San Mateo Countywide
Sustainable Streets Master Plan
FINAL January 2021

C/CAG
City/County Association of Governments
of San Mateo County

Caltrans

IMAGE CREDIT: LOTUS WATER

Table of Contents

Appendices and Background Information

Acknowledgments

IMAGE CREDIT: CD+A

The Sustainable Streets Master Plan was a collaborative effort of the City/County Association of Governments of San Mateo County (C/CAG), the County of San Mateo, and the 20 cities and towns. It was made possible by a climate change adaptation planning grant from the California Department of Transportation (Caltrans). The Master Plan would not have been possible without the key input and efforts of the following individuals.

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City of Millbrae
City of Pacifica
Town of Portola Valley
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IMAGE CREDIT: URBAN RAIN DESIGN

Executive Summary

IMAGE CREDIT: URBAN RAIN DESIGN

E.1 Vision and Purpose

Municipalities across the San Francisco Bay Area are rethinking the way streets are designed to reduce carbon emissions, mitigate urban stormwater pollution, protect against flooding, and provide communities with bikeable and walkable streetscapes through the implementation of sustainable streets. Sustainable streets are right-of-way projects that integrate pedestrian, bicycle, and transit improvements with green infrastructure components like stormwater planters and pervious pavement. Objectives of sustainable street projects include:

- Facilitating active transportation by providing mobility, access, public realm, and safety improvements for bicyclists and pedestrians.
- Expanding the treatment of roadway runoff using green infrastructure to achieve water quality improvements.
- Reducing carbon emissions through supporting sustainable modes of transportation.
- Adapting the transportation network to better address rainfall and heat-related climate change impacts.
- Sequestering carbon and providing shade through the addition and growth of street trees.
- Providing improved habitat for birds and other urban wildlife through the use of tools such as native plants and more wildlife-friendly street lighting.
- Generating integrated projects to meet multiple government and community objectives and provide multiple benefits.

The San Mateo Countywide Sustainable Streets Master Plan (Master Plan) was developed by the City/County Association of Governments of San Mateo County (C/CAG) under its San Mateo Countywide Water Pollution Prevention Program in collaboration with the State of California Department of Transportation (Caltrans). The Master Plan is a roadmap and set of tools to assist public agencies across the county in planning and implementing sustainable streets projects. The flow chart below provides an overview of the master planning process and the tools developed to support municipalities in implementing sustainable streets.

MASTER PLAN

Review Existing Conditions

- Policies/Regulations
- Complete Street Planning Initiatives
- Green Infrastructure Planning Initiatives

Climate Change Adaptation

- Assessment of Climate Change impacts
- Quantification of Sustainable Streets Benefits Reducing Impacts

Sustainable Street Prioritization

- Development of Project Typologies
- Identification and Ranking of Potential Project Opportunities

Sustainable Street Recommendations

- Recommended Projects and Policies
- Identified Funding Opportunities
- Conceptual Designs for Priority Projects

TOOLS FOR THE FUTURE

Curb Extension Feasibility Tool

- Supports Future Rapid Assessment of Opportunities to Integrate Green Infrastructure within Roadways

Drainage Area Assessment Tool

- High-Resolution Drainage Areas for Thousands of Stormwater Catch Basins in County
- Web-based Map Viewer

Typical Design Details

- Catalogue of Design Details to Support Future Project Designs

Tracking Tool

- Web-Based Viewing and Tracking of Projects
- Quantification of Benefits: Area Treated, Stormwater Captured, Mitigations of Climage Change Impacts

Executive Summary

IMAGE CREDIT: URBAN RAIN DESIGN

E.2 Existing Conditions

While the term “sustainable streets” is relatively new, planners and designers have utilized sustainable street components through the “complete streets” and “green infrastructure” movements for decades.

Complete streets are streets that make it safe and comfortable for people using all modes of transportation, from walking to school, biking to work, driving to the store, or riding public transit. Complete street components are wide-ranging and can include protected bicycle lanes, street trees, refuge islands, pedestrian signals, signage, lighting and more. Several statewide and regional initiatives exist to promote the implementation of complete streets, including Caltrans’ Complete Streets Toolbox and Active Transportation Program (ATP), State Senate Bill (SB) 375 and Assembly Bill (AB) 32 requiring sustainable community strategies to reduce expected greenhouse gas emissions by 15%, as well as the various transportation plans developed by C/CAG and its 21 member agencies. The Master Plan dovetails with these efforts by prioritizing active transportation projects, addressing equity issues for access to active transport, reducing carbon emissions by supporting sustainable modes of transportation, and reinforcing local and regional planning efforts and project recommendations.

Green infrastructure uses plants and soils to mimic natural watershed processes, capture and treat stormwater, and create healthier environments. Green infrastructure can provide a host of benefits, including water quality improvement, flood risk mitigation, alleviation of local drainage issues, groundwater recharge, neighborhood beautification, shade and cooling effects, and urban habitat. Tools include bioretention basins, rain gardens, permeable pavement, and rainwater harvesting. To reduce the impact of urban development on waterways, Bay Area cities and counties are required by regulatory agencies to shift from traditional stormwater conveyance systems to green infrastructure systems over time in order to meet water quality goals. The

Master Plan supports green infrastructure goals by describing concrete steps municipalities can take to implement green infrastructure including identifying projects that pool transportation and stormwater management resources, proposing projects that can be incorporated into permit-mandated municipal Green Infrastructure Plans, preparing model policies to facilitate green infrastructure implementation, and providing tools to support future planning, implementation, and tracking of sustainable street and other green infrastructure projects.

E.3 Adapting to Climate Change

Climate research and models predict that California will experience more frequent and intense rainfall over the next century due to a changing climate (Dettinger, 2011). San Mateo County communities can expect to experience more frequent flooding along roadways. One of the objectives of the Master Plan is to evaluate the ability for sustainable streets to offset the expected increases in storm runoff from the roadway due to climate change. The Master Plan's climate resiliency goals align with several countywide climate initiatives, such as the San Mateo County Board of Supervisor's Declaration of Climate Emergency (BOS SMC, 2019), the newly formed Flood and Sea Level Rise Resiliency District, and other County climate collaboratives.

The Master Plan included a robust modeling analysis utilizing the best available data from Cal-Adapt, a repository for the climate research, data, and tools that are most representative of California's unique climate. Pairing global climate models from Cal-Adapt with a watershed model calibrated for the county developed by C/CAG to address water quality requirements, the modeling analysis simulated storm events during a current scenario and a projected 2100 future scenario. Depending on storm frequency, storm sizes were predicted to increase by 11 to 40% in the future, with larger storms experiencing relatively larger increases in rainfall.

IMAGE CREDIT: SAN MATEO COUNTY GREEN INFRASTRUCTURE DESIGN GUIDE

Executive Summary

IMAGE CREDIT: CD+A

Runoff generated from roadways during current and future storms were modeled in bayside watersheds of the county. Green infrastructure projects were evaluated for their ability to capture, or offset, the projected increase in storm runoff due to climate change. With widespread implementation, sustainable streets were able to completely offset the projected increase in roadway runoff due to climate change for the 2-year, 6-hour storm and 40% of the projected increase for the 10-year, 6-hour storm when aggregated across the bayside roads. For reference, most storm drains in the county are sized to accommodate runoff from the 10-year storm. The results demonstrate that, with widespread implementation, sustainable streets can provide appreciable benefits for addressing runoff from roads and providing climate and flood resiliency, especially when considering localized impacts and smaller storms. However, these benefits are relatively small when considering larger storms and runoff from all land uses. Sustainable streets should be considered just one tool out of many that can be used to provide climate and flood resiliency while also providing many other benefits for the community.

E.4 Planning for Sustainable Streets

The Master Plan was developed using a stepwise process to identify and prioritize project opportunities. To find the most practical and cost-effective opportunities, opportunity identification focused first on looking for synergies with transportation and streetscape projects in existing plans. To facilitate this review, project typologies were defined to clarify the design elements, form, and function of four main types of sustainable street projects. Next, existing transportation and streetscape plans developed by C/CAG's member agencies were reviewed to identify planned projects that fit the typologies and represented the best opportunities to incorporate additional elements and implement sustainable streets.

After identifying the best synergy opportunities within existing plans, a set of additional project opportunities was identified to improve the quantity and spatial distribution of opportunities countywide. The focus of this analysis was locating project opportunities which support stakeholders' Safe Routes to School and Safe Routes to Transit program goals as well support the goal of locating projects where there is a need for future pavement reconstruction work. The new project opportunities were identified at intersections within 0.5-mile walking distance from schools and major transit stops which are also in need of pavement rehabilitation.

Once opportunities were identified, they underwent a prioritization scoring process that evaluated a range of metrics related to the site's technical suitability and expected co-benefits. These metrics —developed in collaboration with the 21 C/CAG member agencies and a Stakeholder Advisory Committee — included scores for water quality, flood risk, water supply, climate change impacts, groundwater constraints, utility constraints, vulnerable community indicators, vehicle ownership statistics, urban canopy, and urban heat island effect.

E.5 Implementing Sustainable Streets

The identification methodology was designed to locate practical projects that build on existing planning efforts to meet the multiple objectives of sustainable streets. After opportunities were identified, a prioritization scoring process resulted in the removal of the lowest scoring opportunities. The municipalities reviewed the resulting prioritized project lists and maps for their jurisdictions and provided feedback on the opportunities, including whether additional opportunities should be removed and whether the remaining opportunities were near, mid, or long-term priorities. Out of approximately 800 initial project opportunities, over 500 advanced through the prioritization and review process. These opportunities will need additional analysis to determine feasibility, but they provide a strong starting place for municipalities looking to add project opportunities to their sustainable street networks and their Safe Routes to School and Transit efforts.

IMAGE CREDIT: SAN MATEO COUNTY GREEN INFRASTRUCTURE DESIGN GUIDE

Executive Summary

IMAGE CREDIT: CD+A

In addition to identifying and prioritizing project opportunities, the Master Plan also developed model policy language to assist municipalities in implementing sustainable streets. Policy mechanisms for sustainable streets implementation can draw from and build upon past policy work related to complete streets. Complete streets policies have been adopted by municipalities in San Mateo County, the Bay Area, and nationally over the last 10-30 years. Sustainable streets policies can use some of the same tools and processes that complete street advocates have used, with the aim of complementing and broadening the benefits achieved with complete streets policies to achieve the additional water and climate resiliency benefits of sustainable streets.

The other critical element of implementation is funding. The Master Plan discusses challenges that sustainable street projects face to locate funding and presents strategies for addressing these challenges and securing funding for integrated projects. In addition to discussing funding strategies, the Master Plan also lists eligible funding sources for different types of sustainable streets projects to facilitate grant searches for municipalities.

E.6 Tools and Adaptive Management

Through the development of the Master Plan, a variety of tools were developed to support municipalities through all stages of sustainable street project implementation: from planning, through design, to post-construction tracking.

Several tools were developed to assist municipalities in planning for sustainable streets. These tools include maps designed to help evaluate the technical suitability and co-benefits of potential projects, a tool to facilitate rapid feasibility assessment of the most common type of green infrastructure in sustainable street projects, and a tool that leverages high-resolution elevation data to evaluate the drainage management area (the area from which a project can capture storm runoff) for potential projects.

To support municipalities in the design phase of a project, typical design details for green infrastructure were compiled and reviewed for applicability to sustainable streets projects. These details come from regionally applicable green infrastructure design guides, including those developed by C/CAG and San Francisco Public Utilities Commission. The Master Plan's catalogue of details also includes a number of new details which help address gaps in available design guidance and will facilitate sustainable street implementation throughout the county.

Lastly, a web-based sustainable street and green infrastructure project tracking tool was developed to help municipalities track their progress towards sustainable street implementation and to assist in quantifying benefits provided by their projects. The tool leverages the climate change models from the Master Plan, as well as hydrology and water quality models previously developed by C/CAG to automatically estimate project benefits, like stormwater capture and peak flow reduction, and can be used to evaluate progress towards countywide goals for water quality improvement and climate change adaptation.

IMAGE CREDIT: SAN MATEO COUNTY GREEN INFRASTRUCTURE DESIGN GUIDE


STOP

IMAGE CREDIT: C/CAG

Chapter 1: Vision and Purpose

Table of Contents

CHAPTER 1

1.1 Vision and Purpose

IMAGE CREDIT: PARADIGM

Plan Introduction

Municipalities across the San Francisco Bay Area are rethinking the way streets are designed. There is a growing recognition that redesigning our roadways is critical for meeting the needs of current and future residents, particularly in the face of a rapidly changing climate. Working to mitigate and adapt to climate change will require streets designed to reduce carbon-emissions. To reduce emissions, our families, friends, and neighbors need streets on which it is comfortable to walk and bike. We need safe routes to transit, school, work, and community centers. We need ***complete streets***.

At the same time, our streets can be designed to protect our precious and threatened water resources. When rain falls in our urban areas, it flows across streets and other paved areas before entering the storm drain system. Stormwater runoff is a major source of pollution affecting the health of our creeks, the San Francisco Bay, and the Pacific Ocean. Our waterbodies need streets designed to clean runoff and remove pollutants while buffering against larger storms and the increased flooding anticipated with climate change. ***Green infrastructure*** is one way of providing these benefits. Our cities need complete streets which ecologically manage runoff. Streets that provide these benefits are called ***sustainable streets***.

Streets typically comprise the largest amount of urban public space in the average municipality and also represent the largest single category of public impervious surface. They can occupy up to 80% of urban public space (NACTO, 2013). They typically comprise 13-30% of total developed land area (VTPI, 2020). While redesigning this significant amount of public space is a daunting task, there is a growing set of tools to help transform our streetscapes into more dynamic multi-benefit infrastructure.

The San Mateo Countywide Sustainable Streets Master Plan (Master Plan) was developed by the City/County Association of Governments of San Mateo County (C/CAG) under its San Mateo Countywide Water Pollution Prevention Program. Funding for the Master Plan was provided by the California Department of Transportation (Caltrans) through its Climate Adaptation Planning Grant Program. The Master Plan provides a practical roadmap and set of tools to assist public agencies across the county in locating, designing, and implementing sustainable street projects.

Sustainable streets combine complete streets with green infrastructure and climate change adaptation

IMAGE CREDIT: CD+A

Complete Streets *are streets designed to enable safe use by people of all ages and abilities, regardless of whether they are traveling as pedestrians, bicyclists, drivers, or public transportation riders.*

IMAGE CREDIT: ALTA PLANNING + DESIGN

Green Infrastructure *uses plants and soils to mimic natural watershed processes, capture and clean urban runoff, increase infiltration and create healthier environments. Green infrastructure includes tools such as bioretention basins, rain gardens, pervious pavement, trees and green roofs.*

IMAGE CREDIT: CITY OF PACIFICA

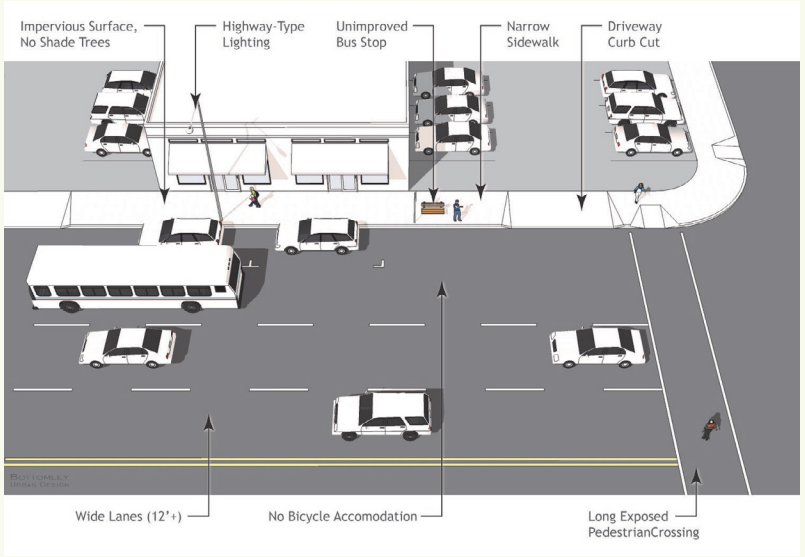
Climate Change Adaptation *is the process of adjusting to actual or expected future climate change and its effects. The goal is to reduce our vulnerability to the harmful effects of climate change - including more extreme weather events and sea level rise.*

1.2 Sustainable Streets

Definition

Sustainable streets are right-of-way projects that incorporate both complete street elements such as pedestrian, bicycle, and transit improvements as well as green infrastructure components such as stormwater planters and pervious pavement. Sustainable streets are designed to provide safe mobility and access for all users with the added environmental and community benefits of green infrastructure – which can provide multiple benefits including reduction of pollutants discharged to waterbodies, flood risk reduction and local drainage improvements, groundwater recharge, traffic calming, neighborhood greening, and reduction in urban heat island effect. Green infrastructure can also include native plants which can provide habitat for urban wildlife and street trees which sequester carbon and provide important shade in warming climates. The term sustainable streets is relatively new, although planners and designers have utilized sustainable street components through the complete streets, better streets, and green streets movements for decades. Figure 1-1 shows imagery of a conventional street, a complete street, and a sustainable street.

Figure 1-1: Street Evolution - From Conventional to Complete to Sustainable Street



Conventional Street
(designed to accommodate vehicles, no urban greening)

IMAGE CREDIT: ALTA PLANNING + DESIGN

Sustainable streets *are right-of-way projects that incorporate both complete street elements such as pedestrian and bicycle improvements as well as green infrastructure components such as stormwater planters and pervious pavement.*

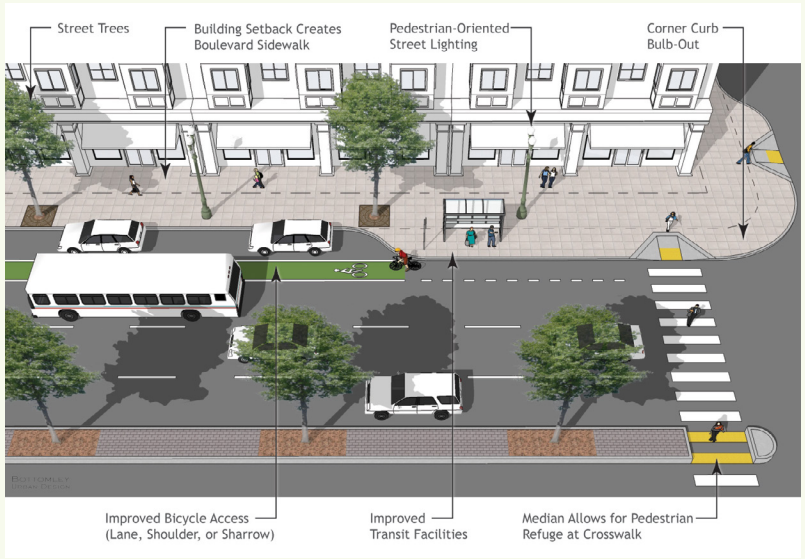


IMAGE CREDIT: BOTTOMLEY DESIGN & PLANNING

Complete Street
(multi-modal, includes facilities for transit, cyclists, and pedestrians)

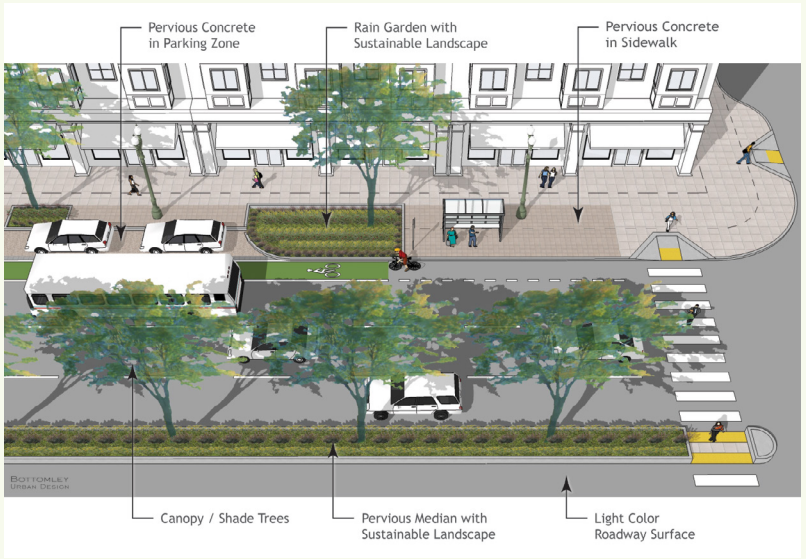


IMAGE CREDIT: BOTTOMLEY DESIGN & PLANNING

Sustainable Street
(combines complete street elements with green infrastructure)

1.3 Plan Purpose, Goals and Objectives

Figure 1-2: Intersection of Sustainable Streets Master Plan with Countywide and Local Initiatives

Purpose, Goals, Objectives

The overarching purpose of the Master Plan is to bring together countywide complete street, green infrastructure, and climate change goals to identify potential locations for integrated sustainable street improvements. The objectives of these improvements include:

- Facilitating active transportation by providing mobility, access, public realm, and safety improvements for bicyclists and pedestrians.
- Expanding the treatment of roadway runoff using green infrastructure to achieve water quality improvements.
- Reducing carbon emissions through supporting sustainable modes of transportation.
- Adapting the street network to better address rainfall and heat-related climate change impacts.
- Sequestering carbon and providing shade through the addition and growth of street trees.
- Providing improved habitat for birds and other urban wildlife through the use of tools such as native plants and more wildlife-friendly street lighting.
- Generating integrated projects to meet multiple government and community objectives and provide multiple benefits.

The master planning process was a coordinated effort by C/CAG's twenty-one member agencies and the State of California Department of Transportation (Caltrans). The Master Plan is designed to incorporate goals, processes, and the data and results from related transportation, stormwater management, and climate change planning efforts. Examples of countywide and local initiatives that intersect with the Master Plan are highlighted in Figure 1-2.

Another primary goal of the master planning process was to identify both practical and viable sustainable street project opportunities. The Master Plan builds off existing planning efforts to identify the strongest opportunities for integrating green infrastructure into planned bicycle, pedestrian, and streetscape projects, and it locates new opportunities for sustainable street

projects near schools and transit. Project opportunities were identified where there is significant cost-sharing potential between proposed transportation and stormwater management elements. The master planning process was also designed to promote project implementation by pairing project types with policy mechanisms and funding sources to facilitate implementation.

To jump start individual project design and construction, and provide support to cities leading implementation, the Master Plan includes detailed plans for 12 project concepts, including planning scale visualizations, drawings, and performance assessments. These project concepts feature opportunities with strong momentum and will assist municipalities across San Mateo County in moving forward with near-term projects.

The Master Plan includes:

- **Section 2 Existing Conditions** – Context on complete street and green infrastructure planning and needs in the county.
- **Section 3 Climate Change Adapation** – Context on predicted climate change impacts in the county, as well as a summary of the climate adaptation analysis conducted for this effort to evaluate the ability of sustainable streets to help mitigate climate change impacts.
- **Section 4 Sustainable Streets Prioritization** – Description of the project typologies developed, the identification of project opportunities, and the prioritization of those opportunities.
- **Section 5 Sustainable Street Implementation Recommendations** – Description of the recommended projects and policies, including preliminary concept designs for priority projects. Also includes a preliminary phasing plan for the prioritized project opportunities and identified funding strategies.
- **Section 6 Tools for the Future** – Reference materials and tools to facilitate future sustainable streets planning, feasibility assessment, design, and tracking.

The Master Plan serves as an implementation roadmap and provides tools to help municipalities locate, design, and construct sustainable streets to adapt to a changing climate, clean our waterways, and encourage safe active transportation.

1.4 Stakeholder Engagement

Over 1,000 county residents, local and regional government officials, and stakeholders from government agencies and other organizations around San Mateo County participated in the Master Plan development by voicing their priorities and concerns surrounding sustainable streets. Outreach efforts targeted to reach a diverse set of residents and visitors with a focus on vulnerable communities in the county. To that end, "pop-up" workshops at existing community events were prioritized over traditional community meetings as part of the engagement process in order to meet people where they are.

IMAGE CREDITS: ALTA PLANNING + DESIGN

At many of these events, game-based tools, such as "Build Your Own Sustainable Street," and other interactive tools for input and data collection were used as more effective ways to collect information and educate the public. People shared their first-hand experiences with flooding on local roadways, concerns about safety while walking or bicycling in their community, the issue of the unequitable distribution of resources and much needed infrastructure in vulnerable communities, and a desire for more comfortable and livable downtown corridors, confirming the community need for sustainable streets in San Mateo County.


SPEED
LIMIT
30

IMAGE CREDIT: CD+A

Chapter 2: Existing Conditions and Needs: Why Sustainable Streets?

