Sustainable Landscapes on Commercial and Industrial Properties in the Santa Ana River Watershed

Heather Cooley, Anne Thebo, Cora Kammeyer, Sonali Abraham, Charles Gardiner, Martha Davis

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The CEO Water Mandate

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ACRONYMS AND ABBREVIATIONS

CCF – Centum (Hundred) Cubic Feet

BMP – best management practice

CI – commercial and industrial

ET_0 – reference evapotranspiration

FEMA – Federal Emergency Management Agency

ft^2 – square feet

LID – low-impact development

MSA – meter service area

MS4 – municipal separate storm sewer system(s)

MWELO – Model Water Efficient Landscape Ordinance

MWDSC – Metropolitan Water District of Southern California

OWOW – One Water, One Watershed

SAWPA – Santa Ana Watershed Project Authority

SBVMWD – San Bernardino Valley Municipal Water District

US EPA – United States Environmental Protection Agency

EXECUTIVE SUMMARY

Pressures on water resources are intensifying due to aging infrastructure, population growth, climate change, and other factors. Marked by vast expanses of thirsty lawns and impermeable pavement, California's urban and suburban communities are ill-equipped to handle these pressures. Outdoor use represents about half of all water used in urbanized areas, and even more in the hottest, driest parts of the state.[1,2] Runoff from lawns carries fertilizers and pesticides into waterways. Similarly, impermeable pavement impedes groundwater recharge; contributes to higher peak flows; warms the urban environment; and carries oils, metals, and other toxins into rivers, estuaries, and the ocean.

The good news is that there are more sustainable options for California communities. Replacing lawns with climate-appropriate plants that are irrigated efficiently can save water and reduce vulnerability to drought. When integrated with bioswales, rain gardens, and other green infrastructure, these projects can boost local water supplies, reduce flooding, and improve water quality. These practices can also save energy, provide habitat, sequester carbon, improve air quality, boost property values, enhance community livability, and increase resilience to climate change.[3,4]

Source: John W. Miller, iStock

1 Heberger, M., H. Cooley, and P. Gleick. 2014. Urban Water Conservation and Efficiency Potential in California. Oakland, Calif.: Pacific Institute. http://pacinst.org/wp-content/uploads/2014/06/ca-water-urban.pdf.

2 Hanak, E., and M. Davis. 2006. "Lawns and Water Demand in California," California Economic Policy 2, No. 2, https://www.ppic.org/publication/lawns-and-water-demand-in-california/.

3 Center for Neighborhood Technology and American Rivers. 2010. The Value of Green Infrastructure: A Guide to Recognizing its Economic, Environmental, and Social Benefits. Center for Neighborhood Technology, Chicago, Illinois. https://www.cnt.org/sites/default/files/publications/CNT_Value-of-Green-Infrastructure.pdf.

4 United Nations Environment Programme, International Union for the Conservation of Nature, The Nature Conservancy, World Resources Institute, Green Community Ventures, US Army Corps of Engineers. 2014. Green Infrastructure: Guide for Water Management. http://wedocs.unep.org/handle/20.500.11822/9291.

The scope and scale of our sustainability challenges warrant action by all Californians–including the business community. Most sustainable landscape programs have focused on residential parcels, yet commercial and industrial properties are disproportionately landscaped with turf grass and have large impervious surfaces. The opportunities for advancing sustainable landscape practices on commercial and industrial properties are not well understood.

This project is a collaboration between the Pacific Institute, the CEO Water Mandate, California Forward, and the Santa Ana Watershed Project Authority. For this study, the project team used data provided by the Santa Ana Watershed Project Authority to conduct a geospatial analysis of the water efficiency and the stormwater retention and capture opportunities that would potentially realize benefits from landscape conversions. In addition, the project team surveyed and interviewed business representatives in the region to understand barriers to and motivations for implementing sustainable landscape practices. While focused on the Santa Ana River Watershed, the approach and methodology can be replicated elsewhere.

The study finds that there are significant opportunities for the business community to contribute to shared watershed goals through investments in sustainable landscape practices on their properties. These landscapes can make substantial contributions toward improved surface water quality, flood management, and water supply reliability in the Santa Ana River Watershed. They can also reduce energy usage and associated greenhouse gas emissions, sequester carbon, improve ecosystem and human health, promote economic activity, and enhance community resilience. Some of these benefits accrue to the property owner, whereas others accrue to the broader community.

The opportunities and potential for realization of these benefits are distributed unevenly across the watershed (Figure ES-1). Most parcels provide at least one benefit, and many parcels, particularly in the northern (i.e., Chino Basin and San Bernardino Valley) and western (i.e., Orange County) portions of the watershed, were found to have the potential to contribute to two or more benefit categories.

A clearer understanding of the business community's motivations and challenges can help to develop programs and policies that effectively encourage businesses to act. Based on surveys and interviews, we find that the business community's motivations for and challenges with installing sustainable landscape practices are varied. Some are motivated by the need to maximize their return on investment, whereas others are motivated by sustainability or reputational benefits. Likewise, challenges range from uncertainty about the costs and benefits of the practices to limited incentives. Considering these motivations and challenges, we recommend the following:

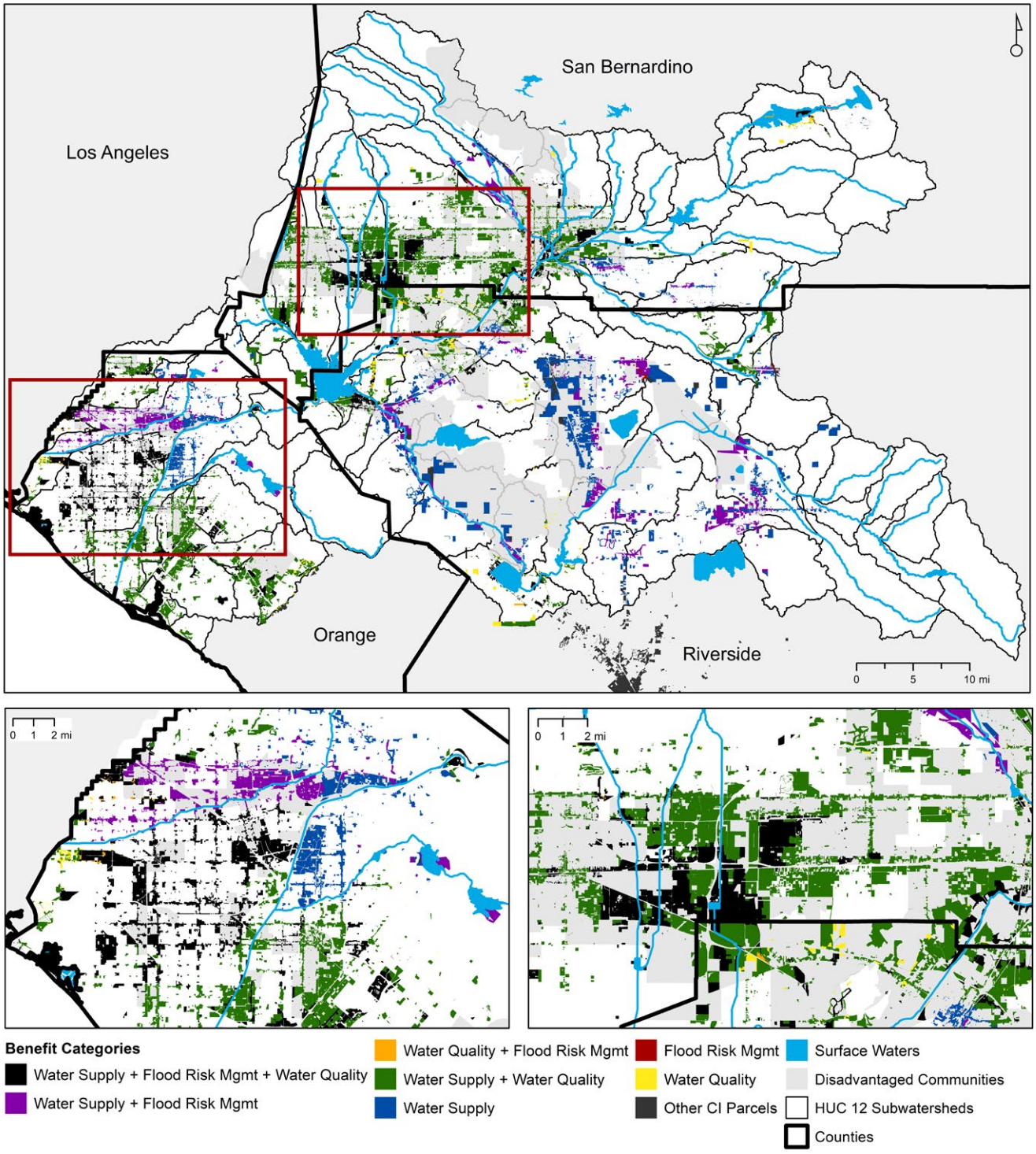
I. Develop Resources to Assist Businesses Considering Sustainable Landscape Improvements

Many commercial and industrial property owners are unfamiliar with the opportunities and options for sustainable landscape installations and the associated costs and benefits. Some are also wary of making changes to the look and feel of their business. There are a variety of tools and resources that would help businesses implement sustainable landscapes. Estimates of the project cost, volume of water saved or recharged, and any changes in maintenance costs would be especially useful. Some businesses, especially larger corporations, have sustainability commitments, and articulating some of the sustainability benefits would provide additional justification for these investments.

Case studies highlighting local businesses that have made these investments would also be helpful, as would lists of design, construction, and maintenance companies that are able to properly install and maintain these landscapes.

Figure ES-1

Commercial and Industrial Parcels Potentially Contributing to One or More Benefit Categories



II. Use Language and Examples that Resonate with the Business Community

Water utilities, cities, and community members who wish to encourage the business community to install sustainable landscapes should remember to use language and terminology that resonates with that community. Highlighting the ways that sustainable landscapes can reduce water risks can be especially effective, as can a discussion of new business opportunities these landscapes can provide. Tailoring materials to a diverse audience can be useful, as business operations and motivations are varied. For example, aesthetics and reputation are strong drivers for consumer-facing brands, and sustainability benefits would motivate companies with sustainability goals (and likely sustainability budgets). Likewise, the ability to charge higher rents for properties with sustainable landscapes would appeal to properties controlled by landlords whereas increased business activity would appeal to properties controlled by business owners.

III. Develop Appropriate Incentive Programs and Policies

A variety of programs can be used to incentivize sustainable landscape practices on private property, such as discounts on stormwater fees, rebate and cost-share programs, and recognition programs. Effective program design is predicated on understanding the constraints, drivers, and motivations of different types of property owners and implementing programs accordingly. [5] With financial incentives like grants and rebates, determining the appropriate amount of the incentive is essential. To ensure that the program is effective in getting businesses to participate while also maximizing uptake of sustainable practices, the incentive should be priced at a level that induces the business to act ***and*** is compatible with the cost of other water sources and stormwater management practices available to the water agency. Incentive programs can be especially useful when there are few examples and limited data available, as is the case with sustainable landscapes on commercial and industrial properties. However, as more case studies and better data become available, there is less need for incentive programs.

IV. Develop Targeted Financial Incentive Programs

Given that budgets for financial incentives are limited, programs and policies should be targeted to yield the greatest benefits. There are a variety of ways to target programs. Programs can be targeted geographically, such as by focusing on areas that provide the greatest benefit, are highly visible or visited, or that have historical environmental justice issues. Programs can also be targeted to specific customers, such as the most wasteful waters users, the largest polluters, or those properties that generate the most runoff.

V. Foster Long-Term Relationships Between Water Managers and the Business Community

Water supply, flood management, and stormwater staff do not typically have relationships with business facility managers or sustainability leads. Even in cases where relationships have been established, staff turnover at the company or utility can make it difficult to maintain those relationships. There are several ways for establishing and maintaining long-term relationships, such as creating a dedicated point of contact or working with a third party that consistently works with the business community.

5 Clements, J., A. St. Juliana, P. Davis, and L. Levine. 2013. The Green Edge: How Commercial Property Investment in Green Infrastructure Creates Value. Natural Resources Defense Council. New York, New York.

VI. Streamline Approval and Permitting Process

Permitting and approval processes can result in disincentives or delays in implementing beneficial projects. Steps to simplify and standardize approval processes can supplement and contribute to the incentive programs described previously. Steps to simplify and standardize the permitting process across the watershed could include:

1. coordination across functional responsibilities (retail water, stormwater, flood management, and city/county planning and building);
2. development of best management practices;
3. development of a multi-benefit general permit;
4. adoption of model requirements; and
5. establishment of a one-stop permitting assistance and approval process.

Developing a coordinated approach to permitting may also identify valuable regulatory relief incentives, e.g., providing expedited permitting for landscape conversion projects that are designed to achieve multiple benefits for the watershed.

VII. Explore Alternative Funding Sources

Funding collective action across a watershed requires creative thinking and innovative approaches. Several approaches warrant further exploration for business landscape conversion. The WaterNow Alliance has highlighted the ability of water agencies to debt-finance investments in water efficiency and green infrastructure (Harrington and Koehler 2016); although still relatively uncommon, debt-financing would substantially increase funds available for these investments. A green bond with dedicated repayment funding from public and private program beneficiaries could be an effective tool for braiding funds to finance a sustainable landscapes program. A parcel tax based on impermeable area, such as Measure W in Los Angeles County, is a "polluter pays" approach that could also be replicated. Redirecting a fraction of development and building permitting fees to fund landscape conversions is another innovative option. Other financing approaches pioneered in the renewable energy field, such as on-bill financing and voluntary property assessments, could be applied to commercial and industrial properties. These alternative funding approaches can help lower up-front costs for sustainable landscaping investments and promote their uptake on a larger number of sites.

VIII. Coordinate Policies and Programs Across the Watershed

Water resource management is spread across multiple agencies, as are the benefits of sustainable landscape practices. Coordinating policies and programs across a watershed could help realize opportunities for greater uptake of these practices, thereby maximizing their benefits. For all the preceding recommendations, coordinating program design and administration could yield economies of scale and scope, reducing program costs for any single entity and helping to optimize the value of regional investments. Coordination and alignment of public agency goals, programs, and approvals would offer simplicity and efficiency, while a partnership approach would allow for a growing commitment by businesses to watershed sustainability.

INTRODUCTION

Across California, pressures on water resources are intensifying due to aging infrastructure, population growth, climate change, and other factors. According to a recent survey, more than $51 billion of investment is needed for California's drinking water infrastructure through 2034 (US EPA 2018). California's population is expected to reach 50 million by 2055 (Department of Finance 2017), and to accommodate this growth, urban areas are projected to increase by more than 3,100 square miles over the next 50 years (Bounoua et al. 2018).

At the same time, climate change has created a "new normal" that requires water managers to plan for new challenges. Precipitation in California is highly variable from year to year, and climate change is exacerbating this variability, producing a rapid shift from very wet to very dry conditions (Swain et al. 2018). For example, 2012 to 2016 were the five hottest, driest years and 2017 the wettest year on record (Gleick 2017, Di Liberto 2017). Further, warmer temperatures increase water demand, cause more precipitation to fall as rain rather than snow, and produce an earlier snowmelt. California faces a more variable and uncertain future that will require major changes in how water is used and managed.

The combination of continued growth and climate change puts California cities at a critical nexus for water and climate resilience. Yet, California's

Source: Dietlinde B. DuPlessis, Shutterstock

urban landscapes are marked by vast expanses of thirsty lawns and impermeable pavement. Outdoor use represents about half of all water used in urban areas (Heberger et al. 2014), and even more in the hottest, driest parts of the state (Hanak and Davis 2006). Runoff from lawns carries fertilizers and pesticides into waterways. Impermeable pavement impedes groundwater recharge; contributes to higher peak flows; and carries oils, metals, and other toxins into rivers, estuaries, and the ocean.

The good news is that there are more sustainable options for California communities. Replacing

lawns with climate-appropriate plants that are irrigated efficiently can save water and reduce vulnerability to drought. When integrated with bioswales, rain gardens, and other green infrastructure, these projects can boost local water supplies, reduce flooding, and improve water quality. These practices can also save energy, provide habitat, reduce the urban heat island effect, sequester carbon, improve air quality, boost property values, enhance community livability, and increase resilience to climate change (Center for Neighborhood Technology 2010, American Rivers 2010, UNEP et al. 2014).

