El Cerrito Green Streets Project
Final Project Certification Report

Funded by: *American Recovery and Reinvestment Act (ARRA)*

Funding Amount: *$392,000*

Total Project Cost: *$392,000*

Watersheds: Baxter Creek, Cerrito Creek, and *the San Francisco Estuary*

Project Type: *Green, Environmentally Innovative, Low Impact Development, Rain Garden Storm Water Infrastructure Project*

Submitted by: *San Francisco Estuary Partnership*

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Appendix II (under separate cover)

A. *Monitoring and Results for El Cerrito Rain Gardens* Report

Appendix III (under separate cover)

A. Rain Gardens As-Built Construction Documents

Executive Summary

Project Description & Purpose:
The El Cerrito Green Streets Pilot Project consisted of installing a series of stormwater treatment rain garden cells at two locations along San Pablo Avenue in the City of El Cerrito. The project also included water quality monitoring, community outreach, and technology transfer to local governments. The purpose of this pilot project was not only to directly improve localized water quality, but also to promote the public's awareness of stormwater pollution, and expand local governments' existing stormwater management toolbox to include green infrastructure approaches.

Project Scope: The scope consisted of rain garden construction, water quality monitoring, development of outreach materials and interpretive signage, and training of City maintenance staff.

Construction started in March 2010 and was completed in July 2010.

Two years of post-construction wet weather monitoring was conducted at one rain garden cell to gage proper functioning and quantify pollutant removal effectiveness. The first year of monitoring was observational, the second year included influent and effluent sampling during four storm events. These samples were analyzed to quantify the pollutant removal efficiencies of the rain gardens for: PCBs, pyrethroids, suspended sediments, mercury, and copper.

Outreach activities of the project occurred throughout the planning, construction and monitoring phases of the project. Many of the outreach materials developed for the project, such as the video podcasts, interpretive signage, and educational pamphlets will continue to provide useful information about the art and science of green streets. Some of these are available on the Estuary Partnership website at www.sfestuary.org.

A half-day training session in the field provided all City maintenance staff with an understanding of the purpose, design, and function of rain gardens, as well as basic inspection and maintenance procedures.

Project Outcomes/Effectiveness/Benefits:
The rain gardens were constructed in the late spring/early summer of 2010, retrofitting about 750 linear feet of sidewalk. Curb cuts direct flows from the adjacent street and sidewalk into depressed vegetated treatment cells underlain with amended soils. The bio-retention cells of the rain gardens filter pollutants before the stormwater is discharged via under-drains plumbed to existing storm drain pipes that discharge to either Baxter Creek or Cerrito Creek, both of which flow to the San Francisco Bay. The two sites have an estimated treatment volume area of 20,700 cubic feet.

Visual observations indicate the rain gardens are functioning properly. The water quality monitoring results showed that the study rain garden cell is successful in reducing pollutant concentrations for most pollutants analyzed. The one exception was mercury which showed

mixed results from the samples collected. More monitoring is needed to understand how dissolved mercury may be better treated using these systems.

The robust outreach program associated with the project successfully engaged multiple target audiences. More than 50 local stakeholders such as adjacent property owners, residents, and commercial business were reached through direct mailings. The project webpage on the Estuary Partnerships website has received nearly 600 hits. The three video podcasts, available on YouTube have gotten about 1,400 views since they were posted. Interpretive signage at the two rain garden facilities continues to educate passers-by.

The City maintenance staff continues to upkeep the gardens using techniques reviewed at the training session. The plants are thriving, adding a lush quality to the streetscaping. Additional technology transfer includes the transmittal of the projects final report and water quality monitoring technical memo to the Countywide Clean Water Programs around the Bay Area.

Problem Statement & Relevant Issues

Urban Runoff Pollution

Municipal stormwater drainage systems around the San Francisco Bay Area collect, convey, and discharge stormwater runoff to local waterways and eventually to the San Francisco Bay, typically without any treatment[1]. This is problematic because stormwater runoff from the urban environment can pick-up a variety of pollutants, such as: trash, sediment, fertilizers, heavy metals (lead, copper, cadmium, mercury, and zinc), automotive fluids (petroleum hydrocarbons), and toxic chemicals (pesticide residues)[2]. The discharge of contaminated stormwater degrades water quality, fish and wildlife habitat in local waterways, kills aquatic organisms, and makes hazardous the consumption of fish caught in the Bay.

To help address the problem of water pollution in the Bay and its local tributary watersheds, the Water Board regulates municipal stormwater discharges through its Municipal Regional Permit (MRP). The MRP mandates best management practices and other proactive measures municipal agencies must undertake to identify pollution sources and reduce or eliminate the discharge of pollutants into receiving waters by and reduce to the maximum extent practicable. The MRP regulates the cities, towns, and county jurisdictions with stormwater drainage systems that discharge to receiving waters in the Counties of Alameda, Contra Costa, San Mateo, and Santa Clara (collectively known as "permittees"). This includes the City of El Cerrito.

LID/Green Infrastructure Requirements & Exemptions

Under MRP Provision C.3., new development and redevelopment projects of a certain size or those that drain to natural creeks must incorporate stormwater management measures that prevent increases in runoff flows and address pollutant discharges. This is to be done primarily through the use of Low Impact Development (LID) techniques. LID promotes a site's pre-development hydrology by preserving existing open spaces; minimizing impervious surfaces; detaining and/or retaining stormwater runoff close to its source; and promoting infiltration, evapotranspiration, and biofiltration. The most common LID practices include rainwater capture and reuse, green roofs, permeable paving, and bio-treatment through rain gardens, bioswales, and planter/tree boxes.

LID measures are applicable in both private and public land uses. LID is often referred to as "Green Infrastructure" or "Green Streets" when it is applied to the public right-of-way (streets and sidewalks). The EPA encourages the use of Green Infrastructure, citing various associated benefits such as: reducing untreated stormwater discharges to surface waters, adding green spaces and recreational opportunities, enhancing ecosystem services, improving air quality,

[1] The City of San Francisco is a notable exception, because it has a combined stormwater and wastewater sewer system that treats the water prior to its discharge to the Bay.

[2] The Clean Water Act's Section 303(d) List of Water Quality Limited Segments identifies trash and pesticides in urban creeks, as well as mercury and PCBs in San Francisco Bay as significant sources of water impairment. As a result, the San Francisco Bay Regional Water Quality Control Board has established Total Maximum Daily Load allocations (TMDLs) for these pollutants. These TMDLs and their implementation measures are designed to prevent urban runoff discharges from causing or contributing to exceedances of water quality objectives.

increasing property values, reducing heat island effects, creating jobs, and increasing carbon sequestration from plants and soils[3].

Many major cities across the country have incorporated Green Infrastructure/LID methods into their existing stormwater management toolbox. Most of these cities, like San Francisco, Seattle, Portland, and Philadelphia that have combined stormwater and sanitary sewer systems, are mandated to reduce wet weather overflows. Implementing LID has become a key strategy for slowing and reducing stormwater flows, which helps to lessen combined sewer overflow volumes. Typically, sanitary sewer operations are considered Enterprise Funds, where user fees pay for the great majority if not all costs of operations and service. Thus combined sewer system operators have more revenue generating flexibility than stormwater managers have in a separated sewer system. Stormwater management is often supported by a combination of fees and taxes, which require significant voter approval to adjust. This can be a significant barrier to implementing LID in most Bay Area cities, like El Cerrito, where the sanitary and stormwater sewer systems are separate.

While the current MRP exempts municipal street replacement and repair projects from the Provision C.3. requirements, there is an obligation for the collective permittees to implement 10 Pilot Green Streets Projects by December 1, 2014. This requirement perhaps signals the future elimination of this exemption.

Technology Transfer to Local Governments

While Bay Area municipalities are aware of potential future green infrastructure requirements, many are reluctant to take the lead in developing LID policies or pilot projects in the public right of way. The list of barriers for municipal adoption of green infrastructure includes: budgetary constraints, the uncertainty of long-term performance, unknown long-term maintenance needs, right-of-way conflicts, and a lack of coordination and leadership. The El Cerrito Green Streets project serves as a model for other municipalities in the Bay Area in successfully overcoming these perceived barriers.

The City of El Cerrito (City) was a perfect partner for this project. It is a relatively small city with a population of about 23,500 and a land area of about 3.7 square miles. El Cerrito has a visionary and innovative Public Works Director and Environmental Services Coordinator. El Cerrito was an early pioneer and adopter of green infrastructure, daylighting a portion of Baxter Creek in Poinsett Park (a former grassy median) in 1997. In 2006, the city opened a new natural park along another restored reach of Baxter Creek, along the heavily traveled San Pablo Avenue. Finally, the city was in the midst of implementing major landscaping improvements along San Pablo Avenue when the El Cerrito Green Streets project was conceived. The rain gardens were a complimentary feature to these upgrades, which greatly improve the pedestrian experience along this automobile-centric thoroughfare.

[3] EPA joint memorandum, April 2, 2011, http://www.epa.gov/npdes/pubs/gi_memo_protectingwaterquality.pdf (consulted on April 29, 2011)

Public Awareness

The general public is largely unaware of stormwater management issues and challenges beyond flood control. This is likely due to how effectively drainage engineers have integrated existing stormwater infrastructure into the urban landscape. Crowned streets with curb and gutter systems quickly convey surface runoff to inlets connected to underground pipes, where it is out of public sight and consciousness. Elevating public awareness about the sources of urban runoff pollution, how it is physically transported thorough the environment, and its associated negative effects can affect personal behaviors that contribute to non-point source pollution. This highly visible green infrastructure project at surface level can increase community awareness about these issues via their physical presence, educational materials, and on-site interpretive signage.

Project Goals

Project-Specific Goals

The El Cerrito Green Streets Project has four overarching goals:

1. Implement stormwater treatment facilities using green infrastructure methods to reduce pollutants in urban stormwater runoff from San Pablo Avenue
2. Quantify the effectiveness of the treatment facilities by conducting water quality monitoring
3. Conduct stormwater pollution prevention outreach, including producing and distributing outreach material
4. Conduct technology transfer to local government

Early on in the project, a Project Assessment and Evaluation Plan (PAEP) was developed to document the project's goals, desired outcomes, output indicators, outcome indicators, measurement tools, methods, and targets (Appendix I-B). The PAEP distilled the project components into three categories, which incorporate the four overarching goals listed above:

- Pollutant Load Reduction (Goal 1)
- Planning, Research, Monitoring, and Assessment (Goal 2)
- Education, Outreach, and Capacity Building (Goal 3 and 4)

The Conclusions section of this final report provides the results of the project as measured by the PAEP. The *Monitoring and Results for the El Cerrito Rain Gardens* Report (see Appendix II-A) provides an in-depth accounting of the pollutant removal monitoring program, which indicates effective pollutant concentration reductions for a variety of urban runoff constituents.

Regional & Statewide Plans and Goals

Beyond individual project goals, the El Cerrito Green Streets project also advances elements of various regional and statewide plans, goals, and objectives. These include the San Francisco Estuary Partnership's *San Francisco Bay Comprehensive Conservation and Management Plan*, the Water Board's *Water Quality Control Plan for the San Francisco Bay Basin (Basin Plan)*,

the State of California's *Nonpoint Source Program Strategy and Implementation Plan*, and the San Francisco Bay Conservation and Development Commission's *San Francisco Bay Plan*.

CCMP Goals

The El Cerrito Green Streets project reduces pollutant concentrations discharged to the Bay. Reducing pollutants in San Francisco Bay and tributary creeks implements estuary enhancement actions in the *Comprehensive Conservation and Management Plan* (CCMP), which calls for *controlling and reducing pollutants entering the Estuary* and *promoting "restoration and enhancement of stream and wetland functions to enhance resiliency and reduce pollution in the Estuary and its watersheds*." (2007 *CCMP*, Pollution Prevention and Reduction Goals). More specifically, Action PO-1.8 calls for "develop[ing] and implement[ing] programs to prevent pollution of the Estuary by…harmful pollutants like trash, bacteria, sediments, and nutrients." The rain gardens will continue to help implement the El Cerrito's Green Streets Program that installs low impact development devices to capture suspended sediments, trash, and other pollutants before they reach the Estuary.

The El Cerrito Green Streets rain gardens project also helped implement the CCMP Land Use Actions 4.1: "Educate the public about how human actions impact the Estuary and its watersheds: *Develop and distribute educational materials that clearly communicate the interrelationship between human activities, including land use and transportation, and impacts on the ecosystem of the Estuary and its tributary waters*." The rain garden locations are on a major thoroughfare; the interpretive signage, fact sheets, and video podcasts will be seen and read by thousands of people.

Water Quality Objectives/Basin Plan

The Basin Plan is the Regional Water Quality Control Board's master water quality control planning document. It designates beneficial uses and water quality objectives for waters of the State, including surface waters and groundwater. It also includes programs of implementation to achieve water quality objectives. *The Basin Plan* has been adopted and approved by the State Water Resources Control Board, U.S. EPA, and the Office of Administrative Law where required. The El Cerrito Green Streets rain gardens is helping to assist in meeting water quality objectives and protect and enhance beneficial uses in the San Francisco Estuary. Filtering pollutants and slowing stormwater flows protects water quality and reduces degradation and scour or in-stream habitat. The beneficial uses impaired by poor stormwater quality that the project is helping to address and will continue to help address include: Estuarine Habitat, Marine Habitat, Preservation of Rare and Endangered Species, Water Contact Recreation, Noncontact Water Recreation, and Wildlife Habitat.

State Nonpoint Source Program Strategy and Implementation Plan

The El Cerrito Green Streets project helps to meet the 5-year implementation strategy that is part of the *Plan for California's Nonpoint Source Program* (Plan). The project uses vegetated treatment systems to control discharges of urban NPS pollution, including sediment, pesticides, PCBs, mercury, and copper, as categorized under the Wetlands and Riparian Category (Section VII), Wetlands MM 6C, Vegetated Treatment Systems. Specifically, this project furthers the state's objectives in that category by evaluating the efficacy of vegetated treatment systems (VTS) through monitoring for different categories of pollutants.

