City of Santa Clara

Green Stormwater Infrastructure Plan

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Prepared by:

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ABBREVIATIONS

ABAG	Association of Bay Area Governments
BASMAA	Bay Area Stormwater Management Agencies Association
Caltrans	California Department of Transportation
CASQA	California Stormwater Quality Association
CIP	Capital Improvement Program
EPA	Environmental Protection Agency
FY	Fiscal Year
GI	Green Infrastructure
GIS	Geographic Information System
GSI	Green Stormwater Infrastructure
LID	Low Impact Development
MRP	Municipal Regional Stormwater NPDES Permit
MS4	Municipal Separate Storm Sewer System
NPDES	National Polluant Discharge Elimination System
O&M	Operation and Maintenance
PDA	Priority Development Areas
ROW	Right of Way
RWQCB	San Francisco Bay Regional Water Quality Control Board
SCVURPPP	Santa Clara Valley Urban Runoff Pollution Prevention Program
SCVWD	Santa Clara Valley Water District, now known as Valley Water
State Board	State Water Resource Control Board
SWRP	Storm Water Resource Plan
SWRCB	State Water Resource Control Board
TMDL	Total Maximum Daily Load
Valley Water	Santa Clara Valley Water District
Water Board	San Francisco Bay Regional Water Quality Control Board

EXECUTIVE SUMMARY

Urban development has traditionally involved replacing natural landscapes with solid pavements and buildings, and using storm drain systems to carry increased amounts of stormwater runoff and pollutants directly into local streams. To reduce the impact of urban development on waterways, Bay Area municipalities are augmenting traditional stormwater conveyance systems with Green Stormwater Infrastructure (GSI) features.

GSI features mimic nature, and use plants, soils, and/or pervious surfaces to collect stormwater, allowing it soak into the ground, and be filtered by soil. This reduces the quantity of water and pollutants flowing into local creeks.

The City of Santa Clara has prepared this GSI Plan to guide the siting, implementation, tracking, and reporting of GSI projects on City-owned land over the next several decades. Development of the GSI Plan is required by the City's Municipal Regional Stormwater National Pollutant Discharge Elimination System (NPDES) Permit.

The GSI Plan describes the City's methodology to identify and prioritize areas for implementing GSI, and estimates targets for the extent of the City's area that will be addressed by GSI through 2040. The Plan includes maps of the City's prioritized areas, and lays out the City's GSI implementation strategy. Key elements of the strategy include: identification of GSI opportunities in capital projects; coordination with private development; exploring opportunities as Focus Areas are redeveloped; and creating projects that achieve multiple benefits and provide safer, sustainable, and attractive public streetscapes. The Plan contains guidance and standards for GSI project design and construction, and describes how the City will track and map constructed GSI projects and make the information available to the public. Lastly, it explains existing legal mechanisms to implement the GSI Plan, and identifies potential sources of funding for the design, construction, and maintenance of GSI projects.

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1. INTRODUCTION

Urban development has traditionally involved replacing natural landscapes with solid pavements and buildings, and using storm drain systems to carry increased amounts of stormwater runoff and pollutants directly into local streams. Green stormwater infrastructure (GSI), however, uses plants and soils to mimic natural watershed processes, capture stormwater and create healthier environments. Bay Area cities and counties are required by State and regional regulatory agencies to move from traditional (grey) stormwater conveyance systems to GSI systems over time. This GSI Plan serves as an implementation guide for the City of Santa Clara (City) to incorporate GSI into storm drain infrastructure on public and private lands where feasible over the next several decades.

1.1 Purpose and Goals of the GSI Plan

The purpose of the City's GSI Plan is to demonstrate the City's commitment to augment its traditional storm drainage infrastructure to green stormwater infrastructure. The GSI Plan will guide the identification, implementation, tracking, and reporting of green stormwater infrastructure projects within the City. The GSI Plan will be coordinated with other City plans, such as its General and Specific Plans, Bicycle/Pedestrian Plan, and Storm Drain Master Plan, to achieve multiple potential benefits to the community, including improved water and air quality, reduced local flooding, increased water supply, traffic calming, safer pedestrian and bicycle facilities, climate resiliency, improved wildlife habitat, and a more pleasant urban environment.

Specific goals of the GSI Plan are to:

- Align the City's goals, policies and implementation strategies for GSI with the General Plan and other related planning documents;
- Identify and prioritize GSI opportunities throughout the City;
- Establish targets for the extent of City area to be addressed by GSI over certain timeframes;
- Provide a workplan and legal and funding mechanisms to implement prioritized projects; and
- Establish a process for tracking, mapping, and reporting completed projects.

1.2 City Description

Incorporated in 1852, the City of Santa Clara is located in Santa Clara County, and has a jurisdictional area of 11,628 acres. According to the 2010 Census, the City has a population of 116,468[1], with a population density of 6,327.3 people per square mile and an average household size of 3.18. The City is home to Intel, Applied Materials, NVIDIA, and many other technology companies; Westfield Valley Fair Mall; Levi's Stadium (the San Francisco 49ers professional football team headquarters); and California's Great America Theme Park.

1.2.1 Land Use

Land use within the City of Santa Clara can be classified into six primary land uses -- Commercial and Services, Industrial, Residential, Retail, K-12 Schools, and Urban Parks – with remaining land use, such as open space, classified as "other". The area within each of these land use categories within the City of Santa Clara depicted in ABAG (2005)[2] are provided in Table 1-1.

[1] The California Department of Finance estimates the City's population to be 128,717 as of January 1, 2019.

[2] Source - ABAG 2005 and SCVURPPP.

Table 1-1 Percentages of City of Santa Clara's Jurisdictional Area within ABAG Land Use Classes

Land Use Category	Jurisdictional Area (Acres)	% of Jurisdictional Area
Commercial and Services	1,912.0	17.5%
Industrial	1,983.9	18.2%
Residential	5,065.9	46.4%
Retail	570.7	5.2%
K-12 Schools	378.2	3.5%
Urban Parks	269.2	2.5%
Other	745.2	6.8%

The City is currently close to build-out with very few undeveloped lots. The majority of future development will involve redevelopment, often at higher densities, along major transportation corridors.

The City contains 38 parks, playgrounds and open space that total nearly 450 acres, including the Golf and Tennis Club's 155 acres. The Ulistac Natural Area, a 40-acre open space park on the former Fairway Glen golf course, opened in 2001. There are currently over 10,500 street trees within the City, and the City has been designated a Tree City USA since 1987.

1.2.2 Transportation

Five State highways, including El Camino Real, and three County expressways serve Santa Clara. In addition, three light and heavy rail corridors, as well as VTA bus service and future BART service, enhance transit options for residents, visitors, and employees. These transit services offer an opportunity for new, concentrated growth that minimizes impacts on existing neighborhoods and provides choices for living and working with less reliance on the automobile for every trip. As these transportation corridors are redeveloped, they may offer opportunities for implementing GSI.

1.2.3 Stormwater Drainage System

The City has an estimated 195 linear miles of storm drains and 8,452 nodes (including manholes, catch basins, pump stations, detention basins, and outfalls). Runoff captured by the storm drain network is discharged through a combination of gravity outfalls and pump stations into three ephemeral creeks (Calabazas Creek, Saratoga Creek, and San Tomas Aquino Creek) and the Guadalupe River. Calabazas Creek and San Tomas Aquino Creek are primarily conveyed through the City via concrete-lined channels, whereas Saratoga Creek (upstream of its confluence with San Tomas Aquino Creek) and the Guadalupe River consist of natural earthen channels.

A variety of agencies maintain storm drainage systems within the study area. The most significant of these is Valley Water (formerly called the Santa Clara Valley Water District), which has jurisdiction over the creeks and river running through the City. County roads (including Central Expressway, Lawrence Expressway, and San Tomas Expressway) and many of the storm drain collection systems within them fall within Santa Clara County's jurisdiction. Projects that cross or connect to County roads require coordination with the County Roads and Airports Department. Likewise, Caltrans maintains State roads,

including Highway 101 and El Camino Real, and requires coordination for projects within their jurisdiction.

1.2.4 Geographic Characteristics

The City is relatively flat with little geographic relief. Depths to first groundwater range from 30-50 feet in the southern part of the City to 0-10 feet in the northern part. The soils within the City's boundaries consist of 1.1% Group A soils, 13.9% Group C soils, and 84.9% Group D soils[3] (City of Santa Clara Storm Drain Master Plan, 2015). Given the high percentage of Group D soils, it is likely that most GSI facilities within the City will be landscape-based stormwater "biotreatment" areas with limited infiltration.

1.2.5 Water Supply

The City receives its potable surface water supply from the San Francisco Public Utilities Commission and Valley Water, and groundwater from City-owned wells. The City's Water and Sewer Utilities serve to provide these supplies, as well as recycled water, to City residents and businesses.

Valley Water's 2010 Urban Water Management Plan commits to meeting water demands for Santa Clara County (including the City) though 2025. However, water conservation and capture and use of rainwater to offset potable water supplies are important strategies for protecting City supplies during drought years.

1.2.6 Growth Projections

The City of Santa Clara developed growth/development forecasts as part of its General Plan, and updated them through approved General Plan Amendments. In 2010, the City of Santa Clara contained approximately 43,021 households[4]. The General Plan predicts the number of households to increase to 175,001 by 2040. The City is expected to have approximately 88,542 housing units and 91 million square feet of non-residential building space by 2040. This is an increase from 44,166 housing units and 58.8 square feet non-residential building space in 2008.

1.3 Regulatory Context

1.3.1 Federal and State Regulations and Initiatives

The U.S. Environmental Protection Agency (EPA) has authority under the Clean Water Act to promulgate and enforce stormwater related regulations. For the State of 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. Stormwater NPDES permits allow stormwater discharges from municipal separate storm sewer systems (MS4s) to local creeks, San Francisco Bay, and other water bodies as long as they do not adversely affect the beneficial uses of or exceed any applicable water quality standards for those waters. Since the early 2000's, the EPA has recognized and promoted the benefits of using GSI in protecting

[3] The NRCS has classified soils into four hydrologic soil groups (A, B, C, and D) according to their infiltration rates. Group A soils have low runoff potential when thoroughly wet and typically consist of sand or gravel type soils. Group B soils are moderately well draining when thoroughly wet and consist of loamy sand or sandy loam textures. Group C soils have moderately high runoff potential when thoroughly wet and consist of loam, silt loam, sandy clay loam, clay loam, and silty clay loam textures. Group D soils have high runoff potential when thoroughly wet and consist of clayey textures.

[4] The Census Bureau defines a household as a person or group of persons living in a housing unit, as opposed to persons living in group quarters, such as dormitories, convalescent homes, or prisons.

drinking water supplies and public health, mitigating overflows from combined and separate storm sewers and reducing stormwater pollution, and it has encouraged the use of GSI by municipal agencies as a prominent component of their MS4 programs.

The State and Regional Water Boards have followed suit in recognizing not only the water quality benefits of GSI but the opportunity to augment local water supplies in response to the impacts of drought and climate change as well. The 2014 California Water Action Plan called for multiple benefit stormwater management solutions and more efficient permitting programs. This directive created the State Water Board's "Strategy to Optimize Resource Management of Stormwater" (STORMS). STORMS' stated mission is to "lead the evolution of storm water management in California by advancing the perspective that storm water is a valuable resource, supporting policies for collaborative watershed-level storm water management and pollution prevention, removing obstacles to funding, developing resources, and integrating regulatory and non-regulatory interests."[5]

These Federal and State initiatives have influenced approaches in Bay Area municipal stormwater NPDES permits, as described in Section 1.3.2.

1.3.2 Municipal Regional Stormwater Permit

The City is subject to the requirements of the Municipal Regional Stormwater NPDES Permit (MRP) for Phase I municipalities and agencies in the San Francisco Bay area (Order R2-2015-0049), which became effective on January 1, 2016. The MRP applies to 76 municipalities and flood control agencies that discharge stormwater to San Francisco Bay, collectively referred to as permittees.

Over the last 13 years, under Provision C.3 of the MRP and previous permits, new development and redevelopment projects on private and public property that exceed certain size thresholds ("regulated projects") have been required to mitigate impacts on water quality by incorporating "Low Impact Development" (LID) measures, including site design, pollutant source control, stormwater treatment and flow control measures as appropriate. LID treatment measures, such as rainwater harvesting and use, infiltration, and biotreatment, have been required on most regulated projects since December 2011.