The scope and scale of our sustainability challenges warrants action by all Californians–including the business community. Commercial and industrial (CI) properties are disproportionately landscaped with turf grass and have large impervious surfaces. Yet, most sustainable landscape programs have focused on residential parcels. The opportunities for advancing sustainable landscape practices on CI properties are not well understood.

The goal of this project is to advance sustainable landscapes on CI properties. This project is divided into two phases. Phase 1, the focus of this report, assesses the opportunities and barriers for greater uptake of sustainable landscape practices on CI properties. During Phase 2, we will work with the business community to install sustainable landscapes on their properties and monitor the associated water savings and other co-benefits.

This work is focused on the Santa Ana River Watershed and is a unique, collaborative effort among the Pacific Institute, the CEO Water Mandate, California Forward, and the Santa Ana Watershed Project Authority (SAWPA). For this study, the project team used data provided by SAWPA to conduct a geospatial analysis of the water efficiency and stormwater retention and capture opportunities on CI properties in the watershed that would potentially realize benefits from landscape conversions. In addition, the project team surveyed and interviewed business representatives to understand barriers to and motivations for adopting sustainable landscape practices. While focused on the Santa Ana River Watershed, the approach and methodology could be replicated elsewhere.

This report is organized into seven sections. Section one provides an overview of the project and the report. Section two defines sustainable landscapes and describes the approach used in this study. Section three quantifies the water supply, water quality, and flood risk management benefits of sustainable landscape practices, and identifies areas and parcels where landscape improvements would have the greatest benefits. Section four identifies the co-benefits of these practices, and Section five describes the motivations and objectives for pursuing sustainable landscape practices among various stakeholder groups. Section six examines some of the challenges with implementing these practices, and Section seven provides conclusions and recommendations for scaling implementation of sustainable landscape practices on CI properties in the Santa Ana River Watershed and elsewhere.

STUDY APPROACH

Terminology

This report uses 'sustainable landscapes' to refer to those landscapes that are in balance with local climate and ecology and actively contribute to watershed health by providing economic, social, and environmental benefits. Key elements of sustainable landscapes include building healthy, living soils; preserving vegetative cover; using climate-appropriate plants; treating water as a resource and using irrigation to supplement

rainfall; and conserving material resources (American Society of Landscape Architects 2009, Metropolitan Water District 2017, Green Gardens Group 2018). For this project, we focus on the following landscape practices:

1. TURF REPLACEMENT

Turf replacements involve removing cool-season turf grass or other high water-use plants and installing climate-appropriate plants native to California or well suited for the local climate.

2. BIOSWALES AND RAIN GARDENS

Bioswales and rain gardens are trenches or basins filled with shrubs and grasses designed to capture stormwater runoff and let it infiltrate into the ground. While not all plants are appropriate for bioswales and rain gardens, there is a wide selection of plants that can tolerate both extended inundation from water and extended dry periods.

3. PERMEABLE PAVEMENT

Permeable pavement can be used as an alternate to concrete or asphalt in parking lots, streets, patios, and walkways. It allows water to flow through it into the ground, as opposed to running off it.

4. GREEN ROOFS

Green roofs are building rooftops that are partially or fully covered in vegetation. They can vary in their complexity, from a simple native groundcover to a more complex garden planted with shrubs and trees that offers recreational space.

5. RAIN TANKS AND CISTERNS

Rain tanks and cisterns collect rain water in a large container, typically from rooftops via a gutter system. Collected water can be used for irrigating landscapes or other non-potable applications.

1. Turf Replacement

2. Bioswales and Rain Gardens

3. Permeable Pavement

Source: BanksPhotos, iStock

4. Green Roofs

Source: Maxvis, iStock

5. Rain Tanks and Cisterns

Source: Sharon Wills, iStock

Geospatial Analysis

Sustainable landscapes provide multiple benefits, but the realization and value of these benefits on CI properties varies across the Santa Ana River Watershed. Site specific analysis for each subwatershed is still needed, but this analysis identified areas within the watershed that offer the best potential to contribute toward watershed objectives if sustainable landscapes are installed on CI parcels. Our analysis consisted of five primary steps, outlined in Figure 1.

The analysis includes three categories of benefits: surface water quality, flood risk management, and water supply. These categories were selected based on relevance to priorities identified in the SAWPA One Water, One Watershed (OWOW) Plan and the availability of data to assess their relative importance across the entire watershed. Future work will focus on translating identified benefits and costs into economic terms. Table 1 shows the potential water-related benefits associated with each of the five landscape practices included in this study.

Metrics were developed to assess the contribution that sustainable landscape practices could make for each benefit category. These include:

- *Surface water quality*: Subwatersheds with a 303(d)-listed stream segment or water body were identified as subwatersheds with opportunities for practices contributing to surface water quality improvements.[1]
- *Flood risk:* The Federal Emergency Management Agency (FEMA) flood zone classifications for 100- and 500-year floods were used to assess the relative benefits of practices contributing to flood risk management. Localized flooding due to insufficient or inadequately maintained stormwater infrastructure is also a major problem but was beyond the scope of this analysis. These issues should be accounted for in future site assessments (Phase 2).
- *Water supply:* Each water agency within the SAWPA region relies on a complex array of water supplies, including imported water, local groundwater, recycled water, and other locally relevant supplies. While assessing the water supply portfolio of each agency was beyond the scope of this analysis, it is broadly recognized that agencies prefer to lessen their reliance on imported water. Several practices considered in this analysis can contribute to this goal by reducing water demand and/

1 Section 303(d) of the Clean Water Act requires periodic assessment of the quality of surface waters relative to the standards assigned to that water's designated use. If these waters do not meet the standard for designated use, the waters are placed on the 303(d) list.

Figure 1

Overview of Geospatial Analysis Approach

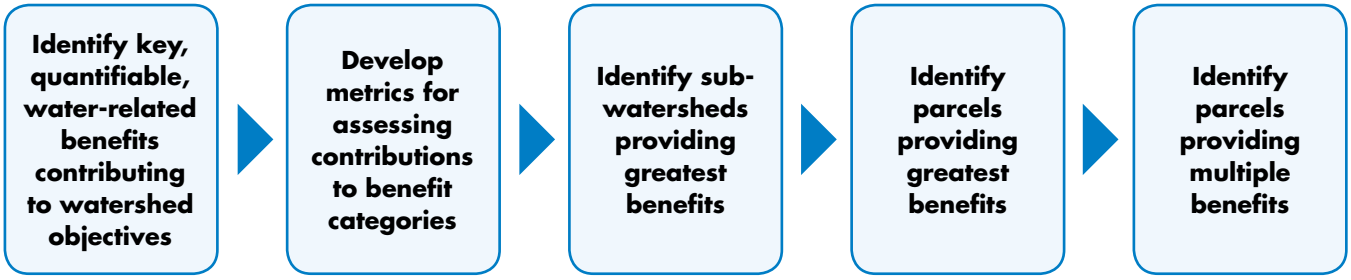


Table 1

Relationship Between Landscape Practices and Water-Related Benefit Categories

Watershed Level Benefits/ Objectives	Practices				
	Turf Replacement	Bioswales & Rain Gardens	Permeable Pavement	Green Roofs	Rain Tanks & Cisterns
Surface Water Quality	X*	X	X	X	X
Flood Risk Management		X	X	X	X
Water Supply	X	X	X		X

*Realization of water quality benefit is predicated on the removal of turf and an associated reduction in fertilizer and/or pesticide runoff.

or augmenting supply through groundwater recharge or direct use of stormwater. [2] The first section of this analysis identifies regions where there are opportunities for groundwater recharge or direct use of stormwater. The second section of the analysis identifies regions where conversion to low-water use plants would provide the greatest reductions in irrigation water demand based on evapotranspiration rates across the watershed.

Certain land use characteristics create more favorable conditions for specific landscape practices, both in terms of technical feasibility and the scale of the benefits that could be realized. The magnitude of the benefits realized from implementation of each sustainable landscape project will vary with the area of landscape converted. For instance, larger parcels may provide opportunities for conversion of larger areas of turf. Likewise, the water supply benefits of groundwater recharge would only be realized on parcels where groundwater infiltration is possible. With these considerations in mind, this analysis was conducted at the watershed and CI parcels scale with the following objectives:

1. **Watershed-scale analysis**: Identify sub-areas of the watershed where each of the five identified landscape practices are likely to have the largest positive impact on surface water quality, flood risk management, and/or water supply reliability.
2. **Parcel-scale analysis**: Assess the relative technical feasibility of implementing these practices on CI parcels that have the potential for providing benefits to surface water quality, flood risk management, and/or water supply reliability.

In 2015, SAWPA conducted an aerial survey of the watershed to produce a set of high-resolution (3 inch) imagery of the watershed. Remote sensing in combination with existing data on parcel land use designations were used to generate a comprehensive land use dataset quantifying turf area, irrigated area, and several other metrics at the parcel level. A series of parcel-level metrics were developed from these data (Table 2). These metrics were used as a first-order screening tool to identify parcels where it is likely to be technically feasible to realize the desired benefits and prioritize parcels that will make the greatest contribution to achieving a desired watershed outcome (e.g., improvements in surface water quality). Site assessments are required to evaluate the benefits

2 "Direct use" in CWC Section 10608.50 (b) is taken to mean the use of intentionally captured stormwater, which may involve short-term storage (e.g., via rain barrels, underground tanks, equalization basins) or stormwater treatment plants.

Table 2

Parcel-Level Metrics for Assessing Technical Feasibility

Parcel-Level Assessment Metrics	Practice				
	Turf Replacement	Bioswales & Rain Gardens	Permeable Pavement	Green Roofs	Rain Tanks & Cisterns
Building (Roof) Area*				X	X
Turf Area	X	X			
Vegetated Area		X			
Impervious Surface Area (estimated)		X	X		X***
Potential for Infiltration**		X	X		

*In the SAWPA Meter Service Area (MSA), watershed land use data are incomplete but could be used to prioritize across parcels where building area data was recorded.

**Further details on the assessment for potential for infiltration and recharge versus capture and direct use are included in subsequent sections.

***Due to limitations in the building footprint data, estimated impervious surface area was used as a proxy.

and tradeoffs associated with each practice relative to site constraints, budgets, etc. Existing tools, such as the Structural BMP Prioritization and Analysis Tool (SBPAT), could be used to conduct more granular analyses incorporating watershed hydrology and the impacts of specific practices.[3] In addition, careful site-level design plus continued maintenance would be required to ensure that desired benefits are realized and sustained over time.

Co-Benefits of Sustainable Landscape Practices

Sustainable landscape practices provide multiple benefits to different stakeholders. A small but growing number of studies document the benefits and beneficiaries of these practices. For example, The Center for Neighborhood Technology developed a comprehensive guide on benefit measurement and valuation for various green infrastructure projects (Center for Neighborhood Technology 2010, Clements et al. 2013) examine the benefits of green infrastructure practices for commercial property owners and provide illustrative examples for specific building types. More recently, The River Project completed an assessment of the opportunities for and benefits of sustainable landscape projects on residential properties in the City of Los Angeles (Perisho et al. 2018).

For the purposes of this report, the project team developed an initial assessment of the benefits of various sustainable landscape practices for both CI property owners/operators and the broader community. This assessment was based on a review of the literature and done using a mind map. Due to the size and complexity of the maps, we have simplified them for the purposes of this report. More complete versions of the mind maps can be found in Appendices 2 through 11 here. Additional work in Phase 2 will further refine the benefits and beneficiaries of these practices.

3 SBPAT was developed with case examples in Los Angeles and Orange County but could be adapted to additional regions within the Santa Ana River Watershed as needed.

Business Survey and Interviews

For this project, we surveyed representatives from companies who have implemented sustainable landscape projects as well as those who have not yet implemented such projects. Questions were focused on the types of landscape practices considered or implemented, the motivations and process for making those decisions, the cost and benefits realized from implementing the projects, and any barriers encountered. A copy of the survey can be found in Appendix 1. The survey was distributed directly to business representatives working in southern California as well as several business associations serving the region.

In total, eight business representatives completed the survey, of which six were based in the Santa Ana River Watershed. Half of these businesses were commercial, and the other half were industrial. In all except one case, the businesses had direct control over landscaping needs for their facility, while the one exception had a property owner in control. We then conducted in-depth interviews with five of the respondents, who represented hospitality, manufacturing, and technology industries with medium to large facilities, i.e., 10,000 to 50,000 square feet, in southern California. Of the five business representatives interviewed, three had implemented a sustainable landscape project, and the remainder had considered but did not implement a project. The interviews focused on following up on survey questions to obtain a more detailed understanding on the responses. Insights from the survey and interviews have been incorporated throughout this report.

Given the limited sample size, the survey and interviews provided a preliminary understanding of the barriers and motivations. Phase 2 of this project will involve more extensive engagement with the business community in their decision-making process and implementation of sustainable landscape projects. This will provide a deeper understanding of how and why businesses adopt sustainable landscape practices and enable us to identify policies and programs to accelerate uptake of these practices.

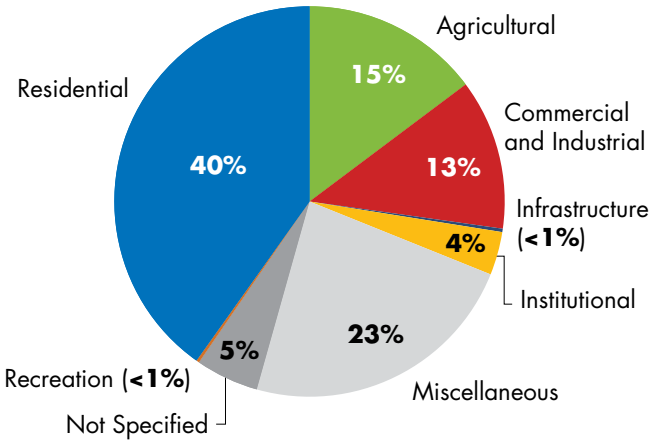
OPPORTUNITIES FOR SUSTAINABLE LANDSCAPES ON COMMERCIAL AND INDUSTRIAL PROPERTIES IN THE SANTA ANA RIVER WATERSHED

Potentially Convertible Area on Commercial and Industrial Parcels

Of the 1.7 million acres of land in the Santa Ana River Watershed, 13 percent (or 220,000 acres) were used for commercial or industrial purposes (Figure 2). The mean area of turf, irrigated area, and building footprint on CI parcels was three to four times that of residential parcels (Figure 3). Practically, this means that a landscape

Figure 2

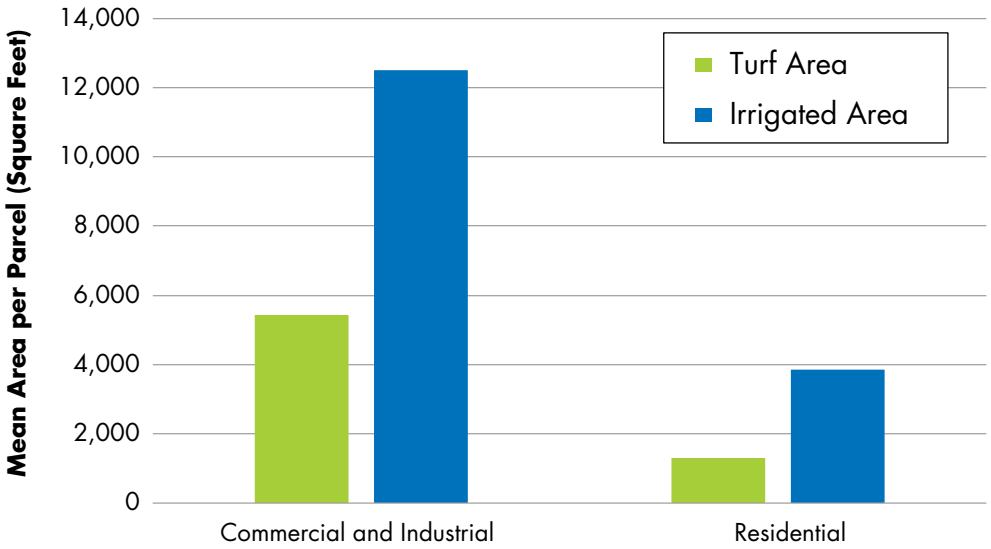
Distribution of Land Use Classes in the Santa Ana River Watershed



Note: Classes "Miscellaneous" and "Not Specified" include a range of undeveloped public or institutional lands.

