Stormwater Planning

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San Mateo Countywide
Water Pollution Prevention Program

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C/CAG Water Committee
August 17, 2016

Stormwater Resource and Green Infrastructure Plans

- Countywide Stormwater Resource Plan
  - Required to compete for voter-approved funds
  - Prioritizes opportunities for stormwater capture
  - Finish by end of 2016
- Local Green Infrastructure Plans
  - Mandated by Municipal Regional Permit
  - Show gradual shift from grey to green
  - Finish by late 2019

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Stormwater Resource and Green Infrastructure Plans

- Develop process to screen and ID possibilities
- Develop project concepts for each agency
- Develop local targets for GI implementation tied to mandated pollutant reduction
- Develop individual GI plans with local community engagement
- Where are there linkages to other efforts?

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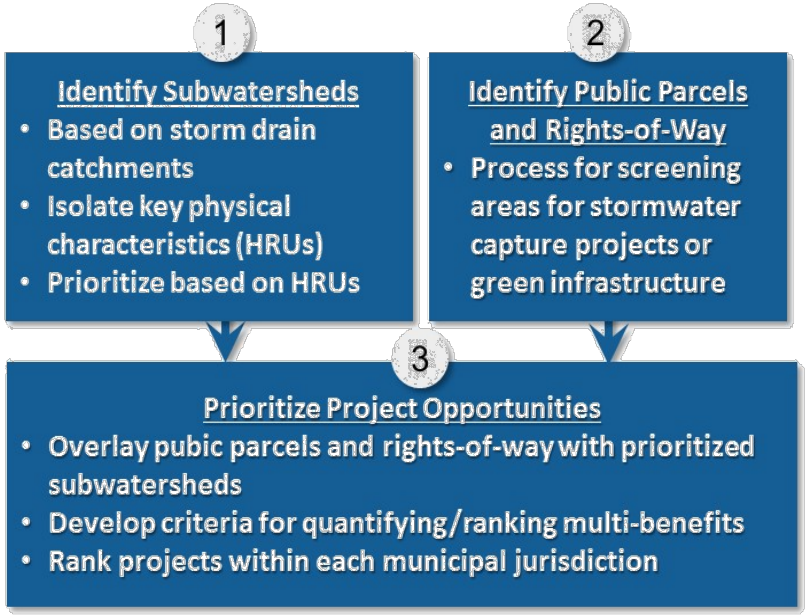
Identify and Prioritize Stormwater and GI Projects

- Process tailored to C/CAG preferences
- GIS screening of public parcels and rights-of-way
- Prioritization based on:
  - Maximum effectiveness for stormwater control
  - Multiple benefits (groundwater recharge, reuse, enhancement of habitat or open space)



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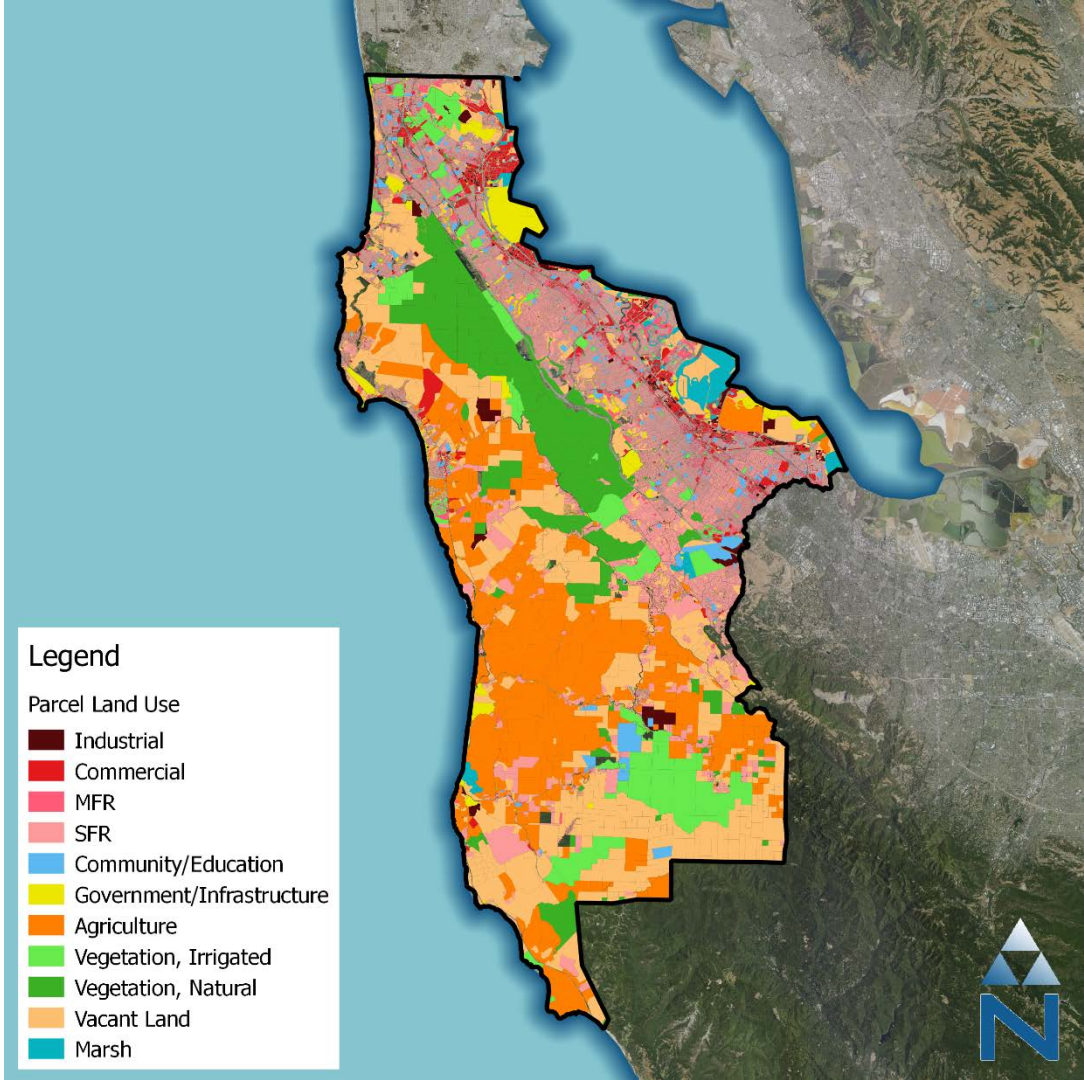
Physical Characteristics

