

SCVURPPP Annual C.3 Workshop
Part 1: GSI - February 28, 2023

**Evaluation of GSI Opportunities
in Street and Parking Lot Projects**

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Santa Clara Valley Urban Runoff Pollution Prevention Program

Presentation Overview

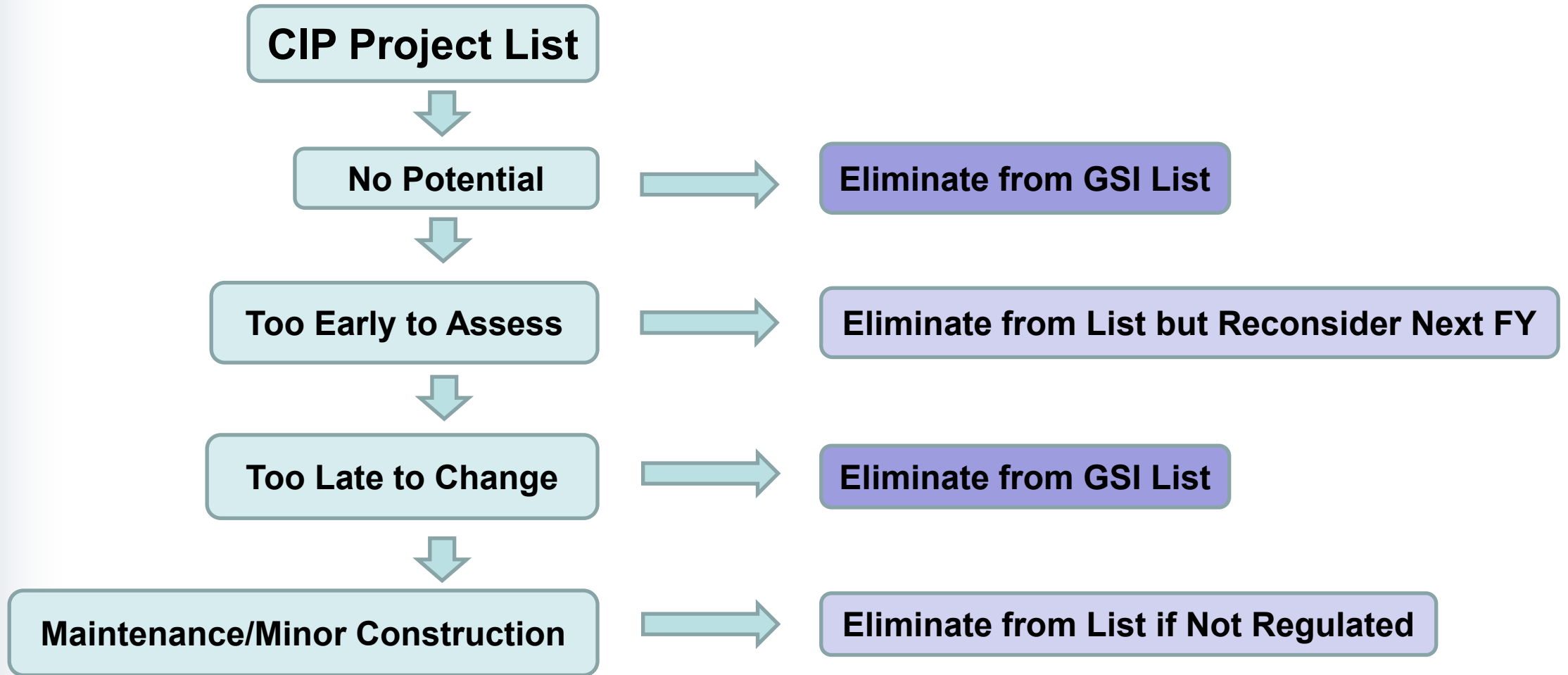
- Review of Capital Projects for “No Missed Opportunities”
- Green Stormwater Infrastructure (GSI) Location Identification and Screening
- Example Desktop Screening Exercise
- Feasibility Analysis Process



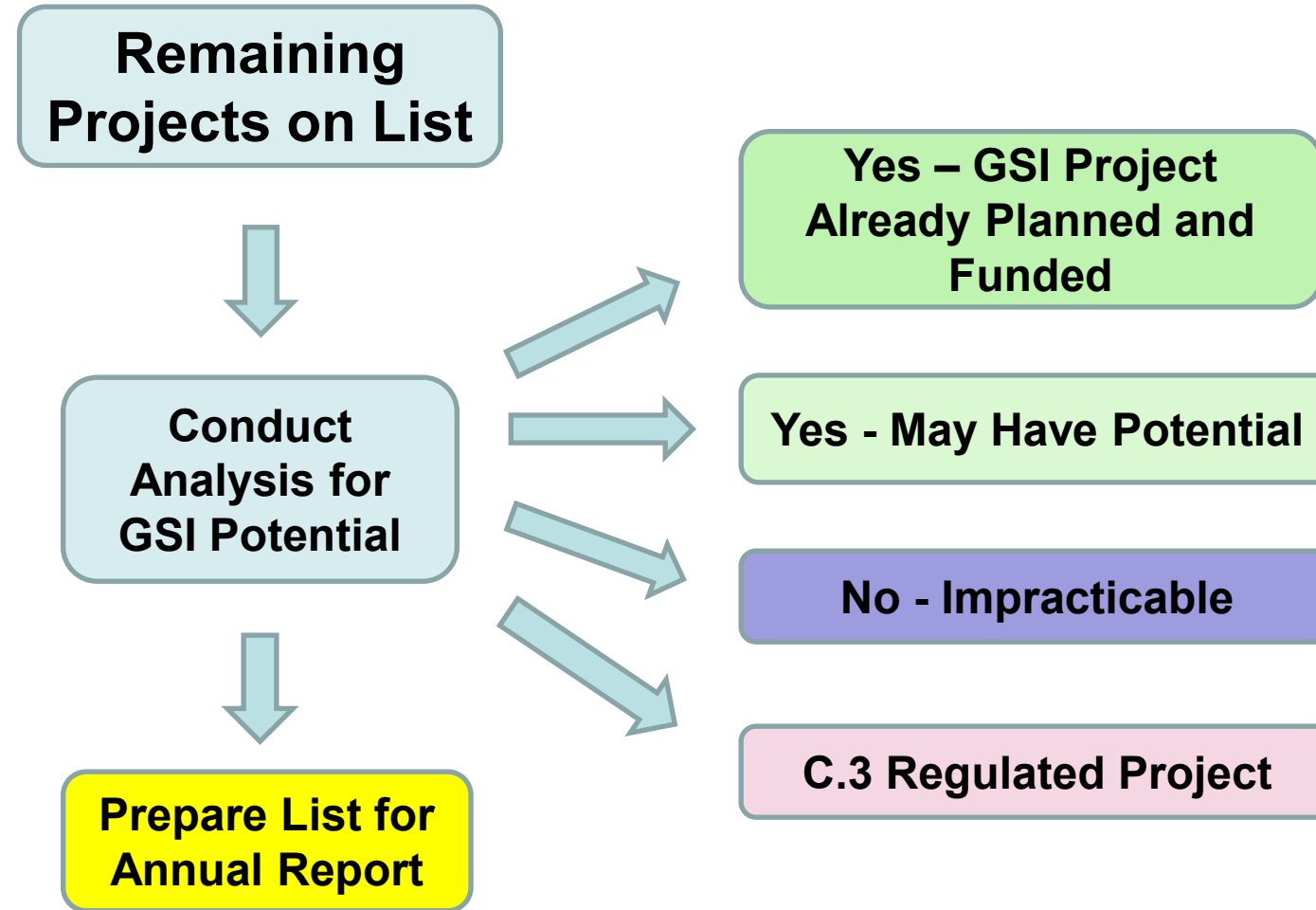
No Missed Opportunities (NMO)