Figure 3

Comparison of Mean Turf and Irrigated Area on Commercial and Residential Parcels in the Santa Ana River Watershed



improvement project on a single commercial parcel may provide more benefits on a per parcel basis than on a single residential property. While there are significant opportunities for landscape improvements on residential parcels, assessment of the opportunities and challenges on CI parcels is a comparatively understudied area. As such, this project focuses on opportunities for advancing the installation of sustainable landscapes on CI parcels.

Ninety-eight percent of commercial parcels contain at least some turf. The mean area of turf on all commercial parcels is 5,446 ft² (Table 3). However, there is tremendous site-to-site variability (as indicated by the standard deviation), and 980 CI parcels contain more than 50,000 ft² of turf. In total, there is more than 425 million ft² (9,756 acres) of turf on CI parcels in the Santa Ana River Watershed. On average, parcels have an additional of 7,015 ft² of other irrigated vegetation such as trees and shrubs. The amount of water used to irrigate this vegetation depends on plant type, local conditions, and the operation of installed irrigation systems. CI parcels with large areas of turf and other irrigated vegetation would be good candidates for the replacement of turf with climate-appropriate plants. Likewise, large areas of turf or other potentially convertible land cover can provide space for improved stormwater management via rain gardens, bioswales, infiltration basins, and other practices.

Ninety-nine percent of CI parcels contained at least some impervious area.[4,5] CI parcels had an average of 89,220 ft² of impervious surface area, with 1,182 CI parcels containing more than 100,000 ft² of impervious area. Site assessments will be needed in Phase 2 to identify the practically convertible area of turf and impervious surface on a given parcel. In total, there were nearly seven billion square feet (158,000 acres) of impervious area on CI parcels in the Santa Ana River Watershed. This represents almost 10 percent of the total watershed area. Impervious surfaces prevent infiltration and increase the velocity of

4 Impervious surface area was estimated by subtracting the vegetated area from the total parcel area.

5 The meter service area (MSA) is the area of water use for a retail water customer's water meter. It is the customer's property parcel modified to include the strip of vegetation–sometimes referred to as a parkway which is often turf grass–outside the parcel adjacent to the street that the customer is often responsible for watering. For the sake of simplicity, this report uses the terms parcel area and MSA synonymously, which differs from usage in tax documents. Areas reported throughout this report indicate MSA areas.

Table 3

Total Commercial and Industrial Parcel Area of Turf, Vegetation, Irrigated, or Impervious Surface

	Turf Area	Vegetated Area	Irrigated Area	(Estimated) Impervious Surface Area*
Mean Area (ft^2)	5,446	12,960	12,490	89,220
Std Dev (ft^2)	51,680	100,900	100,100	333,800
Min Area (ft^2)	0	0	0	0
Max Area (million ft^2)	4.634	6.944	6.894	29.76
Sum Area (million ft^2)	425.9	1,013	976.3	6,923

*Building area was included for some parcels, but data were missing in many instances, particularly Riverside and San Bernardino counties. Estimated impervious surface area includes roofs, parking lots, and other impervious surfaces.

Source: Based on data from the Santa Ana Watershed Project Authority

runoff flows, which contributes to higher peak flows. CI parcels with large areas of impervious surface are good candidates for rain gardens, bioswales, permeable pavement, cisterns, and other stormwater improvements designed to reduce runoff, contamination, and peak flows.

Water Quality Benefits

WATERSHED-SCALE ANALYSIS

Section 303(d) of the Clean Water Act requires periodic assessment of the quality of surface waters relative to the standards assigned to that water's designated use (e.g., cold water habitat, non-contact recreation). If those waters do not meet the standard for its designated use, the waters are placed on the 303(d) list. Total maximum daily load (TMDL) plans are required to be developed for 303(d)-listed waters, and these plans specify required reductions in pollutant loads to bring the surface water back into compliance.

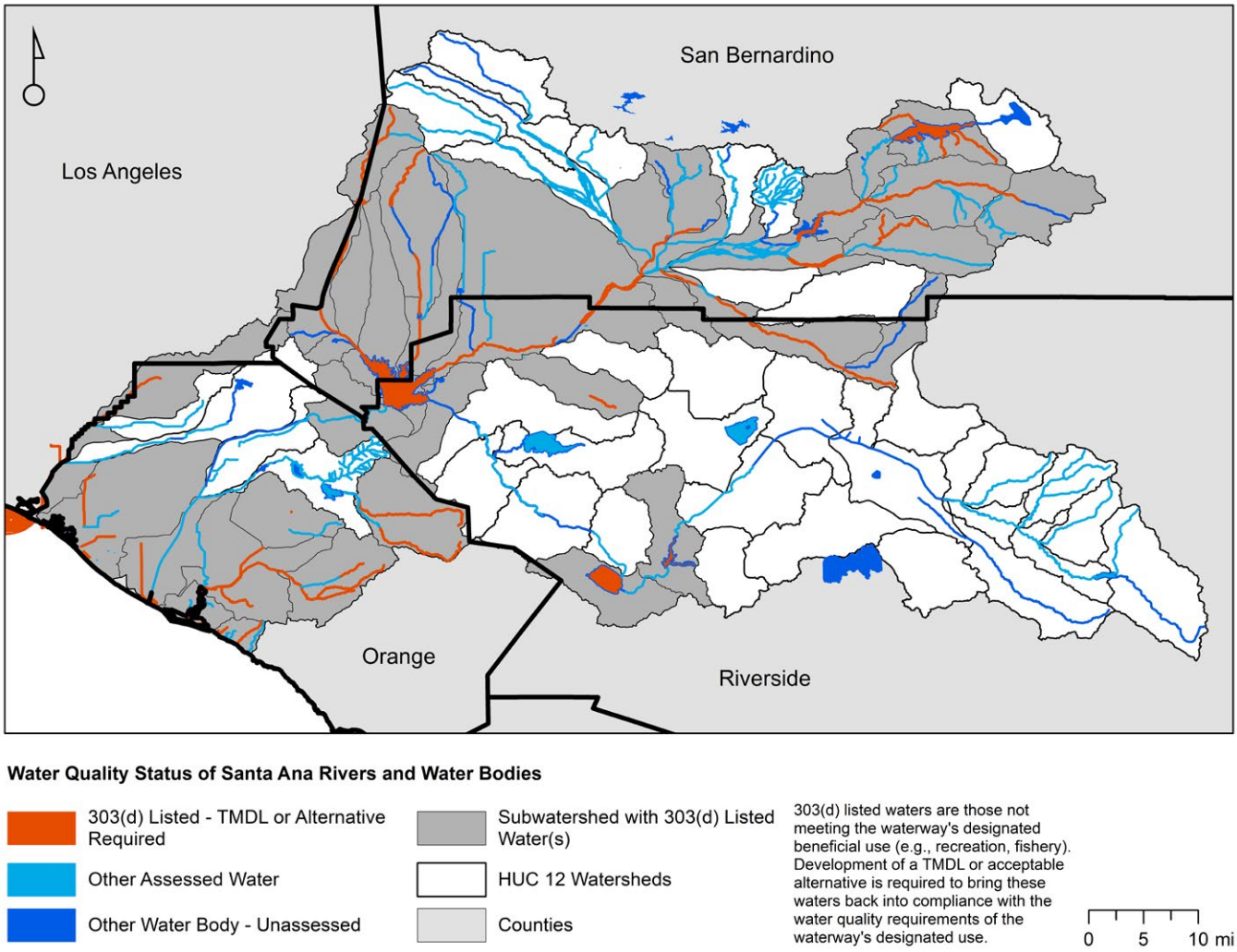
In Figure 4, 303(d)-listed surface waters are highlighted in red, and subwatersheds containing impaired waters are shaded gray. Thirty-three percent (282 miles) of assessed stream miles in the Santa Ana River Watershed were impaired due to one or more contaminants. Siting landscape practices that improve water quality (e.g., bioswales, green roofs) in these subwatersheds would likely provide a greater benefit than interventions in subwatersheds where surface waters are already of acceptable quality. Further, these improvements would likely be particularly valued by wastewater treatment plants and other entities bearing the largest portion of the burden of TMDL compliance.

PARCEL-SCALE ANALYSIS

All sustainable landscape practices considered in this study have the potential to improve surface water quality within the Santa Ana River Watershed (Table 1). CI parcels were classified by site-level potential to contribute to water quality goals, using three tiers of prioritization: subwatersheds containing impaired surface waters, proximity to impaired (303(d)-listed) waters, and parcel size (Figure 5). Parcel size and proximity to impaired waters were included as sub-proxies to further distinguish parcels more likely to be contributing larger loads of pollutants (size) and shorter conveyance times from the site to receiving waters (proximity). Upstream regions can both contribute to and help mitigate water quality issues downstream. Likewise, concentrations

Figure 4

303(d)-listed Water Bodies in the Santa Ana River Watershed



of certain pollutants, such as sediment and fecal indicator bacteria, are attenuated (to varying degrees) along the stream channel due to settling, UV exposure, and other natural processes. More detailed hydrologic and water quality modeling is needed to account for the fate and transport of pollutants through the watershed.

Most CI parcels in areas with impaired water quality were in San Bernardino and Orange Counties (Figure 6). Within Orange County, many of the CI parcels located in subwatersheds with impaired water quality were in coastal watersheds not connected to the main stem of the Santa Ana River, suggesting localized sources of pollution. Sixty-nine percent of the turf area on CI parcels was in impaired watersheds (Table 4). The largest 25 percent of CI parcels within 1,000 feet of an impaired water contained 89 percent of the turf area within 1,000 feet of impaired waters. Likewise, CI parcels had even larger expanses of impervious surfaces (16x) than turf. The largest 25 percent of CI parcels within 1,000 feet of an impaired water only constitute 2 percent of the parcels in the watershed but contain a disproportionate area of both turf (9 percent) and impervious surfaces (6 percent). This

Figure 5

Classification Scheme for Water Quality Benefit Parcel Prioritization

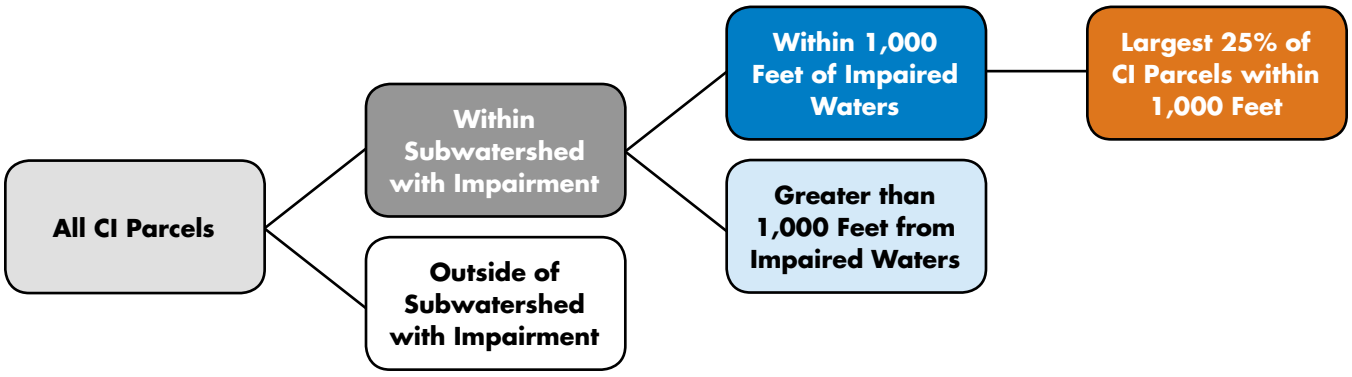


Table 4

Total Commercial and Industrial Parcel Area of Turf, Vegetation, Irrigated, or Impervious Surface

	Area within the Santa Ana River Watershed	CI Parcels in Subwatersheds with Impaired Waters	CI Parcels Within 1,000 Feet of Impaired Waters	Largest 25% of CI Parcels (Within 1,000 Feet of Impaired Waters)
Turf (million ft^2)	425.9	293.8 (69%)	40.47 (10%)	36.17 (9%)
Impervious Surfaces (million ft^2)	6,886	4,764 (69%)	508.5 (7%)	423.9 (6%)
Number of parcels	78,196	53,688 (69%)	5084 (7%)	1272 (2%)

Note: Percent indicates the percent of turf or impervious surface area within the Santa Ana River Watershed.

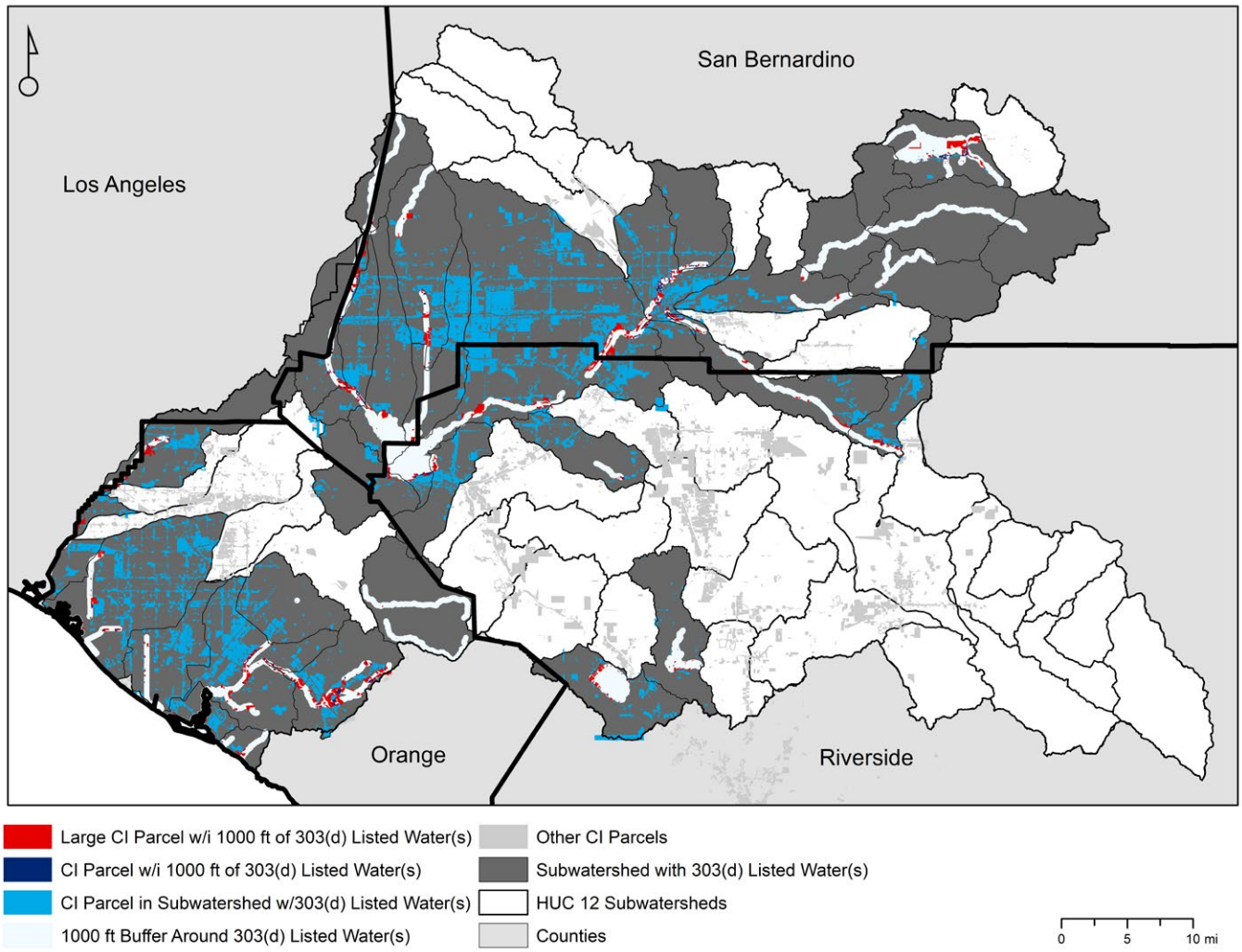
indicates that targeting a comparatively small number of CI parcels within 1,000 feet of impaired waters could provide outsized surface water quality benefits.