Provision C.3.j of the 2016 MRP requires the City to develop and implement a long-term GSI Plan[6] for the inclusion of LID measures into storm drain infrastructure on public and private lands, including streets, roads, storm drains, parking lots, building roofs, and other elements. The GSI Plan must be completed and submitted to the Regional Water Board by September 30, 2019.

While Provision C.3.j of the MRP contains the GSI program planning and analysis requirements, other provisions (C.11 and C.12) establish a linkage between public and private GSI features and required reductions of pollutants in stormwater discharges. Permittees in Santa Clara County (County), collectively, must implement GSI on public and private property to achieve specified pollutant load reduction goals by the years 2020, 2030, and 2040. These efforts will be integrated and coordinated countywide for the most effective and resource-efficient program. As an indication as to whether these load reductions will be met, Permittees must include in their GSI Plans estimated "targets" for the amounts of impervious surface to be "retrofitted" (i.e., redeveloped or changed such that runoff from

[5] https://www.waterboards.ca.gov/water_issues/programs/stormwater/storms/

[6] Although the MRP uses the term green infrastructure (GI), the agencies within Santa Clara County, including the City of Santa Clara, prefer to use the term green stormwater infrastructure (GSI). Therefore, the term GSI is used in this document.

those surfaces will be captured in a stormwater treatment system or GSI measure) as part of public and private projects over the same timeframes (2020, 2030, and 2040).

A key part of the GSI definition in the MRP is the inclusion of GSI systems at both private and public property locations. This has been done in order to plan, analyze, implement and credit GSI systems for pollutant load reductions on a watershed scale, as well as recognize all GSI accomplishments within a municipality. The focus of the GSI Plan is the integration of GSI systems into public buildings, parks, parking lots, and rights-of-way (e.g. road or bike path). However, the GSI Plan may also establish opportunities to include GSI facilities at private properties or in conjunction with private development, so they can contribute to meeting the target load reductions on a county-wide level as well as implement GSI on a larger scale.

1.4 GSI Plan Development Process

1.4.1 GSI Plan Development and Adoption

The GSI Plan development process began with the preparation of the City's GSI Plan Framework (Framework), a work plan describing the goals, approach, tasks, and schedule needed to complete the GSI Plan. Development of the Framework was a regulatory requirement (Provision C.3.j.i(1) of the MRP) to demonstrate the City's commitment to completing the GSI Plan by September 30, 2019. The City completed the Framework and City Council approved it on June 6, 2017.

The City established a GSI Work Group, consisting of staff from the City's Public Works and Planning Departments. The GSI Work Group worked with a consultant team to develop the GSI Plan. The Plan was presented to the City Council in August 2019.

1.4.2 Regional Collaboration

The City is a member of the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), an association of thirteen cities and towns in the Santa Clara Valley, the County of Santa Clara, and the Water District that collaborate on stormwater regulatory activities and compliance. The City's GSI Plan was developed in collaboration with SCVURPPP; SCVURPPP input included technical guidance, templates, and completion of certain GSI Plan elements at the countywide level. SCVURPPP guidance and products are discussed in more detail in relevant sections of the GSI Plan.

The City, via SCVURPPP, also coordinated with the Bay Area Stormwater Management Agencies Association (BASMAA) on regional GSI guidance and received feedback through BASMAA from MRP regulators on GSI expectations and approaches. BASMAA members include other countywide stormwater programs in Alameda, Contra Costa, and San Mateo Counties, and area-wide programs in the Vallejo and Fairfield-Suisun portions of Solano County, whose participating municipalities are permittees under the MRP.

1.4.3 Education and Outreach

To get support and commitment to the Plan and this new approach to urban infrastructure, educating department staff, managers, and elected officials about the purposes and goals of green stormwater infrastructure, the required elements of the GSI Plan, and the steps needed to develop and implement the GSI Plan was an important step in the development of the GSI Plan. Another important step was local community and stakeholder outreach to gain public support. The City began this process in fiscal year FY 2016-2017 by completing the following tasks.

- Public Works staff attended the SCVURPPP GSI workshop on developing and implementing municipal GSI Plans, review of public projects for identifying GSI opportunities, and a group exercise to review an example CIP project list for GSI opportunities.
- Planning department staff attended the SCVURPPP annual C.3 workshop covering basic C.3 training, new requirements in the MRP, and presentations on GSI materials and design, construction and maintenance considerations for pervious paving.
- The City provided in-house training to Planning and Public Works Department staff on GSI requirements, strategies, and opportunities and convened interdepartmental meetings with affected department staff and management to discuss GSI requirements.
- Public Works department staff attended a presentation on the City's progress in developing a GSI plan during the bi-monthly department meeting in June 2019.
- Staff from Public Works and Parks & Recreation departments discussed a few funding options for GSI in June 2019. Alternative compliance and in-lieu fee area among viable options to further studied.

In addition, the City has coordinated with SCVURPPP on a countywide outreach and education program about GSI for the general public[7], which includes a GSI website, public presentations, and radio and online advertising to promote GSI features.

The City of Santa Clara will continue to conduct internal and external education and outreach about GSI as the GSI Plan is implemented and seek community input as specific projects are designed and constructed.

1.5 GSI Plan Structure and Required Elements

The remainder of the GSI Plan is structured as follows:

- Chapter 2 describes the definition, purpose, and benefits of GSI, and describes the different types of GSI facilities.
- Chapter 3 describes the relationship of the GSI Plan to other planning documents and how those planning documents have been updated or modified, if needed, to support and incorporate GSI requirements. For documents whose desired updates and modifications have not been accomplished by the completion of the GSI Plan, a work plan and schedule are laid out to complete them.
- Chapter 4 outlines the materials being developed by SCVURPPP and the City to provide guidelines, typical details, specifications and standards for municipal staff and others in the design, construction, and operation and maintenance of GSI measures.
- Chapter 5 presents the methodology and results for identifying and prioritizing areas for potential GSI projects.
- Chapter 6 outlines the City's strategy for implementing prioritized potential GSI projects within the next ten years and through 2040, presents targets for the amounts of impervious surface to be "retrofitted" with GSI within the City by 2020, 2030, and 2040, and discusses the variety of mechanisms to be employed by the City in order to implement the GSI Plan, including future planning, tracking, and funding.

[7] http://www.mywatershedwatch.org/residents/green-streets/

The GSI Plan elements required by Provision C.3.j.i.(2) of the MRP and the section of the document in which each component can be found are summarized in Table 1-2 below.

Table 1-2 Summary of GSI Plan Elements required by Provision C.3.j.i of the MRP

MRP Provision	GSI Plan Elements	GSI Plan Section
C.3.j.i.(2)(a)	Project Identification and Prioritization Mechanism	Chapter 5
C.3.j.i.(2)(b)	Prioritization Outputs	Section 5.3
C.3.j.i.(2)(c)	Impervious Surface Targets	Section 6.6
C.3.j.i.(2)(d)	Completed Project Tracking System	Section 6.7
C.3.j.i.(2)(e,f)	Guidelines and Specifications	Chapter 4
C.3.j.i.(2)(g)	Alternative Sizing Requirements for Green Street Projects	Section 4.1
C.3.j.i.(2)(h,i)	Integration with Other Municipal Plans	Chapter 3
C.3.j.i.(2)(i)	Workplan for Integration of GSI Language into City Planning Documents	Section 3.2
C.3.j.i.(2)(j)	Workplan to Complete C.3.j Early Implementation Projects	Chapter 6.3
C.3.j.i.(2)(k)	Evaluation of Funding Options	Section 6.5
C.3.j.i.(3)	Legal and Implementation Mechanisms	Section 6.4

2. WHAT IS GREEN STORMWATER INFRASTRUCTURE?

In natural landscapes, most of the rainwater soaks into the soil or is taken up by plants and trees. However, in developed areas, building footprints and paved surfaces such as driveways, sidewalks, and streets prevent rain from soaking into the ground. As rainwater flows over and runs off these impervious surfaces, this "urban runoff" or "stormwater runoff" can pick up pollutants such as motor oil, sediment, metals, pesticides, pet waste, and litter. It then carries these pollutants into the City's storm drains, which flow directly to local creeks and San Francisco Bay, without any cleaning or filtering to remove pollutants. Stormwater runoff is therefore a major contributor to water pollution in urban areas.

As urban areas develop, the increase in impervious surface also results in increases in peak flows and volumes of stormwater runoff from rain events. Traditional "gray" stormwater infrastructure, like most of the City's storm drain system, is designed to convey stormwater flows quickly away from urban areas. However, the increased peak flows and volumes can cause erosion, flooding, and habitat degradation in downstream creeks to which stormwater is discharged, damaging habitat, property, and infrastructure.

2.1 Green Stormwater Infrastructure

A new approach to managing stormwater is to implement green stormwater infrastructure. GSI uses vegetation, soils, and other elements and practices to capture, treat, infiltrate and slow urban runoff and thereby restore some of the natural processes required to manage water and create healthier urban environments. GSI facilities can also be designed to capture stormwater for uses such as irrigation and toilet flushing.

GSI integrates building and roadway design, complete streets, drainage infrastructure, urban forestry, soil conservation and sustainable landscaping practices to achieve multiple benefits. At the city or county scale, GSI is a patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the neighborhood or site scale, GSI comprises stormwater management systems that mimic nature and soak up and store water.[8]

2.2 Benefits of Green Stormwater Infrastructure

GSI can provide multiple benefits beyond just managing rainfall and runoff. These benefits include environmental, economic, and social improvements.

GSI measures can mitigate localized flooding and reduce erosive flows and quantities of pollutants being discharged to local creeks and the San Francisco Bay. Vegetated GSI systems can beautify public places and help improve air quality by filtering and removing airborne contaminants from vehicle and industrial sources. They can also reduce urban heat island effects by providing shade and absorbing heat better than paved surfaces, and provide habitat for birds, butterflies, bees, and other local species. When GSI facilities are integrated into traffic calming improvements such as curb extensions and bulb-outs at intersections, they can help increase pedestrian and bicycle safety and promote active transportation, which in turn can result in improved human health.

GSI facilities designed with extra storage can capture stormwater for later use as irrigation water or non-potable uses such as toilet flushing and cooling tower supply, thus conserving potable water supplies.

[8] https://www.epa.gov/green-infrastructure/what-green-infrastructure

Widespread implementation of GSI potentially offers significant economic benefits, such as deferring or eliminating the need for some gray infrastructure projects. By providing more storage within the watershed, GSI can help reduce the costs of conveyance and pumping of stormwater. When cost-benefit analyses are performed, GSI is often the preferred alternative due to the multiple benefits provided by GSI as compared to conventional infrastructure.

2.3 Types of Green Stormwater Infrastructure Facilities

Integrating GSI into public spaces typically involves construction of stormwater capture and treatment measures in public streets, parks, and parking lots or as part of public buildings. Types of GSI measures that can be constructed in public spaces include: (1) bioretention; (2) stormwater tree well filters; (3) pervious pavement, (4) infiltration facilities, (5) green roofs, and 6) rainwater harvesting and use facilities. A description of these facility types is provided below.

Biotreatment/Bioretention

Bioretention areas are depressed landscaped areas that consist of a ponding area, mulch layer, plants, and a special biotreatment soil media composed of sand and compost, underlain by drain rock and an underdrain, if required. Bioretention is designed to retain stormwater runoff, filter stormwater runoff through biotreatment soil media and plant roots, and either infiltrate stormwater runoff to underlying soils as allowed by site conditions, or release treated stormwater runoff to the storm drain system, or both. They can be of any shape and are adaptable for use on a building or parking lot site or in the street right-of-way. Parking lots can accommodate bioretention areas in medians, corners, and pockets of space unavailable for parking.

Figure 2-1 Stormwater curb extension, Rosita Park, Los Altos (Source: City of Los Altos)

Bioretention systems in the streetscape have specific names: stormwater planters, stormwater curb extensions (or bulb-out), and stormwater tree well filters (described in the next section).

A stormwater curb extension (Figure 2-1) is a bioretention system that extends into the roadway and involves modification of the curb line and gutter. Stormwater curb extensions may be installed midblock or at an intersection. Curb bulb-outs and curb extensions installed for pedestrian safety, traffic calming, and other transportation benefits can also provide opportunities for siting bioretention facilities.