- Per Provision C.3.j.iii, continue to maintain a list of:
 - GSI projects planned for implementation during permit term
 - Infrastructure projects planned for implementation during the permit term that have potential for GSI
- In each Annual Report, submit the list and summary of:
 - Planning or implementation status for each GSI project
 - How each public infrastructure project with GSI potential will include GSI measures to the MEP during the permit term; OR
 - For any public infrastructure project where implementation of GSI measures is not practicable, describe project and reasons why
- BASMAA Guidance (2016) developed to assist NMO analyses

CIP Review Process – Part 1: Initial Screening



CIP Review Process – Part 2: Assess Potential



Annual Report Section C.3.j.ii.(2)

Table A – Public Projects Reviewed for Green Infrastructure

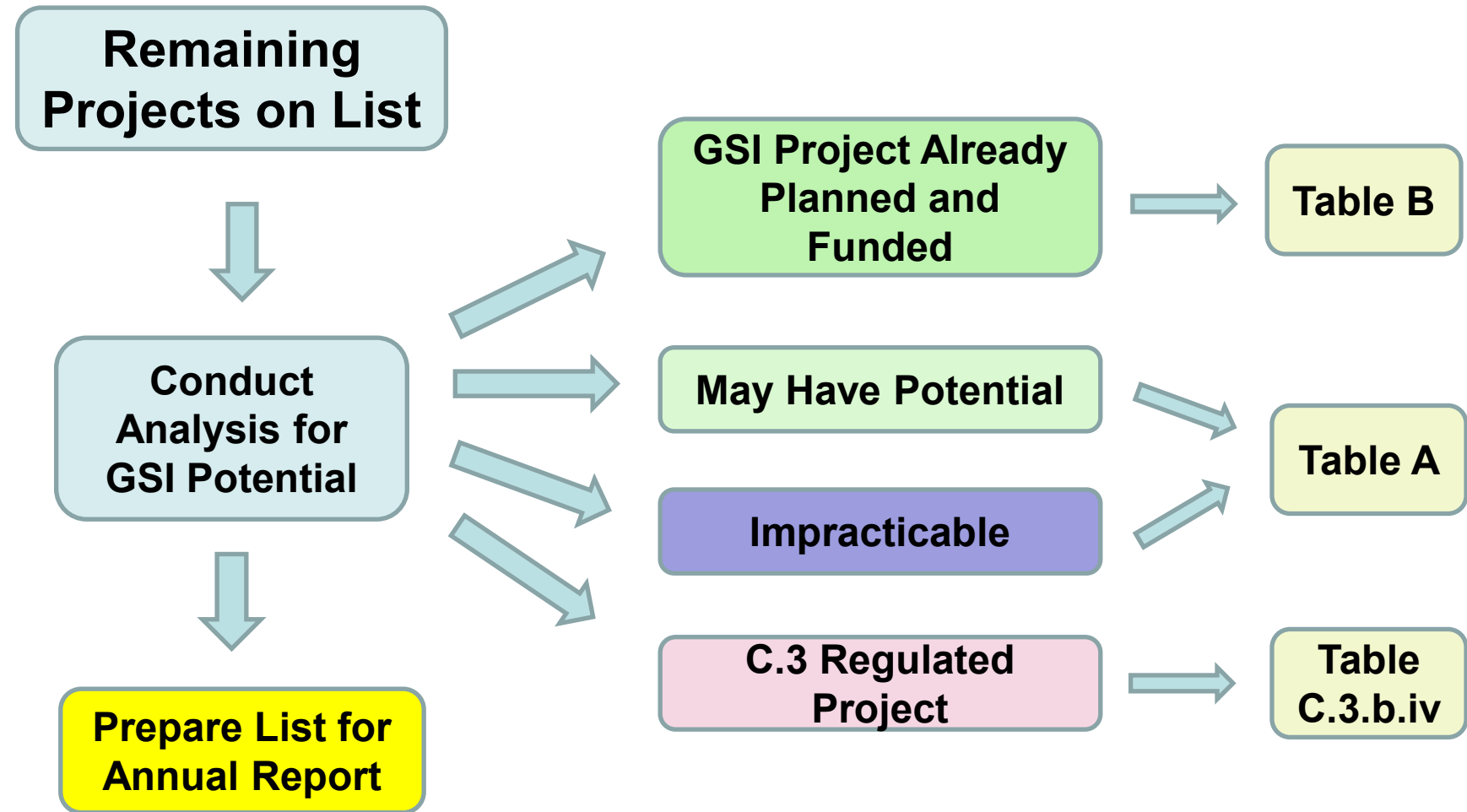
C.3.j.ii.(2) ▶ Table A - Public Projects Reviewed for Green Infrastructure				
Project Name and Location ⁴⁴	Project Description	Status ⁴⁵	GI Included? ⁴⁶	Description of GI Measures Considered and/or Proposed or Why GI Is Impracticable to Implement ⁴⁷
EXAMPLE: Storm drain retrofit, Stockton and Taylor	Installation of new storm drain to accommodate the 10-yr storm event	Beginning planning and design phase	TBD	Bioretention cells (i.e., linear bulb-outs) will be considered when street modification designs are incorporated