Surface waters in the Santa Ana River Watershed are impaired due to elevated concentrations of nutrients, pathogens, trash, metals, sediment, and other pollutants. Some waters have multiple identified causes of impairment. Replacement of turf with climate-appropriate plants can reduce loads of nutrients and other lawn chemicals to impaired waters. Appropriately designed[6] stormwater management practices can also contribute to water quality improvements through the treatment of stormwater runoff from both turf and impervious surfaces. However, the quality of stormwater runoff should be surveyed prior to implementation to ensure that the practices selected will safely manage and treat priority contaminants in the site's runoff and infiltrated water.

6 Not all practices are equally effective at improving the quality of stormwater runoff. The International Stormwater Management BMP database provides an extensive compilation of data on observed BMP performance for common water quality parameters.

Figure 6

Prioritization of CI Parcels Relative to Potential Water Quality Benefits



Flood Risk Management Benefits

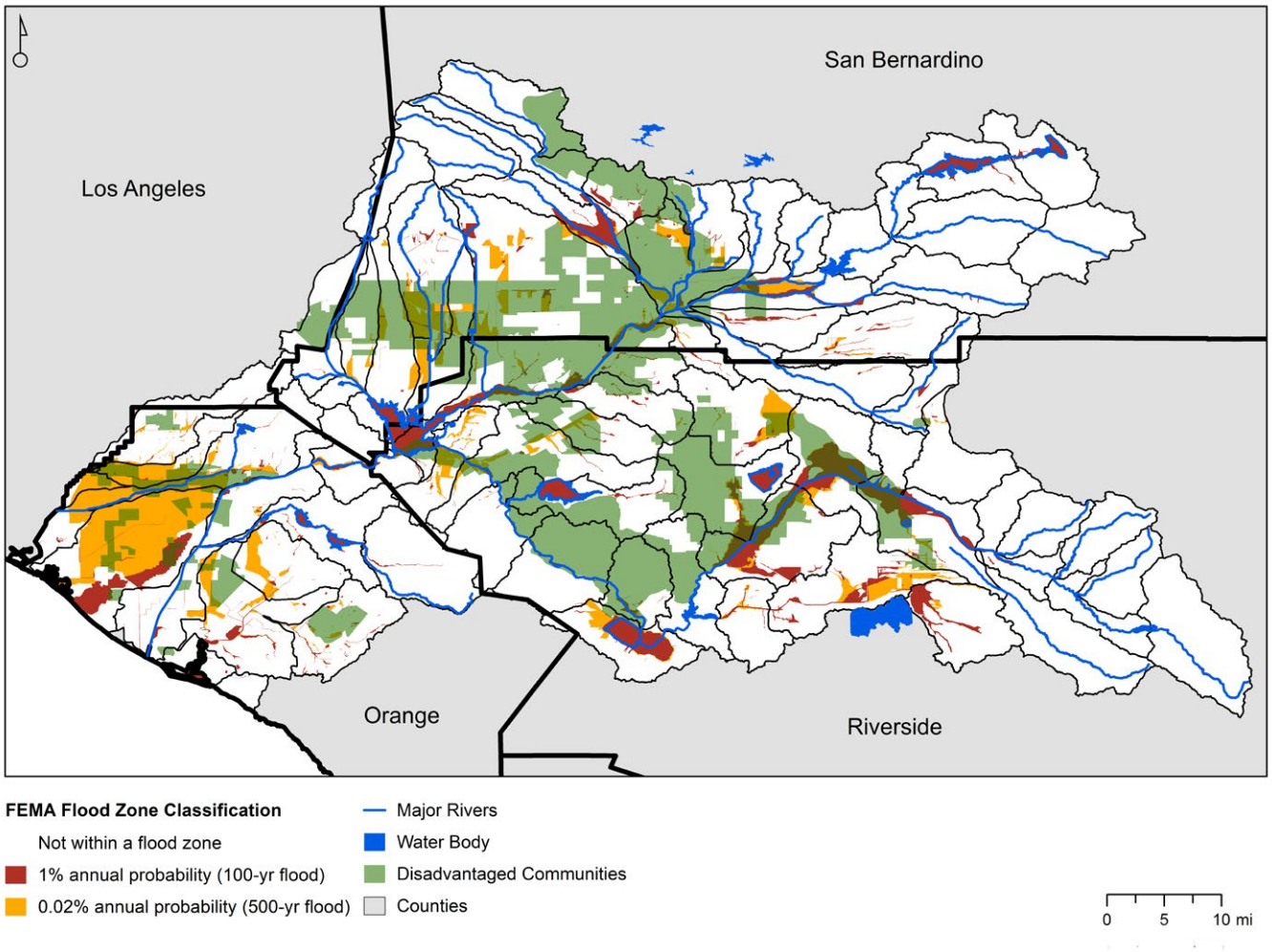
WATERSHED-SCALE ANALYSIS

FEMA periodically assesses the probability of flooding adjacent to stream channels across the United States. These maps are used for risk assessments and to designate zones required to purchase flood insurance. Areas within the 100-year flood zone (or a 1 percent annual probability of flooding) are shaded in orange while areas within the 500-year flood zone (or a 0.02 percent annual probability) are shaded in red (Figure 7).

Thirteen percent (224,000 acres) of the Santa Ana River Watershed is within a 100- or 500-year flood zone. Some portion of 90 percent of subwatersheds are within the 100- or 500-year flood zone. In these subwatersheds, an average of 11 percent of the total subwatershed area is located within a flood zone. However, the region adjacent to lower reaches of the mainstem of the Santa Ana River (in Orange County) was a notable exception with 72 percent of the subwatershed located within a flood zone.

Figure 7

Santa Ana River Watershed Areas Within the 100- or 500-year Flood Zones



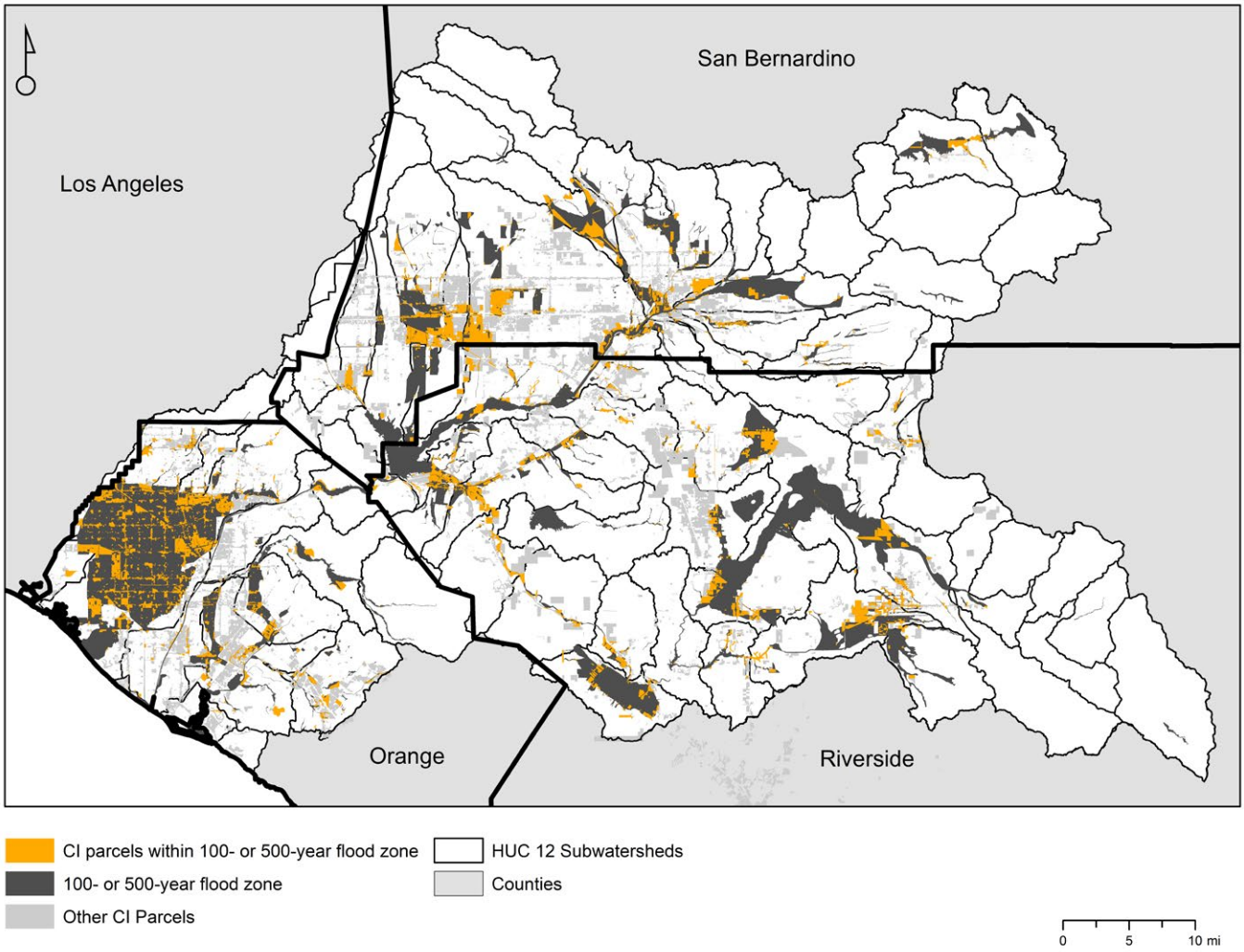
Disadvantaged communities are disproportionately located in flood zones, with 20 percent (73,000 acres) of the area of disadvantaged communities (372,000 acres) located within a 100- or 500-year flood zone.[7] By comparison, 13 percent of the watershed is located within a 100- or 500-year flood zone. This trend was particularly noteworthy in Riverside County, where much of a five-mile stretch of the 100-year flood zone was almost entirely within disadvantaged communities (Figure 7).

Investing in landscape practices that provide flood risk management benefits in subwatersheds with large areas within a flood zone would likely be of greater value than in watersheds where riverine flooding is not a major issue. Flood zones are located throughout the upper and lower reaches of the Santa Ana River Watershed. While more detailed analysis would be required, significant reductions in peak flows in and upstream of flood zones could help remove some areas from FEMA flood zones, which could lessen flood insurance costs for some parcels. This analysis does not address issues of localized flooding caused by infrastructure issues, such as blocked or undersized storm drains.

7 The AB 1550 and SB 535 disadvantaged community boundaries from CalEnviroScreen 3.0 were used in this analysis.

Figure 8

Prioritization of Commercial and Industrial Parcels Relative to Potential Flood Risk Management Benefits



However, these same landscape practices (e.g., bioswales, cisterns) would help mitigate localized flooding by attenuating peak flows.

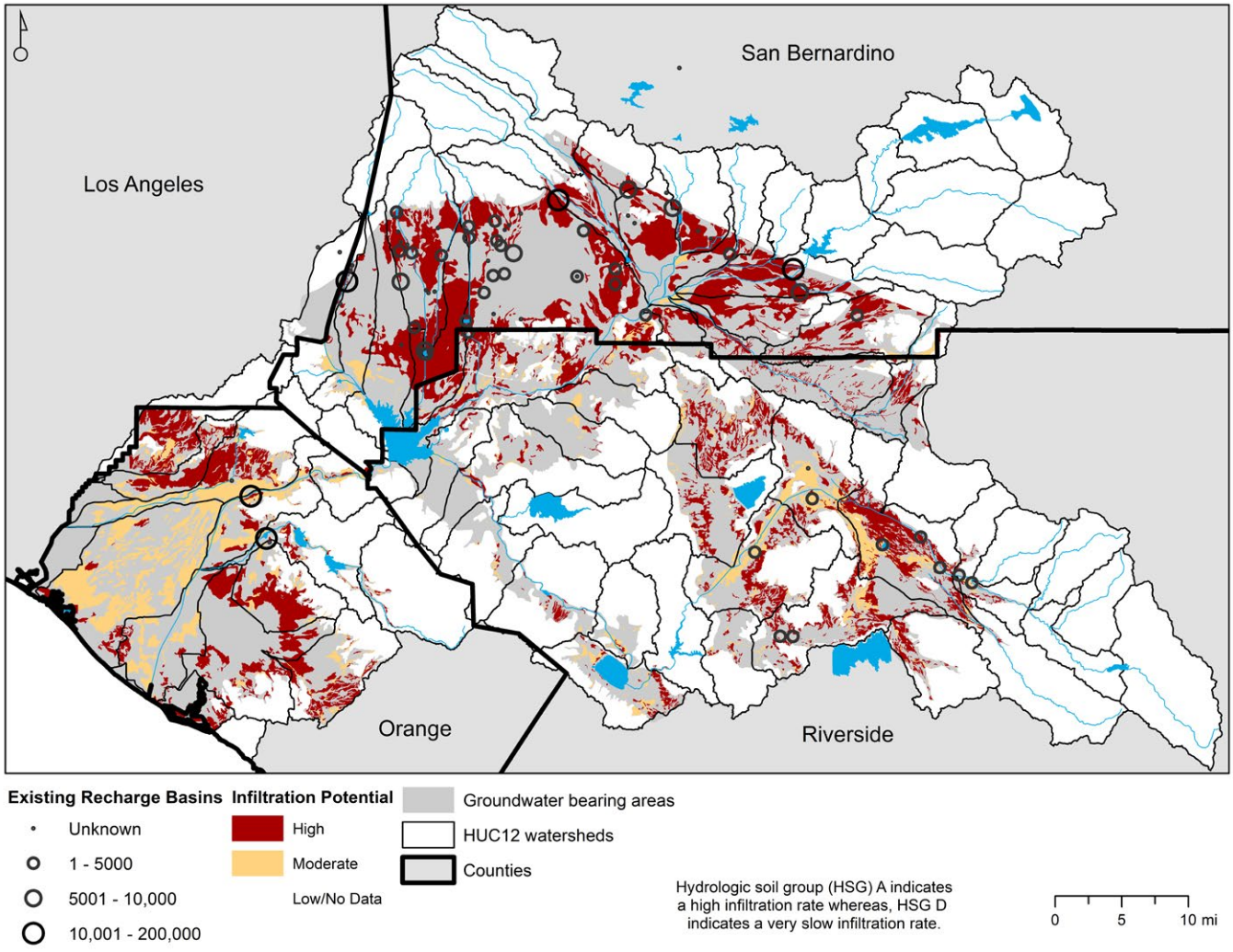
PARCEL-SCALE ANALYSIS

Impervious surfaces prevent infiltration and alter the timing, velocity, and amount of stormwater conveyed to local surface waters. Large areas of impervious surfaces can cause or exacerbate flooding. CI parcels located within the 100- or 500-year FEMA flood zone were identified as areas where sustainable landscape practices would provide the greatest flood benefits (Figure 8). Stormwater management activities in the upper watershed can help mitigate the timing and intensity of peak flows in downstream reaches. Opportunities for flood risk management in the upper Santa Ana River Watershed likely exist, but there were relatively few CI parcels within these regions.

On average, 91 percent of the surface area of CI parcels in the Santa Ana River Watershed is impervious (Table 5). Of the total area of CI parcels, 29 percent (2,849 million ft^2) is located within a 100- or 500-year flood zone. Reducing

Figure 9

Infiltration Potential Within Groundwater Bearing Areas in the Santa Ana River Watershed



impervious surfaces, installing green roofs, and many stormwater management practices can help reduce or slow the quantity of runoff leaving sites. Likewise, large areas of turf can be repurposed for infiltration basins, rain gardens, cisterns, and other stormwater management practices. Improved stormwater management on these parcels could benefit both property owners and external stakeholders through potential reductions in flooding.

Water Supply Benefits

WATERSHED-SCALE ANALYSIS OF GROUNDWATER RECHARGE

Soils, groundwater connectivity, hydrogeology, and slope affect the potential for practices such as bioswales or infiltration galleries to recharge groundwater. A simple overlay analysis identified areas of soils with high infiltration potential located within groundwater-bearing areas. [8] While

8 Soils data were obtained from the United States Department of Agriculture's Natural Resources Conservation Service gridded soil survey (gSSURGO) database.

further site assessment and design are needed to estimate the quantity of water that could infiltrate on a given site, this analysis provides a general assessment of watershed areas where there is likely to be potential for landscape improvements to recharge groundwater. Soil amendments and tailored substrates can improve groundwater recharge rates and efficiency in some regions where (1) local soils are not favorable to infiltration; and (2) opportunities exist for infiltration and storage of large quantities of stormwater (e.g., managed aquifer recharge), although we did not assess that in this analysis. In this analysis, onsite stormwater capture and direct use via practices such as cisterns and rain tanks, was assumed to be more suitable on parcels with limited potential for groundwater recharge.

