Grant Progress Report

Bay Area Green Infrastructure Master Planning Project
GA# 12-415-550

Progress Report # 4

Reporting Period: 4/01/2014 to 6/30/2014

Submittal Date 8/15/2014

Grant Agreement No: 12-415-550
Project Name: Bay Area Green Infrastructure Master Planning Project
Contractor Name: San Francisco Estuary Partnership / ABAG

I certify under penalty of law that this document and any attachment was prepared by me or under my direction in accordance with the terms and conditions of each Grant Agreement Exhibit. Based on my inquiry of the persons or persons who manage the project, or those directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. All information submitted in this document and all attachments conform to and is in accordance with the state and federal laws and I so here certify with my signature. I am aware that there are significant penalties for submitting false or misleading information.

Project Director: Judy Kelly – Printed Name Judy A. Kelly Signature

Summary of Work Completed To Date

Work Item	Items for Review	Critical Due Date	Estimated Due Date	Percent Work Complete	Date Submitted
EXHIBIT A – SCOPE OF WORK TO BE PERFORMED BY THE GRANTEE					
A.	PLANS AND GENERAL COMPLIANCE REQUIREMENTS				
1.	GPS information for Project site and monitoring locations	Day 90		100%	10/26/13
2.	Monitoring and Reporting Plan	N/A	N/A	N/A	N/A
2.1	Project Assessment and Evaluation Plan (PAEP)	Day 90		100%	10/26/13
2.2	Monitoring Plan (MP)	N/A	N/A	N/A	N/A
2.3	Quality Assurance Project Plan (QAPP)	N/A	N/A	N/A	N/A
2.4	Proof of Water Quality Data Submission to CEDEN	N/A	N/A	N/A	N/A
3.	Copy of final CEQA/NEPA Documentation	Day 90		100%	10/26/13
4.	Public Agency Approvals, Entitlements, or Permits	N/A	N/A	N/A	N/A
B.	PROJECT-SPECIFIC REQUIREMENTS				
1.	Project Management				
1.2	Notification of Upcoming Meetings, Workshops, and Trainings		15 Days In Advance		
2.	TAC				

2.1	List of TAC Members, Their Affiliated Organizations, and Their Roles and Responsibilities		November 2013	100%	12/2/13
2.2	Three (3) TAC Meeting Agendas, Sign-In Sheets, and Minutes		As Needed	100%	8/15/14
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	100%	12/31/13
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	100%	10/26/13
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	44% (4/9)	8/15/14
G.	REPORTS				
1.	Progress Reports within forty-five (45) days following the end of the calendar quarter (March, June, September, and December)		Quarterly	44% (4/9)	8/15/14
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			

Progress Report Narrative

GreenPlan Bay Area is a collaborative effort between San Francisco Estuary Partnership (SFEP), San Francisco Estuary Institute (SFEI) and several Bay Area municipalities. SFEI will develop spatial tools which will be used by several Bay Area municipalities to develop plans that 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 Green-Plan-it, will include four components: a GIS siting tool with user interface to determine site suitability, a watershed model to identify high-yield runoff and pollutant areas ('hot spot'), optimization techniques to search for optimal combinations of LID locations, types and configurations, and a post-processor to compile and display outputs in user-friendly formats.

After development, Green-Plan-it will be pilot tested in several municipalities/watersheds. The results of Green-Plan-it will serve as the basis for municipal Green Infrastructure Master Plans and/or a list of priority LID sites for each jurisdiction. Conceptual designs will be developed for 8 LID sites/projects. Jurisdictions will also collaborate with ABAG/SFEP to explore potential funding frameworks (such as alternative compliance programs) for LID retrofits.

Summary of Activities

- SFEP and SFEI held a Technical Advisory Committee meeting on June 17th in Oakland. Meeting agenda and summary are attached.
- SFEP and SFEI held a TAC conference call with participating municipalities and TAC members on July 2, 2014 to discuss prioritizing the suggestions and revisions to the GreenPlan-it toolkit that were proposed during the June 17th TAC meeting.
- SFEI continued development of the feasibility and the effectiveness modules of GreenPlan-IT, including consultations with technical advisors. This is documented in the attached SFEI quarterly progress report. The group utilized comments and suggestions made in the TAC meetings to refine and revise the functionality and contents of the GreenPlan-it modeling and GIS tools.
- SFEP staff continued research on Alternative Compliance program models.
- SFEP completed updates to the GreenPlan Bav Area webpage including meeting notes and agendas. www.sfestuary.org/greenplanning.
- SFEP revised the project PAEP as per direction from State Board. Revisions attached.

Summary of Items for Review

Invoice #4

Proiect Administration (Cumulative 44% complete)
Project administration during this quarter has included the completion of Invoice 4, project management including completing the quarterly report, updating the project website, reviewing project deliverables submitted by SFEI and attending team meetings.

Proiect Design (Cumulative 30% complete)
Project design included the tasks listed on the attached SFEI quarterly progress report as well as attending development meetings with staff from participating municipalities and SFEI; reviewing documents and providing input.

Proiect Deliverables

1. Exhbit B - G1 - Progress Reports (Cumulative 44%,4 out of 9 complete) - continues on a quarterly basis no delays or issues to report.
2. Exhibit A- A2.1Revised PAEP

Attachments

1. SFEI progress report #4 (Quarter 4 – April 1, 2014 through June 30, 2014)
2. Match Documentation: Annual C.3 Stormwater Workshop Agenda and presentation by SFEI 6-4-2014
3. TAC Meeting 6-17-2014 Agenda, summary and sign-in sheet
4. TAC Meeting 7-2-14 Agenda, summary and list of attendees
5. Revised PAEP

Summary of Items in Progress

SFEP

- Exhibit B - G1 Progress Reports - continues on a quarterly basis; no delays or issues to report.
- Exhibit A - B4.6 Evaluation of potential funding mechanisms - alternative compliance research)
- Exhibit A - B4.2 Toolkit results and secondary meeting minutes - meetings with San Jose and San Mateo to present GreenPlan-IT outputs
- Exhibit A - B4.3 List of Potential LID retrofit sites for field verification
- Revisions to PAEP (submitted with this report) and one year review of PAEP

SFEI

- Updating GreenPlan-IT Model
- Running updated GreenPlan-IT outputs for San Jose and San Mateo
- Setting up future TAC meetings
- Exhibit A - B2.3 TAC status report

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SFEI Green Infrastructure Master Planning Project Quarterly Progress Report
April - June 2014

Task 1: Project Assessment and Evaluation Plan

Work Completed during the Period

- No work completed on this task during Quarter 2 2014. However, Dave Senn and Pete Kauhanen billed to an incorrect task during the quarter. There is a negative entry within the task to show that hours were moved from task 0012 task 003.

Task 2: Technical Advisory Committee

Work Completed during the Period

SFEI prepared for and held the 2nd project TAC meeting.

- Preparation included developing questions for each toolkit module (site locator tool, modeling, optimization) in order to get guidance and input from the technical advisory team.
- Presentations for each toolkit module were drafted, reviewed, and finalized. Presentations included project background, project goals, methodology, progress to date, graphics development, next steps, and questions. All presentations were submitted to the State Board.
- Staff worked with Jennifer Walker (a consultant on this project) in preparation for the TAC meeting. Jennifer Walker of WatEarth provided information on LID features in the SWMM model and helped prepare the modeling presentation for the TAC.
- The TAC meeting was held on June 17, 2014.
- A meeting summary document was drafted and sent to the State Board along with the attendance list.

SFEI prepared for and held the 3rd project TAC meeting.

- This meeting focused on follow-up items from the June 17 meeting and presented a spreadsheet noting TAC recommendations and next steps for the site locator tool. The meeting also focused on getting guidance and input on the optimization module.
- This TAC meeting was held on July 2, 2014. The meeting summary is attached.

Task 3: LID Toolkit

Work Completed during the Period

SFEI continued to hold internal meetings to check in on project progress, discuss technical questions, and plan project next steps.

Staff continued to work with Jennifer Walker of WatEarth. Tasks completed included:

- Provided model troubleshooting assistance on SWMM model
- Provided technical support on hydrologic and LID parameters
- Researched modeling parameters
- Provided technical support on model calibration
- Provided technical support on modeling water quality performance of LID and pollutants
- Provided technical support on LID features and configurations
- Reviewed results and provided feedback

Staff completed a project progress report on the cost-benefit analysis module and submitted to SFEP for review.

Staff finalized the 1st draft of the modeling tool which mostly focused on model calibration (sediment and hydrology data) during the 2nd quarter. Staff continued to QAQC the model and work to verify model outputs. The hydrology model calibrated well and we consider this model to be stable and a good working draft. The sediment model had acceptable calibration and we are continuing to try and improve the sediment model.

Staff ramped up on the development of the site locator tool infrastructure. Pertinent GIS data layers were solicited and collected from partner cities (San Jose and San Mateo) and added to the project GIS library. A draft schematic for module structure, input parameters, and function was developed. This module is based on a series of GIS layers that act as opportunities and constraints for siting LID in the landscape. These data layers can be weighted by each municipality according to their priorities which will affect the final rankings of the site locator tool output. A pilot run of the module was completed for San Jose and presented at the TAC meeting. Review and guidance was solicited from the TAC and feasible recommendations were incorporated into a workplan for the locator tool. Post TAC meeting, staff began developing the GIS data layers for the city of San Mateo.

Staff held a phone conference with the city of San Mateo to discuss the city's needs of the site locator tool as well as timing needs for the site locator output. Available GIS layers were also discussed and subsequently collected for implementation into the site locator module. Staff also requested GIS data layers from ABAG which included a Bay Area map of priority development areas. Staff also began review of regional data layers that could be incorporated into the module.

Task 4: Green Infrastructure Master Plans

Work Completed during the Period

Staff began planning for summer fieldwork to ground truth draft output from the site locator tool.

Task 5: Education and Outreach

Work Completed during the Period

Staff prepared for and gave a presentation, on this project, at the ANNUAL C.3. STORMWATER WORKSHOP hosted by the Santa Clara Valley Urban Runoff Pollution Prevention Program (agenda attached). Staff presented on the goals and planned outputs for the 3 toolkit modules.

Match Total - GreenPlan Bay Area - Quarter 4 (April 1, 2014 - June 30, 2014)		
Bay Area Green Infrastructure Master Planning Project **GA# 12-415-550**		
Activity	**Date**	**Total Match**
SCVURPPP C3 Annual Stormwater Workshop 106 total participants (not including SFEP or SFEI staff) 0.5 hours @ $100 per hour.	6/4/2014	$5,300
	TOTAL MATCH QR4	**$5,300**

Santa Clara Valley
Urban Runoff
Pollution Prevention Program

ANNUAL C.3. STORMWATER WORKSHOP:

"Current Trends in Low Impact Development and Green Street Implementation"

Wednesday, June 4, 2014

Campbell Community Center, Orchard Banquet Hall - 1 West Campbell Avenue, Campbell, CA

WORKSHOP AGENDA

8:00 AM	Early Registration for Basic Training (and Refreshments)	
8:15 AM	**Pre-Workshop Basic Training** – Stormwater Controls for Development Projects	Jill Bicknell *SCVURPPP*
9:00 AM	Registration (for registrants not attending Basic Training)	
9:30 AM	**Main Workshop** -- Welcome and Introduction • Update on Current and Future Stormwater Permit Requirements	Jill Bicknell *SCVURPPP*
	• Site Design for Protecting Water Quality – 2014 Award Winning Projects	Vishakha Atre *SCVURPPP*
10:10 AM	Experiences Reviewing Stormwater Control Plans and Conducting Treatment Measure Inspections	Caitlin Gilmore/Robin Lee *Schaaf & Wheeler*
10:50 AM	**Break**	
11:00 AM	Panel Presentation – Implementation of Low Impact Development (LID) Requirements in Local Projects	
12:00 PM	**Lunch and Vendor Exhibits**	
1:00 PM	GreenPlan Bay Area	Staff from SFEI/SFEP
	Developing a Long-term Green Streets Plan	Peter Schultze-Allen
	Funding Sources for Green Street Projects and implementation challenges *(e.g., internal approvals, coordination with other agencies. San Jose has a number of grant funded green street projects)*	Peter Schultze-Allen /San Jose staff
2:30 PM	**Panel Presentation: Green Street Projects in the South Bay**	
	Hacienda Avenue, Campbell	Campbell staff
	Southgate Neighborhood, Palo Alto	Shari Carlet *Palo Alto*
	San Jose projects	San Jose staff
3:30 PM	Adjourn	

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Green Plan-IT Technical Advisory Committee (TAC)
Meeting Agenda

June 17th, 2014, 10:00am – 2:30pm
1515 Clay St., Oakland, CA
Room 9, 2nd Floor

Item	Title	Time	Staff
1	**Introduction** • Welcome, introductions, ground rules • Goals for today's meeting: review desired outcomes, list of questions to be resolved	10:00	Lester McKee
2	**Overview of the project inception and overall goals and component** • Set the scene more broadly to provide context for today's focus • Projected timeline and deliverables Desired outcome: Informational update	10:10	Lester McKee/ Jennifer Krebs
3	**LID Site Locator Tool development (Suitability)** • Summarize base model • Summarize new additions to the tool • Summarize progress to date and challenges • Summarize next steps and likely challenges Desired outcome: Advice and review (5 minutes of summary thoughts from each advisor in relation to the key questions)	10:30	Patty Frontiera/Pete Kauhanen
4	**LID Modeling Tool development (Hydrologic model)** • Summarize model development steps • Summarize progress to date and challenges • Summarize next steps and likely challenges Desired outcomes: Advice and review (5 minutes of summary thoughts from each advisor in relation to the key questions)	11:30	Jing Wu
	Lunch (not provided, can be purchased at local cafe)	12:30	
5	**LID Optimization Tool development (linking site locator, modeling, and optimization through statistical optimization)** • Summarize overall general methodology (high level workplan steps) • Summarize progress to date and challenges • Summarize next steps and likely challenges Desired outcome: Advice and review (5 minutes of summary thoughts from each advisor in relation to the key questions)	1:00	Jing Wu
6	**Synthesis of the day** Desired outcomes: Recap areas of agreement, outstanding issues, information gaps, and action items	2:00	Lester McKee
7	**Plan next meeting**	2:20	Jennifer Hunt / Jennifer Krebs
8	**Adjourn**	2:30	Lester

GreenPlan Bay Area

GreenPlan TAC meeting

June 17, 2014

Welcome and introductions

- Who's in the room?
- Lunch Café
- Toilets

Green Plan Bay Area overview

- Prop 84 grant fund
- Project team
  - SFEP – grant management & master plan lead
  - SFEI – technical lead on tool kit development
  - Jennifer Walker – modeling support
  - Dan Cloak – landscape designs
  - San Jose, San Mateo – partnering municipalities
- Timeline
  - Funding started in August 2013
  - Toolkit user guide and documentation by May 2015

Green Plan Bay Area overview

- Project goals
  - Develop a set of tools to identify optimal locations to implement LID – GreenPlan-IT
  - Develop master plans for partnering municipalities based on the results of GreenPlan-IT
  - Conceptual designs for selected LID types
  - Identify alternative funding opportunities to realize LID implementation
  - Public outreach

GreenPlan to-date

- Kick Off Meeting (first TAC meeting 9/13)
- Survey of Municipalities as to GreenPlan needs, interest in being a “Master Planning Agency”, data sets available
- Selection of San Jose and San Mateo (City) as Master Planning Agencies

Next TAC

- Fall 2014 (likely)
- Status of GreenPlan Documents for San Jose & San Mateo
- Regional Questions about Siting Documents and Alternative Compliance Program
- Additional GreenPlan-IT updates

Objectives of todays meeting

- Provide a "look under the hood" at the GreenPlan-IT tool to local stakeholders, other observers, and technical advisors
- Receive advice and review on "key questions"
  - On technical matters
  - To ensure the products are successful
- Be collegiate and explore with us
  - Keep comments concise
  - Don't restate what others have said – say I agree
  - Do you part to keep the meeting on schedule!

Structure of todays meeting

- During each item on the agenda
  - Presentation by project staff
  - General discussion
  - Key TAC advisors provide recommendations

- TAC
  - Dino Marshalonis – US EPA
  - Matt Fabry – San Mateo County
  - Sarah Sutton – Placeworks
  - Keith Lichten – Water Board

- Moderator (Lester) will move us along if the discussion morphs towards a later item

Key meeting questions

- See Handout

Key Meeting Questions

Agenda Item 3: LID Site Locator Tool development (Suitability)

1. Add one more LID treatment type?
    a. Infiltration trench.
    b. Other?

2. What data would you recommend including?
    a. Opportunities, constraints, knockout constraints?
    b. Default values?

3. We are developing two analysis modules to identify specific street and parking lot locations that will support certain LID types. Can you recommend other analysis modules that we should consider?

4. Does the tool logic seem sound?
    a. Will it produce useful results?

Agenda Item 4: LID Modeling T*ool development (Hydrologic model)*

1. Is the model sufficiently calibrated for the purposes of supporting the optimization component?

2. How do we deal with pollutant reduction since SWMM has no built-in mechanism to simulate it?

Agenda Item 5: LID Optimization Tool development (linking site locator, modeling, and optimization through statistical optimization)

1. What optimization technique should be used?
    a. Genetic Algorithm

2. What should be targeted reduction goal?
    a. Flow - peak, volume?
    b. Pollutants – PCBs, Hg?

3. What type of storm event should be used for optimization?
    a. 2-year design storm suggested by San Jose (1.86 inch with 24 hour duration)

4. What types of LID should be included in optimization?
    a. Bioretention, Infiltration trench, Porous pavement

5. Should Grey infrastructure be considered as an option? If so, what kind? San Jose suggested large bioretention with storage

6. Do we need to set upper limit for # of LID implemented or %impervious area treated?

7. How to drive cost function for optimization? Unit cost approach in literature, but cost differs by location. How should we take that into account?

8. Scale issue: Currently sub-basins range from 20 to 150 acre because of size of development area. Not spatially explicit enough to pinpoint specific LID locations. How should we handle this issue? Use siting tool for further guidance?

GreenPlan Bay Area

GreenPlanIT TAC meeting

June 17, 2014

Why GreenPlan Bay Area?
Impaired Water Bodies

- San Francisco Bay
  - High priority: PCBs, Hg
  - Dioxin/furans, Se
  - Emerging contaminants
- Local tributaries
  - Pesticide related toxicity
  - Fipronil
- Hydro-modification

MRP 2.0 (2015-2019)

- C.3.
  - Considerable effort to implement Green Infrastructure (GI/LID) at watershed and regional scales
    - Default: Implement LID for all road related projects
    - Or produce a watershed plan to identify opportunities outside of the road foot print.
- C.8.
  - Quantify and track pollutant concentrations/loads: Focus shifting to characterizing more watersheds
    - 6 detailed study sites/yr → 25 "reconnaissance" sites/yr.
- C.9. , C.10., C.11. & C.12.
  - Broad scale implementation to remove or abate pollutants at source or near source

LID implementation challenges (re MRP 1.0 & 2.0 implementation)

- Permits require LID implementation yet no regional planning to provide guidance on where, why, how, and the likely benefits
  - LID not part of muni Capital Improvement Plans (CIP) or infrastructure upgrades
  - LID not in planning/development funded by the Metropolitan Transportation Commission (MTC)
  - Many State grant programs require a plan before funding LID implementation
- The lack of planning and design of effective and economically viable LID sites is a major barrier to optimal LID implementation

Outputs not outcomes…

- LID placement has been opportunistic (random acts of kindness) – lacking considerations for:
  - Prolonging existing grey infrastructure lifetime
  - Pollutant sources and treatment
  - Historic (intrinsic) landscape function
  - Consideration of broad multiple benefits
    - Urban heat issue
    - Riparian flows and biological habitat & connectivity
    - Greenhouse gas emissions
    - Water reuse/ supply reliability
    - Applicability to future pollutants of concern

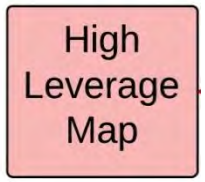
Managers and policy makers ask…

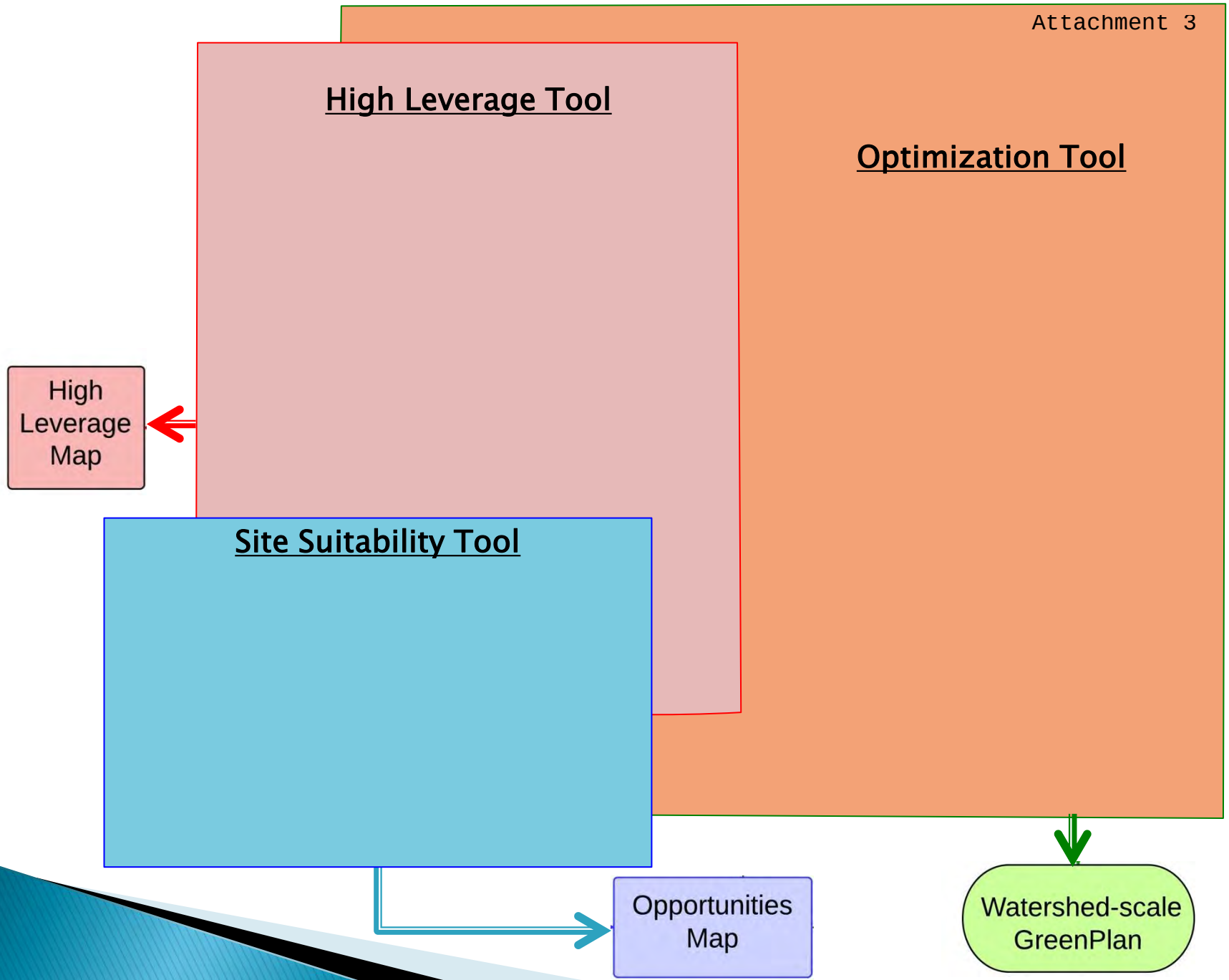
- Where? (Suitable & Effective locations)?
- What improvements in WQ can be made with public funding $$?
- Are these improvements cost-effective, or which ones in what combinations are most cost effective?