GSI Included?
Yes, No, or TBD

Table B – Planned Green Infrastructure Projects

C.3.j.ii.(2) ▶ Table B - Planned Green Infrastructure Projects			
Project Name and Location ⁴⁷	Project Description	Planning or Implementation Status	Green Infrastructure Measures Included
EXAMPLE: Martha Gardens Green Alleys Project	Retrofit of degraded pavement in urban alleyways lacking good drainage	Construction completed October 17, 2015	The project drains replaced concrete pavement and existing adjacent structures to a center strip of pervious pavement and underlying infiltration trench.

CIP Review Process – Part 2: Assess Potential



Subsequent Annual Reports

Table A – Public Projects Reviewed for Green Infrastructure

C.3.j.ii.(2) ► Table A - Public Projects Reviewed for Green Infrastructure

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Table B – Planned Green Infrastructure Projects

C.3.j.ii.(2) ► Table B - Planned Green Infrastructure Projects

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EXAMPLE: Martha Gardens Green Alleys Project	Retrofit of degraded pavement in urban alleyways lacking good drainage	Construction completed	The project drains replaced concrete pavement and existing adjacent structures to a center strip of pervious pavement and underlying infiltration trench.

Annual Reports for MRP 3.0 – Added New Table

Table B – Planned Green Infrastructure Projects

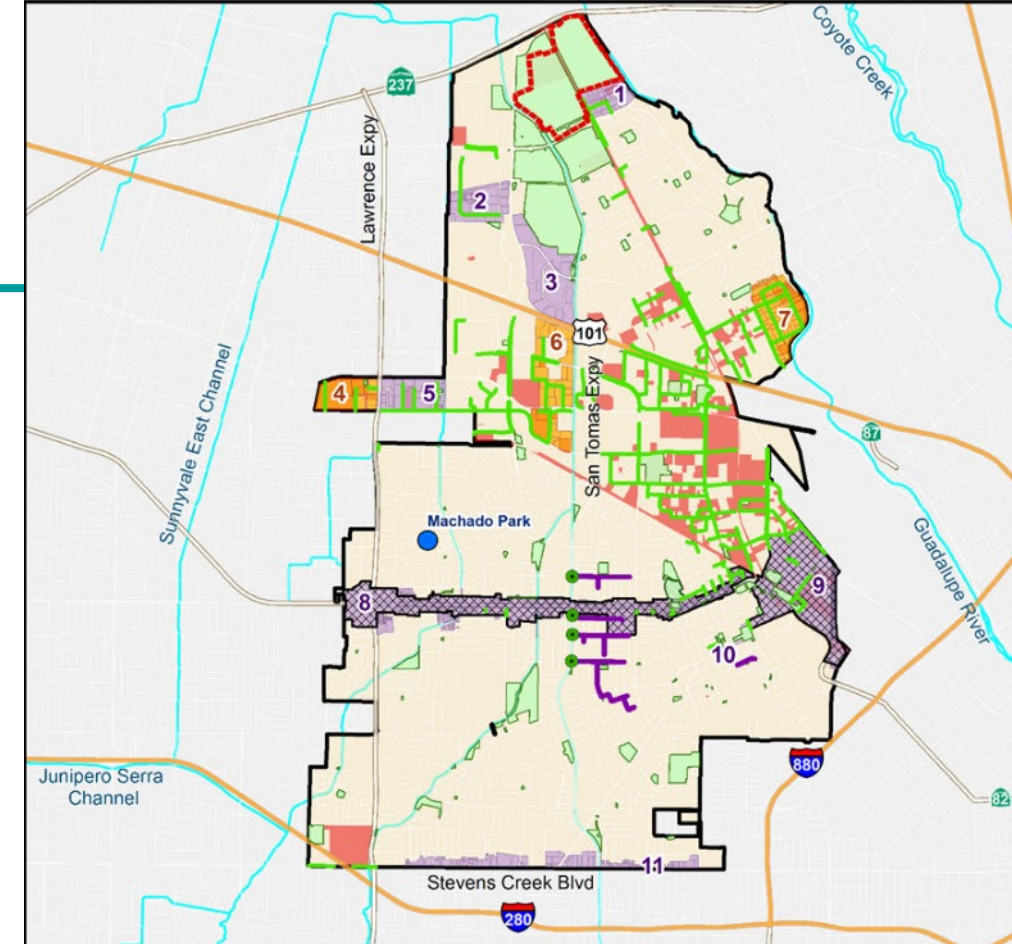
C.3.j.ii.(2) ▶ Table B - Planned Green Infrastructure Projects			
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EXAMPLE: Martha Gardens Green Alleys Project	Retrofit of degraded pavement in urban alleyways lacking good drainage	Construction completed	The project drains replaced concrete pavement and existing adjacent structures to a center strip of pervious pavement and underlying infiltration trench.

↓
**If project with GSI is constructed,
 enter information in new table**
 ↓

C.3.j.v.(1)(a)▶ Non-Regulated (Green Infrastructure) Projects Reporting Table – Projects Constructed During the Fiscal Year Reporting Period									
Project Location, Street Address	Name of Owner	Project Description	Construction Completion Date	Treatment Measures	Party Responsible for O&M	Hydraulic Sizing Criteria ⁵¹	Total Area Draining to Treatment Measures (ft ²)	Impervious Area Treated (ft ²)	Pervious Area Treated (ft ²)

GSI Location Identification

- Results of CIP review
- Prioritized lists of roads or parking lots for maintenance
- Coordination with Safe Routes to School or Active Transportation Plans
- GSI Plan opportunity maps
- SCVURPPP Stormwater Resource Plan lists
- Urban Forestry - planned plantings