Parcel land use

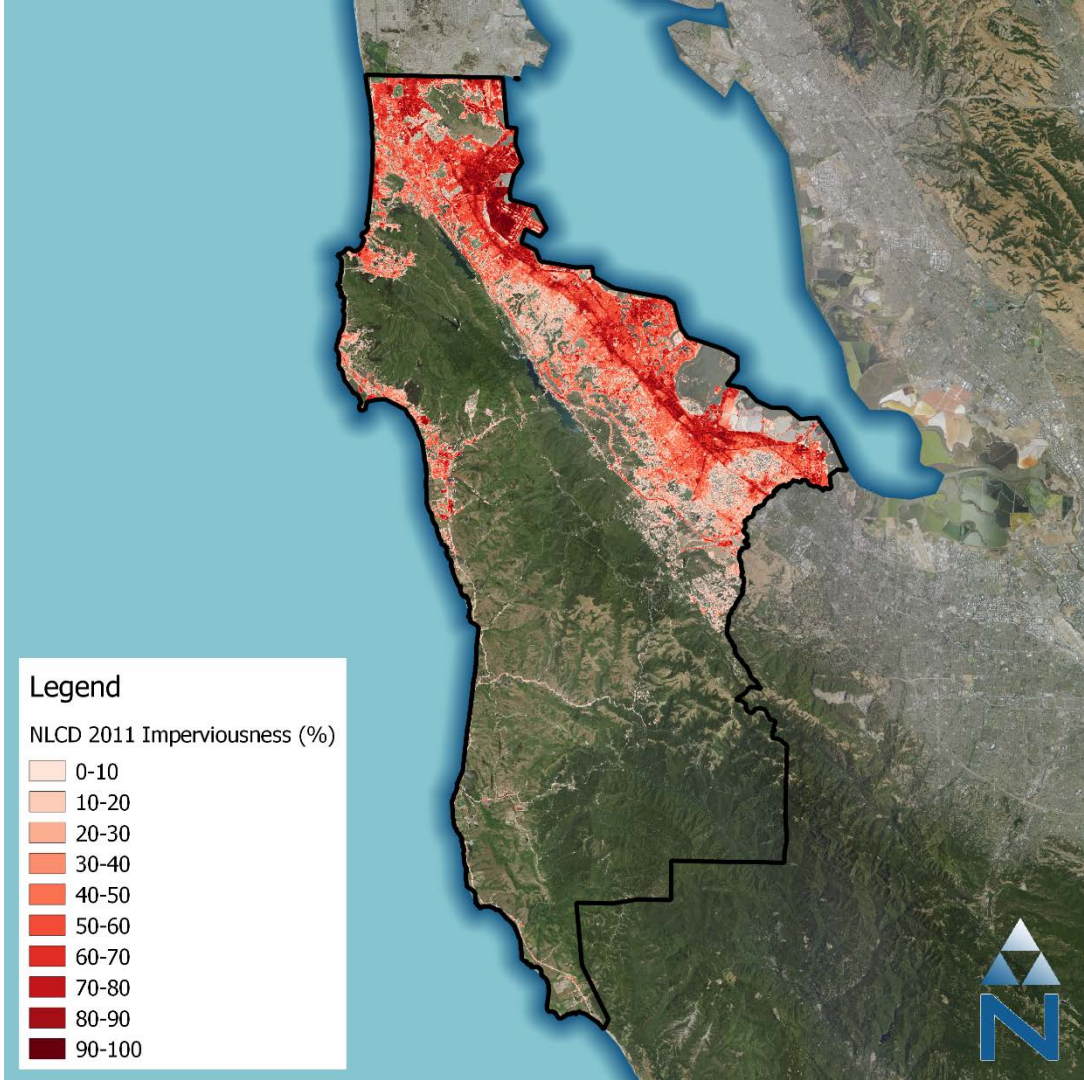
- screen public parcels
- prioritize land uses suitable for each project type



Physical Characteristics

Impervious area

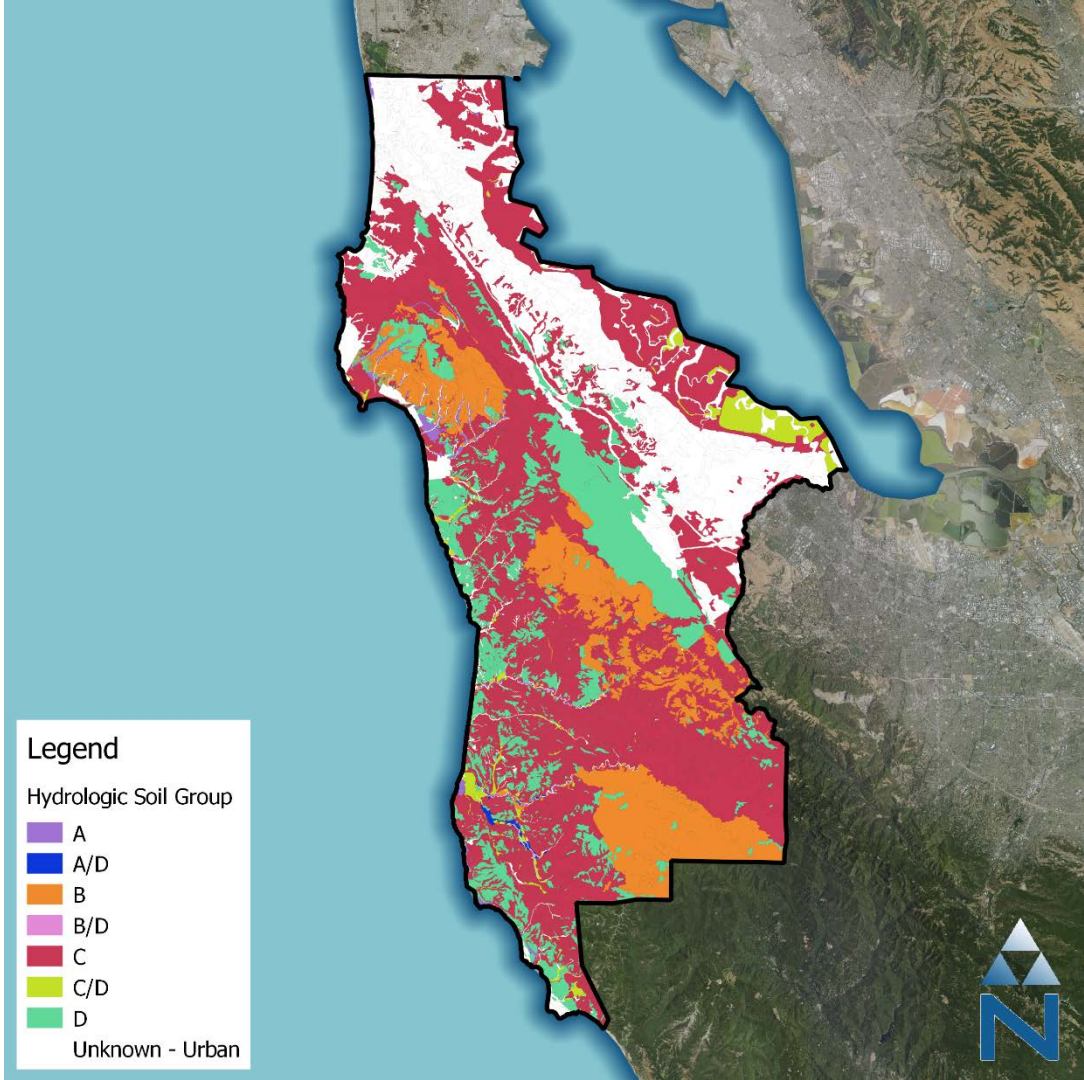
- high impervious area is correlated to large runoff potential
- Priority given to sites with high imperviousness