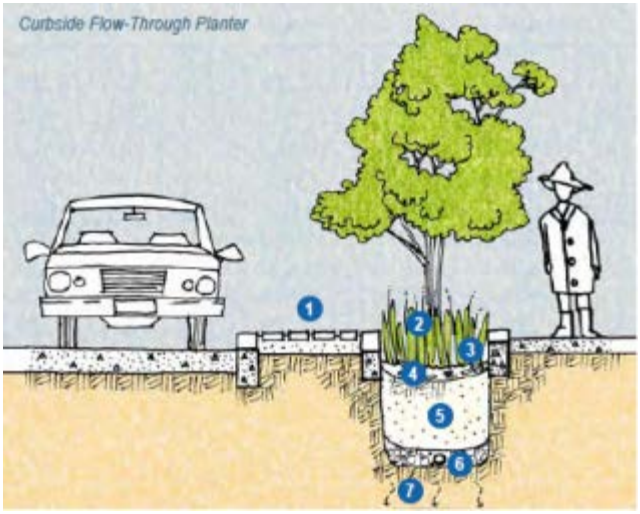
The El Cerrito Green Streets rain gardens project also works and will continue to further objectives in the Urban Category of the Plan to prevent pollutant loadings and treat unavoidable loadings by evaluating and implementing stormwater management practices that "offset impacts from increased impervious areas and land disturbances; and provide a vegetation buffer to control pollutants from entering the Bay." These goals are set forth in the San Francisco Bay Conservation and Development Commission's *San Francisco Bay Plan* and reiterated in the State Board's 5-year implementation strategy.

Project Description

Green Infrastructure Implementation

Treating stormwater runoff before discharge into water bodies such as lakes, rivers and wetlands is an important strategy in protecting water quality. Many cities across the country are implementing green infrastructure technologies to manage stormwater and achieve greater compliance with the National Pollutant Discharge Elimination System (NPDES) regulations. These technologies are designed to mimic pre-development hydrologic conditions by allowing runoff to infiltrate through vegetated areas and soils. Besides controlling runoff, these green technologies have several benefits related to water pollution prevention, groundwater recharge, habitat, flood protection, and cleaner air[4].

The El Cerrito Green Streets/Rain Gardens project addresses stormwater runoff pollutants by implementing rain gardens on San Pablo Avenue. A rain garden consists of shallow, landscaped depressions used to collect and hold stormwater runoff to promote infiltration into native soil while allowing pollutants to settle and filter out (*New York Stormwater Management Design Manual*).



KEY TO FIGURE 1:

1. Parking egress zone with curb cut
2. Dense wet- and dry-tolerant vegetation
3. 6-inch maximum ponding depth
4. 2-to 3-inch mulch depth
5. 18 inch bioretention planting soil
6. Perforated pipe in gravel jacket
7. Infiltration where feasible

Figure 1 Diagram of a Rain Garden, Source: *San Francisco Stormwater Design Guidelines,* pg 72

Project Type

The El Cerrito Green Streets project is a green infrastructure project that retrofits portions of a developed urban corridor with vegetated stormwater treatment facilities. The project uses the LID practice of bioretention to detain and treat urban runoff, removing pollutants prior to discharge into existing storm drain pipelines. Bioretention was promoted by the design and construction of multiple-cell rain gardens at two sites within the public right-of-way on San Pablo Avenue (State Route 123).

[4] *Reducing Stormwater Management Costs Thorough Low Impact Development Strategies and Practices,* US EPA, 2007.

The project was financed by the American Recovery and Reinvestment Act of 2009 (ARRA) through the Clean Water State Revolving Fund (CSRF). The project helped the State to meet the goal of allocating 20% of ARRA funding towards accelerating the implementation of sustainable, green projects.

The first site is located near the intersection at Madison Street (11000 block of San Pablo Ave), where seven rain garden cells were built. The second site, near the Eureka Street intersection (10200 block of San Pablo Ave) has twelve rain garden cells. The highly-visible project ties in to the city's federally-funded streetscape improvement project and long-range efforts to build high-density, pedestrian-oriented development along this heavily travelled transportation corridor.

The project included post-construction water quality monitoring over two years to observe hydraulic/hydrologic performance and to quantify associated pollutant load reductions. Although the total volume of stormwater treated is relatively small, this pilot project was designed to quantify pollutant reduction effectiveness, provide technology transfer to local government, increase public awareness and understanding of stormwater management challenges, and encourage greater use of green stormwater treatments such as rain gardens in both public and private settings.

Project Costs

Project funding from the Clean Water State Revolving Fund totaled $392,000. Table 1 provides an accounting of how the funding was expended for activities associated with: project administration & management, outreach, construction, and monitoring. The San Francisco Estuary Partnership provided project management and coordination. This included procuring professional services contracts with project partners and non-construction related contractors. The Estuary Partnership staff also participated in the development of the Project Assessment and Evaluation Plan (PAEP), outreach material content (fact sheets, video podcasts, and flyers), the rain garden planting palette, and the monitoring plan.

The rain garden construction budget was provided directly to the City of El Cerrito who was already conducting major renovations to the right-of-way. The rain gardens were an add alternate line item to the City’s construction bid package that was awarded to Golden Gate Construction. The City controlled this portion of the project and funding, which included procuring soil and plant material, and the creation and installation of interpretive signage.

The San Francisco Estuary Institute (SFEI), a scientific research non-profit organization, developed and implemented the water quality monitoring plan. This included working with the construction firm to site monitoring ports into the concrete form-work, conducting precipitation data collection, one season of visual observation, one season of stormwater sampling, and generating a technical report. SFEI also helped SFEP develop the PAEP.

Kay Productions LLC, in close partnership with SFEP staff, developed and produced three green streets/green infrastructure video podcasts.

Table 1 Project Expenditures Table

Type of Expense	Contractors	Work Done	ARRA Final Agreement Budget (Funding Available)	Total Costs Incurred
Allowances			$68,992.75	$68,992.75
	Association of Bay Area Governments/ San Francisco Estuary Partnership	Project management & coordination; contracting with prime contractors; site visits & photo documentation; coordination of media event with EPA; monitoring oversight; develop web content; complete PAEP; work with videographer on "Making of a Rain Garden" video; perform project accounting & reporting requirements; design project flyer & brochures; review plant selection; monitor Davis-Bacon Compliance		$67,119.12
	Lisa Krieshok	Illustration for Green Streets; conceptual rendition of demonstration green stormwater treatment facilities; graphic design and production for Green Street Flier		$229.94
	Bobbi Sloan	Graphic design Green Sheets fact sheet		$554.88
	J.T. Litho	Printing fact sheet on El Cerrito Rain Gardens; poster; Estuary Newsletter Insert on Rain Gardens; plan copies		$1,088.81
Construction			$323,007.25	$323,007.25
	City of El Cerrito			$215,295.00
	Golden Bay Construction	Construction of Rain Gardens		$159,295
	Magnolia Landscape, Inc. Vallejo, CA	Provision of Soil and Plants		$36,000
	Gates and Associates	creation & installation of interpretive signs, developed rain garden planting plan		$20,000
	San Francisco Estuary Institute	Water quality & hydrologic monitoring		$97,712.25
	Kay Productions	Produced & developed video podcasts		$10,000.00
TOTAL			**$392,000.00**	**$392,000.00**

Project Methodology

Site Selection

This is the first project to install rain gardens on a California State Highway (State Route 123). Several locations were considered for installation of the rain gardens. The City considered site characteristics such as high public visibility, proximity to existing storm drain infrastructure, readily apparent utility conflicts, and width of exiting sidewalks. Ultimately, the City decided on two sites along the east side of San Pablo Avenue:

1) between Eureka and Lincoln Avenues (Eureka site)
2) between Madison and Manila Aves (Madison Site)

2 Site 1: San Pablo Avenue at Eureka[5]

[5] Figures 2 & 3 show an aerial view of both project sites. The yellow line indicated the drainage area of the public right-of-way to the rain gardens. The white diamonds are tools for drawing the drainage polygons, the green squares are the midpoints of each yellow line. The red line shows the city boundary.

3 Site 2: San Pablo Ave @ Madison

Both watersheds are characterized by a land use mix of commercial, medium to dense residential and local roads. The rain garden sites are within walking distance of the City's LEED-certified City Hall, which opened in 2008. They also fall within the overall footprint of the San Pablo Avenue Streetscape project, a smart growth and economic development effort to green a three-mile stretch of this major transportation corridor through tree plantings and providing additional transit, bicycle, and pedestrian amenities. The Streetscape Project also removed three miles of turf from the San Pablo Avenue median, replacing it with low-water-use, drought-tolerant plants. These efforts compliment the public education values of the nearby rain gardens.

Design

The City of El Cerrito was well underway in its design and implementation of its major Streetscape Improvement Project when funding came for the rain gardens. The civil engineering firm, Bellecci & Associates, designed and engineered the rain garden retrofits. As-built

construction documents are included as Appendix III-A. Both rain gardens are designed as treatment-only facilities, with minimal infiltration expected (a perforated under drain is elevated slightly above native soils to promote some degree of infiltration). The extended rain gardens act as flow-through planters, able to accept runoff from a 2-year, 24 hour duration storm event.

Neither site is sized adequately to treat the design storm associated with its respective drainage area, both falling short of the Contra Costa Clean Water Program's *Stormwater C.3 Guidebook's* minimum sizing method for a treatment-only bioretention facility[6]. This is primarily due to the amount of space available at the sites, where conflicts with existing utilities, driveways, and other competing uses of the public right-of-way constrained the dimensions and layout of the rain gardens. The construction budget was also a limiting factor.

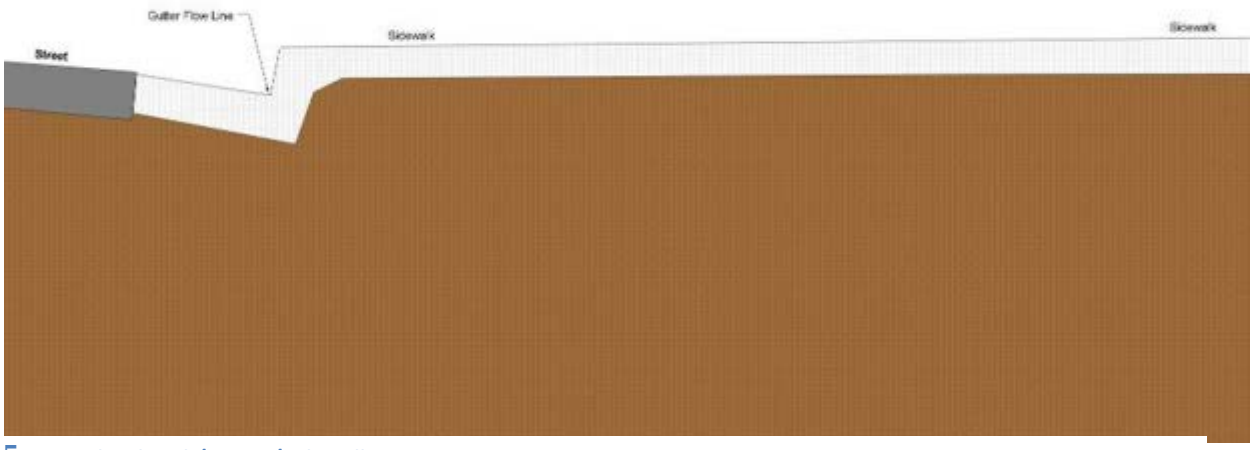
The rain garden cells are filled with a well-draining soil mixture that drains at a percolation rate of 5"/hr. This mixture is comprised of 10-20% topsoil, 50-60% fine sand, and 30-40% composted organic matter. The plant palette is mostly California native with some species selected for color variety. The plant list includes: Yarrow, Rushes, Iris, Sticky Monkey Flower, Wild Rye, Lilac Verbena, Dogwood, California Rose, Flowering Gooseberry, Bowman California Fuchsia, and Red Maple.

The rain garden designs incorporate safety and convenience elements to preserve the existing uses at the site. This includes setting back the treatment cells from the curb and covering the length of the inlets with grates to allow passengers from parked cars have a step-out area. A 6-inch curb around the rain garden cells delineate non-walking areas for pedestrians, minimizing the potential for pedestrians to accidentally walk or fall into the cells.

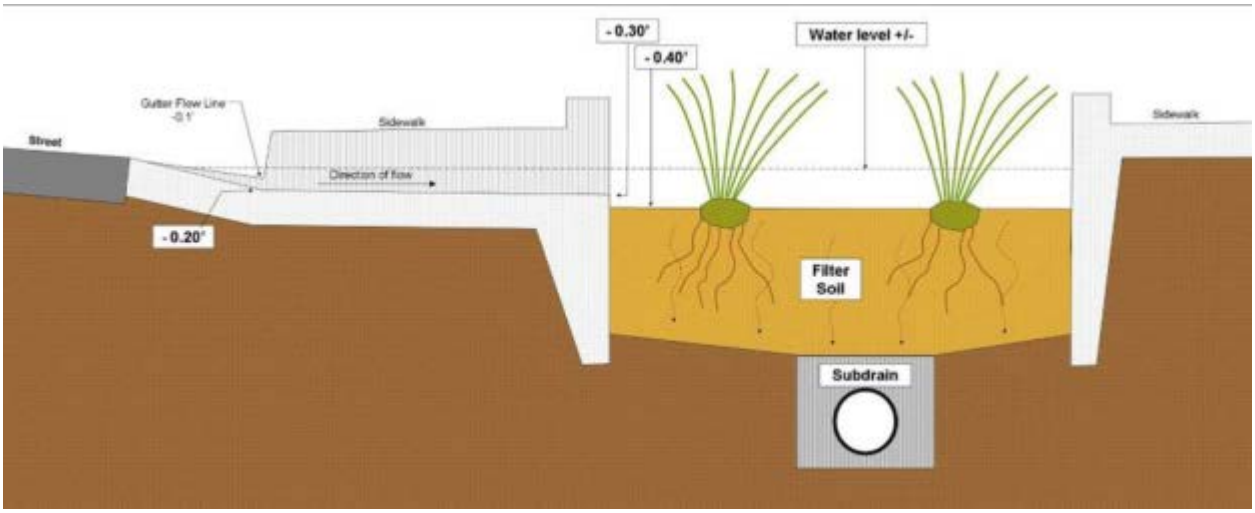
4 Planted Rain Garden Cell

[6] According to the Guidebook, the minimum sizing method for determining the area for a treatment-only bioretention facility is calculated by multiplying the tributary drainage area by 0.04. Both sites are able to accommodate runoff treatment from the public right-of way portions of their respective drainage areas; however the runoff contributions from adjacent private lands alter this ratio. The Eureka site drains an area of approximately 1.7 acres (74,000 sq. ft.); 1 acre of this catchment area is public right-of-way. 74,000 multiplied by 0.04 = 2,960 sq. ft. The actual area of the treatment cells is 1,115 sq. ft., which means that about 38% of runoff from the drainage area can be accommodated. The Madison rain garden cells comprise an area of 652 sq. ft., which effectively accommodates runoff from about 70% of the 0.4 acre watershed.

