
FINAL REPORT: BAY AREA GREEN INFRASTRUCTURE MASTER PLANNING PROJECT

State Water Resources Control Board Grant Number 12-415-550

DATE: OCTOBER 29, 2015

WATERSHED: San Francisco Estuary

- Sub-watersheds of focus:
 - City of San Mateo:
 - Burlingame Creek
 - Poplar Creek
 - Leslie Creek
 - Borel Creek
 - Laurel Creek
 - City of San Jose:
 - Guadalupe Watershed

PROJECT TYPE: Planning

FUNDING SOURCES:

State Water Quality Control Board

Matching Funds: \$87,912

TOTAL PROJECT COST:

\$685,813.00 including 13% match

TABLE OF CONTENTS

| | |
|---|----|
| Date: October 29, 2015 | 1 |
| Watershed: | 1 |
| Project Type:..... | 1 |
| Funding Sources: | 1 |
| Total Project Cost: | 1 |
| Executive Summary | 3 |
| Background (What was the Problem?) | 4 |
| Project Description (What was the Solution?)..... | 7 |
| Project Type..... | 7 |
| Project Cost – total cost, matching funds, grant funds, other fund sources | 7 |
| Project Schedule | 9 |
| Project Goals – How project will address the problem discussed in Background | 11 |
| Project Methodology/CEQA/Permitting/Construction/Description/Pollutant Load..... | 12 |
| Public Outreach – if applicable, include what was completed to involve the public | 13 |
| Project Evaluation and Effectiveness (What was/is the Effectiveness?) | 14 |
| Conclusions – Next Steps? Was the project terminated? If so, why? Lessons learned..... | 19 |
| Appendices | 20 |
| A. Plans and General Compliance..... | 20 |
| B. Project Specific Requirements | 20 |
| C. Conceptual Design Reports for 8 sites/projects..... | 20 |
| D. Project Reporting and Budget Info..... | 20 |

Funding for this project has been provided in full or in part through an agreement with the State Water Resources Control Board

EXECUTIVE SUMMARY

The Bay Area Green Infrastructure Master Planning Project is a collaborative effort between San Francisco Estuary Partnership (SFEP), San Francisco Estuary Institute (SFEI) and several Bay Area municipalities. The project name was rebranded as “GreenPlan Bay Area” to reflect its potential alignment with PlanBay Area, a regional land-use, transportation, and housing planning strategy towards sustainable communities in the face of projected population growth. SFEI developed spatial tools which were used by several Bay Area municipalities to identify the optimal combination of Green Infrastructure (GI)/Low Impact Development (LID) features for achieving desirable outcomes at the watershed scale.

The spatial tools, aka GreenPlan-IT, include three components: 1) a GIS siting tool with user interface to determine site suitability, 2) a watershed model to identify high-yield runoff and pollutant areas (‘hot spot’), and 3) optimization techniques to search for optimal combinations of LID locations, types and configurations. A post-processor is used to compile and display outputs in user-friendly formats.

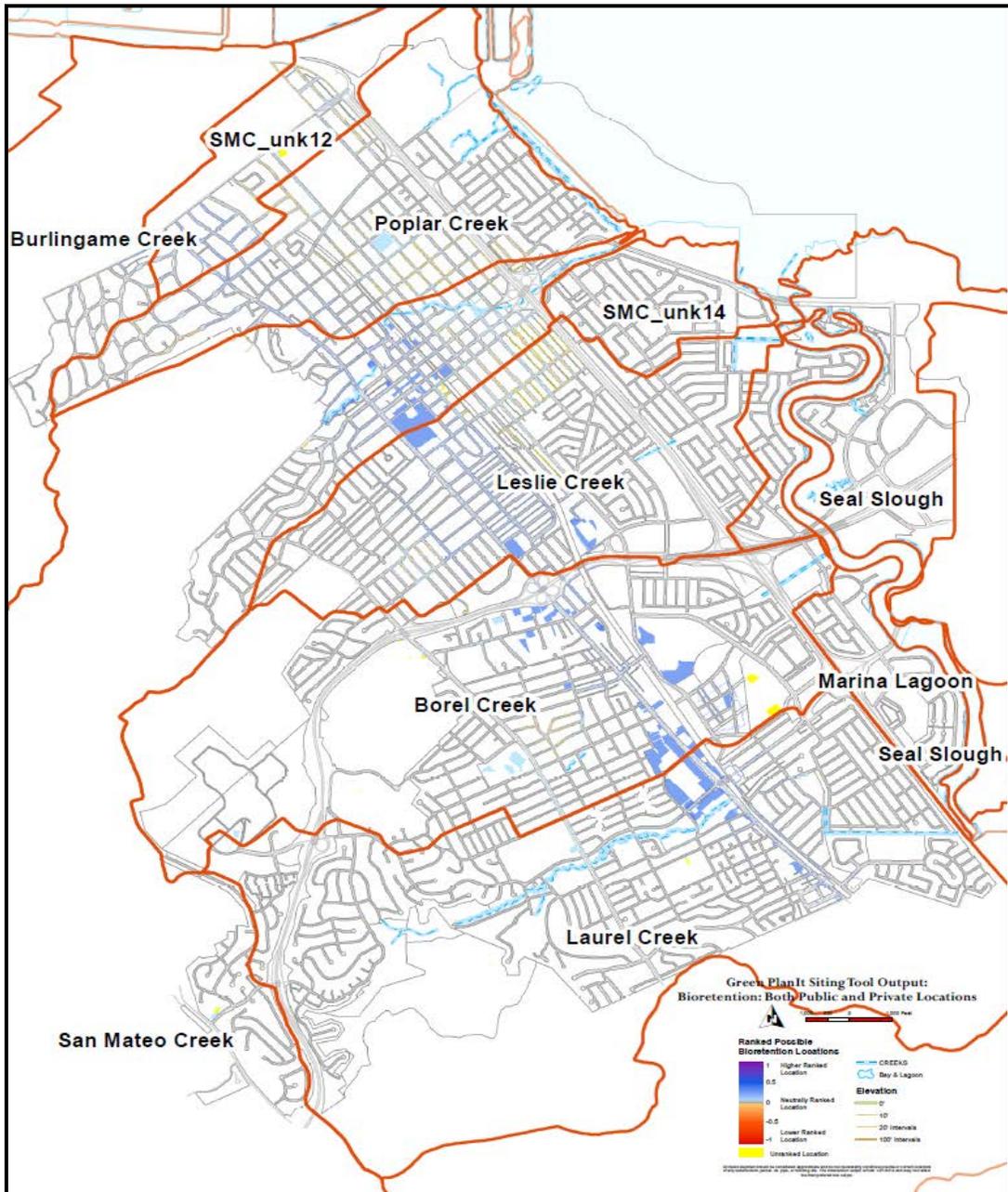
After development, GreenPlan-IT was pilot tested in several municipalities/watersheds. The results of GreenPlan-IT serve as the basis for municipal Green Infrastructure Master Plans and/or a list of priority LID sites for each partnering jurisdiction. Conceptual designs were developed for 8 LID sites/projects. Partnering jurisdictions also collaborated with ABAG/SFEP to explore potential funding frameworks (such as alternative compliance programs) for LID retrofits.