Physical Characteristics

Hydrologic Soil Group

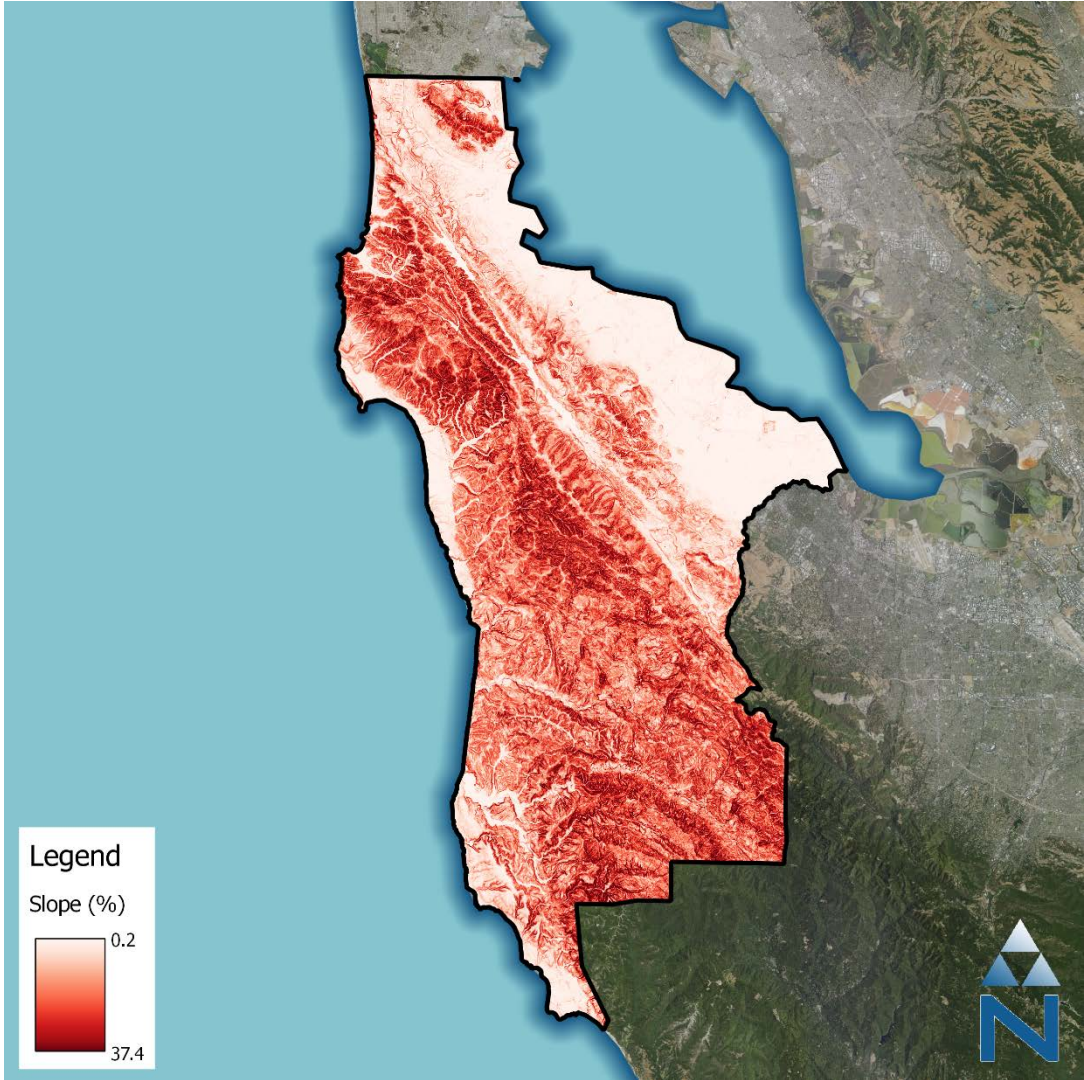
- grouped based on drainage characteristics of soils
- **Group A** represents *well*-drained soils
- **Group D** represents *poorly*-drained soils.



Physical Characteristics

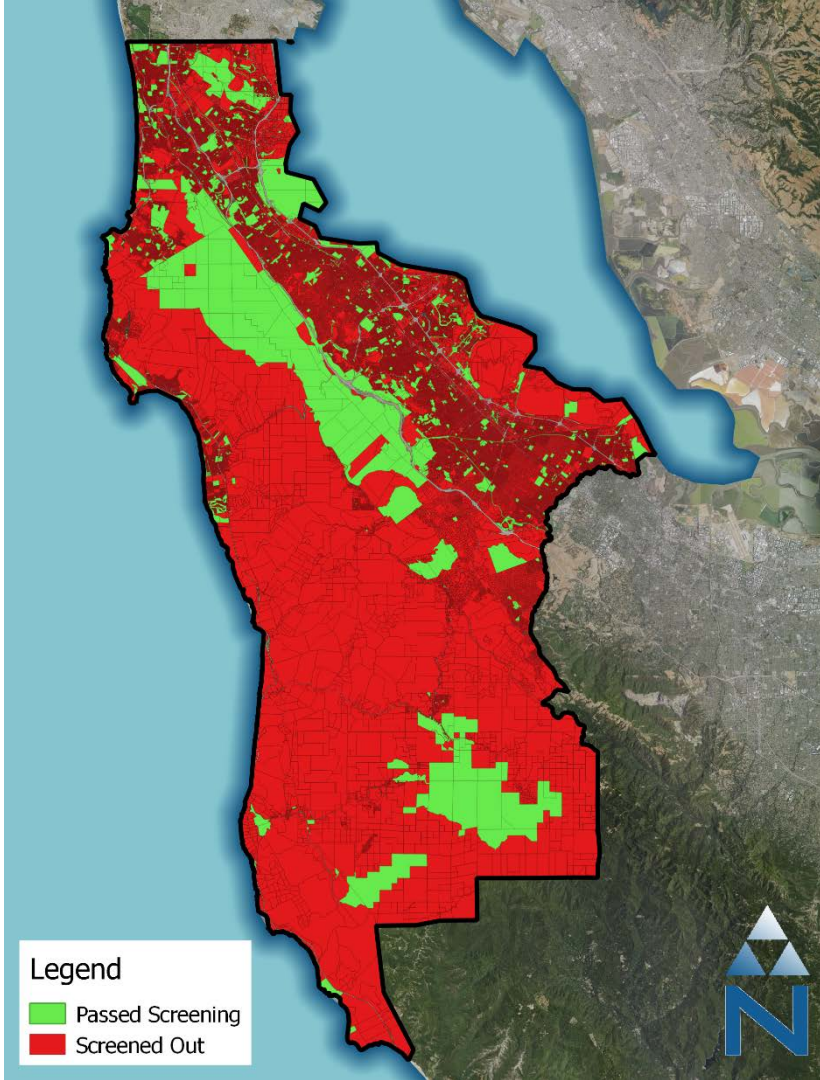
Slope

- mild slopes are more feasible for stormwater capture
- steep slopes present difficulties with implementation and performance



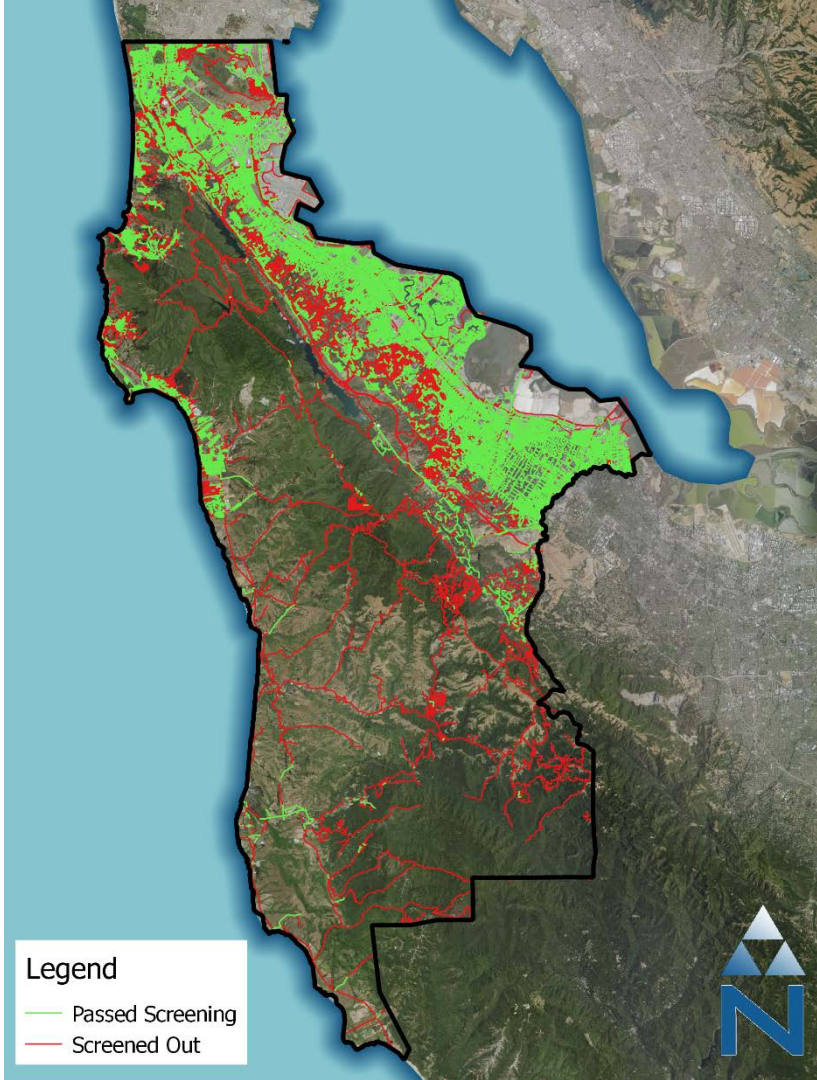
Screening of Sites for Onsite LID/Regional Projects