Conceptual Before & After Cross-Section of Rain Garden Cell:



5 Generalized Curb/Gutter/Sidewalk Cross Section



6 Generalized Retrofitted Curb/Gutter/Sidewalk Cross section for Rain Garden

Construction

Golden Bay Construction won the competitive bid to build the rain gardens. The work included all physical implementation elements from mobilization through final planting. Construction activities commenced in March 2010 and ended in July 2010. As a public works project, the construction sequencing was standard. The general construction activities involved demolition of the curbs and sidewalks, excavation for the rain gardens, construction of new curb and sidewalk,

as well as installation of sub-drainage piping, irrigation systems, soils, and plants. The following photographs show the course of construction between the two rain garden sites.

7 Sidewalk removal, Eureka site

8 Excavation, Madison Site

9 Loading Spoils for disposal, Madison site

10 Pouring concrete for new sidewalk, Madison site

11 Formed rain garden cells, Madison site

12 Filling rain garden cells with amended soils (native soils with organic matter), Eureka site.

13 Close-up of unfinished cell and inlet, site unknown

14 Close up of newly installed plantings, site unknown

15 Planting process underway, Eureka site

Monitoring

The San Francisco Estuary Institute (SFEI) developed and implemented the project's monitoring program, which focused on the Eureka rain garden site. Monitoring included field observations in the first year after construction, with water sampling and analyses occurring during the second year after construction. The rationale for performing observation monitoring in the first year and water sampling in the second year was to allow enough time for the plants to mature (planted in early 2010, growth during the summer of 2010 and 2011) so that the garden functions as intended before water quality sampling occurs. A full accounting of the water quality monitoring program and it results is provided in SFEI's report (Appendix III-A).

In the first year after-construction (2010-2011), SFEI conducted wet weather observation monitoring, including photo-monitoring and collected rainfall data from the rain gage installed on-site. These observations provided information on the timing of run-off at both the rain garden's inlet and outlet, as well as on the proper functioning of the built improvements.

The following wet season (2011-2012), SFEI collected water samples during four (4) wet season storms including one approximating "the first flush". For the first three storms, inlet and outlet sampling was conducted for selected cells using a flow-weighted composite method to determine pollutant concentrations coming into the facility versus pollutant concentrations coming out. Under this method sub-samples are collected during the entire storm event weighted in relation to flow; at higher flow rates the sub-sample pacing is greater than at lower flow rates. During the fourth storm, four discrete samples were collected at the inlet to help determine how concentrations for each of the analytes changed throughout the course of the storm.

16 Water Quality Monitoring underway by SFEI Associate Environmental Scientist, Alicia Gilbreath

SFEI staff preserved samples properly in the field, documented them, and shipped them to various laboratories for analysis. The pollutant types and analytical laboratory methods were:

Analysis	Method
PCBs	EPA 1668 (40 congeners)
Pyrethroids	MLA-046
SSC	ASTM D3977
Total & Dissolved Hg	EPA 1631
Methyl Hg	EPA 1630
Total & Dissolved Cu	EPA 1638

Maintenance Training

The project aimed to increase city staff understanding of the purpose and benefits of the rain gardens and their maintenance needs. Two Bay Area Low Impact Design experts, Dan Cloak (Contra Costa Clean Water Program consultant) and Megan Stromberg (environmental consultant for WRA, Inc.), provided a training workshop for El Cerrito's Public Works Maintenance Division staff on May 10, 2011. The LID training session occurred in the field at the Madison rain garden site and around the City Hall, surrounded by LID landscaping. The workshop covered important topics such as:

- Purpose, design and function of rain gardens
- Key operating components (elevations, inlets, outlets, soil permeability)
- Role of plants and soils in pollutant removal
- Basic inspection and maintenance procedures
- Plant selection criteria
- Irrigation, fertilization, weed abatement, pest control, pruning, and mulching

All maintenance staff were present (the attendance roster is included as Appendix I-D). The city continues to routinely maintain the rain garden sites.

17 Maintenance staff training, Madison site

18 Maintenance training, El Cerrito City Hall grounds

Existing/Pre-Project Data (Photos)

Eureka Site:

19 Eureka site, pre-construction, looking south

20 Eureka site, pre-construction, looking north

Madison Site:

21 Madison Site, pre-construction, looking north

22 Madison site, pre-construction, looking south

Post-Construction Photographs (Year 1)

23 Madison Site, looking north, 1 year post-construction (March 2011)

24 Madison Site, looking north, 1 year post construction (March 2011)

25 Eureka site, looking north, 1 year post-construction (March 2011)

26 Eureka site, looking north, 1 year post-construction (March 2011)

Post-Construction Photographs (Year 2)

27 Eureka site, looking north, Year 2 (July 2012)

28 Eureka site, looking south, Year 2 (July 2012)

29 **Madison site, looking north, Year 2 (June 2012)**

Data Evaluation/Pollutant Reduction

A full accounting of the water quality monitoring program is provided in SFEI's technical report, *Monitoring and Results for El Cerrito Rain Gardens* (Appendix II-A). The following is a summary of SFEI's major findings, conclusions, and recommendations.

Pollutant Concentration Reduction Results

Concentrations of each analyzed pollutant at the inlet versus outlet for each storm event[7] monitored indicated that in most cases, effluent concentrations were lower than influent concentrations. Total and dissolved copper (Cu), total methyl mercury (MeHgT), total PCBs, and pyrethroid pesticides all decreased between inlet and outlet samples. The rain gardens had the largest impact on reducing organic pollutants. PCBs decreased by 79-99% (average 87%) after treatment through the rain gardens. The outlet sample results suggest that permethrin (the only pyrethroids detected) is filtered to below detectable levels as stormwater passes through the rain gardens. Particle-bound Cu appears to be more effectively treated than dissolved (CuD). Total Cu concentrations decreased in the outlet samples in relation to the inlet samples between 62-76 % (average 69%), and CuD decreased 8-70% (average 34%). MeHgT was consistently treated by the rain garden, decreasing the outlet concentrations by 36-56% (average 45%).

Mixed results were reported for total and dissolved mercury (HgT and HgD, respectively). Total Hg decreased in storms 1, 3 and 4, between 3-52% (average 32%), and was on average 35% dissolved on the inlet and 50% dissolved on the outlet. Concentrations of HgD at the inlet and outlet are not very different from one another, and therefore HgD does not appear to be filtering out. Storm 2 was different in that the outlet concentration was nearly threefold greater than at the inlet.

Table 2 Pollutant Concentration Reduction Table

Pollutant Analyzed	**Average Change in Concentration (Inlet-Outlet)**
Pyrethroids (ND = 0)	100%
PCBs	87%
Suspended Sediment Concentration	79%
Total Copper	69%
Pyrethroids (ND = 0.5 x MDL)	50%
Total Methyl Mercury	45%
Dissolved Copper	34%
Total Mercury (excluding Storm 2)	32%
Dissolved Mercury	-8%
Total Mercury (all data)	-17%

[7] An equipment malfunction during Storm 2 resulted in no inlet sampling for dissolved copper and mercury during that storm event.

Particle Ratios

Concentrations of pollutants were normalized by the corresponding suspended sediment concentration to derive an estimate of particle concentration (mass of pollutant per mass of suspended sediment, e.g. pg PCB: mg SSC). This "particle ratio" estimates particle concentration by assuming pollutants are transported entirely in a particle form (not true for dissolved phase fractions). Particle ratios for the metals were either similar between the inlet and outlet (CuT), or greater at the outlet (HgT, MeHgT). These ratios increase because suspended sediments are filtered by the rain garden more effectively than the total fraction of the metals. Since a much greater fraction is in dissolved phase when suspended sediment concentrations are low, the expected result is often described as an irreducible concentration.

On the other hand, particle ratios for the organic pollutants decreased after being treated in the rain garden, despite the simultaneous decrease in SSC. As opposed to the metals, the organic pollutants measured were filtered by the rain garden more effectively than suspended sediment, overall causing a decrease in the particle ratios –thus it appears that the organic pollutants (despite a portion likely being in liquid or dissolved phase), were better adsorbed or more "sticky" than some of the metals within the rain garden. Nevertheless, tPCBs also showed evidence of an irreducible concentration; regardless of the inlet concentrations, tPCBs in the samples measured were never treated to levels below about 1,000 pg/L.

Conclusion

While influent quality fluctuated between storm events for most analytes (possibly in part due to the seasonal first flush effect though not apparently affected by storm size) effluent quality remained fairly consistent for most analytes across all four storms. Water quality monitoring data showed that the rain garden generally had a moderate to substantial effect at reducing concentration loads for a variety of contaminants. Of the total fractions, concentrations were found to be reduced for CuT, MeHgT, tPCBs, and pyrethroids, whereas HgT was only reduced in three of the four storm events. For dissolved concentrations, CuD indicated some treatment by the rain garden for one event but otherwise no significant differences were seen between inlet and outlet concentrations.

SFEI infers from the results that the coarser the particle entering the rain garden, the more likely the rain garden will filter it out and detain its release at the outlet, while finer particles and pollutants in the dissolved phase will be less likely to be trapped within the rain garden. The total and dissolved water concentrations for Hg and Cu support this conceptual model. That data also suggests that while the dissolved portions are relatively unaffected by the rain garden, approximately 50% and 90% of the particulate-bound portions of Hg and Cu, respectively, are being detained by the rain garden. The assumption is that Hg and Cu sources for this watershed are primarily from atmospheric deposition and vehicle residues, both sources of which are dissolved and fine particulate phase. It is unclear at this time why the rain garden is more effective at filtering out particulate Cu than particulate Hg, but the presumption is that Hg in this watershed is associated with finer particles than Cu. Along these same lines, the data suggests that in this watershed, either PCBs are more associated with coarser particles and that hardly any are in the dissolved phase, or that the rain garden is effective at adsorbing dissolved phase PCBs unlike the dissolved metals.

Public Outreach

Bringing stormwater pollution prevention information to the public was a critical component of the project. The outreach activities and materials focused both on the general public and on the local community. A variety of approaches was used to promote awareness and understanding of green stormwater treatment technologies. These approaches included creating web-based podcasts, conducting field tours, distributing project flyers, and informing local press to have articles published in news media outlets.

Local Community

Project Announcement Flyer

Outreach activities promoting the El Cerrito Streetscape Improvement Project had already begun prior to the initiation of the El Cerrito Rain Gardens project. Thus community members were already aware that large-scale up-grades to right-of-way landscaping were coming. In September 2009, SFEP and El Cerrito partnered to develop a single page flyer announcing the Rain Gardens as a component of the larger project. SFEP staff took the flyer door-to-door to property-owners, renters and businesses adjacent to the project sites. The project announcement flyer is included in this report in Appendix I-C.

Green Streets Tours & Events

SFEP sponsored and participated in three events bringing interested parties to Green Streets sites in El Cerrito:

1. On October 9, 2009, the Estuary Partnership sponsored the "Beads on a Green Necklace: Green Streets/Resilient Watersheds Tour," a free two-hour tour of two creek restoration projects in El Cerrito (both on Baxter Creek), the El Cerrito City Hall LID grounds, and the pre-constructed rain garden sites. A group of approximately 30 people comprised of interested city planners, public works personnel, landscape architects, and local elected officials.

2. On February 16, 2011, SFEP produced a highly successful green streets forum attended by 100 people. The forum featured speakers from several local jurisdictions, as well as guest speaker, Kevin Robert Perry from Portland, author of the San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook. The forum brought together project designers, engineers, planners, and other interested parties together to discuss Green Streets projects that have gone in the ground to date around the Bay and elsewhere, and lessons learned from those projects. Landscape architects and engineers discussed their concerns and perspectives related to green streets, the challenges of retrofitting urban areas, design innovations, and how to move these types of projects forward in the Bay Area. The Green Streets/Cleaner Stormwater program flyer is included in this report in Appendix I-C.

3. Finally, the City of El Cerrito held its "San Pablo Avenue Spring Fling!" on Saturday May 14, 2011 from 10am to 2pm. This event celebrated the new streetscape

improvements with opening ceremonies presented by the Mayor and a project review by city staff. Following light refreshments and a public transit give-away, Fling attendees toured the avenue. Mini-presentations took place every 30 minutes at the Eureka Rain Garden, City Hall, and Baxter Creek/Gateway Park. The lead project design firm (Gates and Associates) staffed a table to answer questions from the community. The event included live entertainment as well as discounts and samples provided by many participating local businesses. The Spring Fling program flyer is included in this report as Appendix I-C.

Interpretive Signage

To promote stormwater quality awareness to the local community and passers-by, interpretive signage was developed and installed at both rain garden sites in February 2011. The multilingual signs describe how the soil media filters pollutants from stormwater and also provide readers with tips on stormwater pollution prevention.

Media

SFEP, USEPA, and El Cerrito city staff worked to inform various media outlets about the rain gardens project. Media outlets included newspapers, on-line blogs, and newsletters. In February 2010, USEPA issued a press release touting ARRA's funding of green infrastructure projects in El Cerrito. From 2009-2011, articles about the rain gardens ran in the *Contra Costa Times*, the *San Francisco Chronicle*, the *El Cerrito Patch*, the *El Cerrito Journal*, *Estuary News*, and ABAG's *Service Matters* newsletter. City efforts included informing the public about the larger Streetscape Improvement project as well. A final press release describing the monitoring results and introducing the San Pablo Avenue Green Stormwater Spine project was sent to various media outlets around the region in late November 2012.