A stormwater planter is a linear bioretention facility in the public right-of-way along the edge of the street, often in the planter strip between the street and sidewalk. They are typically designed with vertical (concrete) sides. However, they can also have sloped sides depending on the amount of space that is available.

Stormwater Tree Well Filters and Suspended Pavement Systems

Stormwater tree well filters and suspended pavement systems are especially useful in settings between existing sidewalk elements where available space is at a premium. They can also be used in curb extensions or bulb-outs, medians, or parking lots if surrounding grades allow for drainage to those areas. The systems can be designed to receive runoff through curb cuts or catch basins or allow runoff to enter through pervious pavers on top of the structural support.

Figure 2-2 Stormwater tree well filter conceptual examples: modular suspended pavement system (left), column suspended pavement system (right). (Courtesy of City of Philadelphia Water Department)

Pervious Pavement

Pervious pavement is hardscape that allows water to pass through its surface into a storage area filled with gravel prior to infiltrating into underlying soils. Types of pervious pavement include permeable interlocking concrete pavers, pervious concrete, porous asphalt, and grid pavement. Pervious pavement is often used in parking areas or on streets where bioretention is not feasible due to space constraints or if there is a need to maintain parking. Pervious pavement does not require a dedicated surface area for treatment and allows a site to maintain its existing hardscape.

Figure 2-3 Permeable Interlocking Concrete Pavers, Mayfield Playing Fields, Palo Alto (Source: EOA)

There are two types of pervious pavers: Permeable Interlocking Concrete Pavers (PICP) and Permeable Pavers (PP). PICP (Figure 2-3) allow water to pass through the joint spacing between solid pavers, and PP allow water to pass through the paver itself and therefore can have tighter joints. Porous asphalt and pervious concrete are similar to traditional asphalt and concrete, but do not include fine aggregates in the mixture, allowing water to pass through the surface. All types are supported by several layers of different sizes of gravel to provide structural support and water storage.

Infiltration Facilities

Where soil conditions permit, infiltration facilities can be used to capture stormwater and infiltrate it into native soils. The two primary types are infiltration trenches and subsurface infiltration systems.

An infiltration trench is an excavated trench backfilled with a stone aggregate and lined with a filter fabric. Infiltration trenches collect and detain runoff, store it in the void spaces of the aggregate, and allow it to infiltrate into the underlying soil. Infiltration trenches can be used along roadways, alleyways, and the edges or medians of parking lots. An example of an infiltration trench is shown in Figure 2-4.

Figure 2-4 Infiltration Trench, San Jose (Source: City of San Jose)

Subsurface infiltration systems are another type of GSI measure that may be used beneath parking lots or parks to infiltrate larger quantities of runoff. These systems, also known as infiltration galleries, are underground vaults or pipes that store and infiltrate stormwater while preserving the uses of the land surface above parking lots, parks and playing fields. An example is shown in Figure 2-5. Storage can take the form of large-diameter perforated metal or plastic pipe, or concrete arches, concrete vaults, plastic chambers or crates with open bottoms. Prefabricated, modular infiltration galleries are available in a variety of shapes, sizes, and material types that are strong enough for heavy vehicle loads.

Figure 2-5 Subsurface infiltration system (Source: Conteches.com)

Green Roofs

Green roofs are vegetated roof systems that filter, absorb, and retain or detain the rain that falls upon them. Green roof systems are comprised of a layer of planting media planted with vegetation, underlain by other structural components including waterproof mem branes, synthetic insulation, geofabrics, and underdrains. A green roof can be either "extensive", with 3 to 7 inches of lightweight planting media and low-profile, low-maintenance plants, or "intensive", with a thicker (8 to 48 inches) of media, more varied plantings, and a more garden-like appearance. Green roofs can provide high rates of rainfall retention via plant uptake and evapotranspiration and can decrease peak flow rates in storm drain systems because of the storage that occurs in the planting media during rain events. An example of a green roof is provided in Figure 2-6.

Figure 2-6 Green Roof at Fourth Street Apartments, San José (Source: EOA)

Rainwater Harvesting and Use

Rainwater harvesting is the process of collecting rainwater from impervious surfaces and storing it for later use. Storage facilities that can be used to capture stormwater include rain barrels, above-ground cisterns (Figure 2-7), below-ground cisterns, open storage reservoirs (e.g., ponds), and various underground storage devices (tanks, vaults, pipes, and proprietary storage systems). The captured water is then fed into irrigation systems or non-potable water plumbing systems, either by pumping or by gravity flow. Uses of captured water may include irrigation, vehicle washing, and indoor non-potable use such as toilet flushing, heating and cooling, or industrial processing.

Figure 2-7 Rainwater harvesting cistern, Environmental Innovation Center, San José (Source: City of San Jose)

The two most common applications of rainwater harvesting are: 1) collection of roof runoff from buildings; and 2) collection of runoff from at-grade surfaces or diversion of water from storm drains into large underground storage facilities below parking lots or parks. Rooftop runoff usually contains lower quantities of pollutants than at-grade surface runoff and can be collected via gravity flow. Underground storage systems typically include pre-treatment facilities to remove pollutants from stormwater prior to storage and use.

Figure 2-8 Subsurface vault under construction (Source: Conteches.com)

3. INTEGRATION WITH OTHER PLANNING DOCUMENTS

To ensure the success of the GSI Plan and its implementation, its goals, policies and implementation strategies should align with the City's General Plan and other related planning documents. The MRP requires that municipal agencies review such documents and include in their GSI Plans a summary of any planning documents aligned with the GSI Plan or updated or modified to appropriately incorporate GSI requirements. The GSI Plan must also include a workplan identifying how GSI measures will be included in future plans.

3.1 City Planning Document Review

The City completed a review of its existing planning documents to determine the extent to which GSI-related language, concepts and policies have been incorporated. The planning documents that were reviewed are listed below:

- General Plan - Goals and Policies
- General Plan – Housing Element
- General Plan – Climate Action Plan
- Tasman East Specific Plan
- El Camino Real Specific Plan
- Lawrence Station Area Plan
- Bicycle Plan Update
- Storm Drain Master Plan

The following sections provide a brief discussion for each planning document. A prioritized workplan for the integration of GSI language into existing and future City planning documents is provided in Section 3.2.

3.1.1 General Plan - Goals and Policies

The General Plan describes the long-term goals for the City's future and guides decision-making in many different areas. The current General Plan was adopted November 2010; the timeframe of the plan is 2010-2035. The Goals and Policies section of the General Plan does not include language specific to GSI, but does contain language to support GSI concepts, including the following:

> ***Section 1.3.2 (and Section 3.3.2) Vision for the Future****: Encourage sustainability to protect energy, water supplies and air quality.*
>
> ***Section 4.3 Promote Sustainability****: Policies encourage sustainability measures for both new and existing development, ranging from those that help reduce water and energy consumption to those that promote redevelopment of infill sites as a healthy, cost-effective way to improve the local environment.*
>
> ***Policy 5.10.5-P11:*** *Require that new development meet stormwater and water management requirements in conformance with State and regional regulations.*
>
> ***Policy 5.10.5-P15:*** *Require new development to minimize paved and impervious surfaces and promote on-site Best Management Practices for infiltration and retention, including grassy swales, pervious pavement, covered retention areas, bioswales, and cisterns, to reduce urban water run-off.*

Policy 5.10.5-P16: *Require new development to implement erosion and sedimentation control measures to maintain an operational drainage system, preserve drainage capacity and protect water quality.*

3.1.2 General Plan - Housing Element

The Housing Element of the General Plan focuses on ways to promote residential infill development and provide safe, appropriate and well-built housing for residents of the City. It was last updated in December 2014 and integrated into the General Plan.

Regulated development projects are subject to MRP Provision C.3 requirements for low impact development (LID) site design, source control, and stormwater treatment measures; however, there is an opportunity in the Housing Element to emphasize the City's commitment to sustainable development to protect water quality.

3.1.3 General Plan - Climate Action Plan

The City Council adopted the Climate Action Plan in 2013, and it was incorporated into the General Plan. It does not include language specific to GSI. The current plan does contain some language to support GSI concepts, including the following

7.2 Urban Cooling Performance metric: *All new uncovered parking lots and spaces utilize light-colored and/or permeable pavements.*

The next update of the Climate Action Plan is planned for 2021.

3.1.4 Tasman East Specific Plan

The Tasman East project area is an existing industrial neighborhood 45 acres in size, bounded by Tasman Drive to the south, the Guadalupe River to the East, the Santa Clara golf course to the north, and Lafayette Street to the west. The purpose of the Tasman East Specific Plan is to create a framework for the development of a high-density transit-oriented neighborhood (currently proposed to be up to 100 dwelling units per acre), along with supportive retail services. The Specific Plan lays out allowed uses, densities, height limits and design criteria in the Tasman East area. Connections to the existing Guadalupe River trail, potential locations for parkland, and strategies for better access to transit are also incorporated into the plan. The Santa Clara City Council adopted the Tasman East Specific Plan on November 13, 2018. The plan includes the following language to support GSI:

Section 3.4 Sustainability Framework – Stormwater *On an area-wide basis, "Green Streets" concepts should be integrated into street designs to minimize the impacts of polluted runoff. For the purpose of this Specific Plan, green streets may include biotreatment areas in the form of stormwater curb extensions, stormwater planters and stormwater tree systems, to drain and treat runoff from curb flowlines, or equivalent technology. Other systems, such as pervious pavement may also achieve this objective.*

Stormwater related measures that promote sustainability on a project-by-project basis include:
- *Connect rooftop drain and hardscape surface drainage systems to landscape swale areas;*
- *Design landscape features that capture and infiltrate initial runoff flows into grounds/soil; and*
- *Design landscape swales to capture and treat runoff waters that flow to river outfalls.*

Section 4.7 Stormwater Management *The integration of stormwater management in public open spaces lowers infrastructure costs, increases space efficiency, provides ecological benefits, and creates opportunities for public interaction. Stormwater areas should be designed amenities that function effectively and contribute aesthetically to the site as a whole, integrating with the architecture and streetscape design of the surrounding context. For example, raised planters can function as seating or stormwater treatment can be a feature within the pavement.*

Guidelines: *Designed treatment systems such as bioswales, flow-through planters, permeable paving, and green roofs should be utilized as part of a comprehensive approach to stormwater management.*

3.1.5 El Camino Real Specific Plan

The El Camino Real Specific Plan is currently under development and is scheduled to be completed in Spring 2020. The El Camino Real is the City's most visible and identifiable commercial corridor. The City's General Plan vision for El Camino Real is to transform the area from a series of automobile-oriented strip malls to a tree-lined, pedestrian and transit-oriented corridor with a mix of residential and retail uses. The City will ensure that the El Camino Real Specific Plan is consistent with the GSI Plan and will look for opportunities to incorporate GSI into the plan area.

3.1.6 Lawrence Station Area Plan

On November 29, 2016, the City Council adopted the Lawrence Station Area Plan (LSAP), along with the associated General Plan and Zoning Ordinance Amendments. The plan includes language to support GSI, including the following:

Chapter 6 Landscape Master Plan

Section 6.1 Overview *- The LSAP encourages high-performing landscapes that simultaneously embrace social, recreational, ecological, and aesthetic values. A driving factor behind the planning and design of the landscape is the interdependence between aesthetic and recreational outdoor environments and green infrastructure, like green roofs and vegetated structures (trellis, green screens), that deliver ecological benefits.*

Section 6.3 Landscape Design Guidelines, Recommendation OSD 4.1 *- Hardscape is to be used to provide a durable, all-weather surface to accommodate pedestrian activity and outdoor gatherings and activities. Wherever possible, hardscape materials should be chosen to maximize pervious surface area to reduce stormwater runoff volume, rate, and pollutants.*

Chapter 7 Streetscape Master Plan

Section 7.1 General Design Objectives *- Provide generous sidewalks with sufficient width to accommodate clear pedestrian passage while allowing sufficient room for street trees, planters, stormwater facilities, and other streetscape amenities.*

Section 7.3 Streetscape Design Guidelines, Street Parking Design *- Use water permeable materials for stormwater capture.*

Chapter 9 Infrastructure Program

> ***Section 9.1 Grading*** *- Fine grading will address new landscape features, and stormwater runoff from hardscape areas shall be directed toward planted landscape zones for treatment per the San Francisco Bay Regional Water Quality Control Board requirements.*
>
> ***Section 9.3 Stormwater, Sustainable Infrastructure*** *- Sustainable design measures will help ensure that runoff generated by development under the LSAP does not increase runoff amounts above existing levels. Site development will incorporate planted landscape zones dedicated to stormwater infiltration, such as at-grade rain gardens and bio-swales. Moreover, impervious hardscape areas will be designed to drain to these landscape zones and other pervious surfaces so as to comply with regional permitting requirements.*

3.1.7 Bicycle Plan Update

The City's Bicycle Plan Update, completed in September 2009, presents a "blueprint for expanding the bicycle network that will promote safer alternative modes of transportation and help position the City for future funding for bicycle projects and roadway improvements benefiting the cycling community" (Plan Background and Goals). The 2009 update to the Bicycle Plan does not include language related to GSI.