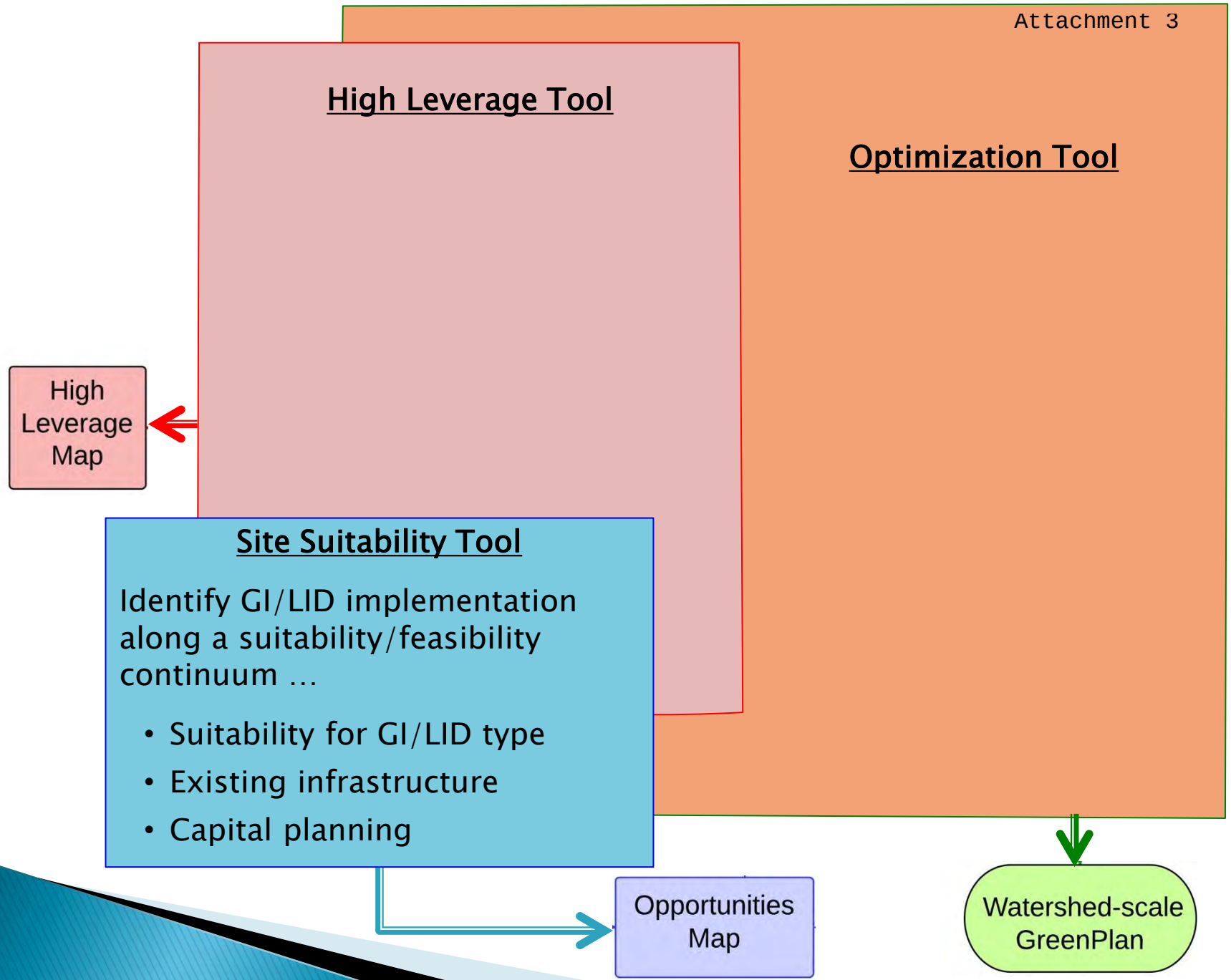
GreenPlanIT Overarching Goals

Develop a set of linked planning tools for local governments

- Opportunity sites for GI/LID
- High-leverage areas for installing LID
- Optimized plans for implementing GI/LID




High Leverage Tool
Optimization Tool
High Leverage Map
Site Suitability Tool
Opportunities Map
Watershed-scale GreenPlan


High Leverage Tool
Optimization Tool
High Leverage Map
Site Suitability Tool
Identify GI/LID implementation along a suitability/feasibility continuum …
• Suitability for GI/LID type
• Existing infrastructure
• Capital planning
Opportunities Map
Watershed-scale GreenPlan

High Leverage Tool

Identify areas expected to yield the most runoff or contaminants through

- Hydrol./contaminant modeling;
- GIS-based approach; or
- Both

High Leverage Map

Optimization Tool

Site Suitability Tool

Identify GI/LID implementation along a suitability/feasibility continuum …

- Suitability for GI/LID type
- Existing infrastructure
- Capital planning

Opportunities Map

Watershed-scale GreenPlan

High Leverage Tool

Identify areas expected to yield the most runoff or contaminants through

- Hydrol./contaminant modeling;
- GIS-based approach; or
- Both

High Leverage Map

Optimization Tool

Identify combination(s) of GI/LID that achieve objectives at the best cost

- Simulate multiple scenarios
- Estimate effectiveness and cost of each scenario
- Zero in on optimal approaches for achieving various objectives
- Use optimization output with Opportunities to identify…

Site Suitability Tool

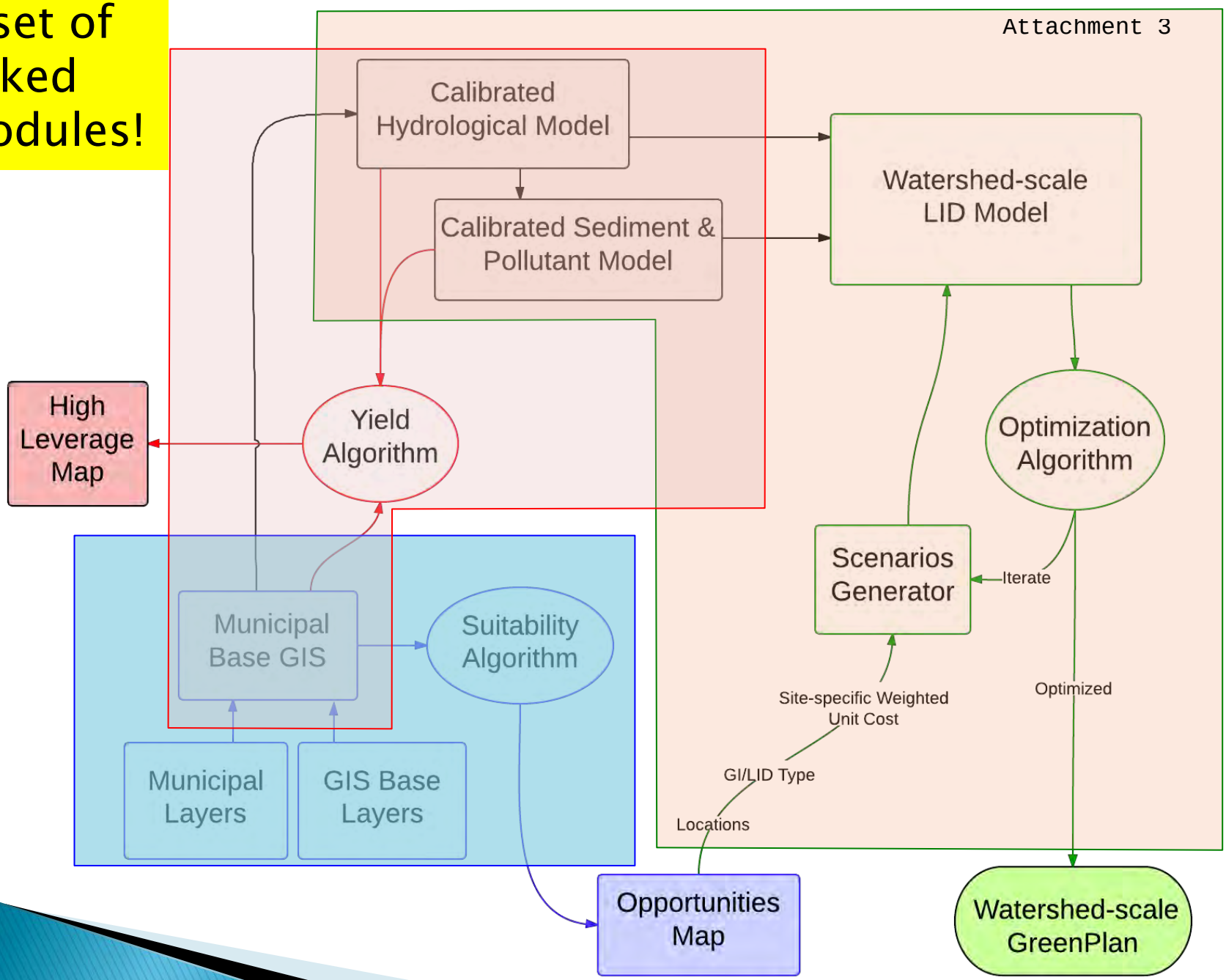
Identify GI/LID implementation along a suitability/feasibility continuum …

- Suitability for GI/LID type
- Existing infrastructure
- Capital planning

Opportunities Map

Watershed-scale GreenPlan

A set of linked modules!



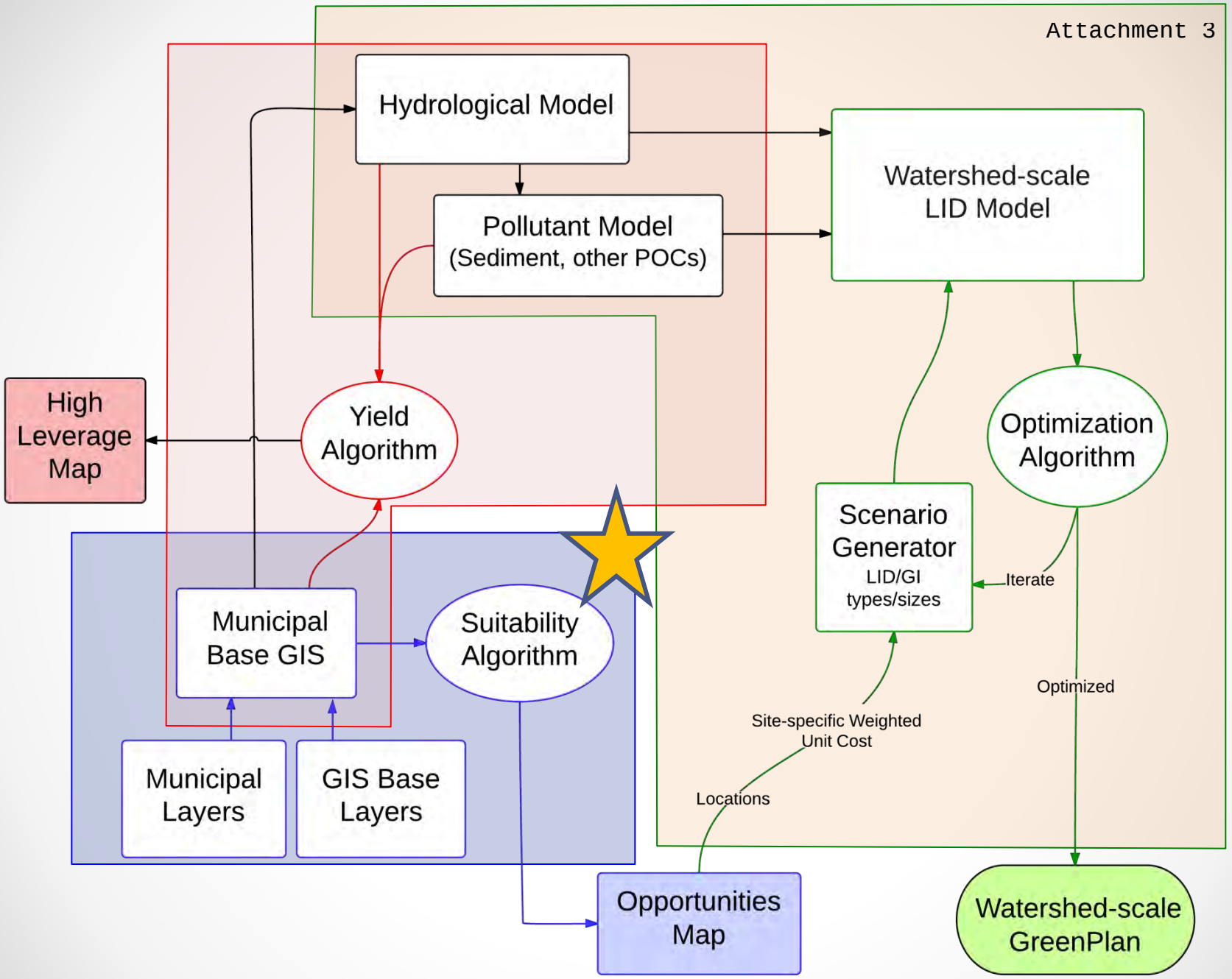
Definition of Success!

- Success if the tools are:
  - A balance between “simple” to operate and complex enough to generate useful outcomes
  - Locally applicable
  - Regionally transferable
  - Implementable

GreenPlanIT
LID Site Suitability Tool

Patty Frontiera, pattyf@sfei.org
Pete Kauhanen, petek@sfei.org
Marshall Kunze, marshallk@sfei.org

GreenPlanIT TAC Meeting, 06/17/2014


Hydrological Model
Pollutant Model
(Sediment, other POCs)
Watershed-scale
LID Model
High
Leverage
Map
Yield
Algorithm
Optimization
Algorithm
Scenario
Generator
LID/GI
types/sizes
Iterate
Municipal
Base GIS
Suitability
Algorithm
Optimized
Site-specific Weighted
Unit Cost
Municipal
Layers
GIS Base
Layers
Locations
Opportunities
Map
Watershed-scale
GreenPlan

LID Site Suitability Tool

- Talk Outline
  - Our questions
  - Overview of the tool
  - Example of the tool with City of SJ data
  - Discussion of our questions

Our Questions for the TAC

- Add one more LID treatment type?
- What key data / analysis factors should be considered to identify and prioritize locations suitable for LID?
- Site Specific LID Refinements
  - We are developing two analysis modules to identify specific street and parking lot locations that will support certain LID types. Can you recommend other analysis modules that we should consider?
- Does the tool logic seem sound?
  - Will it produce useful results?

LID Site Suitability Tool

- Goal: identify potentially suitable sites for LID implementation
- Objectives: practical, flexible, broadly applicable, freely available, and useful
- Requires local data and knowledge, GIS software, staff
- The utility and limitations of the Siting Tool and analyses are driven by the underlying data as well as the tool logic

LID Site Suitability GIS Tool Components

- ArcGIS python scripts that will be accessible in the ArcGIS toolbox
- Configuration files defining suggested local layers and default parameters
- Data layers
  - Local + regional base analysis (Kass et al, 2011)
- Documentation on how to use and extend the tool

Building upon previous work

- 2011 regional GIS analysis for LID treatments – the base analysis
  - Kass et al. (2011). White Paper on Regional Landscape Characterization for Low Impact Development Site Suitability Analysis . SFEI.
- Regional Base Analysis Method

Regional Base Analysis Method

Bioretention

Wet Pond

Permeable Pavement

Vegetated Swale

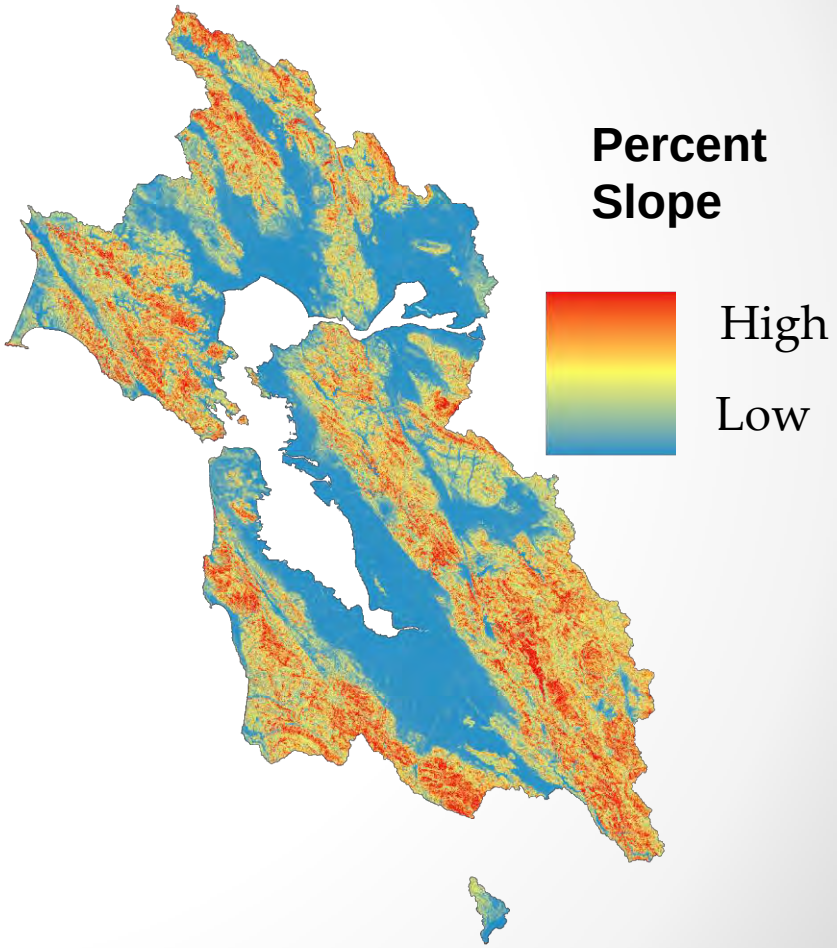
Stormwater Wetland

Identified 5 LID Treatment Types

Regional Base Analysis

Landscape factors that affect LID siting

1. Depth to groundwater
2. Slope
3. Soil type
4. Land use
5. Liquefaction



Study Area: SF Bay Regional Water Board boundary

Categorical Weighted Overlay

variables		bins	OVERLAY VALUES (1-low -> 3-high)				
			BIOR	SWWT	WTPD	VGSW	PRPV
27	depth to ground-water	0-2 ft	x	3	x	x	x
		2-3 ft	x	2	1	x	x
		3-5 ft	1	2	1	1	2
		> 5 ft	3	1	3	3	3
27	slope	0-2 %	3	3	3	3	3
		2-3 %	3	2	3	3	2
		3-5 %	2	2	2	3	1
		5-7 %	2	1	2	2	x
		7-8 %	1	1	1	2	x
		8-10 %	1	x	1	2	x
		10-12 %	1	x	x	1	x
		12-15 %	x	x	x	1	x
		> 15 %	x	x	x	x	x
20	soil hydrologic type	A	3	1	1	3	3
		B	3	1	1	3	3
		C	2	2	2	3	2
		D	1	3	3	3	2
16	land use	residential	3	2	3	3	2
		commercial	3	2	2	2	3
		open space	2	3	3	3	x
		agriculture	1	3	2	3	x
		transportation	3	2	2	3	3
		industry	1	1	1	1	1
10	risk of lique-faction	very low	3	3	3	3	3
		low	3	3	3	3	3
		medium	3	3	3	3	3
		high/very high	1	1	1	1	1