Information Sheets

SFEP developed and published its *Green Streets, Cleaner Stormwater: A Primer* in 2011. This glossy four-page informational pamphlet artfully summarizes what "green streets" are and how they work. It provides examples of other LID approaches, compatible with both public and private land uses. SFEP staff distributed the Primer to residents and businesses adjacent to the rain garden sites. Copies of the Primer are displayed and available for the taking at the Regional Water Boards office in downtown Oakland. They are also downloadable from the SFEP website, www.sfestuary.org. The Primer is included in this report as Appendix I-C.

Podcasts

SFEP used a competitive Request for Proposals process to procure professional production of three informational video podcasts. Kay Productions completed the three short (6 to 10 minute) podcasts in 2010. The podcasts can be accessed from the SFEP website or through YouTube.

- **Slow it, Spread it, Sink it**: Speakers, Brock Dolman with Occidental Arts & Ecology Center and Keith Lichten with San Francisco Bay Regional Water Quality Control Board, teach about green streets and stormwater. (6/16/2010)
- **Nature's Filtration Systems**: Environmental scientists, Lester McKee and Sarah Pearce with the San Francisco Estuary Institute, explain how the soil and plants in green stormwater treatment systems filter pollutants and how scientists study the process and report their results.(8/4/2010)
- **Cut the Curbs to Claim the Rain**: Two pioneers from the City of El Cerrito and two scientists from the Estuary Institute explain how green stormwater treatment systems help slow and filter polluted water before it reaches local creeks and San Francisco Bay. (12/14/10)

Website

The Estuary Partnership maintains a website that provides an overview of the organization, project description pages, links to internal and external resources, and a library of podcasts and publications. SFEP staff periodically updated the El Cerrito Green Streets Rain Gardens project description page, which received close to 600 visits since its creation. A screenshot of the project description page is included in this report as Appendix I-E.

Conclusions

Quantification of Project Effectiveness

Overall PAEP Evaluation and Effectiveness

By nearly every measure of the Project Evaluation and Effectiveness Plan, the El Cerrito Green Streets Rain Gardens Project has been a success. All project goals have been achieved.

The project has also been successful in achieving benefits that were not listed in the PAEP. The project advanced the implementation of the *Comprehensive Conservation and Management Plan* (CCMP), a multi-stakeholder developed document that recommends over 200 actions over 9 program areas to improve water quality and habitat conditions in the San Francisco Bay-Estuary.

The project also advanced achievement of water quality objectives and protection and enhancement of beneficial uses in the San Francisco Estuary, as described in the *Strategy for Implementing State Revolving Fund for Expanded Use Projects*. The project has also helped the State Board implement its Plan for California's Nonpoint Source Program.

Finally, the project created meaningful jobs and stimulated the local economy, which were prime drivers of the ARRA funding.

Stormwater Treatment Unit Installation

While the concept of green infrastructure is relatively simple, natural treatment facilities must be designed, engineered, and constructed properly to ensure immediate and long-term functionality. The designs must account for the contributing drainage area to size the facility correctly. Safety concerns must be factored in due to the high use of the public right-of-way. Existing utility locations must be identified to reduce conflicts or potential change orders from the contractor. Getting water from the gutter into the rain garden cells can be a challenge due to the propensity of sediment or trash to build up at inlet locations. Finally, a proper plant palette is essential for a sustainable, low maintenance landscape adapted to the local climate conditions.

The construction phase was impacted by an unknown water service pipeline under the proposed project area, which necessitated some alterations to the original plan set. The contractor also installed a filter fabric and used some exotic plant species. The filter fabric was removed to avoid potential clogging by fine sediments. A new plant palette was developed and installed. Both changes were minor and the project was constructed without additional problems.

Goal I: "Install stormwater treatment units to reduce pollutants in urban stormwater runoff from San Pablo Avenue."

Category: Pollutant Load Reduction

The output results for this goal were as follows:

Output Indicator	Output Measurement Results	Output Target Reached (Yes/No)
Photo documentation of construction progress.	Photo documentation of construction conducted, submitted with quarterly progress reports in Year 1	Yes
Quarterly and annual inspections and photo documentation	Annual and quarterly reports include project inspection findings and photo documentation	Yes
Record drawings	Hard copies of As-Build drawings submitted in Year 1	Yes
Complete draft project certification	Draft project certification submitted in October of Year 3	Yes
Post-construction monitoring report documenting number of samples taken and concentrations of pollutants in each	Post Construction monitoring report submitted November of Year 3	Yes

The outcome/target results for the goal were as follows:

Target	Measurement Tool and Methods	Outcome Indicator	Outcome Indicator Results	Target Reached? (Yes/No)
Accurately construct gardens, and meet construction timeline by completing all plans and specifications	Photomonitoring to assess construction progress and comparison of final photos to plans and specs to determine if all work is complete	Confidence that the gardens were constructed correctly and will function as intended based upon final photos that match the final plans and specs.	Photomonitoring of the sites during construction and post-construction to show the facilities to be constructed as planned.	Yes
Obtain final project certification by 09/30/2012.	Project certification date. Comparison between the final project report submittal date and the target date.	Demonstration of reduction in pollutants based upon submittal date of Final Project Report after post construction monitoring	The final project report submittal date was after the target date.	No. The initial date set was not met, due to delays in sampling related to unseasonably dry weather conditions
Measurably reduce pollutant concentrations between inlet and outlet samples	As described in the monitoring plan, comparison of pollutant concentrations in inlet verses outlet samples	Demonstration of reduction in pollutants based upon the % of pollutant reduction reported in the final monitoring plan report.	SFEI monitoring report shows reduction in pollutant concentrations for Pyrethroids, PCBs, Copper, SSC, and Methyl Mercury.	Yes

The desired outcome results for the goal were as follows:

Desired Outcome	Desired Outcome Results
Functioning treatment units that reduce the concentrations of stormwater-transported pollutants entering Baxter and Cerrito Creeks and ultimately SF Bay	Although the final project certification deadline was not achieved, monitoring of a representative subset of the treatment facilities shows the constructed rain gardens to be effective at reducing the concentration loads of a number of common urban runoff pollutants and photo monitoring supported this, indicating that all work was completed. As a result, the desired outcome was determined to be reached.

The goal of installing the rain gardens to reduce pollutants in urban runoff from San Pablo Avenue was achieved. Two of the 3 targets were reached. Final project certification by 09/30/2012 was not obtained, as it took longer than expected to get all 4 storm samples for the season. This pushed back the water quality monitoring results, which pushed back the final project certification timeline.

With the benefit of 20/20 hindsight, we would have allowed ourselves more time to complete the project certification report, to account for cases where there might be a later wet season. We also would use the City Inspector's final sign-off, rather than photomonitoring, as an indicator for accurate construction. A critical lesson learned is that the construction manager should be well-versed in green infrastructure principles to avoid the use of certain construction materials and approaches typical to conventional street and sidewalk projects, such as filter fabrics, over compaction, and inappropriate plant species.

Monitoring

For Green infrastructure to be accepted as a standard element in the stormwater management toolbox, it must demonstrate pollutant removal effectiveness. The El Cerrito Green Streets monitoring component adds to the sparse but growing amount of water quality data collected from green infrastructure technologies implemented in the San Francisco Bay Area. According to the *San Francisco Stormwater Guidelines*, rain gardens can capture and treat 80% of runoff volume, and are capable of removing 80% of total suspended solids (TSS) and 40% total phosphorus (TP) (San Francisco Stormwater Guidelines).

The El Cerrito Green Streets monitoring component analyzed the treatment effectiveness of the rain gardens for these common stormwater pollutants:

- PCBs
- Pyrethroids
- SSC
- Total and Dissolved Mercury
- Total and Dissolved Copper
- Total and Dissolved Organic Carbon

Goal II: "Quantify the effectiveness of the gardens by conducting monitoring".

Category: Planning, Research, Monitoring and Assessment

The output results for this goal are as follows:

Output Indicator	Output Measurement Results	Output Target Reached (Yes/No)
Observation notes and photos from storm events during the garden's first year.	Four observations conducted (3 during storm event, 1 after). Notes and photographs submitted with quarterly monitoring progress reports in Year 2	Yes
A prescribed number of samples collected from the inlet and outlet of the garden during the second year.	Sampling conducted in second year after construction. Notes and photographs submitted with quarterly monitoring progress reports in Year 3	Yes
Laboratory data quantifying pollutants at in inlet and outlet samples	Samples quantifying pollutants at inlet and outlet were analyzed by laboratories. Results included in Technical Report, draft submitted in September of Year 3.	Yes
Technical scientific report discussing laboratory results and garden's effectiveness.	Technical report developed discussing laboratory results and garden's effectiveness. Draft submitted in September of Year 3. Final technical report submitted in November of Year 3.	Yes
Hardcopy and electronic versions of the report prepared for distribution	Technical report distributed electronically to 7 East Bay cities, 6 Clean Water Programs (MRP), and on SFEP website in November of Year 3.	Yes for electronic versions. No, for hard copy versions.

The outcome/target results for this goal are as follows:

Target	Measurement Tool and Method	Outcome Indicator	Outcome Indicator Results	Target Reached? (Yes/No)
Observe at least 4 storms during the garden's first year	Using notes from professional observations and photo documentation, comparison of number of storms observed to the targeted number of storms	Confidence in the garden's physical functioning based on the number of storms observed	3 storms were observed during the garden's first year. The target number of storms was 4.	No
Collect inlet & outlet samples during 4 storms from the garden's second year	Based upon field notes, confirmation of adherence to the sampling protocol, including automatic and manual sampling methods and techniques Number of storm samples collected	Ability to document the garden's effectiveness based upon the number of storms from which samples were collected.	Water samples collected at inlet and outlet locations during 4 storm events in Year 2	Yes
Receive at least 90% useable data from the labs	Comparison of the % useable data returned from the lab to the target.	Ability to document the garden's effectiveness based upon the % of useable data returned from the laboratory	Greater than 90% of laboratory data was useable (meeting SFEI's QA/QC needs.)	Yes
Complete one technical report	Laboratory reports confirming they followed cited EPA methods for each analyte.	Synthesis of observations, data, and recommendations into a single scientific monitoring report highlighting the functioning and effectiveness of the garden.	Technical monitoring report synthesizes observations, data, and recommendations submitted in November of Year 3.	Yes
Distribute 10 copies of the monitoring report document through on-line delivery or direct distribution	Comparison of the number of copies of the monitoring report sent out to the target number.	Effective communication of results based upon the number of report copies distributed.	13 copies of monitoring report distributed in November of Year 3. The target number was 10.	Yes

The desired outcome results for this goal was as follows:

Desired Outcome	Desired Outcome Results
Broad understanding of the garden's functioning based upon observation during the first year	First year observations provided a better understanding of how the different rain garden cells perform during storm events, the amount of rainfall needed to accumulate standing water and generate outflow, and maintenance needs at inlets where sediments and trash can build up, even though only 3 storms were observed.
Quantitative documentation of the garden's effectiveness of reducing pollutant concentrations, based upon stormwater samples.	Water samples collected from the inlet and outlets during four storm events in the second year after construction were analyzed, providing quantitative documentation of pollutant concentration reduction effectiveness of the rain gardens.
Observations and recommendations from this garden to help locate and size future rain gardens	Recommendations based on observations, analyses, and calculation estimates from the monitoring program show that the sizing and location of the rain gardens provided enough filtration to effectively remove pollutants and decrease concentrations of most target analytes. By increasing volume detention in future projects, pollutant loads could be further reduced. The demonstrated effectiveness of the rain gardens to reduce PCBs and pyrethroids supports the use of rain gardens as a management tool at future locations where these pollutants may be more prevalent. The successful development of the technical report and distribution of the report helped detail and inform others of these observations, analyses, and calculated estimates.

The goal of quantifying the effectiveness of the gardens by conducting monitoring was met. The technical report provides scientific analysis of quality controlled/quality assured data that can be informative to subsequent green infrastructure efforts in the region. All associated targets were reached, with the exception of SFEI observing only three out of four storm events in year two, during the observational monitoring phase. This was due to a discrepancy between the approved PAEP (mandating four wet weather observational visits) and the SFEI's contracted scope of work, which did not specify the number of wet weather observational visits. In hindsight, both the project manager and the contractor should have noticed this discrepancy and corrected it. After making three wet weather site visits in year two, SFEI staff opted to visit the site after a storm event to observe the rain garden's condition and need for maintenance. These site visits did provide enough information for SFEI staff to make necessary inferences for the following year's sampling program and recommendations for maintenance. Notwithstanding this detail, the monitoring program was a success that could be improved with a larger budget over a longer time frame to conduct more sampling and analyses.

Although pollutant loads at the inlet and outlet could not be estimated due to lack of flow measurement, the study explored possible load reductions (mass reductions) under different runoff volume reduction scenarios. This exploration found important management implications for sizing criteria in relation to targeting the reduction of specific types of pollutants. For some of

the very hydrophobic pollutants that were likely bound to larger sized particles, filtration through the rain garden was effective at reducing the pollutant concentrations and therefore even small sized rain gardens could be effective for these pollutants as long as there is adequate filtration. On the other hand, dissolved phase pollutants and pollutants likely bound to very fine particles were not well-treated by the rain gardens (e.g. the dissolved mercury and copper fractions), and therefore detention of volume will be the more effective mechanism for reducing transport of these types of pollutants to downstream water bodies in future green infrastructure efforts.

Looking to the future, one of the major data gaps in green infrastructure monitoring is quantifying hydrologic impacts. Municipalities may be more ready to employ green infrastructure measures as more proven information becomes available about associated runoff volume reduction benefits, which would relieve some of the burden on existing storm drainage facilities.

Stormwater Pollution Prevention Outreach

An important role of a demonstration project is to raise awareness and understanding. A major prong of the outreach component of the project focused both on the general public and on the local community most affected by the project. The outreach effort aimed to increase community awareness about stormwater management, pollution prevention, and local watershed & creek issues through the development and distribution of educational and outreach materials. In addition the use of local and regional news outlets was also part of the outreach strategy. Both the City of El Cerrito and the Estuary Partnership have created webpages on their websites to inform the public about the project and its intended benefits.

Goal III: "Conduct stormwater pollution prevention outreach, including producing and distributing outreach material."