3.1.8 Storm Drain Master Plan

The City's Storm Drain Master Plan (SDMP) establishes a prioritized capital improvements program to reduce the risk of flooding within the City of Santa Clara. It was last updated in December 2015 and does not include language relevant to GSI. However, all CIP projects including those from the SDMP are reviewed by the City for GSI opportunities (see Chapter 6, GSI Implementation).

3.2 Workplan for Integration of GSI Language into Existing and Future City Planning Documents

Although several City plans are generally aligned with and support the GSI Plan, others could benefit from the inclusion of additional GSI-related language. Table 3-1 below summarizes the plans that will be updated and the schedule for completion.

Table 3-1 Workplan for Integration of GSI Language into Existing City Planning Documents

Name of Plan To Be Updated	Anticipated Date of Completion/Update
General Plan - Goals and Policies	FY 2023-24
General Plan – Housing Element	FY 2023-24
General Plan – Climate Action Plan	2021
Bicycle Plan Update	Fall 2019

When preparing new planning documents, such as the Pedestrian and Parks-specific Master Plans, and Specific Plans for the Freedom Circle area, the Patrick Henry Drive area, and the Downtown area, the City will ensure that GSI requirements and policies are incorporated. Examples of GSI related language can be found in existing City plans, and in references such as SCVURPPP's Model Green Infrastructure Language for Incorporation into Municipal Plans (2016).

3.3 GSI Plan Relationship to Regional Plans

The City of Santa Clara participates in the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP), an association of 13 cities, the County of Santa Clara, and Valley Water that are permittees under the MRP. This partnership allows sharing of resources toward permit compliance and collaboration on projects of mutual benefit.

The City is collaborating with SCVURPPP, Valley Water, and other agencies on several large-scale planning efforts including those described below.

3.3.1 Santa Clara Basin Stormwater Resource Plan

A collaboration between SCVURPPP and the Water District during 2017 and 2018, the Santa Clara Basin Storm Water Resources Plan (SWRP) supports municipal GSI Plans by identifying and prioritizing potential multi-benefit GSI opportunities on public parcels and street rights-of-way throughout the Basin (i.e., Santa Clara Valley) and allows them to be eligible for State bond-funded implementation grants. The SWRP includes a list of prioritized GSI opportunity locations for each SCVURPPP agency, including Los Altos. As described in Section 5.2, the City's GSI Plan builds on the SWRP output to further identify, evaluate, and prioritize potential projects.

3.3.2 Valley Water's One Water Plan

Valley Water's Watershed Division is leading an effort to develop an Integrated Water Resources Master Plan to identify, prioritize, and implement activities at a watershed scale to maximize established water supply, flood protection, and environmental stewardship goals and objectives. The "One Water Plan" establishes a framework for long-term management of Santa Clara County water resources, which eventually will be used to plan and prioritize projects that maximize multiple benefits. The One Water Plan incorporates knowledge from past planning efforts, builds on existing and current related planning efforts; and coordinates with relevant internal and external programs. The One Water Plan has five goals:

1. "Valued and Respected Rain" – Manage rainwater to improve flood protection, water supply, and ecosystem health.
2. "Healthful and Reliable Water" – Enhance the quantity and quality of water to support beneficial uses.
3. "Ecologically Sustainable Streams and Watersheds" – Protect, enhance and sustain healthy and resilient stream ecosystems.
4. "Resilient Baylands" – Protect, enhance and sustain healthy and resilient baylands ecosystems and infrastructure.
5. "Community Collaboration" – Work in partnership with an engaged community to champion wise decisions on water resources.

Tier 1 of the effort, for which a draft plan was completed in 2016 [9], is a countywide overview of major resources and key issues along with identified goals and objectives. Tier 2 (2016 to 2020) will include greater detail on each of the County's five major watersheds, including the West Valley and Guadalupe watersheds in which the City of Santa Clara is located. The City's GSI Plan aligns with the goals of the

[9] Santa Clara Valley Water District. 2016. One Water Plan for Santa Clara County. An Integrated Approach to Water Resources Management. Preliminary Draft Report 2016. https://onewaterplan.wordpress.com/

One Water Plan and may be able to coordinate with specific projects yet to be identified in the West Valley and Guadalupe Watershed areas.

3.3.3 Bay Area Integrated Regional Water Management Plan

The Bay Area Integrated Regional Water Management Plan [10] (IRWMP) is a comprehensive water resources plan for the Bay region that addresses four functional areas: 1) water supply and water quality; 2) wastewater and recycled water; 3) flood protection and stormwater management; and 4) watershed management and habitat protection and restoration.

It provides a venue for regional collaboration and serves as a platform to secure state and federal funding. The IRWMP includes a list of over 300 project proposals, and a methodology for ranking those projects for the purpose of submitting a compilation of high priority projects for grant funding. The Santa Clara Basin SWRP was submitted to the Bay Area IRWMP Coordinating Committee and incorporated into the IRWMP as an addendum. As SWRP projects are proposed for grant funding, they will be added to the IRWMP list using established procedures.

[10] http://bayareairwmp.org/

4. GSI DESIGN GUIDELINES, DETAILS, AND SPECIFICATIONS

The MRP requires that the GSI Plan include general design and construction guidelines, standard specifications and details (or references to those documents) for incorporating GSI components into projects within the City. These guidelines and specifications should address the different street and project types within the City, as defined by its land use and transportation characteristics, and allow projects to provide a range of functions and benefits, such as stormwater management, bicycle and pedestrian mobility and safety, public green space, and urban forestry.

The City, along with other SCVURPPP agencies, helped fund and provided input to the development of countywide guidelines by SCVURPPP to address the MRP requirements and guide the implementation of GSI Plans. The resulting SCVURPPP GSI Handbook (Handbook) is a comprehensive guide to planning and implementation of GSI projects in public streetscapes, parking lots and parks. The Handbook consists of two parts, the contents of which are described in the following sections. The City intends to use this Handbook as a reference when creating City-specific guidelines and specifications to meet the needs of the various departments.

4.1 Design Guidelines

Part 1 of the Handbook provides guidance on selection, integration, prioritization, sizing, construction, and maintenance of GSI facilities. It includes sections describing the various types of GSI, their benefits, and design considerations; how to incorporate GSI with other uses of the public right-of-way, such as bicycle and pedestrian infrastructure and parking; and guidelines on utility coordination and landscape design for GSI. In addition, the Handbook also provides guidance on post-construction maintenance practices and design of GSI to facilitate maintenance.

Part 1 also contains a section on proper sizing of GSI measures. Where possible, GSI measures should be designed to meet the same sizing requirements as Regulated Projects, which are specified in MRP Provision C.3.d. In general, the treatment measure design standard is capture and treatment of 80% of the annual runoff (i.e., capture and treatment of the small, frequent storm events). However, if a GSI measure cannot be designed to meet this design standard due to constraints in the public right-of-way or other factors, the City may still wish to construct the measure to provide some runoff reduction and water quality benefit and achieve other benefits. For these situations, the Handbook describes regional guidance on alternative design approaches developed by the Bay Area Stormwater Management Agencies Association (BASMAA) for use by MRP permittees.

4.2 Details and Specifications

Part 2 of the Handbook contains typical details and specifications that have been compiled from various sources within California and the U.S. and modified for use in Santa Clara County. The Handbook includes details for pervious pavement, stormwater planters, stormwater curb extensions, bioretention in parking lots, infiltration measures, and stormwater tree wells, as well as associated components such as edge controls, inlets, outlets, and underdrains. It also provides typical design details for GSI facilities in the public right-of-way that address utility protection measures and consideration of other infrastructure in that space.

4.3 Incorporation of SCVURPPP Details and Specifications into City Standards

The City will refer to the GSI Handbook for typical details as needed. Over time, the City may choose to customize some commonly used details and incorporate these into the City standards.

5. GSI PROJECT PRIORITIZATION

To meet the requirements of the MRP, the City's GSI Plan must contain a project identification and prioritization mechanism. The mechanism must include the criteria for prioritization and outputs that can be incorporated into the City's long-term planning and capital improvement processes.

This chapter describes different GSI project categories considered within the City, followed by a description of the process employed by the City to identify public lands that offer opportunities to implement GSI and prioritize those opportunities, and the results of the process.

5.1 Project Types

GSI project types that have been or may be implemented in the City fall into the following categories: Early Implementation Projects, C3 Regulated Projects, green streets, LID Retrofits, and Regional Projects. Green streets, LID Retrofits, and Regional Projects are types of GSI capital projects that the City may implement to meet the water quality goals in the MRP and multi-benefit objectives defined in the GSI Plan. GSI capital projects are typically not regulated projects (although they must conform to the sizing and design requirements contained in Provision C.3, except under certain circumstances) and they are primarily public projects under control of the City. Green streets, LID Retrofits, and Regional Projects are the focus of the prioritization process described in Section 5.2, but all five GSI project types are considered as part of the City-wide GSI strategy presented in Chapter 6. Several factors, such as change in scope of work, funding, site conditions, etc. determine the ability of the City to implement GSI capital projects.

5.1.1 Early Implementation Projects

Early Implementation Projects are GSI projects that have already been implemented by the City, or are planned for implementation during the permit term (i.e., before December 2020), or have been identified as the City as having potential for GSI. The City has already implemented one GSI project, as discussed in Section 2.4. The City identified additional Early Implementation projects through a review of its Capital Improvement Program (CIP), as discussed in Section 5.2.2 below

5.1.2 Regulated Projects

C3 Regulated Projects are those implemented as part of new and redevelopment within the City, both private and public, that must meet the post-construction stormwater treatment requirements per Provision C.3 of the MRP. Regulated projects include private development or redevelopment projects, such as multi-family residential buildings, commercial office buildings, or shopping plazas, as well as public projects, such as libraries, police stations, and parking lots, that exceed the impervious surface thresholds.

5.1.3 LID Projects

LID projects mitigate stormwater impacts by reducing runoff through capture and/or infiltration and treating stormwater on-site before it enters the storm drain system. LID projects may include bioretention facilities, infiltration trenches, pervious pavement, green roofs, and systems for rainwater harvesting and use. For the purposes of the GSI Plan, LID projects are GSI facilities that treat runoff generated from a publicly-owned parcel on that parcel.

5.1.4 Regional Projects

Regional projects capture and treat stormwater runoff from on-site and off-site sources, including surface runoff and diversions from storm drains. The benefits of regional stormwater capture projects can include flood risk reduction, stormwater treatment and use, and groundwater recharge. These projects may take a variety of forms such as detention and retention basins and subsurface vaults and infiltration galleries. The site characteristics will determine what types of regional projects are feasible, e.g., whether a project is on-line or off-line from the storm drain network, whether it is desirable to change the functionality of the site, whether the project is above ground or underground, and the size of the project.

5.1.5 Green Street Projects

Green street projects are GSI opportunities in the public right-of-way that capture runoff from the street and adjacent areas that drain to the street. The technologies used for green streets are similar to those used in LID projects but are limited to designs that can be used in the right-of-way. Green street projects may include bioretention (e.g., stormwater planters, stormwater curb extensions or stormwater tree filters), pervious pavement, and/or infiltration trenches. Green street GSI features can be incorporated into other improvements in the right-of-way, including complete streets designs and improvements for pedestrian and cyclist safety.

