JANUARY 2019

CONTRA COSTA CLEAN WATER PROGRAM

Contra Costa Watersheds Stormwater Resource Plan Appendices B-F

Greening the Community for Healthy Watersheds

Prepared by

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Table of Contents

List of Figures

List of Tables

List of Acronyms

ABAG	Association of Bay Area Governments
AGOL	ArcGIS Online
APN	Assessor's Parcel Number
BAIRWMP	Bay Area Integrated Regional Water Management Plan
BMP	Best Management Practice
CAD	Computer aided design
CCCWP	Contra Costa Clean Water Program
CCRCD	Contra Costa Resource Conservation District
CCW SWRP	Contra Costa Watersheds Stormwater Resource Plan
CEQA	California Environmental Quality Act
CIP	Capital improvement plan
DAC	Disadvantaged community
DDD	Dichlorodiphenyldichloroethane
DDE	Dichlorodiphenyldichloroethylene
DDT	Dichlorodiphenyltrichloroethane
EBMUD	East Bay Municipal Utility District
EBRPD	East Bay Regional Park District
EDA	Economically Distressed Area
ESAs	Environmental Sensitive Areas
FEMA	Federal Emergency Management Agency
GI	Green infrastructure
GIS	Geographic Information System
GPS	Global Positioning System
HSPF	Hydrological Simulation Program
IRWM	Integrated Regional Water Management
IRWMP	Integrated Regional Water Management Plan
LID	Low impact development
LSPC	Loading Simulation Program in C++
MRP	Municipal Regional Permit
MS4	Municipal Separate Storm Sewer System
NGO	Non-governmental organization
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
OC pesticides	Organochlorine pesticides
OEHHA	Office of Environmental Health and Hazard Assessment
PAHs	Polycyclic aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
RAA	Reasonable assurance analysis
RMC	Regional Monitoring Coalition
RMP	Regional Monitoring Program for Water Quality in San Francisco Bay

ROW	Rights-of-way
SFEI	San Francisco Estuary Institute
SUSTAIN	System for Urban Stormwater Treatment and Analysis Integration
SWMM	Storm Water Management Model
TAG	Technical advisory group
TMDL	Total Maximum Daily Load
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WLA	Waste load allocation
WQBEL	Water quality-based effluent limitation

Appendix B: Green Infrastructure Project Concepts

ANTIOCH

Municipal contacts for information about the project concept:

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Scott Buenting sbuenting@ci.antioch.ca.us

VIERA AVENUE-WILBUR AVENUE GREEN STREETS PROJECT

SITE DESCRIPTION

Jurisdiction:	**City of Antioch**
Location:	Vieira Avenue from Wilbur to East 18th Street and Wilbur Avenue from Minaker Drive to Hwy 160
APN(s):	051071004, 06503011, and rights-of-way
Land Owner:	City of Antioch
Planning Unit/Watershed:	East County Planning Unit / East Antioch Creek Watershed
Right-of-Way Length:	2.65 miles
Soil Type:	HSG A Type

PROJECT CONCEPT

The proposed Viera Avenue-Wilbur Avenue Green Street project will retrofit a newly annexed area in the City of Antioch that currently has no stormwater infrastructure to include bioretention stormwater treatment facilities and associated storm drain piping (Figure D-1). The proposed design will convey flows along two roadways to green infrastructure facilities, which will provide water quality treatment and promote infiltration. The roadways ultimately drain to the San Joaquin River, a source of potable water for Antioch.

A total of 28 bioretention facilities are proposed within seven drainage areas (ANT-01 – ANT-07, shown in Figure D-2 through Figure D-8). Twenty-seven of the facilities are located within the right-of-way along Wilbur Avenue and Viera Avenue. One of the proposed facilities is a regional bioretention basin (ANT – 06.1) located on a publicly-owned parcel along Viera Avenue that will treat drainage from the neighborhood adjacent to the parcel (ANT-06). The conceptual design was developed with the following assumptions:

- Wilbur Avenue is crowned along the length of the project.
- Sizing for the bioretention facilities along Wilbur Avenue assume no additional contribution from the surrounding areas.
- Impervious area for bioretention facility sizing in drainage area ANT – 05.6 and ANT-05.7 is assumed to be 33.5% of total drainage area.
- Impervious area for bioretention facility sizing in drainage area ANT – 06.1 is assumed to be 36% of the total drainage area.
- The bioretention facilities are located at low points within the project site locations, identified using Google Earth elevation profiles and ArcGIS.

A schematic profile and example bioretention facilities are illustrated in Figure D-9. Note that as there is no existing storm drain infrastructure along Wilbur Avenue and Vera Avenue, the proposed bioretention facilities could be designed without an underdrain if the soil infiltration characteristics are found to be suitable based on-site investigations. Proposed conveyance

channels were not evaluated along Wilbur Ave. and Vieira Ave., but conveyance is needed in the area and can be paved channels or swales.

DESIGN INFORMATION

Drainage Catchment Size:	15 acres
Drainage Catchment Imperviousness:	100%
Land Use Yield Category:	Category: Percent of Total Area **New Urban**: 33% **Old Industrial**: 6% **Old Urban**: 39% **Open Space**: 22%
Precipitation Depth:	13 inches
Facility Type:	Bioretention (without underdrain)
Facility Sizing:	Estimated per location, as listed below

Location	BMP Index	Total Drainage Area (acres)	BMP Foot Print Required (sq ft)
ANT- 01	ANT - 01.1	1.06	923
ANT- 02	ANT - 02.1	0.56	488
	ANT - 02.2	0.54	473
	ANT - 02.3	1.06	923
	ANT - 02.4	0.45	394
	ANT - 02.5	0.48	414
	ANT - 02.6	0.33	290
	ANT- 02.7	0.32	274
	ANT - 02.8	0.37	324
	ANT - 02.9	0.27	241
ANT - 03	ANT - 03.1	0.88	770
	ANT - 03.2	0.80	695
ANT - 04	ANT - 04.1	0.79	688
	ANT - 04.2	0.75	657
	ANT - 04.3	0.38	330
	ANT - 04.4	0.45	395
	ANT - 04.5	0.42	369
	ANT - 04.6	0.44	385
ANT - 05	ANT - 05.1	0.26	228
	ANT - 05.2	0.17	151
	ANT - 05.3	0.20	176
	ANT - 05.4	0.14	122
	ANT - 05.5	0.131	110
	ANT - 05.6	4.50	15
	ANT - 05.7	4.50	15
ANT – 06	ANT - 06.1	13.84	4,340
ANT – 07	ANT - 07.1	0.48	417

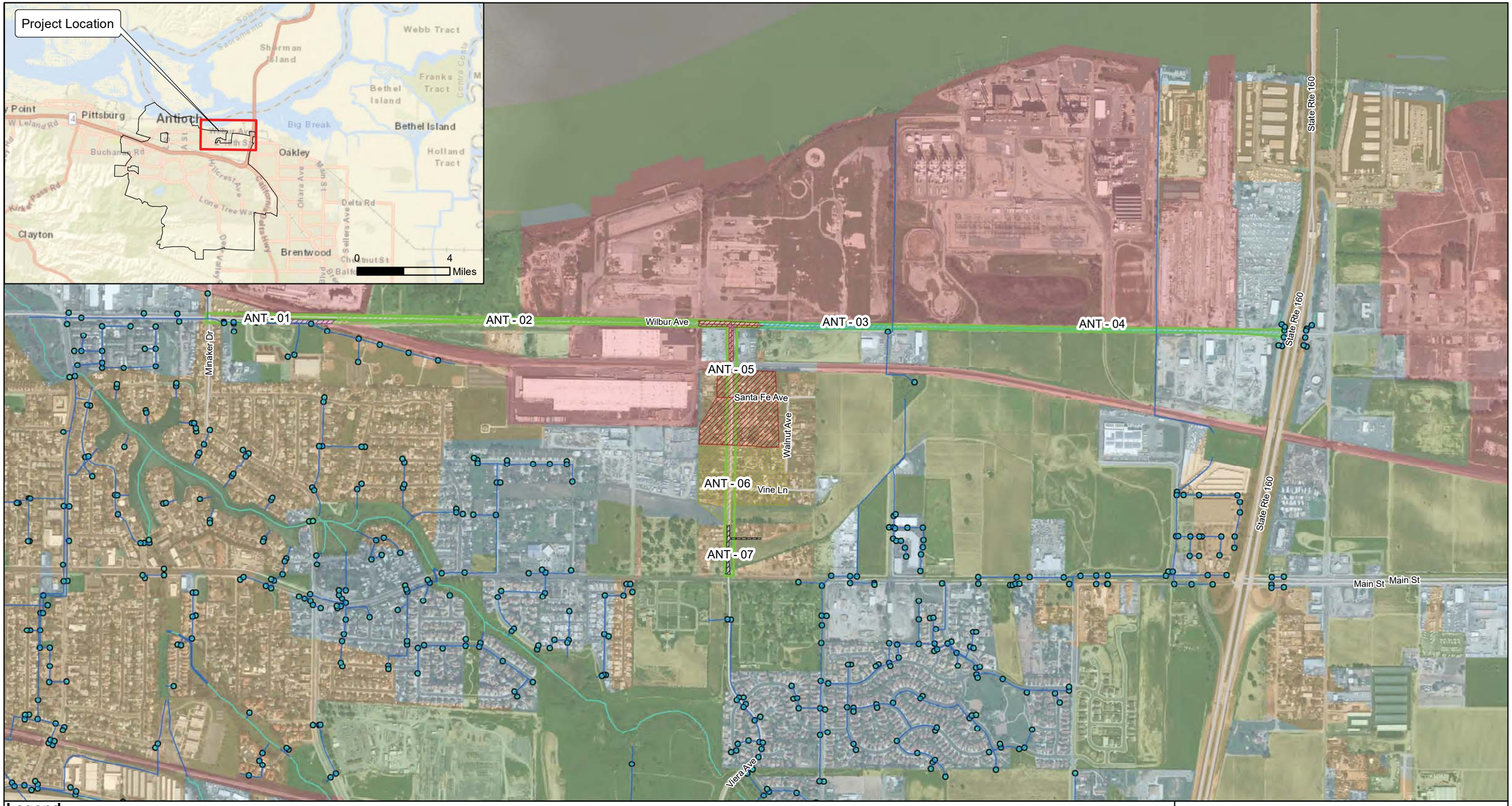
PROJECT BENEFITS

PCBs Loads Reduced:	1.1 grams per year[1]
Mercury Loads Reduced:	0.2 grams per year[1]
Water Supply Benefits:	N/A
Flood Management Benefits:	The project will provide flood management benefit through detention and infiltration.
Natural Drainage System Benefits:	The project will provide hydrologic benefit to natural drainage system by allowing for infiltration.
Habitat or Open Space Benefits:	The project will add a total of 0.3 acres of green space within an urban area.
Community Benefits:	The project will provide water quality educational signage at Site 6.

[1] Note: Project runoff factors for computing load reduction were estimated for each drainage area using Table 3-2 from the Contra Costa Stormwater C.3. Guidebook, 7th Edition. Load reduction estimates for PCBs and mercury assume all vegetated bioretention-type devices will capture 80% of long-term runoff volume with an assumed infiltration rate of 0.24 inches per hour. Actual site-specific infiltration testing should be performed as part of final design.

COST ESTIMATE

DESCRIPTION	QUANTITY (acres)	DESIGN AND CONSTRUCTION UNIT COST	TOTAL COST
Green Streets	13.37	$114,687 x acres + $36,927	$ 1,570,000
Regional Bioretention Basin	1.75	$38,633 x acres	$ 67,600
		DESIGN AND CONSTRUCTION COST	**$ 1,637,600**



Legend

- Project Area

Existing Stormwater Infrastructure

- Inlet
- Storm Drain
- East Antioch Creek

Land Use Yield Category

- New Urban
- Old Industrial
- Old Urban
- Open Space

Control Measure Drainage Areas

- ANT - 01
- ANT - 02
- ANT - 03
- ANT - 04
- ANT - 05
- ANT - 06
- ANT - 07

N

0 1,000 Feet

Contra Costa Watersheds Stormwater Resource Plan
Vieira Ave and Wilbur Ave Green Streets
10% Conceptual Design
Antioch, CA

Geosyntec consultants | Contra Costa Clean Water Program

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Figure D - 1

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Legend

Existing Stormwater Infrastructure
- Inlet
- Surface Flow Direction

Control Measure Drainage Areas
- ANT - 01
- ANT - 02

Proposed Control Measures
- Storm Drain Inlet
- Storm Drain
- Bioretention without underdrain

N

0 100 Feet

Contra Costa Watersheds Stormwater Resource Plan
Viera Avenue-Wilbur Avenue Green Streets Project
10% Conceptal Design
Detail Panel 1
Antioch, CA

Geosyntec consultants | Contra Costa Clean Water Program

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Figure D - 2

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Note: Control measure placement locations were identified using ArcGIS and Google Earth, and represent the approximate size of the footprint needed per drainage area. Further investigation is needed to verify the locations of underground utilities and control measure implementation feasibility.

Legend

Existing Stormwater Infrastructure
- Inlet
- Storm Drain
- Surface Flow Direction

Control Measure Drainage Areas
- ANT - 01
- ANT - 02
- ANT - 05

Proposed Control Measures
- Storm Drain
- Valley Gutter
- Conveyance Channel
- Bioretention without underdrain

N

0 300 Feet

Contra Costa Watersheds Stormwater Resource Plan
Viera Avenue-Wilbur Avenue Green Streets Project
10% Conceptal Design
Detail Panel 2
Antioch, CA

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Figure D - 3

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Note: Control measure placement locations were identified using ArcGIS and Google Earth, and represent the approximate size of the footprint needed per drainage area. Further investigation is needed to verify the locations of underground utilities and control measure implementation feasibility.

Legend

Existing Stormwater Infrastructure
- Inlet
- Storm Drain
- Surface Flow Direction
- Existing Curb Cuts

Control Measure Drainage Areas
- ANT - 03
- ANT - 04
- ANT - 05

Proposed Control Measures
- Storm Drain
- Valley Gutter
- Conveyance Channel
- Bioretention without underdrain
- Bioretention with underdrain

N

0 80 Feet

Contra Costa Watersheds Stormwater Resource Plan
Viera Avenue-Wilbur Avenue Green Streets Project
10% Conceptal Design
Detail Panel 3
Antioch, CA

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Figure D - 4

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Note: Control measure placement locations were identified using ArcGIS and Google Earth, and represent the approximate size of the footprint needed per drainage area. Further investigation is needed to verify the locations of underground utilities and control measure implementation feasibility.

Legend

- Storm Drain
- Surface Flow Direction
- Existing Curb Cuts

Control Measure Drainage Areas

- ANT - 03
- ANT - 04

Proposed Control Measures

- Proposed Storm Drain Inlet
- Storm Drain
- Valley Gutter
- Conveyance Channel
- Bioretention without underdrain

N

0 150 Feet

Contra Costa Watersheds Stormwater Resource Plan
Viera Avenue-Wilbur Avenue Green Streets Project
10% Conceptal Design
Detail Panel 4
Antioch, CA

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Figure D - 5

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Note: Control measure placement locations were identified using ArcGIS and Google Earth, and represent the approximate size of the footprint needed per drainage area. Further investigation is needed to verify the locations of underground utilities and control measure implementation feasibility.