LID treatments

weights

cell values

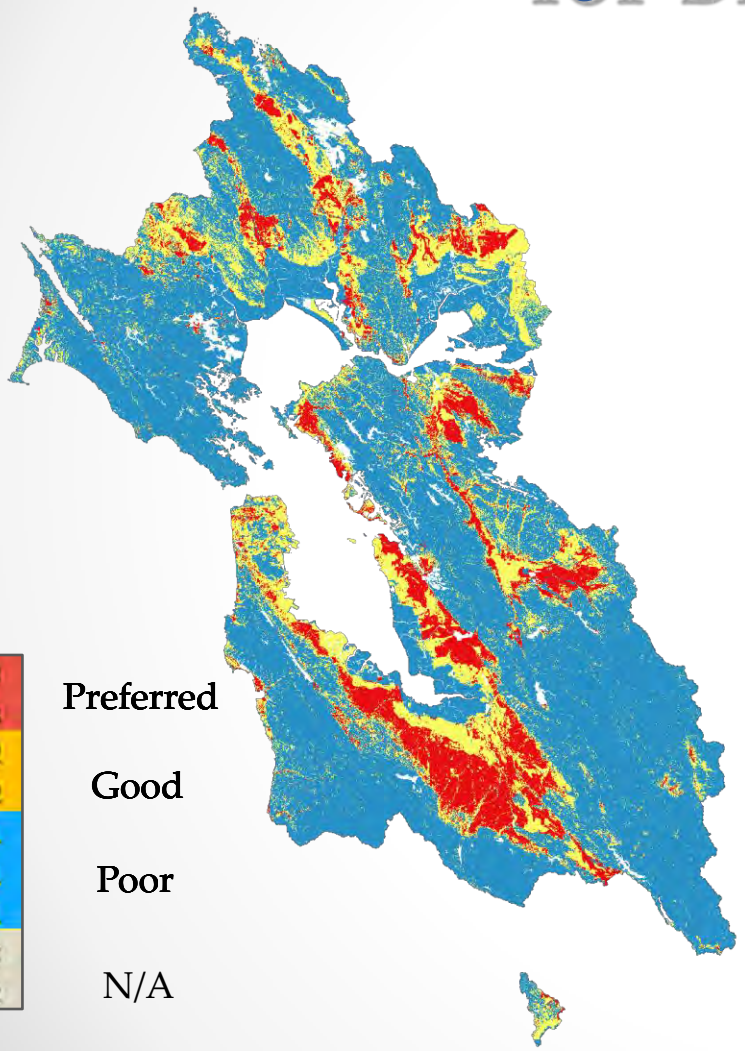
3 3 Preferred

2 2 Good

1 1 1 Poor

x x N/A

Regional Base Analysis Output for Bioretention



3 Preferred
2 Good
1 Poor
x N/A

x = 3 (BEST)

area > 1000 sq ft

LID Site Suitability Tool

Enhancements

- Incorporate Regional Base Analysis
  - Add additional LID treatment type(S) to Base Analysis
- Allow users to add local-scale data
  - 2 partners – Cities of San Mateo and San Jose
- Allow user to customize parameters
  - But recommend defaults based on expert input
- Tool generated outputs:
  - GIS layer per LID type
  - Tabular report summarizing parameters
- Verification of Siting Results
  - Desktop Reconnaissance
  - Field Verification

LID Site Suitability Tool

Prep work:
Goals, Data, local expertise

Regional Base Analysis Module

Extend | Configure | Use

LID Best suitability polygons (1/0)

X	LID1: BIOR
X	LID2: SWWT
	LID3: WTPD
	LID4: PRPV
X	LID5: VGSW

Local Knock-out Constraints
Exclusion Model + (config table2)

Layers to remove from priority areas	buffer(ft)
Building Footprints	0
High Pressure Gas Lines	10
Existing LID	
Open Water	

Local Siting Refinements
(Local data + Add-on Modules)

Location Type (1/0)	*LID 1*	*LID 2*	*LID 5*
Wide Streets	0	1	1
Wide Sidewalks	0	1	1
Pedestrian Streets	1	1	1
Uncovered Parking Lots	1	0	1
Publicly owned open space			

INTERSECT

ERASE

INTERSECT

Local Opportunities and Constraints:
Additive Model + (config table1)

weight	*Factor*	*weight*	*Priority Layer*	*LID 1*	*LID 2*	*LID 5*
1:nf	local development	1:nl	Priority Development Areas	1	1	1
		1:nl	Capital Improvement Projects	1	1	1
		1:nl	Recently retrofitted streets	0	-1	0
		1:nl	Proximity to storm drains	1	1	1
1:nf	Water Quality	1:nl	Pollutant loading			
		1:nl	Proximity to wetlands, streams			
		1:nl	Areas of known floodding			
1:nf	Community Needs	1:nl	Park and open space deficits			
		1:nl	Population density			
		1:nl	High crime areas			
1:nf	Conservation	1:nl	priority Habitat/biodiversity areas			
		1:nl	Connectivity / linkages			

Tool Outputs

- One layer per selected LID type
- Summary report

Site Visit

Model Refinement

Iteration

Key Municipal Data Layers

- **Streets**, transportation
- **Parcels with ownership**
- **Building footprints**
- **Parking lots**
- **High pressure gas lines**
- Storm drains and sizes
- **Land use**
- Open space
- Slope, elevation
- **Aerial Imagery**
- Soils / geology
- **Priority development areas**
- Impervious surfaces
- **Capital improvement projects**
- Habitat conservation areas, biological diversity
- Floodways
- Liquefaction zones
- City Tree Inventory
- Existing LID

Tool Add-on Analysis Modules

- Streets Analysis Module
- Parking Lot Analysis Module

Given required input layers, these tools can generate new outputs that can be used to refine the suitability analysis.

Streets Analysis Module

Street centerlines with FOC and ROW

FOC >= 36’ Buffer by ½ FOC (residential and commercial)
*customizable

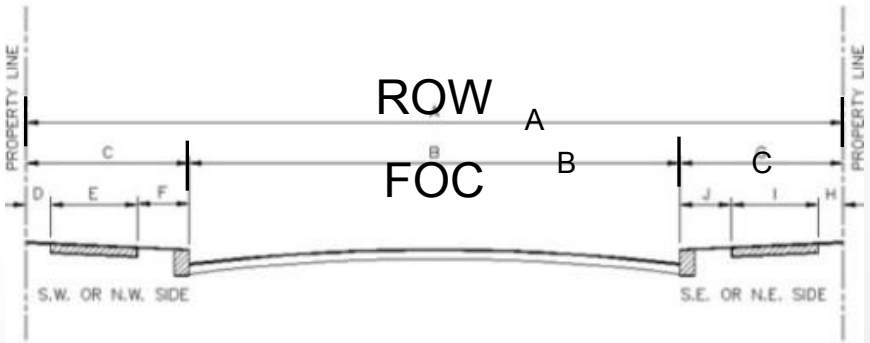
Wide Streets

ROW-FOC >= 26' Buffer by 1/2 ROW and erase buffer of 1/2 FOC (residential and commercial)
*customizable

Wide Sidewalks

Class = PA with buffer

Pedestrian Streets



Parking Lot Analysis Module

Parking lots (or OSM) Building footprints

→

Parking where >50% of area is not-building; and size of polygon (parking with building footprint is erased) >= 7000sqft
*customizable

→

Uncovered Parking

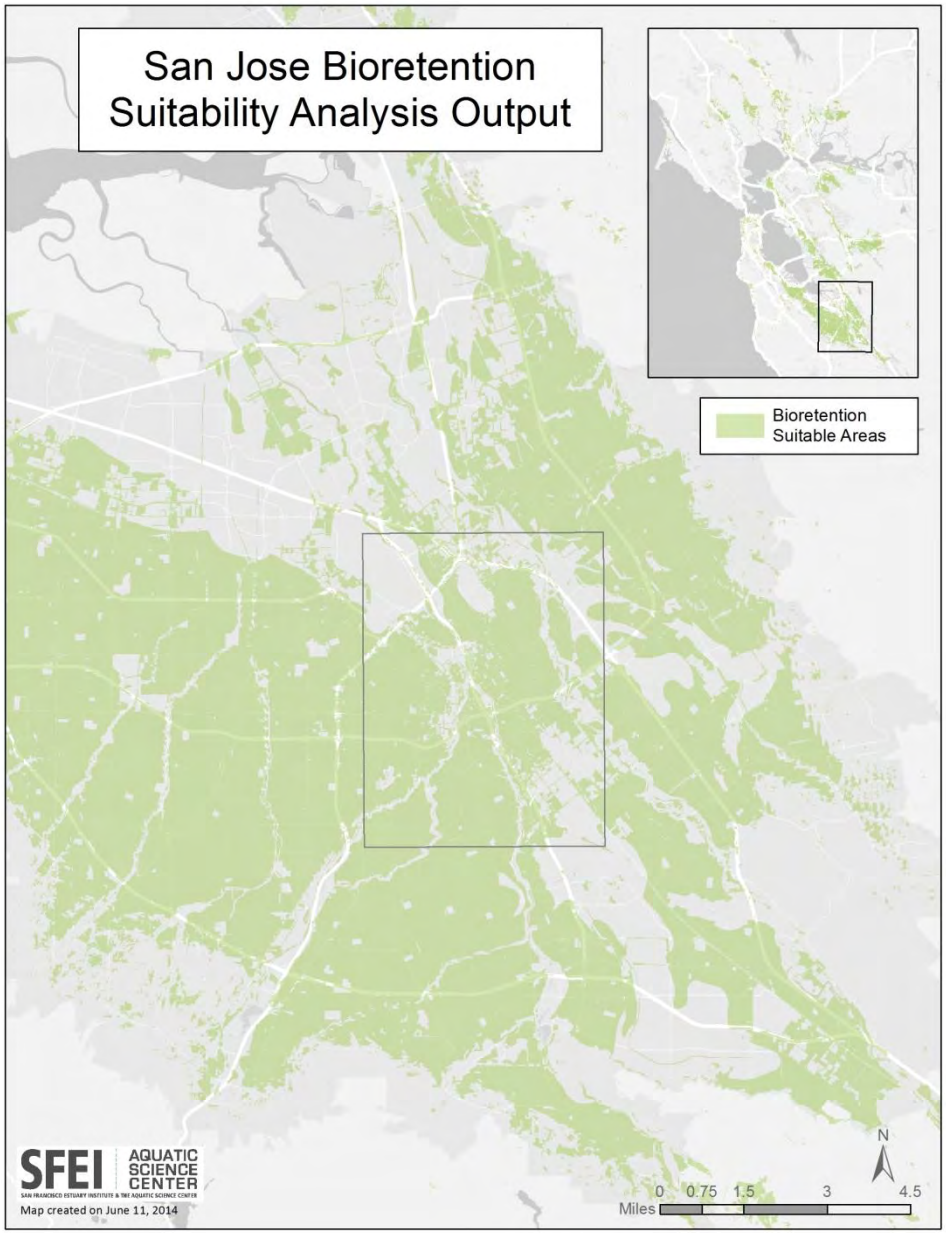
Example: City of San Jose

- Vegetated Swale
- Bioretention

VEGETATED SWALE

BIORETENTION

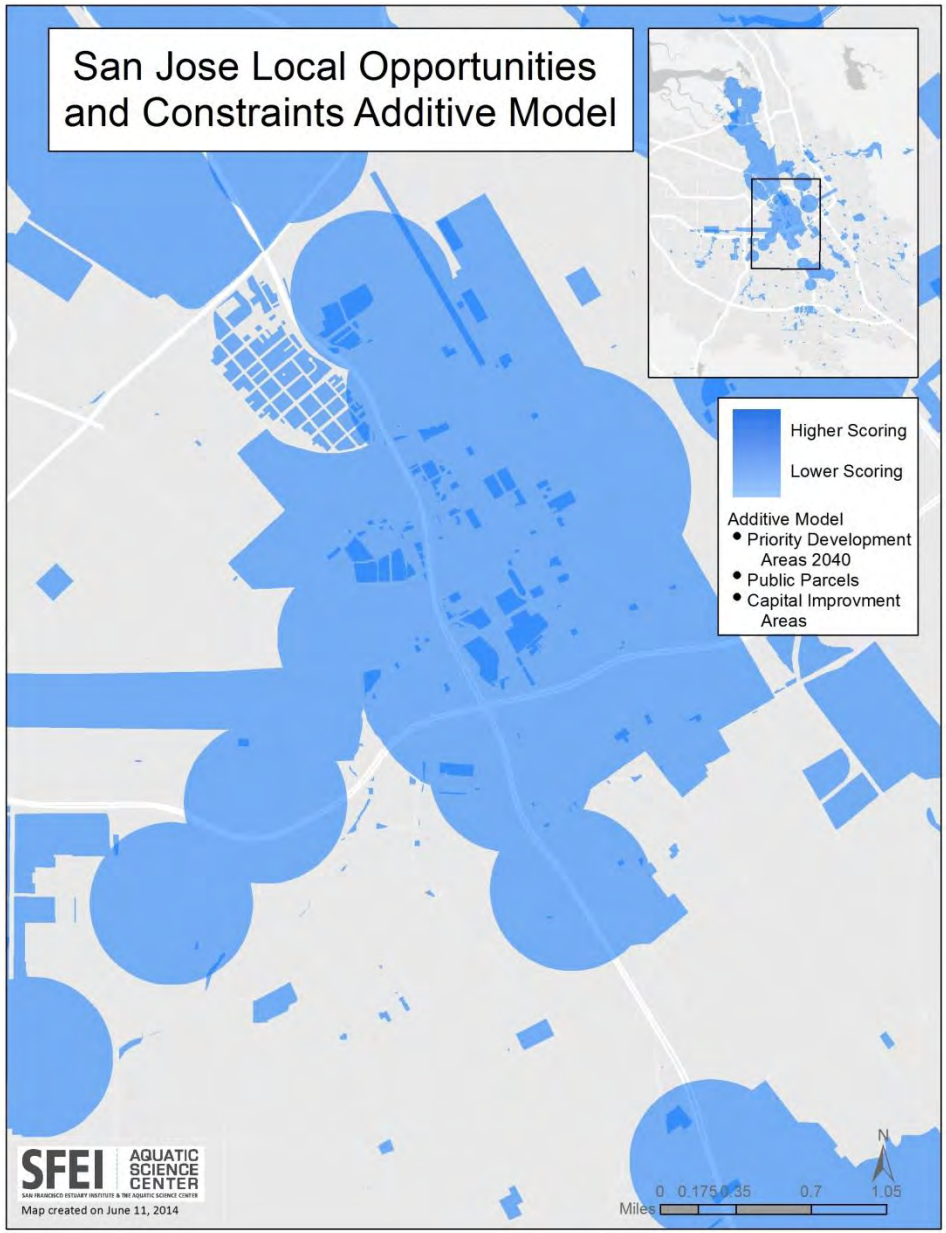
Attachment 3

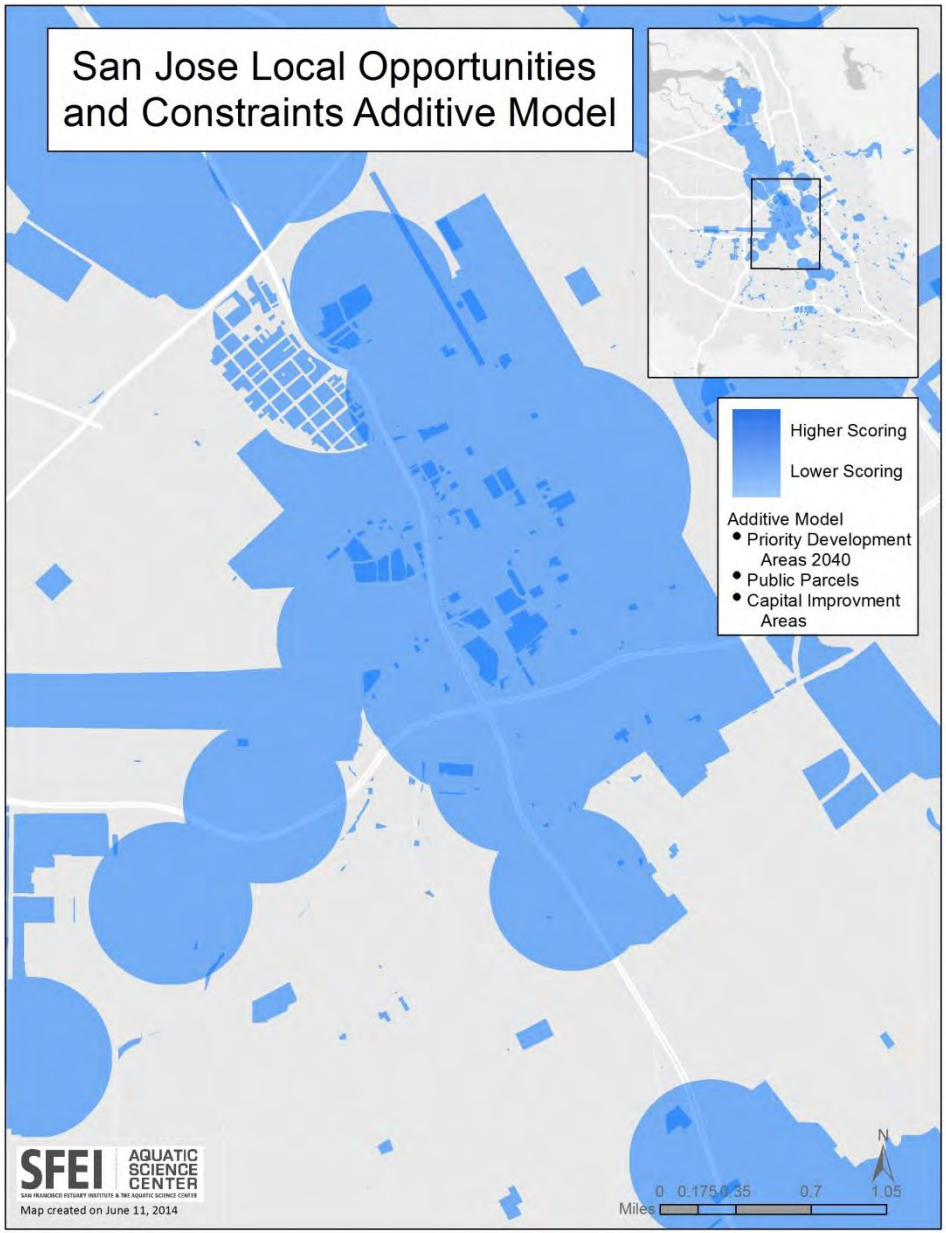


VEGETATED SWALE

BIORETENTION

Attachment 3





VEGETATED SWALE

BIORETENTION

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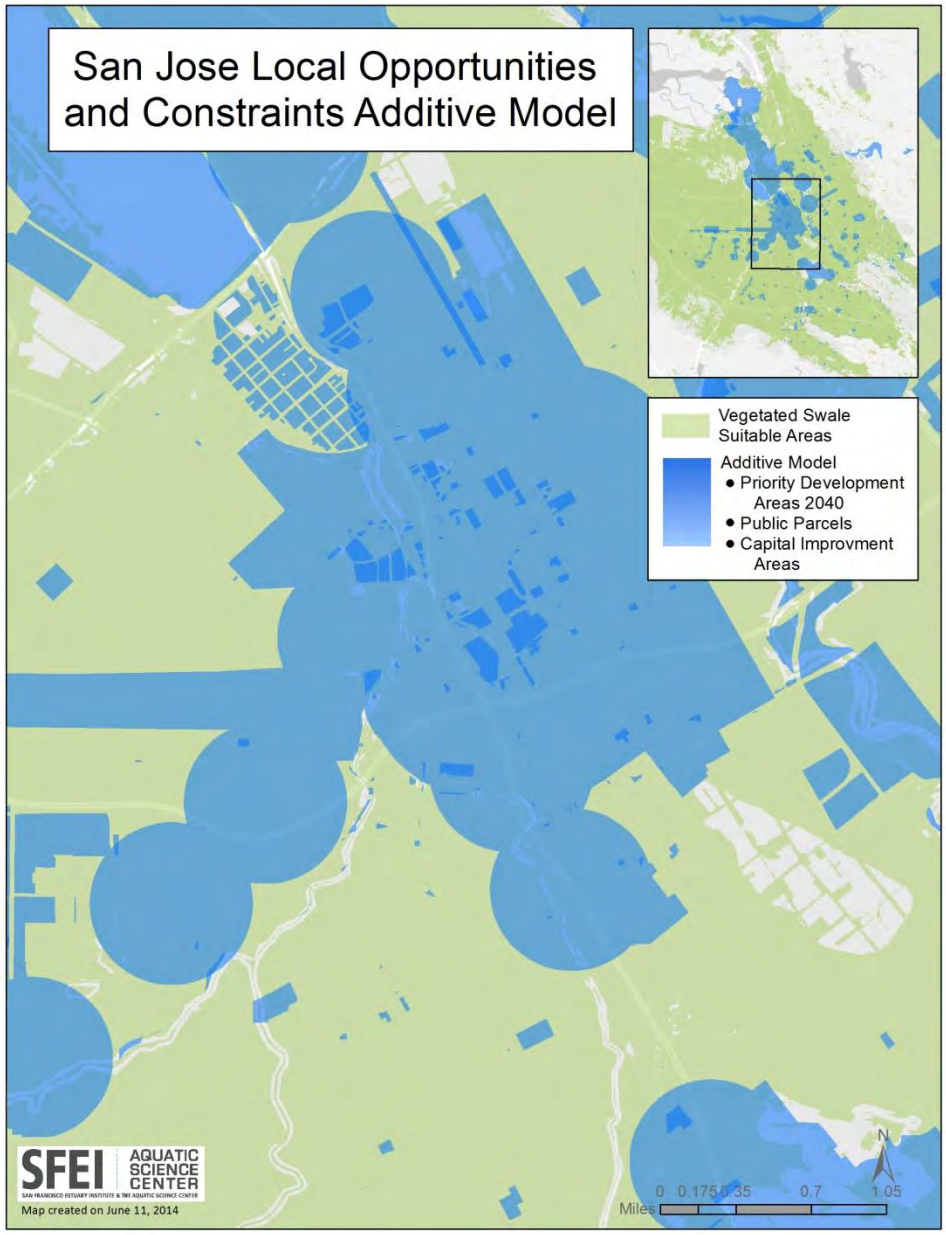
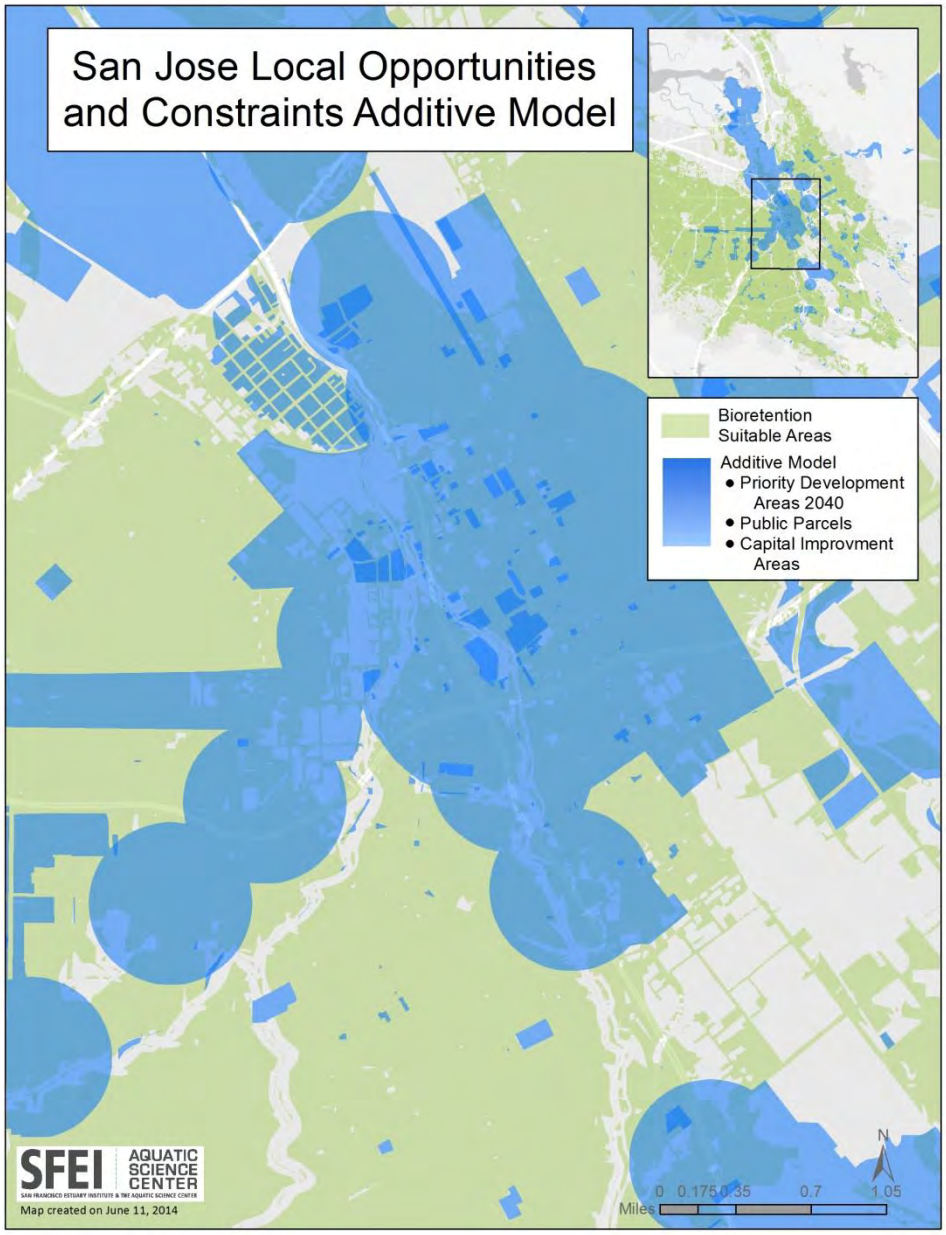