5.2 Identification and Prioritization Process

The City of Santa Clara GSI opportunity identification and prioritization process involved two steps. The first step was the screening and prioritization methodology used in the Santa Clara Basin SWRP (see Section 3.3.1) to identify and prioritize GSI opportunities on public parcels and street segments within the City's jurisdictions. The second step in the process involved overlaying City-specific priorities, planning areas, and upcoming City projects onto the regional prioritization results to align the results of the SWRP prioritization process with the City's priorities. These steps are described in detail below.

5.2.1 Step 1: Stormwater Resource Plan Prioritization

Building on existing documents that describe the characteristics and water quality and quantity issues within the Santa Clara Basin (i.e., the portion of Santa Clara County that drains to San Francisco Bay), the SWRP identified and prioritized multi-benefit GSI opportunities throughout the Basin, using a metrics-based approach for quantifying project benefits such as volume of stormwater infiltrated and/or treated, and quantity of pollutants removed. The metrics-based analysis was conducted using hydrologic/ hydraulic and water quality models coupled with Geographic Information System (GIS) resources and other tools. The products of these analyses were a map of opportunity areas for GSI projects throughout the watershed, an initial prioritized list of potential project opportunities, and strategies for implementation of these and future projects.

The process began by identifying and screening public parcels and public rights-of-way that can support GSI. Project opportunities were split into the three categories described above – LID, regional, and green streets projects -- because of fundamental differences in GSI measures used, project scale, and measures of treatment efficiency. Screening factors are presented in Table 5-1.

After the identification of feasible GSI opportunity locations, screened streets and parcels were prioritized to aid in the selection of project opportunities that would be the most effective and provide the greatest number of benefits. In addition to physical characteristics, several special considerations

were included in the prioritization methodology to consider coordination with currently planned projects provided by agencies, as well as consideration of additional benefits that projects could provide. A discussion of the screening and prioritization process for each project category is presented in the subsequent sections. Figures 5-1 through 5-3 present the results of the various steps.

Table 5-1 Screening factors for parcel-based and right-of-way project opportunities

Screening Factor	Characteristic	Criteria	Reason
Parcel-based			
Public Parcels	Ownership	County, City, Town, SCVWD, State, Open Space Agencies	Identify all public parcels for regional stormwater capture projects or onsite LID retrofits
	Land Use	Park, School, Other (e.g., Golf Course)	
Suitability	Parcel Size	≥ 0.25 acres	Opportunity for regional stormwater capture project
		< 0.25 acres	Opportunity for on-site LID project
	Site Slope	< 10 %	Steeper grades present additional design challenges
Right-of-Way			
Selection	Ownership	Public	Potential projects are focused on public right-of-way opportunities
Suitability	Surface	Paved	Only roads with paved surfaces are considered suitable. Dirt roads were not considered.
	Slope	< 5%	Steep grades present additional design challenges; reduced capture opportunity due to increased runoff velocity
	Speed	≤ 45mph	Excludes higher speed roads such as major arterials and highways

LID and Regional Stormwater Capture Project Opportunities

The screening criteria for LID and regional project opportunities were ownership (focusing only on public parcels), land use, parcel size and site slope. As shown in Table 5-1, parcel size was used to determine whether a location could support a regional or LID project.

Parcels that met the screening criteria were prioritized based on physical characteristics such as soil group, slope, and percent impervious area, proximity to storm drains, proximity to flood-prone creeks and areas, proximity to potential pollutant sources, whether they were in a priority development area,

whether they were within a defined proximity to a planned project, and whether the project was expected to have other benefits such as augmenting water supply, providing water quality source control, re-establishing natural hydrology, creating or enhancing habitat, and enhancing the community. Prioritization metrics for LID project scoring and regional project scoring are shown in separate tables in Appendix A. The result of the parcel prioritization was a list and map of potential project locations based on the above criteria.

Green Street Project Opportunities

The screening criteria for green streets project opportunities in the public right-of-way were ownership, surface material, slope, and speed limit (Table 5-1). The screened public right-of-way street segments (approximately one block in length) were then prioritized based on physical characteristics, proximity to storm drains, proximity to flood-prone creeks and areas, proximity to potential pollutant sources, whether they were in a priority development area, whether they were in proximity to a planned project, and whether the project was expected to have other benefits (similar to LID and regional projects). Prioritization metrics for green streets projects are shown in Appendix A.

The initial prioritization process resulted in a large number of potential green streets project opportunities within the Santa Clara Basin. In order to identify the optimal locations for green street projects, the street segments in each municipality's jurisdiction with scores in the top 10 percent of ranked green street opportunities were identified and mapped.

The City-owned parcel-based and top ten percent green street opportunities for the City of Santa Clara are shown in Figure 5-1. This subset of project opportunities from the SWRP was carried over into Step 2 City-Specific Prioritization (Section 5.2.2).

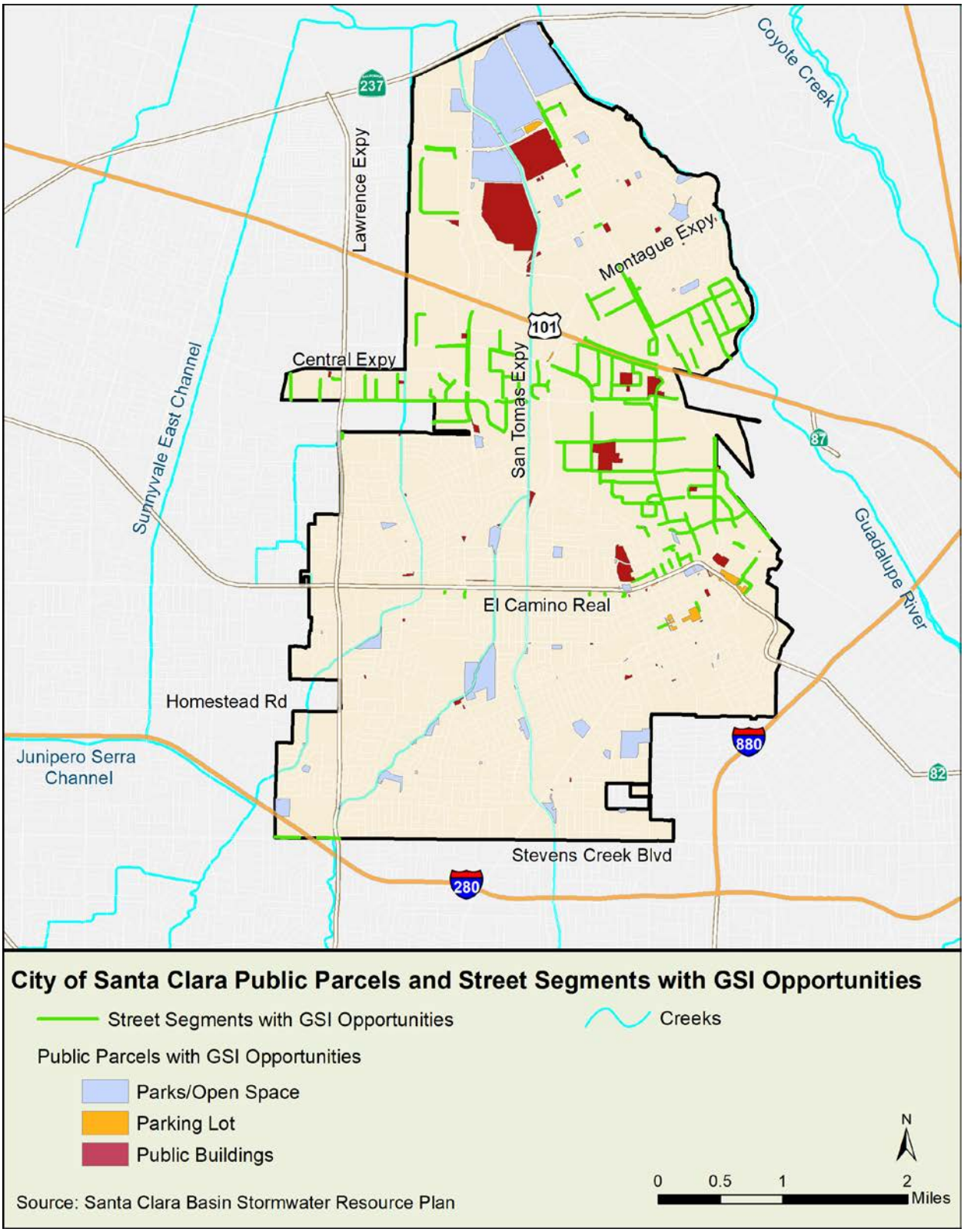


Figure 5-1 City of Santa Clara Public Parcels and Street Segments with GSI Opportunities (Source: Santa Clara Basin Stormwater Resource Plan)

5.2.2 Step 2: City-Specific Prioritization

The City's local priorities for project implementation include: 1) upcoming capital improvement projects that can be combined with GSI projects, 2) opportunities to implement GSI projects in conjunction with anticipated Focus Areas of private development and 3) opportunities to address pollutants in runoff from old industrial areas.

Upcoming Capital Improvement Projects with Potential for GSI

As required by the MRP, the City reviews its Capital Improvement Program (CIP) project list annually to identify opportunities for GSI. Based on this review, the City prepares and maintains a list of any public GSI projects that are planned for implementation during the permit term and public projects that have potential for GSI measures. As part of this process, the City identified the Machado Park Rehabilitation project as a planned GSI project. The project design includes bioretention areas for stormwater treatment. The project location is shown in Figure 5-4.

Focus Areas

The City of Santa Clara's General Plan identifies eleven Focus Areas that represent locations with opportunities for more intense development with limited impact on existing neighborhoods.

The current Near-term and Future Focus Areas are:

Near-term Focus Areas:

- El Camino Real Focus Area
- Downtown Focus Area
- Santa Clara Station Focus Area
- Stevens Creek Boulevard Focus Area
- Lawrence Station Focus Area (East of Lawrence Expressway)
- Tasman East Focus Area
- Freedom Circle Focus Area
- Patrick Henry Focus Area

Future Focus Areas:

- Central Expressway Focus Area
- De La Cruz Focus Area
- Lawrence Station Future Focus Area (West of Lawrence Expressway)

The City has completed the development of the Lawrence Station Area Plan (for the Lawrence Station Focus Area located east of Lawrence Expressway). The El Camino Real Specific Plan and the Freedom Circle Area Specific Plan are under development. The specific/area plans will provide detailed guidelines for development in these Focus Areas. Because a high level of development is expected to occur within the Focus Areas, they have a high potential for opportunities to construct GSI facilities. The GSI projects could be part of private redevelopment projects or public improvement projects. In addition, the City has identified one Master Planned Community, called City Place Santa Clara. Redevelopment of this area may also offer opportunities for constructing GSI. The Focus Areas and the Master Planned Community are shown in Figure 5-2.

Priority Development Areas

In 2008, ABAG and the Metropolitan Transportation Commission created a regional initiative, called Plan Bay Area, to support local efforts linking job opportunities with housing to create sustainable communities. Plan Bay Area identifies Priority Development Areas (PDAs) within existing communities. PDAs are locally-identified, infill development opportunity areas. They are generally areas where there is local commitment to developing more housing along with amenities and services to meet the day-to-day needs of residents in a pedestrian friendly environment served by transit. PDA's are within an existing community, near existing or planned fixed transit or served by comparable bus service, and planned for more housing.

Plan Bay Area 2040, an updated, long-range Regional Transportation Plan and Sustainable Communities Strategy for the nine-county San Francisco Bay Region, was adopted by the executive bodies of MTC and ABAG on July 26, 2017. It identifies two PDAs in the City of Santa Clara. These PDAs lie within the El Camino Real and Santa Clara Station Focus Areas. The PDAs are shown in Figure 5-2.

Old Industrial Areas

Stormwater runoff from industrial areas can contain more pollutants than runoff from other land uses. GSI installations in public streets near industrial areas may help remove these pollutants from stormwater runoff. Old industrial areas (i.e., industrial areas developed before 1980) located in the City of Santa Clara are shown in Figure 5-3. As these industrial areas are redeveloped, the City will explore installing GSI features in the public right-of-way.

Storm Drain Rehabilitation Projects

The City's Storm Drain Master Plan (SDMP), updated in 2015, establishes a prioritized capital improvement program to reduce the risk of flooding within the City. Storm drain rehabilitation projects provide an opportunity for simultaneous installation of green stormwater infrastructure to help reduce peak flows and the frequency of local flooding. The highest priority storm drain projects from the City's SDMP are mapped on Figure 5-4.