City of Santa Clara GSI Overview

- | | |
|---|--|
| Street Segments with GSI Opportunities | Future Focus Areas |
| Public Parcels with GSI Opportunities | 4 - Lawrence Station Future Focus Area |
| Planned Public Project with GSI | 6 - Central Expressway Future Focus Area |
| Near-term Focus Areas | 7 - De La Cruz Future Focus Area |
| 1 - Tasman East Focus Area | City Place Master Planned Community |
| 2 - Patrick Henry Focus Area | Priority Development Areas (PDAs) |
| 3 - Freedom Circle Focus Area | Old Industrial Areas |
| 5 - Lawrence Station Focus Area | Highest Priority Storm Drain Projects |
| 8 - El Camino Real Focus Area (also a PDA) | Outfalls |
| 9 - Santa Clara Station Focus Area (also a PDA) | Creeks |
| 10 - Downtown Focus Area | |
| 11 - Stevens Creek Boulevard Focus Area | |

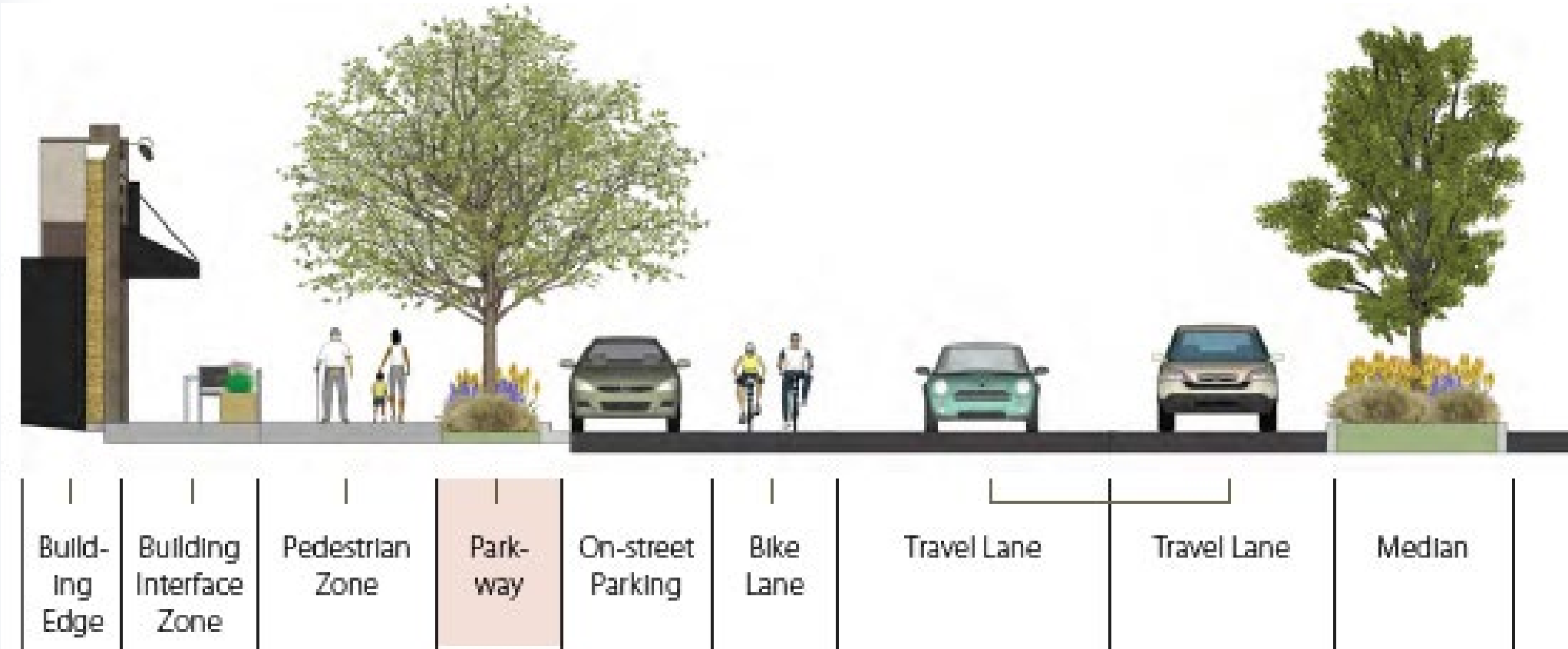
GSI Feasibility Screening Process

- Purpose:
 - Quick analysis to rule out locations with obvious constraints
- Helpful tools:
 - Google Maps/Street View/Google Earth
 - Maps/GIS layers: jurisdiction boundaries, topography, utilities
- Characteristics to look for (sides of street may differ):
 - Right-of-way (specifically street and sidewalk) width
 - Land uses (industrial, residential, commercial etc.)
 - Sidewalk/planter strip/curb & gutter configuration and red curbs
 - Presence of bikeways (lanes, sharrows, paths etc.)
 - Soil permeability (recharge basins nearby?)

GSI Feasibility Screening Process

- Characteristics to look for (continued):
 - Extent of on-street parking and parking demand
 - Evidence of utilities (power lines, vaults)
 - Presence and size of street trees
 - Available open or landscaped areas
 - Location of storm drain inlets
 - Other street issues (overnight truck parking, encampments, trash)
- Assess drainage patterns
- Identify potential locations for and types of GSI
 - Most types will require a nearby storm drain connection

Locations of GSI in ROW



SCVURPPP GSI Handbook (2019)

Types of Bioretention in the Streetscape

Stormwater Planter



Stormwater Curb Extension



Tree Well Filter/
Pervious Pavement



Credit: EOA

Credit: EOA

Credit: ICPI

Types of Bioretention in the Streetscape



Credit: EOA, Inc.

Two-way, raised, separated bikeway with stormwater planter (Emeryville, CA)



Credit: SMCWPPP

Stormwater curb extension in Safe Routes to School improvements (San Mateo, CA)

Types of Bioretention in the Streetscape

Tree Well Filter



Credit: DeepRoot Green Infrastructure

Suspended Pavement System with Silva Cells under Pervious Pavement (Palo Alto, CA)

Tree Well Filter



Credit: StormTree

Open box tree well filter (StormTree)

Tree Well Filter



Credit: EOA, Inc.

Suspended Pavement System with Structural Soil under sidewalk (Emeryville, CA)

Other Types of GSI Measures in the Streetscape

Pervious Pavement



Credit: EOA, Inc.



Credit: EOA, Inc.

