Creation of redundant water and wastewater systems to reduce likelihood of service disruption (+)

*Realization of outcomes and impacts, both positive and negative, depend on local context and are proportional to the extent to which ONWS are implemented.

**NPDES stands for National Pollutant Discharge Elimination System; WDR stands for Water Discharge Permit. Both refer to permitting requirements under the federal Clean Water Act.

Realizing the benefits of ONWS in Silicon Valley for water and wastewater systems and the community — and addressing risks and reservations — requires coordination between the public and private sectors. Failing to incorporate the expansion of ONWS into water and wastewater master plans can lead to unnecessary infrastructure investments and ultimately higher costs to ratepayers. Likewise, large-scale investments in ONWS (and related reduced dependence on public systems) can create a host of financial, operational, equity, and other issues. Integrated planning is key to advancing the benefits, and managing for the trade-offs, of ONWS in Silicon Valley.

OPPORTUNITIES IN SILICON VALLEY

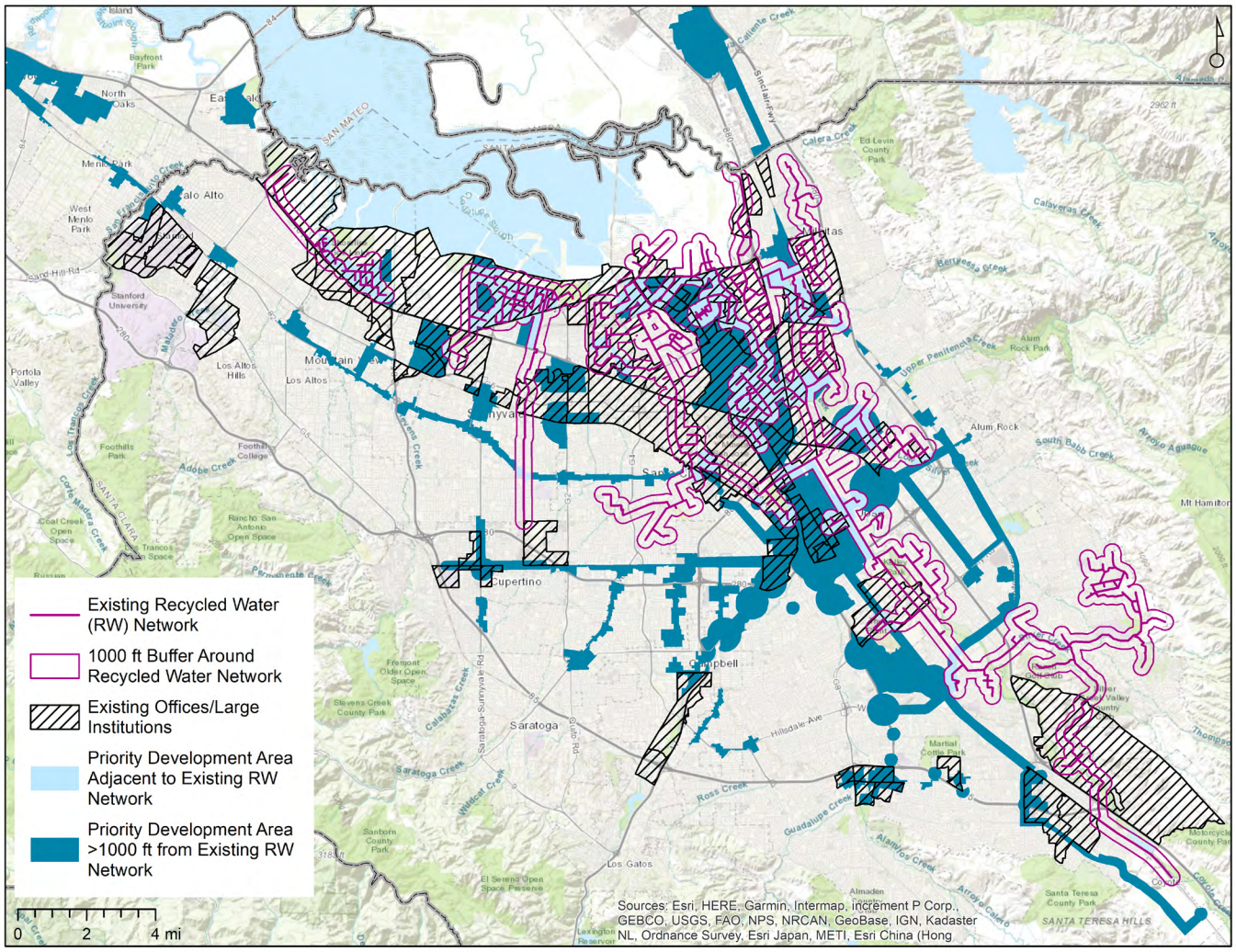
ONWS can provide a multitude of benefits, but realizing these benefits requires integration with existing infrastructure systems and planning decisions. Evaluating the opportunities for ONWS to contribute to these benefits at the system-scale can help identify areas with the greatest potential for realizing and maximizing the value of these benefits. ONWS have relatively modest potential for contributing to the region's water supply portfolio but, if integrated into water planning, may provide water infrastructure augmentation, redundancy, and resilience benefits in some locations.