Legend

Existing Stormwater Infrastructure
- Inlet
- East Antioch Creek
- Surface Flow Direction

Control Measure Drainage Areas
- ANT - 04

Proposed Control Measures
- Storm Drain Inlet
- Storm Drain
- Valley Gutter
- Conveyance Channel
- Bioretention without underdrain

N

0 100 Feet

Contra Costa Watersheds Stormwater Resource Plan
Viera Avenue-Wilbur Avenue Green Streets Project
10% Conceptal Design
Detail Panel 5
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Figure D - 6

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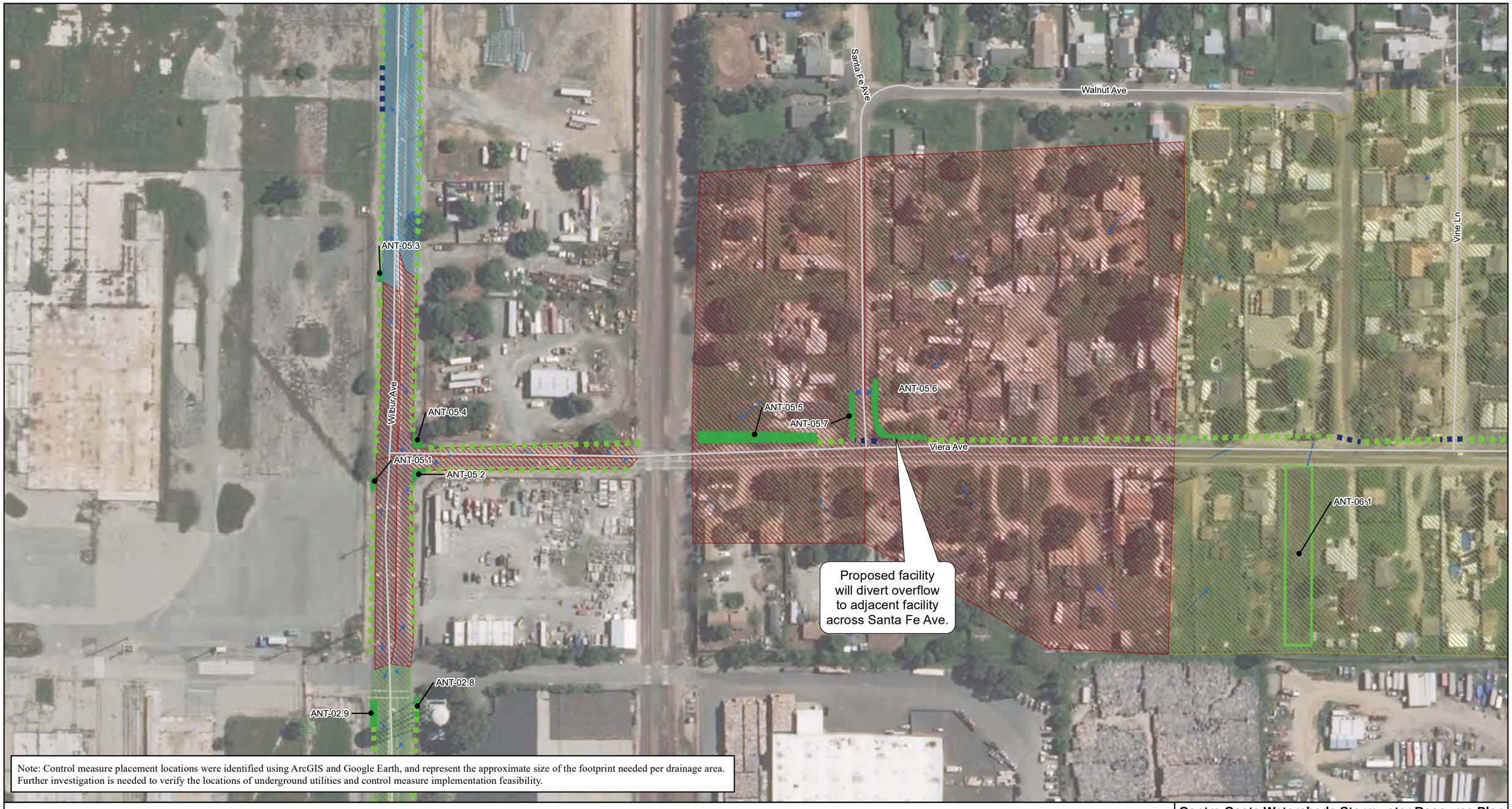

Note: Control measure placement locations were identified using ArcGIS and Google Earth, and represent the approximate size of the footprint needed per drainage area. Further investigation is needed to verify the locations of underground utilities and control measure implementation feasibility.

Legend

Surface Flow Direction

Existing Infrastructure

Storm Drain

Control Measure Drainage Areas

- ANT - 02
- ANT - 03
- ANT - 05
- ANT - 06

Proposed Control Measures

- Storm Drain
- Valley Gutter
- Conveyance Channel
- Bioretention without underdrain
- Regional Bioretention

N

0 150 Feet

Contra Costa Watersheds Stormwater Resource Plan
Viera Avenue-Wilbur Avenue Green Streets Project
10% Conceptal Design
Detail Panel 6
Antioch, CA

Geosyntec consultants

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Figure D - 7

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Santa Fe Ave

Walnut Ave

Vine Ln

Viera Ave

ANT-05.7

ANT-05.6

ANT-05.5

ANT-06.1

ANT-07.1

Proposed facility will divert overflow to adjacent facility across Santa Fe Ave.

Note: Control measure placement locations were identified using ArcGIS and Google Earth, and represent the approximate size of the footprint needed per drainage area. Further investigation is needed to verify the locations of underground utilities and control measure implementation feasibility.

Legend

Surface Flow Direction

Existing Infrastructure

Storm Drain

Control Measure Drainage Areas

ANT - 05

ANT - 06

ANT - 07

Proposed Control Measures

Storm Drain

Valley Gutter

Conveyance Channel

Bioretention without underdrain

Regional Bioretention

N

0 120 Feet

Contra Costa Watersheds Stormwater Resource Plan
Viera Avenue-Wilbur Avenue Green Streets Project
10% Conceptal Design
Detail Panel 7
Antioch, CA

Geosyntec consultants

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July 2018

Figure D - 8

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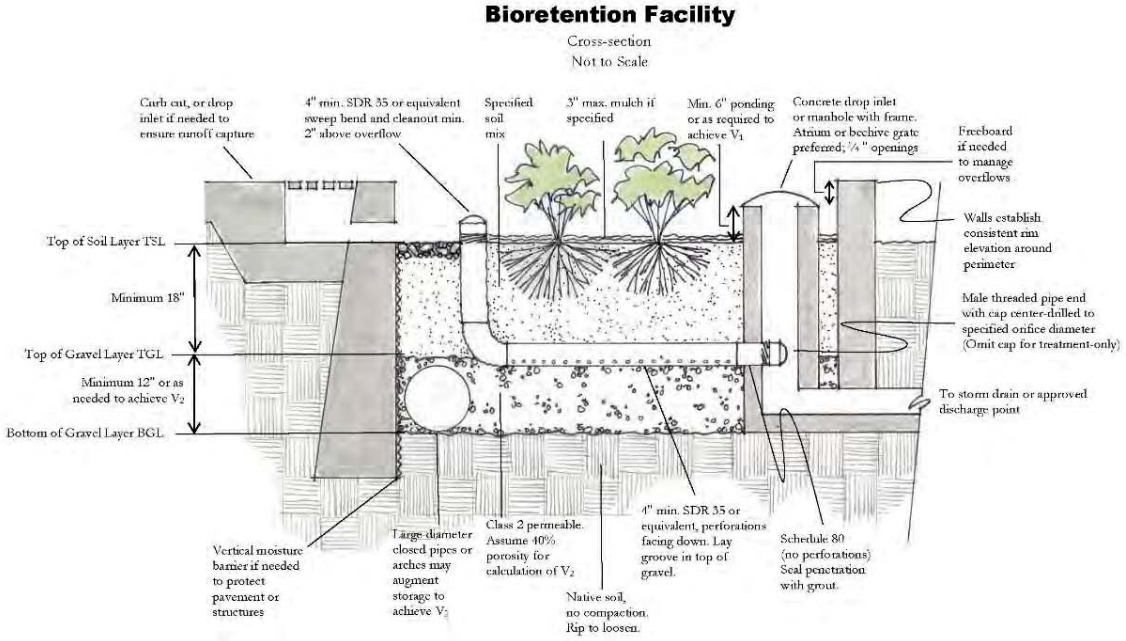


Figure D-9
Bioretention Profile Schematic and Examples

CONCORD

Municipal contact for information about the project concept:

Mitra Abkenari mitra.abkenari@cityofconcord.org

HILLCREST PARK REGIONAL PROJECT

SITE DESCRIPTION

Jurisdiction:	**City of Concord**
Location:	Hillcrest Community Park
APN(s):	110130011
Land Owner:	City of Concord
Planning Unit/Watershed:	Central County Planning Unit / Walnut Creek Watershed
Parcel Size:	33 acres
Soil Type:	HSG C type
Depth to Ground Water:	6 feet to 20.5 feet

PROJECT CONCEPT

The Hillcrest Community Park Regional Project will retrofit one of the City of Concord's largest parks with stormwater facilities to mitigate water quality impacts and to supplement water supply (Figure D-10). The project includes two hydrodynamic separators (HDS) units that will collect trash, debris, and sediment (with associated sediment-bound pollutants, such as PCBs and mercury) from surrounding areas, an underground storage vault that will be used to capture stormwater for irrigation use, and five bioretention facilities.

The proposed control measures are described below and shown on Figure D-11:

- **HDS-01**: Hydrodynamic separator (HDS) unit proposed to capture drainage from approximately 500 acres of old urban and transportation area that drains via existing storm drain infrastructure towards the Hillcrest Community Park. HDS unit will also provide pretreatment for the stormwater flows diverted to the CON-02 underground storage vault. Figure D-12 provides a conceptual illustration of a hydrodynamic separator.
- **HDS-02**: HDS unit will collect drainage from approximately 83 acres of old urban residential and commercial area north of Hillcrest Community Park that drains via existing storm drain infrastructure.
- **CON-02:** An underground storage vault under a new parking area in the north-central portion of the park is proposed to capture runoff from the parking areas, and the diverted flows from HDS - 01. The storage vault will be used to store stormwater for irrigation of the turf areas within the park, replacing the potable water source that is currently used for this purpose. Figure D-13 provides a conceptual illustration of an underground storage vault.
- **CON-01, CON-03 – CON-06**: Five bioretention facilities are proposed to treat runoff from approximately one acre of existing and new parking lots within the park. These bioretention facilities will include an underdrain that will connect to the CON-02 underground storage vault. Figure D-14 provides a bioretention facility profile schematic and examples.

DESIGN INFORMATION

The proposed HDS units were sized using the rational method for the 1-year, 24-hour design storm to meet trash capture requirements. The 1-year, 24-hour storm includes an intensity of approximately 1.32 inches, obtained from the San Jose Main Station rain gauge.

The underground storage vault was sized using a water balance approach with monthly precipitation values to verify the reliability of irrigating the adjacent 13-acre park, requiring a water demand of approximately 42 ac-ft per year. To estimate the demand, the dry weather runoff was assumed to be negligible and the irrigation rate was estimated using the Lawn Water Guide for California (University of California Agricultural and Natural Resources Publication 8044) for cool-weather grass.

The available storage under the new proposed parking lot is estimated to be approximately 205,000 ft^3. This assumes that approximately 50% of the lot can be utilized for an underground tank that is 10 feet deep. The proposed design will utilize a passive detention tank with a Continuously Monitored and Adaptively Controlled (CMAC) system. This tank is estimated to capture the equivalent to approximately 80% of the average annual runoff produced by a 24-acre, 75% impervious tributary area when stored runoff is used for irrigating the 13-acre vegetated area. A tank of this size may be able to provide 21 ac-ft per year of water for irrigation, approximately half of the estimated water demand. The CMAC system is intended to optimize the storage available in the detention tank, while providing adequate water for irrigation by an independent system. The runoff directed to the storage tank would be diverted from HDS-01.

The CMAC system would be connected to a cloud-based platform and would be primarily comprised of a controlled discharge valve at the outlet, a water level sensor, and an electrical control enclosure. The cloud-based platform would aggregate information from the water level sensor and national weather service forecast to implement custom logic to make automated decisions on when to operate the discharge valve. For example, open the discharge valve prior to a forecast rainfall event to create additional storage for incoming runoff and, therefore, minimize outflow during periods of active rainfall.

Key design features for a CMAC system include:

- Access to hard wired single-phase power;
- Access to a reliable cellular connection;
- A secure location for electrical control enclosure (e.g., minimal vandalism concerns);
- Proper sizing of the discharge valve to enable drawdown of the detention tank within four to eight hours;
- Pretreatment to remove fines/debris to protect the discharge valve;
- Passive overflow in the event of system surcharge; and

- Reliable estimates of estimated inflow (default is to initially estimate based on the modified rational method and calibrate the system accordingly once installed but may be more complex in systems where baseflow exists).

Drainage Catchment Size:	583 acres	
Drainage Catchment Imperviousness:	75%	
Irrigation Storage Volume Provided:	205,000 ft^3	
Land Use Yield Category:	Category	Percent of Total Area
	New Urban	0%
	Old Industrial	0%
	Old Urban	100%
	Open Space	0%
Precipitation Depth:	15 inches	
Facility Type:	Stormwater diversion for irrigation, HDS, and bioretention facilities	

BMP Index	Facility Type	Total Drainage Area (acres)	(Flow Rate[1] [cfs] or Footprint [sq. ft.])
HDS-01	Hydrodynamic Separator	500	15 cfs
HDS-02	Hydrodynamic Separator	83.	3 cfs
CON-01	Bioretention	0.40	296 sq. ft.
CON-02	Bioretention	0.94	695 sq. ft.
CON-02	Underground Detention Tank	24	20,500 sq. ft.
CON-03	Bioretention	0.28	207 sq. ft.
CON-04	Bioretention	0.36	267 sq. ft.
CON-04	Bioretention	0.16	119 sq. ft.
CON-06	Bioretention	0.28	209 sq. ft.

[1] Design flow was estimated using the rational method for the 1-year, 24-hour design storm; an intensity of approximately 1.32 inches, obtained from the San Jose Main Station Rain Gauge, and a runoff coefficient of 0.54 (calculated using the WEF method for a 75% impervious drainage area).

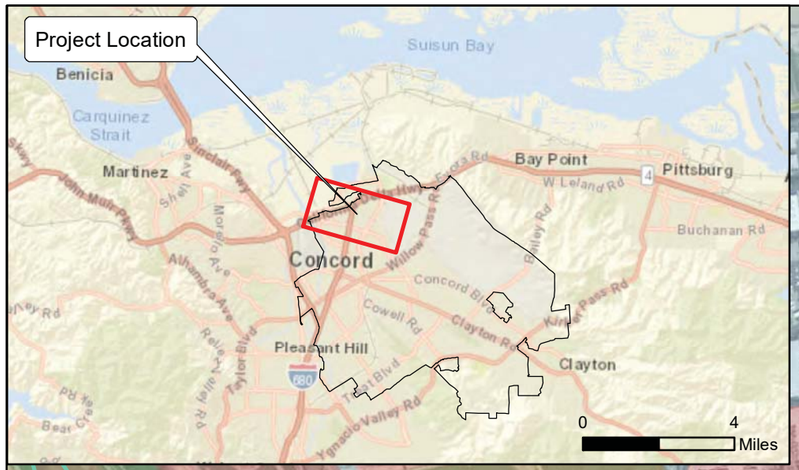
PROJECT BENEFITS

PCBs Loads Reduced:	1.6 grams per year[1]
Mercury Loads Reduced:	10.5 grams per year[1]
Water Supply Benefits:	The project will harvest urban runoff for irrigation.
Flood Management Benefits:	N/A
Natural Drainage System Benefits:	N/A
Habitat or Open Space Benefits:	N/A
Community Benefits:	The project will provide water quality educational signage.