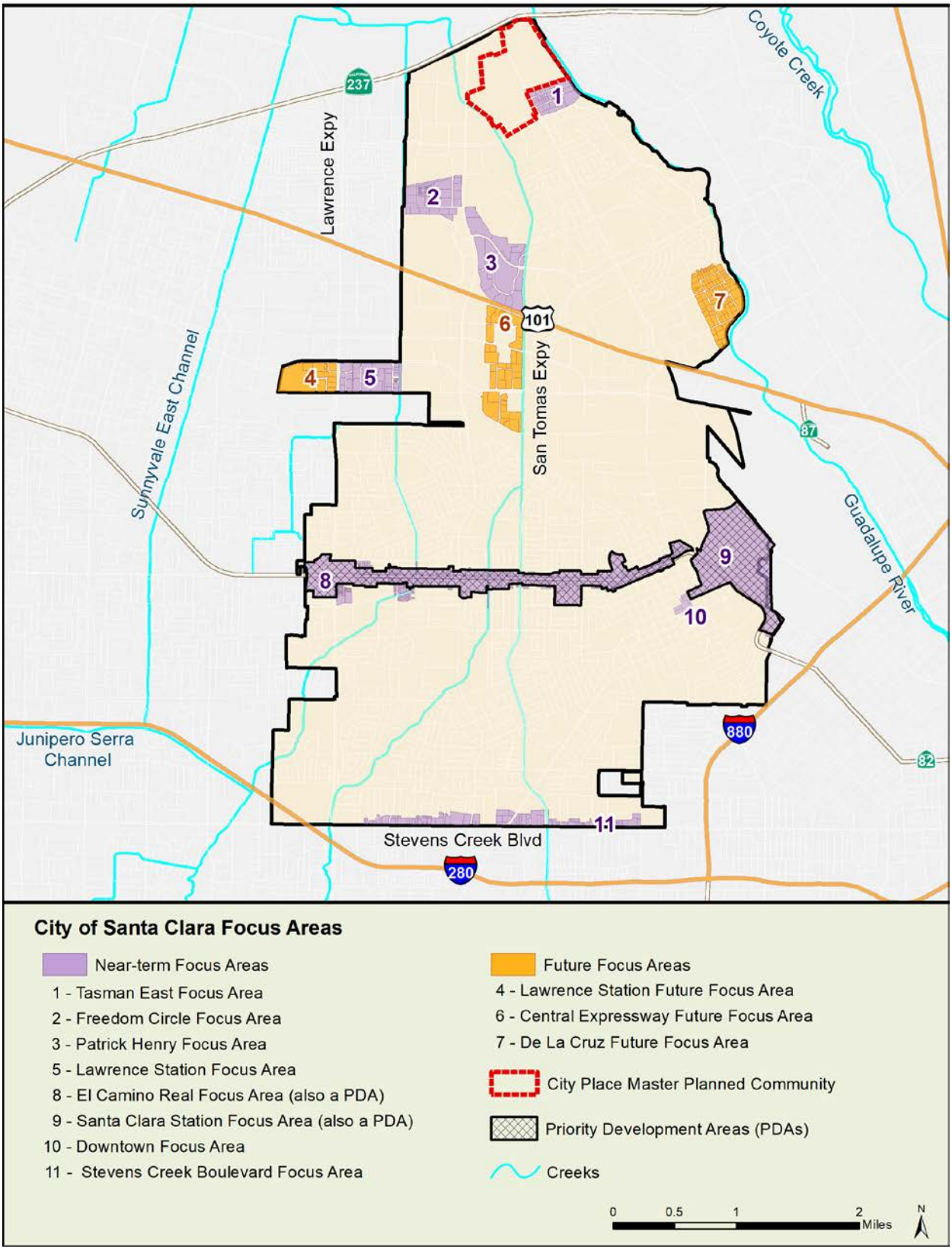


Figure 5-2 City of Santa Clara Focus Areas, Master Planned Community, and Priority Development Areas (Source: City of Santa Clara General Plan)

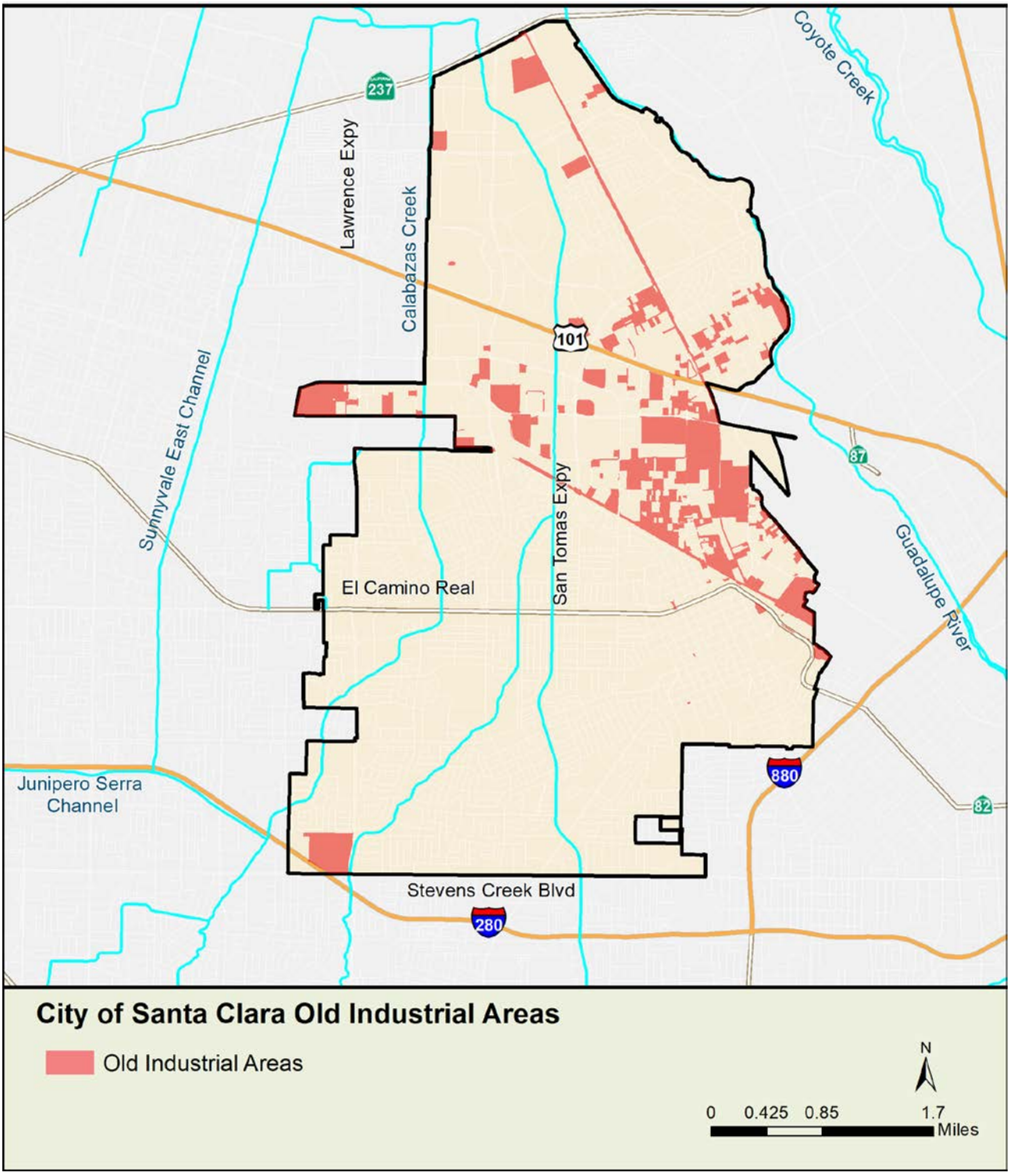


Figure 5-3 City of Santa Clara Old Industrial Areas (Source: SCVURPPP)

5.3 Prioritization Results

The map in Figure 5-4 shows a compilation of the factors involved in prioritizing the City's opportunities for GSI projects. The City-owned parcel-based and top 10 percent of green street project opportunities identified by the SWRP prioritization are overlaid here with the City's prioritization factors including Focus Areas, old industrial areas, priority storm drain projects, and the City's planned GSI project. The location of the City's completed GSI project is also shown on Figure 5-4 to demonstrate the City's efforts towards the implementation of GSI. An implementation plan is described in Chapter 6 to guide the City's development and implementation of GSI projects.

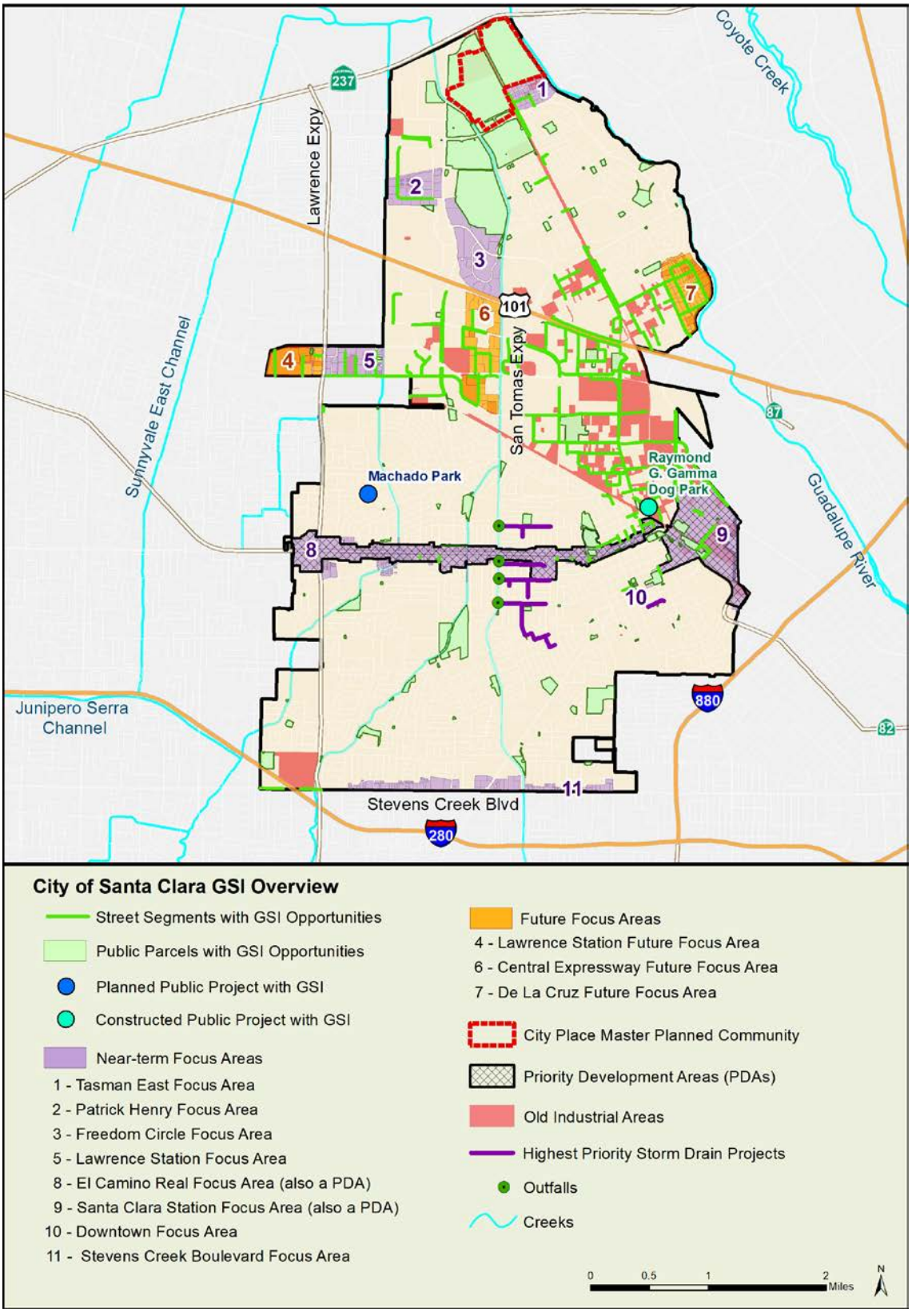


Figure 5-4 City of Santa Clara GSI Prioritization Overview

6. GSI IMPLEMENTATION PLAN

This chapter provides an overall strategy and steps for implementing GSI within the City of Santa Clara over the long term. The implementation plan has the following main components: (1) the citywide GSI strategy; (2) a process for identifying and evaluating GSI opportunities, (3) a workplan to complete Early Implementation Projects, (4) the legal and funding mechanisms that enable implementation, (5) estimated targets for the amounts of impervious surface to be "retrofitted" (i.e., redeveloped with GSI facilities to treat runoff from impervious surfaces) within the City, and (6) the technical tools that ensure the tracking of implemented projects.