Stormcrete Pre-cast Pervious Concrete Slabs
(Berkeley, CA)

Recommended GSI Measures for Various Land Uses & Road Types.

Legend: **✗** = Not Recommended **○** = Potential **✓** = Recommended

Street Type:	Local Streets				Collectors	Minor Arterials	Principle Arterials	Parking Lots
Land Use Type:	Residential Alley	Low Density Residential	High Density Residential	Commercial	Commercial	Industrial	Industrial	
Stormwater Curb Extension:								
Midblock	✗	✓	○	○	✓	○	○	✗
Corner	○	✓	✓	✓	✓	○	✗	✗
Stormwater Planter	○	○	✓	✓	✓	✓	○	✓
Stormwater Tree Well Filter	○	✓	✓	✓	✓	✓	○	✓
Pervious Pavement	✓	✓	✓	✓	✓	○	✗	✓
Infiltration Trench	✓	○	○	○	✗	✗	✗	✓
Infiltration Device	✓	○	○	○	○	○	✗	✓
Characteristics	Narrow streets; Narrow or no sidewalks; consider heavy loads of garbage trucks	Low to moderate demand for street parking; Light pedestrian traffic; moderate vehicle traffic; sidewalks can be varying sizes; driveways and underground utilities may be limitations	Moderate to high demand for street parking; moderate pedestrian traffic; moderate vehicle traffic; sidewalks can be varying sizes; underground utilities may be limitation	Moderate to high pedestrian traffic; sidewalks likely to be wide; moderate to high parking demand; underground utilities may be limitation	Moderate to high pedestrian traffic; sidewalks likely to be wide; moderate to high parking demand; underground utilities may be limitation; may be able to narrow wide roadways	Low pedestrian traffic; high vehicle traffic; possible opportunity for road diet; pervious pavement may only be possible in sidewalk areas <u>or gutter.</u>	Low pedestrian traffic; high vehicle traffic; may be possible to incorporate GSI into medians; heavy vehicles, sediment loads, and large turning radii, may limit GSI.	

Example of GSI in Road Reconstruction Project



Transformation of Hacienda Ave, Campbell

- Reconstructed pavement
- 63 bioretention areas
- Traffic calming bulb-outs at intersections
- Bike lanes
- Safer sidewalks
- 60 street trees