[1] Note: Project runoff factors for computing load reduction were estimated for each drainage area using Table 3-2 from the Contra Costa Stormwater C.3. Guidebook, 7th Edition. Load reduction estimates for the underground detention tank assume a 100% load reduction for the volume reduced by reuse through irrigation.

COST ESTIMATE

DESCRIPTION	ACRES TREATED	UNIT COST	TOTAL COST
HDS CON-01	N/A	$190,000	$190,000
HDS CON-02	N/A	$90,000	$90,000
Distributed Green Infrastructure	2.4	$176,647 x acres + 12,935	$440,420
Regional Retrofit Project	24 acres	$38,633 x acres	$927,200
		DESIGN AND CONSTRUCTION COST	**$1,650,000**



HDS - 02

HDS - 01

CON - 01

CON - 02

CON - 05

CON - 03

CON - 04

Legend

Project Area

Existing Stormwater Infrastructure

- CDS Trash Capture Device
- Outlet
- Inlet
- Manhole
- Pipe Join
- Storm Drain
- Walnut Creek Tributary

Land Use Yield Category

- New Urban
- Old Industrial
- Old Urban
- Open Space

Control Measure Drainage Areas

- CON - 01
- CON - 02
- CON - 03
- CON - 04
- CON - 05
- HDS - 01
- HDS - 02

N

0 1,000 Feet

Contra Costa Watersheds Stormwater Resource Plan
Hillcrest Park Regional Retrofit
10% Conceptual Design
Concord, CA

Geosyntec consultants

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Figure D - 10

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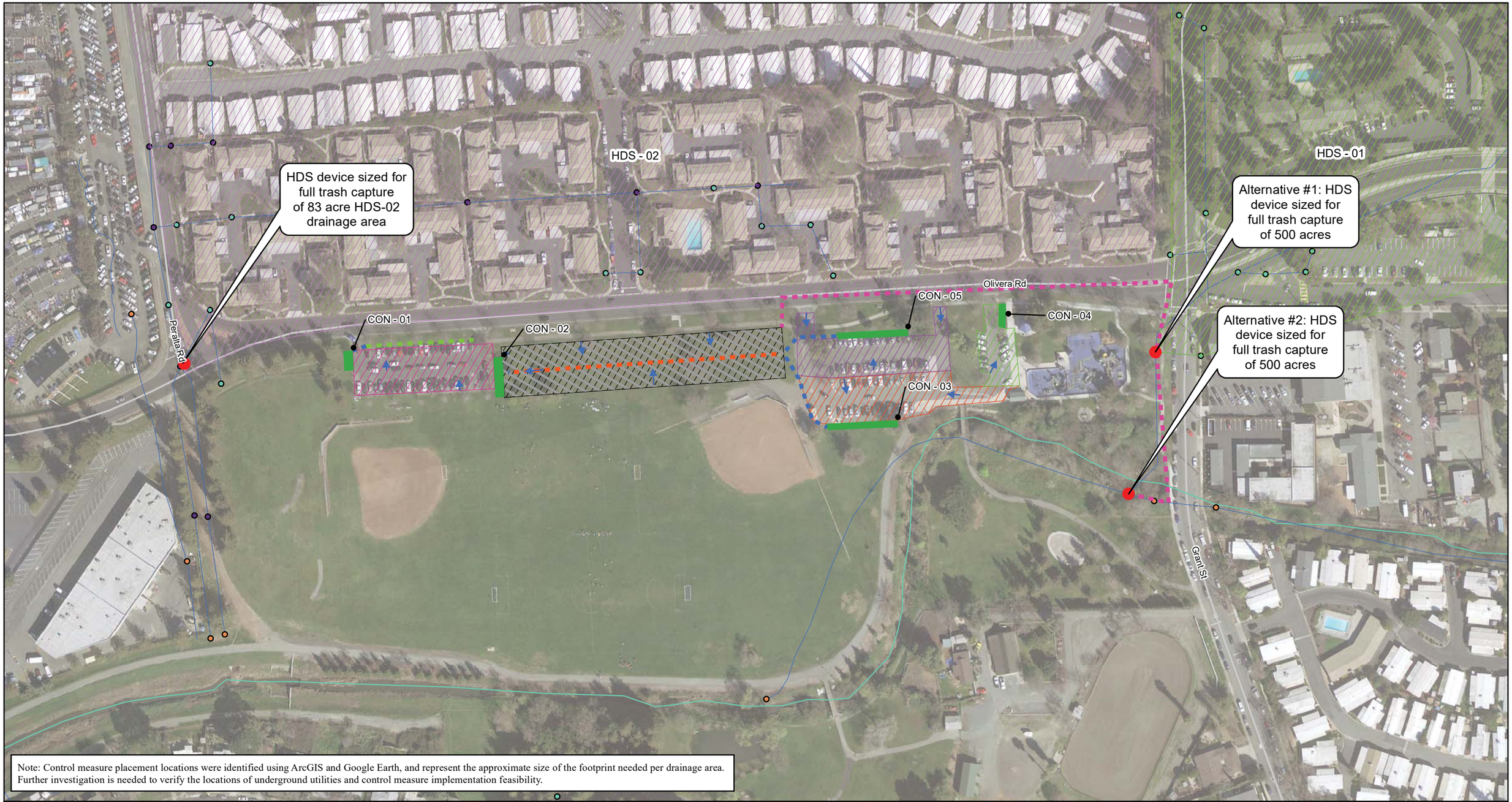

Note: Control measure placement locations were identified using ArcGIS and Google Earth, and represent the approximate size of the footprint needed per drainage area. Further investigation is needed to verify the locations of underground utilities and control measure implementation feasibility.

Legend

Existing Stormwater Infrastructure
- Inlet
- Manhole
- Pipe Join
- Storm Drain
- Walnut Creek Tributary
- Surface Flow Direction

Control Measure Drainage Areas
- CON - 01
- CON - 02
- CON - 03
- CON - 04
- CON - 05
- HDS - 01
- HDS - 02

Proposed Control Measures
- HDS Unit
- Proposed Conveyance Channel
- Proposed Diversion for Irrigation
- Proposed Storm Drain
- Proposed Trench Drain
- Bioretention with underdrain
- Underground Detention Tank for Irrigation Storage

N

0 200 Feet

Contra Costa Watersheds Stormwater Resource Plan
Hillcrest Park Regional Retrofit
10% Conceptual Design
Detail Panel
Concord, CA

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Figure D - 11

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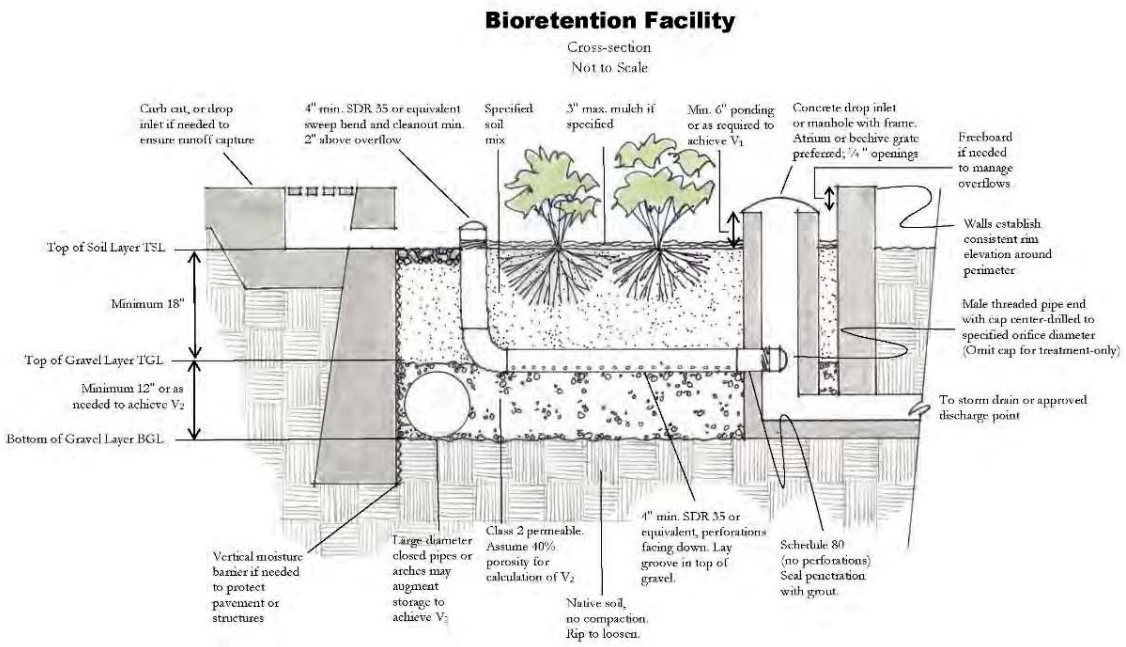
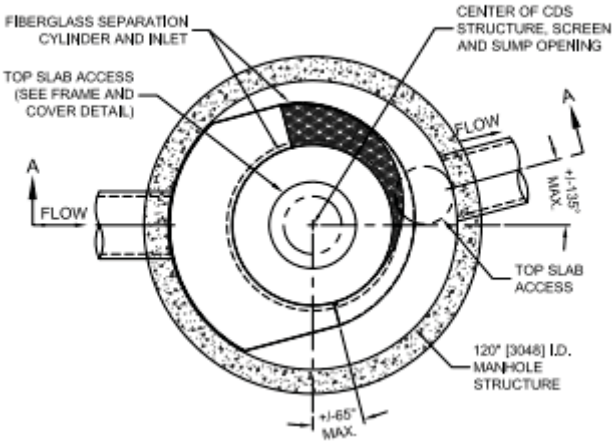


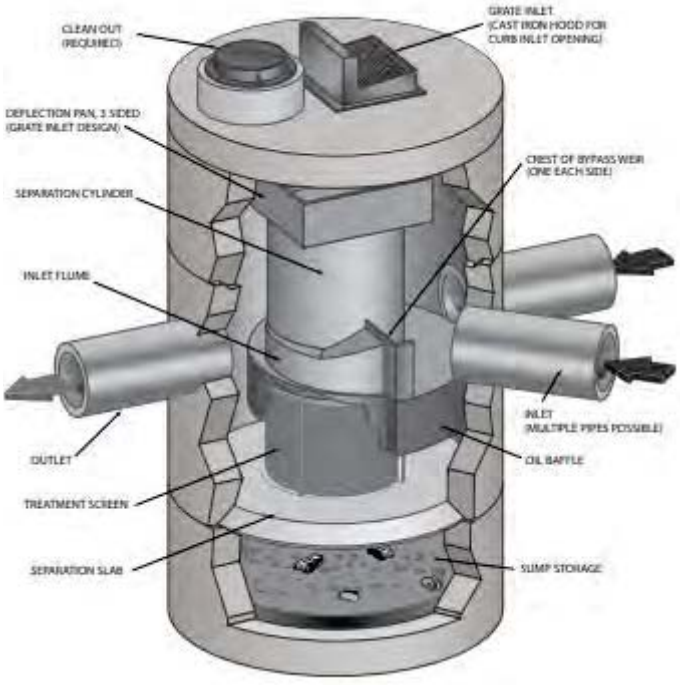
Figure D-12
Bioretention Profile Schematic and Examples

Plan View



CDS5653-10-C Inline CDS Standard Detail. *CDS5653-10-C Inline CDS Standard Detail*, CONTECH Engineered Solutions LLC.

Profile



CDS Guide Operation, Design, Performance and Maintenance. *CDS Guide Operation, Design, Performance and Maintenance*, CONTECH Engineered Solutions LLC.

Figure D-13
Conceptual Illustration of a Hydrodynamic Separator

Profile

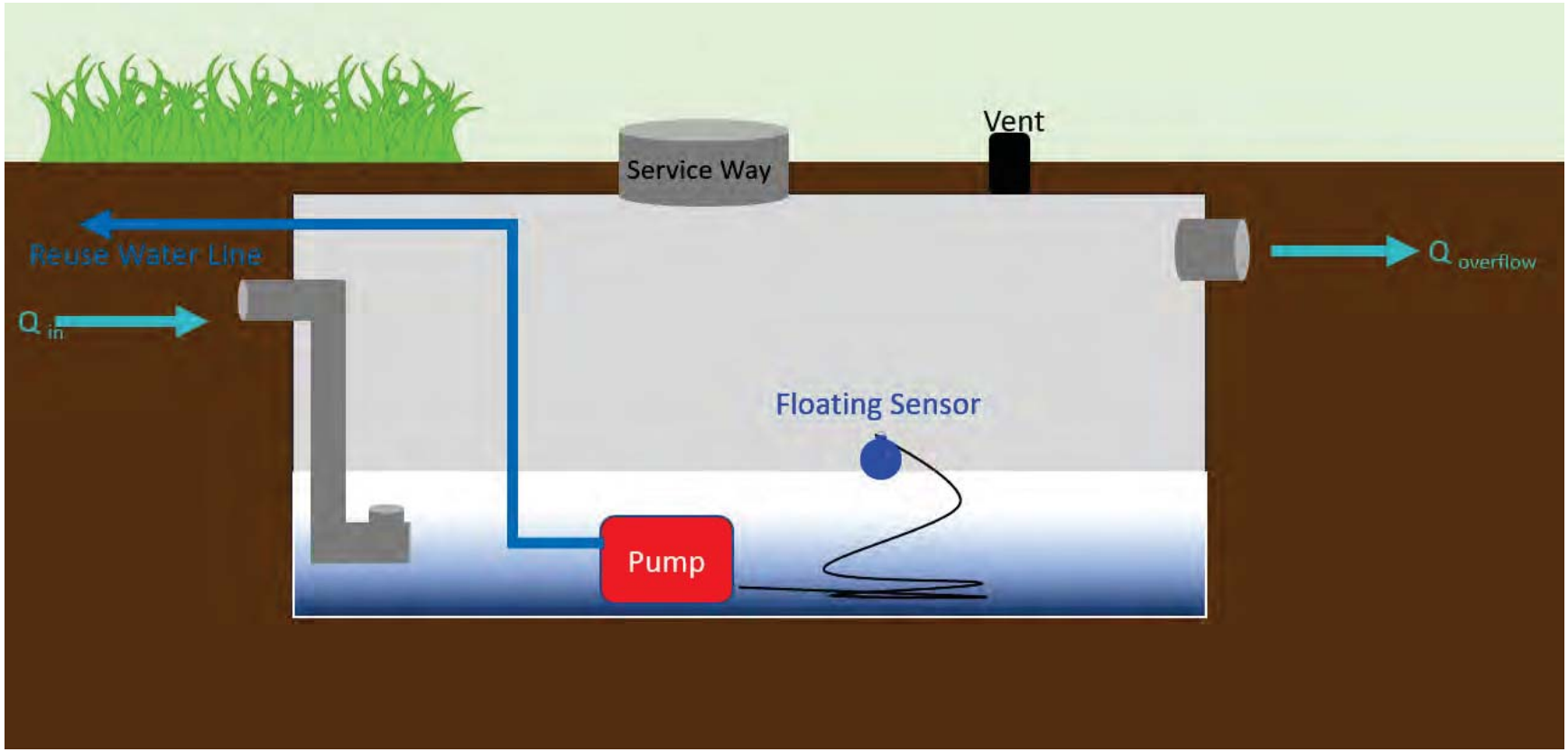


Figure D - 14
Conceptual Illustration of a Cistern

DANVILLE

Municipal contact for information about the project concept:

Chris McCann cmccann@danville.ca.gov

SYCAMORE VALLEY ROAD PARK AND RIDE EXPANSION

SITE DESCRIPTION

Jurisdiction:	**Town of Danville**
Location:	I-680 Danville Park and Ride, Sycamore Valley Rd., Danville, CA 94506
APN(s):	216041001 and 216043001
Land Owner:	Town of Danville
Planning Unit/Watershed:	Central
Soil Type:	HSG C

PROJECT CONCEPT

The Town of Danville is planning a capital improvement project to expand the Sycamore Valley Road Park and Ride to add 63 new parking spaces on the east side of the parking lot. The project will retrofit an existing open space to the north of the park and ride facility to include a bioretention facility. The bioretention facility will treat the existing parking spaces, new parking lot addition, and contributing drainage from the adjacent I-680 highway (Figure D-15).