Table of Contents

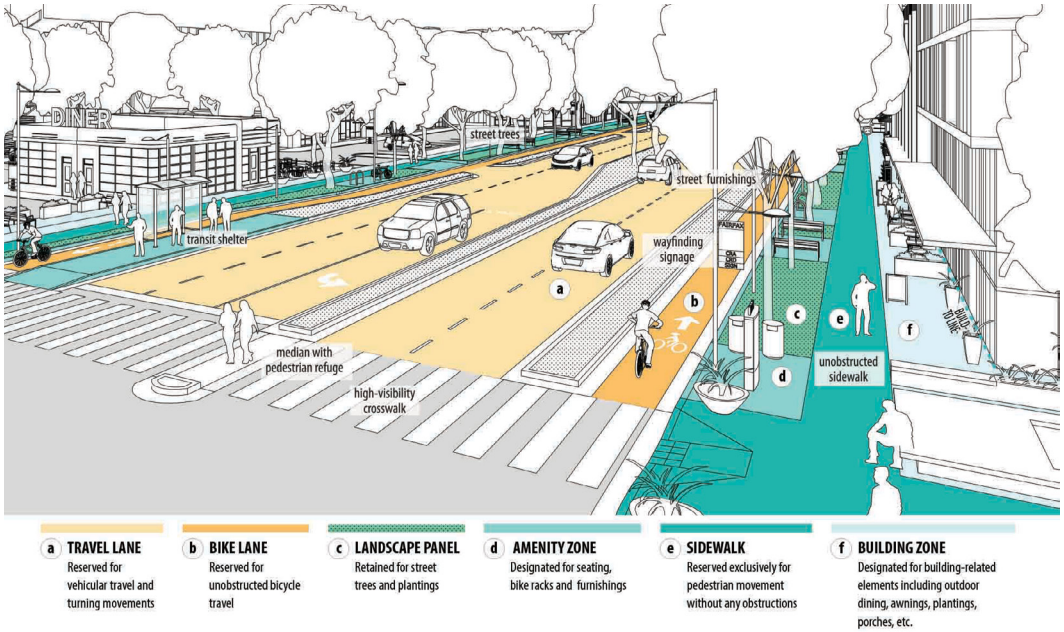
CHAPTER 2

2.1 Existing Conditions: Complete Streets

IMAGE CREDIT: CD+A

Policy and Regulatory Context

The official Caltrans definition for complete streets is "a transportation facility that is planned, designed, operated, and maintained to provide safe mobility for all users, including bicyclists, pedestrians, transit vehicles, truckers, and motorists, appropriate to the function and context of the facility" (California Department of Transportation, 2020). Complete streets are streets that make it safe and comfortable for people to walk to school, bike to work, drive to the store, or ride public transit; thus improving the street network for everyone, regardless of their age or ability. Complete streets incorporate a wide-range of infrastructure improvements, from sidewalks to shared-use paths, bicycle lanes to street trees and landscaping, planting strips to accessible curb ramps, crosswalks, refuge islands, pedestrian signals, signage, street furniture, bicycle parking, and more.



Through these improvements, complete streets promote "active transportation," which is defined as any self-propelled, human-powered mode of transportation, such as walking or bicycling.

The Master Plan promotes the implementation of existing and future complete street projects by highlighting the synergies between green infrastructure and bicycle and pedestrian network improvements as a way of assisting municipalities throughout San Mateo County in meeting their transportation, stormwater, and climate change goals. The following summarizes some of the major initiatives driving complete street and active transportation planning in San Mateo County.

State Regulations and Initiatives

With the passage of the California Complete Streets Act of 2008, municipalities were required to adopt complete street policies in their general plan circulation elements when they are substantially revised. Complete streets are now the standard approach for designing roadways and other transportation facilities. In 2014, Caltrans adopted the Urban Street Design Guide and Urban Bikeway Design Guide developed by the National Association of City Transportation Officials (NACTO, 2013) and has now integrated the complete street concepts from those guides and other documents into their Complete Streets Toolbox and Active Transportation Program (ATP) (California Dept of Transportation, 2018). Climate change mitigation and greenhouse gas reduction from the implementation of multi-modal transportation are driving factors in this move away from automobile-dominated roadway planning and implementation.

At a statewide level, California law has also established several pieces of landmark legislation to address climate change that impact transportation policy around the state -- including Senate Bill 375 and Assembly Bill (AB) 32. AB 32 requires California to reduce its greenhouse gas (GHG) emissions to 1990 levels by 2020 — a reduction of approximately 15 percent below emissions expected if 2006 emissions patterns were to continue as usual (California Air Resources Board, 2006). Senate Bill 375 requires "Metropolitan Planning Organizations (MPOs) to include Sustainable Communities Strategies (SCSs) in their Regional Transportation Plans (RTPs) for the purposes of reducing GHG emissions, aligning planning for transportation and housing, and creating incentives for the implementation of strategies."

IMAGE CREDIT: ALTA PLANNING + DESIGN

IMAGE CREDIT: CD+A

Complete streets promote active transportation such as walking and biking

CHAPTER 2

2.1 Existing Conditions: Complete Streets

IMAGE CREDIT: ALTA PLANNING + DESIGN

San Mateo County Safe Routes for Health and Wellness: The San Mateo County Office of Education developed guidebooks and a process to integrate SRTS into the daily lives of students and their families throughout the county. The Safe and Supportive Schools Travel Kit identifies ways SRTS can help school and district staff accomplish their goals throughout various departments. The Parent and Community Empowerment Toolkit and training identifies discrete activities parent champions can lead to build enthusiasm for events.

San Francisco Bay Area Initiatives

In 2017, the MTC adopted its long-range Regional Transportation Plan and Sustainable Communities Strategy for the nine-county Bay Area, called Plan Bay Area 2040, to identify how the Bay Area will meet its GHG emissions targets. Key performance targets in Plan Bay Area are supported by the Master Plan. For example, Plan Bay Area identifies "increased non-automobile mode share" as a key target to improve the effectiveness of the Bay Area's transportation system. Plan Bay Area also identifies a "decrease[d] share of lower-income households' budgets spent on housing and transportation" as a target to increase equitable access in the region. Plan Bay Area includes an investment strategy of short-term and long-term transportation projects resulting in a total investment of $303 billion, made up of local and regional funding sources. Transportation projects identified in the Master Plan have the potential to help achieve these GHG reduction targets, increase rates of walking, bicycling, and transit use, and ease the burden of automobile transportation costs on low-income households in the county.

Countywide Initiatives

The Master Plan is complementary to other C/CAG planning efforts, including the Countywide Bicycle and Pedestrian Plan, which was developed concurrently with the Master Plan. Though these parallel countywide planning efforts both reference local active transportation plans to identify and prioritize project opportunities, the plans focus on different goals. The Countywide Bicycle and Pedestrian Plan is intended to address gaps in the countywide active transportation network, with an emphasis on improving north-south and east-west connectivity via a "backbone" of regionally interconnected transportation improvements. Whereas the Master Plan seeks to prioritize the optimal locations for integrating distributed green infrastructure with planned and newly identified transportation project opportunities, with a lens towards water quality and climate resiliency. To leverage the work done in both plans and to raise the visibility of overlapping project opportunities, the Countywide Bicycle and Pedestrian Plan (which will be completed after the Master Plan) will include a reference list of synergistic project opportunities.

The Plan also supports the San Mateo Countywide Transportation Plan 2040, which calls for "a transportation system that is safe and convenient for all people whether travelling on foot, by bicycle, via public transportation, or in an automobile, to reach the places they wish to go"(C/CAG, 2017). This plan also envisions "a San Mateo County in which bicycling for both transportation and recreation is safe, comfortable, and convenient" (C/CAG, 2017).

Another countywide planning effort related to transportation is the Safe Routes to Schools program. The Safe Routes to Schools program "encourages and enables school children to walk and bicycle to school by implementing projects and activities that improve the health, well-being, and safety of children and result in less traffic congestion and emissions caused by school-related travel" (San Mateo County Office of Education, 2020).

The voter-approved Measure A (1988) and Measure W (2018), administered by the San Mateo County Transportation Authority (TA), provides funding for projects aimed at improving transit and relieving traffic congestion. Projects include bicycle and pedestrian facilities, local street repair, and improved transit connections. Both measures feature core principles associated with the design of green infrastructure and complete streets.

IMAGE CREDIT: ALTA PLANNING + DESIGN

Safe Routes to School Projects Grow in San Mateo County

Case Study: Half Moon Bay Safe Routes to School Project

The Half Moon Bay Safe Routes to School and Green Streets Infrastructure Pilot Project is adjacent to the new Half Moon Bay Library and one block from the Manuel F. Cunha Intermediate School. A 2013 walk audit documented congestion at the intersection and identified safety concerns resulting from low visibility, missing curb ramps, and long crossing distances. The City also sought to address water quality and local flow accumulation issues. With projected increases in rainfall in future years, especially on the coastside, managing current conditions will help the community adapt to future precipitation impacts. The project addresses safety and stormwater concerns by managing runoff in bioretention areas in conjunction with updated pedestrian bulbouts and new crossings.

Sustainable Street Components

- Three bi-directional ADA pedestrian bulbouts
- Continental crossings on all four crossings
- Five bioretention areas integrated with bulbouts
- Subsurface hydraulic connections to improve drainage to bioretention

Grant Funding

C/CAG provided a $180,000 grant to cover a portion of the project construction costs

2.1 Existing Conditions: Complete Streets

IMAGE CREDIT: CITY OF SOUTH SAN FRANCISCO

The communities of Colma, South San Francisco, and San Bruno all benefit from the connectivity of the Centennial Trail, which parallels Grand Boulevard Initiative's El Camino Real.

Major Improvement Themes in the County

Municipalities throughout the county establish their own guidelines and plans for the future of their transportation systems through either General Plans, Bicycle Plans, Pedestrian Plans, or combined Bicycle/Pedestrian Plans (often referred to as Active Transportation Plans). Other local transportation projects and priorities are identified in Neighborhood Specific Plans or Capital Improvement Plans. Future active transportation projects found in these plans are a result of citywide planning and analysis aided by a robust public outreach component. While communities throughout the county are unique in their own way, many of them share common themes that help weave individual municipal plans together into a more comprehensive and countywide active transportation network. These include:

- **Regional Connectivity:** Regionality is important to cities across the county. Connections between cities and to major job centers on both ends of the county are just as important to residents as intracity connections. Therefore, municipalities across San Mateo County aim to create strong regional active transportation connections. As an example, the Grand Boulevard Initiative is long-range conceptual plan that brings many neighboring cities together to assist with the re-development and revitalization of El Camino Real in an effort to make the corridor more vibrant and conducive to active transportation. Establishing strong regional connections will advance both local and regional active transportation goals. Similarly, the Unincorporated San Mateo County Active Transportation Plan establishes goals, infrastructure recommendations, and programmatic recommendations to make the unincorporated areas of the county better connected to the bicycle and pedestrian network.
- **Downtown Connectivity:** Many cities have main street or downtown areas that are home to important destinations such as city halls, public libraries, retail, restaurants, mixed-use housing, and major transit connections. Many municipal active transportation plans and projects aim to strengthen connections to their downtowns for active transportation users.
- **Bay Trail Connectivity:** The San Francisco Bay Trail, also known as the Bay Trail, is a "planned 500-mile walking and bicycling path around the entire San Francisco Bay." The trail's development has been supported by municipalities throughout the county that share a vision

for a connection around the Bay where bicyclists and pedestrians can access parks and bay front destinations while preserving environmentally-sensitive areas. A common hurdle cities share is connecting to the Bay Trail from residential neighborhoods and over the right-of-way for Highway 101 and the Caltrain. Installing missing trail segments and improving crossings are shared goals for cities throughout the county.

- **Neighborhood Greenways:** Residential communities throughout the county are often characterized by compact streets that are less comfortable for active transportation users sharing the road with vehicle traffic. A common method for mitigating these effects is the adoption of Neighborhood Greenways or Bicycle Boulevards, and the use of traffic calming features to slow vehicle traffic and encourage active transportation. These include traffic circles, speed humps, or traffic diverters to reduce the speed and volume of cars and improve the comfort of people walking and bicycling. Greenways can also provide space for large trees that provide shade for cyclists and pedestrians.

IMAGE CREDIT: ALTA PLANNING + DESIGN

Burlingame's new bicycle and pedestrian overpass helps residents travel over Highway 101 and reach the bayfront.

IMAGE CREDIT: ALTA PLANNING + DESIGN

Downtown Burlingame's Burlingame Avenue after the city's latest streetscape improvement project.

2.1 Existing Conditions: Complete Streets

IMAGE CREDIT: ALTA PLANNING + DESIGN

In the neighboring Santa Clara County, Palo Alto has pioneered the concept of bicycle boulevards, giving bicyclists priority of the road over vehicles.

IMAGE CREDIT: CD+A

Complete street with green infrastructure and a bike facility in Portland, Oregon.

Needs this Plan Will Address

The Master Plan addresses several key transportation planning needs in San Mateo County, which were identified in the analysis of local planning efforts, as well as through the stakeholder engagement process, to ensure broader community goals are considered. These needs include:

- **Creating a blueprint to help prioritize and guide county-wide investments in active transportation projects that can also build climate resiliency.** The Master Plan identifies active transportation project locations where stormwater capture benefits are high when paired with green infrastructure design. This cohesive approach helps the active transportation network address the need to adapt to precipitation impacts from climate change while reducing GHG emission through mode shifting. These results can serve as guidance for future county-wide initiatives and investments in active transportation projects.
- **Addressing active transportation equity and reducing the transportation cost burden of low-income households.** Sustainable street improvements that make it safer and easier for people to walk are particularly important for people who rely on walking or bicycling as their principal mode of transportation, ensuring that the cost of private automobile use or ownership is not a barrier to mobility and access to jobs, services, and other essential needs in San Mateo County.
- **Facilitating higher rates of active transportation through complete street improvements in line with local, county, and regional transportation goals.** Active transportation planning initiatives throughout San Mateo County establish goals for achieving higher rates of walking, bicycling, and transit ridership. These goals also establish targets for improved bicycle and pedestrian safety outcomes on streets throughout the county. Sustainable street improvements have the potential to create safer and more comfortable conditions for pedestrians, bicyclists, and transit riders.

- **Reducing carbon and GHG emissions by supporting sustainable modes of transportation.** Promoting sustainable street transportation improvements allows for greater adoption of active modes of transportation, which in turn helps decrease GHG emissions caused by automobile dependency. It also provides the added benefit improved adaptation to climate change impacts from precipitation and urban heat island effects.
- **Reinforcing existing local and regional planning efforts and active transportation project recommendations.** The Master Plan is the first planning initiative in the county to analyze where complete street improvements can accompany green infrastructure improvements, accelerating the achievement of important countywide goals and opening up the opportunity for cost-sharing.

IMAGE CREDIT: CD+A

Urban greening can reduce the effects of GHG emissions.

IMAGE CREDIT: MATT FABRY

Green infrastructure complements a high-visiblity crossing that is part of a complete street.

2.2 Existing Conditions: Green Infrastructure

IMAGE CREDIT: JENNIFER LEE

Bioretention in the City of Burlingame mimics natural hydrologic processes by retaining and infiltrating stormwater runoff.

IMAGE CREDIT: JENNIFER LEE

Another Burlingame site shows bioretention designed to incorporate street trees.

Policy and Regulatory Context

Urban development has resulted in the replacement of natural landscapes with impervious pavement and buildings, and storm drains that convey increasing amounts of stormwater runoff and pollutants directly into local waterways. Green infrastructure uses plants and soils to mimic natural watershed processes, capture stormwater, increase filtration, and create healthier environments. Green infrastructure can improve water quality, reduce flooding, alleviate local drainage issues, and recharge groundwater, as well as provide a host of additional benefits including cooling effects, neighborhood beautification, urban habitat and street safety. Tools include bioretention basins, rain gardens, permeable pavement, and rainwater harvesting. To reduce the impact of urban development on waterways, Bay Area cities and counties are required by regulatory agencies to shift from traditional stormwater conveyance systems to green infrastructure systems over time in order to meet water quality goals (SFBRWQCB, 2015).

Federal and State Regulations and Initiatives

The U.S. Environmental Protection Agency (EPA) has authority under the Clean Water Act to create and enforce stormwater-related regulations. In California, EPA has delegated the regulatory authority to the State Water Resources Control Board (State Water Board), which in turn, has delegated authority to the San Francisco Bay Regional Water Quality Control Board (Regional Water Board) to issue National Pollutant Discharge Elimination System (NPDES) permits in the San Francisco Bay Region. In 2015, the Regional Water Board issued the current version of the Municipal Regional Stormwater NPDES Permit for the Bay area. Municipalities throughout San Mateo County are subject to the requirements of this permit, which includes the following relevant requirements for stormwater management and the implementation of green infrastructure.

Requirements for New Development and Redevelopment Projects

Under the stormwater permit, new development and redevelopment projects that exceed certain size thresholds are required to mitigate stormwater impacts on water quality by incorporating green infrastructure. Construction of new roads is covered by these requirements, but projects related to existing roads are not currently regulated unless they include creation of an additional travel lane (SFBRWQCB, 2015).

Green Infrastructure Plan Requirements

The stormwater permit also requires each municipality throughout San Mateo County to develop and implement Green Infrastructure Plans that demonstrates how they will gradually shift from traditional "gray" storm drain infrastructure—which channels polluted runoff directly into receiving waters without treatment—to a more resilient and sustainable storm drain system which includes green infrastructure. The Green Infrastructure Plans must demonstrate how each municipality plans to facilitate incorporation of green infrastructure measures on public and private lands, including existing streets, roads, storm drains, parking lots, building roofs, and other elements. The stormwater permit also requires that all related municipal planning documents be updated to incorporate new green infrastructure requirements. This includes transportation planning processes and any complete street plans and active transportation plans. The Master Plan is one of the tools San Mateo jurisdictions can use to demonstrate proactive progress at a countywide scale toward integration of transportation planning processes and green infrastructure goals and requirements. The Green Infrastructure Plans were completed by each municipality and submitted to the Regional Water Board in 2019.

Pollutant Reduction Requirements through Green Infrastructure

Other sections of the stormwater permit include requirements for municipalities to control pollutants of concern in stormwater discharges, including polychlorinated biphenyls (PCBs), mercury, trash, and pesticides. Green infrastructure measures, while not always the most cost effective method for treating stormwater, are useful tools for removing pollutants from stormwater runoff while providing many other community benefits. For this reason, the stormwater permit establishes a linkage between green infrastructure retrofits of existing public infrastructure, such as streets, and required reductions in discharges of PCBs and mercury. Over the next few decades, San Mateo County municipalities must reduce the loads of PCBs and mercury in stormwater discharges through various means, with a portion of these load reductions achieved through the installation of green infrastructure. Reduction of other pollutants, including trash and pesticides, should also be coordinated with implementation since, when properly designed, constructed and maintained, some green infrastructure systems may also be used for trash and pesticide reduction (County of San Mateo, 2019).

IMAGE CREDIT: PARADIGM ENVIRONMENTAL

CHAPTER 2

2.2 Existing Conditions: Green Infrastructure

IMAGE CREDIT: GREEN INFRASTRUCTURE DESIGN GUIDE

Needs this Plan Will Address

In order to demonstrate that San Mateo County municipalities' can meet the water quality requirements of the stormwater permit, C/CAG developed a detailed modeling system that estimates existing PCB and mercury loads to the Bay, and sets goals for the amount of green infrastructure needed to meet the water quality requirements (SMCWPPP, 2020a and 2020b).

The Master Plan supports municipalities green infrastructure goals and will address the following needs:

- **Describes concrete steps that municipalities can take to implement green infrastructure within transportation corridors.** The Master Plan identifies sustainable street project and policy options with specific focus on existing bicycle and pedestrian project opportunities in active transportation plans across the county. The Master Plan improves on previous green infrastructure and stormwater planning efforts by using improved data sources and new analyses to identify and prioritize project opportunities. The Master Plan also provides tools to assist in the design and implementation process, including concept designs for priority projects and a catalogue of typical details for sustainable street components.
- **Introduces new projects that can be incorporated in Green Infrastructure Plans.** The municipal Green Infrastructure Plans are intended to be living documents and will likely be updated to meet future stormwater permit mandates. The Master Plan presents projects that can be incorporated into future updates to Green Infrastructure Plans to enhance existing project lists and help municipalities make progress towards long term water quality goals.
- **Prioritizes opportunities to pool resources and integrate transportation and green infrastructure planning needs.** The Master Plan focuses on cost-sharing between transportation and green infrastructure components in proposed project opportunities. For example, the Master Plan identifies sustainable street project opportunities that can be integrated within Safe Routes to School and Safe Routes to Transit efforts.

- **Provides sustainabletreet evaluation tools to support future planning efforts to identify additional projects..** The Master Plan presents tools that can be used for locating and vetting additional project opportunities which are not yet identified in existing active transportation plans or through the Master Plan's new project opportunity analysis. These tools include maps and data for project feasibility and benefit analysis, a Stormwater Curb Extension Feasibility Assessment Tool, and additional tools described in Section 6.
- **Introduces a tool to track stormwater capture benefits through future implementation of sustainable street projects.** The Green Infrastructure Plans quantify goals, in terms of impervious area retrofitted and stormwater volumes managed, in order to meet requirements for pollutant load reductions to the Bay. As green infrastructure (including sustainable streets) is implemented in the future, the Tracking Tool developed as part of the Master Plan will provide municipalities the ability to monitor progress towards meeting these goals. As future projects are built, estimates of average annual stormwater volumes can be automatically generated by the tool for each project based on the site location, drainage area, and design details entered by the user. This will also help with tracking progress toward building resilience to climate change, discussed more in the subsequent Section. The tool may also provide data for use in grant applications. More detail on the Tracking Tool is discussed in Section 6.3.

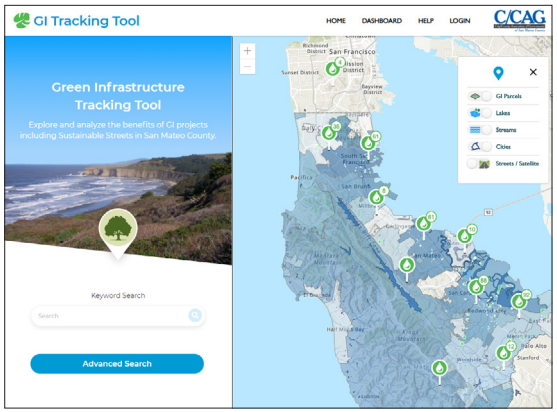


IMAGE CREDIT: JENNIFER LEE

Green infrastructure can provide a buffer between pedestrians and busy roadways.

IMAGE CREDIT: CD+A

Stormwater planters aso offer a green buffer between parking and the pedestrian zone.


NO PARKING ANY TIME
NEW SEASONS MARKET
Shellmound St
STOP

IMAGE CREDIT: CD+A

Chapter 3: Adapting to a Changing Climate

Table of Contents

3.1 Adapting to Climate Change

Most climate research and models predict that California will experience more frequent and intense rainfall over the next century due to a changing climate (Dettinger, 2011). Increased frequency in high intensity storms will put strain on the existing storm drain infrastructure. Storm drains, which are conventionally designed based on an analysis of historical rainfall, may be undersized in the future due to a changing climate. Additionally, rising sea levels expected to accompany climate change may further exacerbate flooding of stormwater infrastructure draining to tidally influenced waterbodies like the Bay.

As a result, San Mateo County communities can expect to experience more frequent flooding along roadways, adversely impacting local infrastructure and having the potential to disproportionately affect vulnerable communities who may be more reliant on active transportation, like walking, biking, and public transit. Recognizing the increased risk of flooding along county roadways, one of the objectives of the Master Plan is to quantify the impact on road runoff due to climate change and to evaluate the ability for sustainable streets to offset that impact. This aligns with other countywide policy goals of prioritizing mitigation and adaptation efforts, as illustrated by the recent Declaration of Climate Emergency by the San Mateo County Board of Supervisors (BOS SMC, 2019). The Declaration demands accelerated actions on the climate crisis and calls on local and regional partners to join together to address climate change and emphasizes the importance of protecting vulnerable communities by focusing on equitable mitigation and adaptation strategies. The Master Plan shares the goal of climate adaptation with several other countywide initiatives, including the Sea Level Rise Vulnerability Assessments and the Climate Ready Adaptation Collaborative from San Mateo County, and the recent establishment of the Flood and Sea Level Rise Resiliency District.

<< Tide gates at the mouth of Bayfront Canal during low tide. The gates prevent tidewater from entering the canal during high tide.

As discussed in Section 2.3, sustainable street projects include the integration of green infrastructure to capture, infiltrate, and treat stormwater runoff. This ability to capture stormwater can reduce the runoff of present-day storms but also offset the projected increase in runoff from future storms. This may alleviate strain on the storm drain infrastructure that would otherwise result from the projected increases in high-intensity storms. Thus, sustainable streets have the potential to improve resiliency of the roadway network in the face of climate uncertainty. A robust modeling analysis was conducted to quantify the countywide effect of future climate scenarios on stormwater runoff from roads, and the benefit that sustainable streets can potentially have on mitigating the impacts of climate change. Appendix A provides a full report of the methods and outcomes of the climate change risk and adaptation analysis utilized to support the Master Plan. The following sections provide an overview of these results.

Flooding of Atherton Channel at the Haven Avenue bridge during a storm event.

IMAGE CREDIT: CITY OF PACIFICA

3.2 Predicting the Impacts of Climate Change on Storm Events

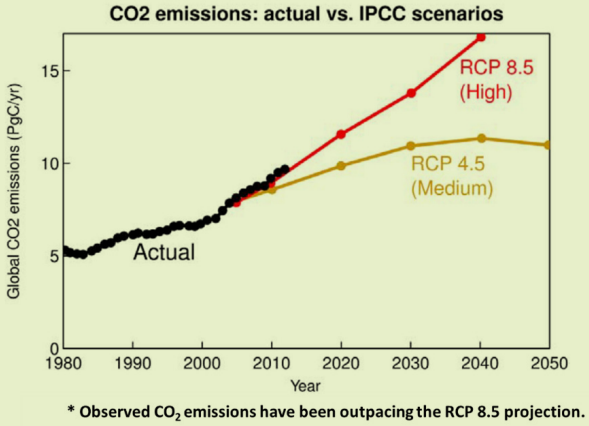


Figure 3-1: Selected Representative Concentration Pathways for climate change analysis (IIASA 2009).

To predict the impact of climate change to future storms in the county, C/CAG leveraged an ensemble of 10 general circulation models (also commonly referred to as global climate models or GCMs) from Cal-Adapt, a repository for climate research, data, and tools that are most representative and relevant for California's unique climate. Each GCM considers different future projection scenarios, or Representative Concentration Pathways (RCPs), that represent varying levels of carbon emissions. For example, RCP 4.5 represents a stabilization of carbon emissions by 2040 and RCP 8.5 represents a scenario in which carbon emissions continue to climb at historical rates (IIASA, 2009). Although these are estimated future trajectories, comparisons to actual emissions levels at the time of the IIASA study suggest that observed emissions have been outpacing the RCP 8.5 scenario (Figure 3-1). As a conservative estimate of future carbon emissions and resulting rainfall, the median of the outputs from the 10 GCMs for RCP 8.5, projecting out to 2100, was used for evaluating future rainfall scenarios.