BACKGROUND (WHAT WAS THE PROBLEM?)

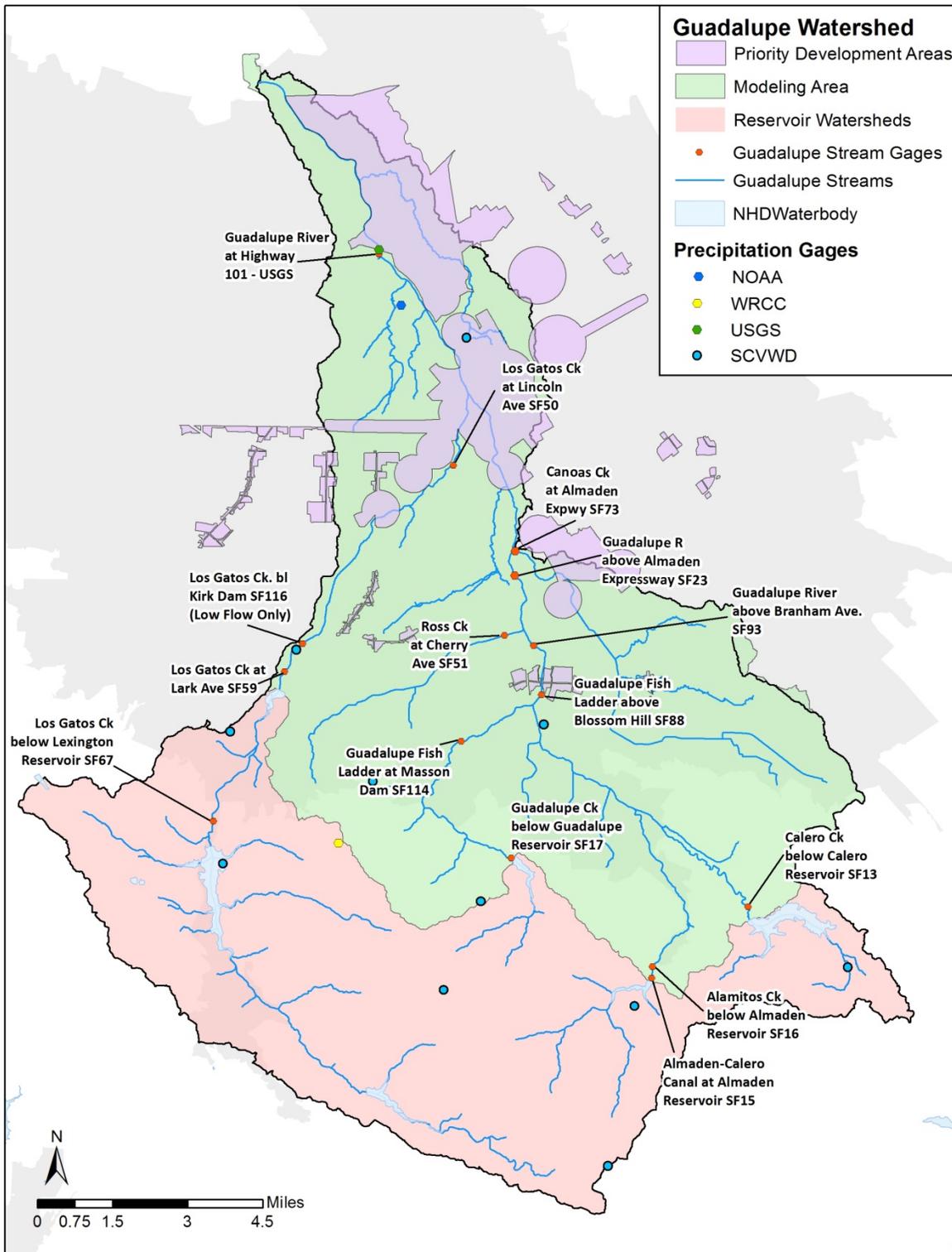
CITY & COUNTY INFORMATION – PROVIDE LOCATION MAP AND VICINITY MAP; DESCRIBE WHERE IT'S LOCATED

The City of San Mateo and the City of San Jose were the primary municipal partners for the project. Both cities are located in the south-west quadrant of the San Francisco Bay. Both are permittees under the San Francisco Regional Water Quality Control Board's Municipal Regional Stormwater Permit (MRP). Smaller watersheds in San Jose and San Mateo were identified to test the methodology and the tools.

Map of San Mateo showing Watersheds and Prospective LID Locations



Map of San Jose's Guadalupe Watershed



DISCUSSION OF WATERSHEDS & HISTORICAL USES

SAN MATEO WATERSHEDS

San Mateo County, located on the San Francisco Peninsula, is bisected by the Santa Cruz Mountain range with the San Francisco Bay to the east and the Pacific Ocean to the west. The climate is temperate and

subhumid and is modified greatly by marine Influence with annual temperatures ranging from an average maximum of 66.8 °F to an average minimum of 47.1°F. Average total mean annual precipitation for the San Mateo area is 20.16". The bay side (project study area) has experienced high amounts of urban development which required flood control modifications within its watersheds. Streams that once naturally flooded and meandered around hillsides before reaching the San Francisco Bay were hardscaped and straightened into channels. In San Mateo, the GIS Site Locator Tool was demonstrated in five discrete watersheds including Borel Creek, Laurel Creek, Leslie Creek, Poplar Creek, San Mateo Creek, as well as multiple unnamed drainages. One of the primary goals for San Mateo was to identify potential GI locations for inclusion in the Sustainable Streets Plan.