The conceptual design presented herein proposes to treat the entire parking lot area with a single bioretention facility (Figure D-16). The proposed bioretention facility is anticipated to accept sheet flow from the parking lot that is collected at a single inlet located at the northwest corner of the parking lot. A vegetated swale is proposed to provide pretreatment and convey water into the proposed bioretention facility. Furthermore, it is proposed that the bioretention facility accept an estimated 1.9 acres of contributing drainage from I-680, which will be routed to the bioretention facility by modifying the existing flow pathways and storm sewer connections, if needed.

The two drainage areas that contribute potential flows to the project location are described below and shown on Figure D-15:

- **DAN-01:** 7.8-acre drainage area comprising the park and ride and adjacent open space area. Once the planned parking lot expansion is complete, this area will consist of approximately 3.4 acres of impervious area and 4.4 acres of pervious landscape.

  Currently, this area sheet flows to the northwest corner of the parking lot. Two storm drains are present inside the parking lot. Flow routing from these storm drains is currently unknown. Treating the existing parking lot may require routing runoff from these storm drains directly into the proposed bioretention facility, or sealing the existing storm drains to allow for surface runoff to sheet flow to the northwest corner of the parking lot.

- **DAN-02:** 1.9-acre highway drainage area. This area is estimated based on street view assessments of inlet locations and needs to be confirmed with an onsite drainage assessment. This area is considered to be 100% impervious for this conceptual design.

The conceptual design is dependent on the following assumptions:

- The identified Caltrans drainage area from I-680 can be routed to the bioretention facility.
- Select tree removal is feasible to allow for locating the bioretention facility in the identified location.
- Runoff from the entire existing parking lot area can be routed to the bioretention facility.

DESIGN INFORMATION

Total Drainage Catchment Size:	9.7 ac (including 1.9 ac DAN-02 Caltrans run-on area)	
Drainage Catchment Imperviousness:	59% (5.7 acres)	
Land Use Yield Category (%):	Category	Catchment Area
	Old Urban	100%
Annual Precipitation Depth (in):	21.5	
Facility Type:	Bioretention with underdrain	
Sizing Factor:	2.2% of effective impervious area	
Facility Footprint[1] (sq-ft):	5,350	

The proposed bioretention facility will be graded level with sloped side walls within the footprint identified in Figure D-16. The precise facility location should be determined based on identified tree and grading constraints. It is recommended that pretreatment be provided using a vegetated swale used to convey flows to the bioretention facility from the park and ride lot. The proposed location of the bioretention facility should also be evaluated with regards to the tree canopy to prevent clogging from leaf litter. A representative cross section of the bioretention facility is shown in Figure D-17, along with photos of example bioretention facilities.

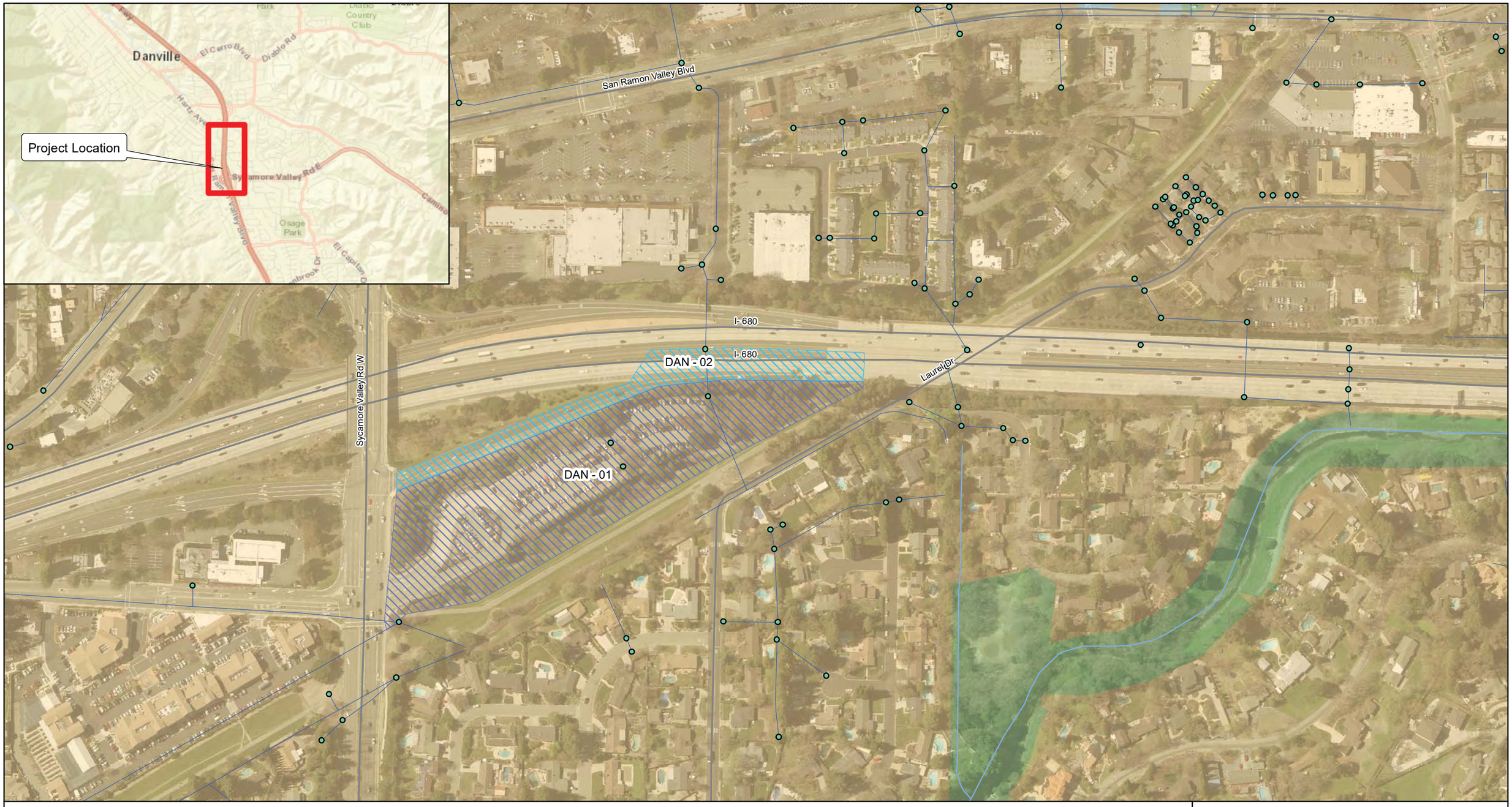
PROJECT BENEFITS

PCBs Loads Reduced:	0.6 grams per year[1]
Mercury Loads Reduced:	0.5 grams per year[1]
Water Supply Benefits:	N/A
Flood Management Benefits:	The project will provide flood management benefit through detention and infiltration benefits.
Natural Drainage System Benefits:	The project will provide hydrologic benefit to natural drainage system by allowing for infiltration.
Habitat or Open Space Benefits:	N/A
Community Benefits:	The project will provide water quality educational signage.

[1] Note: Project runoff factors for computing load reduction were estimated for each drainage area using Table 3-2 from the Contra Costa Stormwater C.3. Guidebook, 7th Edition.

COST ESTIMATE

DESCRIPTION	TREATED AREA (AC)	UNIT COST	TOTAL COST
Regional Retrofit Project	9.7	$38,633 x acres	$375,000
		DESIGN AND CONSTRUCTION COST	**$375,000**



Legend

Existing Stormwater Infrastructure
- Inlet
- San Ramon Creek Tributary
- Storm Drain

Land Use Yield Category
- New Urban
- Old Urban
- Open Space

Control Measure Drainage Areas
- DAN - 01
- DAN - 02

N

0 250 Feet

Contra Costa Watersheds Stormwater Resource Plan
Sycamore Valley Road Park and Ride Expansion
10% Conceptual Design

Danville, CA

Geosyntec consultants

CONTRA COSTA CLEAN WATER PROGRAM

Figure D-15

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Note: DAN-02 depicts estimated Caltrans runon drainage area based on visual assessment of inlet locations using Google Earth street view and available topography data. A detailed drainage analysis should be conducted to confirm drainage area.

DAN - 02

DAN - 01

Note: Control measure placement locations were identified using ArcGIS and Google Earth, and represent the approximate size of the footprint needed per drainage area. Further investigation is needed to verify the locations of underground utilities and control measure implementation feasibility.

Legend

Planned Parking Lot Expansion

Existing Stormwater Infrastructure
- Inlet
- Outfall
- Surface Flow Direction
- Open Channel
- Storm Drain

Anticipated Caltrans Drainage
- Existing Inlet
- Proposed Storm Drain

Control Measure Drainage Areas
- DAN - 01
- DAN - 02

Proposed Control Measures
- Bioretention with Underdrain
- Pretreatment Swale

N

0 100 Feet

Contra Costa Watersheds Stormwater Resource Plan
Sycamore Valley Road Park and Ride Expansion
10% Conceptual Design
Detail Panel

Danville, CA

Geosyntec consultants

CONTRA COSTA CLEAN WATER PROGRAM

Figure D-16

WW2371 | July 2018

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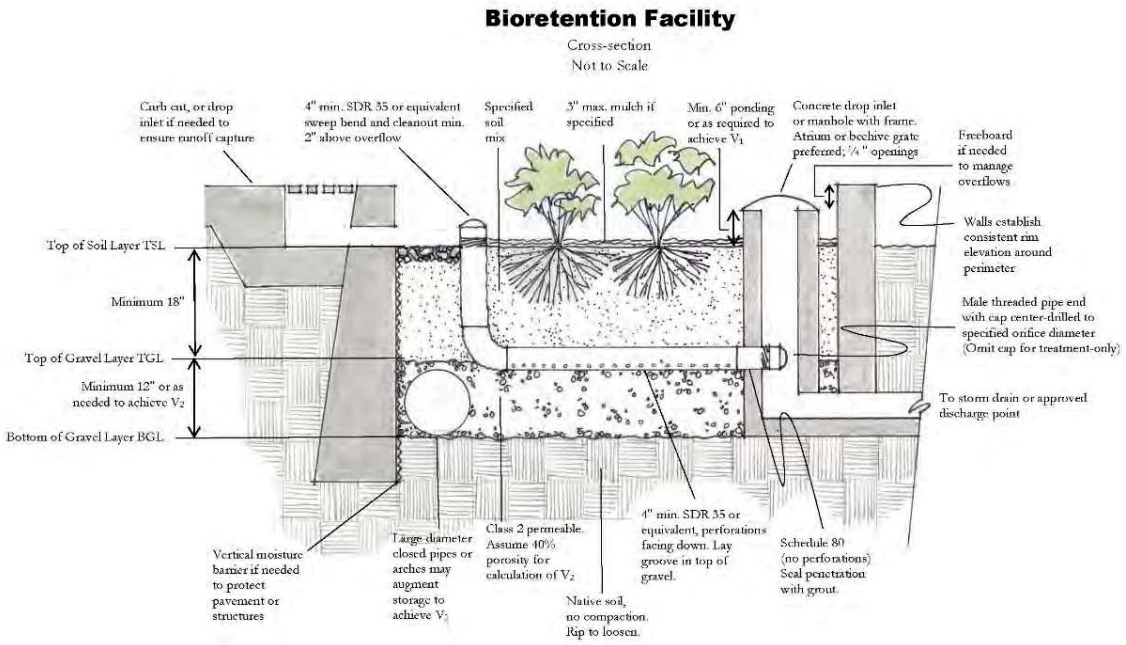


Figure D-17
Bioretention Profile Schematic and Examples

EL CERRITO

Municipal contact for information about the project concept:

Will Provost wprovost@ci.el-cerrito.ca.us

EL CERRITO DEL NORTE TOD COMPLETE STREETS IMPROVEMENTS

SITE DESCRIPTION

Jurisdiction:	**El Cerrito**
Location:	El Cerrito del Norte BART Station, Cutting Blvd., El Cerrito, CA 94530
APN(s):	502061005
Land Owner:	San Francisco BART District and El Cerrito Public Works
Planning Unit/Watershed:	West/Baxter/Cerrito Richmond Drainages
Soil Type:	HSG D

PROJECT CONCEPT

The El Cerrito del Norte TOD Complete Street Improvements project will improve transportation access along the San Pablo Avenue corridor adjacent to the El Cerrito del Norte BART station (Figure D-18). The existing plans for this project identify proposed street and pedestrian walkway modifications to allow for traffic calming, bicycle lanes, greenway connections, and improved traffic flow[1]. The current plan does not include any green infrastructure improvements. Four potentially feasible locations for bioretention that could be included in the Improvements project were identified based on the proposed street modifications (MIG, 2015) and siting assessment using aerial photography. Only locations that fit within the current plan proposal were considered. A description of the four proposed bioretention facilities corresponding with the areas (shown in Figures D-19 and D-20) is as follows:

- **ELC-01:** This 0.3-acre San Pablo Ave roadway drainage area is proposed to be treated by a bioretention facility located within a constructed bulb-out at the north corner of the San Pablo Avenue and Cutting Boulevard intersection.
- **ELC-02:** This 0.1-acre Cutting Boulevard roadway drainage area is proposed to be treated by a bioretention facility located within a constructed bulb-out south of the BART railroad tracks.
- **ELC-03:** This 0.8-acre San Pablo Ave roadway drainage area is proposed to be treated by a bioretention facility located within a constructed bulb-out at the north corner of the San Pablo Avenue and Hill Street intersection. The proposed bulb-out size may need to be increased compared to what is in the current plan proposal to allow for adequate bioretention sizing.
- **ELC-04:** This 0.5-acre San Pablo Avenue roadway drainage area is proposed to be treated by a bioretention facility located within an existing vegetated area that will be modified as

[1] Source: MIG. 2015. City of El Cerrito San Pablo Avenue Specific Plan, Multimodal Capital Improvement Program

part of the current plan proposal at the south corner of the Peerless Avenue and Eastshore Boulevard intersection. Additional field investigation of utilities in this area is necessary.

A schematic profile and example bioretention facilities are provided in Figure D-21.

The siting of green street features as part of the El Cerrito Del Norte TOD Complete Streets Improvements is currently limited by several unknown factors regarding site drainage and planned improvements. It is recommended that the following conditions be further investigated for inclusion in the complete street design:

- **Parking Lot Retrofits:** The Safeway and BART parking lots to the northeast of San Pablo Avenue may have opportunities for parking lot island bioretention retrofits or larger scale regional control facilities.
- **Crosswalk Bulb-Outs:** Several intersection locations identified in MIG (2015) are proposed to have small bulbouts with improved crosswalks. Due to uncertainty in flow paths and confined space due to crosswalk areas, these areas were determined to be infeasible for bioretention planters. However, if bulb-out geometries can be reconfigured, opportunities may be present.
- **Green Street Specific Improvements:** The current design identified opportunities based on the proposed complete street design. No green infrastructure improvements were identified for the following street locations within the project area due to a lack of proposed areas that could fit stormwater facilities: San Pablo Avenue northwest of Knott Avenue, Cutting Boulevard west of San Pablo Avenue, and Eastshore Boulevard south of San Pablo Avenue. Stormwater facilities may be feasible along these streets if green infrastructure specific improvements are considered.