Historical and future rainfall were used as inputs to C/CAG's modeling system to obtain estimates of historical and future runoff during standard flood design storms (storm sizes that occur once every 2, 5, 10, 25, 50, and 100 years). The model results (presented in Table 3-1 and Figure 3-2) show precipitation will increase between 10 to 40%, depending on storm size, with larger storms experiencing relatively greater increases in precipitation.

Table 3-1: Comparison of historical and estimated future storm events

Scenario	6-hour Storm Size (in.) by Recurrence Interval					
	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
Current (Historical)	1.69	2.09	2.39	2.79	3.10	3.40
RCP 8.5 GCM Median	1.87	2.39	2.86	3.58	4.16	4.78
Percent Increase	10.7%	14.2%	19.3%	28.1%	34.2%	40.4%

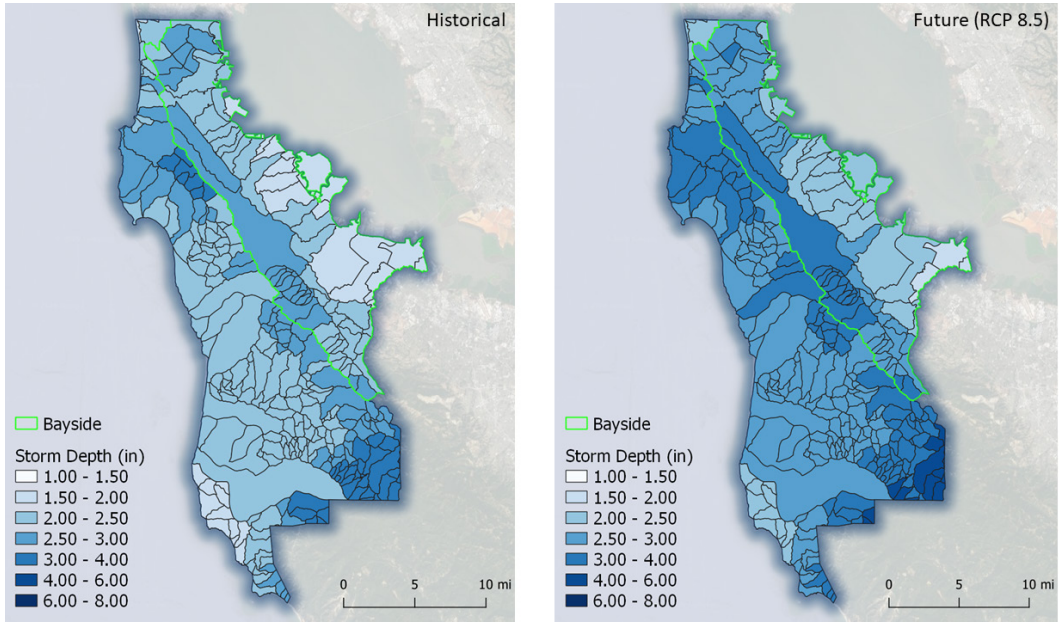


Figure 3-2: Rainfall depth across county watersheds for the historical and future (2100 projection) 10-year, 6-hour storm.

IMAGE CREDIT: JIM GADE, UNSPLASH.COM

3.3 Climate Resiliency Benefits of Sustainable Streets

IMAGE CREDIT: CD+A

Bioretention treating runoff from the adjacent street during a storm.

IMAGE CREDIT: CD+A

Sustainable streets encourage pedestrian activity while serving beneficial environmental purposes.

Previous C/CAG modeling efforts supporting municipal Green Infrastructure Plans identified green infrastructure implementation goals (capacity to store 36.5 million gallons of stormwater runoff across 1,200 miles of roads) to achieve water quality improvement requirements for San Francisco Bay by 2040 (SMCWPPP, 2020b). This water quality-based scenario for green infrastructure implementation was then modeled against rainfall for future climate scenarios to assess the benefits that sustainable streets could have on managing increased runoff. As shown in Figure 3-3, the analysis indicates that the modeled amount of green streets for water quality purposes could completely offset the projected increase in roadway runoff due to climate change from the 2-year storm while having additional capacity to manage more runoff (102% capture of increased runoff). Increased roadway runoff for the 5-year storm is projected to be offset by 65%. As storm size increases, sustainable streets become less effective at mitigating projected increases in runoff due to climate change. However, this demonstrates that sustainable streets may provide a substantial benefit for offsetting the impacts of climate change during smaller, more frequent storm events, which may help to alleviate the frequency and severity of flooding along roads within the county.

Note, the reported benefits of green streets are aggregated for roads in bayside watersheds. The aggregated estimates take into account runoff from all roads, even those where no green street projects were assumed. In reality, the benefits will vary spatially across the county, depending on locations of green street opportunities, rainfall patterns, and climate change variability. On an individual project basis, green streets may provide benefits even greater than the bayside average for their respective treatment area. However, this is only accounting for runoff from roads. The resiliency benefits that sustainable streets can provide when considering large storms and runoff from all land uses is limited. Therefore, sustainable streets should be considered just one tool out of many that can be used to provide climate and flood resiliency while providing many other community benefits.

While also demonstrating that green infrastructure may provide climate resiliency, the modeling analysis resulted in the compilation of large amounts of climate data across the county that were leveraged for the development of the Master Plan and can be utilized to support future analyses and planning estimates. Using these results, the Master Plan helps municipalities consider future

climate change in the selection and tracking of sustainable street projects by incorporating climate change model results in the prioritization of sustainable street project opportunities (discussed in more detail in Section 5) and a web-based tool for C/CAG agencies to track benefits of sustainable streets and other GI projects (discussed in more detail in Section 6).

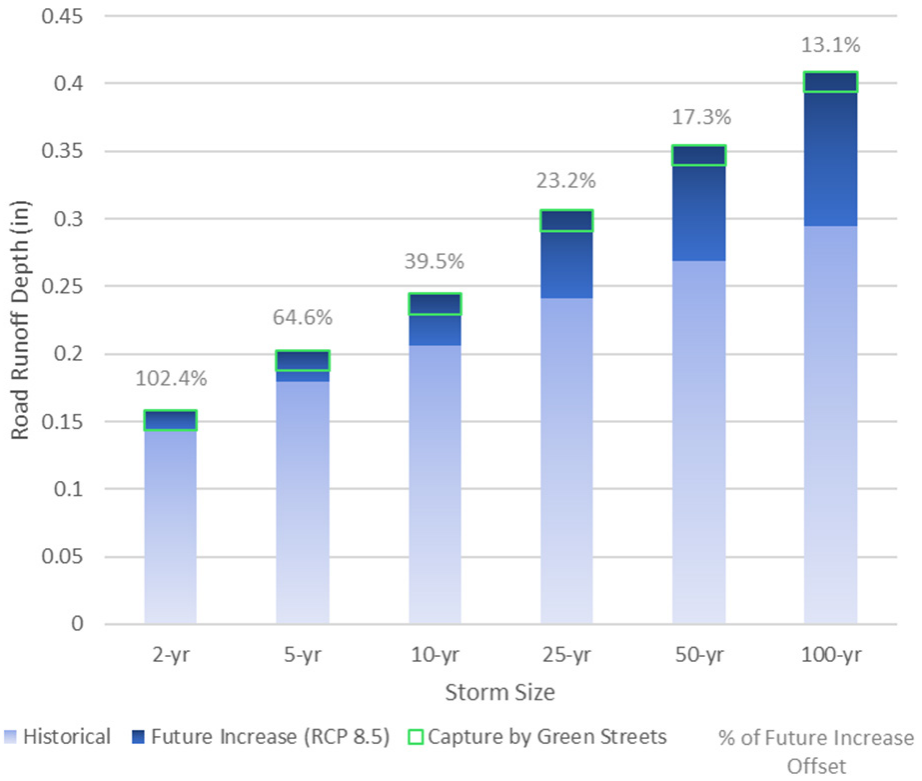


Figure 3-3: Green street effectiveness in mitigating road runoff increases due to climate change averaged across Bayside watersheds.

Sustainable streets are capable of offsetting some of the predicted increases in runoff due to climate change, helping to reduce the frequency and severity of flooding along streets.

IMAGE CREDIT: SCAPE STUDIO

Chapter 4: Planning for Sustainable Streets

Table of Contents

CHAPTER 4

4.1 Planning for Sustainable Streets: Master Plan Methodology

IMAGE CREDIT: PARADIGM

Methodology Overview

The Master Plan was developed using a stepwise process to identify and prioritize project opportunities. San Mateo County is comprised of 20 municipalities, as well as unincorporated areas managed by the county. At the time of Master Plan development, many of these municipalities had recently completed or were in the process of completing relevant active transportation and streetscape plans. Accordingly, the goal of the Master Plan effort was to understand and build off these planning efforts, rather than create a conflicting or redundant prioritization outcome.

To do this, the Master Plan prioritization first defined the sustainable street project typologies that integrated active transportation, stormwater, and climate change goals. Then, active transportation and streetscape plans throughout the county were assessed to identify planned projects that fit into these typologies and had the scope and schedule to integrate green infrastructure. New project opportunities near schools and major transit stops were also identified. These projects were then evaluated by overlaying stormwater performance and feasibility criteria to create technical prioritization scores for each project opportunity. Lastly, criteria related to social and environmental co-benefits were applied to create total prioritization scores for each project opportunity. Figure 4-1 provides a high-level overview of each step and the factors considered and/or resulting from implementation of the step.

Identify Project Typologies

- Sustainable Street Curb Extensions
- Sustainable Street Connectivity Improvements
- Sustainable Streetscape Redesigns
- Sustainable Street Frontage Improvements

Identify Project Opportunities

- Existing Active Transportation and Streetscape Opportunities
- New Opportunities Near Schools and Transit

Apply Stormwater Technical Suitability Criteria

- Runoff Capture Benefits
- Hydrogeological Conditions
- Additional Site/Constructability Characteristics

Apply Co-Benefit Criteria

- Vulnerable Community Indicators incl Low Vehicle Ownership
- Canopy Coverage
- Urban Heat Island Index
- Pavement Condition Index
- Pavement Quality Index

Identify Recommended Projects

- Prioritization Tiers
- Prioritization Scoring
- Stakeholder Feedback

Figure 4-1: Sustainable Streets Identification and Prioritization Method

IMAGE CREDIT: C/CAG

IMAGE CREDIT: STREETFILMS.ORG

Successful sustainable street projects will integrate transportation, stormwater, and climate change goals.

4.2 Planning for Sustainable Streets: Sustainable Street Typologies

Green Infrastructure Design Guide

In 2020, C/CAG updated the San Mateo Countywide Green Infrastructure Design Guide (GI Design Guide) which is a comprehensive design guide to help design, build and maintain green infrastructure. As part of Master Plan development, the project team developed a catalogue of all of the green infrastructure typical design details applicable to sustainable streets in San Mateo County, including details not available when the GI Design Guide was developed. Appendix J includes the table listing available design details by typology. New details will be incorporated in the GI Design Guide when these documents are updated.

Typology Purpose

Project opportunities in the Master Plan are grouped into four different project typologies. While the same active transportation and stormwater management components may be utilized in the different project types, these typologies are characterized by differences in project drivers, geographic extent or size, and complexity and cost. The project typologies are:

1. Sustainable Street Curb Extensions

2. Sustainable Street Connectivity Improvements

3. Sustainable Streetscape Redesign Projects

4. Sustainable Street Frontage Improvements for New Developments

The typologies were useful in communicating to stakeholders the range of projects to be included in the Master Plan. The typologies also assisted in linking project opportunities to relevant implementation mechanisms and funding sources. For example, Typologies 1-3 generally include projects funded through government sources, whereas projects that fall into Typology 4 could be funded by private developers. Different typologies may also need different policy mechanisms to facilitate implementation. The following table summarizes the characteristics of each typology, and the following sections provide additional description.

Table 4-1: Sustainable Street Typologies

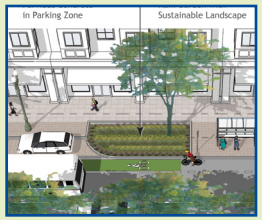
	Sustainable Street Typology	Relative Cost	Example Project Drivers	Example Transportation Design Elements	Example Stormwater Design Elements
1	Sustainable Street Curb Extensions	$	Safe Routes to School, Vision Zero Plans, Safe Routes to Transit, Traffic Calming Corridor,	Crosswalks, Curb Extensions, Pedestrian Refuges	Stormwater Curb Extension
2	Sustainable Street Connectivity Improvements	$$-$$$	First/Last Mile Project, Class I or IV Bikeways, Gap Closure Project	Cycle Tracks, Extended Medians, Bike Lanes	Stormwater Planter, Stormwater Curb Extension, Green Gutter, Pervious Pavement, Tree Well, Infiltration System
3	Sustainable Streetscape Redesign Projects	$$$$	Main Street Redesign, Complete Street Project, Corridor Beautification, Downtown Reinvestment	Street Trees, Seating, Lighting, Sidewalk Widening, Transit and Bike/Ped Improvements	Stormwater Planter, Stormwater Curb Extension, Tree Well Pervious Pavement, Infiltration System
4	Sustainable Street Frontage Improvements for New Developments	$-$$(1)	Development Conditions of Approval	Street Trees, Sidewalk and Pedestrian Improvements	Stormwater Planter, Stormwater Curb Extension, Pervious Pavement, Tree Well, Infiltration System

(1) Costs may be paid by private sector if tied to redevelopment requirements.

1: Bulb Outs and Curb Extensions

2: Connectivity Improvements

3: Streetscape Projects



4: Frontage Improvements

4.2 Planning for Sustainable Streets: Sustainable Street Typologies

IMAGE CREDIT: C/CAG

IMAGE CREDIT: C/CAG

IMAGE CREDIT: C/CAG

Figure 4-2: Examples of Sustainable Street Curb Extensions Reducing Crossing Distances in Millbrae, Daly City, and City of San Mateo

Typology 1: Sustainable Street Curb Extensions

Sustainable Street Curb Extensions are modifications to existing curbs at intersections and mid-block crossings that narrow pedestrian crossing distances and contain green infrastructure facilities. The transportation driver for the improvement is generally pedestrian safety, but the facilities can also be used to provide traffic calming and a safer environment for bicyclists and other roadway users. The addition of green infrastructure facilities can serve both to meet water quality improvement goals as well as provide neighborhood greening and additional community benefits. Green infrastructure facilities can also be designed to address drainage issues associated with installing new bulb-outs and provide a multi-benefit alternative to installing trench drains or other drainage infrastructure on curb extension projects.

Projects in this category are often motivated by Safe Routes to School or Transit programs as well as general pedestrian safety and traffic calming efforts. These projects are also often characterized as spot improvements, and are implemented on single intersections, versus as part of longer linear corridor improvement projects. Figure 4-2 shows examples of built sustainable street curb extensions in different San Mateo County municipalities. Figure 4-3 presents before and after images which envision a new sustainable street curb extension at a school crossing in East Palo Alto.

(IMAGE CREDIT: LOTUS WATER)

(IMAGE CREDIT: LOTUS WATER)

Figure 4-3: This before and after sequence shows how a sustainable street curb extension can shorten pedestrian crossing distance and provide stormwater management and neighborhood greening near a school in East Palo Alto.

4.2 Planning for Sustainable Streets: Sustainable Street Typologies

IMAGE CREDIT: C/CAG

Figure 4-4: Examples of Green Infrastructure Integrated with Bicycle Improvements on Carolan Ave in Burlingame, Delaware St in San Mateo, and Chilco St in Menlo Park

Typology 2: Sustainable Street Connectivity Improvements

Sustainable Street Connectivity Improvements are longer, linear corridor improvements that include transportation facilities such as Class I separated bicycle paths, cycle tracks, multi-use pathways, separated walkways, and extended medians. Green infrastructure facilities can include stormwater curb extensions, stormwater planters, green gutters, tree well filters, and pervious pavement, as well as other features. The transportation drivers for the improvements can include first/last mile projects, bicycle boulevard or other linear bicycle and pedestrian facility projects, Safe Routes to Transit programs, and Complete Street or gap closure project efforts.

Note that like Typology 1, these projects can include curb extensions, but the curb extensions are incorporated into a transportation improvement project that focuses on network connectivity and is larger in scope and includes a longer stretch of roadway. Built examples of this typology are shown in Figure 4-4. Figure 4-5 presents a before and after sequence envisioning a Sustainable Street Connectivity Project along El Camino Real in Colma.

IMAGE CREDIT: URBAN RAIN DESIGN

IMAGE CREDIT: URBAN RAIN DESIGN

Figure 4-5: Before and after images envisioning a Sustainable Street Connectivity Project including bicycle and pedestrian improvements, road diet, and green infrastructure along El Camino Real in Colma.

4.2 Planning for Sustainable Streets: Sustainable Street Typologies

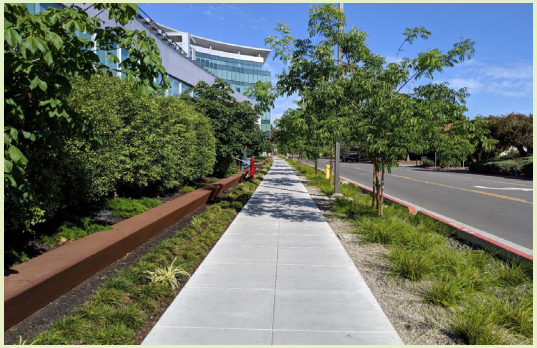


IMAGE CREDIT: C/CAG

Figure 4-6: Examples of Sustainable Streetscape Projects in Menlo Park and Burlingame

Typology 3: Sustainable Streetscape Redesign Projects

Sustainable Streetscape Redesign Projects contain significant public realm improvements, transportation improvements, and green infrastructure facilities. The drivers for Sustainable Streetscape Redesign projects include commercial corridor and downtown revitalization initiatives, and streetscape improvement and complete street efforts. Public realm improvements can include trees, new pedestrian seating, new lighting and sidewalk widening as well as related transit, pedestrian, and bicycle improvements. Green infrastructure facilities can include stormwater planters, stormwater curb extensions, tree well filters, and pervious pavement.

These projects are often located in downtown or main street locations; efforts may be initiated by public realm improvement and commercial district revitalization goals as well as transportation and stormwater management goals. Projects are often several blocks in length and require significant funding due to major reconstruction efforts. Note that though these projects can include curb extensions and connectivity improvements, or other elements in Typologies 1 and 2, they are typically characterized by additional streetscape design goals and components. Local examples of this project typology are shown in Figures 4-6 and 4-7. A before and after example is shown in Figure 4-8.

IMAGE CREDIT: CD+A

Figure 4-7: Green Infrastructure Integrated with Streetscape Improvements in Emeryville, CA

IMAGE CREDIT: URBAN RAIN DESIGN

IMAGE CREDIT: URBAN RAIN DESIGN

Figure 4-8: Before and after images presenting a vision for a Sustainable Street Redesign Project on Santa Cruz Ave in Downtown Menlo Park.

4.2 Planning for Sustainable Streets: Sustainable Street Typologies

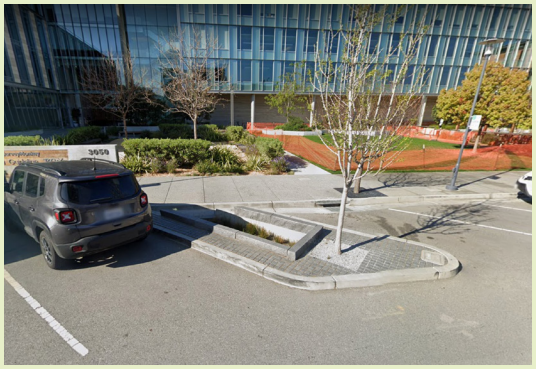


IMAGE CREDIT: C/CAG

Figure 4-9. Examples of Green Infrastructure Frontage Improvements in Burlingame, San Mateo, and Redwood City

Typology 4: Sustainable Street Frontage Improvements for New Developments

Sustainable Street Frontage Improvements for New Developments are transportation, public realm, and stormwater management improvements that are constructed in the frontage area of development projects as part of regulatory requirements for the project. These requirements may be initiated by resolutions or ordinances and codified in public works or other municipal code; they may also be imposed through conditions of approval or included in specific area plans (see Section 5.2 for details). The drivers for Sustainable Street Frontage Improvements are new development projects, and the need to ensure that new development projects are engaged in mitigating negative effects on the environment and improving the livability of the neighborhoods where they are located. Public realm and pedestrian facilities include, but are not limited to, improved sidewalks, street trees, seating areas, and street lighting. Green infrastructure facilities can include tree wells, stormwater trees, and stormwater planters or curb extensions. Local examples of this project typology are shown in Figure 4.9. A before and after vision for this project typology is shown in Figure 4-10.

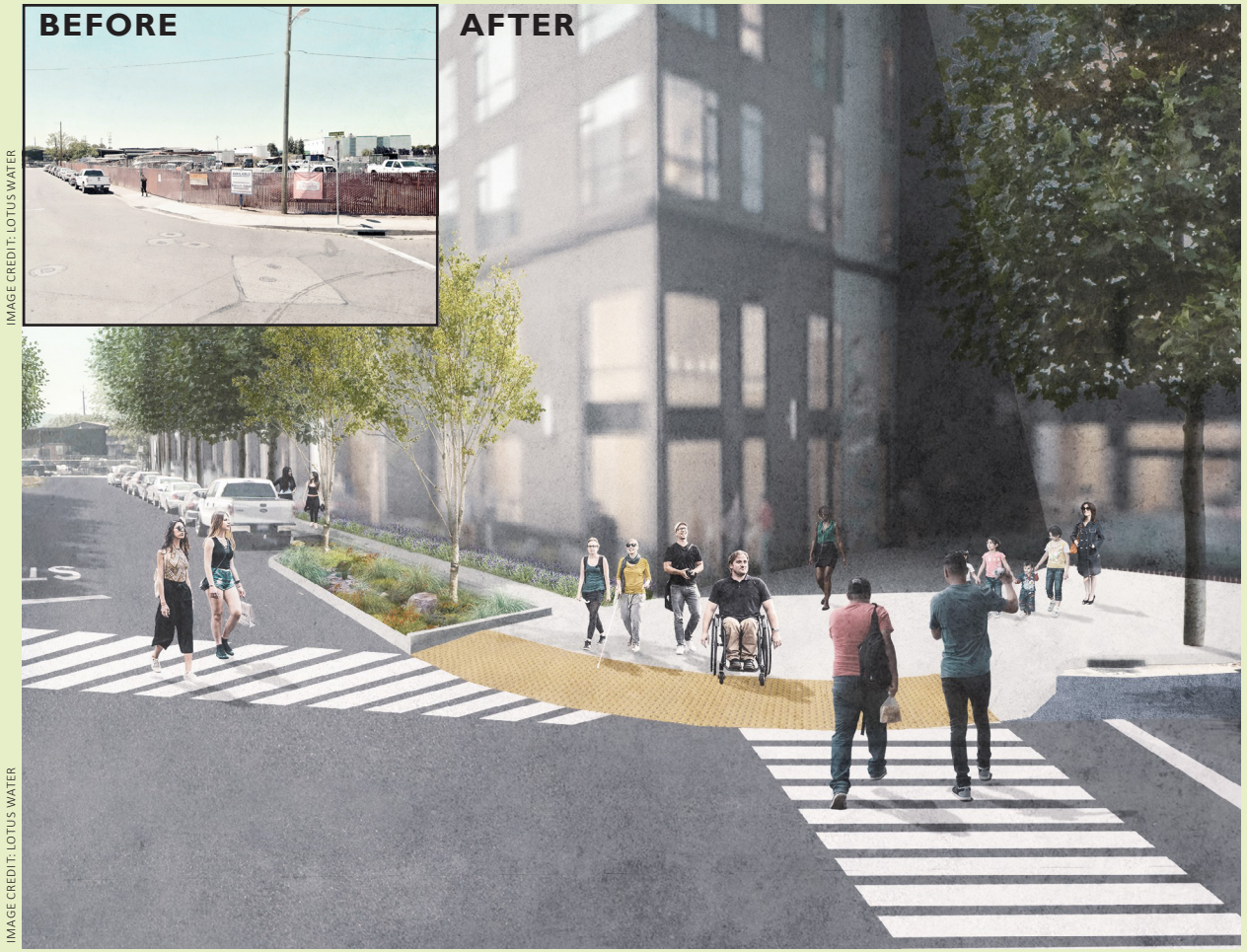


Figure 4-10: Before and after images presenting a vision for Sustainable Street Frontage Improvements for a development project on Edison Way in the County of San Mateo.

4.3 Planning for Sustainable Streets: Identifying Project Opportunities

IMAGE CREDIT: ALTA PLANNING + DESIGN

Building Integrated Safe Routes to School Projects in San Mateo County

Case Study: Oak Grove Project in Menlo Park

This Menlo Park Safe Routes to School and Green Infrastructure Pilot Project is located one block from Menlo Atherton High School and alongside the Nativity Catholic School, Vallombrosa Center and Nativity Church. The Oak Grove Project aims to improve both pedestrian and bicycle connectivity and drainage issues on the street. Safety concerns included lack of accessibility to nearby buildings, lack of sidewalks in area, and limited crossings along Oak Grove Avenue.