According to the San Mateo Chamber of Commerce, the San Mateo area was originally inhabited by the Ohlone Indians, who created a village along Laurel Creek. In 1793, missionaries from the San Francisco Mission established a farming outpost in the area. With the opening of a stagecoach stop, and then in 1861 a railroad station connected to San Francisco, San Mateo's commercial and residential growth hastened. Wealthy San Franciscans set up summer and weekend homes in the area, purchasing large parcels of the former Spanish ranchos. This spurred the building of churches, schools, a volunteer fire department, and local newspaper by 1889. The Crystal Springs dam was built that same year, assuring a reliable supply of drinking water. In 1894, by a vote of 150 to 25, San Mateo became an incorporated municipality. Moderate growth has continued ever since, characterizing San Mateo as a suburban residential community for San Jose and San Francisco professionals.

GUADALUPE WATERSHED

The Guadalupe River Watershed is located in the Santa Clara Valley basin and drains to Lower South San Francisco Bay. The watershed is the fourth largest in the Bay Area with approximately 170 mi² of total drainage area. The headwaters lie in the eastern Santa Cruz Mountains near the summit of Loma Prieta. . On its journey, the Guadalupe River traverses through the town of Los Gatos, and the Cities of San Jose, Campbell, and Santa Clara, and is joined by three other tributaries: Ross, Canoas, and Los Gatos Creeks. The Guadalupe Watershed has a mild Mediterranean-type climate generally characterized by moist, cool wet winters and warm dry summers. Rainfall follows a seasonal pattern with a pronounced wet season that generally begins in October or November and can last to April or May, during which an average of 89% of the annual rainfall occurs.

The upper watershed is characterized by heavily forested areas with pockets of scattered residential areas. Residential density gradually increases to high density on the valley floor. The primary focus of this case study is downtown San Jose, which is highly urbanized. The resulting study area is referred herein as the Lower Guadalupe River watershed with an area of 18,613 acres. Commercial development is focused along major surface streets. Industrial developments are located closer to the Bay, primarily downstream of the El Camino Real crossing. Six major water conservation and storage reservoirs exist in the watershed providing varying amounts of flood control: Calero Reservoir, Guadalupe Reservoir, Almaden Reservoir, Vasona Reservoir, Lexington Reservoir, and Lake Elsmar. Guadalupe River watershed supports both warm and cold water native fish, including a reproducing steelhead trout population, as well as a small run of Chinook salmon.

The Guadalupe River watershed is one of the area's biggest sources of mercury contamination, which can trace its roots to the Gold Rush of the 1800s. Mercury was essential to the process of separating gold from ore and could be found in the hills above San Jose. The New Almaden Mines became the largest mercury

mine in North America, ultimately seeping an estimated 6,500 tons of mercury into the local systems of creeks and rivers between 1850 and 1920.

PROBLEM STATEMENT & RELEVANT ISSUES

Water quality in the San Francisco Bay and its watersheds is impaired by PCBs, mercury, pesticides and a number of other pollutants associated with stormwater runoff. Reducing stormwater runoff and contaminant loads is complex and relies on costly engineering, especially in highly-developed urban environments. Increasingly, distributed management of stormwater runoff using Green infrastructure (GI) is emerging as a multi-benefit solution that can address both stormwater quality and quantity concerns. Consistent with this trend, and under anticipated new stormwater permit provisions due in 2015, Bay Area local governments will be required to develop and implement watershed-scale green infrastructure plans to achieve quantitative water quality improvements.

A major barrier to regional-scale, widespread implementation of GI is a lack of watershed-based planning regarding where opportunity sites exist for GI retrofits and what constitutes the most cost-effective, achievable, and practical management strategy for achieving water quality targets for local landscapes.

PROJECT DESCRIPTION (WHAT WAS THE SOLUTION?)

PROJECT TYPE

GreenPlan Bay Area is a planning project, and is therefore exempt from the California Environmental Quality Act process.

PROJECT COST – TOTAL COST, MATCHING FUNDS, GRANT FUNDS, OTHER FUND SOURCES

| Prop 84 STORM WATER GRANT PROGRAM - BUDGET SUMMARY | | | | | | |
|---|---|------------------|--------------------|----------------------|------------------|----------------|
| Project: Bay Area Green Infrastructure Master Planning Projects | | | | | | |
| Breakdown of Project Tasks by Prop. 84 Category in Grant Agreement | | Grant | Local Match | Other Funding | Total | % Match |
| 1. Direct Project Administration Costs | | \$45,278 | \$0 | \$0 | \$45,278 | |
| Task 1 Project Management | | \$45,278 | \$0 | \$0 | \$45,278 | |
| 1(a) | Provide all technical and administrative services as needed for Agreement completion; monitor, supervise, and review all work performed; and coordinate budgeting and scheduling to ensure the Agreement is completed within budget, on schedule, and in accordance with approved procedures, applicable laws, and regulations. | | | | | |
| 1(b) | Notify the Grant Manager at least ten (10) working days in advance of upcoming meetings, trainings, and workshops. | | | | | |
| 2. Planning/Design/Engineering/ Environmental | | \$513,911 | \$87,912 | \$0 | \$601,823 | |
| Task 2 Technical Advisory Committee (TAC) | | \$44,351 | | \$0 | \$44,351 | |
| 2(a) | Create, coordinate and convene a TAC to ensure | | | | | |

| | | | | | | |
|--|---|----------------|------------|------------|----------------|--|
| | modeling tools developed are scientifically sound, feasible, and practical. Ensure that a representative from the Regional Water Board and/or State Water Board's Division of Water Quality is invited to be involved in the TAC. | | | | | |
| 2(b) | Submit the final list of TAC members, their roles and responsibilities, and commitment letters to the Grant Manager. | | | | | |
| 2(c) | Conduct TAC meetings and record notes from any interactions with the TAC. | | | | | |
| 2(d) | Prepare memo summarizing each TAC meeting and submit to Grant Manager. | | | | | |
| Task 3 Development and Demonstration of an LID Siting Toolkit | | \$299,019 | \$87,912 | \$0 | \$386,931 | |
| 3(a) | Develop the feasibility tool. | | | | | |
| 3(b) | Develop the effectiveness tool. | | | | | |
| 3(c) | Conduct the cost/benefit analysis. | | | | | |
| 3(d) | Submit the LID Toolkit and documentation to the TAC, and to the Grant Manager. | | | | | |
| 3(e) | Demonstrate the LID Toolkit in a minimum of three (3) local communities. Submit list of communities and staff contact information. | | | | | |
| Task 4: Development of Green Infrastructure Master Plans | | \$157,123 | \$0 | \$0 | \$157,123 | |
| 4(a) | Conduct preliminary meetings with participating municipalities to select watersheds for primary focus areas of study. Submit list of selected watersheds to Grant Manager. | | | | | |
| 4(b) | Present results of the LID Toolkit in select watersheds. | | | | | |
| 4(c) | Select sites for field verification based upon input from public works directors and/or stormwater staff in municipalities. Provide list of sites to Grant Manager. | | | | | |
| 4(d) | Complete site verification through field visits and/or remote sensing. | | | | | |
| 4(e) | Select projects for LID conceptual design. Submit list of projects to Grant Manager. | | | | | |
| 4(f) | Complete conceptual design for a minimum of 6 projects and submit to Grant Manager. | | | | | |
| 4(g) | Develop GI priority LID project lists, master plans, and/or programs for implementation by participating municipalities. Provide all documents related to GI master planning to Grant Manager. | | | | | |
| Task 5: Evaluation of Potential Funding Mechanisms | | \$13,418 | \$0 | \$0 | \$13,418 | |
| 5(a) | Identify necessary steps to develop a feasible alternative compliance/in-lieu fee program, acceptable to agencies and partners, to fund LID projects. | | | | | |
| 5(b) | Prepare memo describing program and submit to Grant Manager. | | | | | |
| 3. Construction/Implementation | | | | | | |
| 4. Monitoring/Performance | | \$5,409 | \$0 | \$0 | \$5,409 | |
| Item 2 | Project Assessment and Evaluation Plan | \$5,409 | \$0 | \$0 | \$5,409 | |