DESIGN INFORMATION

Drainage Catchment Size:	1.6 ac
Drainage Catchment Imperviousness:	100%
Land Use Yield Category:	Category: Percent of Total Area **New Urban**: 2% **Old Urban**: 98%
Annual Precipitation Depth:	22 in

Location	Facility Type	Total Drainage Area (ac)	BMP Footprint (ft^2)
ELC – 01	Bioretention with underdrain	0.29	510
ELC – 02	Bioretention with underdrain	0.10	180
ELC – 03	Bioretention with underdrain	0.78	740
ELC - 04	Bioretention with underdrain	0.49	850

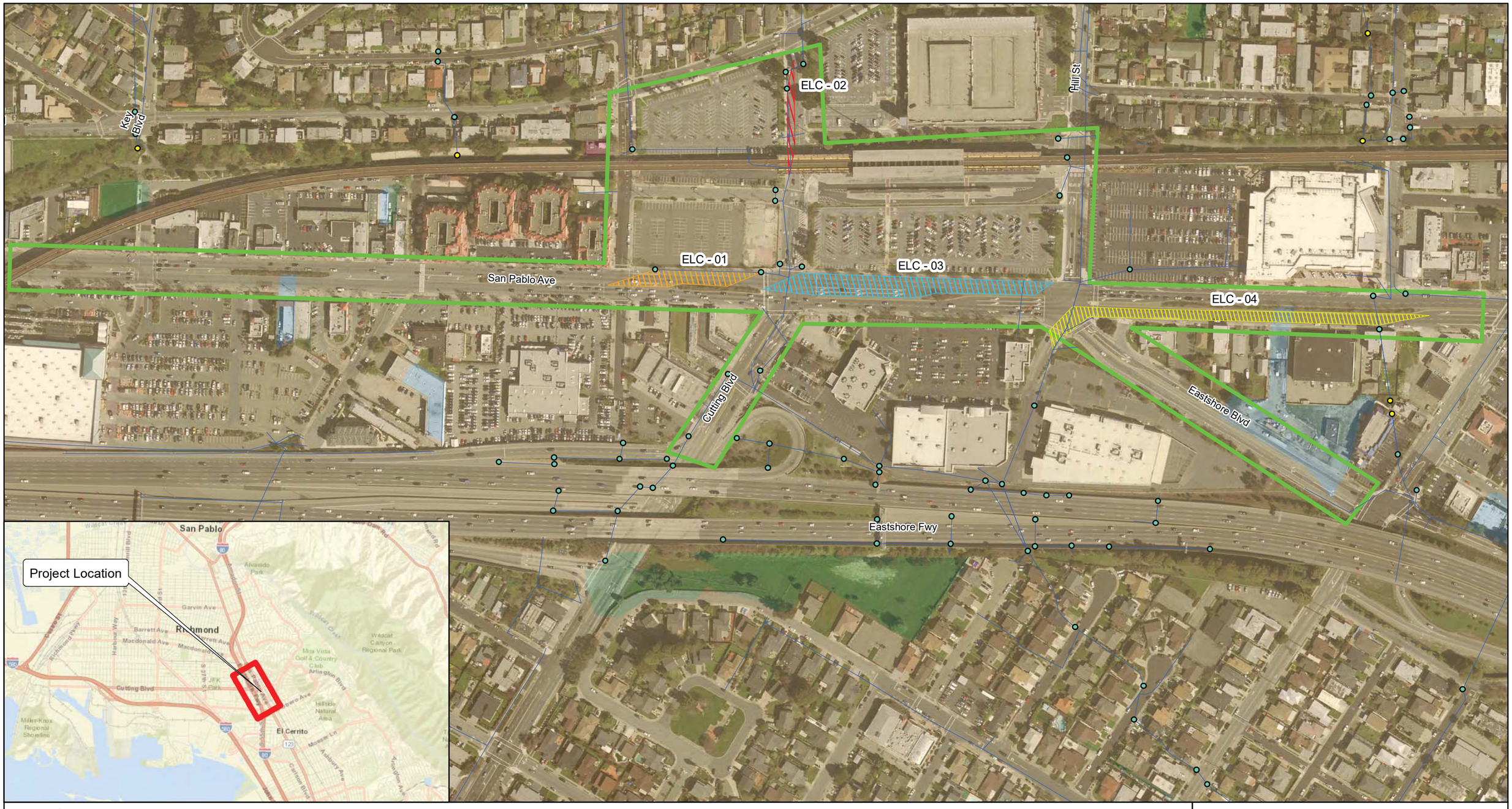
PROJECT BENEFITS

PCBs Loads Reduced:	0.03 grams per year[1]
Mercury Loads Reduced:	0.07 grams per year[1]
Water Supply Benefits:	N/A
Flood Management Benefits:	The project will provide flood management benefit by promoting infiltration.
Natural Drainage System Benefits:	N/A
Habitat or Open Space Benefits:	The project will provide 0.05 acres of green space within the urban area.
Community Benefits:	N/A

[1] Note: Project runoff factors for computing load reduction were estimated for each drainage area using Table 3-2 from the Contra Costa Stormwater C.3. Guidebook, 7th Edition.

COST ESTIMATE

DESCRIPTION	TREATED AREA (AC)	UNIT COST	TOTAL COST
Green Street	1.6	$114,687 x acres + $36,927	$220,000
		DESIGN AND CONSTRUCTION COST	**$220,000**



Legend

- El Cerrito Del Norte TOD Project Area

Existing Stormwater Infrastructure

- Inlet
- Outlet
- Storm Drain
- Coastal Drainage Tributary

Land Use Category

- New Urban
- Old Industrial
- Old Urban
- Open Space

Control Measure Drainage Areas

- ELC - 01
- ELC - 02
- ELC - 03
- ELC - 04

0 250 Feet

Contra Costa Watersheds Stormwater Resource Plan
El Cerrito Del Norte TOD Complete Streets Improvements
10% Conceptual Design
El Cerrito, CA

Geosyntec consultants

CONTRA COSTA CLEAN WATER PROGRAM

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Figure D - 18

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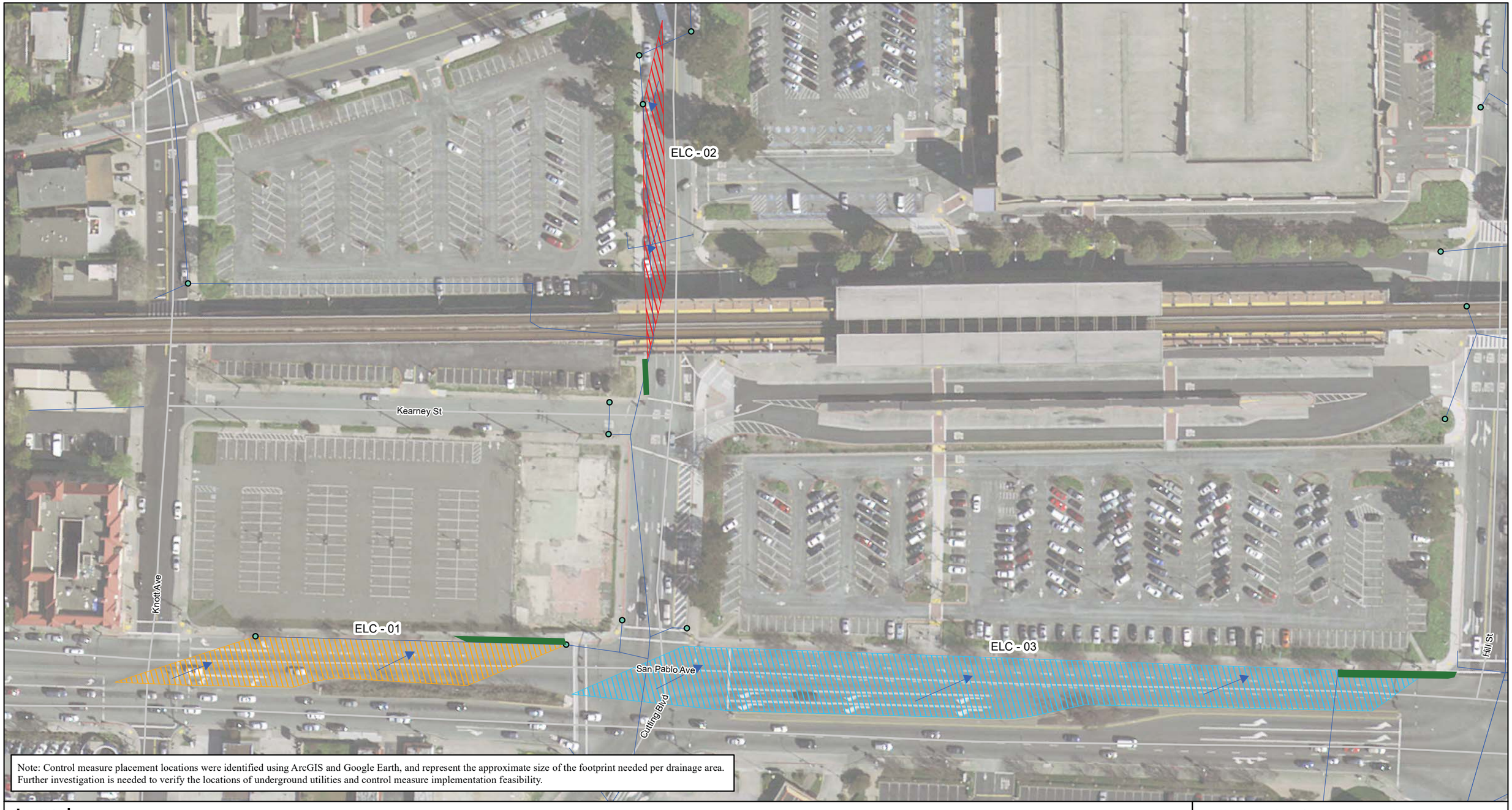

Note: Control measure placement locations were identified using ArcGIS and Google Earth, and represent the approximate size of the footprint needed per drainage area. Further investigation is needed to verify the locations of underground utilities and control measure implementation feasibility.

Legend

Existing Stormwater Infrastructure
- Inlet
- Outlet
- Storm Drain
- Surface Flow Direction

Control Measure Drainage Areas
- ELC - 01
- ELC - 02
- ELC - 03

Proposed Control Measures
- Bioretention facility with underdrain

N

0 85 Feet

Contra Costa Watersheds Stormwater Resource Plan
El Cerrito Del Norte TOD Complete Streets Improvements
10% Conceptual Design
Detail Panel 1
El Cerrito, CA

Geosyntec consultants

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Figure D - 19

WW2371 | May 2018

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Note: Control measure placement locations were identified using ArcGIS and Google Earth, and represent the approximate size of the footprint needed per drainage area. Further investigation is needed to verify the locations of underground utilities and control measure implementation feasibility.

Legend

Existing Stormwater Infrastructure
- Inlet
- Outlet
- Storm Drain
- Surface Flow Direction

Control Measure Drainage Areas
- ELC - 03
- ELC - 04

Proposed Control Measures
- Bioretention facility with underdrain

N

0 70 Feet

Contra Costa Watersheds Stormwater Resource Plan
El Cerrito Del Norte TOD Complete Streets Improvements
10% Conceptual Design
Detail Panel 2
El Cerrito, CA

Geosyntec consultants

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WW2371 | July 2018

Figure D - 20

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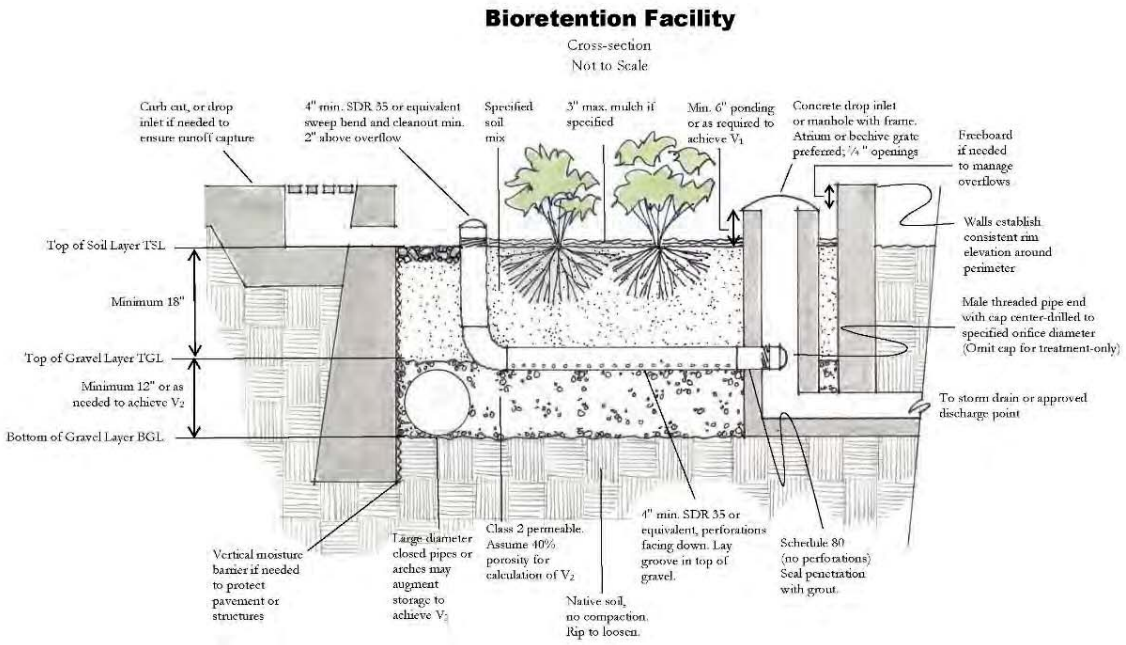


Figure D-21
Bioretention Profile Schematic and Examples

OAKLEY

Municipal contact for information about the project concept:

Billilee Saengchalern Saengchalern@ci.oakley.ca.us

OAKLEY TRAIN STATION GREEN INFRASTRUCTURE PROJECT

SITE DESCRIPTION

Jurisdiction:	**City of Oakley**
Location:	Oakley train station north of Main Street between Norcross Lane and 5th Street
APN(s):	Oakley Train Station: 35164002, 35122008, 37160033, 37160020, 37160015, 37160014, 37160029, 37160030, 37160011, 37160010, 37160021, 37160031, 37160026, 37160032, 37160025, 37160024, 37160034, 37160009, 37160008, 37160007, 37160006, 37160027, 37160022, 37160018; Basin retrofit: APN 037191025
Land Owner:	City of Oakley
Planning Unit, Watershed:	East Planning Unit/East County Delta Drainages
Parcel/ROW Size:	1.03 acres (train station GI), 1.58 acres (basin retrofit), 2.61 acres total
Soil Type:	HSG A

PROJECT CONCEPT

The City of Oakley's "Downtown Development Study: Preferred Plan" identifies the redevelopment and revitalization of the Oakley train station (Figure D-22). The preferred redevelopment plan includes a passenger pickup and drop off area, two park and ride lots, a greenway walking path, and adjacent parcels expected to undergo private redevelopment. The project proposes to include green infrastructure to treat the redevelopment project footprint. A second project element involves retrofitting an existing unused flood control basin, located east of the proposed train station and north of the train tracks, into a regional stormwater treatment facility.