Sustainable Streets Components:

- 200-ft curb-separated pedestrian path on south side of the street
- 800-ft path connecting Nativity Catholic School and Nativity Church
- Rectangular rapid flashing beacon and new midblock crossing
- Linear stormwater planters behind the curb on both sides of the street
- Educational signage

Grant Funding

C/CAG provided a $171,000 grant to cover a portion of the project construction costs

Project Identification

The goal of the Master Plan is to integrate existing climate change, active transportation, and stormwater planning efforts to identify the best opportunities to meet countywide goals within the street network. To that end, rather than creating conflicting or competing project prioritization recommendations, the Master Plan focused on first reviewing planned active transportation projects throughout the county to identify which provided the best opportunities for sustainable streets. After reviewing planned projects throughout the county and assessing their suitability as sustainable streets, the analysis then turned to identifying additional new project opportunities. The new project opportunities were intended to provide a better spatial distribution of opportunities countywide and increase the total number of opportunity sites. The process and results of identifying planned and new project opportunities are described in the following sections.

IMAGE CREDIT: ALTA PLANNING + DESIGN

Analysis of Plans Included Review of Walk Audits and Safe Routes to School Recommendations

Review of Planned Active Transportation and Streetscape Projects

There is strong potential for green infrastructure projects to be integrated as designed components in bicycle, pedestrian, and streetscape improvement projects in San Mateo County; however, to date, many planned transportation and streetscape projects have been developed without green infrastructure features. As a result, the master planning process focused on identifying planned active transportation and streetscape projects with the potential for green infrastructure to be incorporated into their design.

The analysis included assembly and review of over 35 planning documents and project databases from municipalities throughout San Mateo County. Municipalities were engaged to identify relevant planned projects from:

- Active Transportation Plans (including Bicycle & Pedestrian and Complete Streets Plans)
- Green Infrastructure Plans
- General Planning Documents
- Neighborhood Specific Plans
- Safe Routes to School Planning Documents

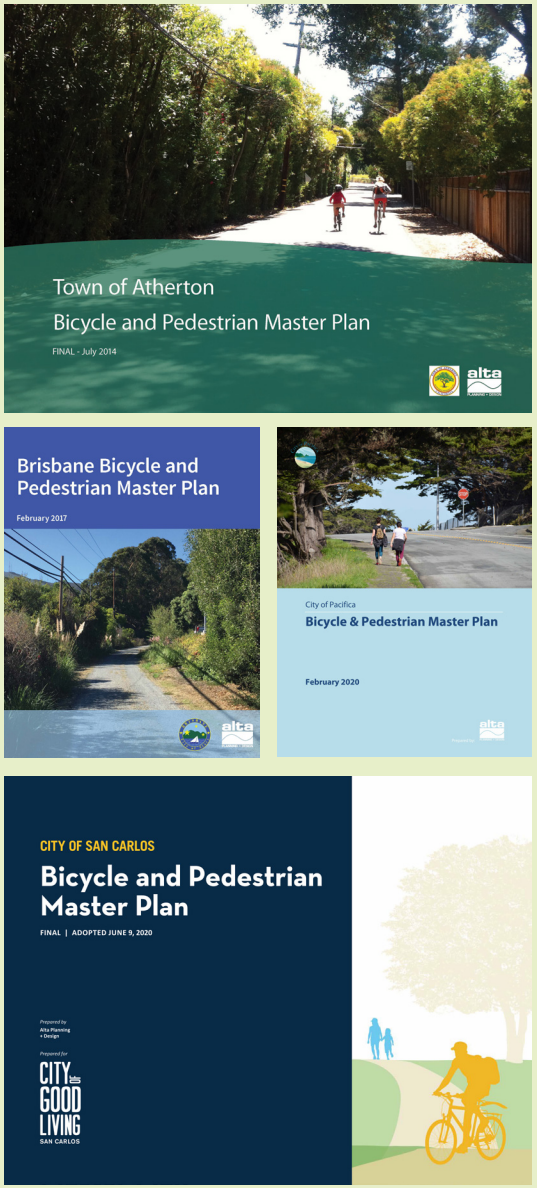


IMAGE CREDIT: ALTA PLANNING + DESIGN

Proposed active transportation improvement projects highlighted in planning documents from all over San Mateo County create a foundation for sustainable street project opportunities

4.3 Planning for Sustainable Streets: Identifying Project Opportunities

IMAGE CREDIT: MATT FABRY

Tier 1 projects, such as bulb-outs at pedestrian crossings, are able to efficiently fuse green infrastructure with the active transportation project components

IMAGE CREDIT: MATT FABRY

Curb Extensions are often requested as part of Safe Route to School projects and are strong opportunities for green infrastructure inclusion.

Planned Project Opportunities

Identified planned active transportation and streetscape projects were compiled into a database and categorized into the appropriate project typologies. Next, a project tier assessment was conducted to split the projects within each typology into either Tier 1 or Tier 2. Projects in Tier 1 were those with the scope and schedule to enable efficient integration of green infrastructure into the planned active transportation project. These projects typically included significant road reconstruction or curb work that provided ample cost-sharing opportunities for stormwater and transportation design elements. Projects that—based on best available data—appeared to lack the scope or schedule to effectively integrate green infrastructure were placed in Tier 2. A full description of the methodology and the list of plans used to compile the existing planned project opportunities can be found in the SSMP Project Identification and Prioritization Technical Memorandum included in Appendix B. The results of the planned project opportunity assessment are shown in Figure 4-11.

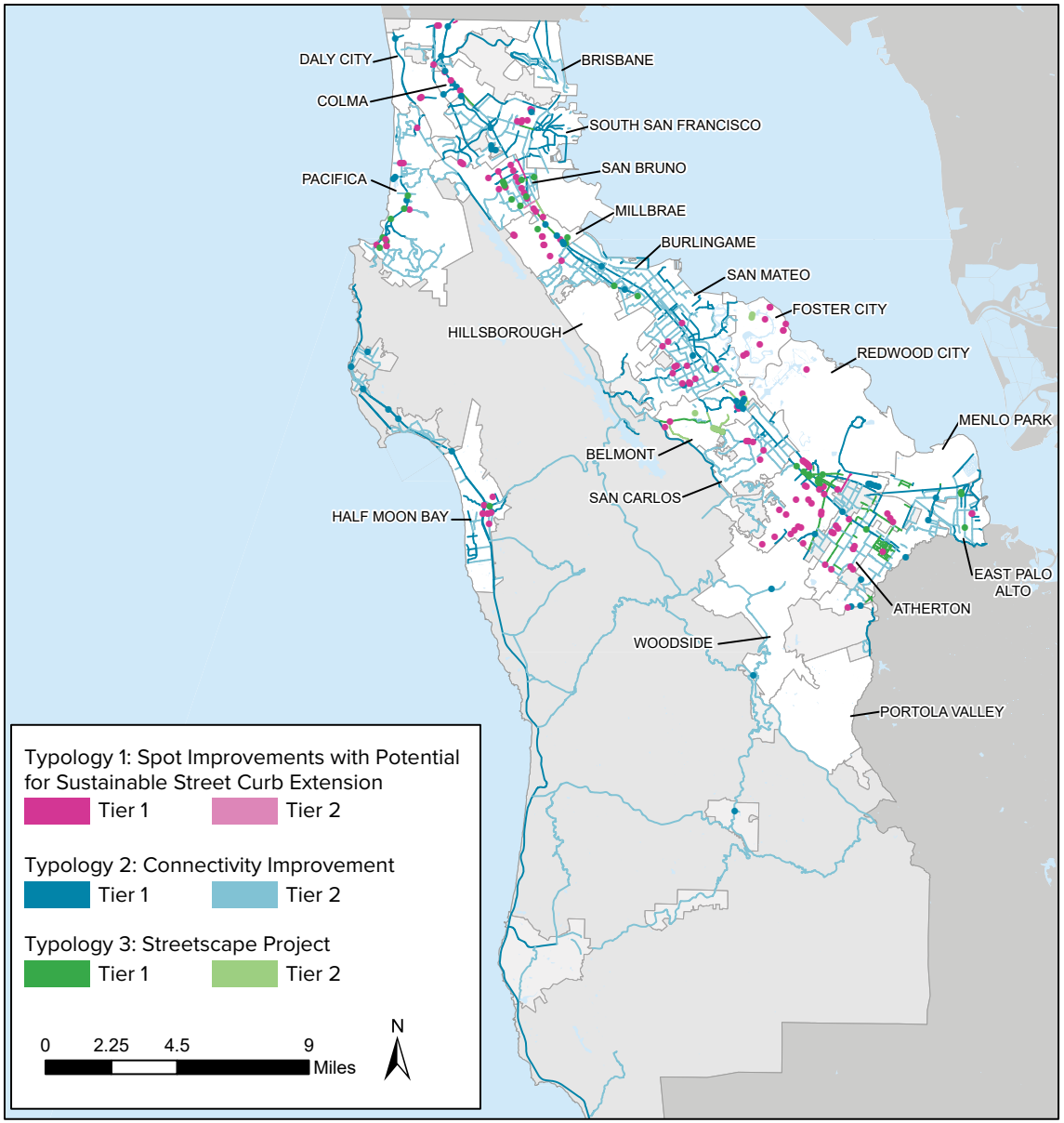


Figure 4-11: Identified Planned Project Opportunities

Over 35 planning documents were reviewed to identify planned projects with the scope and schedule to enable efficient green infrastructure integration.

4.3 Planning for Sustainable Streets: Identifying Project Opportunities

IMAGE CREDIT: PARADIGM

New Project Opportunities

In addition to identifying existing planned project opportunities, the project team also developed a methodology for identifying "new" sustainable street project opportunities. One of the goals of this methodology was to develop sustainable street curb extension project opportunities that would support stakeholders' robust interest in Safe Routes to School and Safe Routes to Transit programs. Intersections within half a mile of schools and major transit stops can benefit from traffic calming and pedestrian safety improvements as they are within the "walking shed" of these major trip generators. Another goal of the methodology was to identify project opportunities that have synergies with future pavement reconstruction projects and may provide opportunities for cost sharing and reduction of construction impacts through implementation of the two projects simultaneously.

Accordingly, with these two goals, the analysis identified intersections within a 0.5-mile walking distance from schools or major transit stops which are located on streets that are designated for needing reconstruction due to very poor pavement conditions. The 2018 street pavement condition index compiled by the MTC was used to identify streets with poor or failed surface conditions. Intersections along an arterial or collector with a poor or failed surface condition were selected as eligible project opportunity locations and additional screening factors based on transportation needs were applied. The analysis located over 200 new project opportunities. Municipalities with no identified opportunities generally had higher quality pavement as assessed by the MTC street pavement condition index and/or fewer schools. Municipalities interested in identifying additional opportunities can use the project identification and assessment tools provided by the Master Plan and described in Section 6.1. A full description of the new project opportunity identification methodology can be found in Appendix B. The results of the new project opportunity assessment are shown in Figure 4-12.

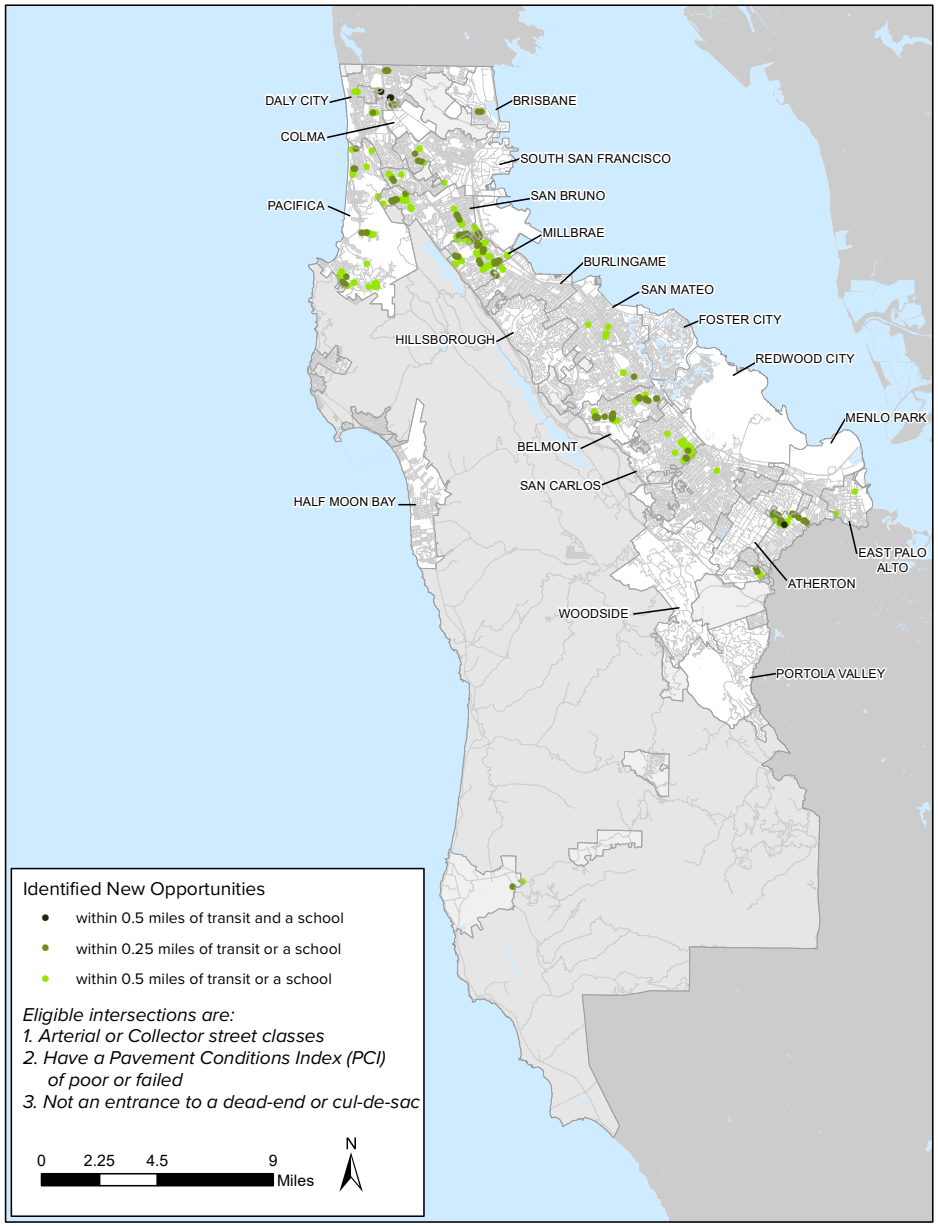


Figure 4-12: Identified New Project Opportunities

New Project Opportunities are within the "walking shed" of schools or major transit stops and support the region's robust interest in Safe Routes to School and Transit Programs.

4.4 Planning for Sustainable Streets: Prioritizing Project Opportunities

The prioritization scoring methodology was developed to further evaluate project opportunities based on technical suitability for green infrastructure and additional community and environmental benefits.

Project Prioritization

After the new and planned project opportunities were identified and categorized, they were then prioritized based on a scoring methodology developed to further evaluate opportunities based on technical suitability for green infrastructure and additional community and environmental benefits. The scoring methodology included eleven green infrastructure technical suitability criteria which can be subdivided into three categories: runoff capture benefits, hydrogeologic conditions, and site space constraints. The additional community and environmental benefit criteria were designed to prioritize project sites located within disadvantaged or vulnerable communities, communities with lower vehicle ownership, communities with less tree canopy and vegetation coverage, and communities which are more significantly impacted by urban heat island effect. These are collectively referred to as the *co-benefits criteria*. The co-benefits criteria also prioritized project locations with poor pavement quality, as these locations provide another opportunity for municipalities to develop multi-objective projects including both street repaving or reconstruction and sustainable street components.

The scoring methodology leverages previous countywide planning efforts from the 2017 Stormwater Resource Plan for San Mateo County (SRP). The Master Plan scoring methodology builds upon methods used in the SRP, but uses more refined prioritization criteria, updated data, and new analyses. Proposed criteria were presented to the C/CAG Stormwater Committee and the Master Plan Stakeholder Advisory Committee (SAC) before developing a methodology memorandum that was then submitted to all CCAG members and the SAC for additional feedback. In addition, the prioritization criteria were presented to the public during engagement activities to confirm that criteria important to the public were included and appropriately weighted to achieve community-based goals and priorities. A full description of the prioritization methodology and each of the prioritization criteria can be found in the Appendix B. Additional detail on the stakeholder engagement process can be found in Appendix I. Table 4-2 presents the technical suitability and co-benefits criteria along with their scores and weights. Each street was assigned a score (1 to 5) for each criterion based on the attributes of the street. For each street the technical suitability score was added to the co-benefits score to arrive at a total prioritization score of up to 85 points.

Figure 4-13 on the following page presents the full prioritization results for the planned project opportunities across San Mateo County. Figure 4-14 presents the full prioritization results for the identified new project opportunities across the county.

Metric[1]		Points						Weight Factor
		0	1	2	3	4	5	
TECHNICAL SUITABILITY CRITERIA								
Runoff Capture Benefits								
Water Quality	Bayside: Modeled Green Street and Other LID Runoff Capture Needed(2)	<0.001	0.001-0.002	0.002-0.003	0.003-0.004	0.004-0.005	>0.005	--
	Oceanside: Annual Runoff Depth	<2 inches	2-5	5-8	8-10	10-15	>15 inches	
Within Watershed of Flood Prone Channel		No					Yes	--
Contains PCB Interest Areas		None		Moderate			High	--
Augments Water Supply (Above Groundwater Basin and Outside Contamination Area)		No					Yes	--
Climate Change Impacts: Runoff Increase from Transportation Network During RCP 8.5 10-yr 6-hr Event (inches by subwatershed)(2)		No runoff from roads	0 – 0.0014	0.0014 – 0.0066	0.0066 – 0.0199	0.0199 – 0.0418	0.0418 – 0.0940	--
Hydrogeological Conditions								
Hydrologic Soil Group			D	Unknown	C	B	A	--
Groundwater Constraints		Depth to GW < 10 ft		Depth to first GW 10-20 ft			Depth to first GW > 20 ft	--
Slope (%)		10 ≥ X > 5	5 ≥ X > 4	4 ≥ X > 3	3 ≥ X > 2	2 ≥ X > 1	1 ≥ X > 0	--
Site Space Constraints								
Available Width per Street Class			Narrowest 33% by Class		Middle 33% by Class		Widest 33% by Class	--
Available Length per Block(4)								
Parcels per Block, Hydrants, SamTrans Stops			Length lost >300 ft per 1000 ft		Length lost ≤300 ft per 1000 ft		Length lost <200 ft per 1000 ft	--
Major Utility Conflicts		Major Utility Conflict (PG&E, BART, CalTrain)					No Major Utility Conflict Present	--
CO-BENEFITS								
Vulnerable Community Indicators - In American Community Survey DAC - In SFBRA-based DAC - In top tier of SMC CVI - In MTC COC - In CalEnviroScreen DAC (AB 535)		Not in any vulnerable community dataset	In 1 vulnerable community dataset		In 2 or more vulnerable community datasets		In 4 or more vulnerable community datasets	2
Community Benefit Vehicle-Ownership		Fewer than 10% of households do not own a vehicle					More than 10% of households do not own a vehicle	--
CalEPA Urban Heat Island Index		< 4,000	4,000 – 8,000	8000 – 12,000	12,000 – 16,000	16,000 – 20,000	> 20,000	--
Canopy Coverage (% within 100-ft of street)		>50%	40%-50%	30%-40%	20%-30%	10%-20%	<10%	--
Pavement Condition Index		Excellent/Very Good, Good/Fair			At Risk		Poor/Failed	--

(1) Refer to Appendix B for the data source and description for each metric.

(2) Modeled runoff capture for green streets and other LID measured as acre-feet capacity per acre of watershed.

(3) Refer to Section 3 and Appendix A for discussion of modeling approach and results.

(4) Length constraints: laterals based on parcel density (2' per parcel), transit stops (10' per stop), fire hydrants (4' per hydrant).