| 5. Education/Outreach | | \$33,303 | \$0 | \$0 | \$33,303 | |
|---------------------------------------|--|-----------|----------|-----|-----------|-----|
| Task 6: Education and Outreach | | | | | | |
| 6(a) | Develop and publish website and submit website link to Grant Manager. | \$3,952 | \$0 | \$0 | \$3,952 | |
| 6(b) | Update website as necessary (e.g., when work products become available, upcoming outreach meeting, project development news). | \$4,180 | \$0 | \$0 | \$4,180 | |
| 6(c) | Publish LID Toolkit model and user's guide on website. | \$8,926 | \$0 | \$0 | \$8,926 | |
| 6(d) - 6(g) | Prepare, advertise and conduct public outreach meetings. Submit advertisement and list of participants to Grant Manager. Present project results to ABAG Executive Board and/or San Francisco Estuary Partnership (SFEP) Implementation Committee. Present project results to the California Stormwater Quality Association (CASQA) and/or the Bay Area Stormwater Management Agencies Association (BASMAA). Submit all Education and Outreach materials to Grant Manager. | \$16,245 | \$0 | \$0 | \$16,245 | |
| Grand Total: | | \$597,901 | \$87,912 | \$0 | \$685,813 | 13% |

During the course of the project, match funds originally envisioned and approved were found to be not eligible. On December 16, 2014, a match reduction was approved by the Water Boards (Match documentation is provided in Attachment D4). These approved match funds are presented in the Budget Summary table above, for a total of \$87,912.10, or about 13% of the total project cost. For more budget information, see the Budget Table Details (Attachment D3).

PROJECT SCHEDULE

| ITEM | DESCRIPTION | CRITICAL DUE DATE | ESTIMATED DUE DATE |
|--|---|-------------------|--------------------|
| EXHIBIT A – SCOPE OF WORK – WORK TO BE PERFORMED BY THE GRANTEE | | | |
| A. | PLANS AND GENERAL COMPLIANCE REQUIREMENTS | | |
| 1. | GPS information for Project site and monitoring locations | Day 90 | |
| 2. | Monitoring and Reporting Plan | N/A | |
| 2.1 | Project Assessment and Evaluation Plan (PAEP) | Day 90 | |
| 2.2 | Monitoring Plan (MP) | N/A | |
| 2.3 | Quality Assurance Project Plan (QAPP) | N/A | |
| 2.4 | Proof of Water Quality Data Submission to CEDEN | N/A | |
| 3. | Copy of final CEQA/NEPA Documentation | Day 90 | |
| 4. | Public Agency Approvals, Entitlements, or Permits | | N/A |
| B. | PROJECT-SPECIFIC REQUIREMENTS | | |
| 1. | Project Management | | |
| 1.2 | Notification of Upcoming Meetings, Workshops, and Trainings | | 15 Days In Advance |

| ITEM | DESCRIPTION | CRITICAL DUE DATE | ESTIMATED DUE DATE |
|---|---|----------------------|--------------------|
| 2. | TAC | | |
| 2.1 | List of TAC Members, Their Affiliated Organizations, and Their Roles and Responsibilities | | November 2013 |
| 2.2 | Three (3) TAC Meeting Agendas, Sign-In Sheets, and Minutes | | As Needed |
| 2.3 | TAC Status Report | December 31, 2014 | |
| 3. | Toolkit | | |
| 3.4 | The Packaged Toolkit | | February 2015 |
| 3.5 | Toolkit Technical Memorandum | April 30, 2015 | |
| 3.6 | List of Communities and Staff Contact Information that Participated in Toolkit Demonstration | | May 2015 |
| 4. | Green Infrastructure Master Plans | | May 2015 |
| 4.1 | Preliminary Meeting Minutes and a List of Selected Watersheds | | February 2014 |
| 4.2 | Toolkit Results and Secondary Meeting Minutes | | December 2014 |
| 4.3 | List of Potential LID Retrofit Sites Selected for Field Verification | | December 2014 |
| 4.5 | List of Selected Sites for LID Conceptual Design | | April 2015 |
| 4.6 | Green Infrastructure Master Plans | | May 2015 |
| 5. | Evaluation of Potential Funding Mechanisms | | |
| 5.1 | Meeting Agendas, Sign-In Sheets, and Minutes | | April 2015 |
| 5.2 | In-Lieu Fee Program Memorandum | | May 2015 |
| 6. | Education and Outreach | | |
| 6.1 | Website Link | | October 2013 |
| 6.3 | Webinar Material | | July 2015 |
| 6.5 | Project Results Presentation Material | | July 2015 |
| EXHIBIT B – INVOICING, BUDGET DETAIL, AND REPORTING PROVISIONS | | | |
| A. | INVOICING | | Quarterly |
| G. | REPORTS | | |
| 1. | Progress Reports within forty-five (45) days following the end of the calendar quarter (March, June, September, and December) | | Quarterly |
| 2. | Annual Progress Summaries | | Annually by 9/30 |
| 3. | Natural Resource Projects Inventory (NRPI) Survey Form | Before Final Invoice | |
| 4. | Draft Final Project Report | August 31, 2015 | |
| 5. | Final Project Report | October 31, 2015 | |
| 6. | Final Project Summary | Before Final Invoice | |
| 7. | Final Project Inspection and Certification | Before Final Invoice | |

PROJECT GOALS – HOW PROJECT WILL ADDRESS THE PROBLEM DISCUSSED IN BACKGROUND

GreenPlan-IT is a planning level tool that was developed by SFEP and SFEI with support and oversight from BASMAA to provide Bay Area municipalities with the ability to evaluate multiple management alternatives using green infrastructure for addressing stormwater issues in urban watersheds. GreenPlan-IT combines sound science and engineering principles with GIS analysis and optimization techniques to support the cost-effective selection and placement of GI at watershed scale and help develop quantitatively-derived watershed master plans to guide future GI implementation for improving water quality in the San Francisco Bay and its tributary watersheds.