Category: Education, Outreach, and Capacity-Building

The output results for the goal were as follows:

Output Indicator	Output Measurement Results	Output Target Reached (Yes/No)
One web page created to provide information about the project (e.g. SFEP or the City web site)	SFEP created a webpage dedicated to the project in Year 1. The City of El Cerrito posted a new page dedicated to rain gardens in November of Year 3.	Yes
Inclusion of the rain gardens on the City Street Tour & the number of people that attended the tour	Green Streets Forum/Tour attended by over 100 people, including public works agencies, landscape architects, NGOs, citizens, and regulatory agencies. Held in February of Year 2.	Yes
Published articles about the project in a number of newspapers or magazines, including one media release	6 articles were published in Year 1 & 2 in both online and print newspapers. The EPA sent out a media release in February of Year 1. SFEP submitted another media release to regional news outlets in November of Year 3.	Yes
Number of informational fliers produced	2 informational flyers were produced in Year 1: 1) the *Coming Soon: El Cerrito Green Streets Rain Gardens* and 2) the *Green Streets Primer*	Yes
Number of outreach materials produced (e.g. interpretive signs at the gardens)	3 podcast videos were produced and uploaded to the SFEP website and YouTube in Year 1 2 interpretive signs were developed and installed at each rain garden site in Year 2.	Yes

The outcome/target results for the goal were as follows:

Target	Measurement Tool and Method	Outcome Indicator	Outcome Indicator Results	Target Reached? (Yes/No)

At least 100 visits on the new website pages	Documentation of the number of web hits, using a web hit calculator. Comparison to the target number.	An increased community understanding of stormwater & associated negative effects, based upon exposure to the website & print articles. Number of visits to the website pages.	According to Google Analytics 595 visits to the webpage have occurred since its creation. Exceeding the target of 100.	Yes
Participation on the Street Tour at least equivalent to the previous year (30 participants)	Number of participants on the street tour, as measured by the sign-in sheet. Comparison with the total attendance number from last year.	An increased public understanding of how a rain garden works based upon the number of participants in the street tour. Understanding of garden's multiple benefit: pollution prevention, storm water flow attenuation, urban greening, City amenity. Increase in number of participants that know which watershed they live in. Number of participants on the Street Tour.	Green Streets Forum/Tour attended by over 100 people, including public works agencies, landscape architects, NGOs, citizens, and regulatory agencies. 4 additional presentations about the gardens were given to: (1) the California Native Plant Society (October 2010); (2) the San Pablo Creek Watershed awareness group, SPAWNERS (February 2011); (3) Cal State East Bay students (May 2011); (4) El Cerrito residents as part of the city's "Spring Fling/Tour of San Pablo Avenue" event (May 2011). (Understanding of participants was not measured.)	Yes
Three newspaper or other articles	Number of articles published, as collected & copied by project partners. Comparison to the target number.	An increased community understanding of stormwater and associated negative effects, based upon exposure to the website & print articles Number of Media stories (e.g. newspaper articles)	At least 6 articles have been published in various print and online media outlets in Years 1 & 2 (Community understanding of stormwater and negative effects was not measured.)	Yes
10 business and 10 residents within the drainage area given fliers	Count of businesses and residents which receive fliers. Comparison to the target number.	Number of businesses & residents within the drainage area flyers were given to	Project outreach flyers were distributed to over 50 surrounding businesses and 50 residents, exceeding the target goal of 10 businesses and 10 residents	Yes

Create 3 outreach materials based on gathered project information	Document listing the number of outreach materials produced. Comparison to the target number.	Number of outreach materials produced	6 outreach materials were produced: (2) informational flyers/handouts; (3) video podcasts; and (1) interpretive sign (at 2 locations)	Yes

The desired outcome results for the goal were as follows:

Desired Outcome	Desired Outcome Results
Increased community knowledge and awareness about stormwater pollution prevention, including public attendance on the street tour & exposure to topical print media.	Community awareness and understanding about stormwater pollution prevention, rain gardens, and local watersheds was promoted-through news articles, the SFEP website, street tours, interpretive signage, and video podcasts. Goals regarding website visits, street tour participation, number of articles published, amount of fliers distributed to businesses and residents, and outreach materials produced, were reached. While the targets and outputs were reached, community knowledge and understanding on stormwater pollution prevention, rain gardens, as well as knowledge of Baxter and Cerrito Creek were not directly measured.
Increased community knowledge & awareness about the rain gardens, including public visits to the webpage, attendance on the street tour, & distribution of outreach materials to businesses and residents	
Increase community knowledge & awareness about the Baxter & Cerrito Creek watersheds, including exposure to outreach material, print articles, and webpages.	

The project met the goal to conduct stormwater pollution prevention outreach, including producing and distributing outreach material. The project was successful in promoting local awareness and understanding of stormwater pollution prevention, as well as the principles and benefits of green infrastructure to local watersheds. The video podcasts are an effective tool because they are accessible to a worldwide audience. The permanent interpretive signage at the sites is also a great educational resource. The City Public Works Director reports that the businesses adjacent to the rain gardens are pleased with the improvements to the streetscape.

However, the desired outcomes of actually increasing community knowledge and awareness could not be determined, because pre-project & post-project community knowledge and awareness was not measured. Instead only the promotion of local awareness and understanding could be determined. In hindsight, the targets and methods should have better corresponded to the desired outcomes.

Technology Transfer to Local Government

Beyond the general and local public, another vital target audience was local government, with emphasis on El Cerrito city staff. The project aimed to increase city staff understanding of the purpose, benefits, and maintenance needs of green infrastructure. This was done to ensure the longevity and proper functioning of the rain gardens, as the City is responsible for their long-term maintenance. The success of this project over time will serve as a model for other projects within the city and throughout the Bay Area.

Goal IV: "Conduct technology transfer to local government."

Category: Education, Outreach, and Capacity Building.

The output results for this goal were as follows:

Output Indicator	Output Measurement Results	Output Target Reached (Yes/No)
One training session for City staff on garden maintenance.	Maintenance Training session, attended by City Maintenance staff; held in Year 2	Yes
Development of a list of possible contacts to distribute project DVDs to.	A list of possible contacts to distribute project DVDs to was not developed	No. A list of possible contacts was determined not to be needed at this time as the video was made available on the web."
A packet of standard project information to provide for outside requests for additional information.	Project information including: the project completion report, the technical water quality monitoring report, video podcasts, and the Green Streets Primer will remain available on the SFEP website. As a result a packet of standard project information to provide for outside requests for additional information was determined not to be need.	No. A packet of standard project information to provide for outside requests for additional information was determined not to be needed, as all the information was made available on-line

The outcome/target results for the goal were as follows:

Target	Measurement Tool and Method	Outcome Indicator	Outcome Indicator Results	Target Reached? (Yes/No)
90% of City maintenance staff attend the training	Number of City staff that attended the training, based upon the sign in sheet. Comparison of the target.	Valuation of the gardens as a city amenity, as evidenced by the number of City maintenance staff attending the training.	All maintenance staff attended training session on May 10, 2011. Staff understands value of rain garden as city amenity and component of stormwater system.	Yes
Maintenance of the gardens through the term of this contract & a city commitment to continue maintenance	Number of maintenance visits (or hours) spent on the gardens, as recorded by the City records	Valuation of the gardens as a city amenity as evidenced by continued commitment and maintenance	The City oversees weekly trash pick-up at both sites; performs annual irrigation testing; and conducts semi-annual plant and mulch maintenance	Yes
Distribution of at least 10 informative DVDs produced about the project	Number of DVDs distributed & comparison to target number	Promotion of the City as a green stormwater leader, as evidenced by the number of DVDs both produced and distributed.	*The Cut Curbs to Claim the Rain* podcast was placed on the internet instead of being distributed via hard copy.	No. Instead, the Cut the Curbs to Claim the Rain video was placed on the internet instead, receiving almost 1,000 views on Youtube, far outpacing the distribution potential of DVDs

The desired outcomes for the goal were as follows:

Desired Outcome	Desired Outcome Results
City staff that understand the rain garden purpose, installation, maintenance, and benefits.	City staff attended training session which helped foster understanding and appreciation of the rain gardens. Their understanding of the rain garden purpose, installation, maintenance and benefits however was not directly measured.
Continued long-term maintenance of the gardens (using City or other appropriate funding)	City staff continue to properly upkeep and maintain the rain gardens, visiting the sites routinely

Provide a demonstration location of green stormwater retrofit in an already-built urban setting that others may use to replicate the project & learn from.	The maintenance to date has resulted in a well vegetated series of lush rain gardens that both improve water quality and neighborhood aesthetics. They serve as an excellent example of an urban green infrastructure retrofit. The video and information on-line promotes the project and its lessons.

A list of possible contacts to distribute the project DVD, a packet of standard project information to provide for outside requests for additional information, and distribution of at least 10 informative DVDs was not performed. We instead changed our plans for this information and posted it to the web, for greater distribution. In hindsight, we see this as the most efficient and effective way to reach people and should have set goals focused on this method of distribution instead.

It could not be determined if the desired outcome that city staff understand the rain garden purpose, installation, maintenance, and benefits was achieved, as the targets and methods were not set up to directly measure this. The desired outcomes should have been better associated with the targets and methods; however the methods and targets do indicate that the purpose, installation, maintenance, and benefits were well promoted.

The City of El Cerrito is committed to greening its facilities and operations. Their Public Works Director and Environmental Services Manager have established this direction for staff who are following their lead. This includes the Maintenance staff that has done an excellent job with tending the sites and ensuring on-going function.

While the maintenance training was clearly a success, as evidenced by their present day conditions, this project component could have been improved by developing a maintenance plan checklist and schedule that the staff could easily use. This would be helpful in assuring all recommended activities are done on schedule and are tracked for easy analysis.

Economic Stimulus

While not a stated goal of the PAEP, the project also provided much needed jobs and hopefully other economic benefits to the local community. As a "shovel-ready" project funded by the American Reinvestment and Recovery Act (ARRA), the project provided immediate stimulus by creating jobs for over 20 people through the following activities (equal to ~7 full time positions):

- Building the project and installing the plants
- Creating interpretive signage
- Creating podcasts for technology transfer
- Monitoring the project
- Creating and disseminating other educational materials

Additionally, the project was part of the San Pablo Avenue Streetscape Improvement Project, a smart growth and economic development effort that includes greening the avenue through tree plantings and providing additional transit, bicycle, and pedestrian amenities along a three-mile stretch of this major transportation corridor. The project will also help mitigate the urban heat island effect that is a problem in this area, thus reducing energy use and saving local businesses dollars spent on air conditioning, etc. Other expected economic benefits to the city include more dollars spent at local businesses by residents and visitors drawn to a more interesting, vegetated streetscape, including the rain gardens with interpretive signage. Property values along the new, greener street will likely increase as a result of its more attractive appearance.

By serving as a pilot project/prototype, the project may inspire other similar projects, leading to additional economic benefits in other communities. And ultimately, a healthier Bay and Estuary with less pollution and more wildlife will attract more tourists, promoting economic benefits to the greater Bay Area region.

Job Creation/ARRA

There are three distinct areas where this project created jobs. The first is in the construction sector, the second is in the provision of the soil, plants and irrigation materials, and the third is the maintenance of the rain gardens. The third is a long term job that should be explored in more detail.

1. Even though, El Cerrito Rain Gardens was part of a large project called El Cerrito Streetscape and the workers were already there, the project of El Cerrito Green Street Rain Gardens needed 23 workers to build the rain gardens. The construction started in March, and it finished in July 2010. The general construction activities involved demolition of the curb and sidewalk, excavation for the rain gardens, construction of new curb and sidewalk, installation of drainage, irrigation system, and soil and planting. According to the payroll reports of Golden Bay Construction, Inc., 23 people worked on the project (total of 2,158.50 hours). According to their 2010 payroll reports, the kinds of jobs were:

Quantity	Job description	Hourly pay rates
10	Cement mason (concrete mix)	$57.07 to $32.54
5	Laborers (different tasks)	$40.71 to $31.28
7	Oper. Eng. journey (Assistant machine operator)	$44.48 to $36.1
1	Carpenter	$40.24

2. The soil and plants and the materials for the irrigation system were purchased at Magnolia Landscape Inc. This business is located in Vallejo, California. The skills that this business requires are workers that know about irrigation and plants. According to their payroll reports from 2010, the average pay rate for their workers is rate is $28/hr. These types of businesses can potentially grow if cities expand implementation of these

technologies. Some materials are needed on an ongoing basis after this type of project is established, such as the mulch that needs to be changed every 2 years.[8]

3. The City of El Cerrito is responsible for maintaining the rain gardens, which is primarily carried out by employees of the Public Works Maintenance Division. Weekly trash removal services are provided by Rubicon, a non-profit job-training agency. According to El Cerrito Public Works Director, Jerry Bradshaw and Maintenance Supervisor, Bill Driscoll, annual rain garden maintenance activities for both sites amount to roughly $5,000.

Table 3 Approximate Annual Maintenance Costs

Task	Frequency (unit)	# of Staff	Hours per visit per person/annual hours all staff	Total Cost (assume $35/hr for staff)
Trash Collection	1 x Wk	1	1/50	$1,750
Weed Abatement	2x Mo	2	1/52	$1,800
Pruning/Trimming	2x Yr	2	4/16	$560
Mulch/Plant Replace	2x Yr	2	4/16	$560
Irrigation	1 x Yr	-	-	-
			Estimated Annual Cost	**$4,670**

[8] San Francisco Stormwater Design Guidelines, 2010

Future Project Plans

San Pablo Avenue Green Stormwater Spine Project

The success of the El Cerrito Green Streets/Rain Gardens Project has led to the development of a larger effort with similar goals, the San Pablo Avenue Green Stormwater Spine Project (Spine Project). The Spine Project will design, build, and monitor the effectiveness of multiple Low Impact Development (LID) retrofit sites along San Pablo Avenue. When completed, the combined LID project sites will treat runoff from at least seven acres of impervious urbanized landscape.

This project is a collaborative effort among the San Francisco Estuary Partnership, the California Department of Transportation (Caltrans), and the cities of Oakland, Emeryville, Berkeley, Albany, El Cerrito, Richmond, and San Pablo. SFEP will coordinate and manage the project. Each city has selected preliminary sites as its potential land area contributions to the project. Caltrans will fund the construction phase—much of this length of San Pablo Ave is also State Highway 123. In addition to construction funding from Caltrans, the project is supported by grants from the US EPA's San Francisco Bay Water Quality Improvement Fund (EPA), the State's Integrated Regional Water Management Program (IRWM), and the State's Urban Green Program (UG) managed by the Strategic Growth Council. Table 4 describes the breakdown of tasks, costs, funding sources, and schedule.