Screening Factor	Parcel Characteristic	Criteria	Reason
Public Parcels	Ownership	City, County or Town	Identify all public parcels for regional storm and dry weather runoff capture projects or onsite LID retrofits
	Land Use	Park, School, Other (e.g., Golf Course)	
Suitability	Parcel Size	>0.25 acres	Adequate space for regional stormwater and dry weather runoff capture project
		All	Opportunity for onsite green infrastructure retrofit
	Site Slope	< 10 %	Steeper grades present additional design challenges



Green Street Screening

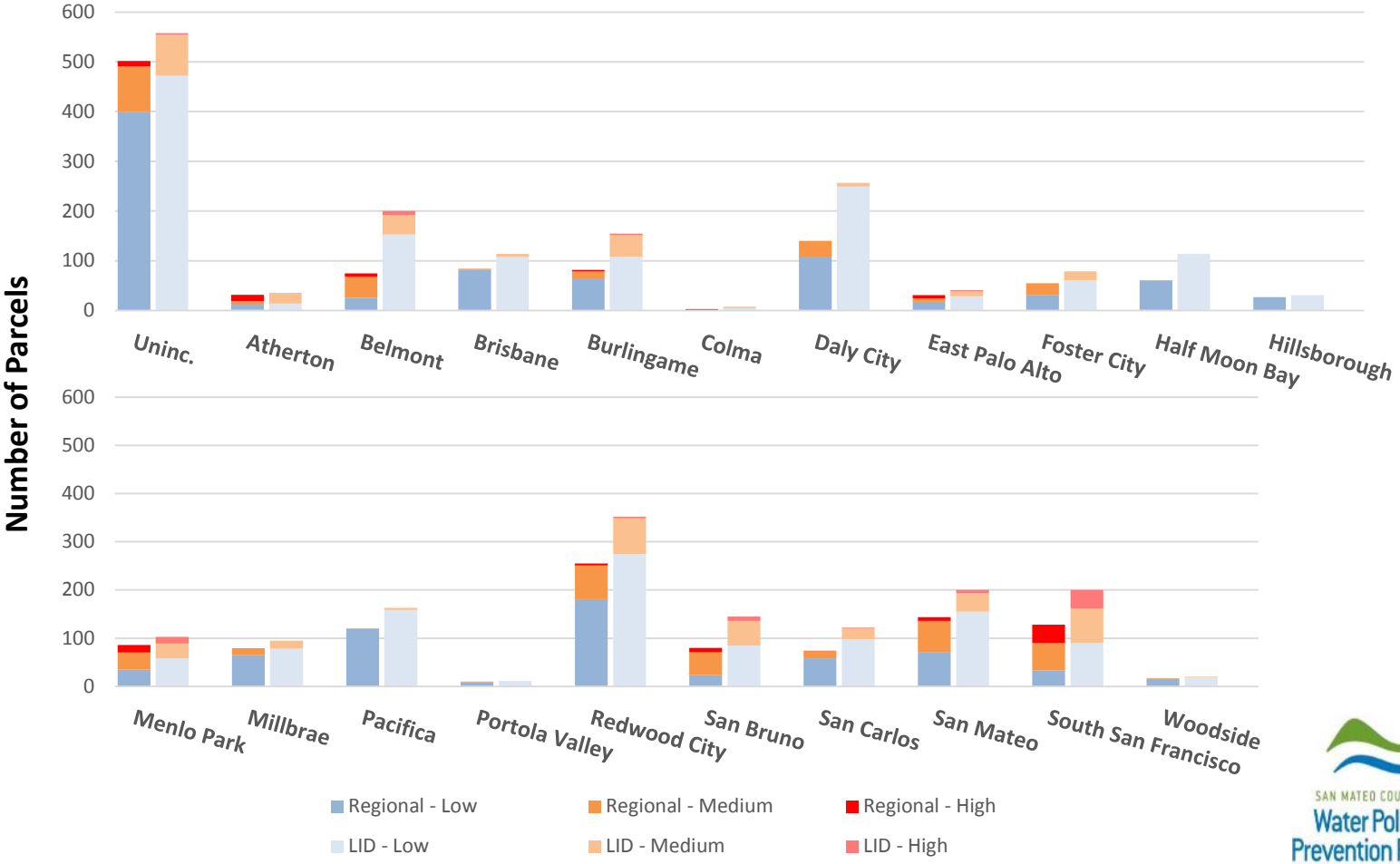
Screening Factor	Street Section Characteristic	Criteria	Reason
Selection	Functional Class	S1400 S1730 S1780	Local neighborhood road, rural road, city street, alley, parking lot roads
Suitability	Ownership	Private	Potential projects are focused on public and right-of-way opportunities
	Road Slope	< 5%	Steep grades present additional design challenges; reduce capture opportunity due to increased runoff velocity



Regional Projects Matrix

	Points						Weight Factor
	0	1	2	3	4	5	
Parcel Land Use	--	--	Schools/Golf Courses	Public Buildings	Parking Lot	Park / Open Space	--
Impervious Area	X < 40	40 ≤ X < 50	50 ≤ X < 60	60 ≤ X < 70	60 ≤ X < 80	80 ≤ X < 100	--
Parcel Size (acres)	0.25 ≤ X < 0.5	0.5 ≤ X < 1	1 ≤ X < 2	2 ≤ X < 3	3 ≤ X < 4	4 ≤ X	--
Hydrologic Soil Group	--	D	Unknown	C	B	A	--
Slope (%)	5 < X ≤ 10	4 < X ≤ 5	3 < X ≤ 4	2 < X ≤ 3	1 < X ≤ 2	0 < X ≤ 1	--
Proximity to Flood-prone Channels (miles)	Not in sub-basin	3 < X	--	1 < X ≤ 3	--	X ≤ 1	2
Contains PCB Risk Areas	None	Potential High Interest	--	High Interest	--	--	--
Currently planned by City or co-located with other City project	No					Yes	2
Drains to TMDL waters	No					Yes	--
Above groundwater aquifer	No		Yes				--
Augments water supply	No	Yes					--
Water quality source control	No	Yes					--
Reestablishes natural hydrology	No	Yes					--
Creates or enhances habitat	No	Yes					--
Community enhancement	No	Yes					--