Structurally, the GreenPlan-IT is comprised of three components: (a) a GIS-based Site Locator Tool to identify potential LID/GI sites; (b) a Modeling Tool that quantifies anticipated watershed-scale runoff and pollutant load reduction from GI sites; and (c) an Optimization Tool that uses cost-benefit analysis to identify the best combinations of GI types and sites within a watershed for achieving flow and/or load reduction goals. The three tool components were designed as stand-alone modules to provide flexibility and their interaction is either through data exchange, or serving as a subroutine to another tool.

The Site Locator Tool has end-user flexibility that results in an iterative tool that can be fine-tuned as questions and goals change or more accurate local data are available. Establishing a representative baseline model is crucial for meaningful results and requires the calibration of Modeling Tool to local data. The Optimization Tool can be very powerful when combined with hydrologic modeling and cost analysis. Successful and meaningful application of the Optimization Tool largely depends on accurate representation of the watershed baseline condition, GI configurations, and the associated GI costs. The cost-effective solutions from the optimization process must be interpreted in the context of specific problem formulation, assumptions, constraints, and optimization goals unique to each application. With the help of this information, decision makers can set realistic goals on how much can be achieved and the level of investment required, as well as determine at what point further investment on GI will yield no improvement on runoff reduction.

The case studies with the City of San Mateo and the City of San Jose explore the use of GreenPlan-IT for identifying feasible and optimal GI locations for mitigation of stormwater runoff. They are provided here to give the reader with an overview of the user application process from start to finish, including problem formulation, data collection, GIS analysis, establishing a baseline condition, LID representation, and the optimization process. These case studies present the general steps and recommendations for how GreenPlan-IT can be applied and interpreted.

The case study with City of San Mateo utilized only the GIS Site Locator tool to screen potential sites for GI implementation in five discrete watersheds (Borel Creek, Laurel Creek, Leslie Creek, Poplar Creek, San Mateo Creek) as well as multiple unnamed drainages. Using selected regional and local data layers and the City's ranking and weighting through five optional analyses, the Site Locator Tool identified 18 acres of City-owned property or right-of-way as highly ranked locations for potential GI implementation, 113 acres as moderately ranked, and 11 acres as lower ranked locations. A remote data validation exercise confirmed that many of the sites identified and ranked highly by the locator tool were also sites previously identified as potential GI

opportunities by the city of San Mateo.

The case study with City of San Jose used the full Toolkit to support a cost-benefit evaluation of stormwater runoff control. The objective of the case study was to demonstrate the capacities and usability of GreenPlan-IT in identifying feasible and cost-effective LID locations at a watershed scale. The focus area was a 4,300 acre proposed development area within the lower part of the Guadalupe River Watershed. The Site Locator Tool identified possible LID locations that serve as the constraints to optimization process; the Modeling Tool established a representative baseline condition through calibration to local data; and then the Optimization Tool was used to repeatedly run the Modeling Tool to iteratively arrive at the optimized GI scenario that minimized the total cost of management while satisfying water quality and quantity constraints. The results of the application included the cost/benefit associated with a range of flow or loads reduction targets, ranking of sites for specific optimal solutions, and maps showing the distribution of GI within the study area under a specific optimal solution.

The GreenPlan-IT Toolkit Demonstration Report with Case Studies is included in this report as Attachment B3.1.

PROJECT METHODOLOGY/CEQA/PERMITTING/CONSTRUCTION/DESCRIPTION/POLLUTANT LOAD

METHODOLOGY

The GreenPlan-IT Toolkit can facilitate identification, evaluation and ranking of potential sites based on their relative feasibility and potential effectiveness in reducing stormwater runoff and pollutant loads. GreenPlan-IT can help Bay Area municipalities to address the following key stormwater management questions:

- Where are the suitable locations for GI implementation within the built-out urban environment?
- Where are the effective locations for GI implementation that could have the greatest potential leverage or effectiveness for reducing peak flow runoff and contaminant loads?
- What quantitative water quality and hydrological improvements can be made with GI approaches?
- What are the most cost-effective GI combinations for achieving certain reduction targets?

GreenPlan-IT combines a GIS screening tool, a publically available modeling platform, and an Optimization Tool to provide users with the ability to evaluate multiple stormwater management alternatives to support their decision making for addressing a variety of issues. The Toolkit can be used to comply with NPDES stormwater permit requirements including the development of an alternative compliance program, as well as addressing loads reduction needs identified in TMDLs. The Toolkit is intended for knowledgeable users familiar with GI and the technical aspects of watershed modeling, and is applicable to predominantly urban watersheds. Although designed as a tool for Bay Area stormwater agencies, the tool has broad applicability and could be used by other regions as well.

In addition to developing GreenPlan-IT, conceptual designs were developed for 8 LID sites/projects. A preliminary list of 10 project sites was developed in November 2014, based on input from staff at the cities of San Jose and San Mateo. Each site was evaluated, and each had one or more of the following conditions:

- The project was already under design, or a conceptual plan had already been prepared.
- There was recently built infrastructure on the site which would be affected by a green infrastructure retrofit.
- The project was only generally defined (for example, defined as a 3-mile length of roadway)

- The project would require extensive coordination with other landowners to determine feasibility.

For two of the project sites in San Mateo, a specific intersection was selected within the larger area identified in the November 2014 list.

San Jose staff identified two additional sites in early 2015. One of these (San Felipe Road and Pso de Arboles) was included in the final project list. The other was considered and an on-site evaluation conducted but was rejected because it is in a residential area (and therefore a lower priority from a pollution-load-reduction standpoint) and because the potential bioretention locations, although on the City-owned landscape strip, would require extensive coordination with homeowners to implement.

One of the sites on the final list (Tully Road and South 7th Street in San Jose) was initially identified by SFEI staff through use of the Toolkit. The remaining four sites were identified using the methodology discussed in the attached report by Dan Cloak Environmental Consulting.