VEGETATED SWALE

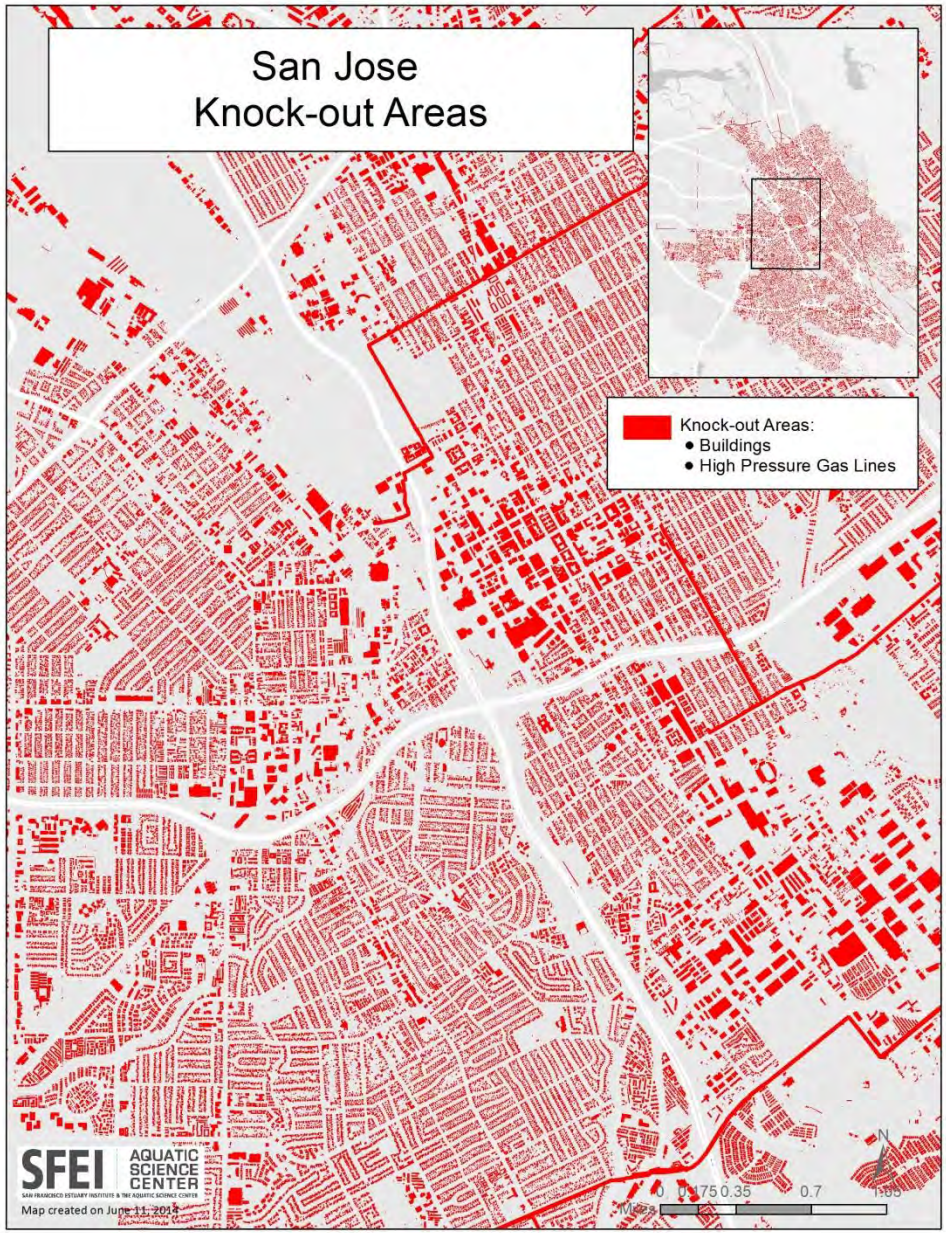
BIORETENTION

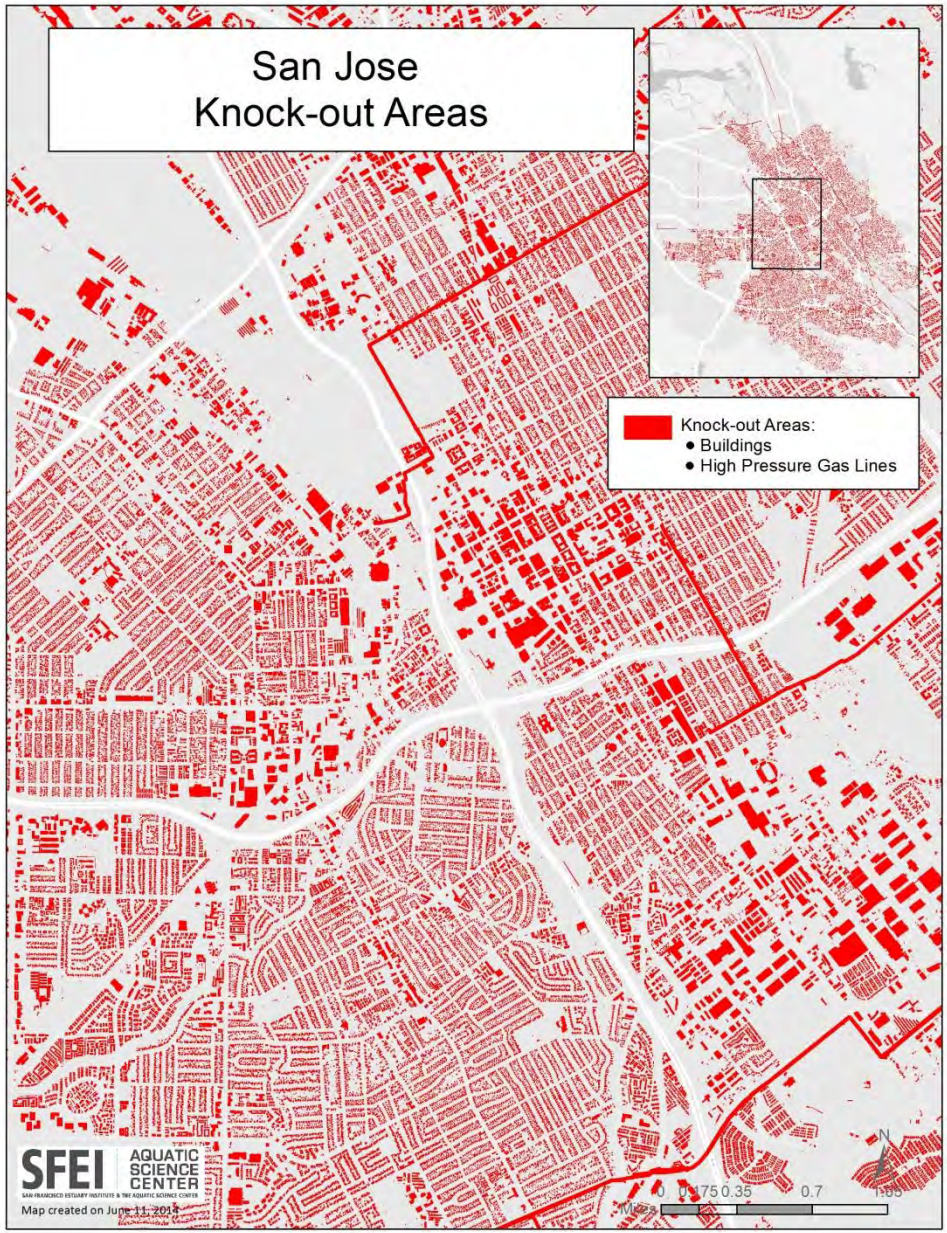
Attachment 3

VEGETATED SWALE

BIORETENTION

Attachment 3





VEGETATED SWALE

BIORETENTION

Attachment 3

VEGETATED SWALE

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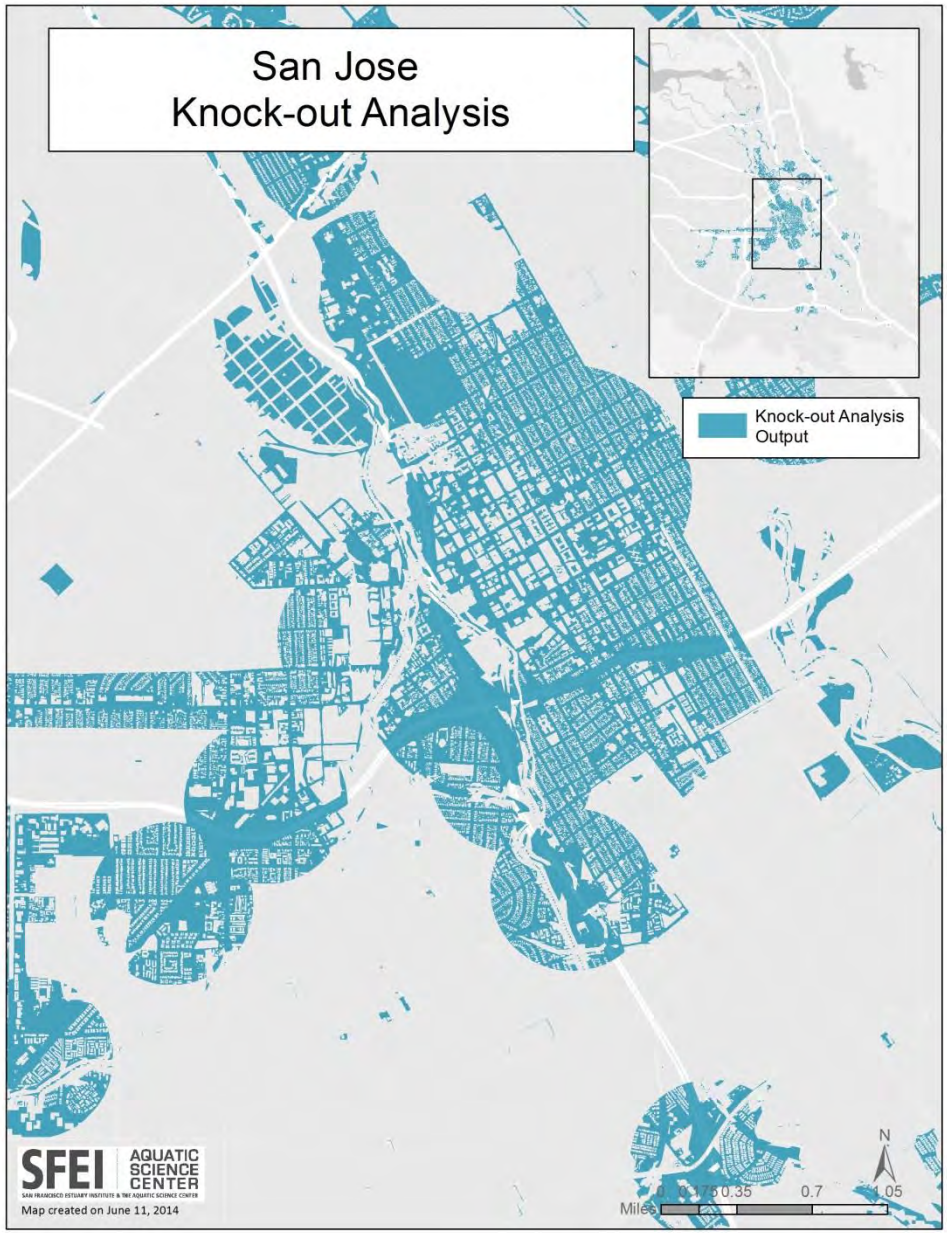

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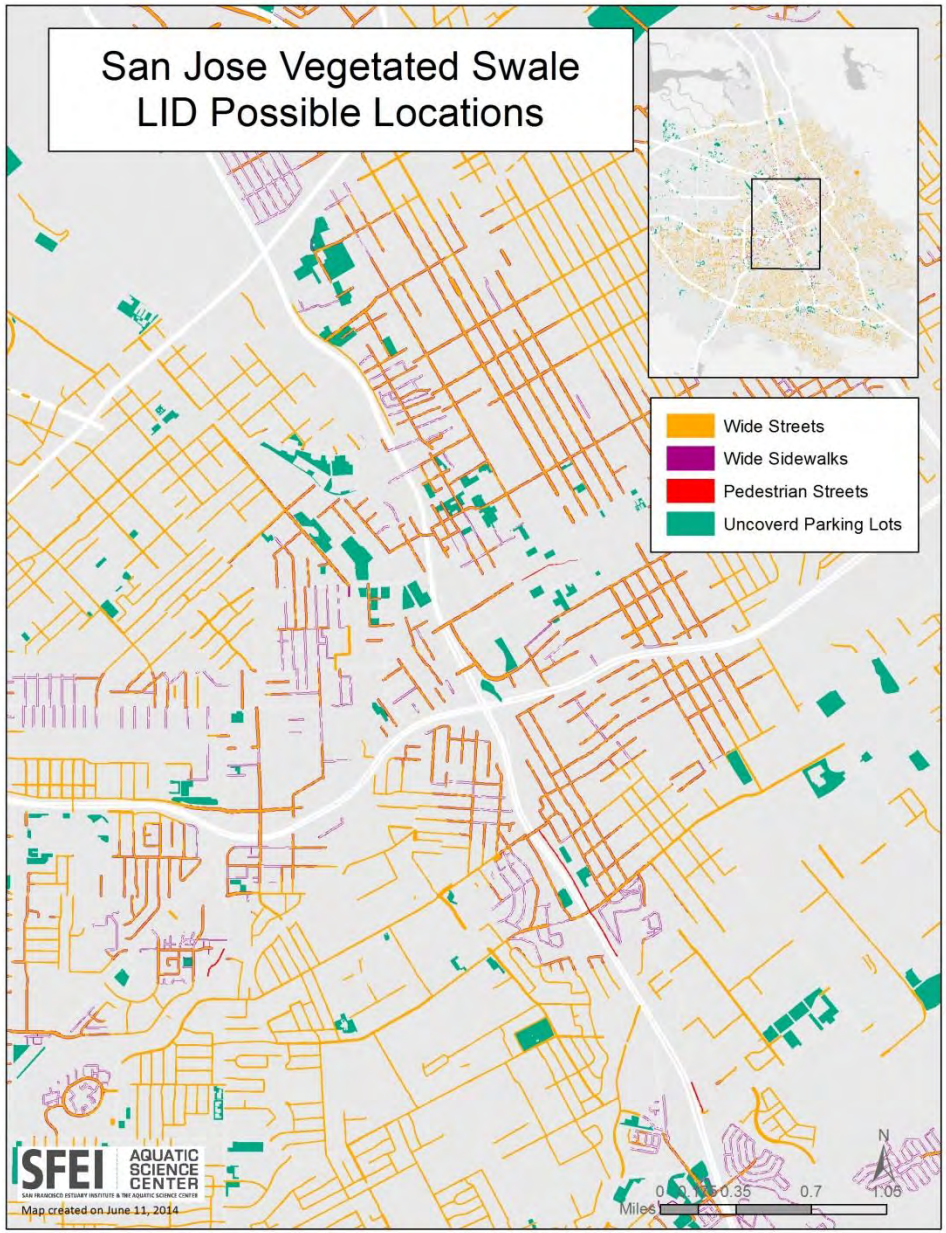

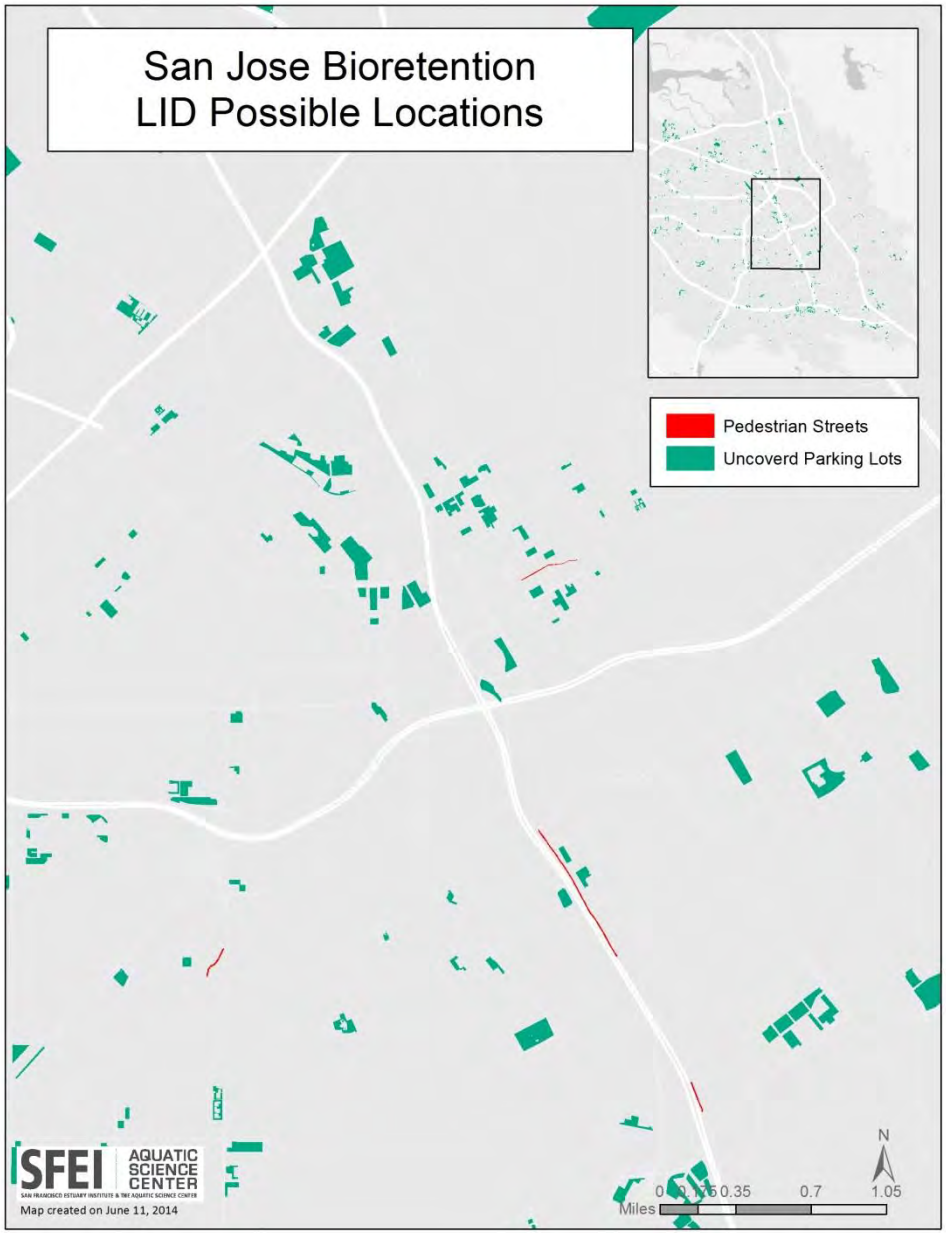

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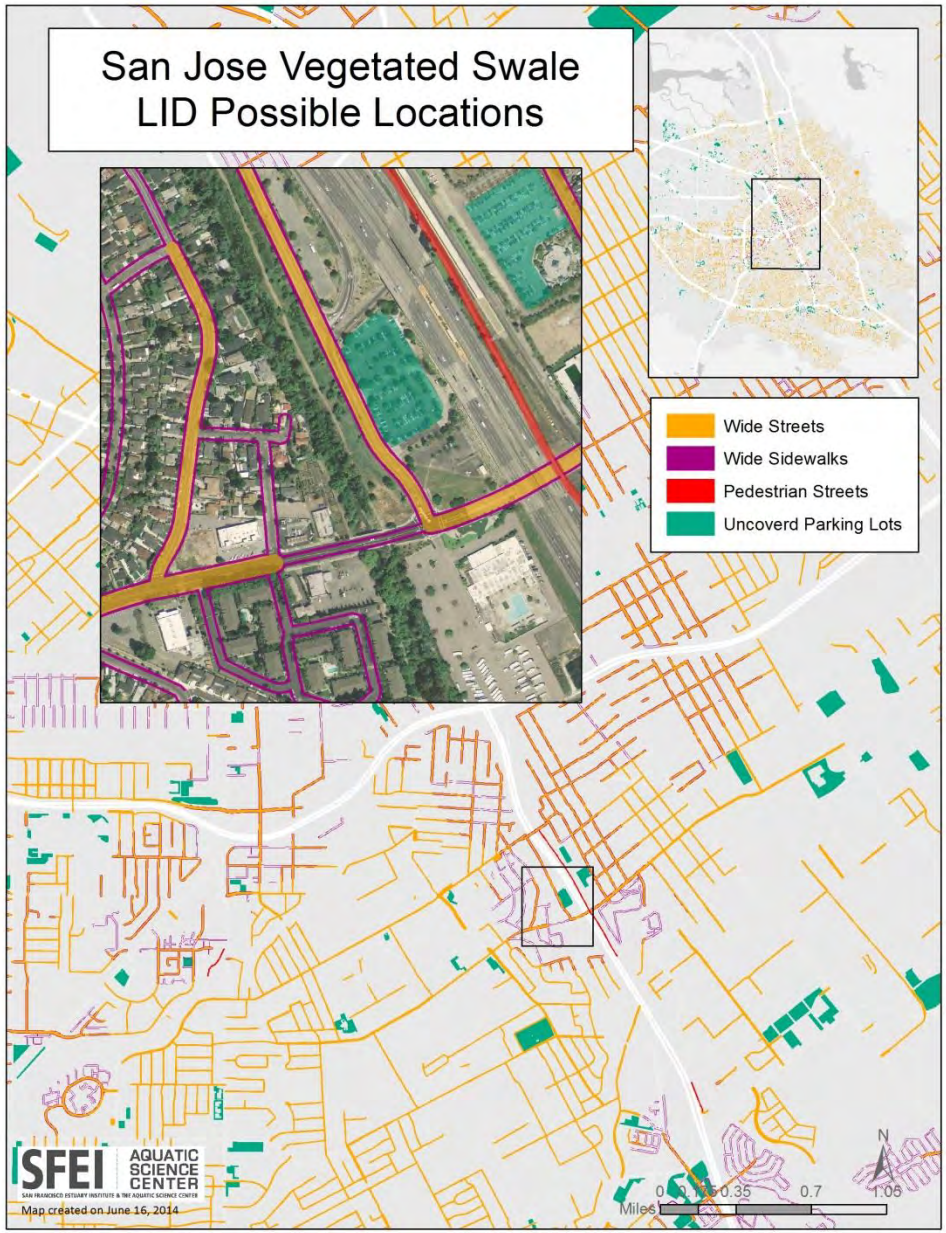