ONWS are most easily integrated into redevelopment and new development projects due to the challenges of retrofitting buildings and installing dual plumbing systems. We found that there are development areas with little or no recycled water infrastructure in portions of downtown San Jose, around most Caltrain Stations, the Southwest Expressway Corridor toward Campbell, and the Stevens Creek Boulevard corridor. In total, roughly 18 square miles of priority development area are within 1,000 feet of existing recycled water distribution networks, while 50 square miles of priority development area are more than 1,000 feet from existing recycled water supply networks (Figure ES1). Redevelopment areas currently unserved by existing recycled water supplies could be good candidate areas for ONWS. While several of these areas are being explored for future recycled water expansion in the current Countywide Water Reuse Master Plan (Brown and Caldwell, 2020), ONWS could avoid the need for extending recycled water networks into these areas.

ONWS provide a reliable supply of non-potable water for sites implementing these projects. The water reuse potential is limited to the quantity of reusable water on commercial, industrial, and institutional properties, and demand for non-potable water on these sites. Given that ONWS will likely be limited to new developments or major redevelopments, they likely will not result in marked reductions in imported water for the region.

ONWS can augment system-level infrastructure and create redundancy, although these benefits are among the most challenging to realize in practice. Water infrastructure in Silicon Valley is aging, and shoreline infrastructure is increasingly vulnerable to sea level rise. Moreover, some priority development areas are likely to be underserved by existing sanitary sewers. However, multiple engineering, municipal code, ownership, and longevity barriers must be overcome for infrastructure augmentation benefits of ONWS to be realized. Designing ONWS to contribute to system redundancy during times of stress, such as in the aftermath of an earthquake, can help ensure these systems serve both the site and the broader community.

Figure ES1. **Metropolitan Transportation Commission Development Areas Relative to Existing Recycled Water Supplies and Communities of Concern**



Source: City of San Jose Open Data Platform, Metropolitan Transportation Commission Open Data Platform, Valley Water District Draft Recycled Water Master Plan

CONCLUSIONS AND RECOMMENDATIONS

There is often a perceived tension between distributed and centralized systems. However, these systems can work together to build more resilient communities where the whole is greater than the sum of its parts. A desirable outcome would be for ONWS to be deliberately sited and effectively integrated into the broader water network, with an explicit acknowledgement and management of the interconnections. By contrast, an undesirable outcome would be for the haphazard placement of ONWS that ignores system constraints and opportunities.

Realizing the benefits of ONWS in Silicon Valley for the water/wastewater system and the community — and addressing risks and reservations — requires coordination between the public and private sectors. We recommend the following actions to ensure integration and maximize the

potential benefits of ONWS while managing for the trade-offs:

Convene regional stakeholders to facilitate a constructive dialogue about the role of ONWS in Silicon Valley. These convenings can help to foster a mutual understanding of stakeholder motivations and concerns and identify areas of agreement and disagreement. Such discussions can help to daylight issues and determine pathways forward. They can also help to build relationships and establish trust among stakeholders, creating opportunities to advance this or other efforts.

Conduct more detailed technical analyses to examine how best to integrate ONWS into existing centralized water and wastewater systems. These analyses should, for example, estimate the supply potential provided by ONWS and impact on recycled water plans. They should also include detailed geospatial analysis to understand where these facilities can provide the greatest benefits and examine possible alternative configurations to achieve desirable outcomes.

Evaluate policies and practices for effectively integrating ONWS into existing water and wastewater systems. This evaluation should examine models for integrated planning with multiple stakeholders, as well as new business and ownership models for developing and operating building- or district-scale ONWS.

Identify opportunities to implement other distributed water strategies in concert with ONWS implementation. By integrating other distributed water strategies — such as rain gardens, rain tanks, natural treatment wetlands, and water efficiency — into new commercial development, sites can maximize the benefits of their onsite water investments. In particular, the opportunity to combine onsite stormwater capture and reuse with ONWS warrants further exploration.

For the full report *The Role of Onsite Water Systems in Advancing Water Resilience in Silicon Valley*, please visit:
https://pacinst.org/publication/onsite-water-systems-silicon-valley

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