The final project list (Task 4.5) is included with the full report by Dan Cloak Environmental Consulting (Attachment C). This report includes Conceptual Plan drawings, and case study summaries, for each of eight projects.

CEQA

GreenPlan Bay Area is a planning project, and is therefore exempt from the California Environmental Quality Act process. The Notice of Exemption is attached (see Attachment A3).

PERMITTING

N/A

CONSTRUCTION

N/A

DATA – EXISTING AND NEW (GRAPHS & TABLES); BMPS IMPLEMENTED; MONITORING LOCATIONS (MAP)

N/A

DATA EVALUATION/POLLUTANT LOAD REDUCTION

N/A

PUBLIC OUTREACH – IF APPLICABLE, INCLUDE WHAT WAS COMPLETED TO INVOLVE THE PUBLIC

N/A. This project's goals are to increase municipal capacity to identify the optimal suite of Green Infrastructure measures within a particular study area and imbed these findings into appropriate planning documents. No public outreach was conducted in this effort, although local agencies may host public meetings to review the findings and draft planning documents prior to adoption actions. SFEP staff worked to ensure elected officials are aware of the project and its goals through presentations to the Association of Bay Area Governments, whose Spring 2015 General Assembly meeting focused on the themes of Green Infrastructure and Water Management. Additionally, SFEP created and maintained a project page on our website at: <http://www.sfestuary.org/our-projects/water-quality-improvement/greenplanning/>.

PROJECT EVALUATION AND EFFECTIVENESS (WHAT WAS/IS THE EFFECTIVENESS?)

PROJECT OBJECTIVES

The primary goals of the project are:

1. Develop and demonstrate a GIS-based LID planning Toolkit to prioritize LID siting.
2. Develop and complete Green Infrastructure Master Plans that use Toolkit outputs and conceptual drawings.
3. Develop and Disseminate outreach and education materials to stakeholders to ensure understanding and use of the LID Toolkit and other project outputs.

The desired outcomes of the project are:

- 1 Development of a LID toolkit for use by municipalities to optimally and cost-effectively implement LID in Bay Area watersheds in order to reduce contaminants entering San Francisco Bay and attenuate stormwater runoff volume.
- 2 Development of Green Infrastructure Master Planning Documents.
- 3 Development of outreach and education materials and participation in a webinar showing toolkit features.
- 4 Dissemination of outreach information lessons learned throughout the state and region.

PROJECT EVALUATION & ASSESSMENT PLAN DISCUSSION – GOALS & TARGETS MET?; IF NOT, WHY?; WHAT CHANGES WOULD BE MADE IN HINDSIGHT?; COST EFFECTIVENESS; INCLUDE APPROVED PAEP TABLE WITH DISCUSSION; ENUMERATE SPECIFIC QUANTIFIABLE ENVIRONMENTAL CHANGES AND RESULTS

Project Performance Measures Tables

Table 1: GIS Toolkit

| | |
|--|---|
| Project Goals | 1. Develop and demonstrate a GIS-based LID planning Toolkit in pilot watershed/municipalities to prioritize LID Siting. |
| Desired Outcomes | Piloting of toolkit in two municipalities to determine the effectiveness of the tool in siting potential LID sites. |
| Output Indicators | <ol style="list-style-type: none"> 1. Develop the LID siting module 2. Develop the effectiveness module 3. Develop the cost/benefit module 4. Develop toolkit output e.g. map or table showing optimal LID locations in two pilot cities 5. Complete site verification of a subset of potential LID locations 6. Develop at least 8 conceptual designs for planned LID projects |
| Outcome Indicators | Final report that summarizes 1) the toolkit's outputs in 2 municipalities 2) municipalities' assessment of the data provided and ease of incorporating data in planning efforts |
| Measurement Tools & Methods | <p><u>TOOLS</u></p> <ol style="list-style-type: none"> 1. GIS locator tool 2. Hydrologic modeling tool (using SWMM) 3. Cost-benefit data analysis tool <p><u>METHODS</u></p> <ol style="list-style-type: none"> 4. Identification of potential LID sites |

| | |
|----------------|--|
| | <ol style="list-style-type: none"> 5. Quantification of potential hydrologic reductions from the sites 6. Identification of number and spatial distribution of prioritized LID sites |
| Targets | <ol style="list-style-type: none"> 1. High priority LID sites identified for 2 municipalities 2. Municipalities verify that sites are good locations 3. Modeled quantification of load benefits to watersheds and/or flow reductions seem realistic to project stakeholders |

The GreenPlan-IT Toolkit is a planning level tool that was developed by SFEP and SFEI with support and oversight from BASMAA and a technical advisory committee. The Toolkit was developed in order to provide Bay Area municipalities with the ability to evaluate multiple management alternatives using green infrastructure for addressing stormwater issues in urban watersheds. The Toolkit was developed over a two-year period beginning in August 2014 and involved multiple technical advisory committee meetings as well as some one-on-one interactions with technical advisors. Stakeholders also participated in these technical advisory committees and provided recommendations on features to be included in the Toolkit.

Based on technical advisor and stakeholder input, we developed the three components as originally proposed but did add some additional functionality. The three components included: (a) a LID siting module to identify potential GI sites; (b) an effectiveness module that quantifies anticipated watershed-scale runoff and pollutant load reduction from GI sites; and (c) a cost-benefit module that uses a cost-benefit analysis to identify the best combinations of GI types and number of sites within a watershed for achieving flow and/or load reduction goals. The three tool components were designed as standalone modules to provide flexibility and their interaction is either through data exchange, or serving as a subroutine to another tool. The Toolkit development process also resulted in collating and incorporating pertinent regional GIS data layers that could be used in the Toolkit. These regional data layers are now readily available within the Toolkit for use by municipalities. The project team has successfully developed the Toolkit as originally proposed and the Toolkit is available for download and use through the project website (<http://greenplanit.sfei.org/>).

Once the toolkit was developed, the project team worked with two partner cities, the City of San Jose and the City of San Mateo, to demonstrate the Toolkit and provide outputs for direct implementation into municipal planning documents.

The pilot effort with the City of San Mateo utilized only the LID Siting Tool to screen potential sites for GI implementation in five discrete watersheds (Borel Creek, Laurel Creek, Leslie Creek, Poplar Creek, San Mateo Creek) as well as multiple unnamed drainages. Using selected regional and local data layers and the City's ranking and weighting and using all five optional analyses, the Tool identified 18 acres of City-owned property or right-of-way as highly ranked locations for potential GI implementation, 113 acres as moderately ranked, and 11 acres as lower ranked locations. A remote data validation exercise confirmed that many of the sites identified and ranked highly by the locator tool were also sites previously identified as potential GI opportunities by the city of San Mateo. The City did not do a field validation effort. The map outputs from the LID Siting Tool were incorporated directly into the cities Sustainable Streets Plan (<http://sustainablestreetssanmateo.com/>) and will be used for future Green Infrastructure planning and implementation within the City.