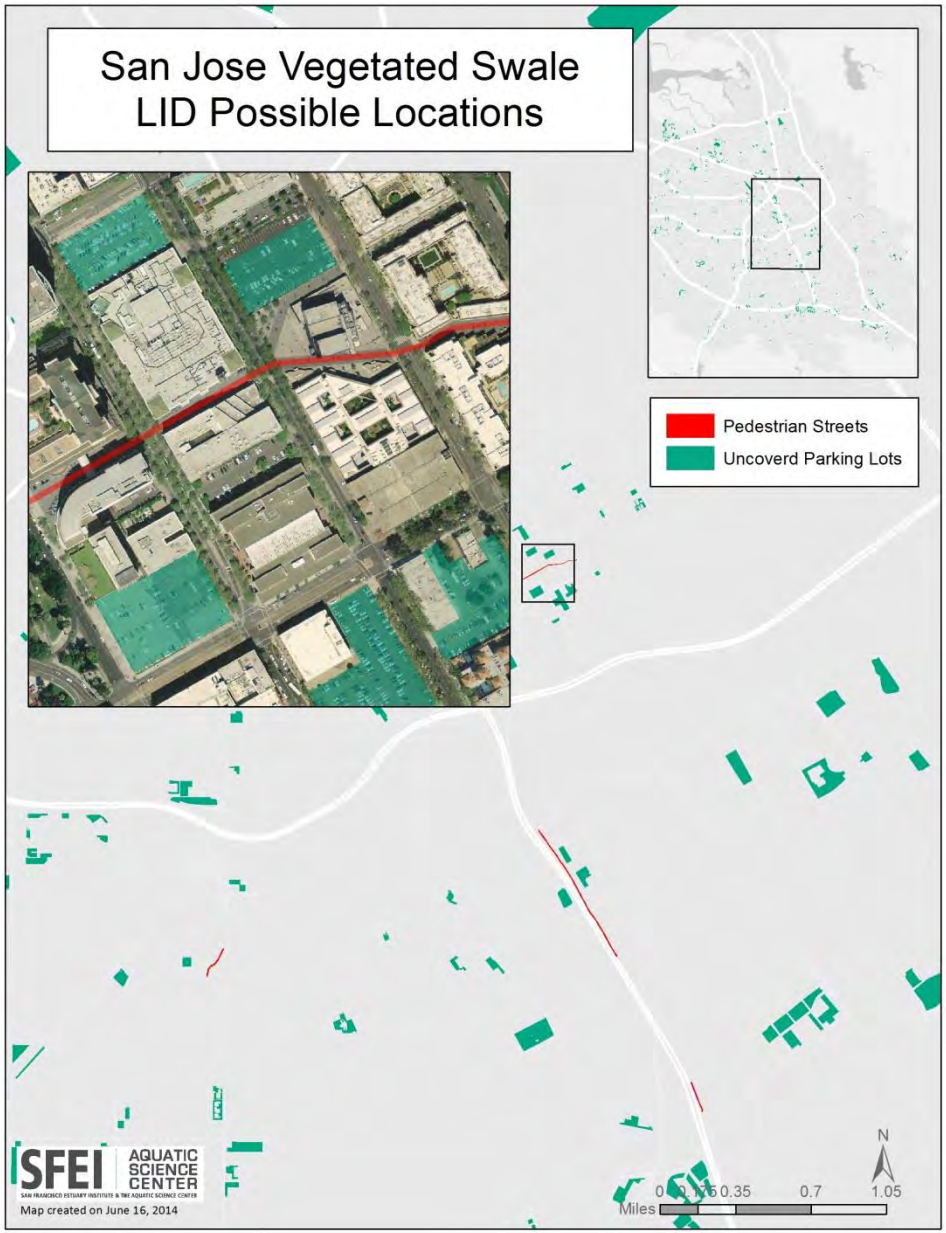

VEGETATED SWALE

BIORETENTION

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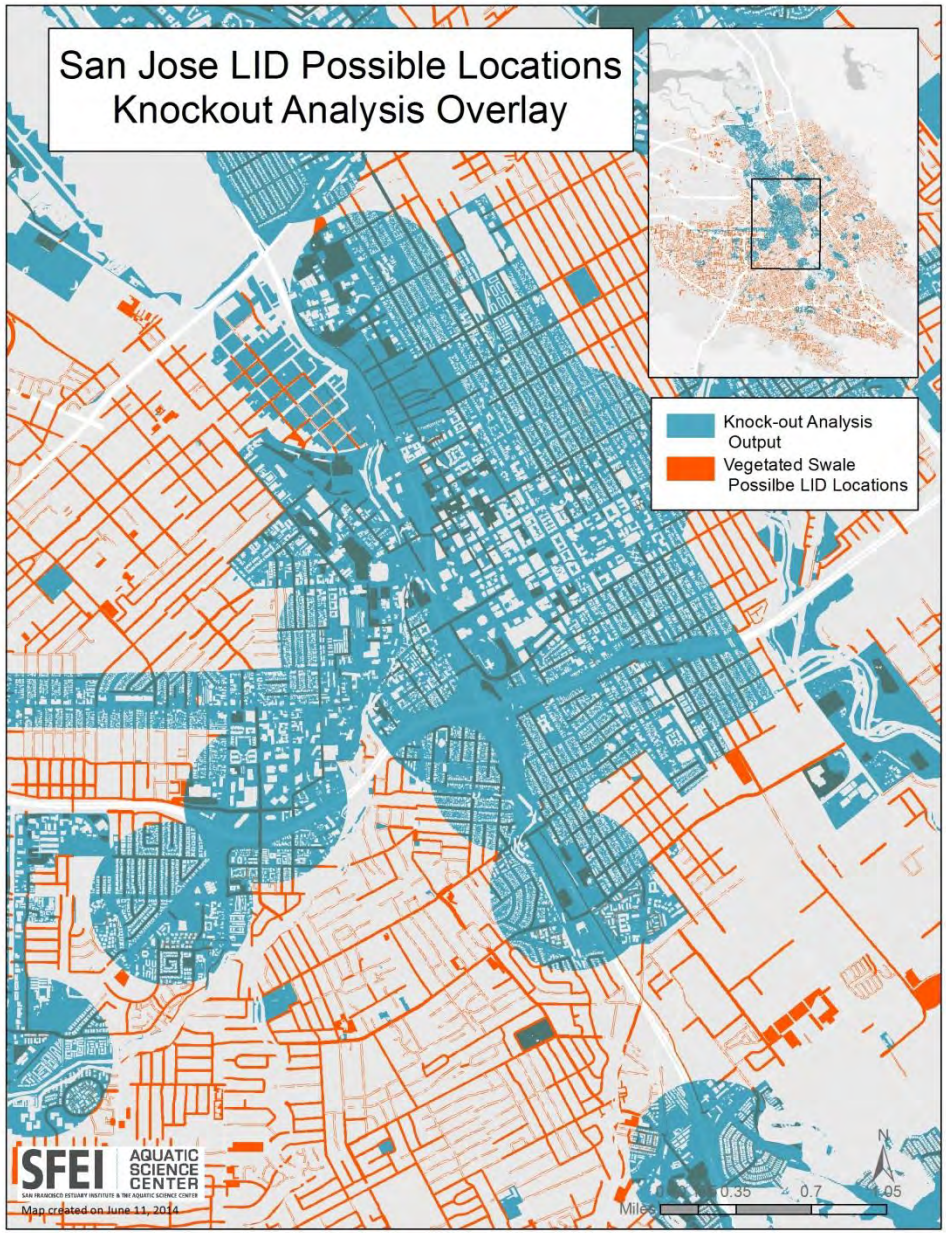
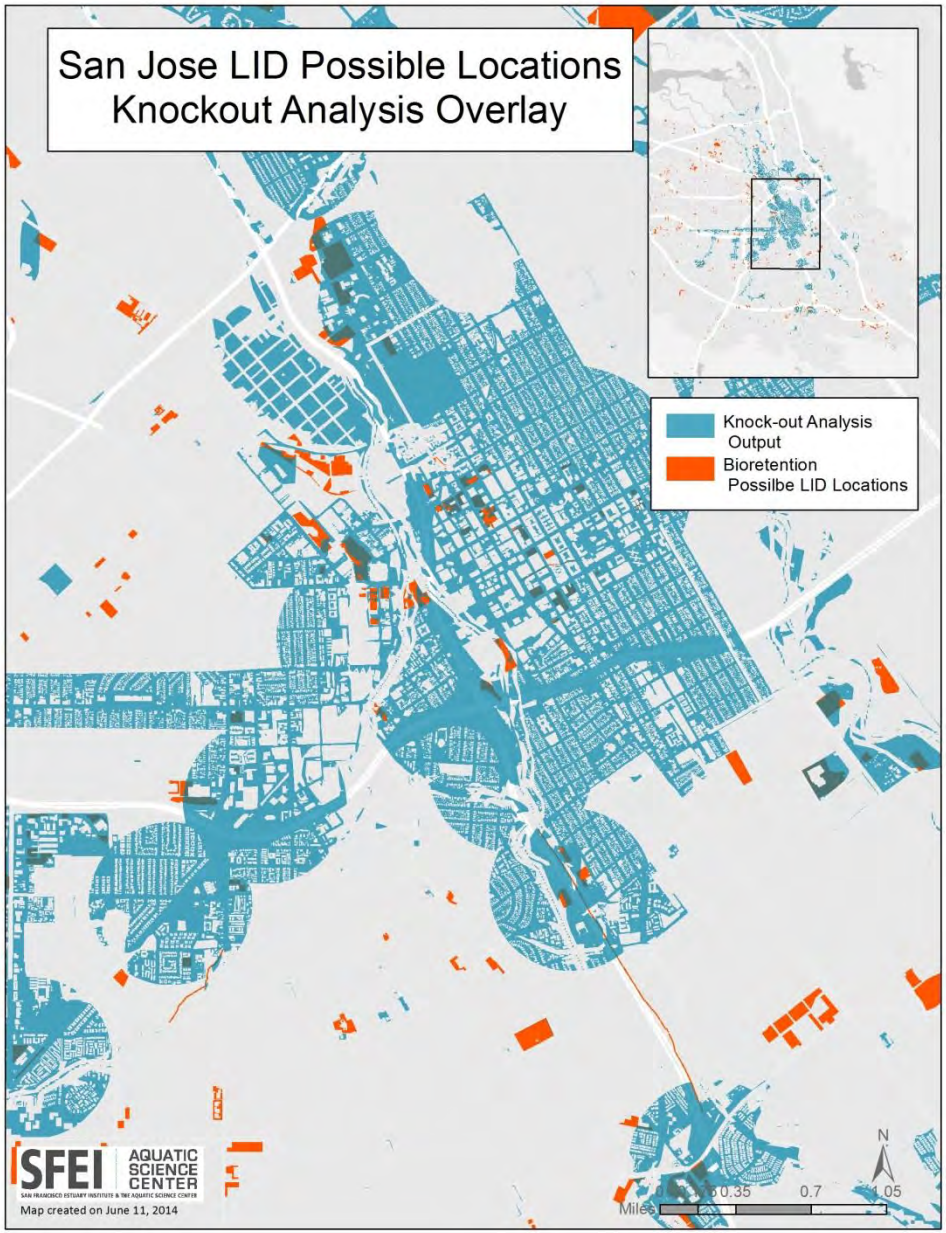
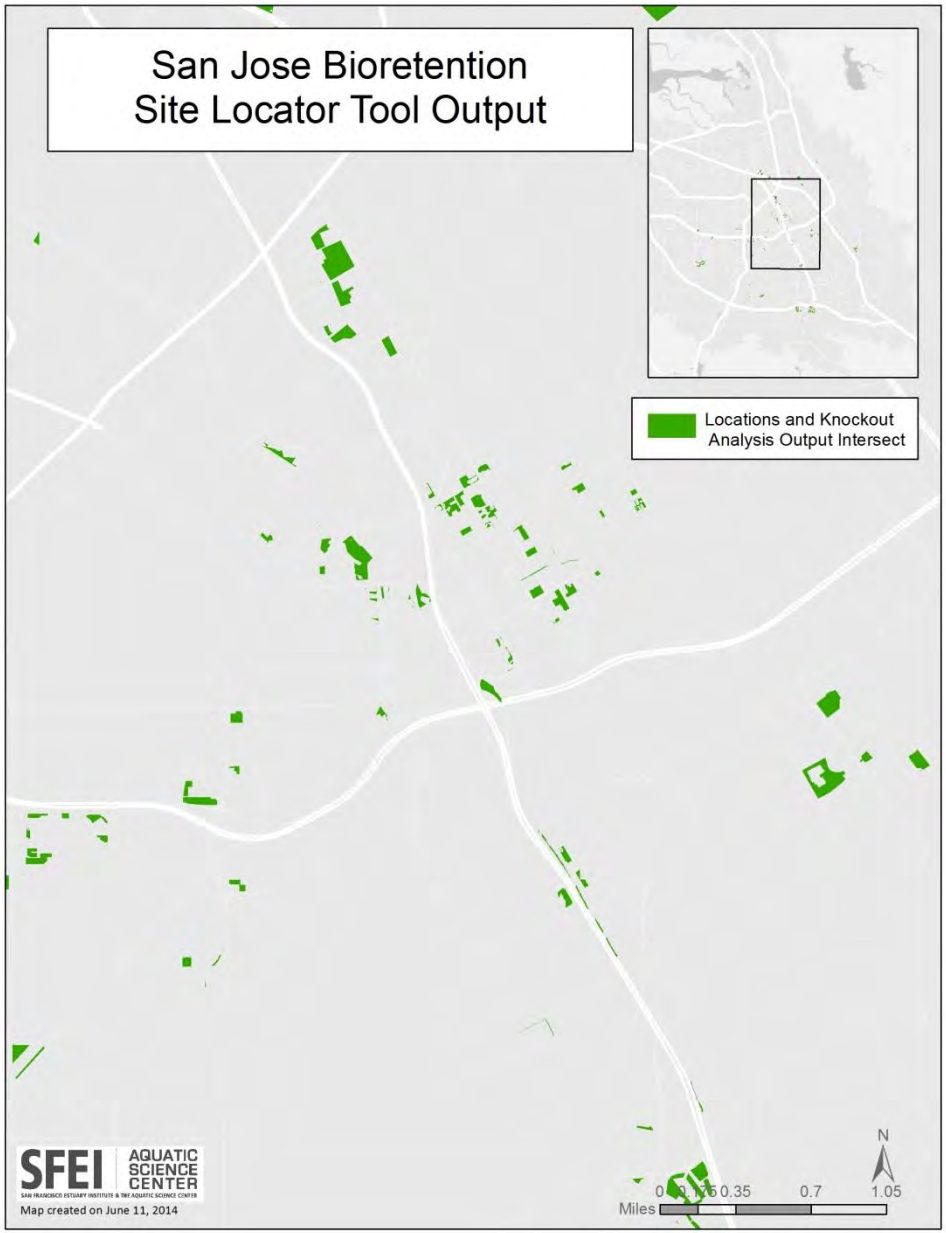