The proposed facilities include:

- **OAK-01** – **OAK-18**: Facility locations were identified using the illustrative plan from the City's study, and are proposed to include a distributed network of bioretention cells with underdrains that will treat the park and ride lots along with adjacent buildings, the pickup and drop off area, and the platform itself, and the northern Main Street right of way in front of the train station area (Figure D-23 and Figure D-24). Figure D-25 presents a schematic profile and example bioretention facilities.
- **OAK-19**: An infiltration basin is proposed for the basin retrofit due to highly infiltrative underlying soils (Figure D-24). A potential site limitation is seasonally high groundwater. If groundwater is found to be less than 10 feet below the proposed bottom elevation of the basin during subsequent site investigations, infiltration may be infeasible or inadvisable and a water quality dry extended basin or constructed wetland would be recommended as an alternative approach. The proposed infiltration basin or water quality basin will retrofit approximately six acres of old residential and commercial land uses. Figure D-26 presents a conceptual illustration of a regional infiltration/bioretention facility.

DESIGN INFORMATION

Drainage Catchment Size:	12 acres (train station GI), 6 acres (basin retrofit), 18 acres total
Drainage Catchment Imperviousness:	93%
Land Use Yield Category (%):	Category: Catchment Area **New Urban**: 10% **Old Industrial**: 2% **Old Urban**: 70% **Open Space**: 18%
Precipitation Depth:	12.7 inches
Facility Type:	Bioretention with underdrains at the Oakley Train Station and an infiltration basin for the existing basin retrofit.
Facility Footprint:	1.03 acres (train station GI), 1.58 acres (basin retrofit), 2.61 acres total

Location	Facility Type	Total Drainage Area (acres)	BMP Footprint (sq-ft)
Regional Infiltration Basin	Infiltration Basin	6.01	68,830
OAK-01	Bioretention with Underdrain	0.70	510
OAK-02	Bioretention with Underdrain	0.93	520
OAK-03	Bioretention with Underdrain	0.72	500
OAK-04	Bioretention with Underdrain	0.91	3,780
OAK-05	Bioretention with Underdrain	0.74	1,950
OAK-06	Bioretention with Underdrain	0.60	2,690
OAK-07	Bioretention with Underdrain	1.52	5,470
OAK-08	Bioretention with Underdrain	0.17	2,000
OAK-09	Bioretention with Underdrain	0.74	5,360
OAK-10	Bioretention with Underdrain	0.97	2,680
OAK-11	Bioretention with Underdrain	0.87	2,500
OAK-12	Bioretention with Underdrain	0.70	2,260
OAK-13	Bioretention with Underdrain	0.58	3,720
OAK-14	Bioretention with Underdrain	0.44	960
OAK-15	Bioretention with Underdrain	0.43	1,600
OAK-16	Bioretention with Underdrain	0.41	1,690
OAK-17	Bioretention with Underdrain	0.35	1,620
OAK-18	Bioretention with Underdrain	0.22	4,930

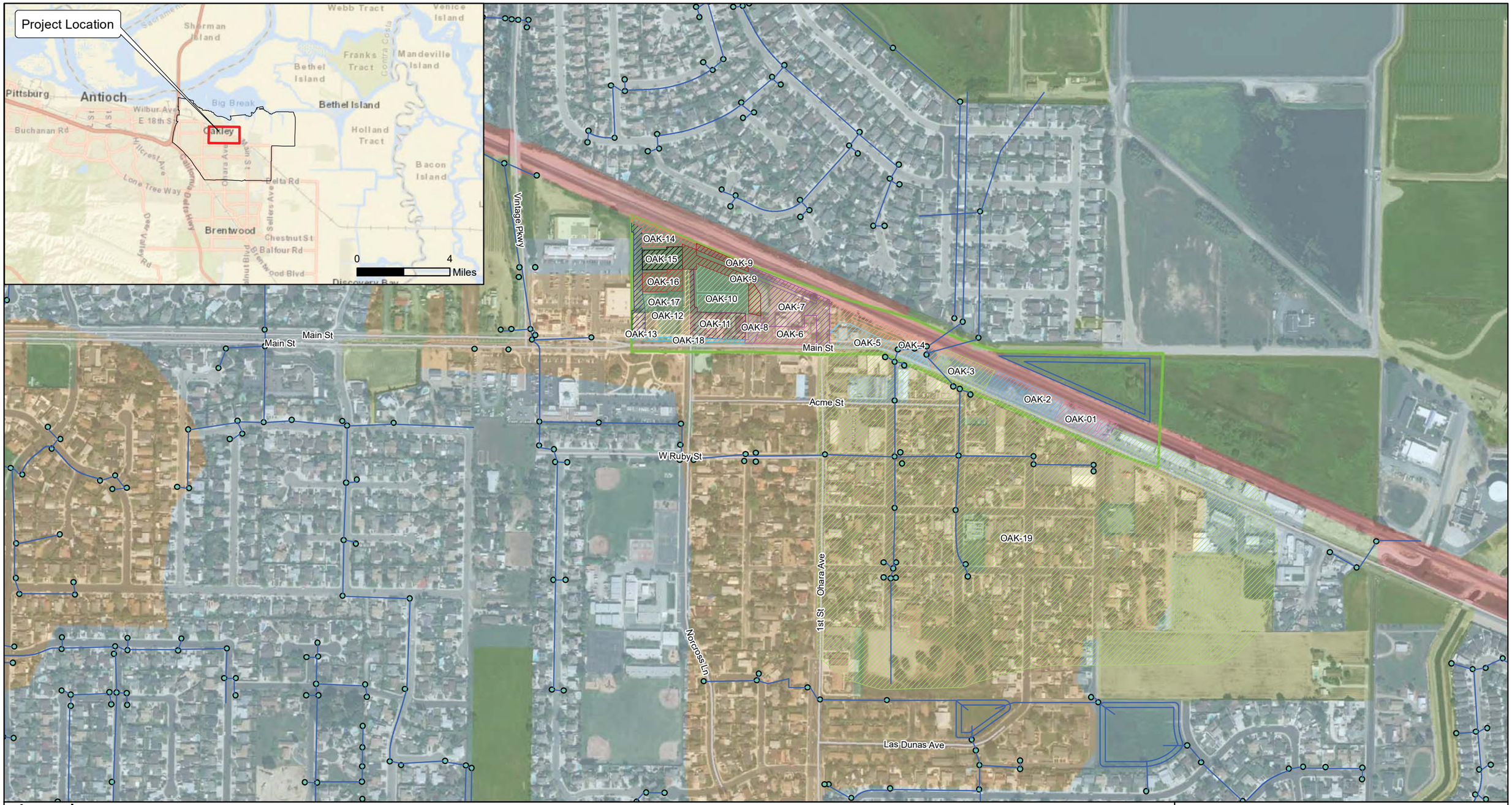
PROJECT BENEFITS

PCBs Loads Reduced:	0.3 grams per year[1]
Mercury Loads Reduced:	1.0 grams per year[1]
Water Supply Benefits:	The project will provide water supply benefits via groundwater recharge at the infiltration basin.
Flood Management Benefits:	The project will provide flood management benefit through detention and infiltration benefits.
Natural Drainage System Benefits:	The project will provide hydrologic benefit to natural drainage system by allowing for infiltration.
Habitat or Open Space Benefits:	The project will provide 2.6 acres of green space.
Community Benefits:	The project will provide water quality educational signage.

[1] Note: Project runoff factors for computing load reduction were estimated for each drainage area using Table 3-2 from the Contra Costa Stormwater C.3. Guidebook, 7th Edition.

COST ESTIMATED

DESCRIPTION	TREATED AREA (acres)	UNIT COST	TOTAL COST
Bioretention with Underdrain	12	$176,647 x acres + $12,935	$2,130,000
Regional Facility	6	$38,633 x acres	$230,000
TOTAL DESIGN AND CONSTRUCTION COST			**$2,360,000**



Legend

Redevelopment Project Area

Existing Stormwater Infrastructure

- Inlet
- Storm Drain
- Stormwater Catch Basin

Land Use Yield Category

- New Urban
- Old Industrial
- Old Urban
- Open Space

Control Measure Drainage Areas

OAK-01, OAK-02, OAK-03, OAK-04, OAK-05, OAK-06, OAK-07, OAK-08, OAK-09, OAK-10, OAK-11, OAK-12, OAK-13, OAK-14, OAK-15, OAK-16, OAK-17, OAK-18, OAK-19

N

0 450 Feet

Contra Costa Watersheds Stormwater Resource Plan
Downtown Train Platform
10% Conceptual Design
Oakley, CA

Geosyntec consultants

CONTRA COSTA CLEAN WATER PROGRAM

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Figure D - 22

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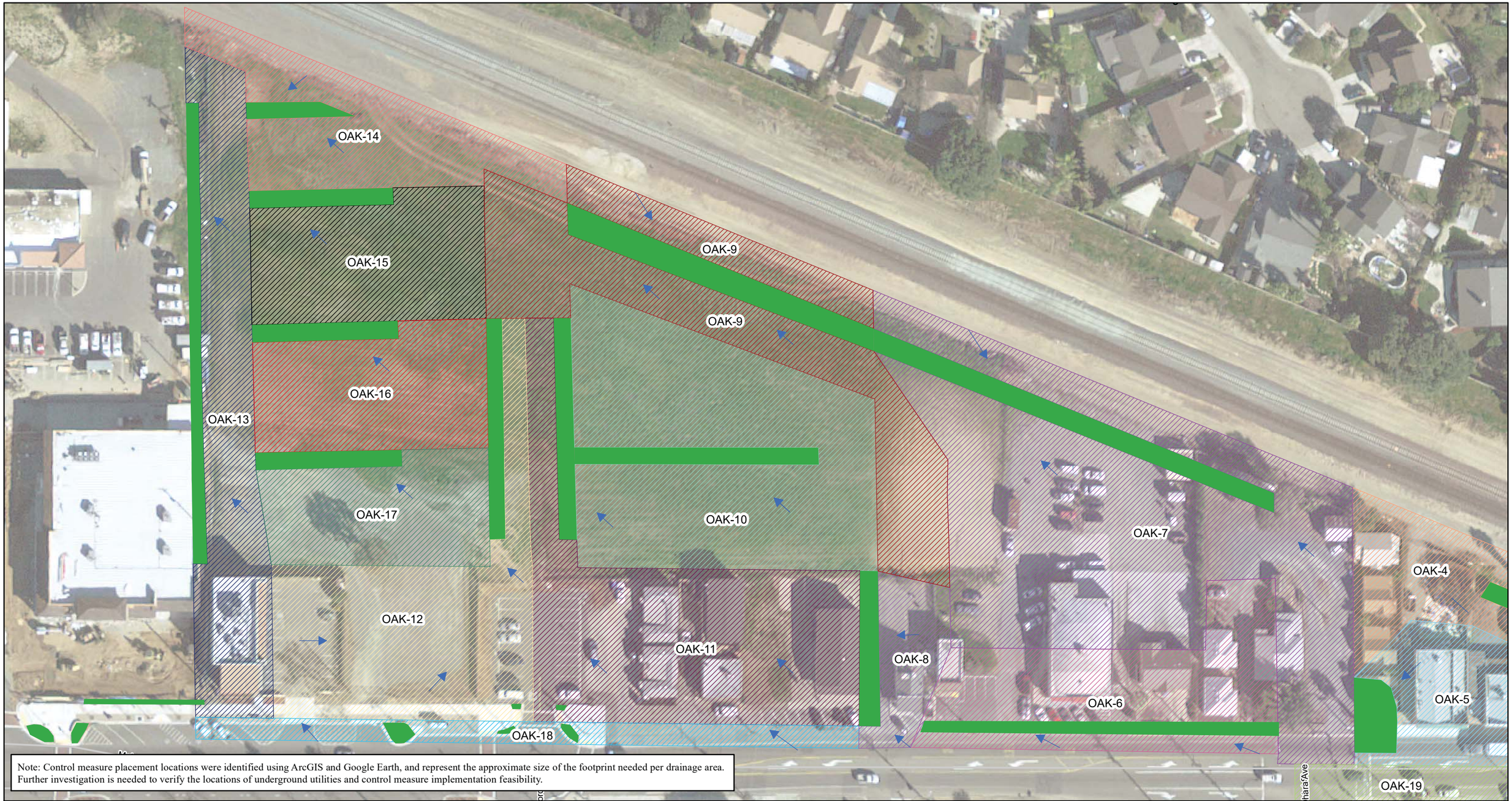

Legend

Existing Stormwater Infrastructure

- Inlet
- Surface Flow Direction

Control Measure Drainage Areas

OAK-04	OAK-08	OAK-12	OAK-16
OAK-05	OAK-09	OAK-13	OAK-17
OAK-06	OAK-10	OAK-14	OAK-18
OAK-07	OAK-11	OAK-15	OAK-19

Proposed Control Measures

- Bioretention with Underdrain

N

0 100 Feet

Contra Costa Watersheds Stormwater Resource Plan
Downtown Train Platform
10% Conceptual Design
Detail Panel 1
Oakley, CA

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WW2371 | May 2018

Figure D - 23

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OAK-7

OAK-4

OAK-5

Main St

OAK-3

OAK-2

OAK-19

OAK-01

Acme St

Note: Control measure placement locations were identified using ArcGIS and Google Earth, and represent the approximate size of the footprint needed per drainage area. Further investigation is needed to verify the locations of underground utilities and control measure implementation feasibility.

Legend

Existing Stormwater Infrastructure

- Inlet
- Surface Flow Direction
- Storm Drain

Control Measure Drainage Areas

- OAK-01
- OAK-02
- OAK-03
- OAK-04
- OAK-05
- OAK-07
- OAK-19

Proposed Control Measures

- Bioretention with Underdrain
- Water Quality Basin

N

0 120 Feet

Contra Costa Watersheds Stormwater Resource Plan
Downtown Train Platform
10% Conceptual Design
Detail Panel 2
Oakley, CA