Like the El Cerrito Green Streets/Rain Gardens, the Spine Project will also serve as a model for local agencies in the region. The project will offer multiple examples of working LID retrofit strategies along this highly traveled public right-of-way. Each facility will be evaluated using the Bay-Friendly Landscape rating system, which promotes sustainability practices.

The San Francisco Estuary Institute will provide water quality analysis to quantify the levels of treatment attained from selected installations. We hope to return to the El Cerrito Rain Gardens to conduct additional wet weather monitoring there as part of the Spine Project, likely in 2014. This would provide a sense of how pollutant removal effectiveness changes over time as the project matures.

Finally, the Estuary Partnership will develop an outreach program that packages LID project data and findings along with the creation of model policy language for Bay Area cities to consider when planning public right-of-way improvements.

Project designs are expected by late spring of 2013, construction in the summer/fall of 2013, with monitoring and outreach activities to be completed by fall 2016. More information about the project is on the SFEP website.

Table 4 San Pablo Avenue Green Stormwater Spine Project

Major Project Tasks	Estimated Costs	Funding Source	Anticipated Timeline
Project Management/Admin	$553,000	All funders	On-going-Dec 2016
Design & Engineering	$328,000	EPA/UG	Late Spring 2013 2012
Environmental Review & Permits	$10,000	EPA/UG	Spring 2013
Construction & Construction Management	$2,900,000	Caltrans/IRWM/UG	Summer-Winter 2013
Water Quality & Hydrologic Monitoring	$215,000	IRWM	Fall 2014 -Spring 2015
Plant Establishment/Maintenance	$523,700	IRWM/UG	Spring 2014-Fall 2015
Model Green Infrastructure Ordinance	$8,300	EPA	Fall 2014
Regional Outreach	$212,700	IRWM	On-going-Fall 2016

References

California Regional Water Quality Control Board, San Francisco Bay Region, 2009. *San Francisco Bay Municipal Regional Permit*

California Regional Water Quality Control Board, San Francisco Bay Region, 2011. *Water Quality Control Plan (Basin Plan)*

Contra Costa Countywide Clean water Program, 2010. *Stormwater C.3. Guidebook*

New York State Department of Environmental Conservation, 2010. *New York State Stormwater Management Design Manual*

San Francisco Bay Conservation and Development Commission, 1969. *San Francisco Bay Plan*

San Francisco Estuary Partnership, 2007. *Comprehensive Conservation and Management Plan*

San Francisco Public Utilities Commission, 2010. *San Francisco Stormwater Design Guidelines*

State Water Resources Control Board, 2010. *List of Water Quality Limited Segments, Clean Water Act, Section 303(d)*

State Water Resources Control Board and California Coastal Commission, 2000. *Nonpoint Source Program Strategy and Implementation Plan*

U.S. Environmental Protection Agency, 2007. *Reducing Stormwater Costs through Low Impact Development Strategies and Practices*

U.S. Environmental Protection Agency, April 2, 2011. *EPA Joint Technical Memorandum*

Appendix I

A. List of Items for Review

B. Performance Assessment & Evaluation Plan

C. Outreach & Informational Pieces

D. Maintenance Training Roster

E. Project Website Screenshot

F. List of Subcontractors

G. Photographs

H. Copies of Peer Reviewed Articles

A. List of Items for Review

Summary of Work Completed

Description	Estimated Dates	Date Submitted
PLANNING AND DESIGN		
Project Assessment and Evaluation Plan (PAEP)	October 2009	03/2010
Construction Permits	October 2009	12/2009
CONSTRUCTION		
Newspaper Advertisement-Segment 2	October 2009	11/2009
Bid Documentation	October 2009	12/31/2009
Project construction contract awards Segment 1 Segment 2	October 13, 2009	 10/2009 12/2009
Photos of construction work	Quarterly	04/2010 07/2010 10/2010 12/2010 01/2011
Training session agenda	January 2010	06/2011
Final Inspection Notes	February 2010	12/2010
Recorded drawings	November 2010	hard copies 11/2010
MONITORING		
Post-construction monitoring data	Annually	electronically on 06/2012 and 11/2012
Monitoring Report	Quarterly with progress reports	01/2009 04/2010 07/2010 05/2011 12/2011 04/2012 07/2012
TECHNOLOGY TRANSFER		
Photo documentation of interpretive signage	October 2010	4/2011

Description	Estimated Dates	Date Submitted
Link to Online Video showing project construction and BMPs	October 2010	12/2010
Street Tour Agenda	October 2010	02/2011
Outreach Flier	October 2010	10/2010
Media Release	October 2010	11/2012
Website Updates	Link once construction begins and quarterly thereafter unil October 2010	10/2009 3/2010 6/2010 10/2010 02/2011 03/2012 9/2012 11/2012
Training Session Agenda	October 2010	06/2011
INVOICING	Quarterly	
PROJECT REPORTING		
Progress Reports	Quarterly	01/2010 04/2010 06/2010 10/2010 12/2010 04/2011 6/2011 9/2011 04/2012 07/2012 12/2012 12/2012
Annual Assessment and Evaluation Plan Report	Annually	5/2011 6/2012
Annual Executive Summary Report	Annually	5/2011 6/2012
Draft Project Certification	September 2012	9/2012
Final Project Certification	November 2012	12/2012

B. Performance Assessment & Evaluation Plan (PAEP)

Approved PAEP

Project Assessment and Evaluation Plan
May 2010

El Cerrito Green Streets Pilot Project
Agreement No. 09-819-550
Project No. C-06-6440-110

I. Project Summary

A. Funding Program: American Recovery and Reinvestment Act of 2009 is providing funding through the State of California Clean Water State Revolving Fund (CWSRF).

B. Project Description: The El Cerrito Green Streets pilot project consists of installing two stormwater treatment rain gardens, monitoring rain garden performance, conducting outreach about the rain gardens and stormwater pollution prevention, and conducting technology transfer. The project retrofits a dense urban corridor with green stormwater infrastructure that detains and treats urban runoff to remove pesticides, PCBs, mercury, and copper as specified in San Francisco Bay Basin Water Quality Control Plan TMDLs and SSOs. The project will construct the rain gardens into existing sidewalks and on-street parking areas to treat stormwater from 1.23 acres of impervious surface (San Pablo Avenue, adjacent commercial properties, and adjacent residential streets), thus reducing pollutant loads. After construction, a monitoring plan will be designed and implemented to quantify the performance of the rain gardens, communicating results via technical report and other communication venues, such as newsletters and websites. Outreach to the public about the rain gardens and stormwater pollution prevention will occur through interpretive signs, information on SFEP's and the City's websites, a Green Streets Tour, a flyer and/or brochure for adjacent businesses and residents, and a media release.

C. Problem Statement: Storm runoff from the urban environment contains pollutants that are transported from the impervious landscape, through storm drain systems and/or creeks, and ultimately to San Francisco Bay. Efforts to reduce or remove pollutants before they enter creeks or the Bay support the San Francisco Bay Basin Water Quality Control Plan TMDL, which calls for reductions of pollutants including pesticides, PCBs, mercury, and copper, transported in urban runoff to the Bay. This project will implement solutions for reducing pollutant loads by treating urban runoff in two rain gardens along San Pablo Avenue (State Route 123) designed to bio-filter the stormwater before discharging it into the storm drain system.

3

Effectiveness of the rain gardens in reducing pollutant loads will be measured by collecting stormwater samples during four (4) storms in the 2011-2012 wet season (approximately October 2011 - April 2012). Paired samples will be collected; one sample taken immediately upstream of the rain garden (inlet sample), and the other at the outlet of the garden before the water is discharged into the storm drain system (outlet sample). Each sample will be analyzed in the laboratory for pollutant concentrations. The comparison of the concentration of each pollutant between the inlet and outlet samples will provide an indication of water quality improvements due to processes occurring within the garden.

Outreach and education is an equally important component of this project. The public is largely unaware of stormwater pollution, including what causes it, where it occurs in the landscape, how it physically is transported through our cities, and its associated negative effects upon the environment. This highly visible project aims to increase awareness in the community about these issues via its presence (with interpretive signs), plus additional outreach materials, both in print and on-line. Although the total volume of stormwater treated by the two gardens is relatively small, this is a pilot project designed to show effectiveness, provide technology transfer to local government, document performance, increase awareness, and hopefully encourage greater use of stormwater treatments such as rain gardens in both public and private settings.

i. Identify or characterize baseline data:
No baseline data exists

ii. Identify pollution source categories:
The two rain gardens will capture and treat runoff from the urban landscape including San Pablo Avenue, adjacent commercial buildings and property, and residential streets and property.

iii. Identify and describe current restoration activities; BMPs; load reduction activities; prevention activities:
Although the City of El Cerrito has installed a rain garden at City Hall, these gardens will be the first of their kind installed along a major transportation corridor and designed to capture more significant volumes of runoff. El Cerrito has undertaken restoration of several creeks in the watersheds that drain the city; the storm drains connected to the rain garden flow to those watersheds (Baxter and Cerrito Creeks).

iv. Describe the manner in which the proposed best management practices or management measures will be implemented:
The rain gardens will be constructed according to design specifications and following guidelines described by the Contra

Costa County C3 stormwater guidebook, and will be regularly inspected and maintained.

v. Summarize how the effectiveness of the proposed practices or measures in preventing or reducing pollution will be determined: The project will include monitoring to quantify effectiveness. During construction, we will observe and photo document the progress and changes to the site. During the garden's first wet season (2010-2011), we will observe the garden during storm events, photo monitor to capture processes and performance, and observe how the garden's performance changes through the wet season as the plant community matures.

   During the garden's second wet season (2011-2012), after the plant community has matured, stormwater samples will be collected to quantify pollutant concentrations of water entering the garden (inlet samples) and water that has been treated by the garden (outlet samples). Based upon the difference between these samples, we will evaluate water quality improvements.

vi. Determine "changes in flow pattern" in affected water bodies: The rain gardens are designed to detain runoff from 1.23 acres of impervious surface; instead of the runoff directly entering the storm drain system, it will be allowed to enter the gardens via curb cuts, and to infiltrate and move through the gardens, and eventually be returned back into the storm drain system. Although the monitoring component of the project will not quantify the volume of runoff that is actually treated, it will qualitatively describe the average time of detention.

vii. Determine economic benefits of implementing the project: When done on a large scale, treatment of pollutants in rain gardens can lower the cost of stormwater treatment. As a pilot project, this one may inspire and lead to several more similar projects (there has already been a great degree of interest in the project). The rain garden may also be of economic benefit to local merchants, property owners, and the community at large due to the improved aesthetics it creates in the immediate area.

D. Project Activities or Tasks: Provide a list of the project activities or tasks that you will undertake to address the issues or problems. (These should be taken from your proposal, agreement or, contract depending on which grant program is providing funds to your project and at what stage you are in the program.)

1. Construct the gardens. The project is under construction. The treatment devices are being built in accordance with final plans and specifications. Construction activities will be inspected and

photo documented to ensure conformance.

2. Conduct one training for City maintenance staff on how to maintain the gardens.

3. Inspect rain garden one to four times per year. Include inspection reports with progress reports.

4. Perform a final inspection to ensure compliance to design plans and specifications. Submit a final inspection report.

5. Prepare record drawings (as-built documents).

6. Observe and photo document qualitative rain garden performance during the first year after construction (2010-2011). Submit updates during quarterly progress reports.

7. Install sampling equipment for stormwater monitoring.

8. Collect and analyze stormwater samples during four storms during the 2011-2012 wet season (October 2011-May 2012). Samples will be analyzed for: PCBs, Pyrethroids, SSC, Total and Dissolved mercury, Methyl mercury, Total and Dissolved copper, Total and Dissolved organic carbon.

9. Communicate monitoring results in a concise technical report and possibly summarize in newsletter and on-line.

10. Design and install interpretive signs to educate the community about the rain gardens and how they work, stormwater pollution prevention, and the watershed in which the garden is located.

11. Create an on-line video showing project construction and BMPs, and place on City, SFEP, and SFEI websites.

12. Include the rain gardens on a Green Streets tour.

13. Develop and distribute an outreach flyer and/or brochure for adjacent businesses and residents after installation.

14. Submit a media release after construction completion to promote stormwater pollution prevention education.

15. Update SFEP's and the City's websites to inform the public about progress on a quarterly basis.

16. Submit quarterly progress reports, an annual project assessment and evaluation plan report, and an annual executive summary

report.

17. Submit a natural resource projects inventory (NRPI) project survey form.

18. Submit draft and final project certification.

E. Category of Project Activities or Tasks: Indicate which of the following categories your activities correspond to:

1) Planning, Research, Monitoring and Assessment
2) Education, Outreach, and Capacity -building
3) Habitat Restoration
4) Pollutant Load Reduction
5) Water Conservation, Reliability Enhancement, and Recycling
6) Flood Attenuation and Flood Protection

This project covers three categories:

Category 1 Planning, Research, Monitoring and Assessment: Tasks 1, 3, 4, 5, 6, 7, 8, 9, 17

Category 2 Education, Outreach, and Capacity-building: Tasks 2, 10, 11, 12, 13, 14, 15

Category 4 Pollutant Load Reduction: Tasks 8, 9, 16, 18

This project will NOT address the following categories directly:
Category 3 Habitat Restoration
Category 5 Water Conservation, Reliability Enhancement, and Recycling
Category 6 Flood Attenuation and Flood Protection

II. Project Goals & Desired Outcomes

Goals:

1. Quantify the effectiveness of the gardens by conducting monitoring.
2. Conduct stormwater pollution prevention outreach, including producing and distributing outreach material.
3. Conduct technology transfer to local government.
4. Install stormwater treatment units to reduce pollutants in urban stormwater runoff from San Pablo Avenue, in accordance with the SF Bay basin water quality control plan TMDL.