4.4 Planning for Sustainable Streets: Prioritizing Project Opportunities

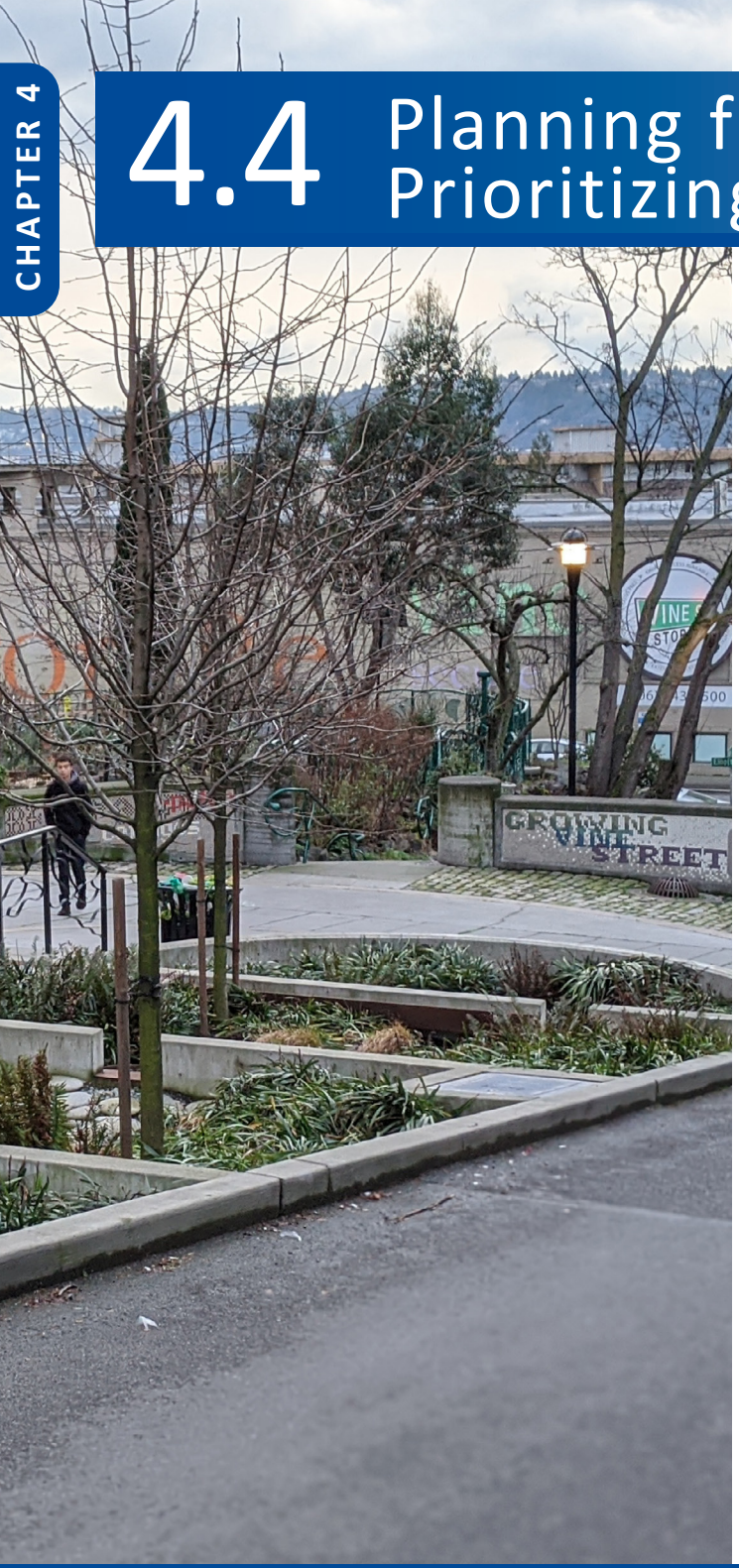


IMAGE CREDIT: LOTUS WATER

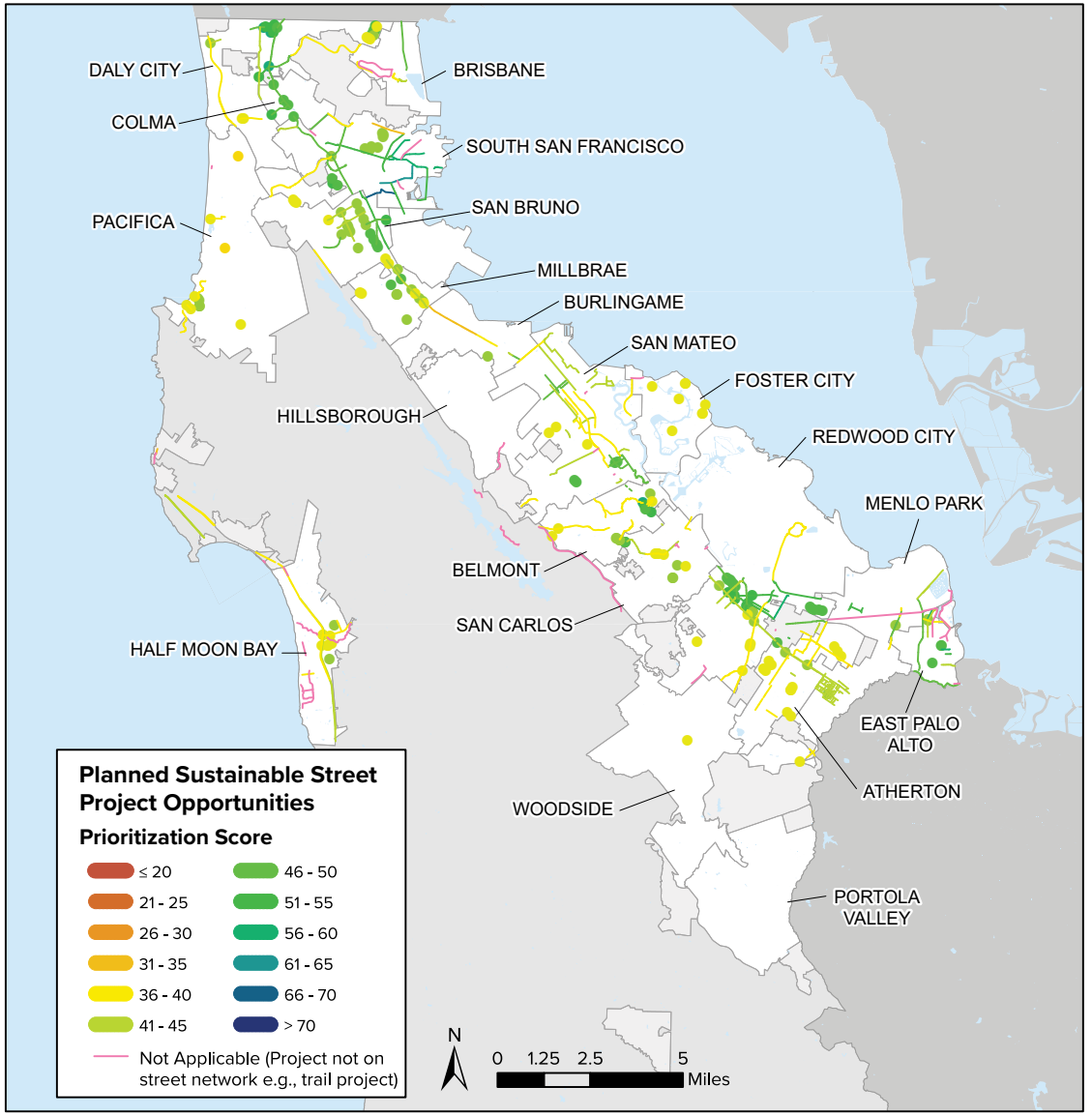


Figure 4-13: Prioritization Scores for Planned Project Opportunities

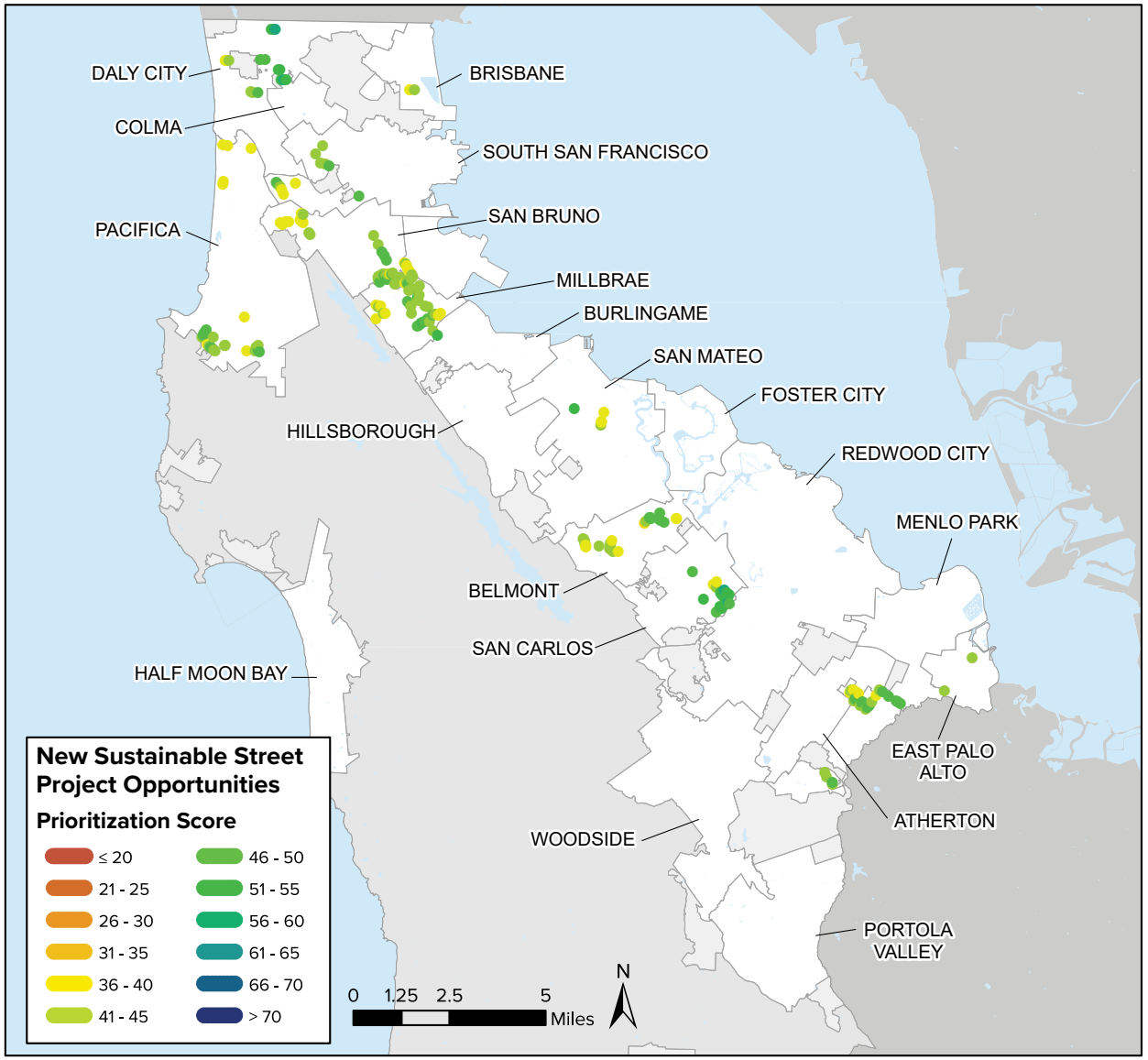


Figure 4-14: Prioritization Scores for New Project Opportunities

IMAGE CREDIT: LOTUS WATER

Chapter 5: Implementing Sustainable Streets

Table of Contents

CHAPTER 5

5.1 Implementing Sustainable Streets: Project Recommendations

IMAGE CREDIT: PARADIGM

Recommendation Overview

The Master Plan provides a practical roadmap to assist municipalities across the county in building sustainable street projects. Sections 5 and 6 of the Master Plan describe the resulting project opportunities, policy options, and the additional tools provided to support jurisdictions as they pursue the vision and implementation of sustainable streets.

To create sustainable street project recommendations, the Master Plan identified, evaluated, and prioritized planned active transportation and streetscape projects throughout the county. In addition to identifying the strongest planned project opportunities for sustainable streets, the Master Plan also identified a set of "new" project opportunities for sustainable streets in San Mateo County. The methodology was designed to locate practical projects that build on existing planning efforts to meet the multiple objectives of sustainable streets. The identified projects provide the strongest opportunities for cost-sharing between active transportation and green infrastructure components, which was a primary goal of the municipal staff and stakeholders guiding development of this plan.

After the prioritization scoring process for each project opportunity was complete, the lowest scoring opportunities were removed and C/CAG member agencies in the county reviewed the resulting prioritized project lists and maps for their jurisdictions and provided feedback on the opportunities, including whether additional opportunities should be removed and whether the remaining opportunities were near, mid, or long-term priorities. Out of approximately 800 initial project opportunities, over 500 advanced through the prioritization and review process. These opportunities will need additional analysis to determine feasibility, but they provide a strong starting place for municipalities looking to add project opportunities to their sustainable street networks and their Safe Routes to School and Transit efforts.

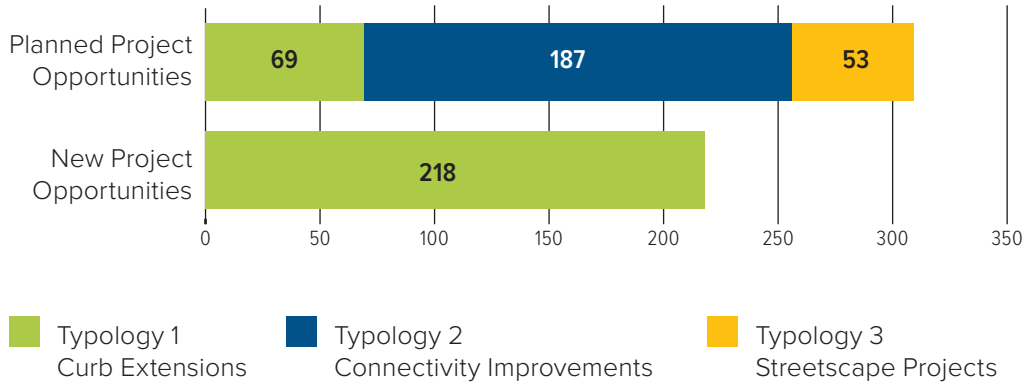


Figure 5-1: Number of Recommended Project Opportunities by Project Typology

Out of approximately 800 initial project opportunities, over 500 advanced through the prioritization and review process.

5.1 Implementing Sustainable Streets: Project Recommendations

Shared phasing information for each project will help municipal departments work together to meet the multiple goals of sustainable street implementation.

Recommended Project Opportunities with Phasing Information

Implementation of sustainable streets will take place over time, as municipalities develop new resources to assist in project design, construction, and maintenance. During the master planning process, each municipality in San Mateo County categorized their planned and new sustainable street project opportunities as near-term projects (0-5 years), mid-term projects (5-10 years), or long-term projects (10-20 years).

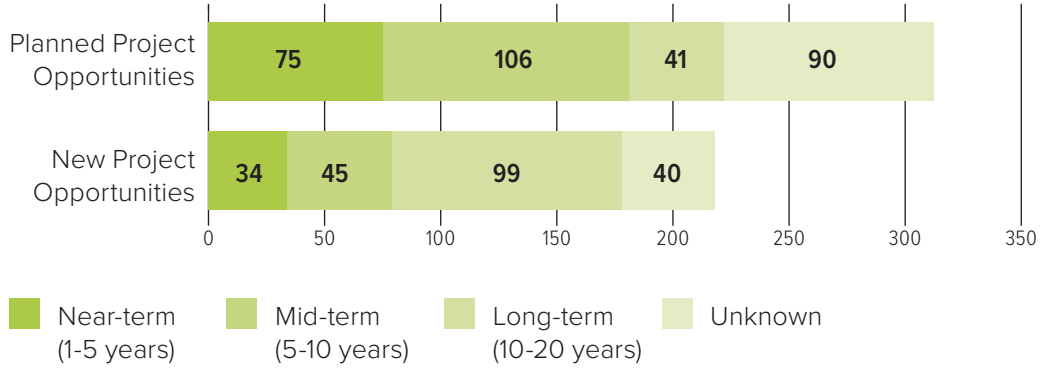


Figure 5-2: Countywide Summary of Phasing Information for Recommended Projects

This phasing information will help municipal departments work together to meet the multiple goals of sustainable street implementation, including bicycle and pedestrian improvements and stormwater management. The recommended sustainable street project opportunities with their implementation time horizons are presented spatially across the county in Figures 5-3 and 5-4. Full lists of the planned and new project opportunities sorted by jurisdiction can be found in Appendices C and D.

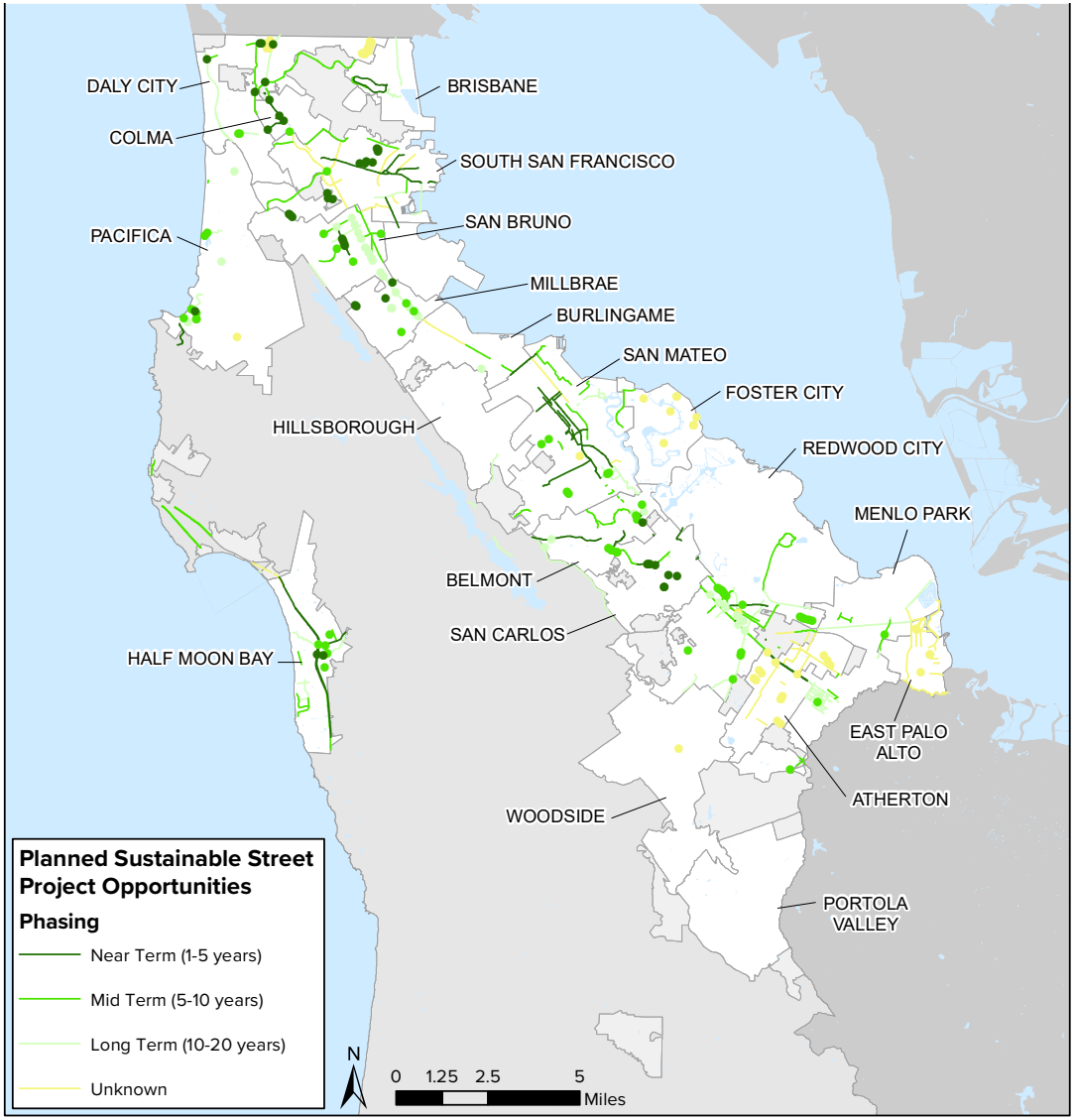


Figure 5-3: Recommended Planned Project Opportunities for Sustainable Streets

IMAGE CREDIT: MATT FABRY

5.1 Implementing Sustainable Streets: Project Recommendations

IMAGE CREDIT: C/CAG

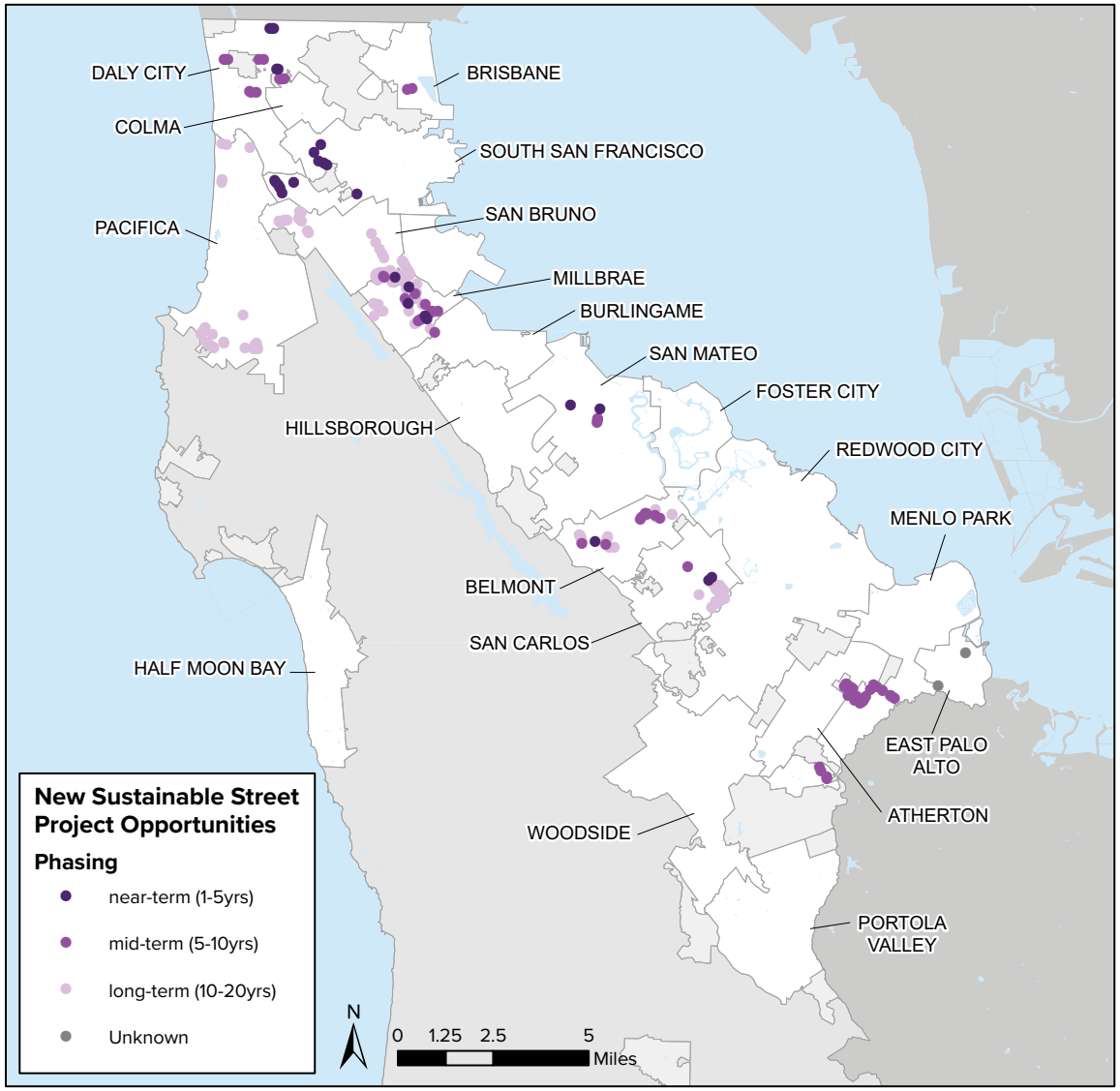


Figure 5-4: Recommended New Project Opportunities for Sustainable Streets

As a zoomed-in example to show project results at a city-scale, Figures 5-5 presents Millbrae's project opportunity results and planning level phasing information.

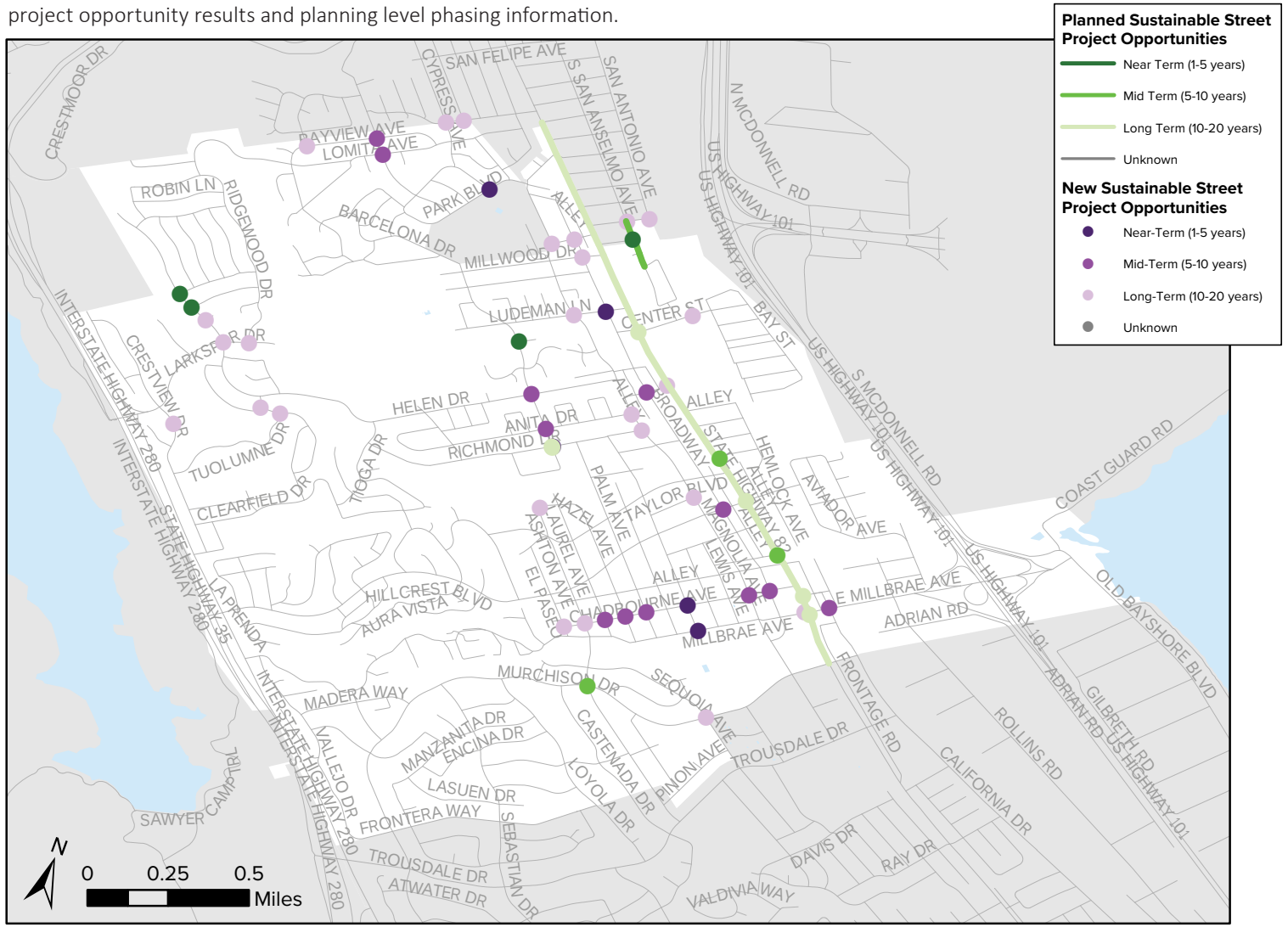


Figure 5-5: Zoomed-in Project Opportunity Results for the City of Millbrae

5.2 Implementing Sustainable Streets: Concept Designs for Priority Projects

IMAGE CREDIT: LOTUS WATER

Preliminary Concept Designs for Priority Projects

Figure 5-6: Before and After Images of the Fordham St and Perdue Avenue Project Concept, East Palo Alto

A primary goal of the Master Plan is to help municipalities in San Mateo County get sustainable streets designed, funded, and constructed. To further this goal, the Master Plan includes detailed planning scale project concept designs for twelve priority projects across the county; each project is located in a different jurisdiction with the exception of Daly City; there are two Safe Routes to School projects in Daly City. Municipalities proposed near term projects from the list of project opportunities identified during the prioritization process. These proposals were rated based on technical feasibility, project readiness, availability of funding and/or goals for future funding, geographic distribution of projects, location in a vulnerable community, and with the goal of providing representations from each of the four project typologies. A map showing the locations of the selected project concepts is shown in Figure 5-7. **Please note: these concepts are for visualization purposes and will require more stakeholder input and design analysis before moving forward.**

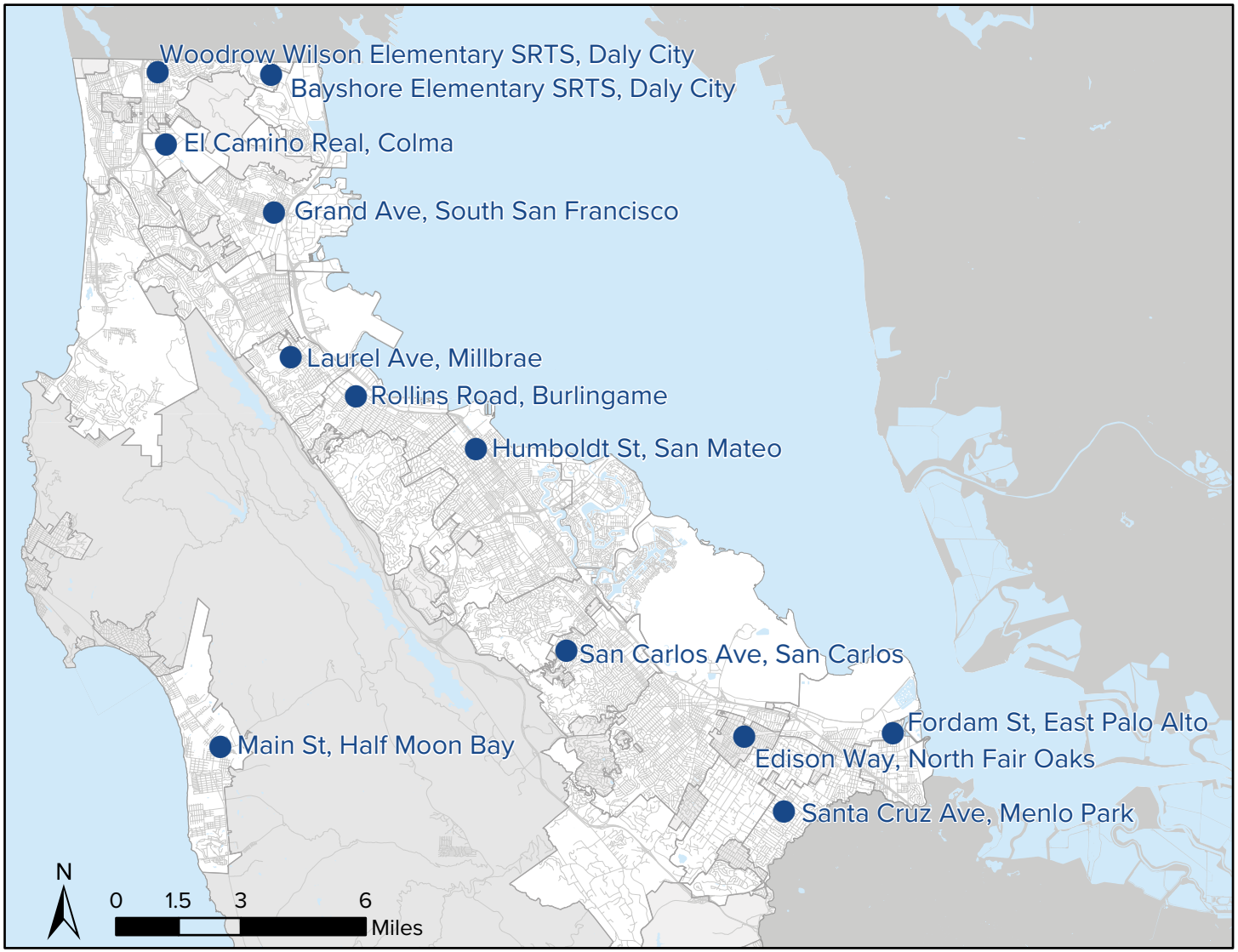


Figure 5-7: Projects Selected for Preliminary Concept Design

5.2 Implementing Sustainable Streets: Concept Designs for Priority Projects

Site Plan for Laurel Avenue Project Concept, Millbrae.