Thirty-four percent of the total groundwater-bearing area in the Santa Ana River Watershed is within an area that has high (205,000 acres) to moderate (78,000 acres) infiltration potential (Figure 9). Groundwater-bearing areas are shaded gray. There have been significant investments in large centralized groundwater recharge projects within parts of the Santa Ana River Watershed, such as the Groundwater Replenishment System in Orange County and the Integrated Recharge and Recovery Program in the Eastern Municipal Water District service area.

PARCEL-SCALE ANALYSIS OF GROUNDWATER RECHARGE

Stormwater capture for groundwater recharge or direct use augments local water supplies. Per the methods described previously, CI parcels located within groundwater bearing areas are classified as likely to be suitable for either (1) infiltration and recharge or (2) capture and direct, on-site use of stormwater. In total, there is 2,420 billion ft^2 (55,620 acres) of land on CI parcels suitable for infiltration and recharge. Far more land within groundwater bearing areas—3,930 billion ft^2 (90,270 acres)—on CI parcels is suitable for stormwater capture for direct use (Figure 10). Local constraints, such as the presence of an underground storage tank, may also affect the feasibility of recharge, though there are still significant opportunities for contributing to reductions in peak flows via other practices.

WATERSHED-SCALE ANALYSIS OF DEMAND MANAGEMENT

Reference evapotranspiration (ET_0) is a measure of evaporation and transpiration from a well-watered reference surface (typically cool-season turf grass). The same vegetation in an area with high evapotranspiration requires more water for irrigation than areas with lower evapotranspiration rates. Climate-appropriate plants have lower evapotranspiration rates and irrigation requirements than turf and other water-intensive plants. Thus, replacing turf can reduce water use for landscape irrigation.

ET_0 zones in the Santa Ana River Watershed ranged from approximately 33.0 inches per year in the narrow foggy coastal zone to 66.5 inches per year in the high desert valley region in the far northern reaches of the watershed (Figure 11).[9] Area weighted average annual ET_0 across the entire watershed was 53.1 inches per year. Average monthly ET_0 peaked during the summer months, ranging from 4.7 to 9.9 inches in July.

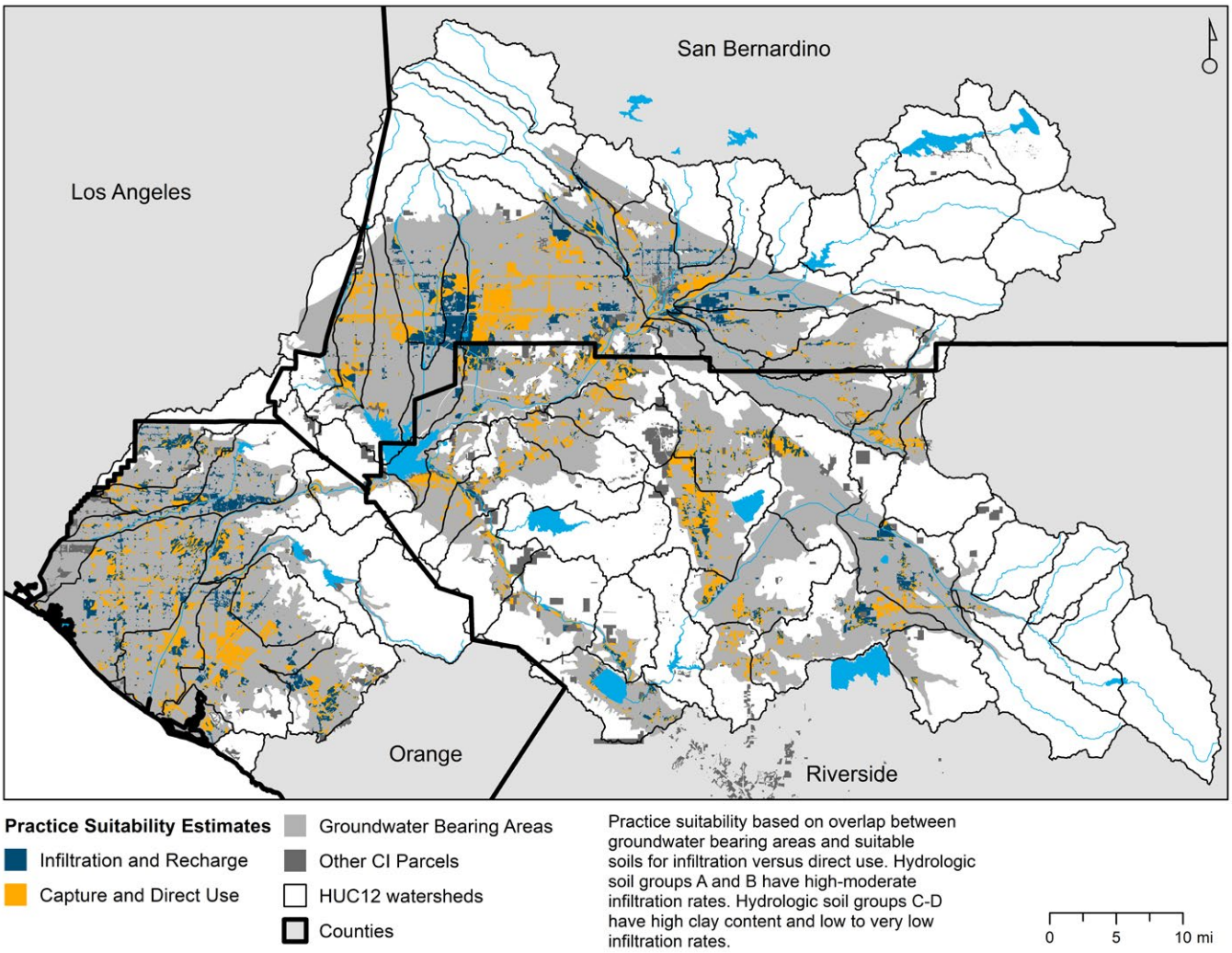
PARCEL-SCALE ANALYSIS OF DEMAND MANAGEMENT

The largest areas of CI parcels in the Santa Ana River Watershed were in evapotranspiration zones 6 and 9 (Figures 11-12). Meeting the average irrigation demand of 1,000 ft^2 of turf in the Santa Ana River Watershed would require approximately 32,000 gallons of water. However, this assumes irrigation application rates at 100 percent of ET_0.

9 ET_0 zones were derived from the California DWR reference ET zones map.

Figure 10

Prioritization of Commercialand Industrial Parcels Relative to Potential Water Supply Benefits



In practice, some CI sites over irrigate while other sites under irrigate. Likewise, the water demand of existing landscape plantings varies widely. Future site assessments should develop site-level water budgets using the methods outlined in California's Model Water Efficient Landscape Ordinance (MWELO) to assess actual versus target outdoor water use at the site level.

There is 426 million ft^2 of turf on CI parcels in the Santa Ana River Watershed. Reducing irrigation water demand on CI parcels by 30 percent would result in a water supply benefit of 11,400 acre-feet (497 million ft^3) per year (Figure 13). Similarly, 55 and 70 percent reductions in water use for irrigation could result in savings of 20,940 acre-feet (912 million ft^3) per year and 26,700 acre-feet (1,161 million ft^3) per year, respectively. For reference, a 55 percent reduction in outdoor water use would roughly bring parcels into compliance with current state efficient outdoor irrigation (MWELO) requirements for new CI landscapes, though site assessments are needed to set precise, site-level targets.[10]

10 MWELO compliance currently requires 0.45 ET_0 for CI landscapes.

Figure 11

Distribution of Turf and Irrigated Area on Commercial and Industrial Parcels by Reference Evapotranspiration Zone

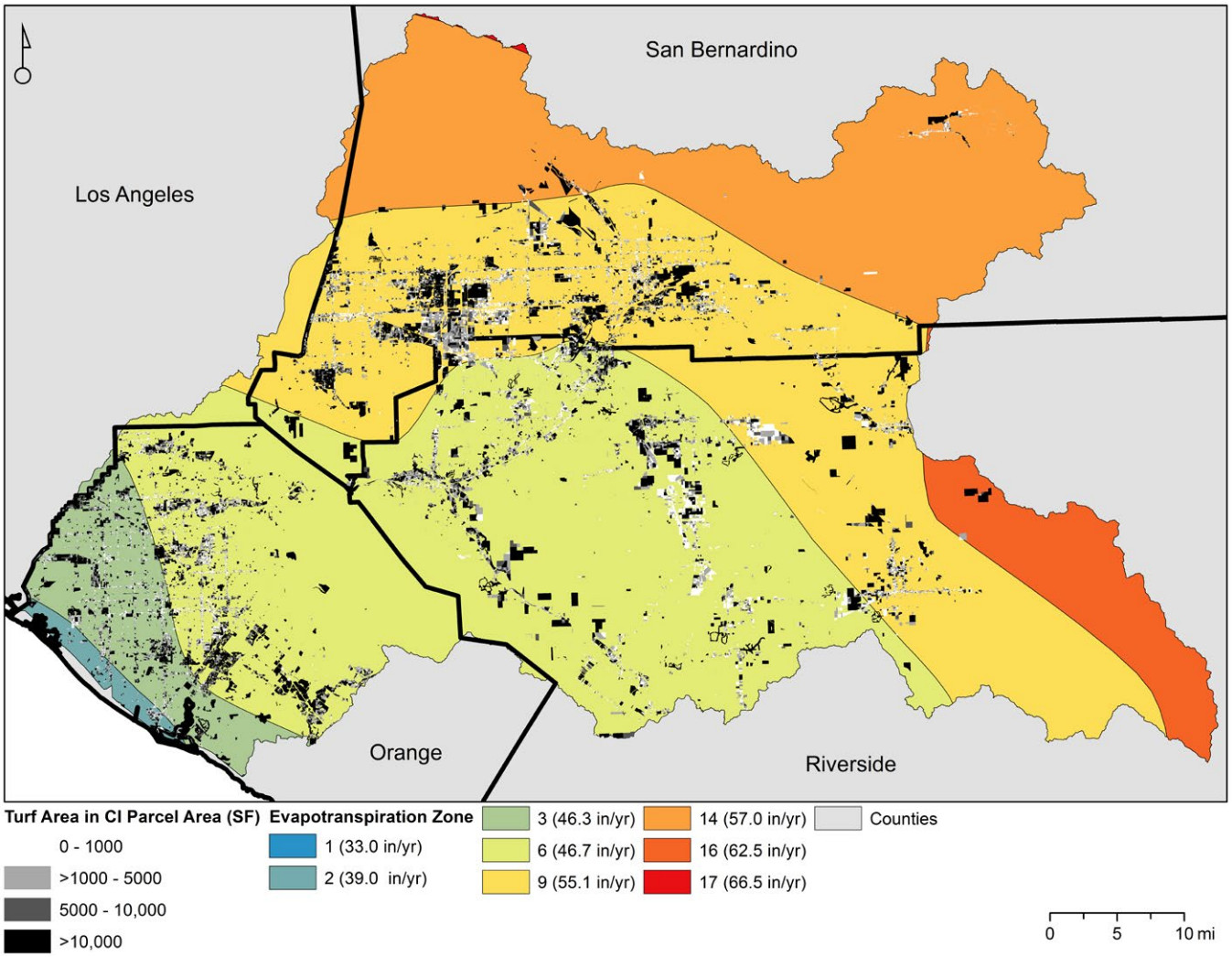


Figure 12

Turf Area on Commercial and Industrial Parcels by Reference Evapotranspiration Zone

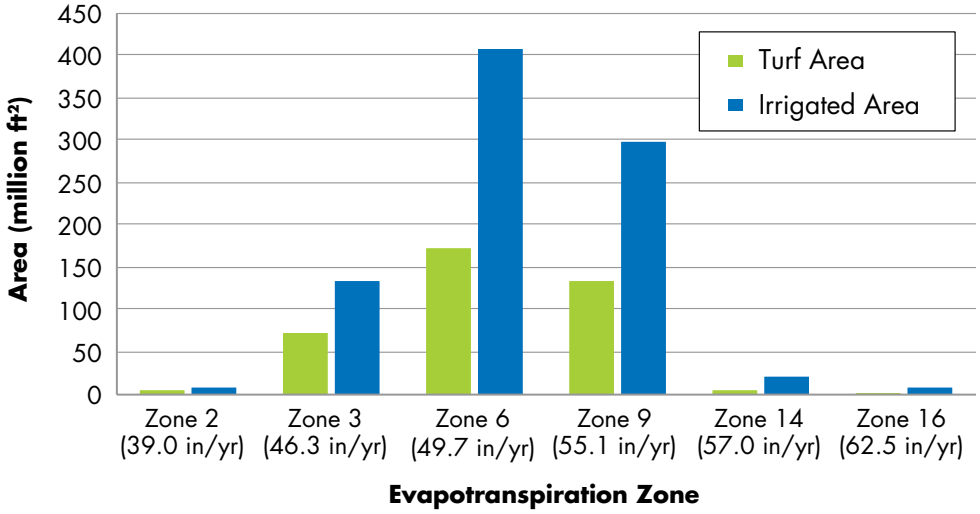
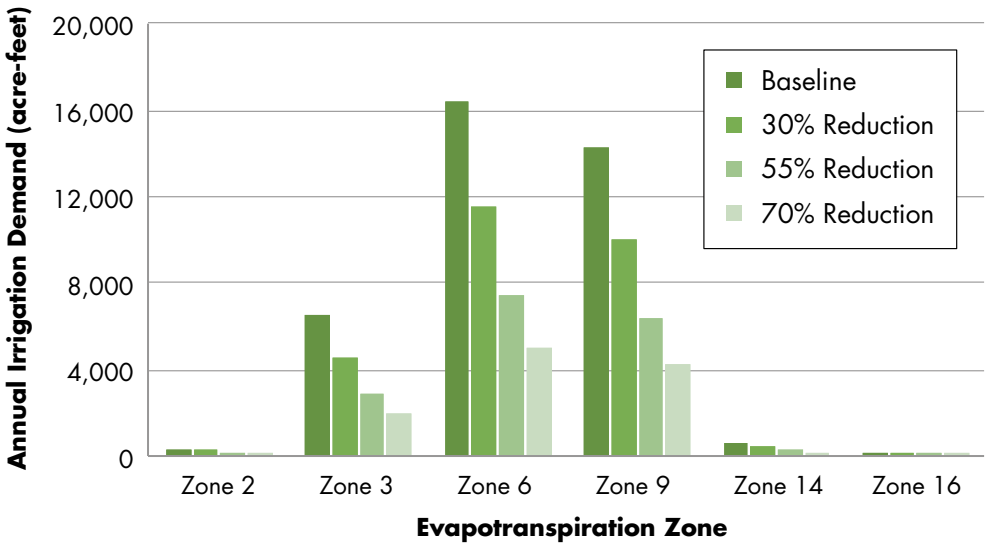


Figure 13

Estimated Reductions in Water Used for Irrigation with Different Levels of Reduction in Irrigation Water Demand



Parcels with the Potential to Contribute Multiple Water-Related Benefits

In some regions, sustainable landscape practices can simultaneously provide multiple water-related benefits. This analysis identified CI parcels that could provide two or more benefits. The outputs used in this analysis included CI parcels in subwatersheds with 303(d)-listed water(s) (water quality); within a 100- or 500-year flood zone (flood risk management); with potential to capture stormwater for recharge or direct use (water supply); and with the highest irrigation demand based on evapotranspiration rates (water supply) (Figure 14). Parcels were also assessed in relation to disadvantaged communities.