Geosyntec consultants

CONTRA COSTA CLEAN WATER PROGRAM

WW2371

May 2018

Figure

D - 24

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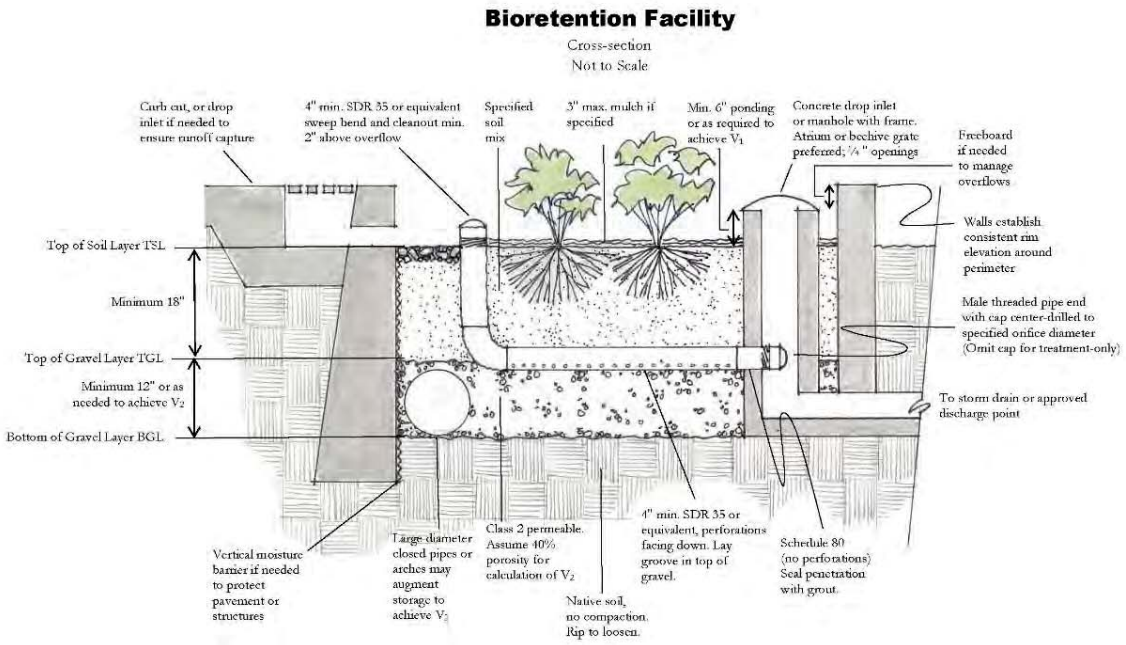
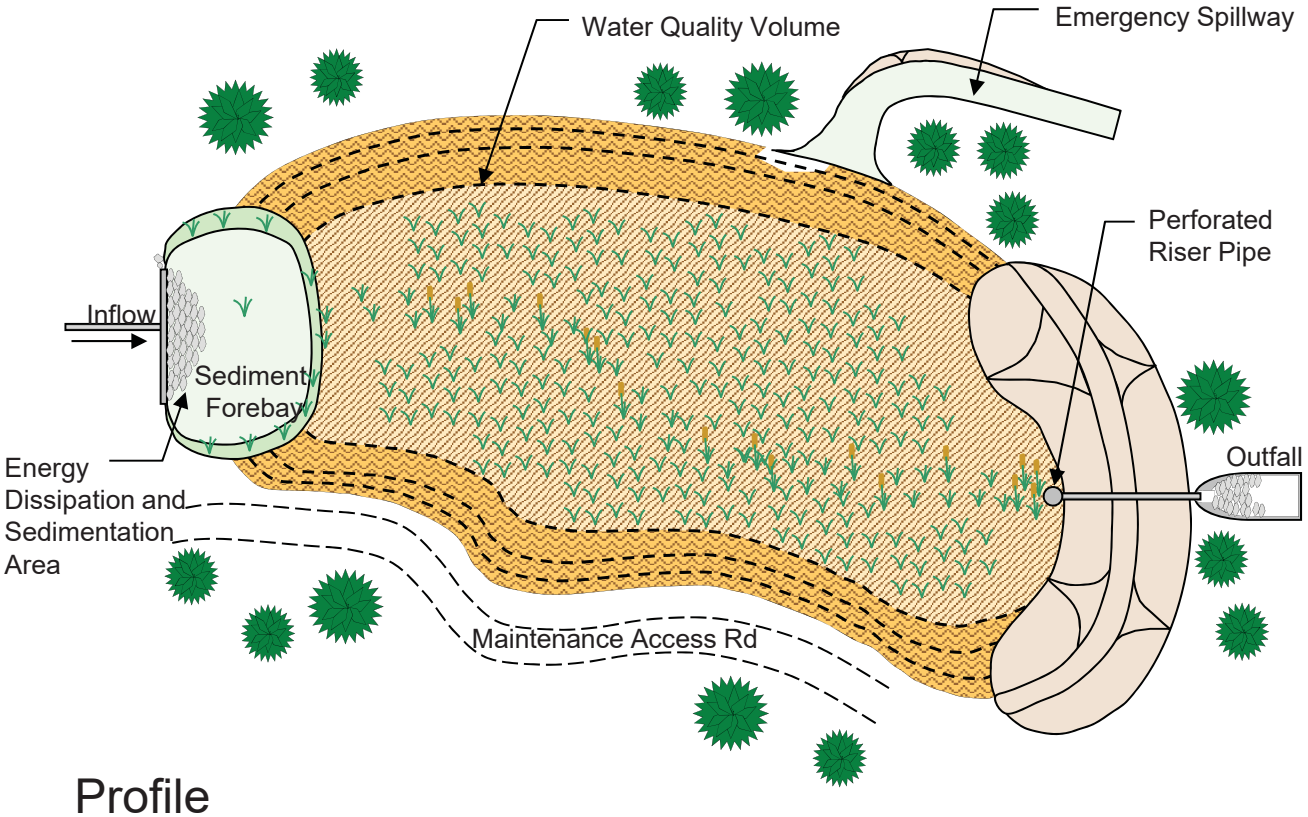
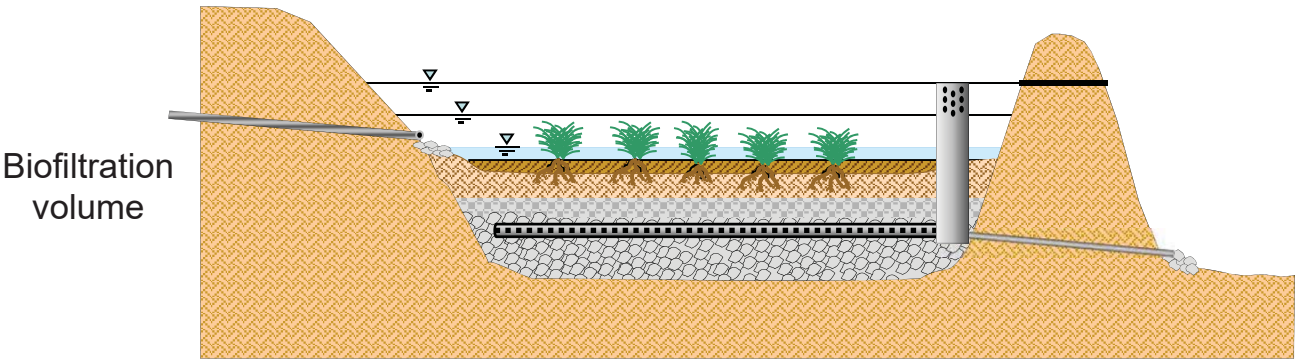


Figure D-27
Bioretention Profile Schematic and Examples

Plan View



Profile



Conceptual Illustration of a Regional Infiltration/Biofiltration Facility

Geosyntec consultants

Oakland | April 2018

Figure D-28

ORINDA

Municipal contact for information about the project concept:

Scott Christie schristie@cityoforinda.org

ORINDA WAY GREEN STREET PROJECT

SITE DESCRIPTION

Jurisdiction:	**Orinda**
Location:	Orinda Way between Camino Sobrante and Santa Maria Way and Orinda Library parking lot
APN(s):	City of Orinda rights-of-way, Orinda Library APN 260200005
Land Owner:	City of Orinda
Planning Unit/Watershed:	South Planning Unit/San Pablo Creek
Parcel/ROW Size:	2.74 acres (Orinda Way green street), 0.82 acres (Orinda Library features), 3.56 acres total
Soil Type:	D

PROJECT CONCEPT

The Orinda Way Green Street Project will install green infrastructure on Orinda Way between Camino Sobrante and Santa Maria Way into existing landscaped bulbout features and other areas within the right-of-way (Figure D-27). This project incorporates bioretention with underdrains into an area of the City near the Orinda Community Park and the Orinda Library as well as a key commercial hub (Figure D-28). Additional opportunities to implement bioretention with underdrains were identified around the Orinda Library within a City-owned parcel (Figure D-29). The proposed bioretention cells, which will include underdrains due to poorly draining soils, will treat a mix of roadway, commercial, and institutional land uses. Urban runoff in the project area drains from a ridge to the north of the project area toward Orinda Way, which then flow west from Santa Maria Way toward Camino Pablo. Figure D-30 provides a schematic profile and example bioretention facilities. The proposed design utilizes available space along Orinda Way, where there are competing priorities for right-of-way usage such as bike paths, sidewalks, and parking spaces.

The potential for conflicts with underground utilities needs to be further investigated via plan review and/or field visits to verify the placement of bioretention facilities along Orinda Way. The proposed connectivity, on Figure 28 and Figure 29, to the existing storm drain network also needs to be further investigated for capacity issues and safe drawdown times.

DESIGN INFORMATION

Drainage Catchment Size:	4 acres
Drainage Catchment Imperviousness:	94%
Land Use Yield Category (%):	100% Old Urban
Precipitation Depth:	19.6 inches
Facility Type:	Bioretention with underdrains
Facility Footprint:	0.23 acres (Orinda Way green street), 0.07 acres (Orinda Library features), 0.30 acres total between 20 bioretention cells implemented with underdrains

Location	Bioretention Type	Total Drainage Area (acres)	BMP Footprint (sq-ft)
OR-01	With Underdrain	0.05	407
OR-01	With Underdrain	0.05	407
OR-02	With Underdrain	0.05	199
OR-02	With Underdrain	0.05	199
OR-03	With Underdrain	0.32	200
OR-03	With Underdrain	0.32	200
OR-04	With Underdrain	0.04	233
OR-04	With Underdrain	0.04	233
OR-05	With Underdrain	0.04	313
OR-05	With Underdrain	0.04	313
OR-06	With Underdrain	0.04	309
OR-07	With Underdrain	0.05	297
OR-08	Linear w/ Underdrain	0.03	26
OR-09	Linear w/ Underdrain	0.07	563
OR-10	With Underdrain	0.03	51
OR-11	Linear w/ Underdrain	0.07	528
OR-12	Linear w/ Underdrain	0.77	2,058
OR-13	Linear w/ Underdrain	0.16	1,279
OR-14	Linear w/ Underdrain	0.3	875
OR-15	With Underdrain	0.03	157
OR-16	With Underdrain	0.1	463
OR-17	With Underdrain	0.06	288
OR-18	Linear w/ Underdrain	0.88	1,130
OR-19	Linear w/ Underdrain	0.43	1,768
OR-20	Linear w/ Underdrain	0.05	44

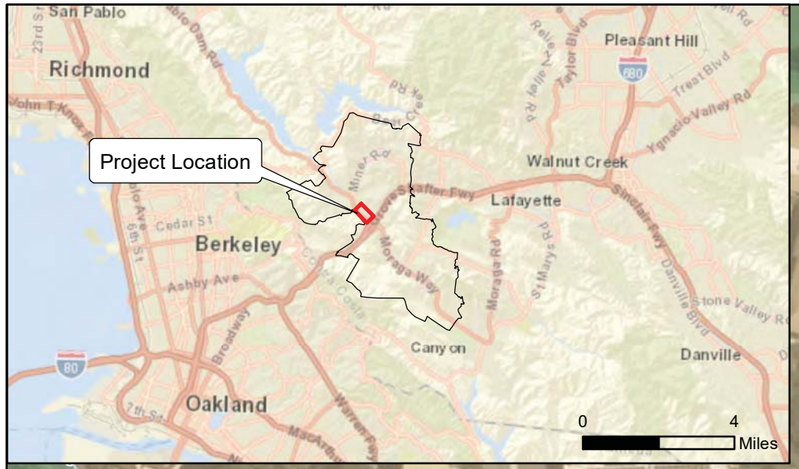
PROJECT BENEFITS

PCBs Loads Reduced:	0.02 grams per year[1]
Mercury Loads Reduced:	0.2 grams per year[1]
Water Supply Benefits:	N/A
Flood Management Benefits:	The project will provide some flood management benefits through peak flow attenuation.
Natural Drainage System Benefits:	N/A
Habitat or Open Space Benefits:	N/A
Community Benefits:	The project will provide water quality educational signage.

[1] Note: Project runoff factors for computing load reduction were estimated for each drainage area using Table 3-2 from the Contra Costa Stormwater C.3. Guidebook, 7th Edition.

COST ESTIMATE

DESCRIPTION	TREATED AREA (AC)	UNIT COST	TOTAL COST
Green Street	4	$114,687 x acres + $36,927	$496,000
TOTAL DESIGN AND CONSTRUCTION COST			**$496,000**



Legend

- Project Area

Existing Stormwater Infrastructure

- Inlet
- Storm Drain

Land Use Yield Category

- New Urban
- Old Industrial
- Old Urban
- Open Space

Control Measure Drainage Areas

OR-01, OR-02, OR-03, OR-04, OR-05, OR-06, OR-07, OR-08, OR-09, OR-10, OR-11, OR-12, OR-13, OR-14, OR-15, OR-16, OR-17, OR-18, OR-19, OR-20

N

0 160 Feet

Contra Costa Watersheds Stormwater Resource Plan
Orinda Way Green Street
10% Conceptual Design
Orinda, CA

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WW2371 | July 2018

Figure D - 27

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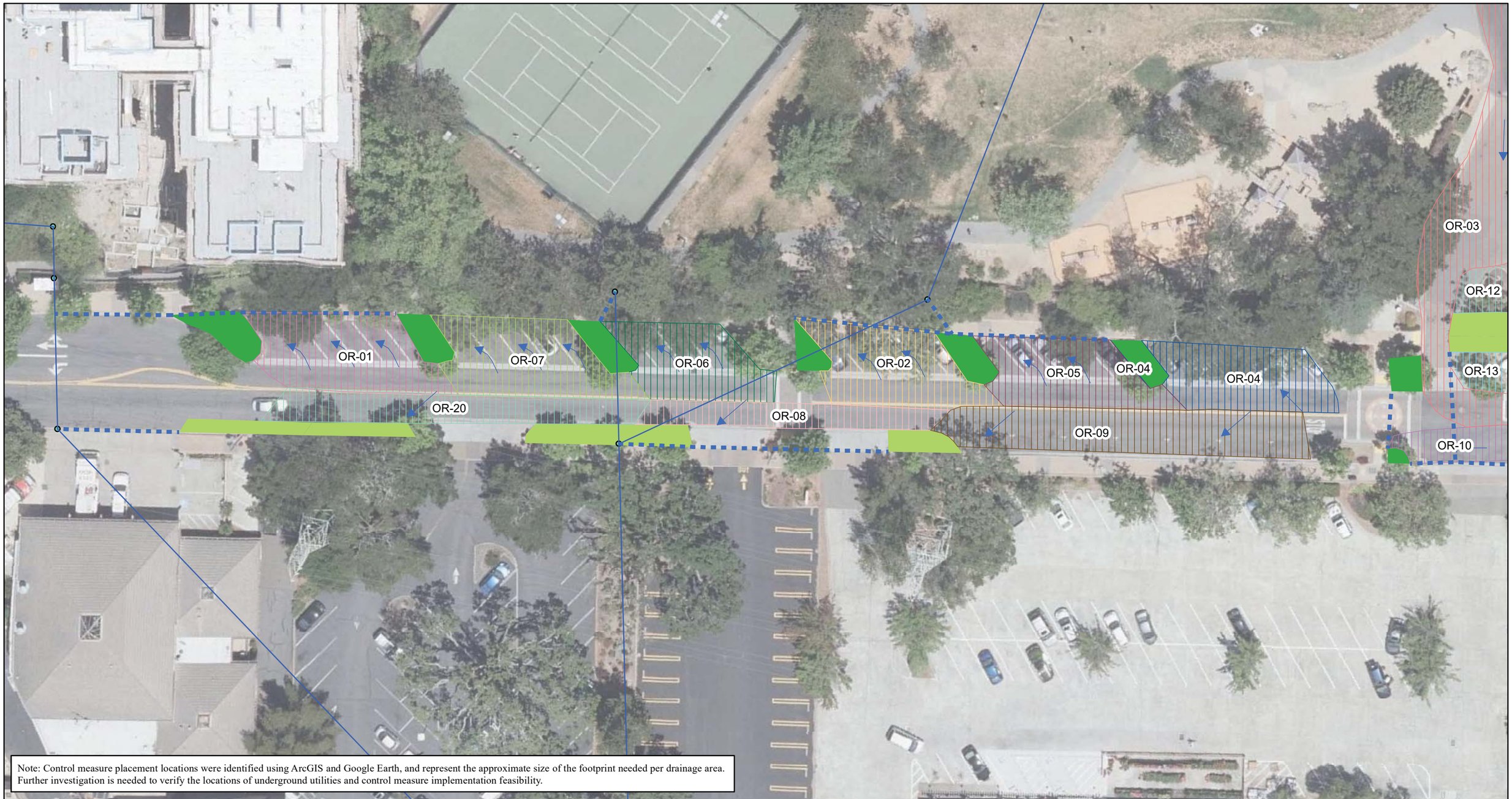

Note: Control measure placement locations were identified using ArcGIS and Google Earth, and represent the approximate size of the footprint needed per drainage area. Further investigation is needed to verify the locations of underground utilities and control measure implementation feasibility.