6.1 Citywide GSI Strategy

The City of Santa Clara's approach to GSI planning will be consistent with the City's General Plan, which provides direction for sustainable, environmentally sensitive development to accommodate the City's growth. Identification of potential GSI projects will be based on the following priorities:

- Evaluation of CIP projects for opportunities – The City will continue to review its CIP list annually for opportunities to incorporate GSI into CIP projects and evaluate the feasibility of such projects. The City has established a process for CIP review to avoid missing GSI opportunities (see Section 6.2).
- Evaluation of non-CIP project opportunities – As awareness of GSI increases, municipal staff or local community members may also identify and recommend GSI projects opportunities. These projects will be considered using the methodology described in Section 6.2.
- Focus Areas of future development – As Specific Plans for the Focus Areas of future development are prepared, the City will explore and identify opportunities for implementing GSI.
- Coordination with private development – The City of Santa Clara will explore working with private property developers to install green infrastructure facilities in public rights-of-way near the properties they are developing, such as along street frontages.
- Evaluation of opportunities identified in the Stormwater Resource Plan – The public parcels and street segments identified in the SWRP are opportunity areas for GSI projects. The City will use the SWRP list to help identify potential project locations for GSI implementation.
- Redevelopment in old industrial areas– GSI installations are designed to remove pollutants from stormwater runoff, and they can be especially effective in treating runoff from old industrial areas that may generate more pollutants than other land uses. The City's GSI planning process will explore installing GSI facilities in industrial areas as they are redeveloped.
- Coordination with BART, VTA, and Caltrans – The City with coordinate with BART, VTA, and Caltrans on local projects to identify GSI opportunities.

The City will also continue to require future development projects to comply with C.3 requirements of the Municipal Regional Permit (MRP), and include site design, source control, treatment control, and hydromodification management measures as applicable.

6.2 Process for Identifying and Evaluating Potential GSI Projects

The City will use the various mechanisms described in its strategy (Section 6.1) to identify GSI opportunities in public projects.

The City will use the guidance developed by BASMAA[11] (See Appendix B) and the SWRP prioritization criteria to evaluate public projects to determine the potential for the inclusion of GSI measures at the project planning level. The evaluation may include site reconnaissance, drainage area delineation, and cost analysis. If not already on the CIP list, projects identified through this process will be added to the CIP list when it is updated. Projects with a GSI component may be included in the CIP as funded or unfunded projects. An unfunded project's inclusion in the CIP demonstrates that it is a City priority pending adequate funding. The City prepares the CIP budget biennially. The next biennial CIP budget will be prepared in 2020 covering FY 2020-21 and FY 2021-22.

The City will map all potential GSI project opportunities to determine their proximity to green street or parcel-based project opportunities identified in the SWRP (Section 5.2.1). Potential GSI projects that are adjacent to SWRP opportunity areas may be eligible for state bond funding. Projects with opportunities for GSI may be submitted to the SWRP during the SWRP update process if they are not already included in the SWRP. This will allow those projects to be eligible for future state bond funding. The SWRP will likely be updated in the 2022-2023 timeframe. At this time, SCVURPPP will reach out to all member agencies to provide their project lists for prioritization and inclusion in the updated SWRP.

6.3 Work Plan for Completing Early Implementation Projects

Provision C.3.j. of the MRP requires that the City identify, prepare, and maintain a list of GSI projects that are planned for implementation during the permit term, and infrastructure projects that have potential for GSI measures. The list is reviewed and submitted with each Annual Report to the Regional Water Board. Table 6-1 includes information on the City's planned GSI project.

Table 6-1 Workplan for City of Santa Clara's Planned GSI Project

Project Name	Description	Status	Timeframe for Construction
Machado Park Rehabilitation	Rehabilitation of playground equipment and surfacing, walkway, landscaping, and irrigation system. Installation of new sewer and water lines for new drinking fountains at park. The runoff from Machado park's two playground areas and concrete walkways will be treated by a bioretention area located near a picnic area.	Under Construction	Summer 2019

[11] BASMAA Development Committee (2016) Guidance for Identifying Green Infrastructure Potential in Municipal Capital Improvement Program Projects. May.

6.4 Legal Mechanisms

Provision C.3.j.i.(3) of the MRP requires permittees to "Adopt policies, ordinances, and/or other appropriate legal mechanisms to ensure implementation of the Green Infrastructure Plan in accordance with the requirements of this provision."

As described in Section 1.3.2, the City of Santa Clara and other municipalities subject to Provision C.3 of the MRP must require post-construction stormwater control measures on regulated development projects. Post-construction stormwater controls reduce pollutants from flowing to streams, creeks, and the Bay and reduce the risk of flooding by managing peak flows. Section 13.20.080 of the City's Municipal Code provides broad legal authority for the City to require regulated private development projects to comply with MRP requirements.

GSI projects are typically not regulated projects (although they must conform to the sizing and design requirements contained in Provision C.3, except under certain circumstances) and they are primarily public projects under control of the City. As part of the GSI Plan process, the City reviewed its existing policies, ordinances, and other legal mechanisms related to the implementation of stormwater NPDES permit requirements and found that it has sufficient legal authority to implement the GSI Plan. Approval of the GSI Plan by the City's Council will further strenghten this authority.

6.5 Evaluation of Funding Options

Implementation of GSI projects is contingent upon the City identifying funding sources for GSI planning, design, construction, and maintenance.

The total cost of GSI includes costs for planning, capital (design, engineering, construction) and ongoing expenditures, including operations and maintenance (O&M), utility relocation, and feature replacement. It is likely that no single source of revenue will be adequate to fund implementation of GSI, and a portfolio of funding sources will be needed. There are a variety of approaches available to help fund up-front and long-term investments. This section discusses the City's current stormwater management funding sources and then describes additional funding strategies available to implement GSI that are being considered by the City for future funding.

Current Funding Sources for GSI Program Elements

The City of Santa Clara currently uses a combination of federal and state grants and general funds to fund construction of projects in its capital improvement program (CIP) and other projects. General funds are used for public street, parking lot and building maintenance; maintenance of stormwater control measures installed at public projects; and maintenance of other landscaped areas (e.g., parks, medians, public plazas, etc.) The City has a Storm Drain Environmental Compliance Fee that is used to implement its Urban Runoff Pollution Prevention Program.

Potential Future Funding Options

As required by the MRP, the City analyzed possible funding options to raise additional revenue for design, construction, and long-term O&M of GSI projects. The City used the guidance on stormwater funding options developed by SCVURPPP (2018) as a reference for conducting its analysis. Table 6-2 summarizes the funding options that will be considered by the City as the Plan is implemented. For each type of funding mechanism, the table provides a brief overview and specifics related to GSI, pros and cons, and applicability to funding planning, capital, and/or long-term O&M costs.

Table 6-2 Potential GSI Funding Options

Section/Overview	GSI Specifics	Pros	Cons	Type of Funding
Parcel Taxes: Revenue stream through taxing property or other system.	Can be used to set up, fund and maintain a stormwater program and MRP compliance.	• Well understood tax • Stable revenue stream over many years • Legally reliable • Can also be done by mail.	• High political threshold • Vulnerable to competition with other measures on the ballot. • Considerable effort and resources required with uncertain odds of success.	• Planning • Capital • O&M
Property-related Fees: Fees on real property.	• Fee on property contributing stormwater runoff to MS4. • Can be used to set up, fund and maintain a stormwater program and MRP compliance.	• Most-commonly used mechanism for funding stormwater programs. • Easier to pass with 50% threshold and mailing process.	• Property-based fees must use a standardized methodology for calculating the fee. • Considerable effort and resources required with uncertain odds of success. • Approval process is more time consuming and expensive for staff. • Schools may have large fees and public schools may be exempt from fees depending on the agency's specific ordinance.	• Planning • Capital • O&M
Development Impact Fees: Fees paid by an applicant seeking approval of a development project.	Could potentially be used to fund retrofits of adjacent public right-of-way areas with GSI as part of development or redevelopment projects.	Cost for retrofitting streets can be leveraged through development activities.	If a fee is found to not relate to the impact created by the development project, or to exceed the reasonable cost of providing the public service, then the fee may be declared a "special tax" subject to approval by a two-thirds majority of voters.	• Planning • Capital

Section/Overview	GSI Specifics	Pros	Cons	Type of Funding
Grants: One-time funds that require an application from a funding agency.	Could be used to plan, design and/or build GSI.	Can fund programs or systems that would otherwise take up significant general fund revenues.	• Usually a one-time source of funding only. • May need to create new programs and systems for each grant. • Usually have strings attached for matching funds and other requirements. • Little control over timing of applications and payment can lead to difficulties in coordination with other programs and grants. • Can be very competitive and resource intensive to apply. • No guarantee of success. • Post-project O&M costs must be borne by the agency.	• Planning • Capital
Integration with Transportation Projects: Leveraging transportation funding to cost-effectively include stormwater quality elements.	Installation and maintenance of GSI facilities as part of integrated roadway programs.	• Roadway projects have more funding than stormwater programs and are generally more popular with the public. • Complete and green streets may be more popular with the public than traditional car-focused streets. • Green streets may be less expensive than traditional streets based on a life cycle cost analysis.	• Roadways have been designed in certain ways with expectations of costs and purposes for decades. • Many roadways are in poor condition and there is not enough funding to fix them all. • GSI is perceived as an “added” cost which, could reduce the number of roadways that can be maintained. • Transportation funding is often restricted to certain roadway construction elements.	• Planning • Capital

Section/Overview	GSI Specifics	Pros	Cons	Type of Funding
Alternative Compliance: Allows developers the flexibility to build, or fund through payment of an in-lieu fee, off-site stormwater treatment systems for regulated projects or set up credit trading programs.	Leveraging development activities to build and maintain GSI systems. In lieu fees can be used by developers who would rather make a lump sum payment and quickly complete their compliance requirements. Credit trading programs can incentivize non-regulated properties to retrofit impervious surfaces.	• Gives flexibility to site GI systems in locations that optimize pollutant loading reduction and other benefits to the community. • Allows for off-site stormwater treatment when stormwater management requirements can't be met within a regulated project site. • An in-lieu fee and/or credit trading system can be used to achieve additional retrofits and installation of GSI.	• Can be difficult to come up with viable alternative locations for GSI installations. • Can be difficult to quantify how much a developer should pay upfront for long-term maintenance costs that the municipality will bear. • May require agencies to modify the stormwater sections of their municipal codes to allow for the creation and/or use of the desired options/programs.	• Planning • Capital • O&M
Public-Private Partnerships (P3s): Agreements or contracts between a municipality and a private company to perform specific tasks.	Can provide for the design, construction and maintenance of GSI systems over a long period.	• Leverages public funds while minimizing impacts to a municipality's debt capacity. • Access to advanced technologies. • Improved asset management. • Draws on private sector expertise and financing. • Benefits local economic development and "green jobs." • Relieves pressure on internal local government resources.	• Stormwater fee or other source of stable revenue over the life of the P3 contract is required. • Contracts out to the private sector the construction and maintenance of GSI systems, possibly removing some municipal control.	• Planning • Capital • O&M

Section/Overview	GSI Specifics	Pros	Cons	Type of Funding
In-Lieu Fee - An option to pay a fee in-lieu of treating a portion of runoff onsite.	Can provide for the design, construction and maintenance of GSI systems over a long period.	• The City's list of priority projects in strategic locations can provide opportunities for GSI implementation. • Can result in a net environmental benefit compared to the developer meeting C.3.d requirements onsite. • The regulated project developer would benefit through maximized area of economically productive development on the property.	• The risk of collecting insufficient fees to implement projects and fees being use for purposes other than project delivery. • The City's focus on establishing the fee to cover all project-related costs is likely to result in a fee that is high enough that it would only be an economically attractive option for high-value real estate development.	• Planning • Capital • O&M

6.6 Impervious Area Targets

As mentioned in Section 1.2, the focus of the GSI Plan is the integration of GSI systems into public rights-of-way. However, other provisions of the MRP (C.11 and C.12) establish a linkage between public and private GSI features and required reductions of pollutants in stormwater discharges. To help estimate the pollutant load reductions that can be achieved by GSI during the 2020, 2030, and 2040 timeframes, the MRP requires that Permittees include in their GSI Plans estimated targets for the amounts of impervious surface to be "retrofitted" (i.e. redeveloped with GSI facilities to treat runoff from impervious surfaces) as part of public and private projects during the same timeframes.