Google Street View Example

- “Walk” down Lincoln Street in Santa Clara
- Look for GSI opportunities

Example Screening Analysis Spreadsheet

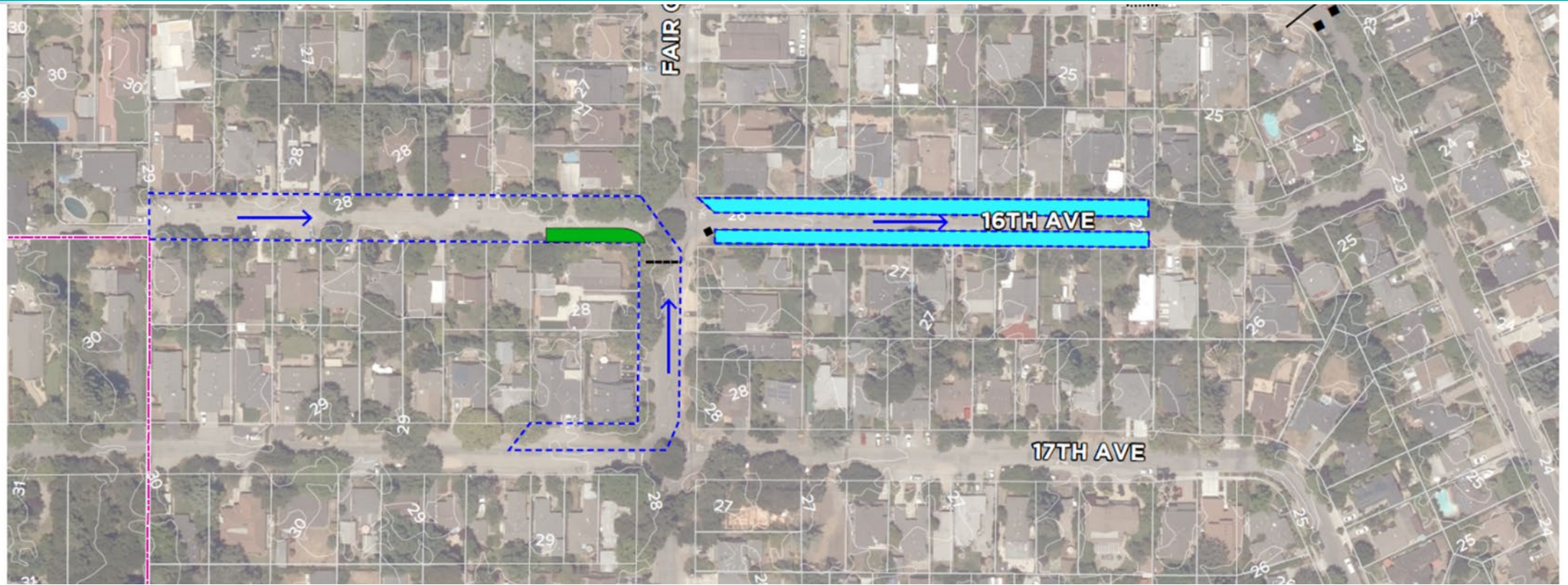
County of San Mateo Green Infrastructure Screening Analysis													
Legend			Beige - Streets northeast of railroad tracks that may not be part of the analysis.								Green - Potential GI feasibility - further analysis recommended.		Yellow - Limited GI feasibility - further analysis not recommended.
Street	From	To	Sidewalk, curb and gutter?	Paved Sidewalk ?	Paved Shoulder ?	Unpaved Shoulder?	Overhead Powerlines?	Street Trees	drain inlets on street?	ROW width (ft)	Road Standards	Notes	Initial GI Feasibility Assessment
Fourth Avenue	William Ave	Edison Way	Most	Yes - some are not paved on 400 and 500 block	No	No - some on 400 and 500 block	Yes - on one side	Yes - north of Middlefield - on 400 and 500 block	No	60	A-3 Urban Residential Collector or Minor Commercial	Generally a high level of imperviousness of the streetscape including parcel frontages	PP in parking lane on 300 block might be good because there are few trees. Might be able to install tree well filters or bioretention near intersections where there is a storm drain line (at Middlefield or Edison). Curb extensions at Middlefield intersection could overlap existing red curb to minimize parking loss. Could potentially combine with PP in parking lanes to treat all ROW runoff. Potential opportunity to large stormwater planter and pedestrian improvements in front of Everest High School where there is already red curb and poor landscaping if we could run SD pipe through school parking lot to connect to SD main in 5th
Fourth Avenue	Dead End	Spring Street/County line	Yes	Yes	No	No	Yes - on one side	Yes - but only in bulb outs	No	60	A-3 Urban Residential Collector or Minor Commercial	Big tree in center island on 600 block - empty island next to it. Middle class. Some businesses. A lot of impervious surface on parcels	Limited GI feasibility if utilities are under parking lane. Might be able to install tree well filters or bioretention at Fair Oaks Ave intersection where there is a storm drain line. Fair Oaks intersection looks like only viable place for bioretention. Large mature trees on last/northernmost block will make GI difficult.
Sixth Avenue	Semicircular Road	Edison Way	Yes - on 300 and 400 block	Yes on 300 and 400 blocks. Some of 500 block.	No	No	No! Underground on 300 block? Yes on 400 and 500 blocks.	No on 300. Yes on 400	Yes - on 300 block and at Park.	60	A-3 Urban Residential Collector or Minor Commercial	400 and 500 blocks have mid-block chicanes with trees and curbs (and some parking behind). Fenced chicane at both ends of the	Large bulbouts at Edison and 6th could become stormwater curb extensions where there is an adjacent storm drain inlet. Bulbouts and barricade area are good opportunity areas for bioretention. No storm drain connections near chicanes limit the opportunities those areas could provide.
Sixth Avenue	Dead End	Bay Road/County Line	Yes	Yes	No	No	Yes - on one side	No	No - only at Spring Street	60 (south of Spring St) 50 (north of Spring St)	A-3 Urban Residential Collector (S of Spring) A-6F Sequoia Tract (N of Spring) no parking, sidewalk	Low parking demand on 700 block. Valley gutter on 800 block with parking on sidewalk.	Limited GI feasibility. GI in PP in parking lane and possibly Tree Well Filters at Spring Street where there is a storm drain inlet? (Confirm)
Eighth Avenue	Middlefield Road	Edison Way	No	No	Some - more pave shoulders on 500 block.	Mostly. Some perpendicular parking in shoulders (wider).	Yes - on one side	Yes	No	60	A-6F Sequoia Tract - unpaved shoulder	400 and 500 blocks have mid-block chicanes with trees and curbs (some with no parking behind). Fenced chicane at both ends of the neighborhood. Tree in roundabout at Oak Street. Large area behind	Large bulbouts at Edison and 8th could become bioretention. Storm drain inlet adjacent on 8th. PP isn't recommended in heavy tree coverage areas so patchwork PP parking areas may not be worthwhile. Also, it looks like PP parking areas will accept run-on and thus need overflow connections. Size of bioretention at Edison is limited by driveway locations on 8th but could potentially wrap bioretention around corners (on Edison).
Eighth Avenue	Fair Oaks Ave	Bay Road/County Line	Yes - on 700 block. Valley gutter on	Yes	No	No	Yes - on one side	No	No	50	A-6B / A-6F Sequoia Tract - no parking, sidewalk	Low parking demand on 700 block. 800 block parking on sidewalk.	Low GI opportunity streets. Difficult with valley gutter. No storm drain inlets. Only opportunity would be to replace concrete parking/sidewalk zone with PP for one block between Spring and Bay.
Sixteenth Avenue	Dead End	Fifteenth Ave	Some - at north end at 15th	Some - at north end at 15th	Some	Mostly	Yes - on one side	Yes	At Fair Oaks Ave	55 (south of Fair Oaks Ave) 60 (north of Fair Oaks Ave)	A-6F Sequoia Tract - unpaved shoulder	Roundabout with tree at Fair Oaks Ave. Chicane at 755 16th.	Bioretention possible in areas near storm drain line. Otherwise PP in Shoulder. No SD connection for Fair Oaks/15th Avenue block makes anything but self-treating PP or small, shallow stormwater planters within parking zones that won't require underdrain connections.



Detailed Desktop Analysis

- If desktop screening step identifies potential for GSI:
 - Create a base map with topographic contours, right-of-way and parcel boundaries, and available utility information
 - Estimate drainage management area boundaries to potential GSI locations and determine if there is sufficient space
 - Evaluate infiltration conditions, based on soil type/data, depth to groundwater, constraints from nearby structures/utilities
- If determined to be infeasible, document findings and end analysis

Detailed Desktop Analysis Example



- | | |
|----------------------|-------------------|
| City County Boundary | Valley Gutter |
| Parcels | Managed Area |
| Catch Basin | Flow Direction |
| Storm Drain | Bioretention |
| Trench Drain | Pervious Pavement |