The pilot study with City of San Jose used the full Toolkit to support a cost-benefit evaluation of stormwater runoff control. The objective of this pilot was to demonstrate the capacities and usability of GreenPlan-IT for identifying feasible and cost-effective GI locations at a watershed scale. The focus area was a 4300 acre proposed development area within the lower part of the Guadalupe River Watershed. The results of the

application included the cost/benefit associated with a range of flow or loads reduction targets, ranking of sites for specific optimal solutions, and maps showing the distribution of GI within the study area under a specific optimal solution. We did multiple remote data validation efforts with City staff with each iteration of the Toolkit runs. We did one field data validation effort with City staff and visited four locations that were ranked highly by the Siting Tool. During the field validation, details such as slope, elevation, distance to near storm drain, and other logistics were noted in terms of feasibility for GI switch to word implementation. The City is still in the planning stages for their stormwater master plan and is not quite ready to implement Toolkit outputs. We have provided the City with all maps, tables, and graphical outputs for eventual inclusion in their master plan.

LID conceptual designs were developed at eight locations throughout the partner cities (Table xx). Dan Cloak, a subcontractor on the project, worked closely with the Cities of San Jose and San Mateo to determine the eight locations where conceptual designs should be developed. For this project, sites were identified, conceptual designs developed, and costs estimated. Costs for green infrastructure retrofit projects using bioretention vary from \$2.00 to \$5.00 per square foot of tributary impervious are within the public right-of-way. The conceptual designs were delivered to their respective cities as part of an output for the project.

Locations for LID conceptual designs in the Cities of San Mateo and San Jose

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|---|
| Site Location |
| 7th Street at Tully Road, San Jose |
| 9th Street and Grant Street, San Mateo |
| Alum Rock Avenue at Pleasant Ridge Avenue, San Jose |
| Commercial Street at Berryessa, San Jose |
| East Poplar Avenue and North San Mateo Drive, San Mateo |
| Oakland Road at Commercial Street, San Jose |
| Oakland Road at US 101, San Jose |
| San Felipe at Pso de Arboles, San Jose |

In summary, the project goals for developing and demonstrating the Toolkit in two pilot communities were achieved. For one of the pilot efforts, Toolkit outputs were implemented directly into a municipal planning document underscoring the useful application of the Toolkit and demonstration effort. LID conceptual designs were developed for eight locations within the Cities of San Mateo and San Jose and delivered to those respective cities. Additionally, a webinar was held in July 2015 to introduce the Toolkit, its applications, and outputs to a larger number of municipalities. The webinar was well attended and had representatives from City of Richmond, City of Palo Alto, City of Fremont, Contra Costa County, City of Burlingame, and Caltrans as well as other municipalities. Maximum participation in the webinar was 43 participants (most likely more than 43 participants as some parties had multiple staff on the web conference).

Table 2: Green Infrastructure Master Planning

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|-------------------------|--|
| Project Goals | 2. Develop and complete Green Infrastructure Master Plans for participating municipalities |
| Desired Outcomes | 1. 2 municipalities adopt Green Infrastructure Master Plans – either stand alone or incorporated into current planning documents |

| | |
|--|--|
| Output Indicators | <ol style="list-style-type: none"> 1. Pages of applicable plans that show identification of LID sites and conceptual drawings 2. Meeting minutes and drafts of Master Planning documents 3. 8 LID conceptual designs |
| Outcome Indicators | <ol style="list-style-type: none"> 1. Pages of applicable plans that show identification of LID sites and conceptual drawings, 2. Links to municipal websites showing planning documents and use to municipality 3. Adoption of final plans |
| Measurement Tools & Methods | <ol style="list-style-type: none"> 1. Development of draft plans and conceptual designs 2. Tracking review/adoption process by municipality 3. Formal consideration by municipalities |
| Targets | <ol style="list-style-type: none"> 1. Selection of 2 municipalities that have agreed to develop master planning documents 2. Development of Green Infrastructure Master Plans 3. Development of at least 8 LID conceptual designs |

The primary outputs from the GreenPlan-IT Toolkit are maps of feasible and ranked sites for GI implementation, a table showing the total acreage of GI within each rank, a graphical output showing the cost benefit for various GI management scenarios, and a table showing how many GI features are needed within delineated catchments to reach water quality and hydrology goals. These outputs were provided to both partner Cities. The City of San Mateo implemented the output from the LID Siting Tool directly into their Sustainable Streets Plan (Appendix H-2, page 463 of <http://sustainablestreetssanmateo.com/wp-content/uploads/2015/06/San%20Mateo%20Sustainable%20Streets%20Full%20FINAL.pdf>). The Sustainable Streets Plan – is now final and will be part of the City’s future planning efforts.

The Green Plan Bay Area project was ahead of the planning efforts for the City of San Jose. Nonetheless, the City wanted to participate in the project as a pilot partner. The City will incorporate the outputs and findings into their Storm Drain Master Plan. This plan will “evaluate the capacity performance of City’s 1,150 miles of existing storm system and will provide a working document that will establish long-term solutions for deficiencies within the system to meet capacity and water quality objectives (<http://bairwmp.org/projects/city-of-san-jose-citywide-storm-drain-master-plan>). The City will complete this plan in 2017.

As noted above, the project included development of eight LID conceptual designs spread across the two partner cities. Once sites were identified, Google Street View was used combined with on-site reconnaissance together additional site information. The method was progressively refined as each site was investigated. It was found effective to first review the site via Street View, noting significant opportunities and information needs, especially regarding relative elevations. A satellite view of the area was then printed (11" x 17" format was used) for use in the field. Field visits provided an opportunity to refine and change the initially conceived design, while also confirming and updating features visible in Street View. The most important task for field visits was to determine (or confirm) the direction of runoff flow by measuring relative elevations. Estimates of cost for implementing the conceptual designs were also developed. The conceptual designs and costs were provided to the respective cities for their eventual installation.