Nineteen percent of CI parcels (15,056 parcels) have the potential to contribute to all three water-related benefit categories (Table 5, Figure 14). The total area of these parcels is 1,789 million square feet (41,070 acres), or 20 percent of the land area of all CI parcels. Upwards of 40,000 parcels would contribute to two or more benefit categories. In

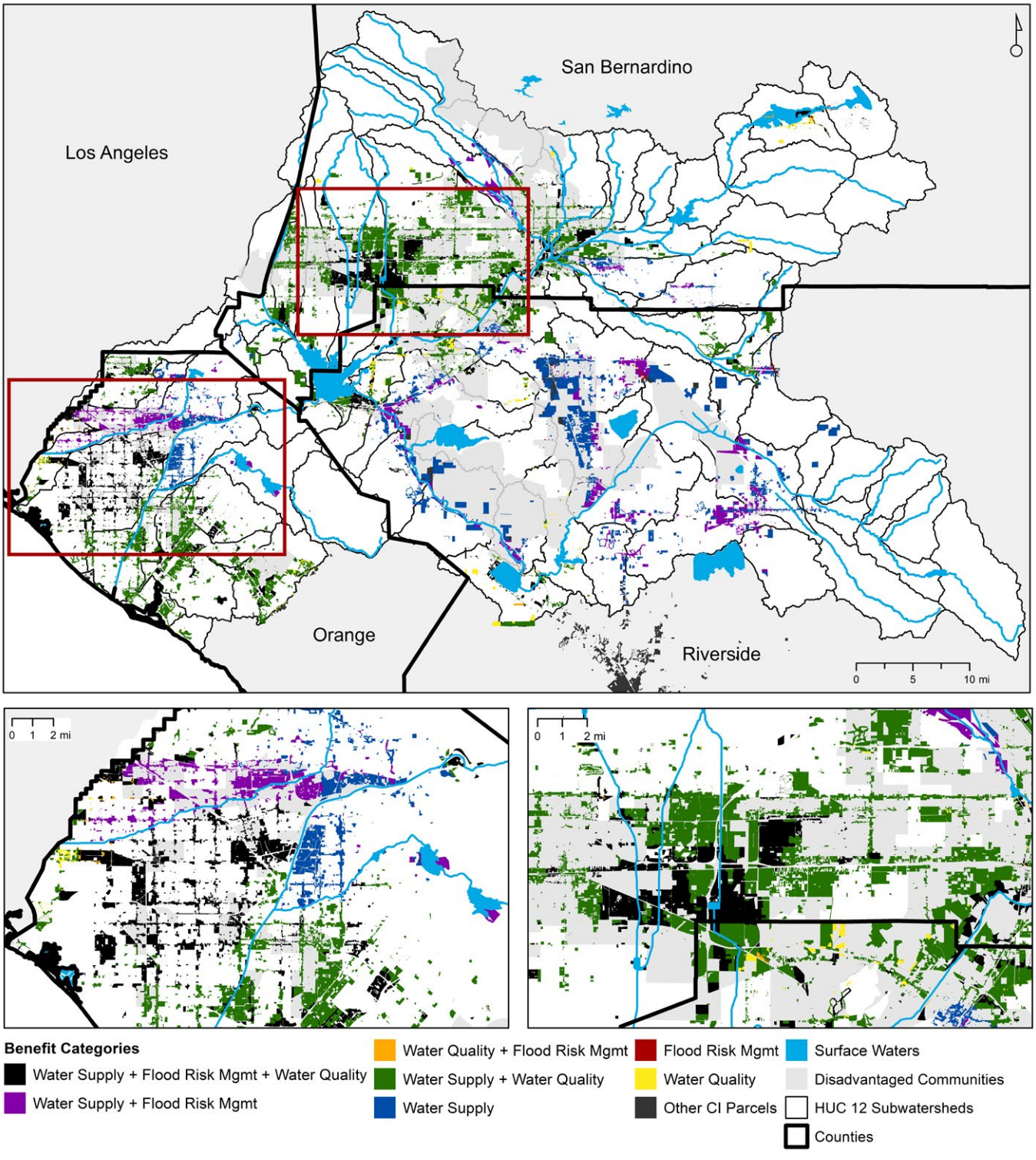
Table 5

Commercial and Industrial Parcels and Area by Benefit Category

Benefit Category	Number of CI Parcels	CI Area (million ft²)	CI Area (acres)	% of CI Parcels	% of CI Area
Water Supply, Water Quality, and Flood Risk Management	15,056	1,789	41,070	19	20
Water Quality and Flood Risk Management	373	30	696	<1	<1
Water Supply and Flood Risk Management	7,145	1,038	23,822	9	12
Water Supply and Water Quality	35,854	3,436	78,874	46	38
Water Supply	12,364	1,705	39,150	16	19
Flood Risk Management	228	20	457	<1	<1
Water Quality	2,410	181	4,163	3	2
TOTAL (CI Parcels)	**78,196**	**8,928**	**204,970**	**94**	**91**

Figure 14

Commercial and Industrial Parcels Potentially Contributing to One or More Benefit Categories



general, improvements in the southern portions of the watershed (Riverside County) are more likely to contribute to water supply and flood risk management benefits. Landscape improvements in Orange and San Bernardino Counties are more likely to contribute to a more diverse range of benefits. There is a large cluster of CI parcels within Ontario and Fontana (within the Inland Empire Utilities Agency service area) where investments have the potential to contribute to all three benefit categories simultaneously.

BENEFITS OF SUSTAINABLE LANDSCAPE PRACTICES

Sustainable landscapes provide multiple benefits. There is broader recognition of the benefits of these practices as they relate to water, i.e., their water quantity, water quality, and flood management benefits. Yet, even here, the benefits are often underappreciated and undervalued. For example, replacing turf grass with climate-appropriate plants is widely recognized as a means of saving water, but less recognized for providing water quality benefits due to reductions in fertilizer and pesticide runoff. Likewise, installing bioswales is broadly recognized as a means of improving water quality and reducing localized flooding, but less recognized for its potential to recharge groundwater and augment local water supplies.

In addition to water-related benefits, these practices provide other benefits related to, for example, ecosystems, energy systems, climate resilience, and community livability. Some of these benefits are directly attributable to the water benefits, whereas others are related to other aspects of the sustainable landscape practice. For example, climate-appropriate plants reduce water use, which, in turn, reduces the amount of energy used to extract, treat, and distribute water and the associated greenhouse gas emissions. Another benefit, which is not directly attributable to water, is the creation of urban habitat and an associated improvement in soil health, biodiversity, and carbon sequestration.

Sustainable landscapes provide these benefits to different stakeholders. Some benefits accrue directly to the site owner and/or operator, whereas others accrue to the broader community. Figure 15 identifies benefits of rain gardens for CI property owners/operators. In this example, replacing a traditional lawn (cool-season turf grass) with a rain garden reduces water use, which in turn reduces the cost of water service, potential property damage (e.g., damage to a fence) and liability (e.g., a slip hazard) associated with overwatering, and the risk of water shortage. Rain gardens also reduce stormwater runoff, thereby reducing stormwater fees and fines and flood damage and liability. They can also prolong the life of any pumps that remove stormwater from the site and reduce energy costs and subsequent greenhouse gas emissions associated with operating those pumps. Rain gardens enhance aesthetics, increasing property values, boosting worker productivity, and improving employee recruitment and retention (American Society of Landscape Architects 2009). Further, rain gardens require less maintenance than lawns over their lifetime, thereby reducing maintenance costs (City of Santa Monica 2013). Finally, rain gardens can help the property owner/operator meet any corporate sustainability targets while improving their reputation.

Sustainable landscapes can also provide broader benefits to the community. For example, some of the potential primary benefits of replacing a traditional lawn with a rain garden include (1) reducing water use, (2) improving soil health, (3) reducing stormwater runoff, (4) creating urban

habitat, and (5) enhancing aesthetics (Figure 16). These primary benefits can lead to a host of other benefits. For example, improving soil health improves the water-holding capacity of the soil, which in turn reduces water use. A detailed examination of the site owner/operator and community benefits of each of the sustainable landscape practices included in this study can be found online here.

Figure 15

Site Owner/Operator Benefits of Rain Gardens

Figure 16

Community Benefits of Rain Gardens

MOTIVATIONS AND OBJECTIVES TO PURSUE SUSTAINABLE LANDSCAPE PRACTICES

As described in the previous section, sustainable landscapes provide multiple benefits to stakeholders. This section explores the motivations and objectives of the business owners and state, local, and regional water managers advancing these landscapes. Understanding the motivations and objectives of each group can help to identify shared intent and goals and better align efforts among stakeholders.

State of California

The benefits of sustainable landscapes are well aligned with state policy objectives, including those found in the California Water Action Plan, the state's climate adaptation strategy (California Natural Resources Agency 2018), California's Wildlife Action Plan (California Department of Fish and Wildlife 2015), and the Healthy Soils Initiative. For example, a key objective of the California Water Action Plan and the climate adaptation strategy is to improve water conservation and efficiency. In support of this objective, Governor Brown signed SB 606 (Hertzberg) and AB 1668 (Friedman) in May 2018. The legislation requires urban retail water agencies to calculate water use objectives for 2025 and 2030 based on the water needed for efficient indoor residential and outdoor water use, as well as reasonable amounts of system water loss. While water suppliers are afforded flexibility in meeting these targets, most recognize that landscapes represent the largest water saving opportunity.

A second objective of both the California Water Action Plan and climate adaptation strategy is to increase regional self-reliance and diversify local water supply portfolios. In pursuit of this objective, the state has adopted several policies and programs to support stormwater capture and use, an imperative which the State Water Resources Control Board (State Water Board) identified as a "critically important" priority for California. For example, in 2013, the State Water Board set an explicit goal to increase annual stormwater use over 2007 levels by at least 0.5 million acre-feet by 2020 and at least 1.0 million acre-feet by 2030 (State Water Resources Control Board 2018). They also strongly encourage water suppliers to offer financial incentives to their customers for stormwater projects and urge the Regional Water Quality Control Boards to set less stringent monitoring and regulatory requirements for stormwater treatment and use projects. Sustainable landscapes treat stormwater as a local resource and are therefore consistent with the State Water Board's goal to "change the perspective that stormwater is a waste or hazard, and treat it as a valuable water resource" (State Water Resources Control Board 2016).

Source: Aaron Volkening, Flikr

Sustainable landscapes with features such as bioswales treat stormwater as a local resource.

Santa Ana River Watershed

The Santa Ana River Watershed is in southern California, between Los Angeles and San Diego, in a region with a semi-arid climate and highly variable precipitation. The watershed encompasses more than 2,840 square miles and includes parts of Orange, Riverside, and San Bernardino Counties, as well as a sliver of Los Angeles County. Local groundwater and surface water account for 50 percent of its supply, and 35 percent of the supply is imported via the State Water Project and the Colorado River Aqueduct.[11] Recycled water makes up the remaining 16 percent of the supply (SAWPA 2018). This watershed is highly urbanized and sustains over six million people, including the major population centers of Anaheim, Riverside, and San Bernardino.

The Santa Ana River Watershed is unique with respect to water management and governance. There are over 70 different water-related agencies and governing bodies throughout the watershed, and the Santa Ana Watershed Planning Authority (SAWPA) helps to coordinate multi-benefit projects and regulatory compliance initiatives between agencies. SAWPA was formed in 1968 to help resolve interagency conflicts and address regional water issues within the watershed. SAWPA tackles issues related to water supply reliability and water use efficiency planning, water quality improvement, groundwater management, and brine disposal, and administers the Santa Ana River Watershed Integrated Regional Water Management Plan. This plan is known by stakeholders as the One Water One Watershed (OWOW) Plan, based on the plan's comprehensive view of the watershed and water issues. The goals in the latest iteration of the plan, the OWOW Plan Update 2018, are to:

- Achieve resilient water resources through innovation and optimization;
- Ensure high-quality water for all people and the environment;
- Preserve and enhance recreational areas, open space, habitat, and natural hydrologic function;
- Engage with members of disadvantaged communities and associated supporting organizations to diminish environmental injustices and their impacts on the watershed;
- Educate and build trust between people and organizations; and
- Improve data integration, tracking, and reporting to strengthen decision-making.

The draft OWOW Plan Update 2018 developed these watershed goals after an extensive effort supported by stakeholders, the OWOW Steering Committee, and the SAWPA Board of Commissioners. These goals reflect an emphasis on water supply optimization, technology, innovation, and environmental justice. All goals were designed to develop a sustainable watershed where separate groups and agencies look for mutually beneficial and regional solutions.

Business Community

The private sector can support their communities and improve management of local resources, including water. Increasingly, companies are adopting sustainability programs that reduce their costs while providing benefits to communities and supporting public water policy goals where their facilities are located. Surveys and interviews conducted provide a preliminary understanding of some of the factors motivating the business

11 To avoid double-counting water supplies, the term groundwater is used to refer to precipitation stored as groundwater. Imported water stored in the ground is classified as "imported water."

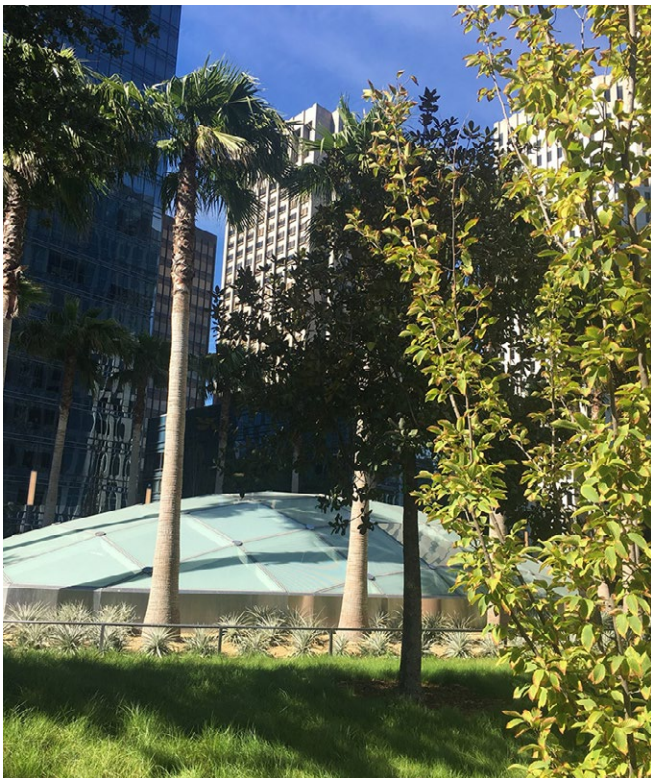
community to adopt sustainable landscape practices.

FINANCIAL CONSIDERATIONS

Financial considerations are important for business investments, including replacing lawn and impervious surface with more sustainable landscapes. Sustainable landscape practices can provide financial benefits through, for example, reduced water, energy, and operation and maintenance costs. In the interviews, all companies cited lower costs as a motivation for adopting sustainable landscapes. Some businesses indicated that they have a set return on investment, or ROI, they must meet to make an investment. However, others, especially those with sustainability budgets, conduct an economic analysis as a way of prioritizing among potential sustainability projects. In either case, demonstrating the financial and even non-financial benefits can make a project more competitive and easier to advocate for internally.

CORPORATE SUSTAINABILITY GOALS AND TARGETS

A growing number of companies have adopted sustainability goals, and these goals can be a motivating factor for the adoption of sustainable landscapes. These internal goals have a direct connection to company actions and allow for measurable progress towards an end-state. Furthermore, companies that have targets for reductions in water and energy use often have separate funding mechanisms for projects with sustainability benefits. During interviews, we found that companies with corporate-level targets have structures in place to achieve these targets and are often more amenable to implementing landscaping projects.



Increasingly, companies are adopting sustainability programs that reduce their costs while providing benefits to communities and supporting public water policy goals.

REPUTATION AND PUBLIC PERCEPTION

Reputation and public perception are important motivators for sustainability actions within the business community. However, the importance of these motivators varies by business type. Through our interviews, we found consumer-focused businesses to be strongly motivated by reputation, and a commitment to sustainability and community service can be an important element of the company's brand. For the hospitality sector, customer feedback is a strong driver, and concerns about aesthetic appeal are important. For some companies, investors may also be a motivator, as the investor community is increasingly calling for improved water management (Lubber 2018). Additionally, we found that meeting goals for recognition programs like the Alliance for Water Stewardship and Leadership in Energy and Environmental Design (LEED) certifications can

further motivate the adoption of sustainable landscape practices.