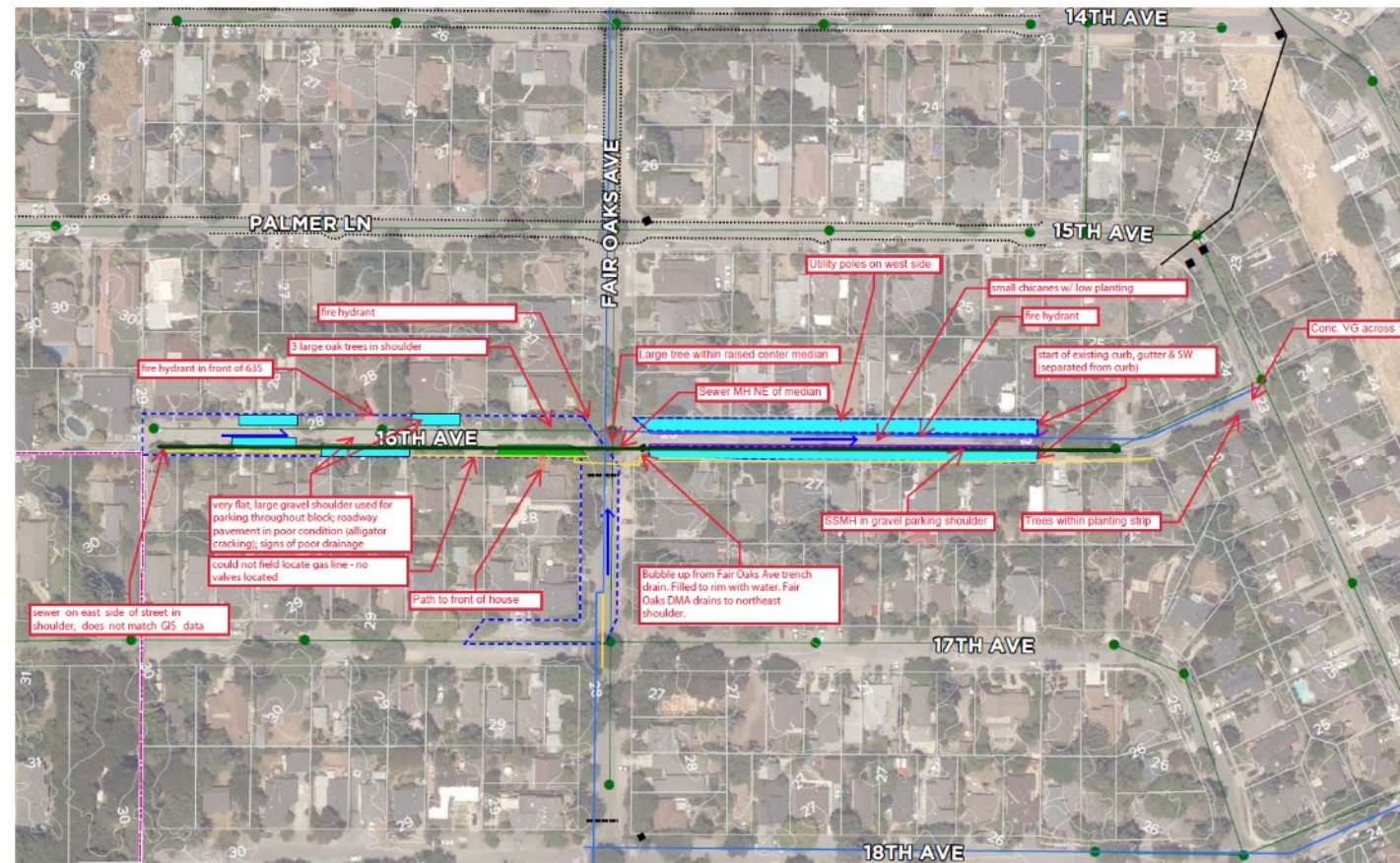
Map courtesy of Lotus Water
Prepared for San Mateo County

0 175 350
Feet



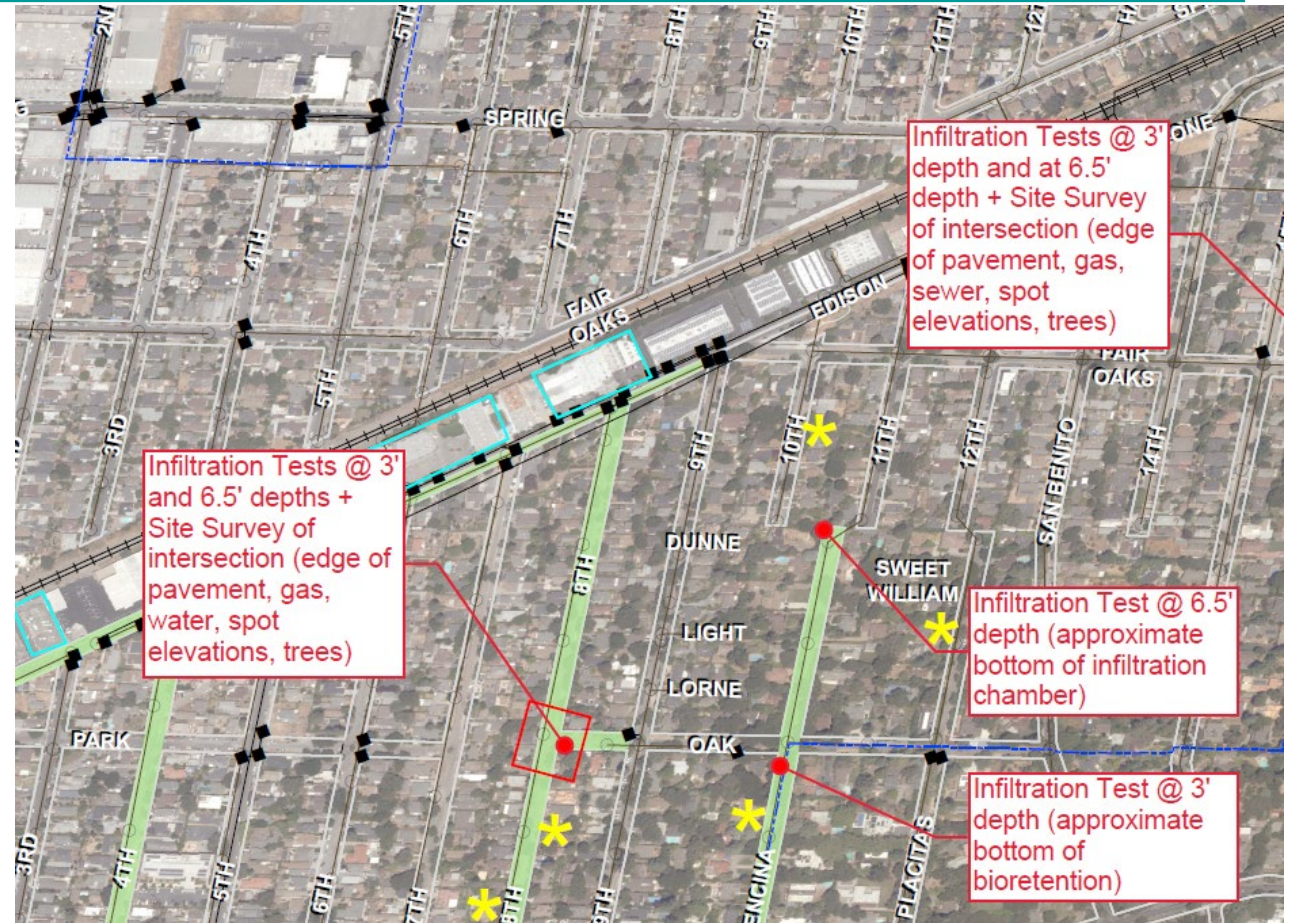
Field Assessment

- Develop Field Map
 - Aerial imagery
 - Right-of-way and parcel boundaries
 - LiDAR contours
 - Storm drain networks
 - Other utilities (water, sewer, electric, telecom)
 - Preliminary drainage delineation
- Conduct Field Visit
 - Confirm assumptions and resolve inconsistencies
 - Note potential causes of infeasibility
 - Determine additional information needed on existing conditions