The City worked with SCVURPPP staff to develop a methodology to predict the extent and location of privately- and publicly-owned land areas that will be redeveloped in their jurisdictions and whose stormwater runoff will be addressed via GSI facilities, and to derive impervious surface targets for GSI retrofits associated with these redevelopment projects. The methodology and results are described in Sections 6.6.1 and 6.6.2 below.

6.6.1 Methodology

The first step in the process used historic development trends and City staff's knowledge of planned/projected redevelopment in the City to estimate the acres of redevelopment that will occur in the City by 2020, 2030, and 2040 via redevelopment of privately- and publicly-owned parcels that would trigger C.3 requirements under the current MRP (i.e. C.3 regulated projects). Stormwater runoff associated with these parcels will be addressed via GSI measures, as required by the permit.

The second step was to estimate the acres of impervious surface associated with future redevelopment of these privately and publicly-owned parcels. To do this, it was necessary to predict the likely locations and types of land areas that are anticipated to be addressed by GSI in the future. Growth patterns and time horizons for development, along with algorithms to identify which parcels were likely to redevelop, resulted in preliminary estimates of the extent of land area predicted to be addressed by GSI facilities in the City of Santa Clara by 2020, 2030, and 2040. Using the current land use of the predicted locations of GSI implementation and associated impervious surface coefficients for each land use type, estimates of the amount of impervious surface that will be retrofitted with GSI on privately and publicly-owned parcels were developed.

The methodology focused on parcel-based redevelopment as the location and timing of projects in the public right-of-way is uncertain and the contribution to overall impervious surface treated by GSI expected to be minor relative to the acreage projected to be treated by C.3 projects.

6.6.2 Results

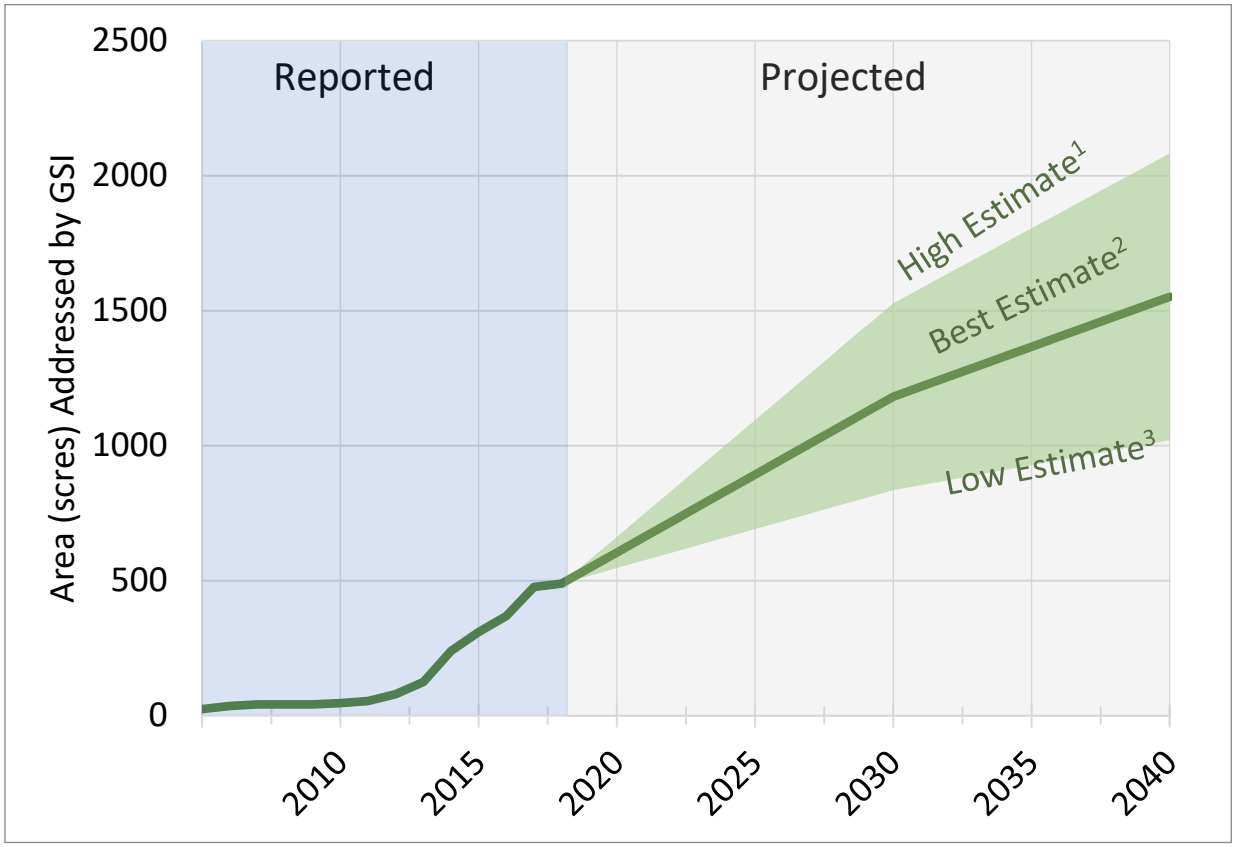
Using the methodology described above, a predicted redevelopment rate of 57.7 acres per year was calculated for the City of Santa Clara for the 2020-2030 timeframe. A lower rate of 37 acres per year was projected for the 2031-2040 timeframe. The higher rate for the 2020-2030 timeframe is based on the high level of development that is currently happening and likely to happen over the next 10 years due to the expected redevelopment of Focus Areas like Tasman East, Freedom Circle, Patrick Henry Drive and City Place.

"Best" estimates of the magnitude of land areas that is predicted to be addressed by future GSI facilities by the 2020, 2030, and 2040 milestones were calculated using the two rates. "High" (i.e., 50% > "best") and "Low" (i.e., 50% < "best") estimates of future GSI implementation were also calculated to provide a

range of potential redevelopment levels and to account for uncertainty in the “Best” estimate. Figure 6-1 and Table 6-3 present the outputs of the analysis and represent the total acreage known to be addressed by GSI in the City of Santa Clara through 2018, and the best estimate of the cumulative land area that will be addressed by 2020 (605 acres), 2030 (1,182 acres), and 2040 (1,552 acres).

6.6.3 Impervious Surface Retrofit Targets

Table 6.4 lists the impervious surface percentage for each land use class, based on impervious surface coefficients typically utilized, and the estimated impervious surfaces for private and public parcel-based projects that are predicted to be retrofitted by 2020 (487 acres), 2030 (732 acres) and 2040 (1,019 acres) in the City of Santa Clara via GSI implementation. Note that these predictions do not include impervious surface that may be addressed by projects in the public right-of-way, and that these predictions have a high level of uncertainty because future redevelopment rates may increase or decrease relative to the historic development trends that the rate for Santa Clara was based on. Therefore, actual impervious surface addressed by GSI by the various milestones may increase or decrease relative to what is presented in Table 6.4.



[1]High estimate – projected from 150% of "Best Estimate; [2]Best estimate – rate of redevelopment based on 10-year average (2009-2018) and active/planned projects; and [3]Low estimate – projected from 50% of "Best Estimate"

Figure 6-1 Existing and projected cumulative land area (acres) anticipated to be addressed via Green Stormwater Infrastructure facilities installed via private redevelopment in the City of Santa Clara by 2020, 2030, and 2040

Table 6-3 Projected cumulative land area (acres) anticipated to be addressed via Green Stormwater Infrastructure facilities via private redevelopment in the City of Santa Clara by 2020, 2030, and 2040

Year	Low[1]	Best[2]	High[3]
Existing GSI[4]	-	**489**	-
2020	547	**605**	662
2030	835	**1,182**	1,528
2040	1,020	**1,552**	2,083

[1] Low estimate – projected from 50% of "Best Estimate"; [2]Best estimate – rate of redevelopment based on 10-year (2009-2018) and adjusted following City staff input; and [3]High estimate – projected from 150% of "Best Estimate"; [4]Total area addressed by parcel-based redevelopment projects with GSI completed as of 2018 (excludes non-jurisdictional and green street and regional projects).

Table 6-4 Actual (2002-2018) and predicted (2019-2040) extent of impervious surface retrofits via GSI implementation on privately-owned parcels in the City of Santa Clara by 2020, 2030, and 2040

Previous Land Use	% of Area Impervious [a]	Retrofits via GSI Implementation									
		2002-2018		2019-2020		2021-2030		2031-2040		Total (2002-2040)	
		Total Area (acres)	Impervious Area (acres)	Total Area (acres)[c]	Impervious Area (acres)	Total Area (acres)	Impervious Area (acres)	Total Area (acres)	Impervious Area (acres)	Total Area (acres)	Impervious Area (acres)
Colleges and Universities	47%	1	1	0	0	2	1	23	11	26	12
Commercial	83%	198	165	59	49	126	104	121	100	504	418
Industrial	91%	103	94	76	70	77	70	106	97	363	330
K-12 Private Schools	67%	0	0	0	0	0	0	45	30	45	30
Residential - High Density	82%	32	26	25	21	1	1	24	20	82	68
Residential - Low Density	47%	7	3	1	0	6	3	2	1	15	7
Retail	96%	40	39	19	19	66	63	28	27	154	148
Urban Parks	20%	5	1	0	0	0	0	5	1	11	2
Open Space[b]	1%	102	1	0	0	234	2	15	0	351	4
Totals		489	329	181	158	512	245	370	287	1,552	1,019
Cumulative[d]		489	329	670	487	1,182	732	1,552	1,019		

[a] Source: Existing Land Use in 2005: Data for Bay Area Counties, Association of Bay Area Governments (ABAG), January 2006

[b] Development totals from 2002-2018 may include new development of open space and vacant properties.

[c] The total area for 2019-2020 is based on facilities that are currently under construction or planned to occur prior to 2020 and not the calculated redevelopment rate and may therefore deviate from the "Best" acres presented for 2020 in Table 6-3.

6.7 Project Tracking System

A required component of the GSI Plan is to develop a process for tracking and mapping completed public and private GSI projects and making the information available to the public. The City will continue to implement existing internal tracking procedures for processing public and private projects with GSI, meeting MRP reporting requirements, and managing inspections of stormwater treatment facilities. In addition, the City will provide data to SCVURPPP for countywide tracking of completed public and private GSI projects. This countywide tracking tool can be used to document a project's pollutant reduction performance as well as overall total progress toward city or county-level stormwater goals

6.7.1 SCVURPPP Project Tracking System

SCVURPPP has developed a centralized, web-based data management system (GSI Database) with a connection to GIS platforms, for tracking and mapping all GSI projects in the Santa Clara Valley. The GSI Database provides a centralized, accessible platform for municipal staff to efficiently and securely upload and store GSI project data, and enhances SCVURPPP's ability to efficiently and accurately calculate and report a variety of performance metrics associated with GSI projects. It also allows portions of the GSI project information to be made publicly available.

6.7.2 City Project Tracking System (Regulated and GSI)

The City currently utilizes an internal tracking system to manage information about installed stormwater treatment measures (including GSI), O&M of public facilities, O&M verification program inspections, and enforcement actions. Tracking of post-construction O&M inspections and enforcement actions for private projects is through an electronic stormwater inspection system. Tracking of operation and maintenance of public stormwater facilities is currently paper based. The City is developing an inventory of its storm drain assets in GIS and plans to activate the storm drain maintenance module later in 2019 or in early 2020.

City staff will continue to collect and manage information on GSI projects and submit it annually to the SCVURPPP GSI Database through a web-based data entry portal for individual projects or upload data for multiple projects in batch on an annual basis, using standardized formats.