Onsite LID/Regional Project Prioritization



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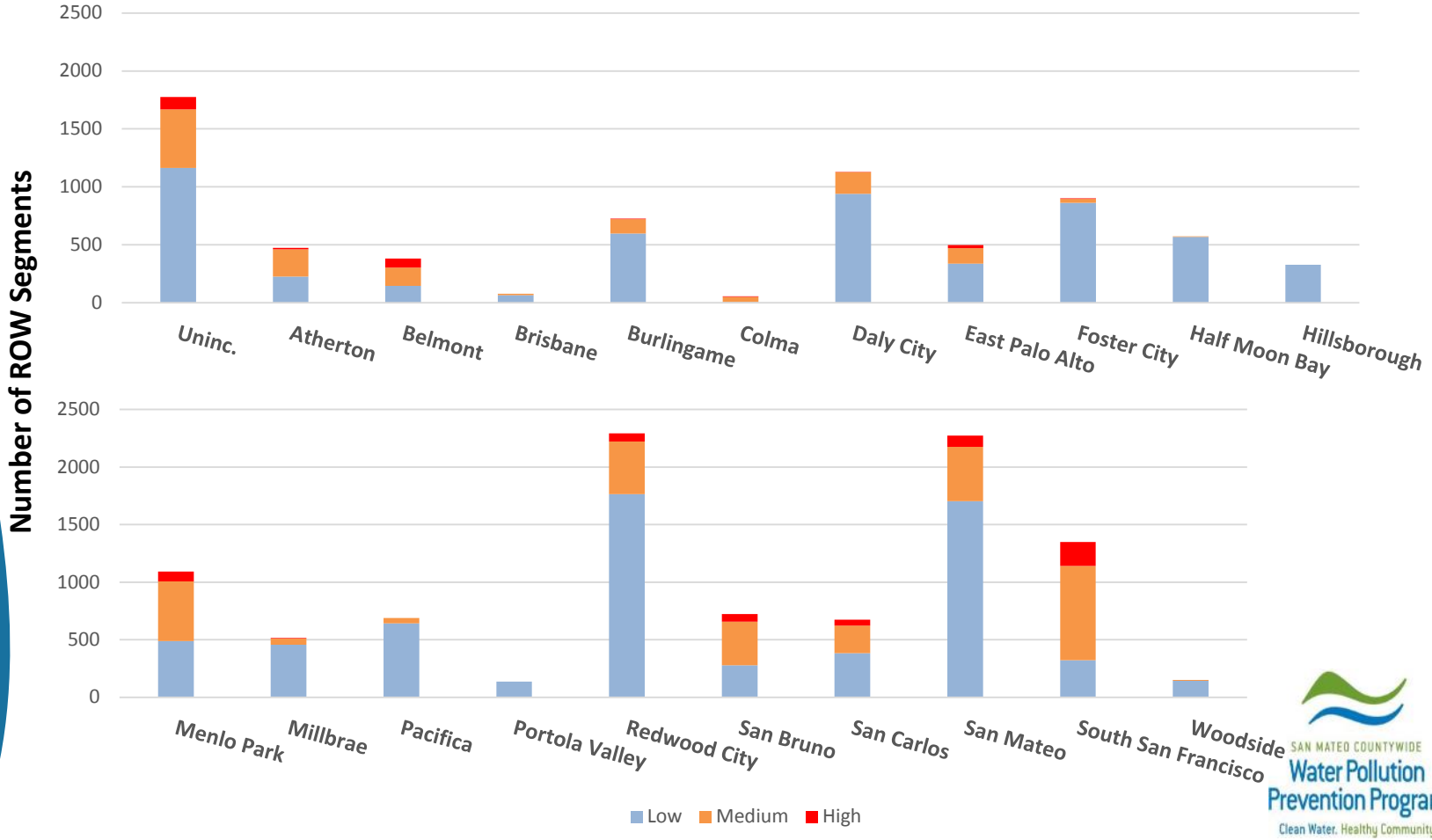
Green Street Prioritization



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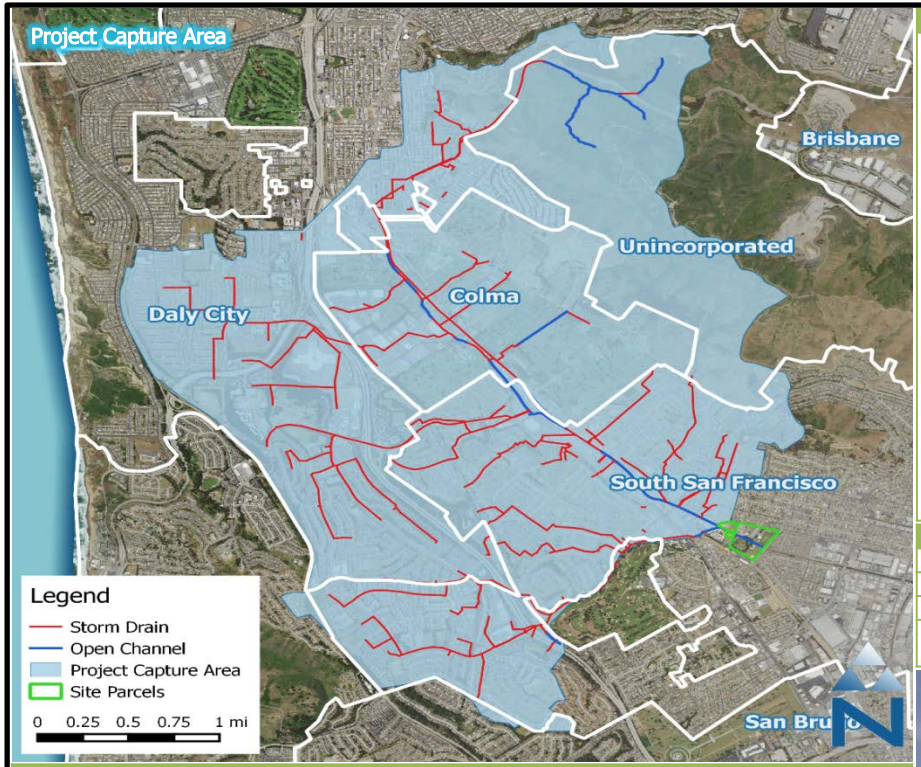


Site Description:

This project concept consists of two offline subsurface infiltration chambers at Orange Memorial Park. The park is a prime location to site a regional stormwater capture project and captures stormwater from large portion of the upper Colma Creek watershed and multiple city and county jurisdictions. The potential capture area of the project is roughly 6,300 acres that drains portions of the cities of South San Francisco, Colma, and Daly City and Unincorporated San Mateo County. A stormwater capture project at this location would aid these jurisdictions in meeting stormwater permit compliance and alleviate flooding in the lower reaches of Colma Creek. The project would also contribute to reductions of high-priority pollutants discharged to San Francisco Bay (including TMDLs that require reductions of mercury and PCB loads), augment water supply by recharging the Westside groundwater basin, and provide community enhancement through integration with the recreational facilities of the park. With the incorporation of a hydrodynamic separator for pretreatment of diverted water from the creek, the project also provides the reduction of trash transported through the creek to the San Francisco Bay. The Orange Memorial Park Master Plan (2007) was referenced in this design to ensure that the concept is consistent with the goals of future development for the park.