Table 3: Education, Outreach, and Capacity-building

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| Project Goals | 3. Develop and disseminate outreach and education materials to stakeholders to ensure understanding and use of the LID Toolkit. |
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|--|---|
| Desired Outcomes | 1. Training of stakeholders and interested parties on toolkit use. 2. Development of outreach/educational materials in order to increase awareness of toolkit beyond the Bay Area |
| Output Indicators | 1. Development of outreach and educational materials 2. Webinar presenting and demonstrating the LID toolkit |
| Outcome Indicators | 1. Municipal and interested party participation in Webinar 2. SFEP Implementation committee or ABAG executive board, CASQA and BASMAA members participation in outreach presentations |
| Measurement Tools & Methods | 1. Count the number of individuals and organizations/ municipalities involved in Webinar 2. Collect qualitative feedback on Webinar 3. Track number of municipal and agency representatives at presentations |
| Targets | 1. Webinar demonstrating toolkit features and use attended by 8 or more municipal staff 2. Quarterly website updates to outreach/educational when applicable 3. Toolkit User's Guide 4. Presentations given 3 or more regional and/or state meetings |

The project team held an online webinar to showcase the Toolkit, its applications, data needs, and outputs on July 30, 2015. Seventy-nine participants including staff from various cities (Richmond, Oakland, Fremont, Sunnyvale, San Jose, Redwood City, Burlingame, Atherton, Palo Alto, San Mateo, Milpitas, Walnut Creek, Livermore, Dublin, Los Altos), countywide stormwater programs (Contra Costa County, Alameda County, San Mateo County, Santa Clara County), other districts (Santa Clara Valley Water District, Caltrans, California Department Of Transportation, BASMAA) signed up for the webinar. Due to limitations in the web conferencing software, we were not able to determine exactly who logged on to the webinar but the maximum number of participants during the webinar reached 43. Post webinar, we did send a survey to all signed up participants but only received two responses. The feedback from the survey respondents noted that:

- The tool was very robust
- The webinar was well done and slides were well thought out

One respondent noted that they would be using the Toolkit in the near future while the other respondent wasn't sure if they would utilize the Toolkit. One change we would implement in the future is to have some mechanism for identifying webinar participants.

The project team gave a presentation to the SFEP Implementation Committee on Wednesday, August 27, 2015. Members of the SFEP Implementation Committee members at this meeting included Tom Mumley (SFBRWQCB), Luisa Valiela (US EPA), Matt Fabry (San Mateo County). Additionally, the project team gave two presentations on the GreenPlan-IT Toolkit at: 1) the State of the Estuary Conference in Oakland on September 17, 2015 (the "Urban Greening of the Bay Area" session: <http://www.sfestuary.org/wp-content/uploads/2015/08/SOE2015ProgramV2.pdf>) and 2) the California Stormwater Quality Association (CASQA) conference on October 19, 2015 (see <https://www.casqa.org/asca/watershed-scale-planning-tool-optimal-selection-and-placement-green-infrastructure-urban>). At these two conferences, the project team provided Toolkit outreach and information to a host of municipal managers, technical staff, consultants, and other interested parties.

CONCLUSIONS – NEXT STEPS? WAS THE PROJECT TERMINATED? IF SO, WHY? LESSONS LEARNED.

The project concluded successfully with the GI planning and design support being well-received by the project's municipal partners. The next steps are: 1) to make additional enhancements to the GreenPlan-IT toolkit, 2) to assist more Bay Area jurisdictions in using the tools to create GI plans, and 3) to explore additional funding streams to facilitate widespread implementation. SFEI will reconvene a Technical Advisory Committee to help identify and prioritize upgrades, likely focused on quantifying estimated pollutant load reductions and maintaining simplicity without losing functionality. We are fortunate that the US EPA has awarded a \$1.7M follow-up grant from its SF Bay Water Quality Improvement Fund to these purposes. The workplan for this 3 ½ year grant also includes development of a GI Project Tracker GIS Database, standard GI design details for typical intersections, and a research paper describing recommended steps to integrate GI planning/implementation with transportation and greenhouse gas reduction programs and expenditures.

With participation from City staff, we are constantly learning that there is a spectrum of planning priorities that vary from city to city. Available municipal GIS data sets and hydraulic studies also vary from city to city. With the pending release of the new Municipal Regional Stormwater Permit (expected by the January 1, 2016), cities will be looking for tools that quantify specific pollutant load reductions (especially PCBs) associated with GI master planning. SFEI is looking to integrate other available models with this capability to the GreenPlan-IT toolkit.

APPENDICES

A. PLANS AND GENERAL COMPLIANCE

- A1 GPS INFO & TRANSMITTAL OF DELIVERABLES MEMO
- A2 PAEP
- A3 CEQA

B. PROJECT SPECIFIC REQUIREMENTS

- B1 PROJECT MANAGEMENT
- B2 TAC FINAL DELIVERABLES
- B3 TASK 3 DELIVERABLES:
 - 3.1 GREENPLAN-IT TOOLKIT DEMONSTRATION REPORT
 - 3.2 DELIVERABLES UPDATE MEMO
- B4 GREEN INFRASTRUCTURE MASTER PLANS
 - 4.1 PRELIMINARY MEETING MINUTES AND LIST OF SELECTED WATERSHEDS.
 - 4.2 TOOLKIT RESULTS AND MEETING MINUTES
 - 4.3 LIST OF RETROFIT SITES
 - 4.4 FIELD VERIFICATION OCCURRED ON APRIL 8, 2015 AND IS DISCUSSED IN 4.6
 - 4.5 LIST OF SELECTED SITES OF LID CONCEPTUAL DESIGNS
 - 4.6 MEMO ON GREEN INFRASTRUCTURE PLANS
- B5 POTENTIAL FUNDING MECHANISMS
 - 5.1 POTENTIAL FUNDING MECHANISM EVALUATION MEETING MINUTES
 - 5.2 GI FUNDING/ALTERNATIVE COMPLIANCE FUNDING (IN LIEU) MEMO
- B6 EDUCATION AND OUTREACH DELIVERABLES
 - 6.1 WEBSITE LINK FOR GRANT/GREENPLAN BAY AREA
 - 6.2 TOOLKIT USER'S GUIDE
 - 6.3 WEBINAR
 - 6.4 WEBSITE UPDATES
 - 6.5 PRESENTATIONS

C. CONCEPTUAL DESIGN REPORTS FOR 8 SITES/PROJECTS

- C1 LID CONCEPTUAL DESIGNS AND PROJECT DESCRIPTIONS FOR 8 SITES
- C2 REPORT ON LID CONCEPTUAL DESIGNS FOR 8 SITES

D. PROJECT REPORTING AND BUDGET INFO

- D1 PROGRESS REPORTS, EXHIBIT B, G1
- D2 ANNUAL PROGRESS SUMMARIES
- D3 BUDGET DETAILS
- D4 MATCH DOCUMENTATION