VEGETATED SWALE

BIORETENTION

Attachment 3

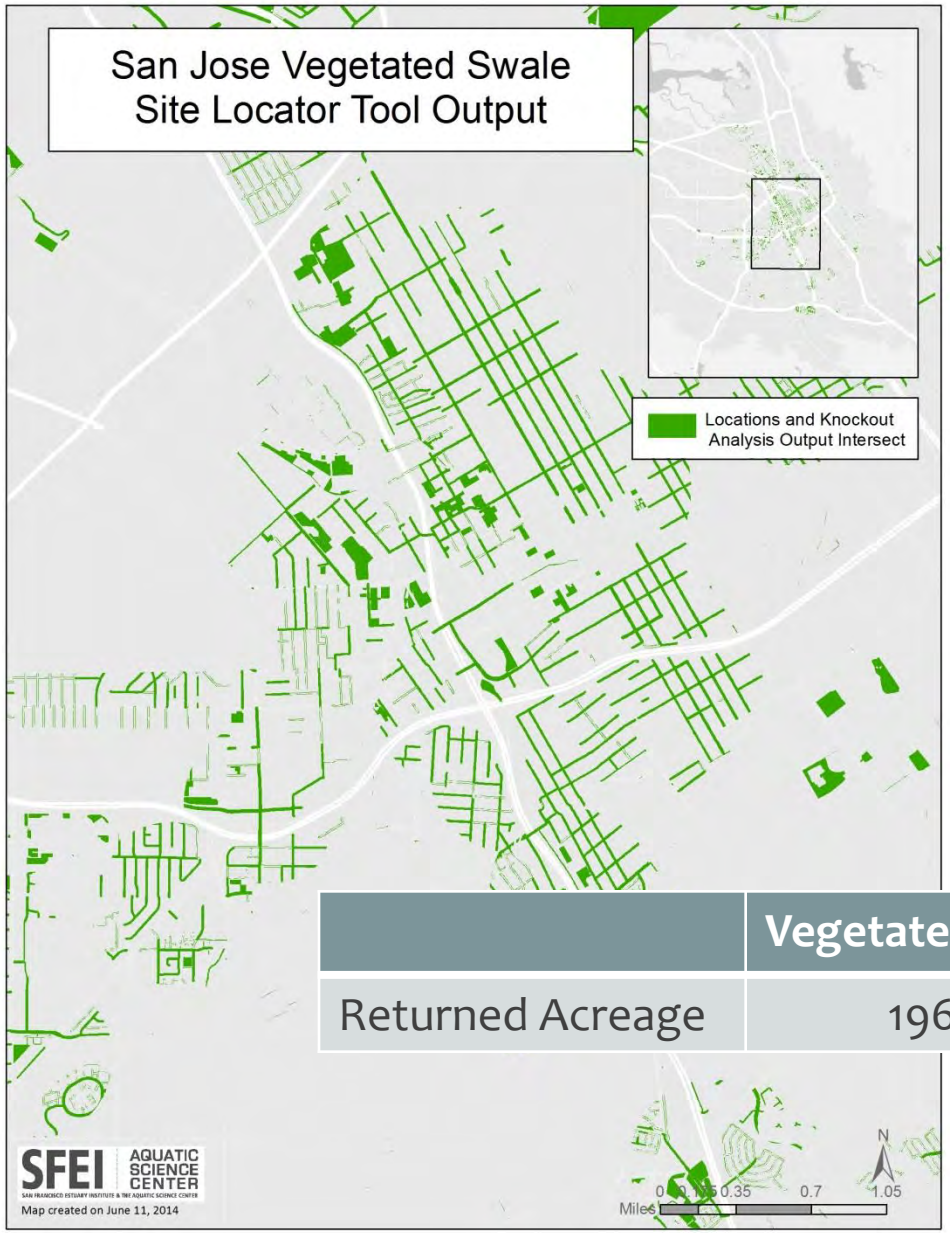


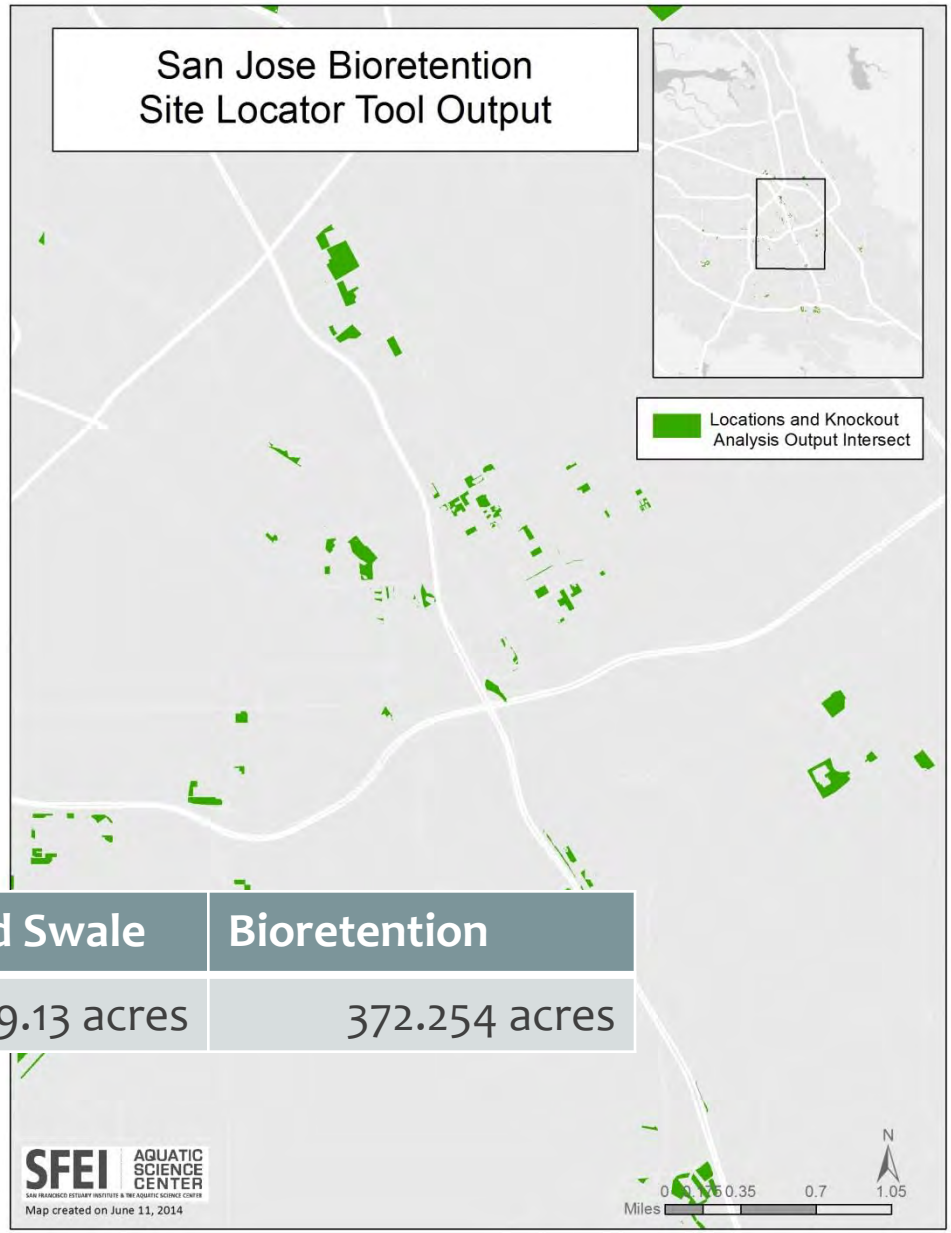
SITE LOCATOR TOOL OUTPUT

VEGETATED SWALE

BIORETENTION

Attachment 3



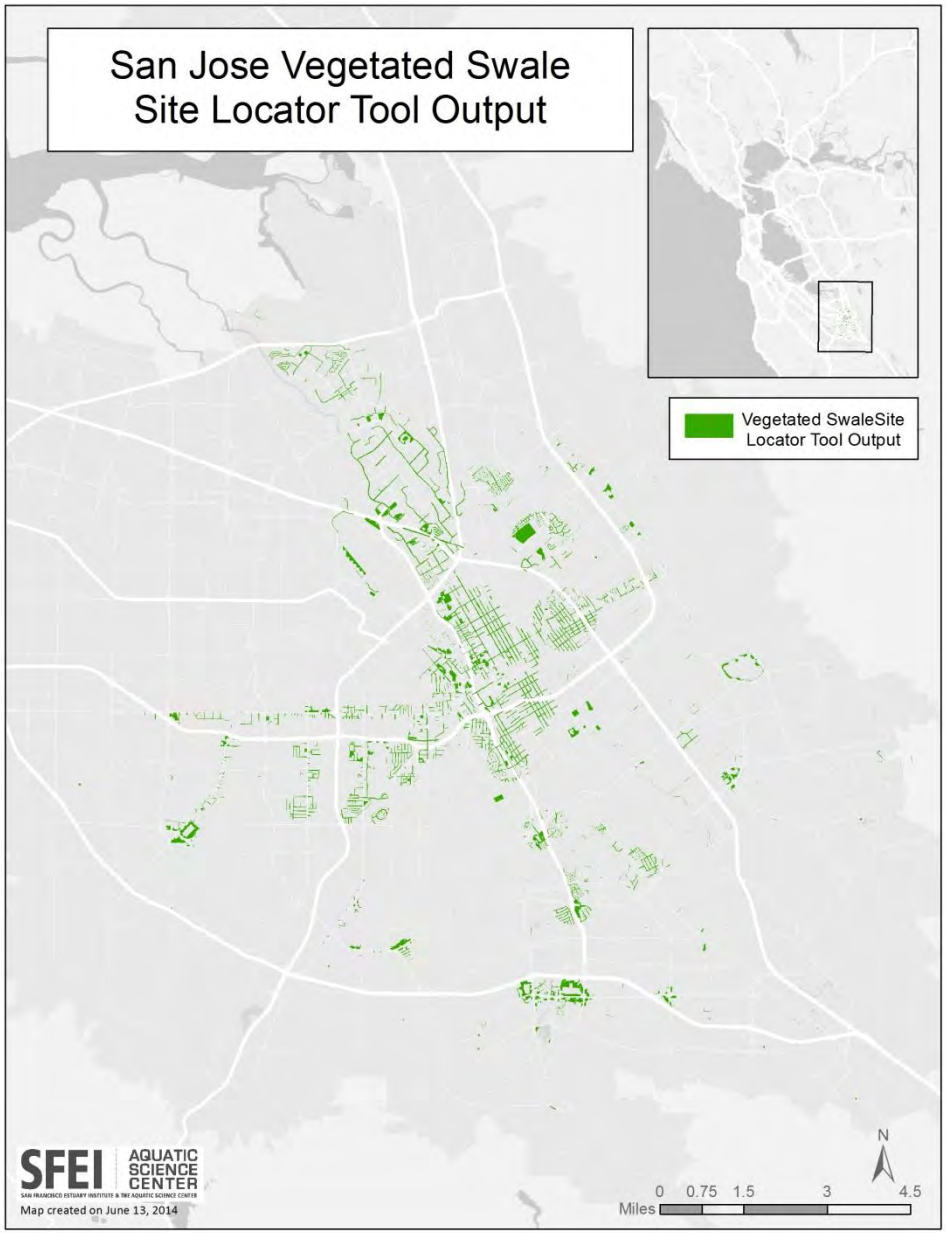


	Vegetated Swale	Bioretention
Returned Acreage	1969.13 acres	372.254 acres

SITE LOCATOR TOOL OUTPUT

VEGETATED SWALE SITE LOCATOR REFINEMENT

Attachment 3



BASE ANALYSIS OUTPUT

SITE LOCATOR TOOL REFINEMENT

Our Questions for the TAC

- Add one more LID treament type to the base analysis: Infiltration trench. Other?

bioretention

wet pond

permeable pavement

vegetated swale

stormwater wetland

What Key Data / Analysis Factors should be considered to identify and prioritize locations suitable for LID?

Opportunities	Constraints	Knockout Constraints
Public schools & facilities	Gas lines	Gas Lines
Demographics: Income, Age	Sewers	Power lines
Land use: High density residential, industrial	Underground power lines	Existing LID
Transportation	Open water	
Parks & Open space	Emergency services (fire hydrants…)	
Areas of known flooding	Contaminated areas	
Impervious surfaces	Red curbs?	
Near streams, wetlands	High crime areas	
High visibility areas		
Land surface temperature		
Conservation & Biodiversity		

Note: CCS Green Solution Project Alameda County, Phase 1 report, 2011 has recommendations

Our Questions for the TAC

- We are developing two analysis modules to identify specific street and parking lot locations that will support certain LID types. Can you recommend other analysis modules that we should consider?
  - Vacant parcels
  - Roundabouts?
  - Intersection Bulb-outs? – how to identify?

Figure 5-9a. Short bulb-out (adjacent to storefront commercial curbside parking

Figure 5-8b. Refuge at mid-block crossing

Our Questions for the TAC

- Does the tool logic seem sound?
- Will it produce useful results?
- What's missing?
  - Site size consideration?

	Vegetated Swale
Returned Acreage	1,969.13 acres

Thank You!

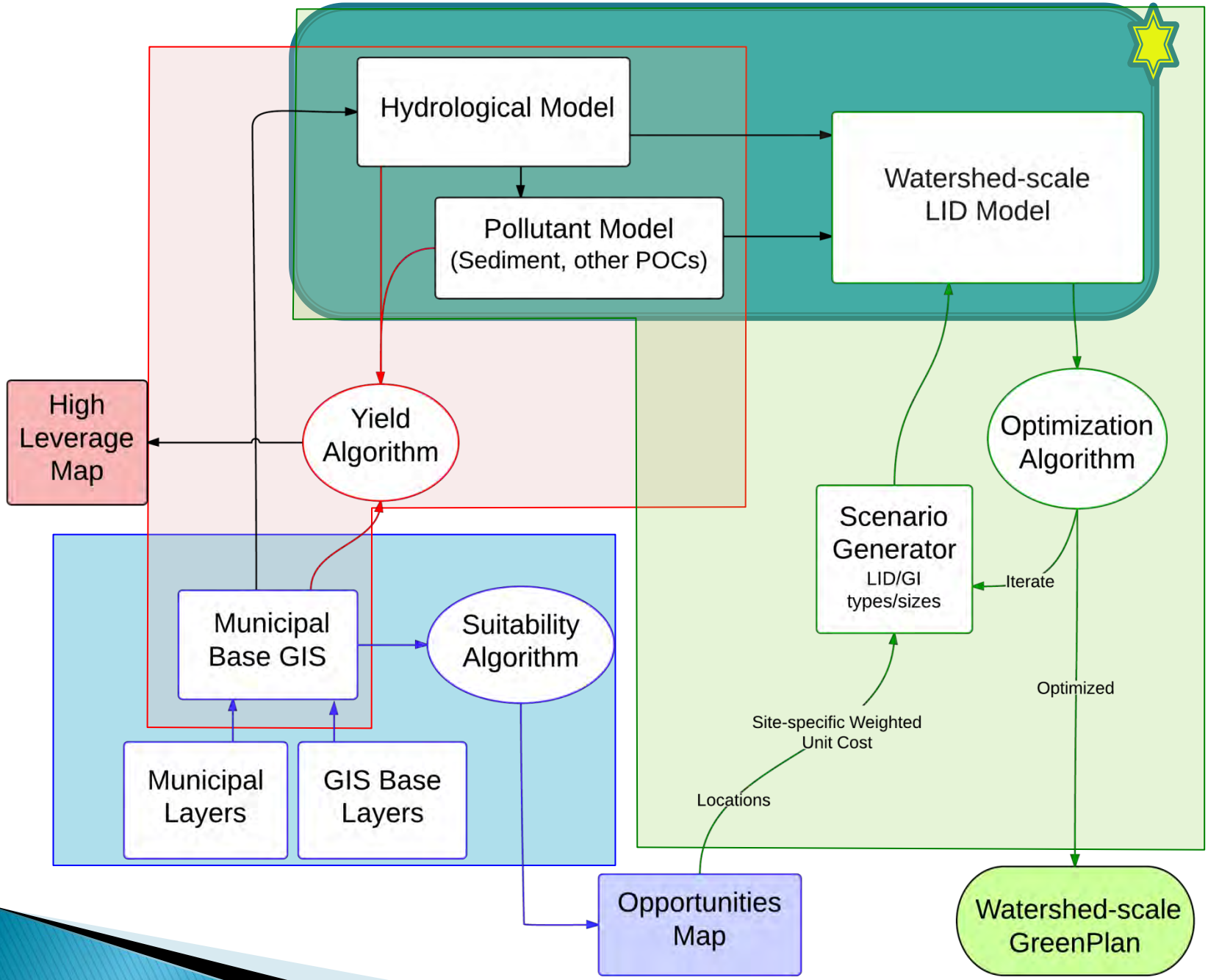
- Please email or call us with additional feedback

Modeling Tool Development

GreenPlanIT TAC meeting

Jing Wu

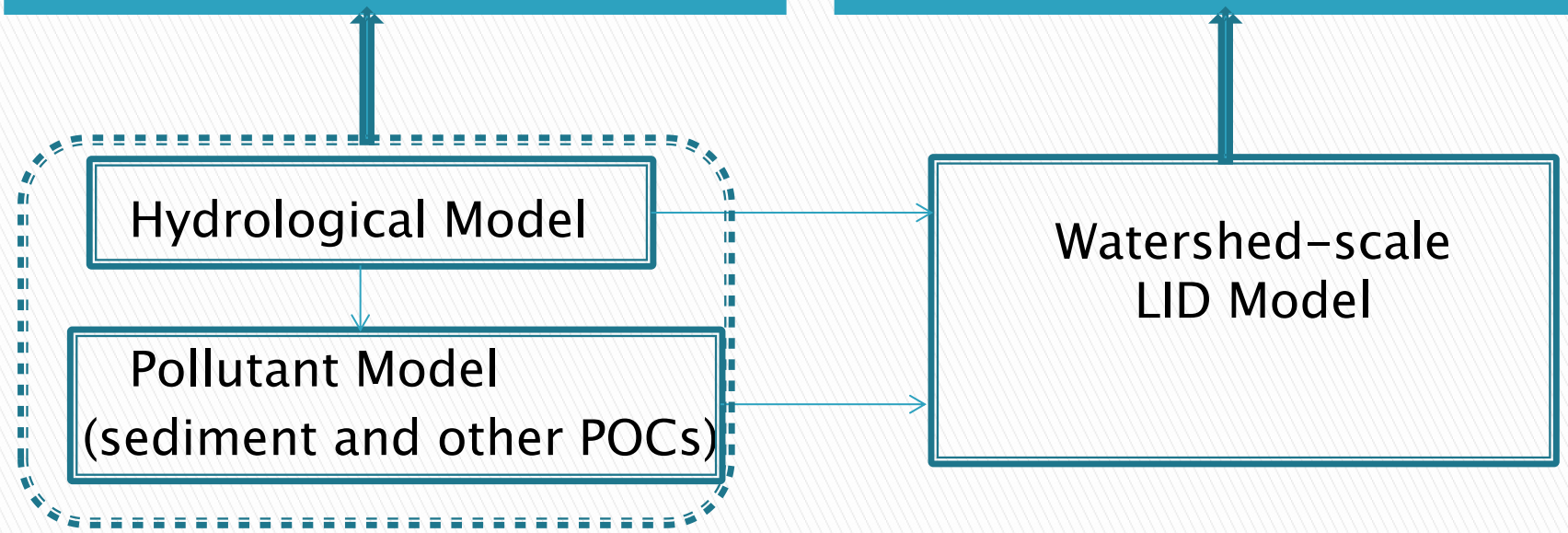
June 17, 2014


Hydrological Model
Pollutant Model
(Sediment, other POCs)
Watershed-scale
LID Model
High
Leverage
Map
Yield
Algorithm
Optimization
Algorithm
Scenario
Generator
LID/GI
types/sizes
Iterate
Municipal
Base GIS
Suitability
Algorithm
Municipal
Layers
GIS Base
Layers
Site-specific Weighted
Unit Cost
Optimized
Locations
Opportunities
Map
Watershed-scale
GreenPlan

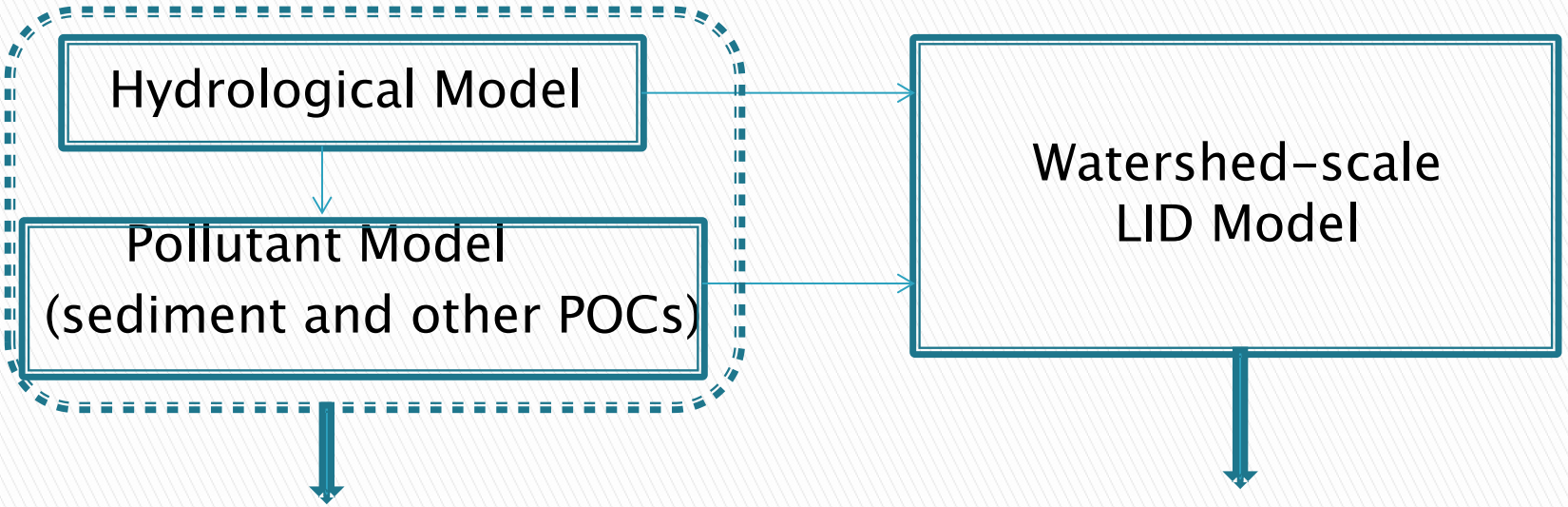
Modeling tool

What are the most effective locations for LID/GI implementation?

What quantitative water quality and hydrological improvement can be made with LID?



Modeling tool



- Establish baseline condition
  - Characterizes the current physical system
  - Represents the reference point for any improvement made through LIDs
  - The starting point for LID selection and placement optimization
- Identify critical sources areas

- Quantify flow and water quality reduction from various LID scenarios

Modeling tool development

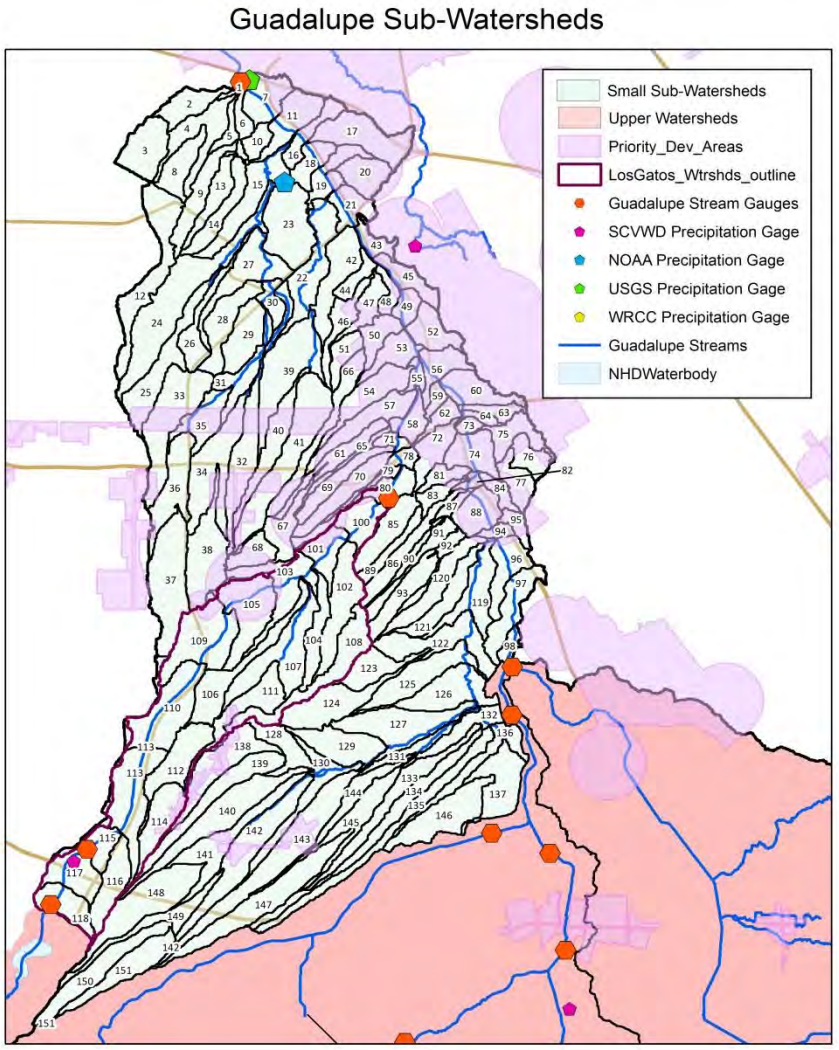
- Model development steps
  - Select model platform
  - Identify target watershed
  - Collect model input data
  - Calibrate model with observed data
  - Generate pre- and post-LID hydrographs and pollutographs

Model platform

- Storm Water Management Model (SWMM)
  - Support by EPA
  - Widely used for stormwater management
  - Capable of simulating hydrology, water quality and LID performance
  - Simplified hydrology and water quality mechanisms
  - Essentially overland flow and no in-stream processes so flow could be flashy