One of the primary objectives of these project concept designs is to assist municipal staff with the components needed to win political, community, and funding support for these projects. The project concept designs include project descriptions and plan and section views of proposed components as well as perspective visualizations. In addition to being useful for project planning and design, these tools can be helpful for outreach efforts with city leaders and community members.

San Mateo Countywide Sustainable Streets Master Plan

Main Street Half Moon Bay

Concept Description

Main Street in Half Moon Bay between Highway 1 and Stone Pine Road is being redesigned to include a separated bikeway. This bikeway will cross Highway 92 and Lewis Foster Drive which provides access to Half Moon Bay High School. This concept proposes to integrate green stormwater infrastructure in the planned bikeway improvements to provide stormwater management and improved safety for bikers while providing streetscape amenities.

Main Street has a 60-foot right-of-way and 46-foot roadway with space for a four-foot wide bike lanes within the shoulder on both sides of the street. Curb extensions and bioretention planters are proposed in areas around the proposed bike lane to provide streetscape improvements and manage stormwater runoff.

A redesign of the approach of Lewis Foster Dr to Main St is proposed that removes the dedicated right-hand turn lane from Lewis Foster Dr. This will create a safer intersection with a better view of oncoming bicycle traffic on Main Street and a shorter pedestrian crossing. In addition, this redesign will provide space for a bioretention planter that can manage runoff from Main Street ad Lewis Foster Dr.

Curb extensions and planters are proposed on the south side of Main St, at the intersection of Main St and Highway 92, and along Stone Pine Road to provide a total of 7,900 square feet of bioretention planter capturing stormwater from approximately 2.4 acres of roadway and providing capture of 4.4 acre-feet or runoff per year. This project is expected to retain 68.6% of runoff.

Site Characteristics

In Priority Development Area
No

Watershed
Pilarcitos Creek

Green Infrastructure Performance

Drainage Management Area
2.4 acres

Annual Runoff Captured
4.4 ac-ft

Bioretention Area / Storage Volume
7,900 sf / 0.27 ac-sf

Permeable Pavement Area / Storage Volume
3,500 sf / 0.05 ac-ft

Active Transportation Performance

Change in Bicycle Level of Traffic Stress (LTS) [🔗]
LTS 4 to LTS 3

Increase in % Likely Bicyclist Usage
11%

Key Transportation Benefits
- » *Added bike space*
- » *Traffic calming*

Figure 5-8: Project Description and Benefit Metrics for the Main Street Project Concept, Half Moon Bay

5.2 Implementing Sustainable Streets: Concept Designs for Priority Projects

IMAGE CREDIT: LOTUS WATER

The project concepts also include descriptions and quantification of project benefits (focused on key grant funding program priority areas regarding transportation, climate resiliency, and water quality) and planning-scale cost estimates. Along with the visualization elements, this information is included to assist municipal staff with locating funding sources for the projects; it can be used in the development of capital budgets or in grant applications for project funding.

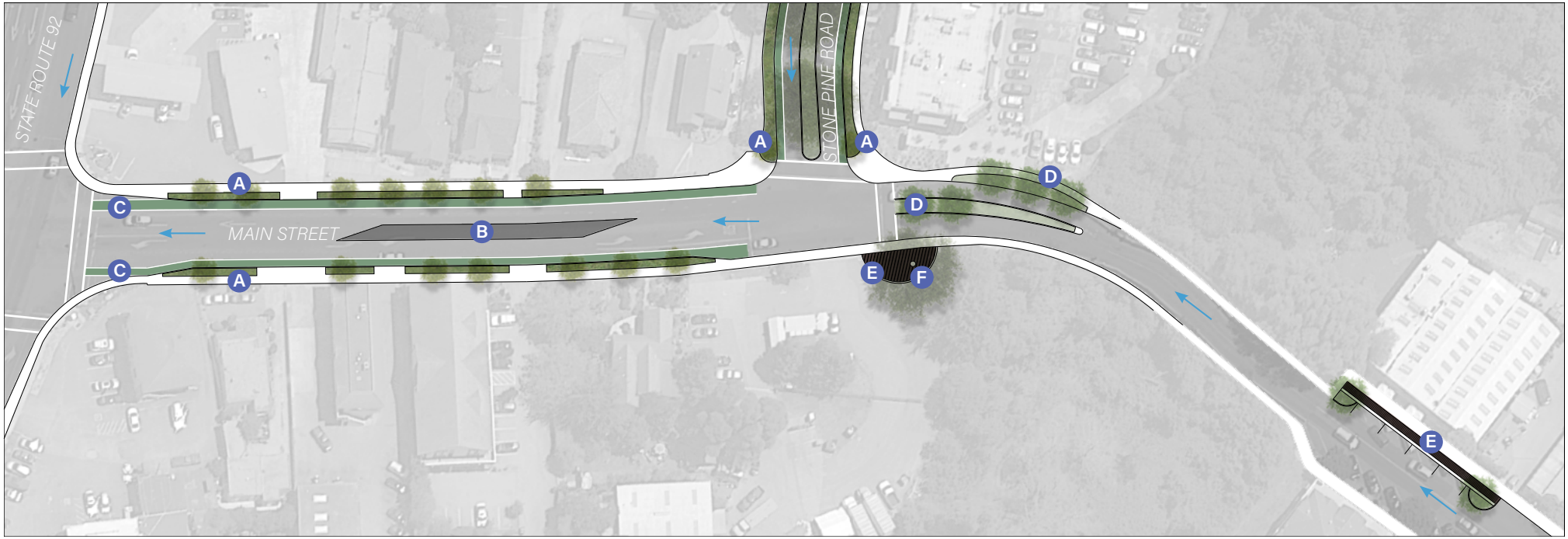
The project concepts are also intended to facilitate the transition from planning to the detailed design phase and will provide guidance and vision for project team members as the project moves forward. All twelve of the project concepts can be found in Appendix E.

Planning-Level Cost Estimate

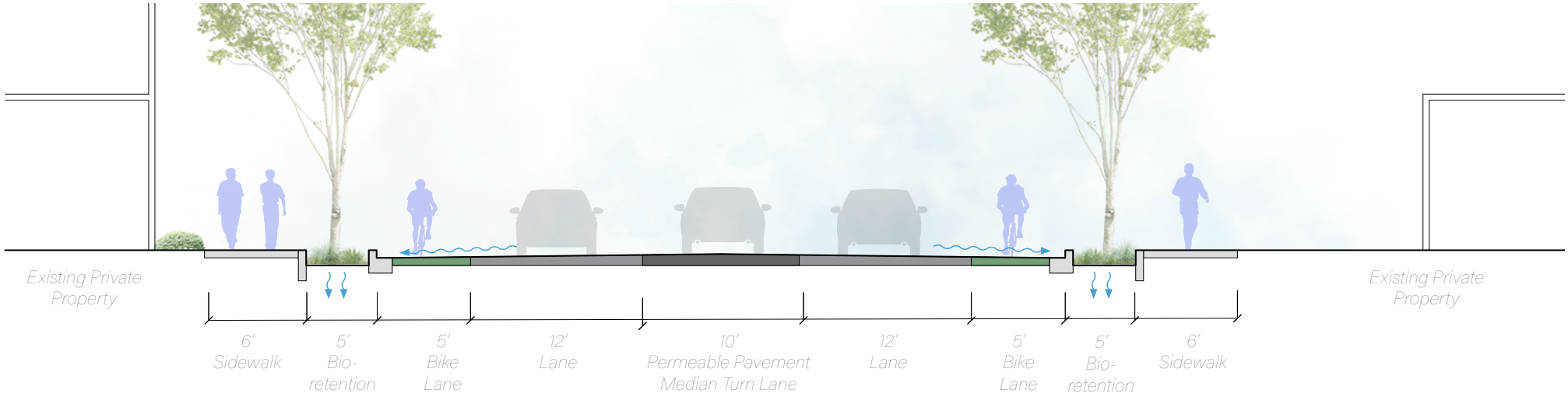
DESCRIPTION	UNIT COST	UNIT COST	QUANTITY	SUBTOTAL
Utilities Protection/Relocation	$100,000	LS	1	$100,000
Sawcutting Pavement	$12	LF	3,520	$42,240
Concrete Demo, Excavation & Offhaul	$11	SF	12,420	$136,600
Planter Excavation & Offhaul	$70	CY	1,360	$95,200
Planter Curb & 36" Sidewalls	$160	LF	1,360	$217,600
Planter Curb & Gutter & 36" Sidewalls	$180	LF	910	$163,800
Concrete Curb	$40	LF	1,172	$46,900
Bio-soil Media	$250	CY	450	$112,500
Underdrains	$6	SF	12,120	$72,700
Drain Rock Subbase	$160	CY	450	$72,000
Bioretention Plantings & Mulch	$25	SF	7,960	$199,000
Wood Boardwalk	$50	SF	1,436	$71,800
Storm Drain Connections	$7,500	EA	6	$45,000
Flush Curb Ribbon	$60	EA	820	$49,200
Bikelane Striping	$12	SF	14,350	$172,200
Sidewalk Repair	$15	SF	6,500	$97,500
Irrigation System	$31,800	EA	5	$159,000
Traffic Sign Relocation	$900	EA	6	$5,400
Trees	$1,500	EA	28	$42,000
Landscaping Soil	$125	CY	450	$56,250
Landscaping Plantings & Mulch	$20	SF	9,920	$198,400
Permeable Pavement	$25	SF	3,510	$87,750
		CONSTRUCTION SUBTOTAL		$2,243,000
Traffic Control				$112,150
Mobilization (10% construction)				$224,000
Contingency (30% construction)				$673,000
Design Fees (15% total)				$488,000
		TOTAL PROJECT COST (DESIGN + CONSTRUCTION)		$3,740,000

This is a planning-level cost estimate ($2020) for design and construction. Soft costs for City administration and project management and post-construction operations and maintenance are not included. Other factors that may affect the cost of future construction include escalation and market conditions.

Example Planning-Scale Cost Estimate



Concept Detail 2: Main Street (south)



Typical Cross Section: Main Street

Figure 5-9: Plan and Section Views for the Main Street Project Concept, Half Moon Bay

5.3 Implementing Sustainable Streets: Policy Recommendations

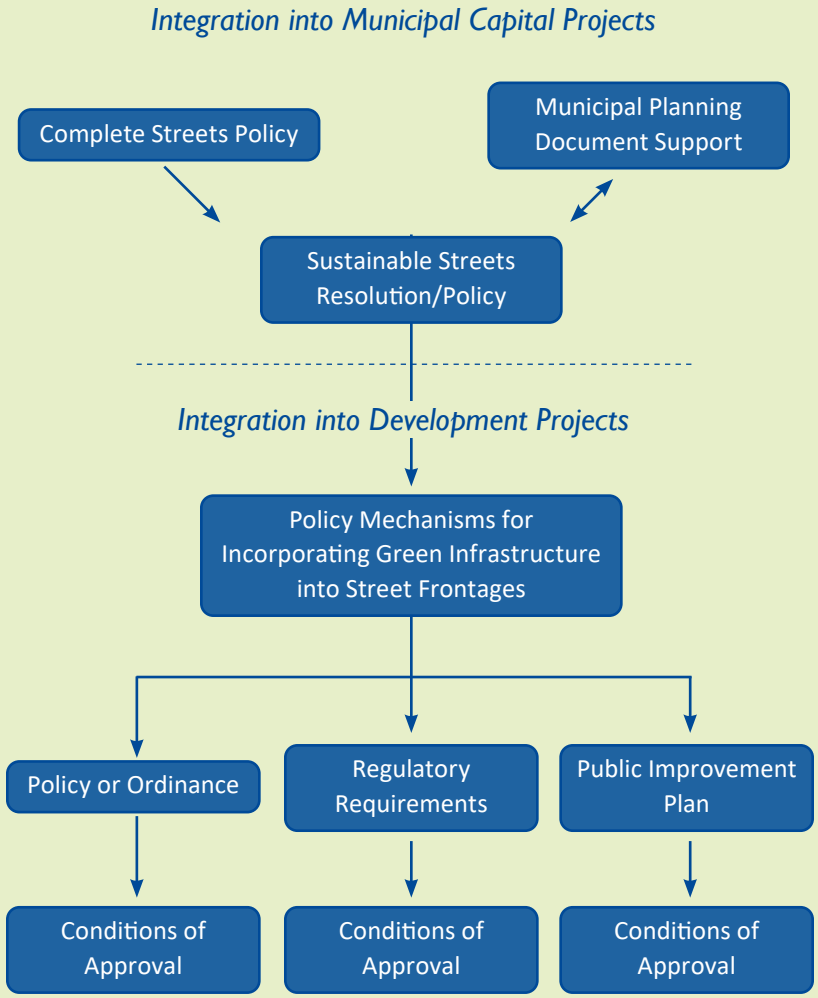
The Master Plan provides model policy language to support sustainable street implementation including a model jurisdiction-wide sustainable street policy and model conditions of approval for development projects.

Sustainable Street Policy Tools

Policy mechanisms for sustainable streets implementation can build upon past policy work related to complete streets. Complete streets policies have been adopted by municipalities in San Mateo County, the Bay Area, and nationally over the last 10 to 30 years. Sustainable streets policies can use some of the same tools and processes that complete street advocates have used, with the aim of complementing and broadening the benefits achieved with complete streets policies to achieve the additional water and climate resiliency benefits of sustainable streets. To streamline this process, local agencies can refer to the complete streets resources compiled by C/CAG and utilize the model policy language included as part of this Master Plan. The provided model policy language focuses on the following two policy components needed to facilitate sustainable streets implementation:

- Citywide Sustainable Streets Policy – This component entails adoption of policies and goals for the general support of sustainable streets in municipal transportation planning activities and projects on a jurisdiction-wide scale. Model policies and recommended language for municipal planning documents (such as General Plans, Active Transportation Plans, etc.) that will assist municipalities with setting policy objectives and metrics for implementation are provided in Appendices F.2 and F.3. The models can be adapted as needed for municipal use.
- Frontage lmprovement Requirements for New and Redevelopments – after developing a sustainable streets policy to create a policy nexus, it is then possible to require integration of green infrastructure and complete street improvements into the frontage areas of appropriate development projects. This is the approach promoted as part of Typology 4 described in Section 4 and is typically achieved through conditions of approval. Appendix F.4 provides model language requiring green infrastructure development standards for new buildings, and Appendix F.5 provides example conditions of approval.

Adopting a sustainable streets policy establishes a foundation for adding sustainable streets language to other municipal planning documents, developing municipal ordinances as needed, and applying conditions of approval to development projects. The flow chart in Figure 5-11 illustrates the relationships among the various options for policy-based sustainable street implementation. More detail and background on policy considerations—along with the language and format needed to draft sustainable street policies, resolutions, and conditions of approval—are included in Appendix F.



Resources in Appendix F:

Appendix F-2: Model Municipal Planning Document Language

Appendix F-3: Model Sustainable Streets Resolution & Policy

Appendix F-4: Model Resolution Establishing Green Infrastructure Development Standards

Appendix F-5: Model Conditions of Approval for Development Projects

Figure 5-10: Policy Approaches for Sustainable Street Improvements

5.4 Implementing Sustainable Streets: Funding Strategies

PUBLIC SECTOR FUNDING

- Typology 1: Curb Extensions
- Typology 2: Connectivity Improvements
- Typology 3: Streetscape Projects

PRIVATE SECTOR FUNDING

- Typology 4: Frontage Improvements

Figure 5-11: Probable Sectors Responsible for Funding for Different Typology Projects

Key Strategies for Funding Sustainable Streets

Dedicated funding programs have historically been limited for sustainable streets, with programs focusing on funding one part of an integrated streetscape project. A common perceived barrier to funding sustainable streets is that green infrastructure elements may be considered ineligible for funding through transportation grants, and transportation elements may be ineligible via resource agency grants. Recent collaborative work between transportation and resource agency representatives and advocates has focused on identifying the ways in which integrated projects can be funded through single sources of funding. The Regional Roundtable for Sustainable Streets led by the Bay Area Stormwater Management Agencies Association (BASMAA) developed a Roadmap of Funding Solutions for Sustainable Streets and funding fact sheets to clarify the ability to implement sustainable street projects with various transportation funding sources (BASMAA, 2018).

One outcome of these analyses has been a focus on how integrated components of sustainable street projects support the goals and objectives of different funding programs and how components can be characterized in funding proposals to demonstrate integrated benefits. For example, a resource agency funding program focused on water quality outcomes that would not be an obvious source of funding for active transportation elements may also have a secondary goal of greenhouse gas emission reductions, something a green street project would have difficulty demonstrating without inclusion of active transportation components. Similarly, characterizing green infrastructure elements in a transportation project as solely focused on water quality improvement may limit eligibility, but when also included as a means of addressing drainage and enhancing safety, become fully eligible.

Transportation Dollars Can Fund Sustainable Streets

CASE STUDY: CAROLAN AVENUE COMPLETE STREETS AND ROAD DIET PROJECT

The Carolan Avenue Complete Streets and Road Diet project in the City of Burlingame used transportation funds to incorporate sustainable street features, including green infrastructure elements. The project was fully funded by a combination of local and federal Congestion Mitigation and Air Quality Improvement Program funds (CMAQ) through the Metropolitan Transportation Commission's One Bay Area Grant Program. Local funds were used for project engineering and design and CMAQ funds for construction. The project proposal indicated bulb-outs would incorporate "proper and appropriate storm drainage facilities at each bulb-out location. The bulb-out landscaping will utilize sustainable green landscaping concepts, such as use of native plants and bio-swales," illustrating the importance of how project components are characterized for funding agency consideration.

Sustainable Street Components:

- Road diet
- Class II bike lanes
- ADA-compliant curb ramps
- Intersection and mid-block bulbouts with green infrastructure

5.4 Implementing Sustainable Streets: Funding Strategies

IMAGE CREDIT: LOTUS WATER

Given the transportation focus of sustainable street projects, transportation funding programs are a key source of sustainable street project funding. Typically, to be fully eligible, the project's overall driver must remain transportation improvements, and stormwater management features must be included and designed to enhance or complement the transportation-based project. Integral to this sustainable street funding solution is understanding and illustrating the types of benefits that green infrastructure can have for transportation projects. Examples from the BASMAA assessment include:

- Curb extension projects can include rain gardens or stormwater planters to address the drainage challenges presented by bulb outs as well as buffer pedestrians from traffic.
- Road diet projects can include both bicycle lanes and stormwater planters to provide a buffer between bicyclists and motor vehicle traffic.
- Street rehabilitation projects can incorporate pervious pavement to address local drainage issues, visually narrow roadways for traffic calming purposes, and provide aesthetic enhancements.
- Landscaping with green infrastructure can provide benefits to the pedestrian realm as well as pedestrian safety improvements.

Table 5-1 presents key transportation funding sources which can be used to fund different types of sustainable streets projects.

Cost-constrained agency and municipal budgets are another major barrier to sustainable street implementation. To help reduce dependence on public sources, a focus of this planning effort was developing tools to facilitate projects that can be funded by other sectors. Projects in the frontage zone of new developments (Typology 4 projects) can be funded by the private sector and can be implemented through the policy mechanisms outlined in Section 5.3. Figure 5-11 classifies the different project typologies by the sector most likely to be responsible for project funding (public or private).

Table 5-1: Potential Transportation Funding Sources for Sustainable Street Projects

Funding Program	Administering Agency	Purpose/Description	Applicable Sustainable Street Typologies
Affordable Housing and Sustainable Communities Program (AHSC)	Strategic Growth Council and Department of Housing and Community Development	The Program funds land-use, housing, transportation, and land preservation projects to support infill and compact development that reduce greenhouse gas emissions. The Program included $550M in its latest round. (California Climate Investments)	• Typology 1 • Typology 2 • Typology 3 • Typology 4
Congestion Mitigation and Air Quality Improvement (CMAQ) Program	Federal Highway Administration (FHWA)	The purpose of the CMAQ program is to provide a flexible funding source to State and local governments for transportation projects and programs to help meet the requirements of the Clean Air Act. The program supports surface transportation projects and other related efforts that contribute air quality improvement and provide congestion relief.	• Typology 1 • Typology 2 • Typology 3
Highway Safety Improvement Program (HSIP)	Caltrans Local Assistance/ FHWA	The Program funds work on any public road or publicly owned bicycle or pedestrian pathway or trail, or on tribal lands for general use of tribal members, that improves the safety for its users. Project maximum funding- $10M. Solicitation varies from annually to semi-annually.	• Typology 1 • Typology 2 • Typology 3
Local Partnership Program (LPP)	California Transportation Commission	The primary objective of this program is to provide funding to counties, cities, districts, and regional transportation agencies in which voters have approved fees or taxes dedicated solely to transportation improvements or that have imposed fees, including uniform developer fees, dedicated solely to transportation improvements. Funding includes $200M/ year to improve aging Infrastructure, Road Conditions, Active Transportation, Transit and rail, Health, and Safety Benefits.	• Typology 1 • Typology 2 • Typology 3
Local Streets and Roads (LSR) Program	California Transportation Commission	The purpose of the program is to provide approximately $1.5 billion per year to cities and counties for basic road maintenance, rehabilitation, and critical safety projects on the local streets and roads system.	• Typology 1 • Typology 2 • Typology 3
Sustainable Communities Planning Grants	Caltrans Division of Transportation Planning	The program includes $29.5 million to encourage local and regional planning that furthers state goals, including, but not limited to, the goals and best practices cited in the Regional Transportation Plan Guidelines adopted by the California Transportation Commission.	• Typology 1 • Typology 2 • Typology 3 • Typology 4

Table 5-1: Potential Transportation Funding Sources for Sustainable Street Projects (continued)

Funding Program	Administering Agency	Purpose/Description	Applicable Sustainable Street Typologies
Transformative Climate Communities (TCC)	Strategic Growth Council and Department of Conservation	The Program funds community-led development and infrastructure projects that achieve major environmental, health, and economic benefits in California's most disadvantaged communities. (California Climate Investments)	• Typology 2 • Typology 3
Urban Greening Grants	California Natural Resources Agency	The Program supports the development of green infrastructure projects that reduce GHG emissions and provide multiple benefits. Must include at least one of the following: • Sequester and store carbon by planting trees • Reduce building energy use by strategically planting trees to shade buildings • Reduce commute vehicle miles traveled by constructing bicycle paths, bicycle lanes or pedestrian facilities that provide safe routes for travel between residences, workplaces, commercial centers, and schools. (California Climate Investments)	• Typology 2 • Typology 3
One Bay Area Grant Program	Metropolitan Transportation Commission (MTC)	Provides funding for active transportation improvements, Safe Routes to School projects, and streetscape improvements.	• Typology 1 • Typology 2 • Typology 3
Active Transportation Program	California Transportation Commission (CTC)	Provides funding for active transportation programs that focus on safety improvements, and may cover applicable landscape or green infrastructure improvements linked with active transportation.	• Typology 1 • Typology 2 • Typology 3
TDA Article 3	MTC establishes guidelines; counties administer funding per MTC guidelines	Provides funding for intersection safety improvements that incorporate bulbouts and curb extensions.	• Typology 1 • Typology 2 • Typology 3
Transportation for Livable Communities	Counties administer Transportation for Livable Communities funding (Source: BASMAA, 2018)	Provides funding for active transportation projects, improving corridor connections, and/or improving commercial cores and high-density neighborhoods. Eligible improvements include: green infrastructure and streetscape improvements associated with multi-modal improvements, and complete streets for improving pedestrian safety.	• Typology 2 • Typology 3
Safe Routes to School	MTC establishes guidelines; counties administer funding per MTC guidelines.	Provides pedestrian safety improvements for crossings within school zones, including bulbouts and curb extensions.	• Typology 1 • Typology 2

Table 5-1: Potential Transportation Funding Sources for Sustainable Street Projects(continued)

Funding Program	Administering Agency	Purpose/Description	Applicable Sustainable Street Typologies
BUILD Grants	Federal Highway Administration (FHWA)	Previously known as TIGER Grants. National competition aimed at highway/ bridge bike/ped/passenger and freight rail/port/intermodal projects.	• Typology 1 • Typology 2 • Typology 3
Transportation Fund for Clean Air	Bay Area Air Quality Management District (BAAQMD)	Green infrastructure and other landscape improvements may be eligible due to carbon sequestration benefits.	• Typology 1 • Typology 2 • Typology 3
San Mateo County TA Measure A C/CAG Measure M SamTrans Measure W	Various agencies	Provides funding for projects that address active transportation improvements and green infrastructure.	• Typology 1 • Typology 2 • Typology 3

Funding Source References:

Bay Area Stormwater Management Agencies Association. Roadmap of Funding Solutions for Sustainable Streets. April 2018.