Desired Outcomes:

1. Broad understanding of the garden's functioning based upon observation during the first year
2. Quantitative documentation of the garden's effectiveness of reducing pollutant concentrations
3. Observations and recommendations from this garden to help locate and size future rain gardens
4. Increased community knowledge and awareness about stormwater pollution prevention, including public attendance on the street tour, and exposure to topical print media
5. Increased community knowledge and awareness about the rain gardens, including public visits to the web page, attendance on the street tour, and distribution of outreach material to businesses and residents
6. Increased community knowledge and awareness about the Baxter and Cerrito Creek watersheds, including exposure to outreach material, print articles, and web pages
7. City staff that understand the rain garden purpose, installation, maintenance, and benefits
8. Continued long-term maintenance of the gardens (using City or other appropriate funding)
9. Provide a demonstration location of green stormwater retrofit in an already-built urban setting that others may use to replicate the project and learn from
10. Functioning treatment units that reduce the concentrations of stormwater-transported pollutants entering Baxter and Cerrito Creeks and ultimately SF Bay

III. Project Performance Measures Tables

Table 1
Planning, Research, Monitoring and Assessment
El Cerrito Green Streets Pilot Project

Project Goals	Desired Outcomes	Output Indicators	Outcome Indicators	Measurement Tools and Methods	Targets
Quantify the effectiveness of the gardens by conducting monitoring	1. Broad understanding of the garden's functioning based upon observation during the first year 2. Quantitative documentation of the garden's effectiveness of reducing pollutant concentrations, based upon stormwater samples 3. Observations and recommendations from this garden to help locate and size future rain gardens	1. Observation notes and photos from storm events during the garden's first year 2. A prescribed number of samples collected from the inlet and outlet of the garden during the second year 3. Laboratory data quantifying pollutants in inlet and outlet samples 4. Technical scientific report discussing laboratory results and garden's effectiveness 5. Hardcopy and electronic versions of the report prepared for distribution	1. Confidence in the garden's physical functioning based upon the number of storms observed 2. Ability to document the garden's effectiveness based upon the number of storms from which samples were collected 3. Ability to document the garden's effectiveness based upon the % of useable data returned from the laboratory 4. Synthesis of observations, data, and recommendations into a single	1. Using notes from professional observation and photo documentation, comparison of the number of storms observed to the targeted number of storms. 1. Based upon field notes, confirmation of adherence to the sampling protocol, including automatic and manual sampling methods and techniques 2. Number of storms samples were collected from 3. Comparison of the % useable data returned from the	1. Observe at least four storms during the garden's first year 2. Collect inlet and outlet samples during four storms from the garden's second year 3. Receive at least 90% useable data from the labs 4. Complete one technical report 5. Distribute 10 copies of the monitoring report document through on-line delivery or direct distribution

			scientific monitoring report highlighting the functioning and effectiveness of the garden 5. Effective communication of results based upon the number of report copies distributed	lab to the target. 4. Laboratory reports confirming they followed cited EPA methods for each analyte 5. Comparison of the number of copies of the monitoring report sent out to the target number	

Table 2
Education, Outreach, and Capacity-building
El Cerrito Green Streets Pilot Project

Project Goals	Desired Outcomes	Output Indicators	Outcome Indicators	Measurement Tools and Methods	Targets
Conduct stormwater pollution prevention outreach, including producing and distributing outreach material	1. Increased community knowledge and awareness about stormwater pollution prevention, including public attendance on the street tour, and exposure to topical print media 2. Increased community knowledge and awareness about the rain gardens, including public visits to the web page, attendance on the street tour, and distribution of outreach material to businesses and residents 3. Increased community knowledge and awareness about	1. One web page created to provide information about the project (e.g. SFEP or the City web site) 2. Inclusion of the rain gardens on the City Street Tour, and number of people that attend the tour 3. Published articles about the project in a number of newspapers or magazines, including one media release 4. Number of informational fliers produced 5. Number of outreach materials produced (e.g. interpretive signs at the gardens)	1 & 3. An increased community understanding of stormwater and associated negative effects, based upon exposure to the web site and print articles 2. An increased public understanding of how a rain garden works, based upon the number of participants in the street tour 2. Understanding of garden's multiple benefits: pollution prevention, storm water flow attenuation, urban greening, City amenity. Increase in number of participants that	1. Documentation of the number of web hits, using a web hit calculator. Comparison to the target number 2. Number of participants on the street tour, as measured by the sign-in sheet. Comparison with the total attendance number from last year 3. Number of articles published, as collected and copied by project partners. Comparison to the target number 4. Count of businesses and residents which receive fliers. Comparison to the target number 5. Document listing the number of outreach materials produced. Comparison to the target number	1. At least 100 visits on the new website pages 2. Participation on the Street Tour at least equivalent to the previous year (30 participants) 3. Three newspaper or other articles 4. 10 businesses and 10 residents within the drainage area given flyers 5. Create 3 outreach materials based on gathered project information

	the Baxter and Cerrito Creek watersheds, including exposure to outreach material, print articles, and web pages		know which watershed they live in 1. Number of visits to the website pages 2. Number of participants on the Street Tour 3. Number of media stories (e.g. newspaper articles) 4. Number of businesses and residents within the drainage area flyers were given to. 5. Number of outreach materials produced		
Conduct technology transfer to local government	1. City staff that understand the rain garden purpose, installation, maintenance, and benefits 2. Continued long-term maintenance of the gardens (using City or other	1. One training session for City staff on garden maintenance 2. Development of a list of possible contacts to distribute project DVDs to	1. Valuation of the gardens as a city amenity, as evidenced by the number of City maintenance staff attending the training 2. Valuation of the gardens as a city	1. Number of City staff that attend the training, based upon the sign-in sheet. Comparison to the target. 2. Number of maintenance visits (or hours) spent on the gardens, as recorded by City records 3. Number of DVDs	1. 90% of City maintenance staff attend the training 2. Maintenance of the gardens through the term of this contract, and a City commitment to continue maintenance 3. Distribution of at least 10 informative DVDs

	appropriate funding) 3. Provide a demonstration location of green stormwater retrofit in an already-built urban setting that others may use to replicate the project and learn from	3. A packet of standard project information to provide for outside requests for additional information	amenity, as evidenced by continued commitment for maintenance 3. Promotion of the City as a green stormwater leader, as evidenced by the number of DVDs both produced and distributed	distributed, and comparison to the target number.	produced about the project

Table 3
Pollutant Load Reduction
El Cerrito Green Streets Pilot Project

Project Goals	Desired Outcomes	Output Indicators	Outcome Indicators	Measurement Tools and Methods	Targets
Install stormwater treatment units to reduce pollutants in urban stormwater runoff from San Pablo Avenue, in accordance with the SF Bay basin water quality control plan TMDL	1. Functioning treatment units that reduce the concentrations of stormwater-transported pollutants entering Baxter and Cerrito Creeks and ultimately SF Bay	1. Photo documentation of construction progress 1. Quarterly and annual inspections and photo documentation 1. Record drawings 2. Complete draft project certification 3. Post-construction monitoring report documenting number of samples taken and concentrations of pollutants in each	1. Confidence that the gardens were constructed correctly and will function as intended based upon final photos that match the final plans and specs. 2. Demonstration of reduction in pollutants based upon the submittal date of Final Project Report after post construction monitoring 3. Demonstration of reduction in pollutants based upon the % of pollutant reduction reported in the final monitoring plan report	1. Photomonitoring to assess construction progress, and comparison of final photos to plans and specs to determine if all work is complete 2. Project certification date. Comparison between the final project report submittal date and the target date 3. As described in the monitoring plan, comparison of pollutant concentrations in inlet versus outlet samples	1. Accurately construct gardens, and meet construction timeline by completing all plans and specifications 2. Obtain final project certification by 9/30/2012 3. Measurably reduce pollutant concentrations between inlet and outlet samples

C. Outreach & Informational Pieces

1. Project Announcement Flyer

COMING SOON:
El Cerrito Green Streets Rain Gardens!

Gates and Associates

This spring, in partnership with the San Francisco Estuary Partnership, using federal stimulus money, the city is installing two new RAIN GARDENS along San Pablo Avenue: at Eureka and Madison. The rain gardens are designed to slow rainwater running off of San Pablo Avenue and adjacent neighborhoods, allowing it to sink into the ground. The water—which contains pollution from the streets and vehicles—will be filtered and cleaned by the plants and soil of the rain gardens. The filtered water will then be sent into the underground storm drain system and on to San Francisco Bay. By cleaning the water before it gets there, the rain gardens improve water quality in the Bay, helping the fish and wildlife that live in it. The trees and plants in the rain garden will also help filter air pollution and provide habitat for birds, bees, and butterflies plus improve the look of the street for pedestrians and shoppers.

The rain gardens are part of the El Cerrito Redevelopment Agency's larger multi-year project to enhance San Pablo Avenue. The goal of the project is to identify El Cerrito as a distinct place along the Avenue, enhance the economic vitality of the area and create a better walking environment.

The Redevelopment Agency has already installed new signage, street banners, created Gateway Park (at Baxter Creek), as well as completed landscaping and irrigation renovations in existing medians.

In early 2010, the Agency will complete the following improvements:

- New medians south of Central Avenue
- Eight new crosswalks
- Pedestrian safety improvements - such as countdown pedestrian crossing signals and in-pavement flashing crosswalks in some locations
- Upgraded landscaping
- New street furnishings including benches and bike racks
- Additional street trees
- Upgraded transit stops with new benches and trash/recycling bins
- Demonstration rain gardens

For more information contact Melanie Mintz at 215-4339 and see http://www.sfestuary.org/projects/detail.php?projectID=41.



The rain gardens will be planted with attractive native species. Photos by Ron Sullivan.

EL CERRITO

SAN FRANCISCO ESTUARY PARTNERSHIP

Funding for this project has been provided in full or in part through an agreement with the State Water Resources Control Board. The contents of this document do not necessarily reflect the views and policies of the State Water Resources Control Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use. (Gov. Code Section 7560, 40 CFR Section 31.20.)

San Francisco Estuary Partnership
1515 Clay Street, 14th Floor
Oakland, CA 94612
(510) 622-2304
www.sfestuary.org

2. Green Streets Forum/Tour Flyer

Green Streets / Cleaner Stormwater

A free half-day forum for engineers and designers
Wednesday, February 16, 2011

Sponsor: San Francisco Estuary Partnership

Space is limited: Contact Lisa Owens Viani at (510) 622-2337 for more info.
To reserve a spot call (510) 622-2304 or email:
degtervanwissekerke@waterboards.ca.gov

Photos by Kevin Robert Perry.

Host: City of El Cerrito

El Cerrito City Hall, 10890 San Pablo Avenue, El Cerrito, CA (short walk from BART)

Interested in greening our streets while improving the quality of stormwater runoff? This forum is designed to bring project designers, engineers, planners, and other interested parties together to

- Discuss projects that have gone in the ground to date around the Bay and elsewhere, new projects, and lessons learned
- Compare goals and ideas from landscape architect and engineering perspectives
- Hear about the latest issues and innovations in green streets designs
- Discuss the challenges and opportunities of green stormwater retrofits in urban areas and how to move these projects forward in the Bay Area

Speaker	Topic	Time
Lisa Owens Viani, San Francisco Estuary Partnership, and **Jerry Bradshaw**, Public Works Director, El Cerrito	Welcome and Introductions	9:00am-9:10am
Tom Dalziel and **Dan Cloak, PE**, Contra Costa Clean Water Program	Administrative and programmatic aspects of planning, designing, constructing, and maintaining green streets and other sustainable building practices. Coordinating compliance with the green street mandates in the SF Bay Regional Water Board's Municipal Regional Permit.	9:10am-9:30am
Mike Roberts, City Engineer, City of Emeryville; **Larry Wight**, MIG	The greening of Adeline Street, Emeryville and new projects in Sacramento	9:30am-9:45am
Frank Bellecci, Bellecci and Associates, Inc.	El Cerrito's new stormwater planters	9:45am-10:00am
Paul Niemeth, Landscape Architect, City of Fremont	Fremont's new tree well filters	10:00am-10:15am
Kevin Robert Perry, Landscape Architect, **Nevue Ngan**, Portland, Oregon, author of the award-winning *San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook*	How deep must we go? New green streets designs	10:15am-10:45am
Panel discussion/Q&A	**Keith Lichten**, SF Bay Regional Water Quality Control Board, and **Eric Berntsen**, State Water Resources Control Board, moderators	10:45am-11:30am
Field trip on foot to San Pablo Avenue Stormwater Planters	**Frank Bellecci** and **Jerry Bradshaw**, City of El Cerrito	11:45pm-12:15pm
LUNCH (brown bag)	On your own if raining; if not, outdoors at Baxter Creek Gateway Restoration site with speaker Drew Goetting (Restoration Design Group) **{carpool to site}**	12:30am-1:15pm
Two Field Trip Options: 1) Adachi site in Richmond for informal design charette **{walk to site}** 2) Adeline Street in Emeryville with Peter Schultze Allen **{drive to site}**	**Joel Camacho, PE, Lynne Scarpa, PE,** City of Richmond, and **Drew Goetting**, Restoration Design Group **Mike Roberts**, Emeryville	1:30pm-2:00pm (2:00 end time)

3. El Cerrito Spring Fling Flyer

EL CERRITO'S
SAN PABLO AVENUE
SPRING FLING!

Saturday May 14, 2011

Schedule of Activities:
10:00 a.m. Welcome Ceremony
Rialto Cinemas Cerrito, 10070 San Pablo Ave
- Welcome from Mayor Ann Cheng
- Project Overview by Melanie Mintz, E.S.D. Manager
- Recognition of Project Funders
- Friends of the Cerrito Theater Star Dedication
- AC Transit giveaway: Re-loadable Clipper cards with unlimited bus travel for today only. (Limited supply.)

11:00 a.m. to 2:00 p.m. Tour the Avenue
Walk, Bike or Take Transit along San Pablo Avenue to experience the Streetscape improvements.
Go at your own pace! Shop and Eat along the way!
See back page for list of participating businesses and refreshment stops.

Presentations every 30 mins from 11:30 a.m. to 1:30 p.m.
Rain Gardens - *Near the Eureka Avenue Rain Gardens*
- Learn about the importance of bioswales from the San Francisco Estuary Partnership.

Meet the Designers! - *At the Stockton Avenue intersection*
- Learn about Bay-Friendly Landscaping, engineering elements and other Streetscape project details from Gates + Associates and Bellecci & Associates.