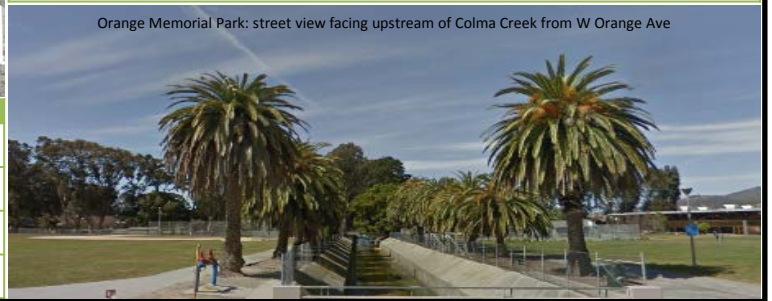
Although not specifically included within this project concept, the project also provides the opportunity for future integration of Low Impact Development (LID) within parking lots of the park to provide further community enhancement and opportunities for public education of LID and other project components.

Drainage Characteristics

Capture Area (acres)	6,300
Impervious Area (%)	38
Dominant Land Use	Residential
Jurisdictions	South San Francisco, Colma, Daly City, Unincorporated San Mateo County

Site Information

Land Owner	City of South San Francisco
Street Address	Orange Ave, South San Francisco, CA 94080
Latitude/Longitude	37° 39′ 13.1″ N / 122° 25′ 35.4″ W
Watershed	Colma Creek



Orange Memorial Park: street view facing upstream of Colma Creek from W Orange Ave

Concept for a Multi-jurisdictional Regional Stormwater Capture Project

Site: Orange Memorial Park (City of South San Francisco)

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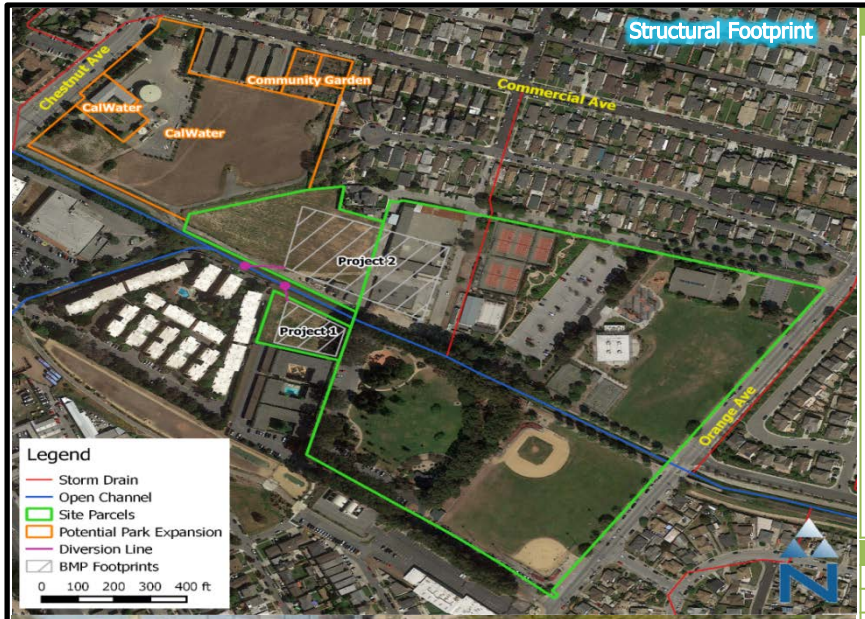

Example concrete infiltration chamber

Site Description:

Two subsurface infiltration chambers will be considered on parcels owned by the City of South San Francisco to the west of Orange Memorial Park. Both parcels were acquired by the City of South San Francisco in 1996 and, while vacant, are included in plans for future park expansion. The first chamber (Project 1) will be located in the vacant parcel to the south of the Colma Creek channel. The second chamber (Project 2) will be located in portions of the vacant parcel to the north of the channel and the current park parcel. The Project 2 site represents the location of the future little league baseball fields according to the Master Plan. Runoff would be diverted directly from Colma Creek and details of the diversion structures will be determined during the design phase through coordination with the San Mateo County Flood Control District. A pretreatment unit (e.g. hydrodynamic separator) will be implemented to provide trash and sediment capture. Two projects are proposed to maximize the amount of available space used for the design and to provide an option for the City of South San Francisco to implement the design in two separate phases. This would allow the City to move forward with each phase separately as funding is acquired. The Master Plan also accounts for the possible purchase of the CalWater parcels along Chestnut Avenue for future park expansion, which could be used to expand Project 2 if that land becomes available. The proposed design (both chambers) would allow for the treatment of 26% of the 85th percentile, 24-hour runoff volume (36.4 of 142.4 ac-ft) for the Colma Creek watershed. As these volumes are completely removed via storage and infiltration, this provides an equivalent 26% reduction of pollutant loads for the storm event.

DISCLAIMER: All elements of this conceptual design are planning-level, based on desktop analysis. All assumptions and parameters must be re-evaluated during the detailed design process. Costs estimates are based on available data. Actual costs will vary.

Design Criteria	
Precipitation, 85th percentile, 24-hr storm (in)	0.83
Colma Creek Runoff Volume, 85th percentile, 24-hr storm (ac-ft)	142.4
Colma Creek Peak Discharge, 85th percentile, 24-hr storm (cfs)	309
Infiltration Rate (in/hr)	0.5

Project Characteristics	Project 1	Project 2
Stormwater Capture Process	Subsurface Infiltration Chamber	
Footprint (acres)	0.5	2.3
Design Height (ft)	12	12
Depth of Excavation (ft)	15	15
Pumping Requirements	Dependent on Geotechnical Investigation	
Design Volume (ac-ft)	6	27.6
24-hr Infiltration Volume (ac-ft)	0.5	2.3
Total Treatment Volume (ac-ft) [1]	**6.5**	**29.9**
Percent Treated [2]	**5%**	**21%**

1 – sum of the Design Volume and 24-hr Infiltration Volume
2 – percentage the 85th percentile 24-hr storm Runoff Volume that is treated

Concept for a Multi-jurisdictional Regional Stormwater Capture Project

Site: Orange Memorial Park (City of South San Francisco)

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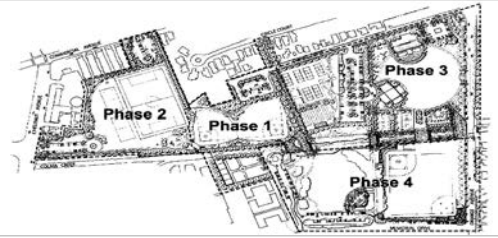
Project Implementation:

The figure to the left depicts the layout for the two subsurface infiltration chambers in relation to the planned improvements in the Orange Memorial Park Master Plan 2007. The figure below depicts the phased implementation of various areas of the park according to the Master Plan. The proposed infiltration chambers would coincide with Phase 1. Adding a stormwater component to the first phase of park improvements would likely garner enthusiasm for park enhancements and open avenues for funding. Phase 1 of the Master Plan can be further split into two sub-phases. The first sub-phase of park improvements would include Project 1 in the location of the future community gardens. The second sub-phase would include Project 2 at the little league baseball fields.