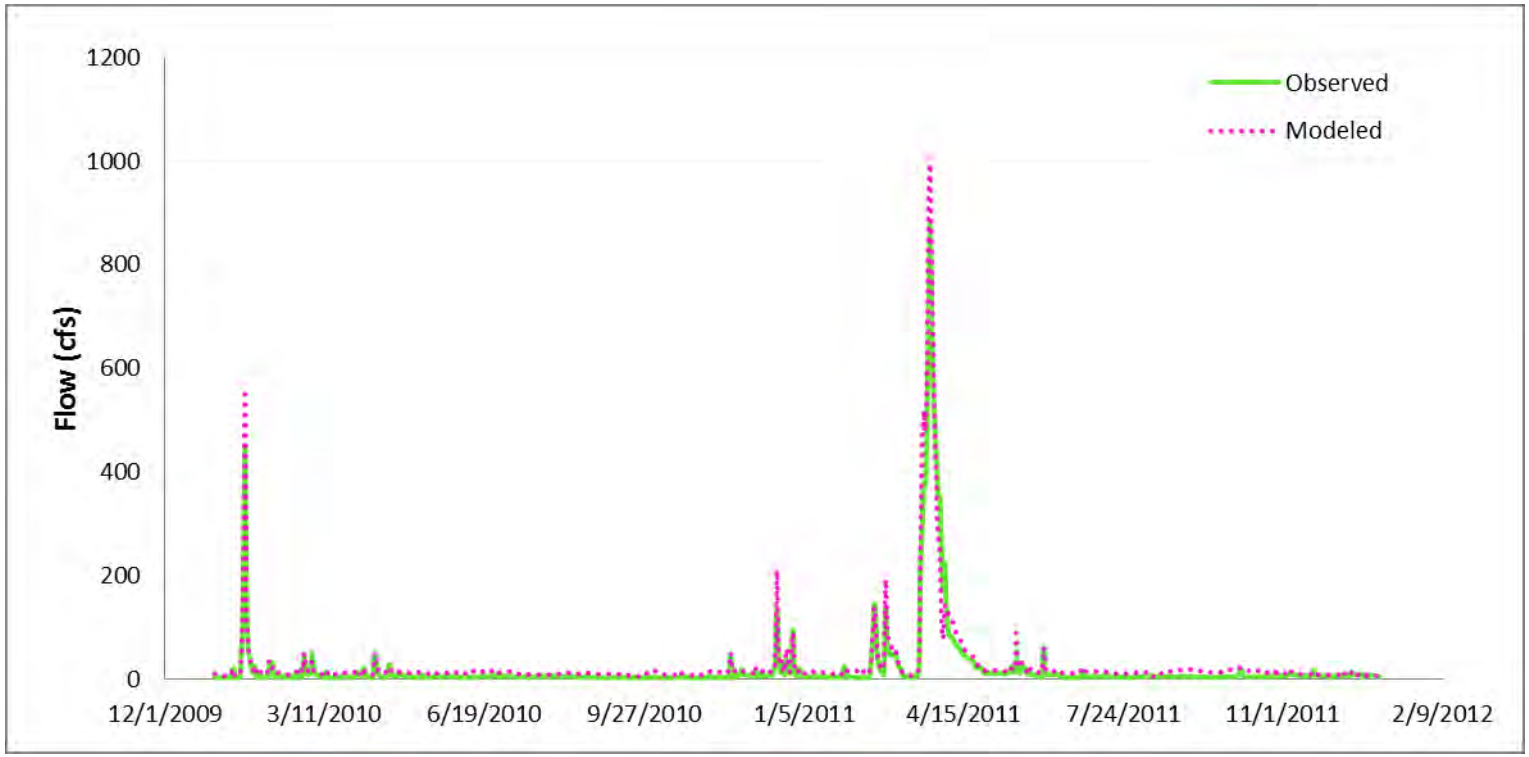
Hydrological and WQ model

- Develop calibrated hydrological and WQ model
- San Jose case study
  - Development area largely within Guadalupe
  - Model area (18613 acre) delineated into 150 sub-basins
  - Model simulation period 2010-2011at 15 minutes step
  - Model calibration@ 2 stations for hydrology and @1 for sediment



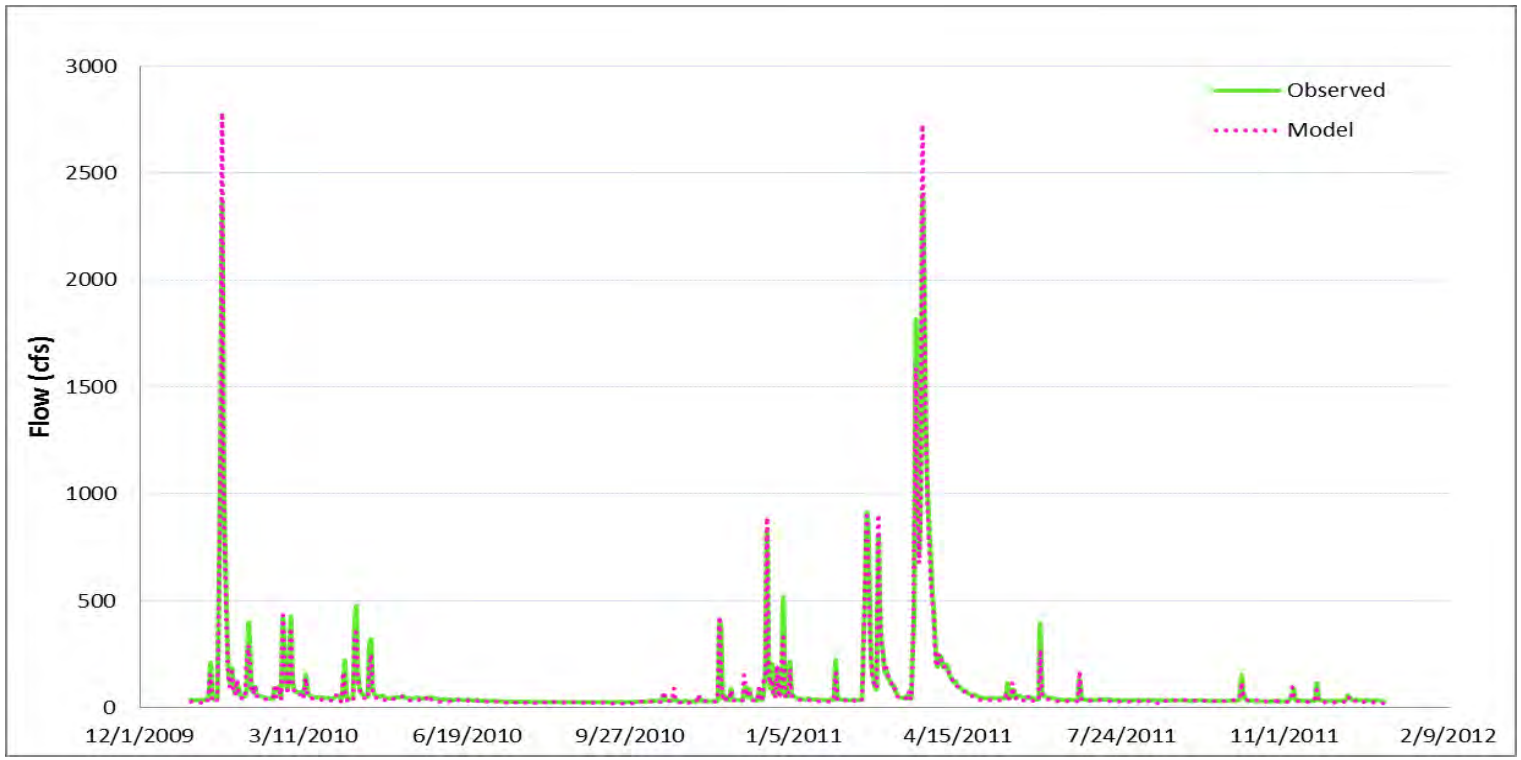
Hydrology calibration

Los Gatos at Lincoln Ave



Hydrology calibration

USGS 11169025 at highway 101

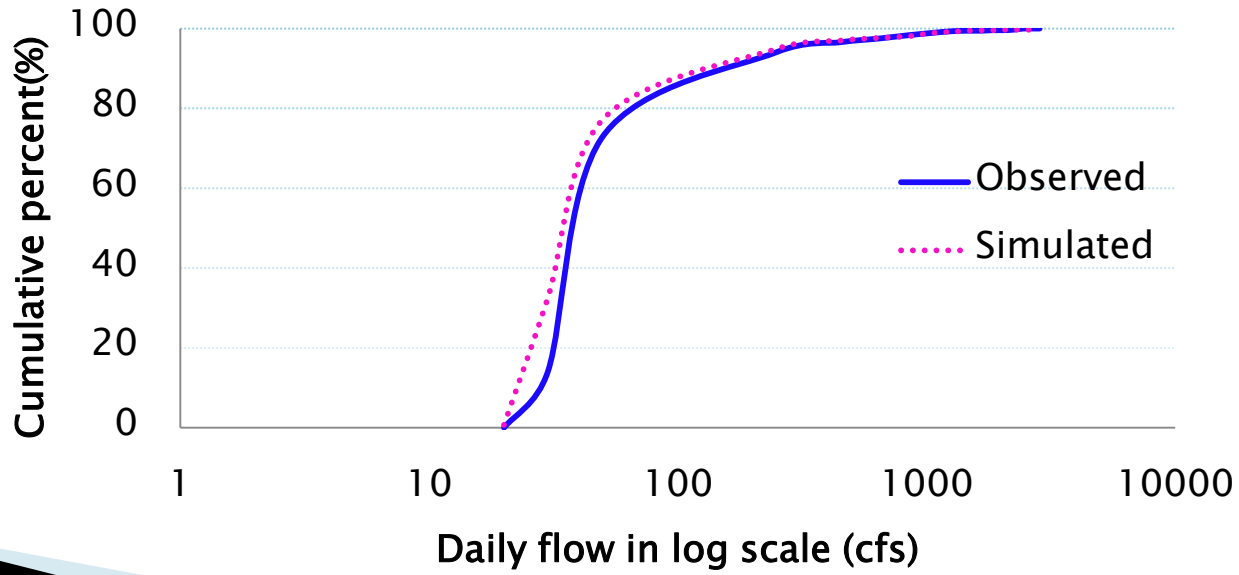


Hydrology calibration

- Calibration statistics

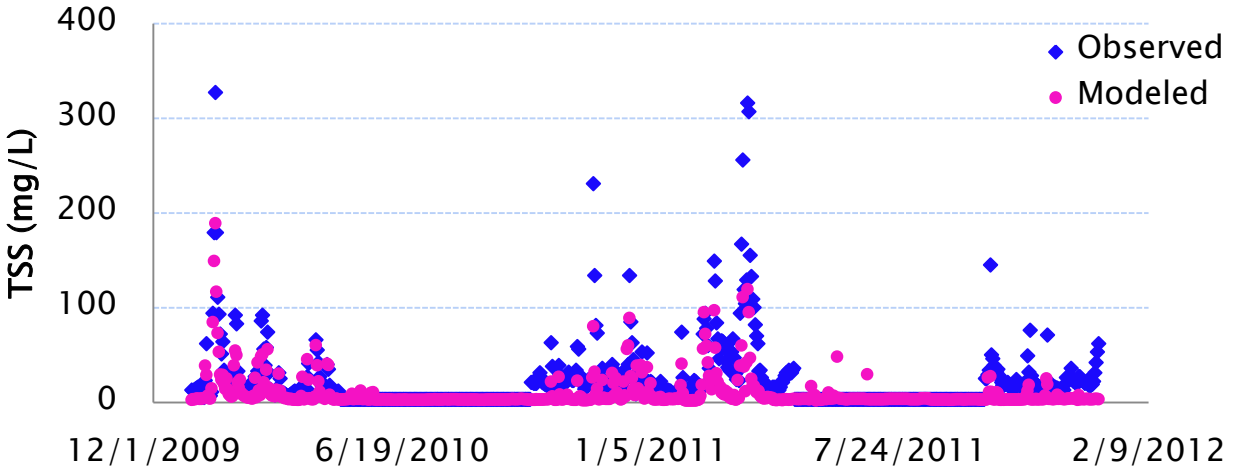
Statistics	Model results	Criteria
Difference in storm volume	-4%	< 10%
Model efficiency	0.97	>=0.7

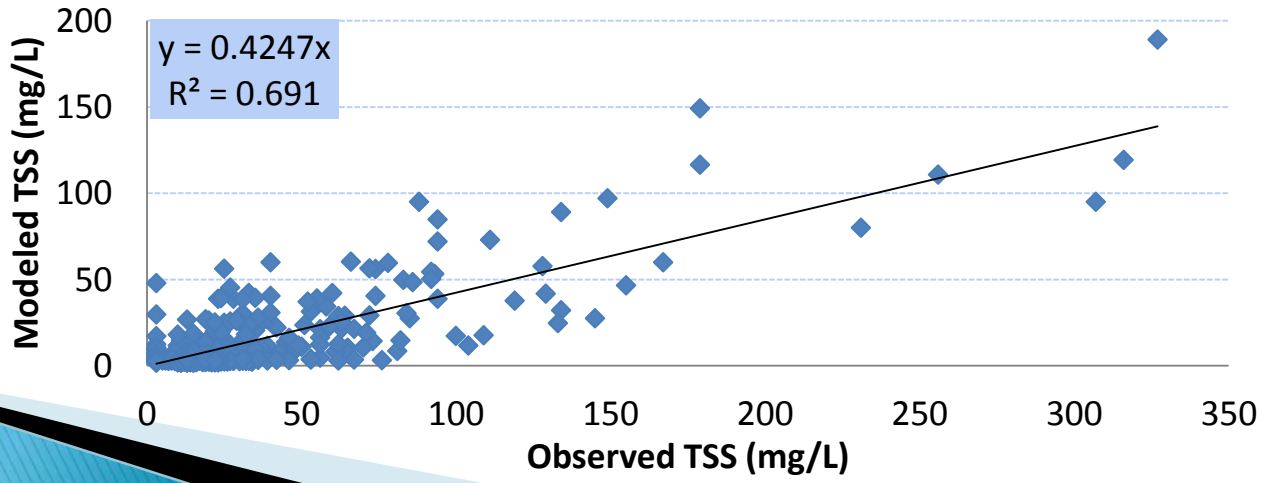
$$NSE = 1 - \left[\frac{\sum_{i=1}^{n} (Y_i^{obs} - Y_i^{sim})^2}{\sum_{i=1}^{n} (Y_i^{obs} - Y^{mean})^2} \right]$$

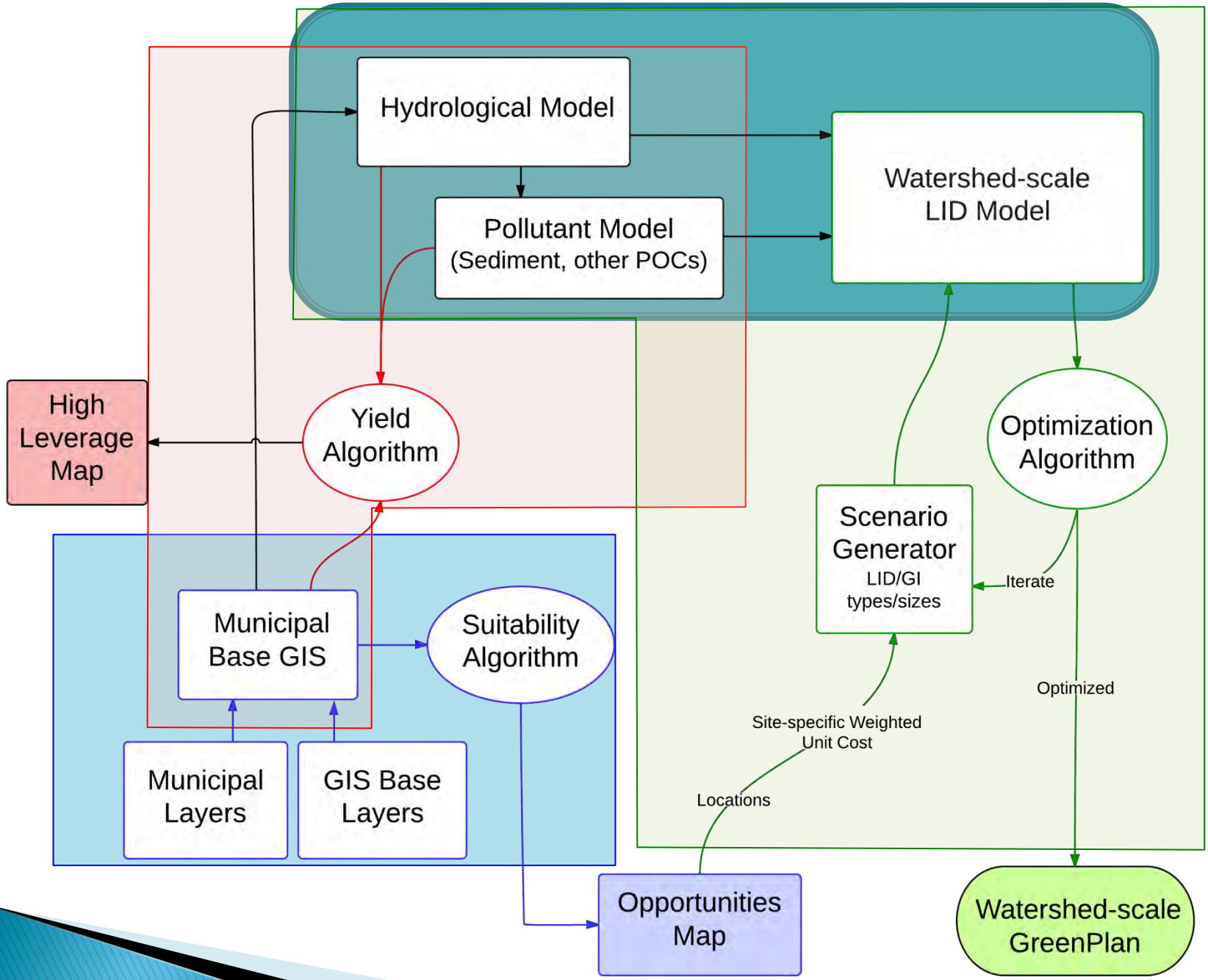


Sediment calibration

- Daily sediment concentration at USGS@101



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Pollutant Model
(Sediment, other POCs)
Watershed-scale
LID Model
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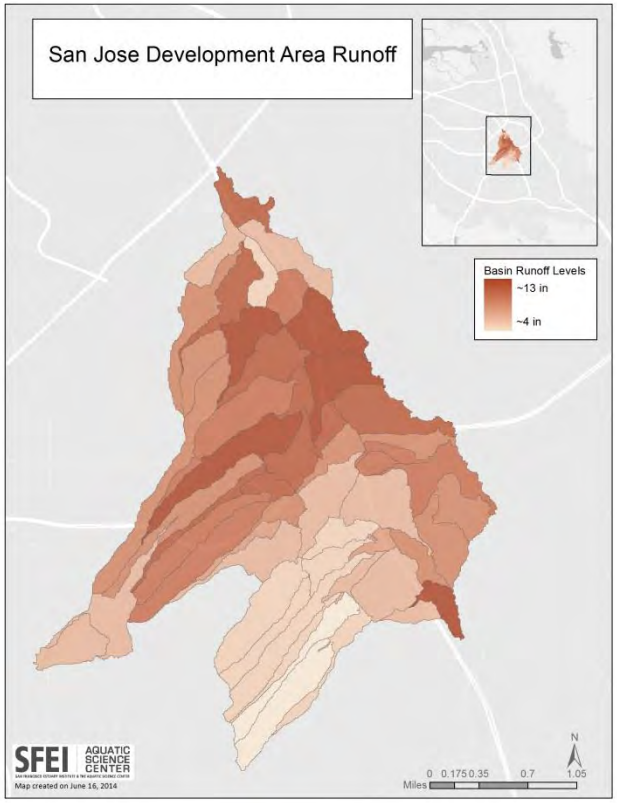
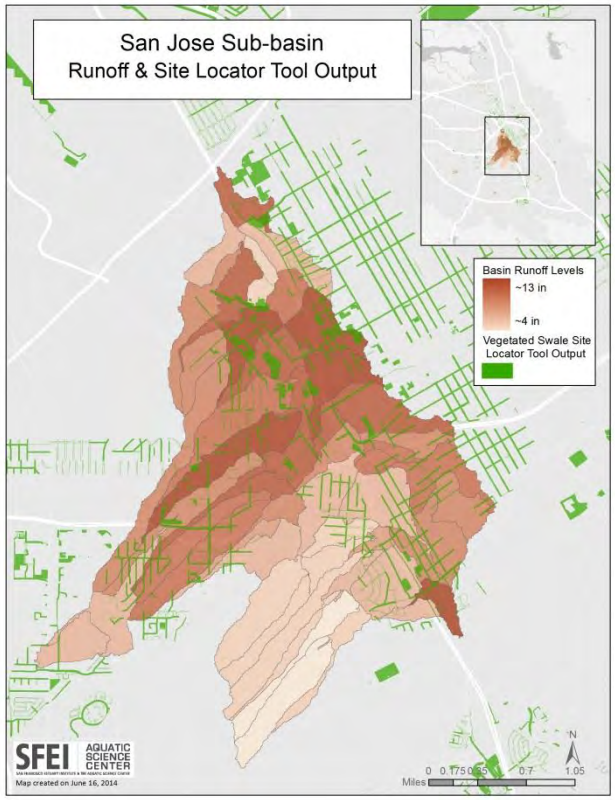
Algorithm
Optimized
Site-specific Weighted
Unit Cost
Municipal
Layers
GIS Base
Layers
Locations
Opportunities
Map
Watershed-scale
GreenPlan

High-leverage sites

- Use calibrated hydrological and pollutant models to identify high-leverage sites





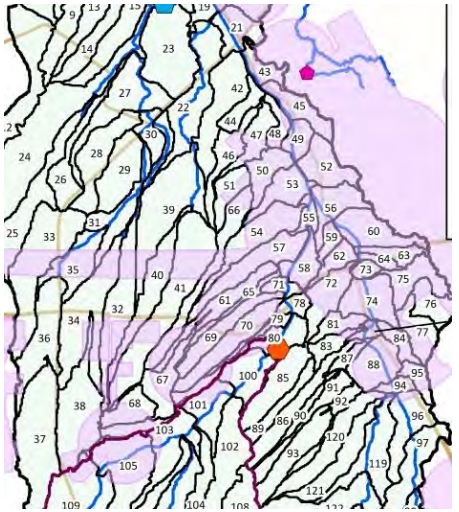
- Similar maps can be produced through GIS analysis (%impervious, source area layers, etc..)