Field Assessment

- Existing Conditions Investigations
 - Borings and infiltration tests
 - Topographic and site feature surveys
 - Utility locating
 - Tree condition assessments by City Arborist
- Additional Data Collection
 - Soil testing, site survey, and utility locating services may be needed
- Documentation of Results
- Concept Development
 - Facilitates development of cost estimate and obtaining funding



SWRP Concept Plan

MARY AVENUE GREEN STREET

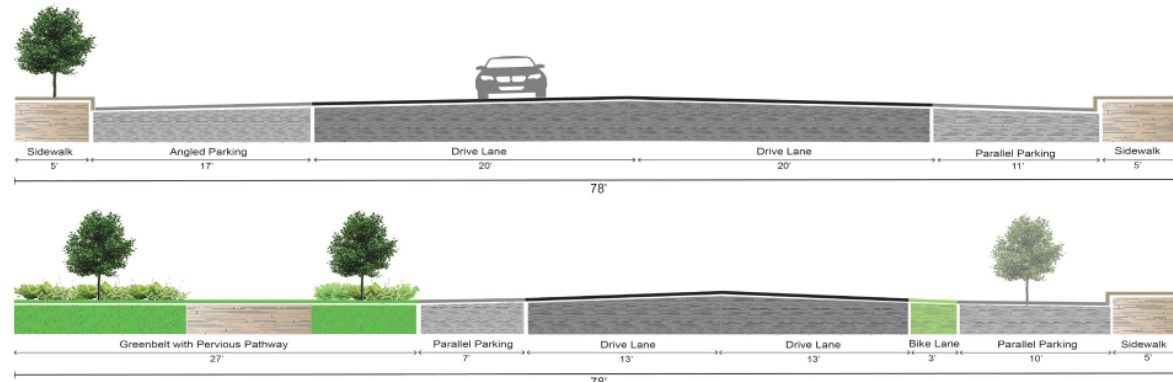
Cupertino

CONCEPT DESCRIPTION

Mary Avenue is an important connector road in the City of Cupertino that is at the hub of many important destinations: Homestead High School, Dan Burnett bicycle-pedestrian bridge over I-280, Mary Avenue Dog Park, City of Cupertino Service Center, The Oaks shopping center, Cupertino Senior Citizen Center, De Anza College, Memorial Park, and the commercial corridor on Stevens Creek Blvd. The road has an 80-ft wide right-of-way with a variety of abutting land uses running 0.72 miles from Stevens Creek Blvd to I-280. It presents a tremendous opportunity for a “complete street” retrofit integrating stormwater management with multiple community and environmental benefits. The City has been considering a complete street concept on Mary Avenue for several years, with a vision of transforming the existing inefficient roadway into a multi-functional corridor.

Surveys have identified “trails and pathways” and “access to nature” as the top two most sought after community benefits among Cupertino residents. Stormwater, habitat, and community benefits will be

realized by creating a wide bioretention-enhanced green belt on the west side of the street containing a pervious multi-use pathway to accommodate bicyclists, pedestrians, strollers, and joggers. Tree wells will be installed every 100 feet on the east side of the street to treat stormwater and, along with new trees in the green beltway, eventually form an arbor archway of green canopy over Mary Avenue. To create space for the proposed improvements, the City plans to remove the center turn lane, convert 20'-wide angled parking on the west side to 7'-wide parallel parking, and incorporate the existing bike lane on the west side into the green belt. A typical cross-section has been developed to show how the roadway could be reconfigured. Pervious pavement will be employed in the roadway closer to the Stevens Creek Blvd intersection where space is in higher demand. Bioretention has a 5% sizing ratio (based on available space and to achieve better performance), and the pervious pavement has a 20% sizing ratio (4 parts run-on area to 1 part pervious pavement).



Pre-construction (top) & Post-construction (bottom) Street Section

CONCEPT METRICS

WATERSHED CHARACTERISTICS

Watershed	SUNNYVALE EAST CHANNEL
Drainage Management Area	12.1 AC
% Impervious of DMA	90
Total Runoff Volume	6.6 AC-FT/YR

FACILITY INFORMATION

BIORETENTION	
Total Facility Area	23,958 SF
Number of Facilities	40
Maximum Surface Ponding	0.5 FT
Storage Volume	0.7 AC-FT

PERVIOUS PAVEMENT	
Total Facility Area	9,583 SF
LOCATED IN PARKING LANE	
Storage Volume	0.2 AC-FT

DESIGN CRITERIA

Total Storage	0.9 AC-FT
Infiltration Rate	0.2 IN/HR
Total Runoff Captured	6.6 AC-FT/YR (100%)



10351 Mary Ave

Cupertino, California

Google Street View

Nov 2022

See more dates



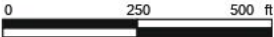
Google

Concept Basemap



LEGEND

- Catch Basins
- Flow Direction
- Greenway with Integrated Stormwater Treatment
- Tree Wells
- Storm Drain Network
- Drainage Management Area
- Pervious Pavement
- A See Precedent Image on Next Page



For More Information:

- **SCVURPPP GSI Handbook**

Chapter 2 – Integrating GSI into various municipal projects

<https://scvurppp.org/2019/09/01/scvurppp-green-stormwater-infrastructure-handbook/>

- **BASMAA Documents**

Guidance for Identifying Green Infrastructure Potential in Municipal Capital Improvement Program Projects

<https://scvurppp.org/2023/02/28/identifying-green-infrastructure-potential-in-municipal-capital-improvement-program-projects-guidance/>

Guidance for Sizing Green Infrastructure Projects

https://scvurppp.org/wp-content/uploads/2020/rowd/10-basmaa-sc-c3/12%20BASMAA_C.3_Guidance%20for%20Sizing%20GI_with%20Dubin%20memo.pdf

Questions?

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