Cost Estimate for Infiltration Chamber south of Colma Creek (Project 1)

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
Excavation/Removal	12,100	CY	$50.00	$605,000
Rubber Dam System	1	LS	$80,000.00	$80,000
Diversion Structure	1	LS	$100,000.00	$80,000
Hydrodynamic Separator Device	1	LS	$90,000.00	$100,000
Pump Structure	1	LS	$1,000,000.00	$1,000,000
Diversion Pipe (24" RCP)	100	LF	$200.00	$20,000
Infiltration Structure	9,680	CY	$300.00	$2,904,000
Restoration	21,780	SF	$2.00	$44,000
			CONSTRUCTION SUBTOTAL	$4,833,000
Mobilization (10% construction)				$483,000
Contingency (25% construction)				$1,208,000
Design (10% total)				$652,000
			TOTAL COST	**$7,176,000**

Cost Estimate for Infiltration Chamber north of Colma Creek (Project 2)

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
Excavation/Removal	55,660	CY	$50.00	$2,783,000
Rubber Dam System (dam from Project 1 can be utilized by both projects)				N/A
Diversion Structure	1	LS	$150,000.00	$150,000
Hydrodynamic Separator	1	LS	$150,000.00	$150,000
Pump Structure	1	LS	$1,750,000.00	$1,750,000
Diversion Pipe (24" RCP)	150	LF	$200.00	$30,000
Infiltration Structure	44,528	CY	$300.00	$13,358,000
Restoration	100,188	SF	$2.00	$200,000
			CONSTRUCTION SUBTOTAL	$18,421,000
Mobilization (10% construction)				$1,842,000
Contingency (25% construction)				$4,605,000
Design (10% total)				$2,487,000
			TOTAL COST	**$27,355,000**

Concept for a Multi-jurisdictional Regional Stormwater Capture Project

Site: Orange Memorial Park (City of South San Francisco)

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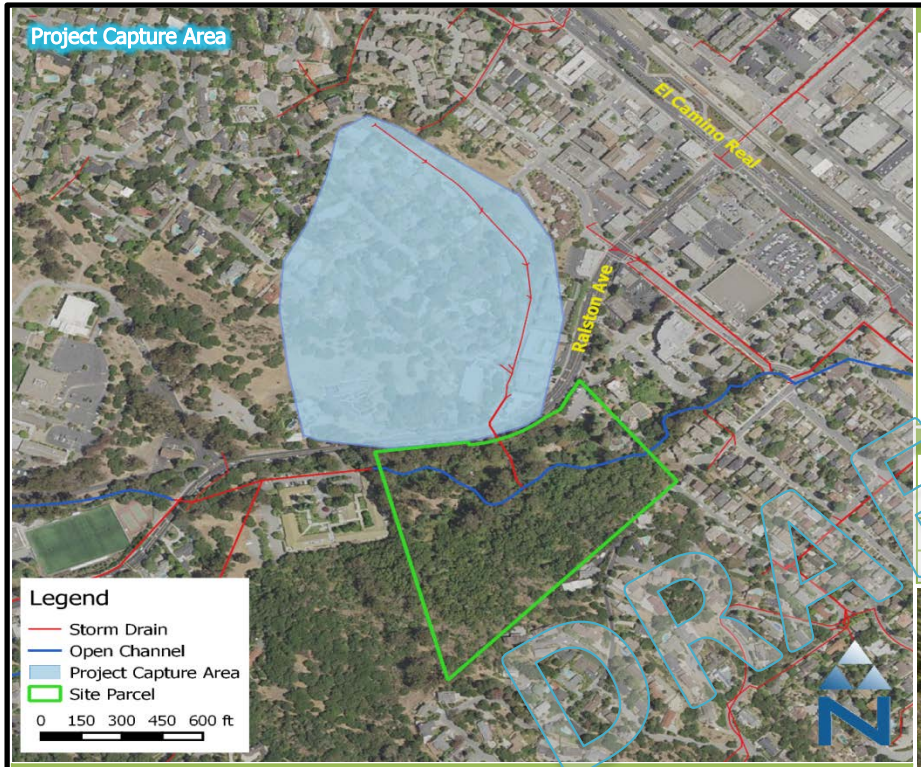

Site Description:

This project concept consists of an offline subsurface infiltration chamber at Twin Pines Park. The park is owned and operated by the City of Belmont and is adjacent to City Hall. The park provides the opportunity to treat runoff from a 30-acre area that is primarily residential and drains directly to Belmont Creek. Due to the heavy tree cover that dominates most areas of the park, the parking lots represents some of the few opportunities for stormwater capture. The project would capture flows and associated pollutant loadings from a small portion of the upper Belmont Creek, entirely within the City of Belmont. The project would help to alleviate flooding issues in lower reaches of Belmont Creek. The project would also contribute to reductions of high-priority pollutants discharged to San Francisco Bay (mercury and PCBs), augment water supply by recharging the Santa Clara Valley groundwater basin, and provide community enhancement through integration with the recreational facilities of the park.

Although not specifically included within this project concept, the project also provides the opportunity for future integration of Low Impact Development (LID) within parking lots of the park to provide further community enhancement and opportunities for public education of LID and other project components.

Drainage Characteristics

Capture Area (acres)	30
Impervious Area (%)	27
Dominant Land Use	Residential
Jurisdictions	Belmont

Site Information

Land Owner	City of Belmont
Street Address	30 Twin Pines Ln, Belmont, CA 94002
Latitude/Longitude	37° 31' 02.3" N / 122° 16' 40.4" W
Watershed	Belmont Creek

Concept for a Multi-jurisdictional Regional Stormwater Capture Project

Site: Twin Pines Park (City of Belmont)

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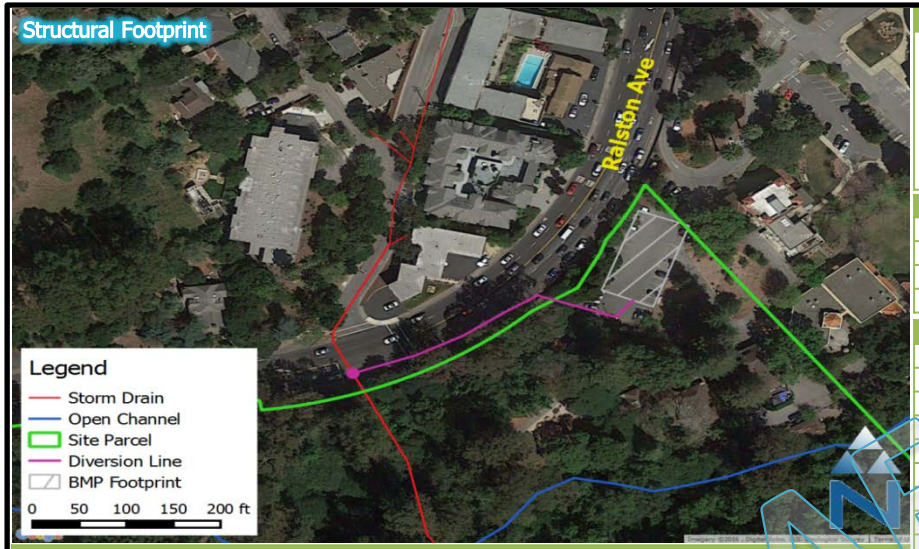

Project Description:

A subsurface infiltration chamber will be considered in the parking lot to the west of the Twin Pines Manor. The project would require a 350-foot diversion from the storm drain that crosses Ralston Avenue at the South Road intersection. A subsurface facility would preserve functional use of the parking lot after construction and would prevent disturbance of other recreational areas of the park. The proposed design would allow for the treatment of over 100% of the 85th percentile, 24-hr runoff volume (0.47 ac-ft) from the 30-acre area.