California Transportation Commission and Caltrans. Funding Programs That May Include Active Transportation Elements. 2020.

Special thanks to the funding source references above for providing detailed information about each funding program

IMAGE CREDIT: C/CAG

Chapter 6: Tools for the Future

Table of Contents

6.1 Tools for the Future: Project Planning

IMAGE CREDIT: PARADIGM ENVIRONMENTAL

Tools for Changing Streets in a Changing Climate

Street networks and their physical and political context are constantly changing and will need to evolve more quickly in the future to adapt to the challenges of climate change. The Master Plan is a living document; as context changes, more work will need to be done to envision additional projects. To assist with the siting and design of additional sustainable street projects, the Master Plan includes a set of tools that can be used to assess project feasibility and benefits in new locations.

Tools described in this Chapter include:

- Green Infrastructure Technical Suitability and Co-Benefit Maps
- Stormwater Curb Extension Feasibility Tool
- Drainage Management Area Assessment Tool
- Typical Details for Sustainable Streets
- Sustainable Street and Green Infrastructure Tracking Tool

Technical Suitability and Co-Benefit Maps

The Master Plan assessment process used four categories of criteria to evaluate feasibility and benefits of potential sustainable street projects and to prioritize them for municipal consideration. These included three categories that assessed technical suitability criteria and one category assessing additional community and environmental benefits. The categories are:

- Runoff Capture Benefits
  - Water Quality Benefit
  - Flood Control Benefit: Within Watershed of Flood-Prone Channel
  - Located in a PCB Interest Area
  - Augments Water Supply: Above Groundwater Basin and Outside Contamination Area
  - Severity of Climate Change Impacts: Runoff Increase from Transportation Network
- Infiltration Feasibility
  - Hydrologic Soil Group
  - Depth to Groundwater
  - Groundwater Contamination
  - Slope
- Site Space Constraints
  - Available Width for Green Infrastructure per Street Class
  - Available Length for Green Infrastructure per Block
  - Major Utility Conflicts
- Co-Benefits
  - Vulnerable Community Indicators
  - Community Health Indicator: Vehicle Ownership
  - Urban Heat Island Index
  - Tree Canopy Coverage
  - Pavement Condition Index

IMAGE CREDIT: SFPUC

6.1 Tools for the Future: Project Planning

IMAGE CREDIT: SFPUC

Appendix G of the Master Plan contains a series of maps presenting the data for these criteria in aggregated and unaggregated form spatially across San Mateo County. These are also provided in a story map format in webmaps (see screen capture example in Figure 6-1 and see flowstobay.org/ssmp for online versions of the maps). These maps are tools for municipal staff and community members to use when conducting planning scale evaluation of the benefits and constraints of future sustainable street projects. The spatial data used to create these maps has also been shared with municipal staff to use in more detailed site-specific investigations. In addition, a database of the project opportunities has been provided to the municipalities that includes an editable prioritization scoring matrix. This database includes directions on how to refine the scoring matrix or project data to update the prioritization results and re-output results into updated GIS maps.

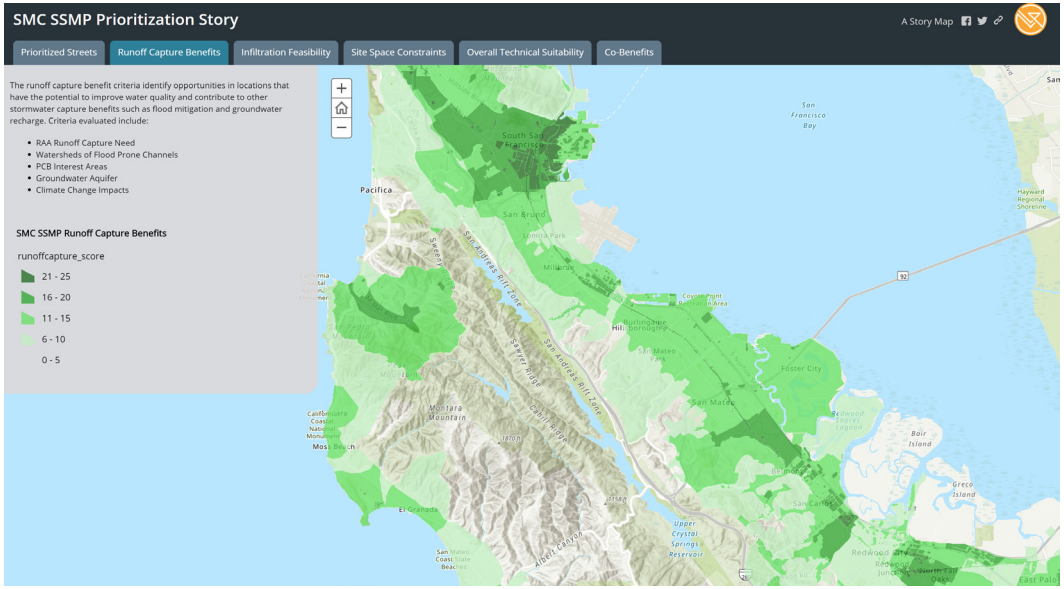
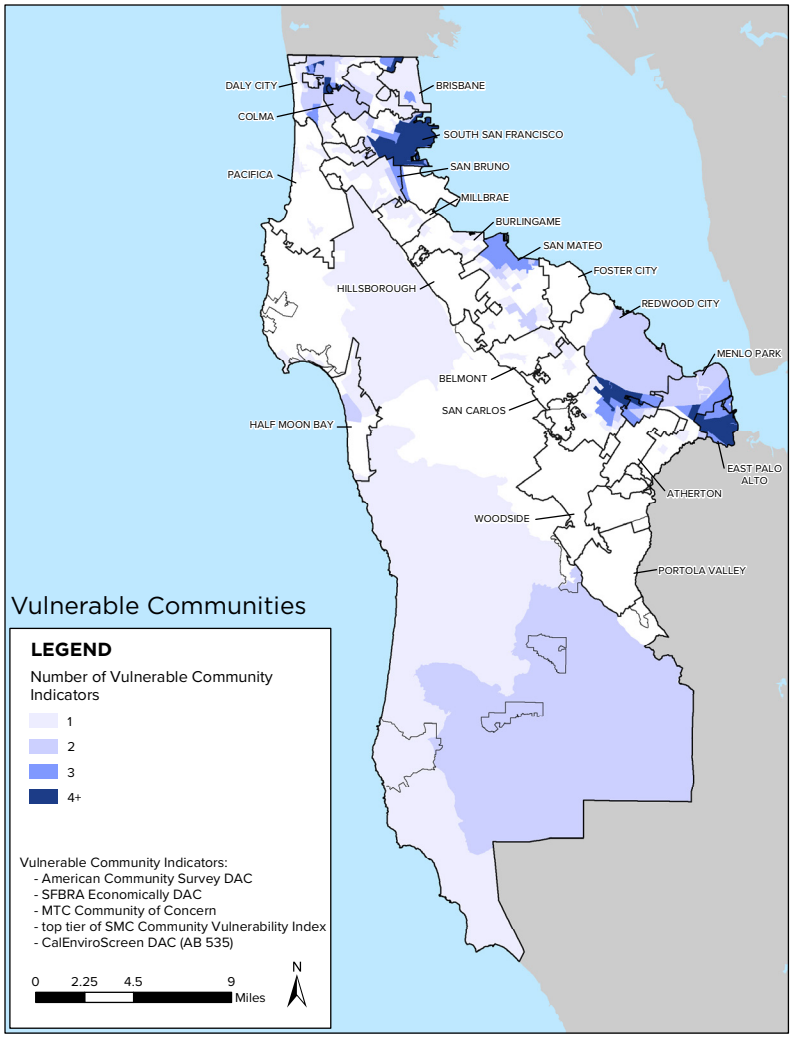


Figure 6-1: Prioritization Storyboard Provided in Webviewer



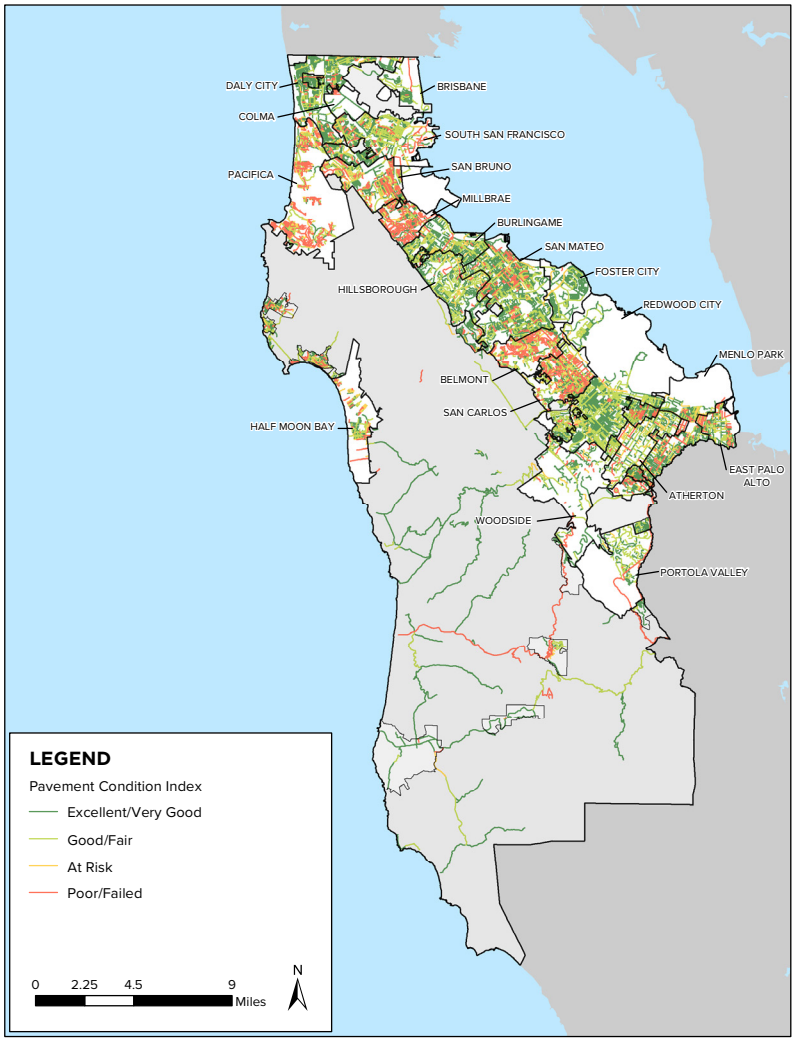


Figure 6-2: Example maps showing technical suitability and community benefit factors for agency staff and stakeholders to consider in locating future projects.

6.1 Tools for the Future: Project Planning

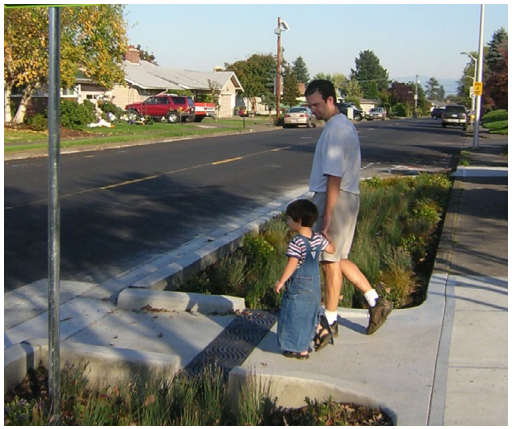
IMAGE CREDIT: CD+A

Stormwater Curb Extension Feasibility Tool

Sustainable Street Curb Extensions are one of the most common sustainable street design tools. These curb extensions are modifications at intersections and mid-block crossings, such as bulb-outs, that narrow pedestrian crossing distances, calm traffic and contain green infrastructure facilities. They are generally paired with crosswalks and are often used as part of Safe Routes to School and Safe Routes to Transit efforts.

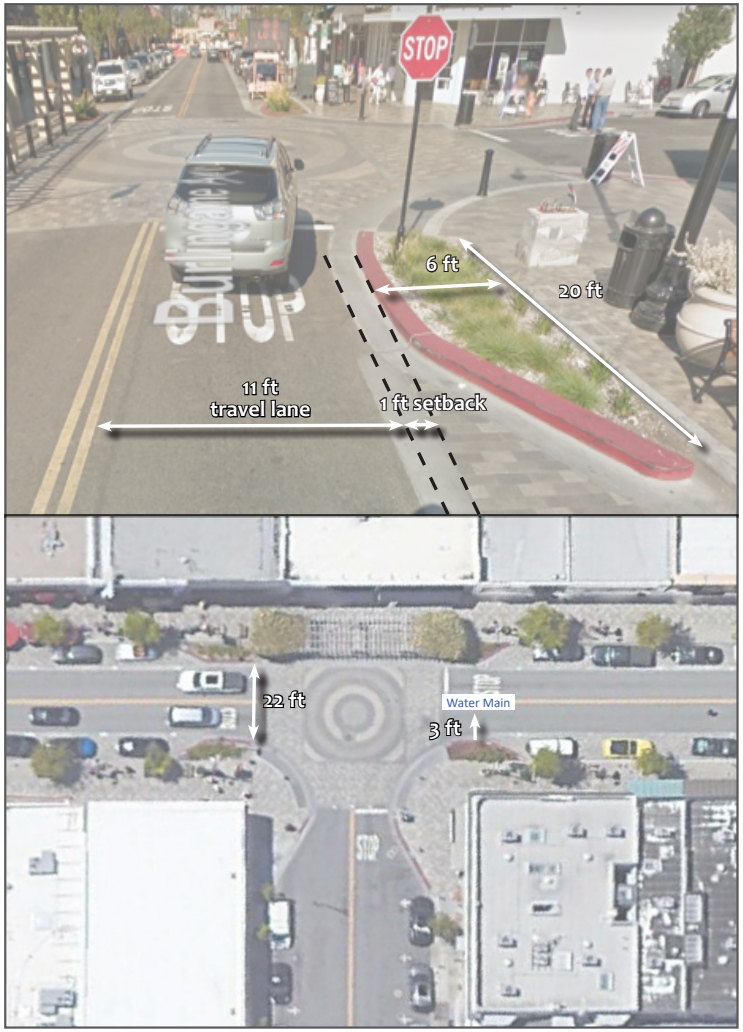
To facilitate feasibility assessment of this type of project opportunity, the Master Plan includes a new Stormwater Curb Extension Feasibility Tool. This tool is designed to facilitate rapid assessment of the feasibility of including bioretention in curb extensions, and provides instructions and examples of the data, maps, and images needed to complete the assessment. The tool outlines the sizing and design criteria, includes a simple checklist for assessment, and provides visual examples of where to make the measurements. The tool is included in Appendix H of this document.

IMAGE CREDIT: PARADIGM



Example Sustainable Street Curb Extensions

STORMWATER CURB EXTENSION - FEASIBILITY CRITERIA



Intersection of Burlingame Ave and Park Road in Burlingame, CA

TABLE 1 - SIZING AND DESIGN CRITERIA

CURB EXTENSION SIZING	
Width	Standard: 6 ft
	Typical: 6 - 7 ft (not including 1 ft setback from curb)
Length[1]	Minimum: 20 ft
	Typical: 20 - 25 ft
Sidewalk Through-way Width	Minimum: 5 ft
DMA Sizing Ratio	Range: 2.5%-5%
	Typical: 4%
DESIGN RESTRICTIONS[2]	
Fire Hydrants	Can't encroach on access
Bus Pad	
Driveway	Must have 2 ft of separation from curb ext.
Existing Roadway Width	Can't be less than corresponding minimum width in Table 2
DESIGN CONSTRAINTS	
Water Main	3 ft of horizontal separation
Duct Bank[3]	
Mature Trees[4]	Outside drip-line or 10x diameter at breast height
Power Poles[5]	Can't be located within planter
Catch Basins	If bulbout will be underdrained, there must be a catch basin at intersection
Bus Stop	Must be room to move bus stop to before bulbout
Existing Sidewalk Width	Meets ADA code (5 ft through-way width)

1 - Assumes 5 ft tangent after S-curve.
2 - Costs to address these constraints often make stormwater curb extensions infeasible.
3 - PG&E requirement, can obtain variance to protect in place through gravel layer.
4 - If tree obstructs line of sight at intersection, risks encroaching on power lines, or is in poor condition, then it may need removal and therefore should not be considered a constraint.
5 - Curb extension design can be adjusted to avoid pole. May reduce sizing ratio and increase cost.

TABLE 2 - MINIMUM ROADWAY WIDTH CRITERIA

Roadway Type	Min. Allowed Width of Travel Lane Nearest to Curb Ext. (ft)	Min. Curb-to-Curb Roadway Width for Curb Extensions[6]	
		2-Lane Road	4-Lane Road
Residential	10	34	54
Transit Route	11	36	58
Freight Route or Industrial	12	38	62
Residential + Bike Lane[7]	15	44	74

6 - Assumes extensions on both sides of roadway with min. width of 6 ft and a 1 ft setback from face of new curb.
7 - Assumes bike lane on both sides of roadway. If only on one side, subtract 5 ft from the total width needed.

Credited by Lotus Water: www.lotuswater.com

Figure 6-3: Example Pages from the Stormwater Curb Extension Feasibility Tool

6.1 Tools for the Future: Project Planning

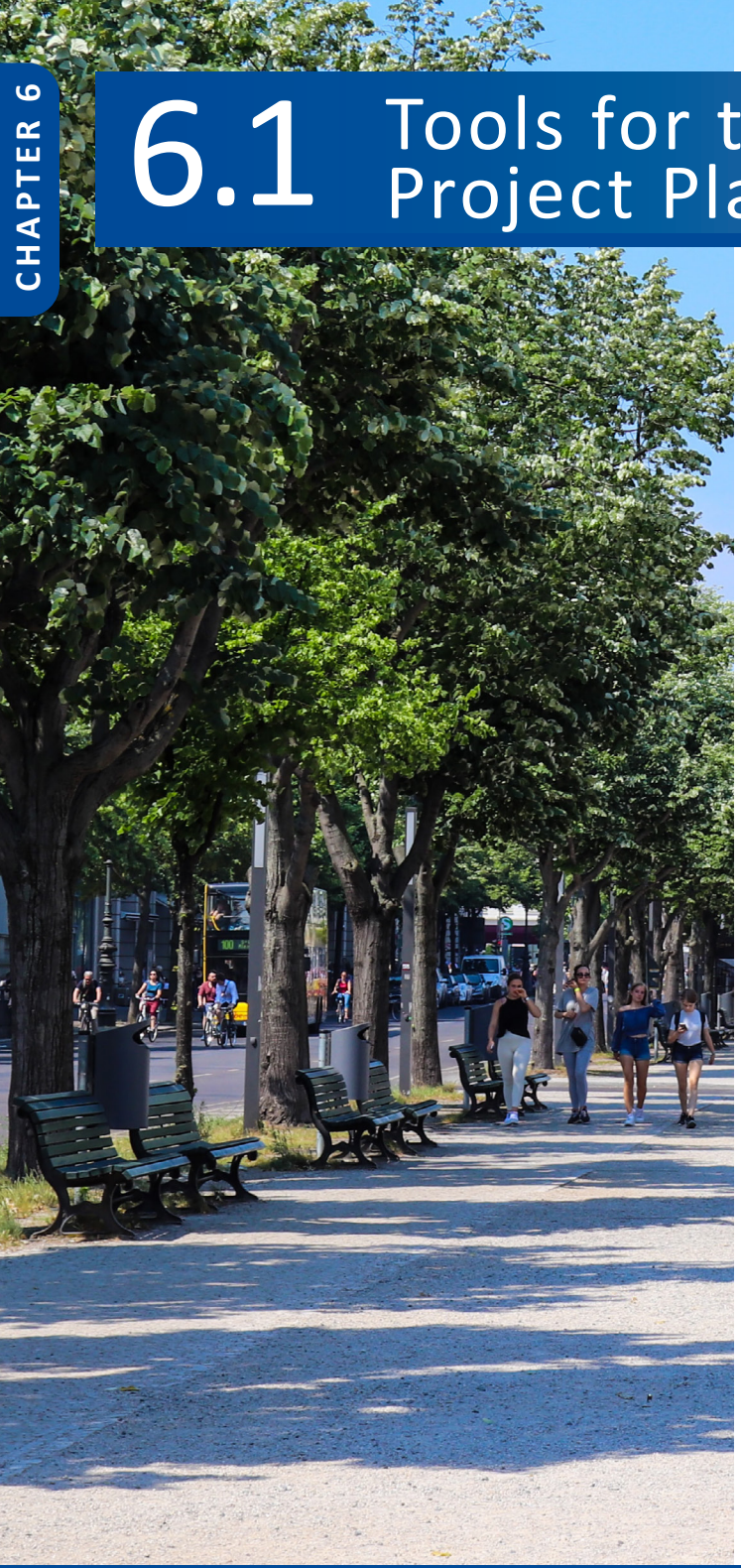


IMAGE CREDIT: CD+A

Drainage Management Area Assessment Tool

To support the identification of sustainable street opportunities and assessment of their potential benefit in terms of capturing and/or treating stormwater runoff, it is important to understand the drainage area addressed by each project. The flow path of urban runoff is typically influenced by nuanced differences in street grade and placement of storm drain infrastructure. Often, cases exist where opposite sides of the street drain to different locations. To evaluate drainage patterns and streamline future efforts for rapid identification of potential sustainable streets projects, high-resolution imaging products were leveraged to delineate drainage areas to thousands of storm drain catch basins throughout the county. Catch basins represent the most downstream point to capture stormwater runoff from roadways before the runoff enters the storm drain. The resulting catch basin drainage areas developed for the Master Plan can be used for future identification and rapid assessment of sustainable streets project opportunities. Additionally, the drainage analysis will help municipalities understand and plan for appropriate green infrastructure locations based on site drainage patterns. For example, municipalities can use the tool to identify when side streets may impact drainage patterns along longer, linear corridor projects.

The countywide coverage of catch basin drainage areas was loaded into a Drainage Management Area Assessment Tool, a web-based map viewer that project planners can reference in the future to obtain quick estimates of project drainage areas (Figure 6-4). The catch basin drainage areas are intended for planning-level analysis and should always be followed by field surveys to confirm and/or refine drainage management area estimates. Field investigations incorporate knowledge of observed street and adjacent property drainage patterns and include the relationships between catch basins located on private properties and those in the public right-of-way.