El Cerrito *City Hall* - *10890 San Pablo Avenue (at Manila)*
- See our LEED-certified City Hall building and talk to staff about the project including pedestrian safety, transit improvements, and economic development efforts.

Environmental Quality Committee (EQC) - *Near the Madison Avenue intersection*
- Meet EQC members and hear about efforts to green El Cerrito.

El Cerrito Historic Society - *Near the Potrero Ave. intersection*
- Learn about our local history, the new interpretive pavers and the role of San Pablo Avenue in shaping today's El Cerrito.

Baxter Creek/Gateway Park - *on Conlon Ave (one block from San Pablo Ave)*
- Talk with City staff about daylighting Baxter Creek, future improvements for the Ohlone Greenway and other bike/pedestrian efforts.

Thank you Spring Fling Sponsors!
golden bay construction, inc. general engineering contractors
AC TRANSIT
COLE Print & Marketing
GATES +ASSOCIATES LANDSCAPE ARCHITECTURE
SAFEWAY

SAN PABLO AVENUE STREETSCAPE PROJECT

The El Cerrito Redevelopment Agency 's exciting multi-year San Pablo Avenue Streetscape project has helped to create a more vibrant San Pablo Avenue in El Cerrito and helped to identify El Cerrito as a more distinct place.

Improvements to make the walking environment more pleasant and safe as well as enhance the economic vitality of the Avenue have resulted in numerous quality of life, resource and environmental benefits. Project elements include:

- New way-finding signs and banners
- Development of Gateway Park (at Baxter Creek)
- Two demonstration sidewalk rain gardens.
- Two new medians and re-landscaping of existing medians
- Extensive "Bay-Friendly" landscaping; tree planting
- Water-saving irrigation renovations
- Four new crosswalks and two new "flashing" crosswalks
- Pedestrian countdown signals and re-striped crosswalks
- Sidewalk bulb-outs for pedestrian safety
- Benches, seat blocks and trash/recycling bins
- Seventy bicycle racks
- Bicycle-activated stoplight detection loops
- Historic-Cultural interpretive sidewalk pavers
- Still to come: Public Art

The City received a "WaterSmart Certification Award" by the East Bay Municipal Utility District (EBMUD) for the project.

THIS PROJECT WAS MADE POSSIBLE BY:
- El Cerrito Redevelopment Agency
- Bay Area Air Quality Management District's Transportation Fund for Clean Air
- Metropolitan Transportation Commission and Contra Costa Transportation Authority's Transportation for Livable Community Programs
- *San Francisco Estuary Partnership with funding from the California State Water Control Resources Board*

EL CERRITO REDEVELOPMENT AGENCY
METROPOLITAN TRANSPORTATION COMMISSION
CONTRA COSTA transportation authority
BAY AREA AIR QUALITY MANAGEMENT DISTRICT
SAN FRANCISCO ESTUARY PARTNERSHIP

El Cerrito Flyer (reduced size)

GREEN STREETS, CLEANER STORMWATER: A PRIMER

CUTTING THE CURBS

The quiet city of El Cerrito is loudly leading the way in the East Bay in tackling and treating the grime and grease and other pollutants that race off its streets into the storm drains—and eventually San Francisco Bay—when it rains. In two block-long stretches of San Pablo Avenue (one at Eureka; the other at Madison), the city cut the curbs to allow stormwater from the street to flow into several large planters. By slowing and holding onto the stormwater, the planters encourage pollutants in the water to drop out and be filtered by the microbes in the soil and plant roots. The plants themselves take up excess nutrients in the stormwater. Projects like these are sometimes called "green streets."

The El Cerrito planters were built below grade so that polluted water running off of the street and sidewalk will flow into them and be filtered before going into the storm drain system and the Bay. Photo by Lisa Owens Viani.

WHAT ARE GREEN STREETS AND HOW DO THEY WORK?

Green streets are streets where plants and soil are a visible part of the storm drain and gutter system. Designed to tie into the existing street and storm drain system, these green streets projects retain and filter stormwater while they beautify the street. A variety of green streets facilities—**stormwater planters, rain gardens, curb extensions** or **bulb-outs, bioswales,** and **vegetated swales**—are now being used by cities to treat pollutants in stormwater. All of these landscape features work by slowing the water down and either allowing it to infiltrate into the ground or to flow through slowly before it goes back into the storm drain system. The purpose is to hold onto the stormwater longer than in a traditional curb-and-gutter system so that pollutants can be filtered out. Whether stormwater **infiltrates** or **flows through** the landscape feature depends on the location and the goal of the project—and practical issues such as whether or not there are facilities, pipes, or conduit located beneath the surface.

Green streets are designed by engineers, who calculate the volume of water they want to treat. No matter what their size, green streets facilities all use the simple principle of letting plants and soil "do the work" to treat pollution. The city of Portland, Oregon and others have found that using plants and soil to treat stormwater can be less expensive than building and maintaining pipes and other "hard" structures. An added benefit of using soil and plants is that, unlike pipes and concrete, they offer habitat for birds, butterflies, and bees.

Plants like these in a Portland stormwater planter help catch and slow runoff while providing habitat for pollinators and birds. Photo by Lisa Owens Viani.

Illustration courtesy of Gates & Associates.

"The City was excited to build this project—a project that could help demonstrate the potential for treating runoff from our streets and roads while at the same time providing an aesthetic improvement to our urban streetscape. It's also exciting to see the interest this project is generating from all kinds of other parties such as Caltrans, clean water organizations, regulatory entities, and private consulting firms." –Jerry Bradshaw, Public Works Director, City of El Cerrito

Curb extensions aka **bulb-outs** (below) are often used on wide streets, and can help slow traffic, in addition to greening up a concrete- and asphalt-heavy landscape.

Stormwater from the street flows into this curb extension in San Bruno.

Rain gardens are often used in residential areas, at schools, or at city halls and other government offices, where there is usually room for bigger stormwater treatment facilities; the one below was built at El Cerrito's City Hall and takes runoff from the building's roof.

A rain garden at El Cerrito City Hall is planted with sedges, vine maples, and other natives.

A small residential rain garden in the city of Portland. Photo courtesy of Portland Sustainable Stormwater Division.

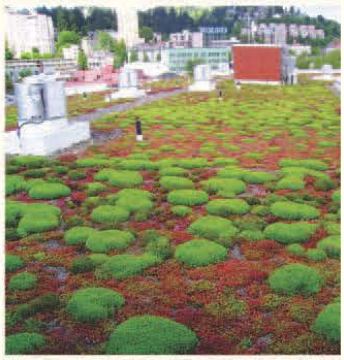
Brisbane built this rain garden at its City Hall. This photo (and the curb extension photo above left) courtesy of the San Mateo Countywide Water Pollution Prevention Program.

Bioswales are long, fairly shallow depressions in the earth that often use a curved or sinuous form to slow water, and are planted with native or non-native grasses and other vegetation. Like the other green streets facilities, bioswales treat stormwater from adjacent parking lots or roads. The one below filters runoff from a parking lot. Research from Portland, Oregon indicates that swales planted with native species filter more pollutants than swales planted with turf.

This bioswale filters runoff from the adjacent parking lot. Photo courtesy Kevin Robert Perry.

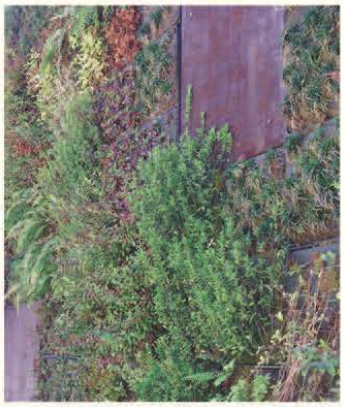
"The old way of managing stormwater was to put it in a pipe and forget about it. That approach doesn't recognize that stormwater can be an asset when it's integrated into building and site design." –Tom Liptan, City of Portland, Sustainable Stormwater Division

Eco-roofs and **green walls** are two additional, innovative and attractive ways of treating stormwater. **Eco-roofs** are roofs on top of which a layer of plastic has first been installed (to prevent water damage), and then a shallow layer of soil and plants added. When rain falls on a traditional hard roof, it often races off into gutters and into the storm drain system—and San Francisco Bay. When rain falls on an eco-roof, it is slowed, absorbed, and filtered.



One of Portland, Oregon's many eco-roofs, blooming with sedum. Photo courtesy of Tom Liptan.

Green walls also filter water that sheets off of roofs before it can make its way to the street. Both eco-roofs and green walls can provide habitat for birds and pollinators. Birds have begun nesting on some eco-roofs in Portland, Oregon.



Green walls like this one at a motel in Portland, Oregon can slow and filter runoff from roofs. Photo by Lisa Owens Viani.

THE SCIENCE OF GREEN STREETS

The San Francisco Estuary Institute (SFEI) recently found that a rain garden installed next to a parking lot in Daly City, California reduced PCBs and mercury in the runoff by 40 percent, and pollutants from motor oil, diesel, and asphalt called PAHs, as well as heavy metals, including zinc, copper, lead, and nickel, by over 80 percent. Most of this pollution comes from cars and other vehicles. In El Cerrito, scientists are testing for copper, mercury, PCBs, pesticides, and other contaminants.

This rain garden in Daly City treats polluted water from an adjacent parking lot. Photo above and below by SFEI.

SFEI scientists study how much pollution the Daly City rain garden filters.

RETHINKING OUR STREETS

All of these landscape features—sometimes called "LID" (for **low impact development**) or **"green infrastructure"**—can be used in both urban and in residential settings, beautifying streets, calming traffic, and offering habitat.

Kevin Robert Perry, of Nevue Ngan, author of the award-winning *San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook*, which can be downloaded at www.flowstobay.org, says green streets can start as simply as planting street trees—and be as advanced as curbless streets, where stormwater simply sheetflows into green streets treatment devices. "We need to go back and reverse our auto-oriented infrastructure and rethink our streets," says Perry.

Photo courtesy of Kevin Robert Perry.

Hear podcast interviews on these topics at www.sfestuary.org/podcast/

Funding for this project has been provided in full or in part through an agreement with the State Water Resources Control Board. The contents of this document do not necessarily reflect the views and policies of the State Water Resources Control Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use. (Gov. Code Section 7550, 40 CFR Section 31.20.)

SAN FRANCISCO ESTUARY PARTNERSHIP

San Francisco Estuary Partnership
1515 Clay Street, 14th Floor
Oakland, CA 94612
(510) 622-2304
www.sfestuary.org

In downtown Portland, a planter adds greenery to the streetscape while treating stormwater. Photo by Lisa Owens Viani.

This residential street in Milwaukie, Oregon has no curbs, just a concrete border. Polluted runoff sheets off the road into the planter where it is filtered. Photo courtesy of Kevin Robert Perry.

"Retrofitting green streets is not just about managing stormwater but is equally about creating streets that promote biking, walking, and transit and doing it in a way that makes our communities far more aesthetic and livable. Retrofitting streets for livability is probably one of the most important aspects in creating healthy and vibrant communities, because streets, good or bad, often define the character of our neighborhoods. In retrofitting neighborhoods with green streets, we have the opportunity to transform a neighborhood's character and do it in such a way that also helps the environment at multiple levels." –Kevin Robert Perry, Nevue Ngan

D. Maintenance Training Attendance Roster

Rain Garden Operations and Maintenance Training Session

Tuesday, May 10, 2011 8:30 am - 10:00 am

Attendance Roster

Trainers:

- Dan Cloak – Cloak
- Megan Stromberg

Name	Position
Jerry Bradshaw	Public Works Director
Bill Driscoll	Public Works Superintendent
Jose Jaramillo	Maintenance Lead Worker
Craig Hunt	Maintenance Worker
Johnny Lee	Maintenance Worker
Fernando Herrera	Maintenance Worker
Alex Martinez	Maintenance Worker
Fabian Herrera	Maintenance Worker
Gail Donaldson	Gates & Associates
Jennie Suen	Gates & Associates

E. Screen Shot of Website

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Project Partners
- City of El Cerrito
- San Francisco Estuary Institute

Project Contact
Josh Bradt

El Cerrito Green Streets Rain Gardens

Construction of the El Cerrito Green Streets rain gardens was completed in July 2010. The rain gardens detain and treat stormwater runoff to remove pesticides, PCBs, mercury, and copper that would otherwise flow into San Francisco Bay. Cuts in the curbs direct stormwater from the street into vegetated basins that treat runoff from 1.23 acres of impervious surface, with an estimated treatment volume-area of 20,700 cubic feet. The plants in the rain gardens filter pollutants, while sediment in the runoff drops out.

This highly-visible, urban retrofit project ties in to the city's federally-funded Streetscape project and efforts to build high-density, pedestrian-oriented development along State Route 123—at San Pablo Avenue and Eureka Avenue, and San Pablo Avenue and Madison Avenue. Interpretive signage explaining the project to passersby was installed in February 2011.

To evaluate the effectiveness of the rain gardens, the San Francisco Estuary Institute is monitoring water quality before and after stormwater flows in and through the rain gardens now that the vegetation is well-established.

One of the completed rain gardens on San Pablo Avenue, July 2010
Photo by Lisa Owens Viani

Water quality monitoring underway during rain event, March 2012
Photo by Josh Bradt

RELATED RESOURCES

Read more information about this project and other green streets projects (download our green streets primer).

Watch a video about the making of this project on our podcast page.

Here are some innovative "green streets" projects in San Francisco. Although not specifically designed to treat stormwater, Plant SF's projects create more permeable surface, let the ground breathe, and help with flooding problems in San Francisco.

Read more about the water quality benefits of green streets.

Funding for this project has been provided in full or in part by the American Recovery and Reinvestment Act of 2009 and the Clean Water State Revolving Fund through an agreement with the State Water Resources Control Board. The contents of this document do not necessarily reflect the views and policies of the State Water Resources Control Board, nor does mention of trade names or commercial products constitute endorsement or recommendation for use. (Gov. Code Section 7550, 40 CFR Section 31.20.)

1515 Clay Street, Suite 1400 • Oakland, CA 94612 • (510) 622-2304

F. List of Subcontractors

See Table 1 on page 14 of this report for a full listing of contractors and subcontractors.

G. Photographs

See pages 26-27 for pre-construction site photographs; pages 19-23 for construction site photographs; and pages 28-31 for post-construction site photographs.

H. Copies of Peer Reviewed Articles

No peer reviewed articles created.