Design Criteria

Precipitation, 85th percentile, 24-hr storm (in)	0.75
Runoff Volume, 85th percentile, 24-hr storm (ac-ft)	0.47
Peak Discharge, 85th percentile, 24-hr storm (cfs)	1.0
Infiltration Rate (in/hr)	0.5

Project Characteristics

Stormwater Capture Process	Subsurface Infiltration Chamber
Footprint (acres)	0.15
Design Height (ft)	3
Depth of Excavation (ft)	6
Pumping Requirements	Dependent on Geotechnical Investigation
Design Volume (ac-ft)	0.45
24-hr Infiltration Volume (ac-ft)	0.15
Total Treatment Volume (ac-ft) [1]	**0.6**
Percent Treated [2]	**100%**

1 – sum of the Design Volume and 24-hr Infiltration Volume

2 – percentage of the 85th percentile 24-hr storm Runoff Volume that is treated

Cost Estimate for Infiltration Chamber at the Meadow Picnic Area

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
Excavation/Removal	1,614	CY	$50.00	$81,000
Diversion Structure	1	LS	$20,000.00	$20,000
Hydrodynamic Separator	1	LS	$15,000.00	$15,000
Pump Structure (450 GPM)	1	LS	$50,000.00	$50,000
Diversion Pipe (12" RCP)	350	LF	$150.00	$53,000
Infiltration Structure	726	CY	$300.00	$218,000
Restoration/Pavement	8,712	SF	$10.00	$87,000
			CONSTRUCTION SUBTOTAL	$524,000
Mobilization (10% construction)				$52,000
Contingency (25% construction)				$131,000
Design (10% total)				$71,000
			TOTAL COST	**$778,000**

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Example plastic infiltration chamber beneath a future parking lot

Concept for a Multi-jurisdictional Regional Stormwater Capture Project

Site: Twin Pines Park (City of Belmont)

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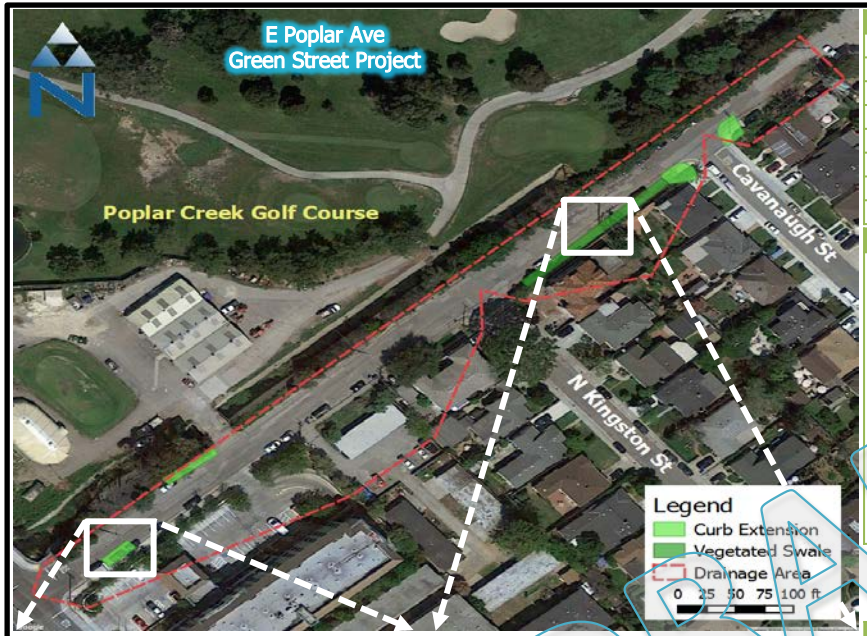

Site Information

Jurisdiction	City of San Mateo
Street Name	E Poplar Ave
Bounding Streets	N Bayshore Blvd / Cavanaugh St
Street Typology	Low-Density Residential
Capture Area (acres)	1.67
Impervious Area (%)	70
85th Percentile Rainfall (in)	0.85
Generated Runoff (ac-ft)	0.08

Site Description:

The proposed project consists of green street improvements along East Poplar Avenue, east of the Bayshore Freeway (US-101). The street segment is approximately 850 feet long. The street is considered low-density residential with development primarily on the south side of the street. Curb extensions are recommended as the primary treatment type and can be placed in such a way to maximize street parking. Curb extensions can occupy "no parking" zones that border lot entrances to perform the same function while also capturing stormwater. In addition to curb extensions, a vegetated swale can be considered between North Kingston Street and Cavanaugh Street, where there currently is no gutter. This would not provide stormwater capture but would provide the added benefits of slowing flows and increased infiltration.

The proposed improvements would capture 100% of the 85th percentile runoff volume (0.04 ac-ft) while providing flood risk mitigation, community enhancement, increased property values, and other multiple benefits.

DISCLAIMER: All elements of this conceptual design are planning-level. Locations of opportunities for placement of green infrastructure shown in the map are preliminary and subject to further site assessment and design. Percent imperviousness is based on best professional judgement. All design assumptions/parameters and cost estimates must be re-evaluated during the detailed design process.

Design Summary

Green Infrastructure Type	Design Width (ft)	Design Length (ft)	Capture Volume (ac-ft)
Bioretention (Curb Extension)	8	230	0.080
Vegetated Swale	3	175	-

Cost Estimate

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
Excavation/Hauling	340	CY	$50.00	$17,000
Bioretention	1,840	SF	$25.00	$46,000
Vegetated Swale	525	SF	$18.50	$10,000
Curbs and Gutters	635	LF	$22.00	$14,000
			CONSTRUCTION SUBTOTAL	$87,000
Planning (20%), Mobilization (10%), Design (30%), Contingency (25%)				$74,000
			TOTAL COST	**$161,000**

Concept for a Green Street Retrofit for Stormwater Capture

Site: East Poplar Avenue (City of San Mateo)

San Mateo Countywide Water Pollution Prevention Program

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Site Information	
Jurisdiction	City of Redwood City
Street Name	Middlefield Rd
Bounding Streets	Main St / Woodside Rd
Street Typology	Arterial
Co-Located Project	Middlefield Streetscape Project
Capture Area (acres)	4.16
Impervious Area (%)	90
85th Percentile Rainfall (in)	0.85
Generated Runoff (ac-ft)	0.27


Curb Extension on an Arterial Street

Site Description:

The proposed project consists of green street improvements along Middlefield Road between Main Street and Woodside Road. The street segment is approximately 2,250 feet long. Middlefield Road is an arterial street that is relatively narrow. Limited space is divided between bike lanes, multiple lanes each direction, turn lanes, and parking lanes. This presents a challenge with siting green infrastructure without sacrificing some usage of the roadway. Curb extensions are recommended as the primary treatment type. Segments of the street that feature two lanes may be reduced to single lanes to allow adequate area for improvements. Center medians can be removed to provide additional area. Curb extensions can also be placed at crosswalks to improve pedestrian safety while increasing stormwater capture capacity. Where lanes cannot be reduced, some parking may need to be removed.

The proposed improvements would capture 100% of the 85th percentile runoff volume (0.27 ac-ft) while providing flood risk mitigation, community enhancement, increased property values, safer pedestrian routes, and other multiple benefits.

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Design Summary

Green Infrastructure Type	Design Width (ft)	Design Length (ft)	Capture Volume (ac-ft)
Bioretention (Curb Extension)	3	2,080	0.270

Cost Estimate

DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL
Excavation/Hauling	1,160	CY	$50.00	$58,000
Bioretention	6,240	SF	$25.00	$156,000
Curbs and Gutters	2,080	LF	$17.25	$36,000
			CONSTRUCTION SUBTOTAL	$250,000
Planning (20%), Mobilization (10%), Design (30%), Contingency (25%)				$213,000
			TOTAL COST	**$463,000**

Concept for a Green Street Retrofit for Stormwater Capture

Site: Middlefield Road (City of Redwood City)

Water Pollution Prevention Program

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Opportunities for Collaboration

- Multi-Benefit Projects
  - Water Quality
  - Flood Control/Sea Level Rise
  - Groundwater Recharge
- Public Outreach/Engagement
- Development of Model Language

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