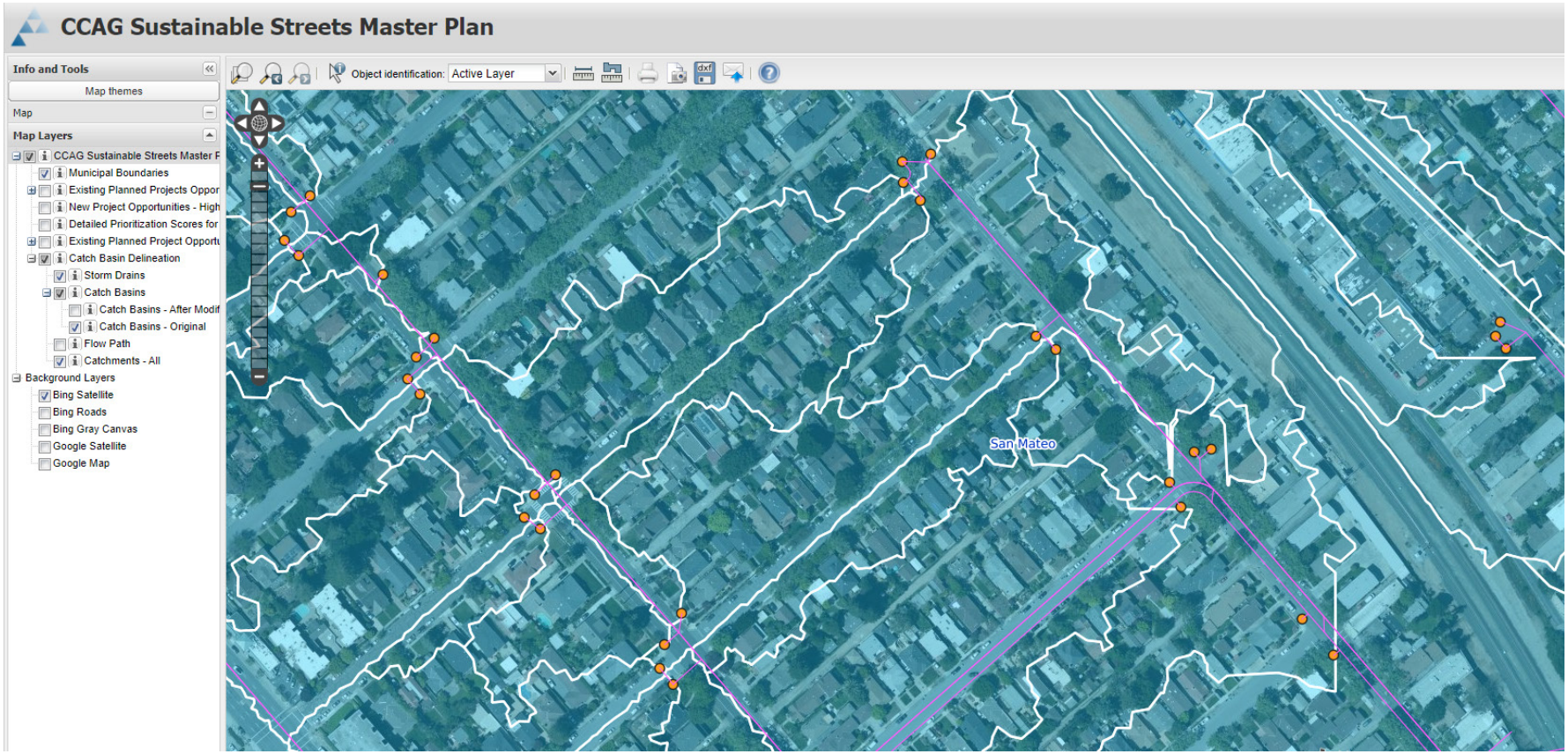


Figure 6-4: Web-based Drainage Management Area Assessment Tool

6.2 Tools for the Future: Project Implementation

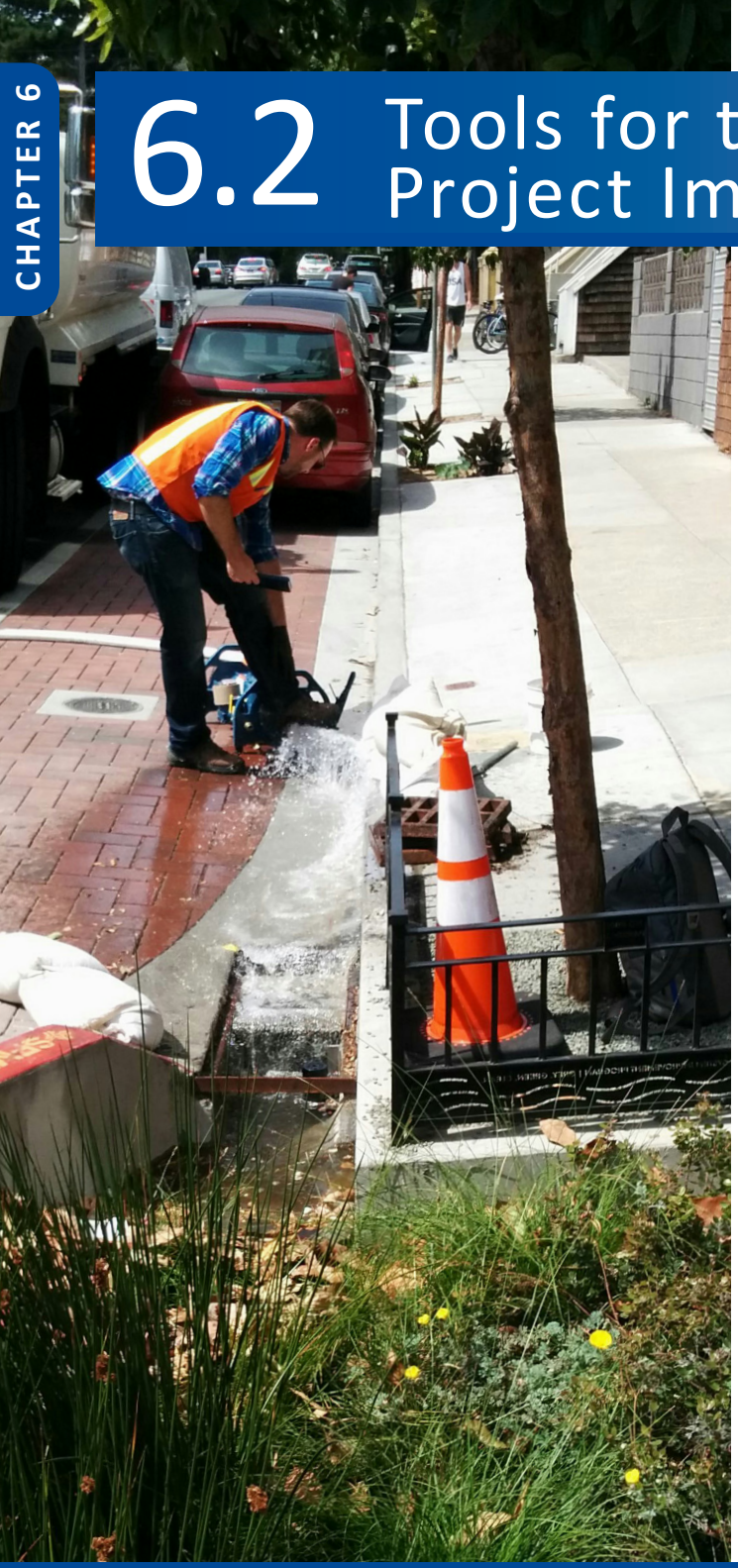


IMAGE CREDIT: LOTUS WATER

Typical Details for Sustainable Streets

Another significant obstacle to sustainable street implementation has been the lack of typical details and specifications for engineers and landscape architects to use in detailed project design, particularly for projects which include green infrastructure. Municipalities across the Bay Area have been making significant progress to remedy this deficiency. C/CAG recently undertook an effort to compile the best available green infrastructure details, including many developed by the San Francisco Public Utilities Commission, and provide guidance on how to customize them for use for San Mateo County. These details are included in the C/CAG Green Infrastructure Design Guide (GI Design Guide). The Master Plan team reviewed the details available in the GI Design Guide, as well as new details developed by C/CAG member agencies since the publication of the GI Design Guide, to compile additional details needed to facilitate sustainable street implementation. The team also requested suggestions for new details to facilitate sustainable streets from C/CAG member agencies, and developed one additional detail variation as part of this project. A catalogue of details applicable to sustainable street projects, including new details and modified versions of those in the GI Design Guideare included in Appendix J. In addition, Appendix J contains all new or updated versions of the details. The list below presents a subset of the key new details developed since GI Design Guide publication and made available as part of the Master Plan.

- Hydraulic Connection under/through a Curb Ramp at a Street Corner
- Stormwater Barrier Planter – Class 4 Bikeway (Plan and Section)
- Stormwater Curb Extension for Street with Valley Gutter (Plan and Section)
- Tree Well Filter for Street with Parking (Plan and Section)
- Timber Foot Bridge over Bioretention Basin
- Bioretention Barriers to Improve Pedestrian Safety and Comfort (metal fencing, wood fencing, and seat wall)
- Bioretention Edge Treaments for Pedestrian Applications
- Bioretention Inlets with Trash Capture

The new and updated details will also be eventually incorporated into the GI Design Guide. The table provided in Appendix J defines which details apply to each sustainable street typology. Figures 6-5 and 6-6 present some examples of sustainable street details included in the catalogue.

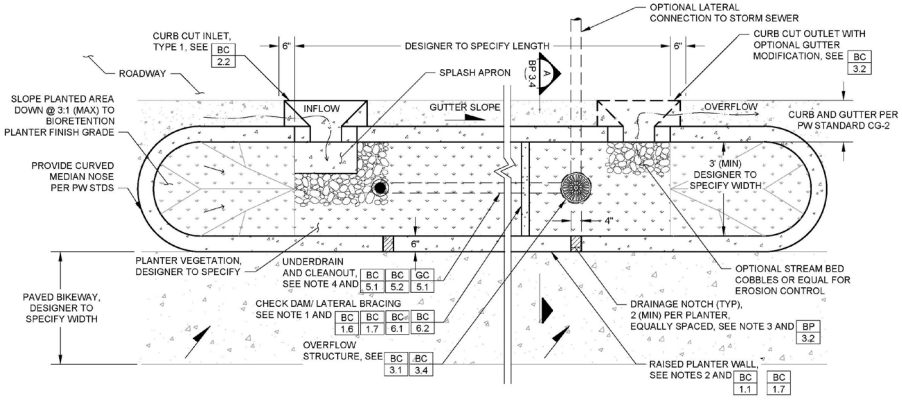


Figure 6-5: Example Sustainable Street Detail: Bioretention Buffer for Separated Bikeway

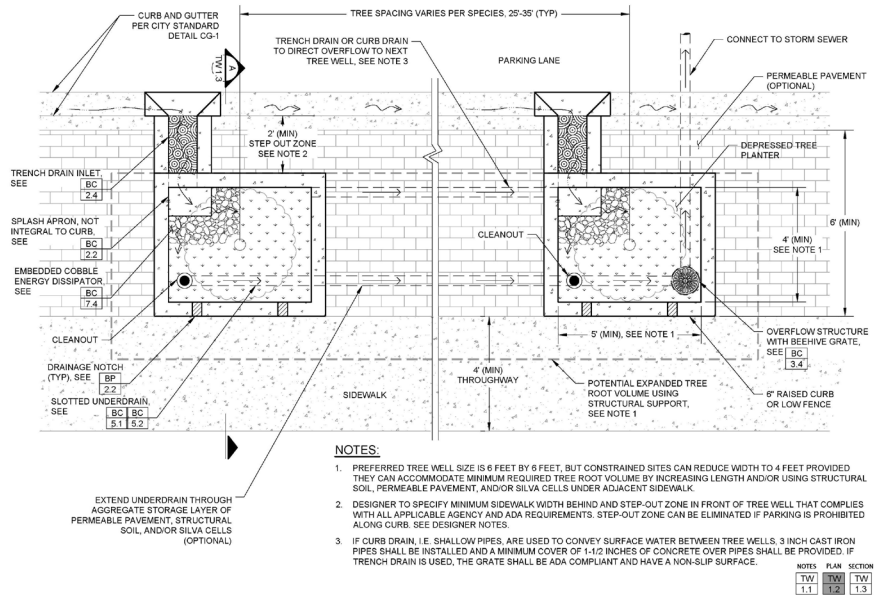


Figure 6-6: Example Sustainable Street Detail: Connected Stormwater Tree Wells

6.3 Tools for the Future: Project Tracking

IMAGE CREDIT: PARADIGM ENVIRONMENTAL

Sustainable Street and Green Infrastructure Project Tracking Tool

Municipalities in San Mateo County are responsible for an array of transportation and stormwater programs that benefit from tracking of sustainable streets and green infrastructure projects. The Sustainable Street and Green Infrastructure Project Implementation Mapping and Tracking Tool (Tracking Tool) was developed to support municipalities in tracking green infrastructure and implementation of sustainable streets from the Master Plan and provide a "dashboard" to demonstrate the benefits of these projects in terms of adaptation to climate change impacts and water quality improvement. The tool will track a variety of green infrastructure, including sustainable streets and other structural stormwater controls associated with private development. The Tracking Tool provides functionality and outputs that will track implementation of projects in the Master Plan over time, while also tracking related benefits for water quality improvement and stormwater capture. The dynamic mapping and visualization of the Tracking Tool can also support a variety of efforts, including public outreach, discussions with public officials, and engagement of potential funding partners and other interested stakeholders to continue to build support for green infrastructure and sustainable street implementation.

At the most basic level, the Tracking Tool tracks the location and type of each project. The locations of projects are shown on a dynamic map along with key base layers (watershed boundaries, waterbodies, city boundaries, storm drains, etc.). The user may click on any project and view more information regarding that project including its type (sustainable street, LID on a parcel, regional facility, etc.).

The Tracking Tool also includes algorithms to quantify performance metrics and tracking of progress toward key implementation goals, including the following:

1. **Estimate of total area and impervious area treated:** for each project, the user can provide information on capture area or the system will estimate 'default' values.
2. **Stormwater volumes managed during the annual average year:** the Tracking Tool includes algorithms that estimate stormwater runoff volumes managed with green infrastructure using methods that are consistent with the Green Infrastructure Plans and C/CAG's hydrologic and stormwater capture modeling system. The stormwater volume metrics are also useful for the Countywide Stormwater Resource Plan (which encourages tracking of stormwater volume capture) and for engaging third parties that are interested in broader water resources programs such as water supply.
3. **Progress toward implementation goals:** the Tracking Tool includes a user-editable database of compliance/implementation goals from the Master Plan (and/or other programs) and provides graphics that aid users in visualizing progress toward those goals.
4. **Climate change mitigation:** based on climate change modeling conducted under the Master Plan (Section 3 and Appendix A), metrics that link green infrastructure to mitigation of climate change impacts are estimated.

The Tracking Tool offers an array of options for filtering and visualizing data that make it a powerful tool for a variety of purposes. The Tracking Tool can show details, performance metrics, and benefits for any individual project of interest. Figure 6-7 shows an example view of the types of project-level information that can be tracked and displayed by the Tool (for direct access to the Tool go to flowstobay.org/ssmp).

Additionally, the Tracking Tool allows users to understand the cumulative benefits of their projects and can gain key insights by focusing on specific attributes. For example, municipalities can filter by projects that are located within their jurisdiction, project type, project status, date of construction, and many more options to gain a broader understanding and more readily adjust strategies for achieving implementation goals. Additionally, the robust mapping capabilities of

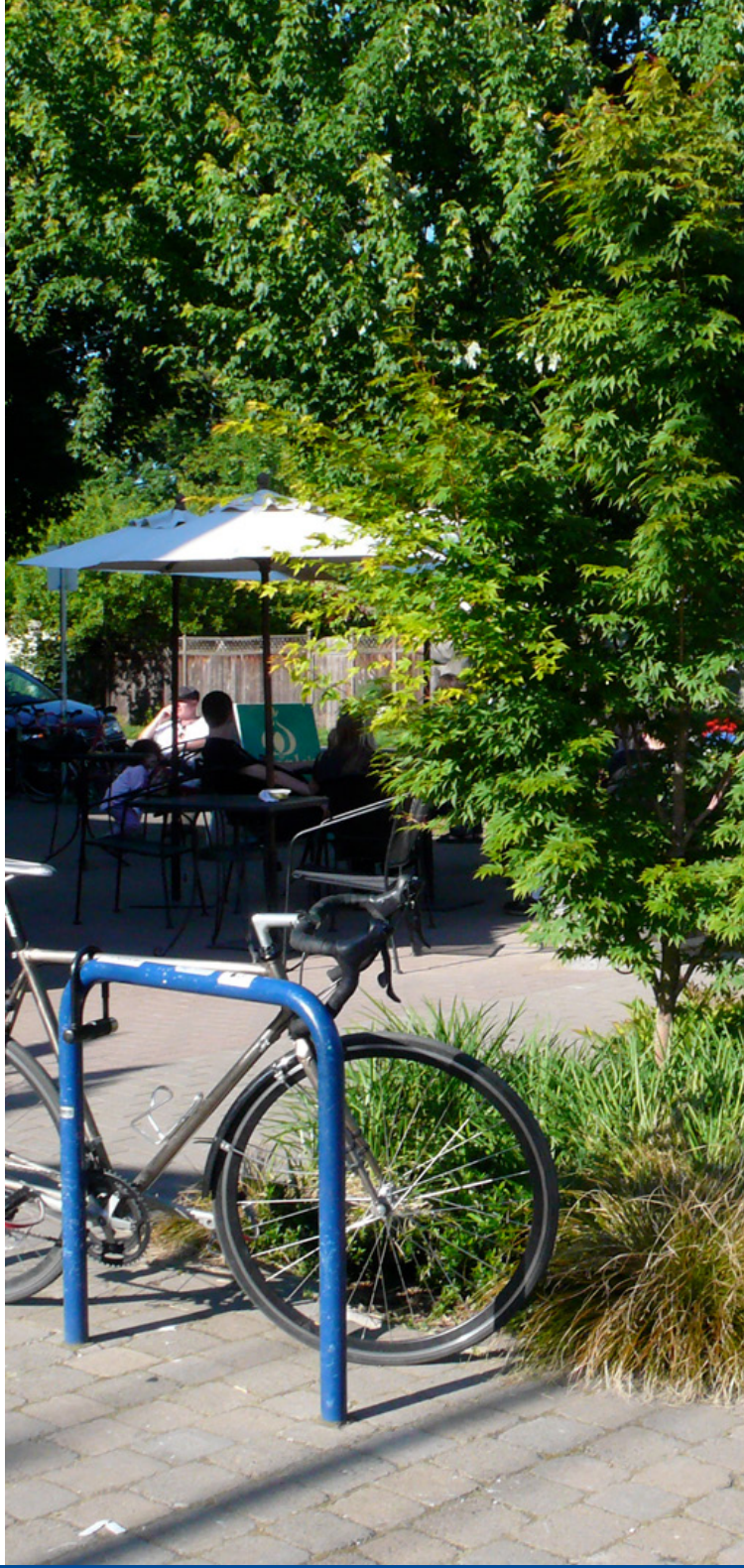


IMAGE CREDIT: CDA

6.3 Tools for the Future: Project Tracking

the Tracking Tool allow users to determine at a glance where projects are concentrated and where future efforts may need to be focused. Figure 6-8 shows an example of an overview of the Tracking Tool dashboard that shows options for filtering, mapping of project locations, and visualizations of cumulative project benefits.

While the main focus is to track progress towards implementing projects from the Master Plan, the Tracking Tool may also be used as a powerful planning tool. The option to enter planned projects into the database is available, which allows users to quantify the expected benefits of the project and to update details and corresponding estimates as the project design evolves.

Figure 6-7: Mapping and visualization of project-level benefits in Tracking Tool

The Tracking Tool is designed in a modular, flexible framework such that other programs, goals, and metrics could be integrated over time. For example, in future phases, the tool could track metrics related to flood control such as peak flow reduction. Climate change modeling can be updated with better data and techniques as understanding of climate science improves. The Tracking Tool could also be updated to estimate triple bottom line benefits, such as carbon sequestration, public health benefits, heat island reduction, and water supply augmentation, that help demonstrate the value of green infrastructure and sustainable streets.

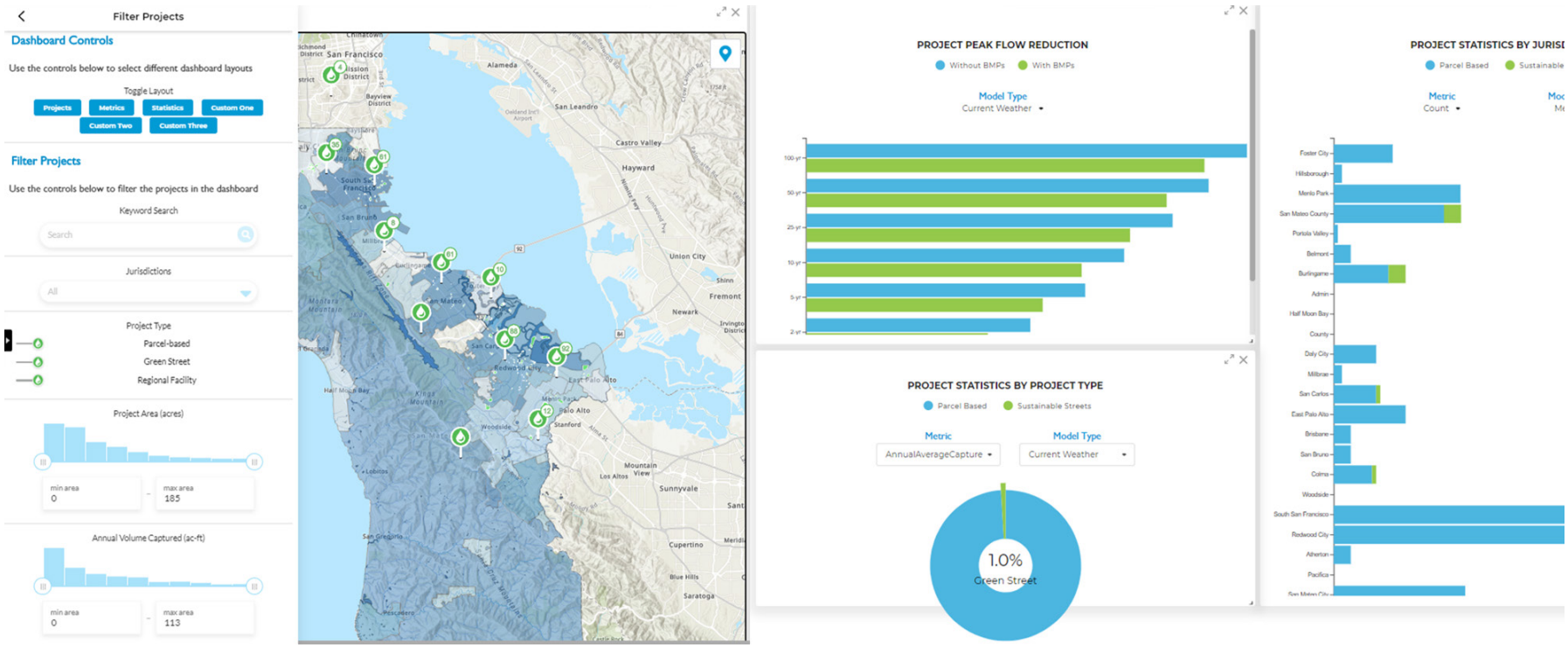


Figure 6-8: Tracking Tool dashboard for countywide mapping of projects and visualization of cumulative benefits.

6.4 Adaptive Management of the Plan

The Master Plan was developed with adaptive management at the forefront, which is demonstrated by the tools developed for San Mateo County's municipalities.

Updating the Master Plan over Time

Adaptive management will be key to ensuring that the Master Plan is implemented effectively and remains relevant as municipalities make progress towards implementation goals for sustainable streets projects. "Adaptive management" is an iterative process of decision-making and implementation of a plan that relies on monitoring of implementation progress, evolving objectives, and improvements in available data so that the Master Plan continues to be relevant to the community despite future uncertainty and a changing context. The Master Plan was developed with adaptive management at the forefront, which is demonstrated by the tools that were developed for San Mateo County's municipalities. These tools establish the Master Plan as a "living" document that will continue to be updated to incorporate sustainable street projects as they are identified. The tools discussed above are intended to guide future projects through identification and conceptualization (planning; Section 6.1), design and construction (implementation; Section 6.2), and tracking of benefits and plan implementation (Section 6.3). These tools provide municipalities with resources to guide sustainable street projects through all phases to completion, resulting in a more effective and relevant plan.

Adaptive management allows the plan to continue to serve as a useful planning tool for guiding project implementation. As projects are implemented and lessons are learned through wider scale integration of sustainable streets projects, the Master Plan will be periodically revised to update the project implementation plan. Throughout implementation of the Master Plan, C/CAG, via the Board of Directors and its committees, will continue to meet to discuss sustainable street planning efforts. An update of the Master Plan can include the following elements:

- **Updates to the prioritization metrics and the evaluation of new project opportunities.** The prioritization process utilized a simple, intuitive data-driven method for evaluating multiple priorities for sustainable streets. The scoring rubric is designed to be transparent in how prioritization scores are calculated and can be easily followed, replicated, and added to, facilitating future updates to the project identification and prioritization. Future updates to the Master Plan can consider new metrics that accommodate other programs and performance metrics. For example, the prioritization can be updated to incorporate goals related to updated stormwater permits or other programs. An update to the Master Plan prioritization analysis can include re-scoring for projects in the plan that have not yet been implemented as well as scoring for newly identified projects.

IMAGE CREDIT: JENNIFER LEE

6.4 Adaptive Management of the Plan

IMAGE CREDIT: K. PERRY

- **Updates to transportation-related priorities and integration of active transportation plans.** The Bay Area's transportation priorities and goals are constantly evolving as the the region grows and changes. Climate change and the need to equitably address transportation needs and the health impacts on our most vulnerable communities will be one of the drivers of this evolution in the future. The evolution of active transportation planning in the county is reflected in the development, both recent and in-process, of new pedestrian and bicycle plans for communities across the area. As an example, at the time this Master Plan was drafted, C/CAG was in process of updating its Comprehensive Bicycle and Pedestrian Plan. Comprehensive cross-jurisdictional planning for regional connectivity will be critical in future development of the County's active transportation networks. As the transportation visioning process evolves and new plans, projects, and policies are developed, the Master Plan will need to evolve and be updated too.
- **Updates to climate change adaptation modeling based on new data and research.** Climate change is an ongoing field of science and the available research and data will continue to improve into the future. The Master Plan can be updated to incorporate the latest advances in the state-of-science to better understand the benefits of sustainable streets projects in creating climate resiliency. This can include updates to project prioritization methods and the models included in the Tracking Tool to estimate the benefits of implemented and planned projects.
- **Continued community outreach to create awareness for sustainable streets projects and receive input on community values and priorities.** The materials created during the development of the Master Plan can be updated and built upon for future community outreach. The engagement process can be adapted for future project opportunities. In this way, future projects will continue to represent the current priorities and values of the community as it evolves. To support ongoing outreach regarding the implemenation of the Master Plan, C/CAG's website (www.flowstobay.org) will continue to serve as a repository of information, which can be integrated within future updates of the Master Plan.

- **Additional studies and tools to support project implementation.** Additional tools and analyses can be developed to add to the "toolkit" supporting implementation of sustainable streets. Examples include the assessment and development of a "Quick-Build" toolkit for sustainable streets. "Quick-Build" design and implementation strategies are currently being pursued to facilitate faster implementation of active transportation projects; a tool which assesses and generates strategies for projects which also contain green infrastructure could be designed. This could be paired with identification of "Quick-Build" project opportunities to facilitate faster implementation of projects throughout San Mateo County.
- **Support for additional project types.** The Tracking Tool may be updated in the future to track the benefits of multi-jurisdictional regional stormwater projects. The tracked metrics can help support discussions for credit-trading or cost-sharing mechanisms.
- **Tracking of potential funding sources.** The Tracking Tool can be updated to track the funding sources of implemented projects. Municipalities can utilize citywide reporting and visualizations to gain insight into the usage breakdown between private, municipal, and grant funds and to identify when a specific funding category may be underutilized.

IMAGE CREDIT: C/CAG

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A *Climate Adaptation Risk Analysis for the San Mateo Countywide Sustainable Streets Master Plan Technical Memorandum*

B *San Mateo Countywide Sustainable Streets Master Plan Project Identification and Prioritization Methodology Technical Memorandum*

C *Recommended Sustainable Street Planned Project Opportunities*

D *Recommended Sustainable Street New Project Opportunities*

E *Sustainable Street Priority Project Concept Designs*

F *Sustainable Street Policy Development*

G *Sustainable Street Technical Suitability and Co-Benefit Maps*

H *Sustainable Street Stormwater Curb Extension Feasibility Assessment Tool*

I Sustainable Street Public Engagement Reports

J Typical Details for Sustainable Streets