Legend

Existing Stormwater Infrastructure

- Inlet
- Storm Drain
- Surface Flow Direction

Control Measure Drainage Areas

- OR-01
- OR-02
- OR-03
- OR-04
- OR-05
- OR-06
- OR-07
- OR-08
- OR-09
- OR-10
- OR-12
- OR-13
- OR-20

Proposed Control Measures

- Bioretention with Underdrain
- Linear Bioretention with Underdrain
- Storm Drain

N

0 50 Feet

Contra Costa Watersheds Stormwater Resource Plan
Orinda Way Green Street
Detail Panel 1

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Figure D - **28**

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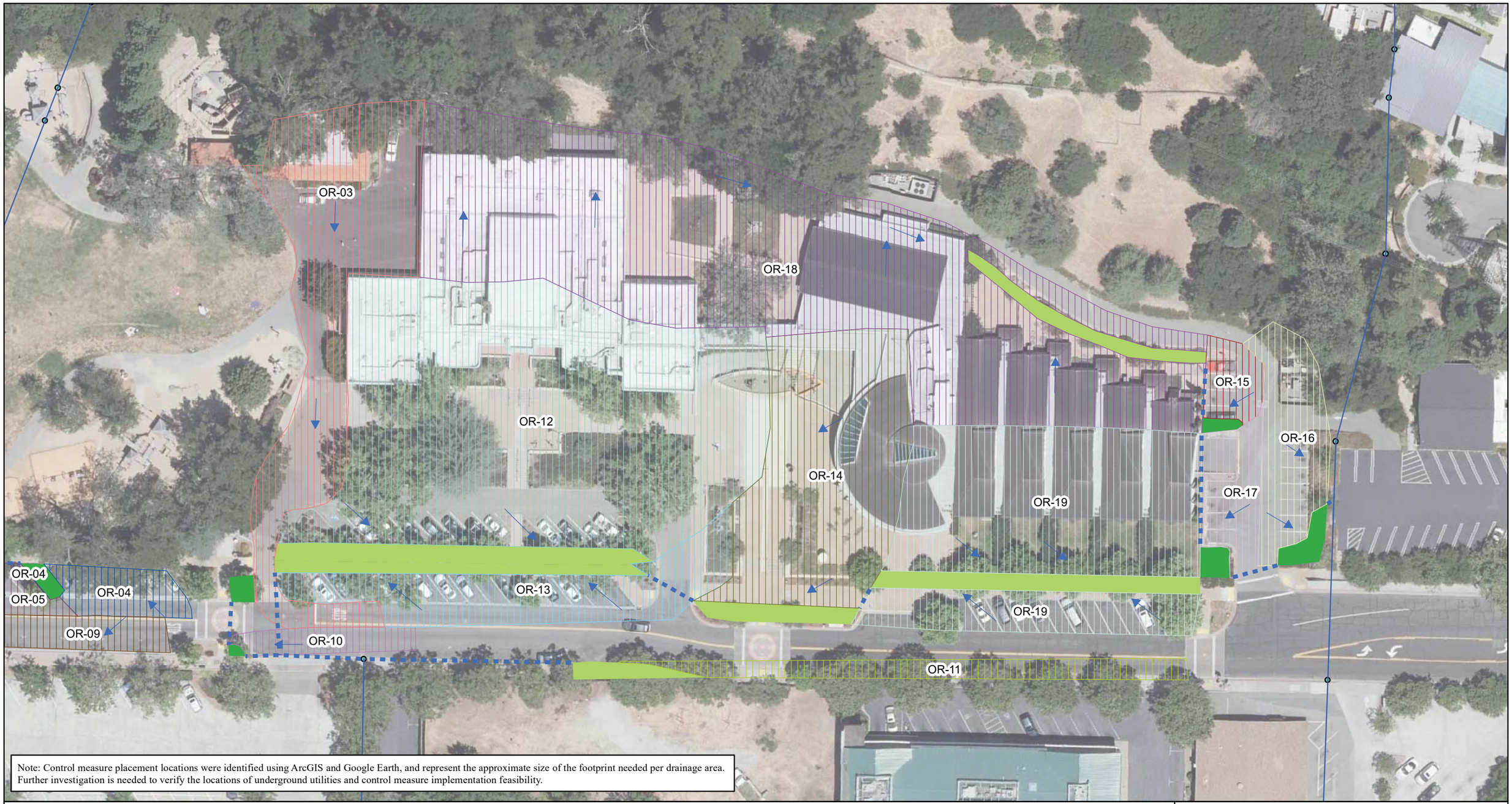

Note: Control measure placement locations were identified using ArcGIS and Google Earth, and represent the approximate size of the footprint needed per drainage area. Further investigation is needed to verify the locations of underground utilities and control measure implementation feasibility.

Legend

Existing Stormwater Infrastructure

- Inlet
- Storm Drain
- Surface Flow Direction

Control Measure Drainage Areas

- OR-03
- OR-04
- OR-05
- OR-09
- OR-10
- OR-11
- OR-12
- OR-13
- OR-14
- OR-15
- OR-16
- OR-17
- OR-18
- OR-19

Proposed Control Measures

- Bioretention with Underdrain
- Linear Bioretention with Underdrain
- Storm Drain

N

0 60 Feet

Contra Costa Watersheds Stormwater Resource Plan
Orinda Way Green Street
Detail Panel 2

Geosyntec consultants

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Figure D - **29**

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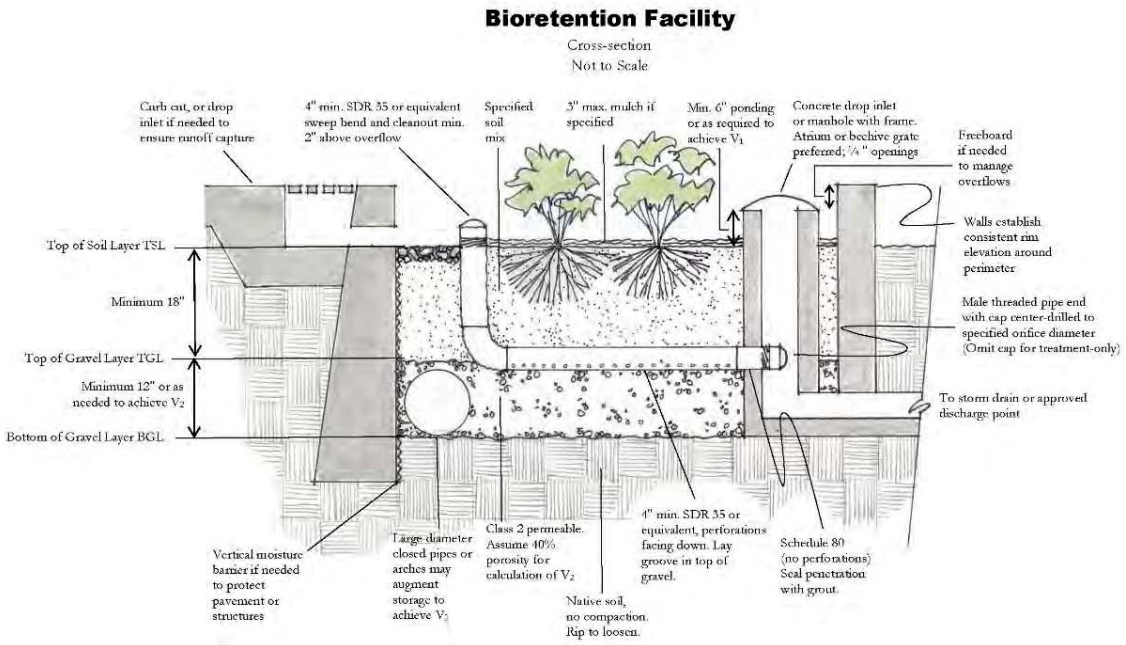

Figure D-30
Bioretention Profile Schematic and Examples

PITTSBURG

Municipal contact for information about the project concept:

Jolan Longway jlongway@ci.pittsburg.ca.us

AMERICANA STORM DRAINAGE PROJECT

SITE DESCRIPTION

Jurisdiction:	**City of Pittsburg**
Location:	1000 N. Parkside Dr., Pittsburg, CA 94565
APN(s):	086010023
Land Owner:	City of Pittsburg/PG&E
Planning Unit/Watershed:	Central/Willow Creek and Coastal Drainages
Soil Type:	HSG C

PROJECT CONCEPT

The City of Pittsburg has historically experienced flooding of North Parkside Drive. This project proposes to retrofit an existing detention basin and adjacent PG&E utility corridor to assist in alleviating flooding and to provide water quality treatment.

The existing detention basin was designed to contain the 25-year, 24-hour storm event from an estimated 6.69-acre residential area to the west of the detention basin, as well as to provide some rate control for offsite stormwater from a 72" stormwater pipe that discharges into a shallow ditch at the southwestern corner of the PG&E utility corridor (Americana Unit IV area).[1] The discharge from this pipe is not well conveyed to the detention basin and periodically floods the PG&E property – therefore the drainage area to this pipe is not shown and not considered to be treated by this project. Per an updated delineation, an estimated 14-acre residential drainage area flows directly to the existing detention basin from the west. Figure D-31 provides a preliminary delineation for this drainage area relative to the project location; this drainage area requires confirmation.

The low flows from the retrofitted detention basin are proposed to be directed through a new vegetated swale that will replace the existing North Parkside Drive ditch system along the project reach. This is anticipated to alleviate flooding resulting from the undersized existing ditch and provide some stormwater treatment. High flows (i.e., the 25-year design storm) from the detention basin will be directed to a larger bypass channel across the PG&E easement, which will discharge into the existing conveyance that flows under North Parkside Drive. The proposed control measures are described below and shown on Figure D-31:

1. **Existing Detention Basin Retrofit:** Two modifications are recommended for the existing detention basin: maintenance to restore system storage capacity and the addition of a rate-controlled outlet structure to provide treatment through detention and settling of particulates and associated pollutants. A conceptual illustration of an extended detention basin is shown in Figure D-32 and a typical outlet structure is shown in Figure D-33.

[1] Source: UDI-Tetrad, 1999. Engineering Report for Americana Units III & IV, prepared by UDI-Tetrad Consulting Engineers for Schuler Homes. January 1999.

2. **Low-Flow Vegetated Swale:** The discharge from the detention basin will flow into the vegetated swale, which will convey low flows along the south side of North Parkside Drive at a sufficiently low velocity to provide pollutant removal through filtration. The swale will discharge to the existing drainage channel on the east side of the easement. A conceptual illustration of a vegetated swale is shown in Figure D-34 and photographs of existing swales are provided in Figure D-35.
3. **High-Flow Bypass Channel:** During rain events at or greater than the 25-year design storm, high flows will be conveyed out of the detention basin into a larger high-flow bypass channel that will traverse the PG&E easement to the east. The swale will also discharge to the existing drainage channel on the east side of the easement.

The project will also include educational signage in the park adjacent to the trail around the basin.

DESIGN INFORMATION

The low-flow vegetated swale is proposed to have a trapezoidal geometry following the facility sizing parameters provided in Table 2. The max width of the swale is specified as 10 ft per design guidance to minimize flow channelization[2]. The swale was sized using Manning's equation with a roughness coefficient of 0.09. The swale is proposed to be vegetated with grass with amended soil along the bottom width to improve infiltration capacity. Check dams along the length of the swale at every foot of elevation break are recommended if infiltration capacity allows for consistent drawdown.

Preliminary design for the bypass channel has been completed by Harrison Engineering Inc.

The current extended detention basin was sized at a total storage volume of 276,500 ft^3 (UDI-Tetrad, 1999). This should allow for sufficient extended detention with a 48-hour drawdown time for capture of the PIT-01 drainage area. It is recommended that a field survey be conducted to investigate maintenance needs to restore capacity of the extended detention basin.

[2] Source: CASQA. 2003. California Stormwater BMP Handbook New Development and Redevelopment, Vegetated Swale TC-30. January 2003.

Drainage Catchment Size:	14 ac[1]	
Drainage Catchment Imperviousness:	59%	
Land Use Yield Category (%):	Category	Catchment Area
	New Urban	30%
	Old Urban	55%
	Open Space	15%
Annual Precipitation Depth:	12.5 in	
Runoff Volume:	194,000 ft^3 [1]	
Facility Type:	Extended Detention	
Facility Sizing:	80% capture of average annual runoff volume[3]	
Facility Footprint:	1.2 ac	
Storage Volume Provided:	275,000 ft^3	

Channel	**Low-Flow Vegetated Swale**	
Drainage Catchment Size:	14 acres[1]	
Design Flow Rate	17 cfs (Water Quality Design Flow Rate 0.2 in/hr intensity)	
Facility Type:	Vegetated Swale	
Facility Sizing:	**Category**	**Value**
	Bottom width (ft)	10
	Depth (ft)[4]	1.1
	Side Slope (ft:1)	4
	Top Width (ft)	27
	Length (ft)	1000
Facility Footprint:	0.6 acres	

[1]Note: These facilities are conservatively sized to provide some rate control from the offsite stormwater from the 72" pipe that discharges at the southwest corner of the PG&E corridor, in addition to containing the 25-year 24 hour storm event from the PIT-01 drainage area. Only the PIT-01 drainage area is considered treated for purposes of load reduction.

[3]Source: Geosyntec Consultants, 2005. Rainfall Data Analysis and Guidance for Sizing Treatment BMPs. Technical memorandum to Tom Dalziel, Contra Costa Clean Water Program. April 20, 2005.

[4] Depth does not include 1-ft of freeboard. Effect of the detention basin outlet structure was not considered.

PROJECT BENEFITS

PCBs Loads Reduced:	1.1 grams per year[1]
Mercury Loads Reduced:	0.2 grams per year[1]
Water Supply Benefits:	N/A
Flood Management Benefits:	The project will alleviate observed localized flooding along North Parkside Drive.
Natural Drainage System Benefits:	The project will provide hydrologic benefit to a natural drainage system by allowing for infiltration.
Habitat or Open Space Benefits:	N/A
Community Benefits:	The project will improve park features and provide water quality educational signage.

[1] Note: Project runoff factors for computing load reduction were estimated for each drainage area using Table 3-2 from the Contra Costa Stormwater C.3. Guidebook, 7th Edition. Load reduction estimates for detention basin and bioswale facilities assume a 70% load reduction, consistent with the Interim Accounting load reduction methodology.

COST ESTIMATE

DESCRIPTION	TREATED AREA (AC)	UNIT COST	TOTAL COST
Regional Retrofit Project	14	$38,633 x acres	$541,000
		TOTAL DESIGN AND CONSTRUCTION COST	**$541,000**

Note: Control measure placement locations were identified using ArcGIS and Google Earth, and represent the approximate size of the footprint needed per drainage area. Further investigation is needed to verify the locations of underground utilities and control measure implementation feasibility.

Legend

Existing Stormwater Infrastructure
- Inlet
- Outlet
- Storm Drain Lines
- Flow Direction
- Detention Basin

Land Use Category
- New Urban
- Old Industrial
- Old Urban
- Open Space

Control Measure Drainage Areas
- PIT - 01

Proposed Control Measure
- High-Flow Bypass Channel
- Low-Flow Vegetated Swale

N

0 200 Feet

Contra Costa Watersheds Stormwater Resource Plan
Americana Storm Drainage Project
10% Conceptual Design

Pittsburg, CA

Geosyntec consultants

CONTRA COSTA CLEAN WATER PROGRAM

Figure D - **31**

WW2371 | May 2018

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