SOCIAL RESPONSIBILITY

Over the past decade, there has been growing understanding and recognition of water-related risks to companies. While companies are often motivated by the desire to reduce business risks, some are also motivated by a commitment to social responsibility. Businesses are aware of the opportunity to operate in a way that benefits them and the broader community. They understand that their cities and neighborhoods will face intensifying water challenges in the future. During interviews, companies in southern California indicated a commitment to sustainability that stems from an understanding that they are operating in a water-stressed region and want to reduce pressures on water resources.

CHALLENGES FOR ADVANCING SUSTAINABLE LANDSCAPES ON COMMERCIAL AND INDUSTRIAL PROPERTIES

This section describes some of the challenges for implementing sustainable landscapes on CI properties. This information is based largely on discussions with water users, water managers, and water and landscaping experts, and supplemented with information obtained through a literature review.

Project Benefits Not Fully Understood and Split Among Multiple Parties

Sustainable landscapes provide multiple benefits, but these benefits vary from site to site and are not fully understood. Through interviews, we found that businesses lacked a comprehensive understanding of the site-level benefits and therefore did not fully capture these benefits in their economic analyses. Most businesses only included likely reductions in their water bill or, in some cases, lower operation and maintenance costs. But even here, the absence of separate outdoor meters can make it difficult to quantify water savings. Reductions in stormwater runoff and reputational benefits are typically not integrated into the decision-making process.

In addition, a key challenge is that project benefits are often realized by multiple parties. Some benefits, such as reductions in water bills, accrue to the building owner, while others, such as the creation of habitat or improvements in water supply reliability, accrue to the broader community. Each entity, however, typically looks at only the benefits and costs that accrue to them, potentially leading to the selection of a suboptimal project. For example, a stormwater capture project may look expensive to an agency only interested in the water supply benefits or one only interested in the water quality improvements. Each agency may, then, choose to pursue other options that collectively cost more than the stormwater project. Integrating the co-benefits into the decision-making process could make the stormwater capture project look more cost effective, thereby optimizing resource use.

Few Financial Incentives to Install Sustainable Landscapes

New developments and significant redevelopments are subject to codes and ordinances that advance some elements of sustainable landscapes (Box 1). For example, California's Model Water Efficient Landscape Ordinance (MWELO) effectively limits the amount of cool-season turf and other water-intensive plants that can be planted in favor of water-efficient landscapes and recommends (though doesn't require) several measures to improve stormwater infiltration. Likewise, low-impact development measures are required for certain new and redevelopment projects.

Source: Denvit, Pixabay

Rain gardens and climate-appropriate plants define the landscape at Google's headquarters in Mountain View, California.

While codes and ordinances, where they exist, are typically applied to new developments and major renovations, financial incentives can be used to motivate change on existing developments. Many water suppliers use conservation-oriented water rates that provide some incentive for reducing water use. Some also provide rebates to replace turf with more water-efficient landscapes. The Metropolitan Water District of Southern California (MWDSC), for example, provided a rebate at $2 per square foot during the recent drought after the agency's staff assessed the lifecycle benefits of landscape transformation programs in comparison to the cost of providing water supply through traditional sources like the Colorado River. In combination, volumetric water rates and rebates provide some incentive to reduce water use. However, there are currently no rebate incentives available in the Santa Ana River Watershed associated with some of the other benefits of sustainable landscapes, such as groundwater recharge and runoff reduction. In the absence of these incentives, there are limited options for motivating sustainable landscapes on private property.

Business Community Often Unaware of Rebate Programs

In the Santa Ana River Watershed, there are approximately 70 retail water agencies and nine wholesale water agencies. Many of these agencies provide rebates to their customers to incentivize them to use less water. For example, two of the wholesale agencies in the watershed, MWDSC and San Bernardino Valley Municipal Water District (SBVMWD), provide rebates for replacing turf grass with water-efficient landscapes. In 2015, the SBVMWD board approved a $1 per square foot rebate for customers who removed their living turf grass. The MWDSC board recently adopted a new program offering a $1 per square foot rebate for combining turf removal, irrigation modification, and rainwater capture or retention (Metropolitan Water District, 2018). Other retailers and wholesalers in the watershed have their own programs, and some have coupled their financial incentives with those of MWDSC or SBVMWD to provide their customers with a larger rebate. While rebates are available, none of the eight companies surveyed used them for the projects they implemented. In all cases, the companies interviewed were unaware of the rebates and did not know where to go for this information.

Limited Funding to Support Efficiency Improvements and Distributed Infrastructure

Large-scale water infrastructure projects have a relatively high initial cost but provide benefits over a long period. When developing these projects, water agencies can issue bonds, allowing them to raise large amounts of capital to pay for

Box 1

Existing Water Quality and Water Efficiency Frameworks in the Santa Ana River Watershed

Water Efficiency Frameworks

In May 2018, Governor Brown signed SB 606 (Hertzberg) and AB 1668 (Friedman), which codified Executive Order B-37-16, Making Water Conservation a California Way of Life, into law. The legislation requires urban retail water agencies to calculate a water use objective based on the water needed in its service area for efficient indoor residential water use, outdoor residential water use, commercial, industrial and institutional irrigation with dedicated meters, and reasonable amounts of system water loss.

While state and federal standards have almost exclusively focused on indoor uses of water, California has adopted an ordinance targeting outdoor landscape water use. California's Model Water Efficient Landscape Ordinance (MWELO), first adopted in 1992 after a severe drought, establishes a landscape water budget based on local evapotranspiration and a plant coefficient, as well as performance standards and labeling requirements for landscape irrigation equipment (California Department of Water Resources 2015). In 2015, the landscape water budget was reduced from 70 percent to 45 percent of local evapotranspiration for non-residential landscapes. In addition, while originally targeting new construction with landscapes exceeding 2,500 square feet, the 2015 update applies to all new construction for residential and non-residential landscapes greater than 500 square feet and rehabilitated landscapes greater than 2,500 square feet. Finally, the revisions encourage the use of more efficient irrigation systems, greywater usage, and onsite stormwater capture (California Department of Water Resources 2015).

Water Quality Frameworks

Municipal separate storm sewer systems (MS4) permits within the Santa Ana River Watershed, which are held by the watershed's three counties (Orange, Riverside and San Bernardino), mandate a low-impact development (LID) approach to stormwater and management of runoff discharges for certain projects. In all counties in the watershed, their priority projects must adopt a water quality management plan and incorporate LID measures in line with the plans. For Orange County, these priority projects include significant redevelopment projects that add or replace 5,000 or more square feet of impervious surface on an already-developed site (Orange County Public Works 2011).

Although less common in comparison to the MS4-driven water quality management plan framework, LID measures may also be required for development and redevelopment projects due to the State Water Resources Control Board's Construction General Permit. The permit establishes statewide post-construction runoff standards and requires the maintenance of a site's predevelopment hydrology in order to control hydromodification (Southern California Stormwater Monitoring Coalition 2010). For the project proponent to maintain coverage under the state's permit, the pre-development site hydrology must be evaluated and approximated using structural and non-structural controls so that there is no increase in the volume of runoff that leaves the site and no decrease in the time of concentration (Southern California Stormwater Monitoring Coalition 2010). Thus, some project proponents across the State have incorporated LID measures to control erosion and protect downstream waterbodies.

the project and then spread this cost over a period more consistent with the timing of the benefits, e.g., 30 years. These projects are owned by the water agency and are therefore assets upon which they can capitalize.

Very few agencies issue bonds to pay for efficiency improvements and other distributed infrastructure projects. These projects weren't considered assets because they weren't owned by the agency. In response, most water agencies paid for these programs out of their operating budgets and then supplemented them with the occasional state or federal grant. The result is that investments in distributed infrastructure have been far lower than those made on large, centralized infrastructure projects.

Complex and Varied Permitting and Regulatory Requirements

For some businesses, external permitting and regulatory requirements are a barrier to implementing sustainable landscape projects. Local requirements and approvals can vary widely across county and city governments. In addition to site requirements, such as business property association aesthetic requirements, a project may need to satisfy a number of other requirements, including stormwater permitting, and city/county building permits and code enforcement. For multi-benefit projects, there may be additional reviews and requirements.

Additionally, outside funding sources and incentive programs may have compliance and verification requirements. For example, residential turf replacement rebates may require pre- and post-project field inspections by a third party, photo documentation, signage, landscaping plans, and landscape contractor receipts. Other funding sources may have a different set of eligibility and verification requirements.

Each of these requirements may involve coordination across multiple departments or agencies. These processes and requirements can be difficult to understand and access and can add additional time, staff resources, and cost for project planning and implementation.

Lack of Established Relationships Between Water Utility Staff and Business Community

One of the challenges that water agencies face when launching sustainable landscaping projects is the lack of established relationships between water utility staff and the business community. As water agencies try to engage businesses to begin landscape projects, it is difficult for them to find the company's lead for sustainability initiatives. Often the water agency's sole contact at a firm is the individual in the businesses' finance department who pays the water bill. Some larger water agencies may have staff from their water resources or public relations departments that work with large volume water customers, but this is not universal. Similarly, the business may not have contacts in the water efficiency departments and thus may not know about the financial incentives and other resources available to support landscape conversions.

Complex and Varied Business Decision-Making Processes

Within a business, landscape conversion and investment may involve diverse parts of business decision-making, including the following:

- Facilities planning;
- Sustainability planning;

- Construction and maintenance;
- Finance;
- Marketing and public relations; and
- Regional and corporate management.

Some of these decisions are made locally. Others are managed at a regional or corporate level that may be removed from the watershed and even from California. Also, in some instances, property landscape may be managed by a landlord and not under the direct control of the business. In the case where a business is a tenant, investment in sustainable landscaping incurred by the tenant is a sunk cost if the business moves. Even if the business owns the property, the future financial impacts of water-related risks, new regulations, and long-term sustainability challenges may not be adequately factored into economic analyses.

As described above, a business considering landscape conversions may also face external review and approvals that can cause additional friction for implementation, including additional decision-makers, increased costs, timing delays, and implementation complexity. These complexities make it difficult to form efficient partnerships among business, public resource managers, and regulating entities for implementing distributed, multi-benefit investments.

Specialized Knowledge Needed to Install and Maintain Landscape Improvements

Proper installation and maintenance of sustainable landscapes requires more specialized and localized knowledge than traditional landscapes, including selecting the right plants for the region, understanding the soil and water needs, and ensuring appropriate maintenance. There is considerable variability of knowledge and capability among vendors and contractors for sustainable landscaping design, construction, and maintenance. Often a business will bid on a long-term landscape maintenance contract based primarily on the lowest cost and secondarily on the bidder's experience with maintaining sustainable landscaping. Typically, the low bid is based on the landscape contractor's costs of maintaining a traditional turf grass landscape and not a water-efficient landscape with a variety of hydrozones and vegetation.

CONCLUSIONS AND RECOMMENDATIONS

Sustainable landscape practices provide many benefits to a variety of stakeholders. They can make substantial contributions toward improved surface water quality, flood management, and water supply reliability in the Santa Ana River Watershed. They can also reduce energy usage, sequester carbon, improve ecosystem and human health, promote economic activity, and enhance community resilience. Some of these benefits accrue to the property owner, while others accrue to the broader community.

This study finds that there are significant opportunities for the business community to contribute to shared watershed goals through investments in sustainable landscapes on their properties. The opportunities and potential for realization of these benefits are distributed unevenly across the watershed. Most parcels provide at least one benefit, and many parcels, particularly in the northern (i.e., Chino Basin and San Bernardino Valley) and western (i.e., Orange County) portions of the watershed, were found to have the potential to contribute to two or more benefit categories.

The scope and scale of our sustainability challenges warrant action by all. CI properties provide significant opportunities for sustainable

landscapes. It is important to realize that the business community is diverse, and motivations are varied. Some companies are motivated by the need to maximize their return on investment, whereas others are motivated by sustainability or reputational benefits. Gaining a clearer understanding of motivations can help to develop programs and policies that effectively motivate and inspire the business community to act.

Likewise, the public managers of water resources are diverse, with varied motivations. Supporting and achieving multiple benefits for the watershed necessitates greater coordination and cooperation. Simplifying and aligning programs around common benefits can improve efficiency and adoption for sustainable landscaping practices in the business community.

Challenges for greater uptake of sustainable landscape practices on CI properties are varied and range from uncertainty about project costs and benefits to limited incentives for landscape improvements. Considering these challenges, we recommend the following:

I. Develop Resources to Assist Businesses Considering Sustainable Landscape Improvements

There are a variety of tools and resources that would help businesses implement sustainable landscapes. For example, company representatives indicated that they were unfamiliar with the potential projects they could implement on their site and the associated costs and benefits. Estimates of, for example, the project cost, volume of water saved or recharged, and any changes in maintenance costs would be especially useful.

Some businesses, especially larger corporations, have sustainability commitments, and articulating some of the sustainability benefits would provide additional justification for these investments. For example, some companies have adopted replenish or "water balance" goals to restore a volume of water equal to the amount used by the business. For these companies, estimates of the amount of water saved and/or recharged would be especially useful. Likewise, some companies have adopted goals to reduce greenhouse gas emissions, and information regarding carbon sequestration and energy savings associated with using less water or recharging groundwater would be helpful. Aesthetic or reputational benefits would be especially important to emphasize for consumer-facing brands.

Many CI property owners are unfamiliar with the opportunities and options for installing sustainable landscapes. Some are also wary of making changes to the look and feel of their business. Case studies highlighting local businesses that have made these investments could help address these issues, as can lists of design, construction, and maintenance companies that are able to properly install and maintain these landscapes.

II. Use Language and Examples that Resonate with the Business Community

Water utilities, cities, and community members who wish to encourage the business community to develop multi-benefit projects should remember to use language and terminology that resonates with that community. Highlighting the ways that sustainable landscapes can reduce water risks can be especially effective (Box 2), as can a discussion of new business opportunities these landscapes can provide. For example, there is evidence that green infrastructure, such as bioswales and rain gardens, can increase foot traffic, boosting economic activity for nearby businesses (American Society of Landscape Architects 2009, US EPA 2014).

Box 2

Water-Related Risks for Businesses

Water-related risks can stem from business practices that harm or could harm the environment or communities, such as polluting or wasting water or failing to offer proper drinking water to employees. They can also stem from water conditions in the basins where the company operates, e.g., drought, inadequate infrastructure, and poor water quality. Water risk is typically divided into three categories:

- **Physical Risks:** Physical risks stem from having too little water (scarcity), too much water (flooding), water that is unfit for use (pollution), or inaccessible water. For example, water scarcity can halt industrial production simply because there is not enough water available. Likewise, a contaminated water supply may require additional investment and operational costs for pre-treatment.

- **Regulatory Risks:** Regulatory risks occur because of changing, ineffective, poorly implemented, or inconsistent water policies. Ineffective policy can create a less inviting or unstable business environment or degrade conditions within the catchment. Stricter regulatory requirements often result from water scarcity, ensuing conflict among various users, or excessive pollution.

- **Reputational Risks:** Reputational risks stem from changes in how stakeholders perceive companies' impacts on the quantity and quality of water resources, the health and wellbeing of workers, aquatic ecosystems, and communities. Reputational concerns lead to decreased brand value or consumer loyalty or changes in regulatory posture and can ultimately threaten a company's legal and social license to operate.

Source: CEO Water Mandate

Finally, tailoring materials to a diverse set of audiences can be useful, as business operations and motivations are varied. For example, aesthetics and reputation are strong drivers for consumer-facing brands, and sustainability benefits would motivate companies with sustainability goals (and likely sustainability budgets). Likewise, the ability to charge higher rents for properties with sustainable landscapes would appeal to properties controlled by landlords, whereas increased business activity would appeal to properties controlled by business owners.

III. Develop Appropriate Incentive Programs and Policies

A variety of programs can be used to incentivize sustainable landscape practices on private property. Valderrama et al. (2013) find that "attractive retrofit economics" motivate investments on private property. They point to the success of several incentive programs, such as Philadelphia's Greened Acre Retrofit Program. Incentive programs can be especially useful when there are few examples and limited data available,

as is the case with sustainable landscapes on CI properties. However, as more case studies and better data become available, there is less need for incentive programs.

Incentive programs can provide both financial and non-financial benefits to participants. In a recent assessment, Clements et al. (2018) classifies green infrastructure incentive programs into six categories:

1. **Stormwater fee discounts**: Discounts on stormwater fees if property owners implement green infrastructure or reduce impervious area.
2. **Rebates and cost-share programs**: Reimbursements or co-payments to property owners who install specific green infrastructure practices.
3. **Grant programs**: Grants that provide up to a 100 percent funding for a range of customized green infrastructure projects on private property.
4. **Development and redevelopment incentives**: Incentives that increase revenues or reduce costs or risks of new development and/or redevelopment sites with green infrastructure.
5. **Awards and recognition programs**: Simple recognition through signs/plaques, formal award programs, and/or "green business" certification for property owners.
6. **Stormwater credit trading programs**: Programs that allow developers/property owners to meet stormwater requirements offsite by purchasing stormwater credits from those who voluntarily implement green infrastructure.

Clements et al. (2018) find that effective program design is predicated on understanding the constraints, drivers, and motivations of different types of property owners. Table 6 summarizes some of the advantages, disadvantages, and applicability of each of these incentive programs, all of which should be taken into consideration when selecting programs and program elements.

While focused on stormwater, these or similar incentive programs could be applied to practices that reduce water use or augment water supplies. Many water suppliers have conservation-oriented water rates that provide some incentive to save water. Adjusting water rates to send a stronger conservation signal to CI customers, within the limits imposed by Proposition 218, can provide further incentive to replace turf with climate-appropriate plants.

With financial incentives like grants and rebate programs, determining the appropriate amount of the incentive is essential. If the incentive is too low, then people will not be induced to act. On the other hand, if the incentive is too high, then program funds may run out quickly. In either case, program participation is limited. To ensure that the program is effective in getting businesses to participate while also maximizing uptake of sustainable practices, the incentive should be priced at a level that induces the business to act ***and*** is compatible with the cost of other water sources and stormwater management practices available to the water agency.

IV. Develop Targeted Financial Incentive Programs

Given that budgets for financial incentives are limited, programs and policies should be targeted to yield the greatest benefits. There are a variety of ways to target programs. Programs can be targeted geographically, such as by focusing on areas that provide the greatest benefit, are highly visible or visited, or that have historical environmental justice issues. Programs can also

Table 6

Advantages, Disadvantages, and Application of Incentive Programs

Program Type	Advantages	Disadvantages	Application
Fee Discount	• Can provide educational benefits • Can provide relief to large property owners with significant impervious area • Helps cover maintenance costs • Can be a selling point for participation in other incentive programs	• Not typically enough to incentivize green infrastructure by itself • Not a viable option for municipalities with no fee • (Mostly) perception that discounts can reduce revenue to unacceptable levels	• Can apply across property types, most useful for larger properties • Can be more applicable to retrofit projects because benefits accrue to property owner, not developer
Rebate and Cost-Share	• Can reach many property owners and provide educational benefits • Scalable to available budget, resources, and program goals	• Smaller installations may not be as cost-effective for meeting water quality goals • Can be barriers associated with direct public spending on private property • Requires property owner to have a higher level of understanding of stormwater issues	• Most often available for residential and smaller commercial retrofits • Can be used for new and redevelopment sites, most often green roofs
Grant	• Can incentivize larger, cost-effective projects for meeting water quality goals • Provides opportunities to leverage additional funding sources • Includes educational benefits with highly visible demonstration projects	• Often requires significant design/up-front resources, which can reduce participation • Can require extensive maintenance/property owner agreements • Can be barriers associated with direct public spending on private property	• Mostly retrofits on commercial, industrial, or institutional properties • Can be used for new and redevelopment sites but needs to be well timed with development process
Development/ Redevelopment Incentive	• Includes several low- or no-cost options for utilities/municipalities • Targeted to meet needs and preferences of development community	• Requires coordination across many departments • Dependent on needs of local development market • Can create competition with other green building incentives and/or municipal priorities	• New development and redevelopment sites • Often only utilized/applicable to larger new/redevelopment sites in urban areas
Award and Recognition	• Provides marketing/education for other incentive programs • Can be low-cost or scaled up based on available budget and city goals • Can help drive innovation/adoption • Promotes exemplary projects and green infrastructure benefits	• Typically not enough by themselves to incentivize green infrastructure • Program success/results difficult to quantify • Green infrastructure can be in competition with other green building initiatives	• Applies across residential, commercial, and new/redevelopment sites
Credit Trading	• Provides flexibility for developers • Can result in better water quality outcomes relative to strict onsite retention requirements • Can be relatively low cost once program is up and running	• Requires adequate market and level of development • Can be costly to design/establish • Washington, DC has only functioning market; untested across variety of local conditions	• Existing development sites as well as new and redevelopment sites that are not subject to, or go beyond, stormwater management requirements

Source: Clements et al. 2018

be targeted to specific customers, such as the most wasteful waters users, the largest polluters, or those properties that generate the most runoff.

One potential issue with targeting programs is a concern about unequal treatment of customers. One way to address this is to provide performance-based incentive programs. For example, a rebate of $100 per acre-foot of recharge in areas overlying usable groundwater aquifers. In addition to providing incentives, this approach can institutionalize collaboration rather than require it take place on a case-by-case basis.

V. Foster Long-Term Relationships Between Water Managers and the Business Community

Water supply, flood management, and stormwater staff do not typically have relationships with facility managers or sustainability leads. Even in cases where relationships have been established, staff turnover at the company or utility can make it difficult to maintain those relationships. There are several ways for establishing and maintaining long-term relationships, such as creating a dedicated point of contact or working with a third party that consistently works with the business community.

VI. Streamline the Approval and Permitting Process

Permitting and approval processes can result in disincentives or delays in implementing projects. Steps to simplify and standardize approval processes can supplement and contribute to the incentive programs described previously. Steps to simplify and standardize the permitting process across the watershed could include: (1) coordination across functional responsibilities (retail water, stormwater, flood management, and city/county planning and building); (2) development of best management practices; (3) development of a multi-benefit general permit; (4) adoption of model requirements; and (5) establishment of a one-stop permitting assistance and approval process. Developing a coordinated approach to permitting may also identify valuable regulatory relief incentives, e.g., providing expedited permitting for landscape conversion projects that are designed to achieve multiple benefits for the watershed.

Source: Eie Werk, Wikipedia

Stormwater curb extensions capture stormwater runoff in a depressed planting bed.

Similar approaches could be applied to financial incentives provided by multiple jurisdictions to collect and distribute grant, rebate, or incentive funds. In some cases, wholesale water agencies have assumed these programs. For example, MWDSC has established the Landscape Transformation Program. Coordinating these programs with other sources of funds for multi-benefit projects could

align financial grants and incentives for businesses implementing projects. A coordinated fiscal agent to pool available incentive funds and manage the grant or rebate process would provide a "one-stop shop" and could also reduce administrative costs for the programs. Simple approaches and standards of eligibility could be developed for all benefits.

VII. Explore Alternative Funding Sources

Funding collective action across a watershed requires creative thinking and innovative approaches. Several approaches warrant further exploration for business landscape conversion. The WaterNow Alliance has highlighted the ability of water agencies to debt-finance investments in water efficiency and green infrastructure (Harrington and Koehler 2016); although still relatively uncommon, debt-financing would substantially increase funds available for these investments. A green bond with dedicated repayment funding from public and private program beneficiaries could be an effective tool for braiding funds to finance a sustainable landscapes program. A parcel tax based on impermeable area, such as Measure W in Los Angeles County, is a "polluter pays" approach that could also be replicated. Redirecting a fraction of development and building permitting fees to fund landscape conversions is another innovative option. Other financing approaches pioneered in the renewable energy field, such as on-bill financing and voluntary property assessments, could be applied to CI properties. These alternative funding approaches can help lower up-front costs for sustainable landscaping investments and promote their uptake on a larger number of sites.

VIII. Coordinate Policies and Programs Across the Watershed

Water resource management is spread across multiple agencies, as are the benefits of sustainable landscape practices. Coordinating policies and programs across a watershed could help realize opportunities for greater uptake of these practices, thereby maximizing their benefits. For all the preceding recommendations, coordinating program design and administration could yield economies of scale and scope, reducing program costs for any single entity and helping to optimize the value of regional investments.

For example, San Mateo County in northern California adopted an integrated approach to address the impacts of transportation on water quality. In 2010, voters approved a $10 fee on vehicle registration to support road and street improvements. Twelve percent of the revenue supports stormwater pollution prevention efforts, such as reducing runoff from paved surfaces and installing pervious median strips on roadways (C/CAG 2015).

Similarly, water resource management agencies in the Santa Ana River Watershed could develop a simplified, watershed-wide sustainable landscapes program to provide specified incentives (recognition, funding, and regulatory relief) for businesses that sign onto the partnership and demonstrate actions and contributions toward watershed goals. Coordination and alignment of public agency goals, programs, and approvals would offer simplicity and efficiency, while a partnership approach would allow for a growing business commitment to watershed sustainability.

References

American Rivers. 2010. Putting Green to Work. http://www.allianceforwaterefficiency.org/uploadedFiles/News/NewsArticles/American-Rivers-Putting-Green-to-Work-Sept2010.pdf.

American Society of Landscape Architects. 2009. The Case for Sustainable Landscapes. https://landscapeforlife.org/wp-content/uploads/2017/09/The-Case-for-Sustainable-Landscapes-Brochure.pdf.

Bounoua, L., Joseph Nigro, Kurtis Thome, Ping Zhang, Najlaa Fathi and Asia Lachir. 2018. A Method for Mapping Future Urbanization in the United States. 2018. *Urban Science*. http://www.mdpi.com/2413-8851/2/2/40/pdf.

California Department of Finance. 2017. P-1: State Population Projections (2010-2060). http://www.dof.ca.gov/Forecasting/Demographics/Projections/.

California Department of Fish and Wildlife. 2018. California State Wildlife Action Plan: 2015 Update. Sacramento, California. https://www.wildlife.ca.gov/SWAP/Final.

California Natural Resources Agency. 2018. Safeguarding California Plan: 2018 Update. Sacramento, California. http://resources.ca.gov/docs/climate/safeguarding/update2018/safeguarding-california-plan-2018-update.pdf.

California Department of Water Resources. 2015. The 2015 Updated Model Water Efficient Landscape Ordinance. https://water.ca.gov/LegacyFiles/wateruseefficiency/landscapeordinance/docs/2015%20MWELO%20Guidance%20for%20Local%20Agencies.pdf.

Center for Neighborhood Technology and American Rivers. 2010. The Value of Green Infrastructure: A Guide to Recognizing its Economic, Environmental, and Social Benefits. Center for Neighborhood Technology, Chicago, Illinois. https://www.cnt.org/sites/default/files/publications/CNT_Value-of-Green-Infrastructure.pdf.

City/County Association of Governments (C/CAG), San Mateo. 2015. Measure M – Fiscal Year 2014-2015 Annual Report. http://ccag.ca.gov/wp-content/uploads/2014/05/Measure-M-Update-September-2015_Final-1.pdf.

City of Santa Monica. 2013. Sustainable Landscape Case Study: garden\garden, a comparison of native and traditional gardens in Santa Monica. https://www.smgov.net/uploadedFiles/Departments/OSE/Categories/Landscape/garden-garden-2013.pdf.

Clements, J., A. St. Juliana, P. Davis, and L. Levine. 2013. The Green Edge: How Commercial Property Investment in Green Infrastructure Creates Value. Natural Resources Defense Council. New York, New York. https://www.nrdc.org/resources/green-edge-how-commercial-property-investment-green-infrastructure-creates-value.

Di Liberto, Tom. 2017. Very wet 2017 water year ends in California. NOAA. Retrieved from https://www.climate.gov/news-features/featured-images/very-wet-2017-water-year-ends-california.

Gleick, Peter. 2017. Impacts of California's Five-Year (2012-2016) Drought on Hydroelectricity Generation. Oakland, Calif.: Pacific Institute. Retrieved from http://pacinst.org/publication/impacts-californias-five-year-2012-2016-drought-hydroelectricity-generation/.

Green Gardens Group (G3). 2018. California Watershed Approach to Landscape Design. http://apldca.org/download-g3-watershed-approach-handbook/.

Hanak, E., and M. Davis. 2006. "Lawns and Water Demand in California," California Economic Policy 2, No. 2, https://www.ppic.org/publication/lawns-and-water-demand-in-california/.

Harrington, E. and C. Koehler. Debt Funding for Water Conservation Programs. Government Financing Review: 24-29. https://waternow.org/wp-content/uploads/2017/05/Ed-Harrington_GASB_Debt-Funding-for-Water-Conservation-Programs.pdf.

Heberger, M., H. Cooley, and P. Gleick. 2014. Urban Water Conservation and Efficiency Potential in California. Oakland, Calif.: Pacific Institute. http://pacinst.org/wp-content/uploads/2014/06/ca-water-urban.pdf.

Lubber, Mindy. 2018. Investors Increasingly Engaged on World Water Issues. Ceres. https://www.ceres.org/news-center/blog/investors-increasingly-engaged-world-water-issues.

Metropolitan Water District of Southern California. 2017. California Friendly Landscapes. https://landscapeforlife.org/wp-content/uploads/2017/09/The-Case-for-Sustainable-Landscapes-Brochure.pdf.

Metropolitan Water District of Southern California. 2018. News Release. http://www.mwdh2o.com/PDF_NewsRoom/Turf%20and%20budget%20release_FINAL.pdf.

Orange County Public Works. 2011. Model Water Quality Management Plan. http://www.ocwatersheds.com/civicax/filebank/blobdload.aspx?BlobID=21237.

Orange County Coastkeeper. 2018. Edison Smartscapes. Costa Mesa, Calif: Orange County Coastkeeper. https://www.coastkeeper.org/the-garden/edison-smartscapes/.

Perisho, J., S. Randle, and M. Winter. 2018. Water LA 2018 Report. Studio City, Calif.: The River Project. https://static1.squarespace.com/static/5a21b552bce176df59bb9c8e/t/5a95af0c9140b74923e2a0fb/1519759148508/WaterLA_Report_022318_web.pdf.

Santa Ana Watershed Project Authority (SAWPA). 2018. One Water One Watershed Update 2018: Moving Forward Together. http://www.sawpa.org/wp-content/uploads/2018/11/OWOW-Plan-Update-2018-PRD.pdf.

Southern California Stormwater Monitoring Coalition. 2010. Low Impact Development Manual for Southern California. Prepared by Low Impact Development Center Inc. https://www.casqa.org/sites/default/files/downloads/socallid-manual-final-040910.pdf.

State Water Resources Control Board. 2016. Stormwater Strategy. Sacramento, Calif. https://www.waterboards.ca.gov/water_issues/programs/stormwater/storms/obj1_proj1a_desc.shtml.

State Water Resources Control Board. 2018. Amendment to the Policy for Water Quality Control for Recycled Water. https://www.waterboards.ca.gov/water_issues/programs/water_recycling_policy/docs/2018/draft_stff_rpt_recycled_water_policy.pdf.

Swain, Daniel L., Baird Langenbrunner, J. David Neelin, and Alex Hall. 2018. Increasing Precipitation Volatility in Twenty-First-Century California. Nature Climate Change, 8:5. p.427–33. https://doi.org/10.1038/s41558-018-0140-y.

United Nations Environment Programme, IUCN, TNC, WRI, Green Community Ventures, U.S. Army Corps of Engineers. 2014. Green Infrastructure: Guide for Water Management. http://wedocs.unep.org/handle/20.500.11822/9291.

United States Environmental Protection Agency. 2014. Enhancing Sustainable Communities with Green Infrastructure. https://www.epa.gov/sites/production/files/2016-08/documents/green-infrastructure.pdf.

United States Environmental Protection Agency. 2018. Drinking Water Infrastructure Needs Survey and Assessment. https://www.epa.gov/sites/production/files/2018-10/documents/corrected_sixth_drinking_water_infrastructure_needs_survey_and_assessment.pdf.

Valderrama, A., L. Levine, E. Bloomgarden, R. Bayon, K. Wachowicz, and C. Kaiser. 2013. Creating Clean Water Cash Flows Developing Private Markets for Green Stormwater Infrastructure in Philadelphia. NRDC, EKO Asset Management Partners, and The Nature Conservancy. https://www.nrdc.org/sites/default/files/green-infrastructure-pa-report.pdf.

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