Watershed-scale LID model

- Use calibrated hydrological and pollutant models as baseline condition
- Generate pre- and post-LID hydrographs and pollutographs
- Quantify flow and water quality reduction for various LID scenarios
- Serve as the foundation for Optimization algorithm

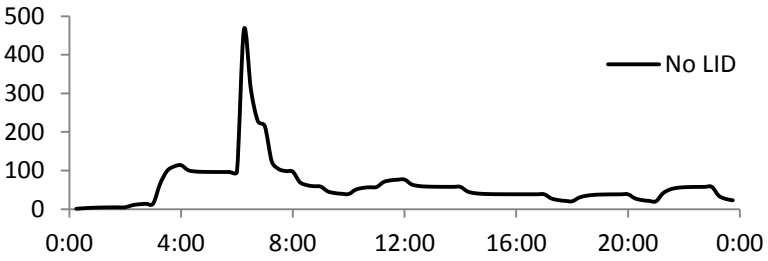
LID model demo

- San Jose development area
  - 4300 acre
  - 53 sub-basins
  - Range from 20 to 150 acres



- 1inch rain with 24-hour duration

- Example Bioretention
  - 5000 square feet surface area
  - Surface storage depth 12in
  - Soil thickness 18 in
  - Storage height 12 in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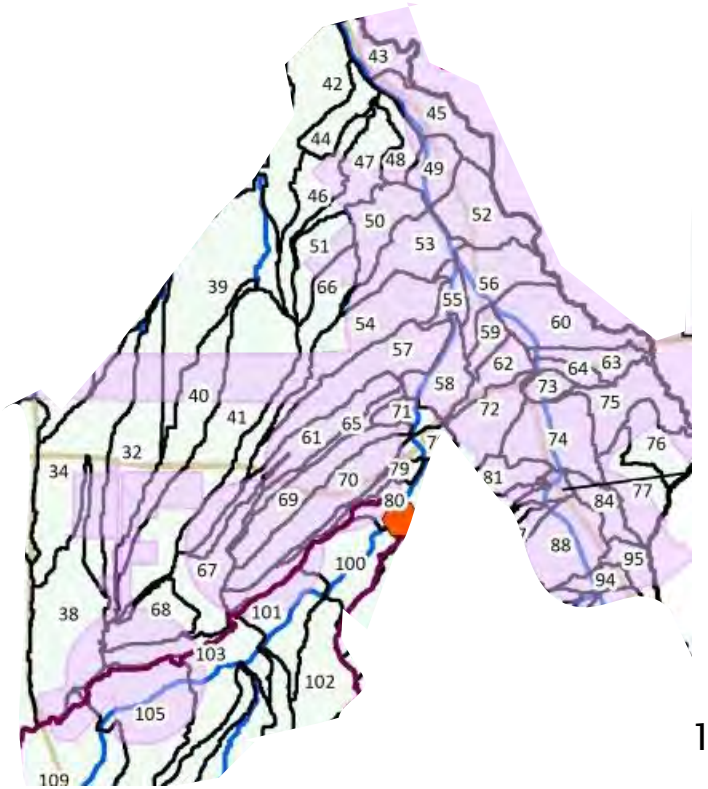
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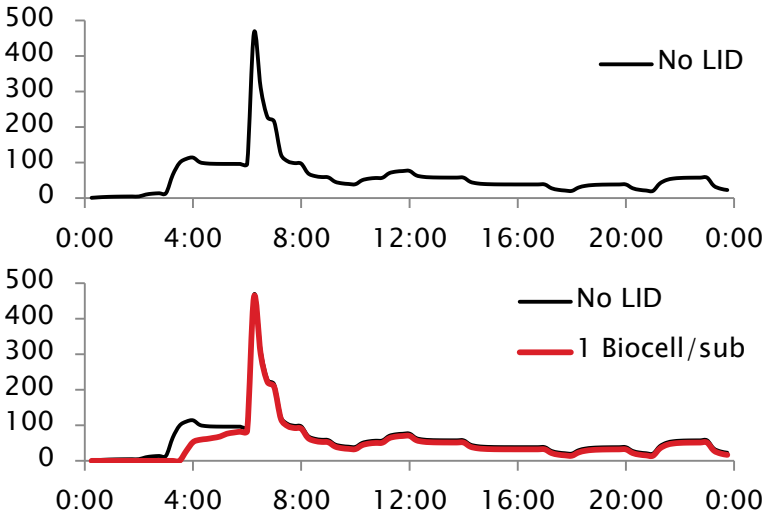
Item #4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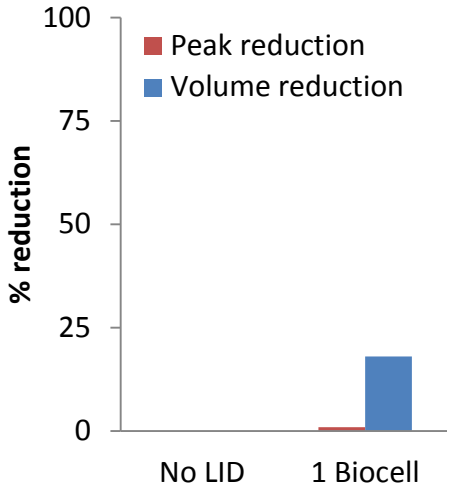
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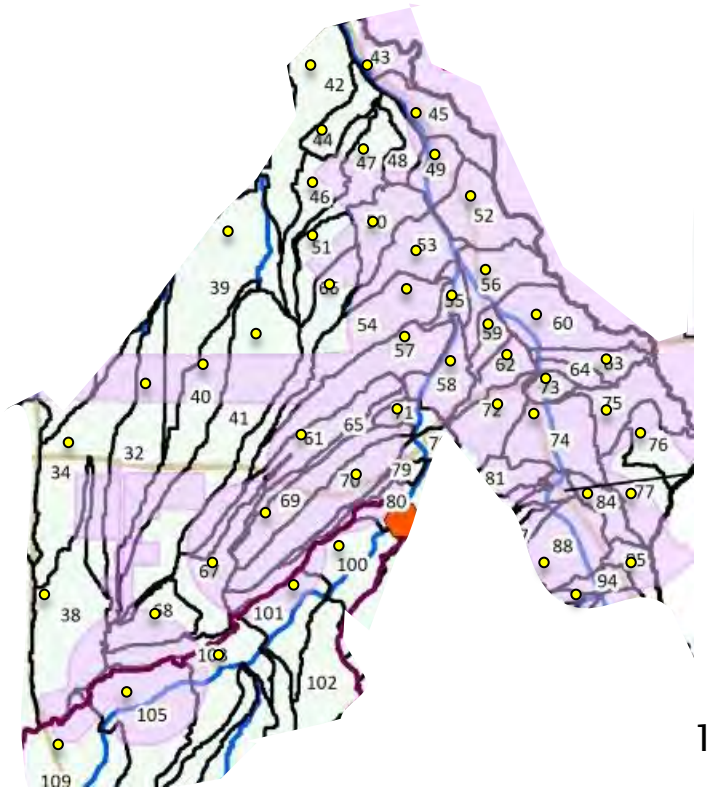

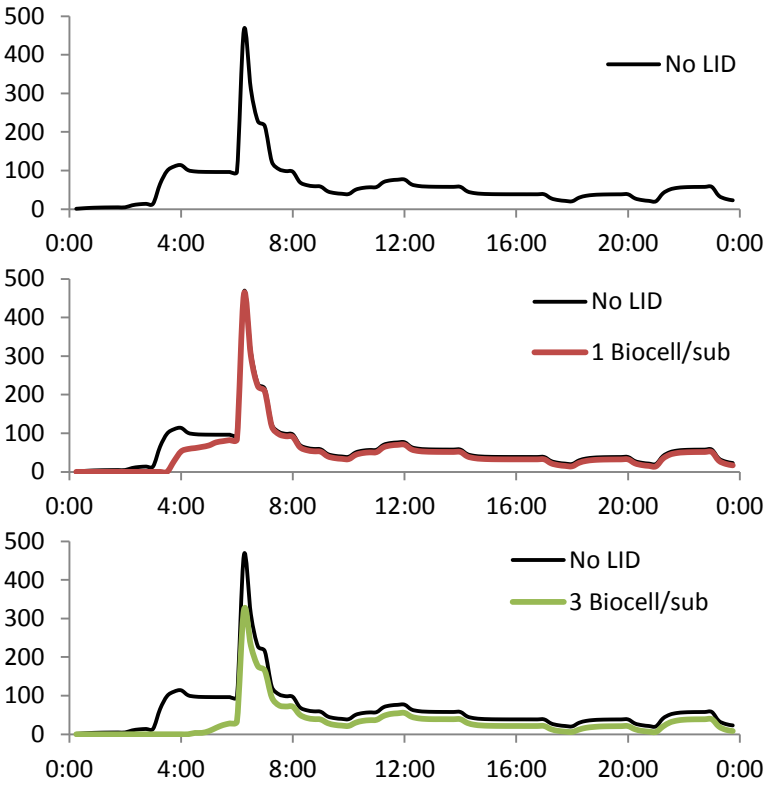
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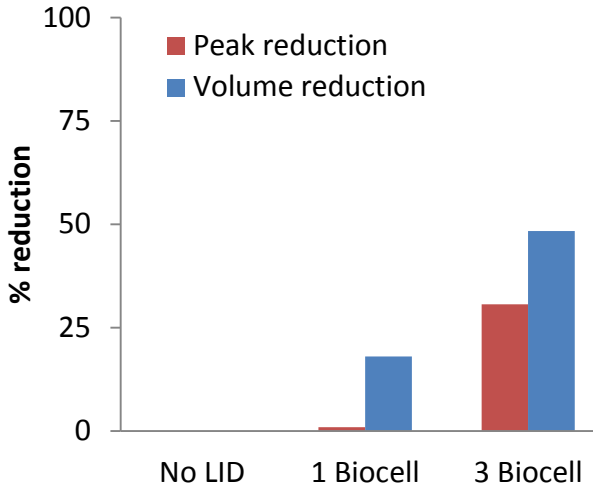
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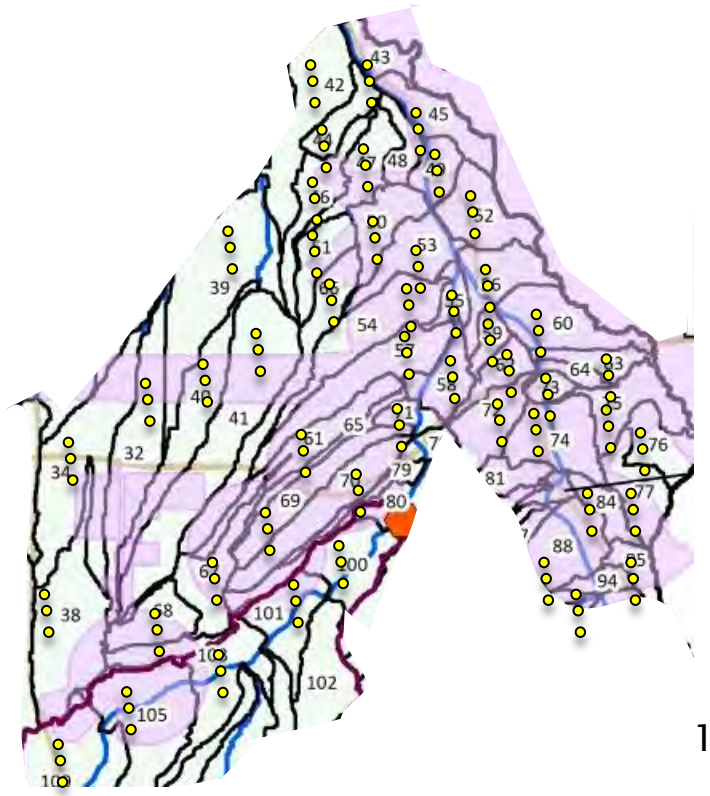

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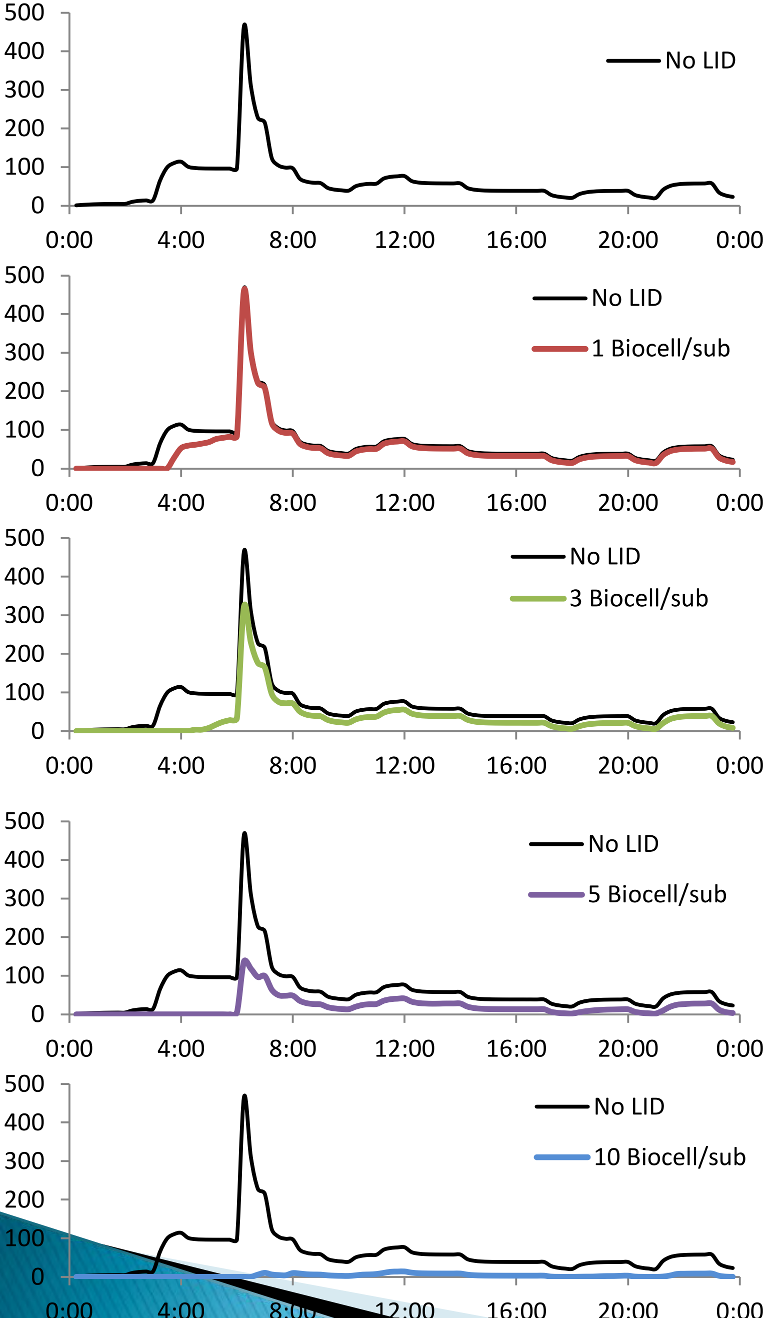
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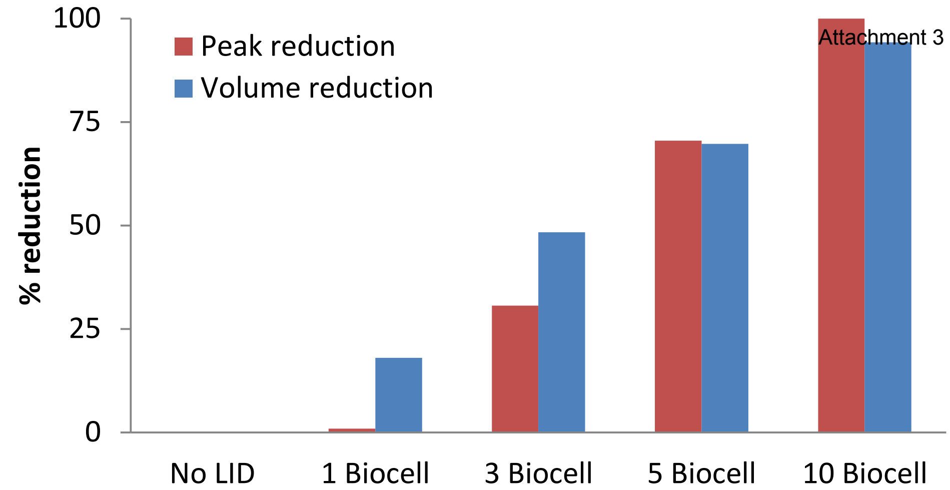
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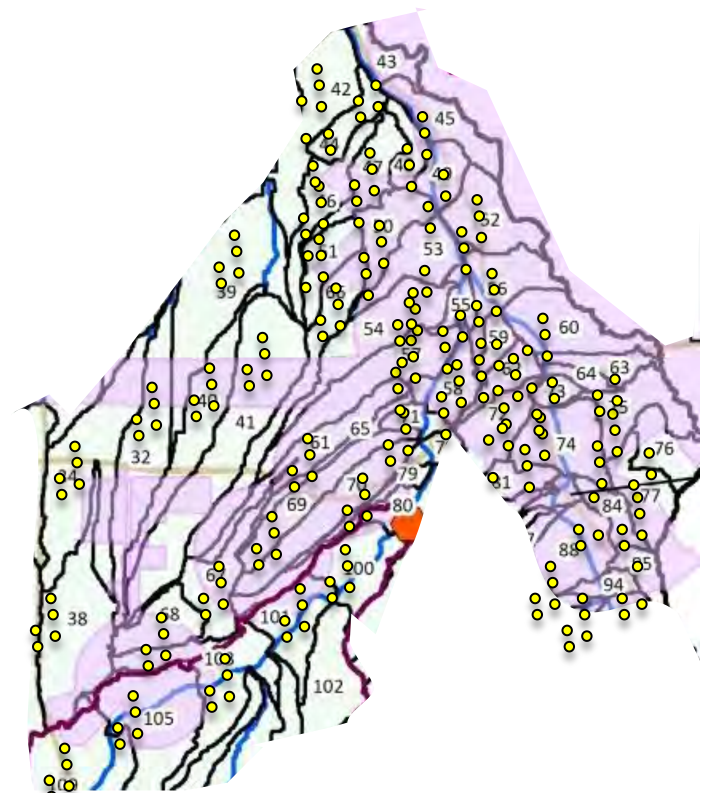

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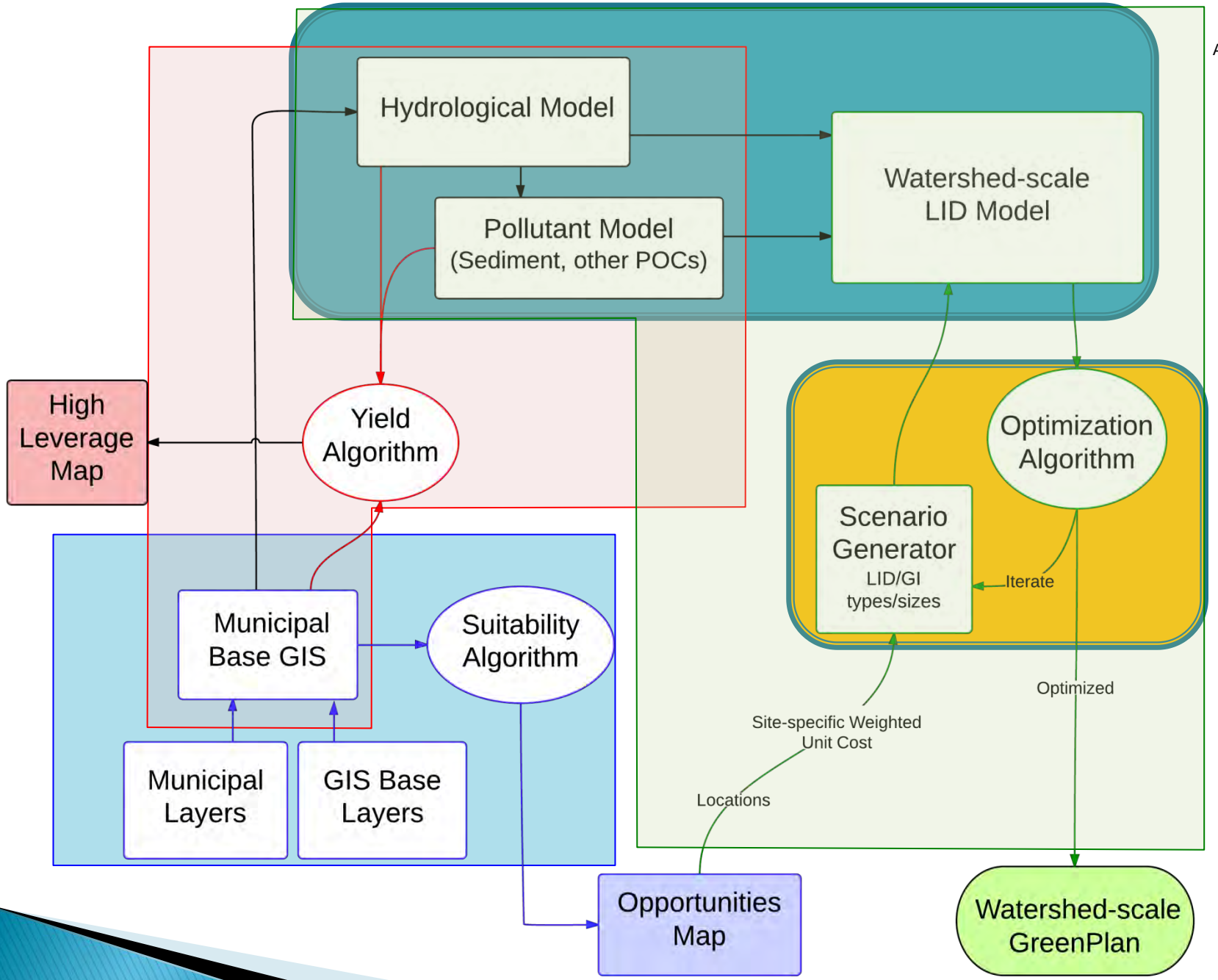
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Pollutant Model
(Sediment, other POCs)
Watershed-scale
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Generator
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Base GIS
Suitability
Algorithm
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Site-specific Weighted
Unit Cost
Optimized
Locations
Opportunities
Map
Watershed-scale
GreenPlan

Questions for TAC

- Is the current base model suitable for serving as a basis for optimization tool and master plan development?
  - Are current calibration results acceptable?
  - What further improvement is needed?
  - Other pollutants
    PCB/Hg
    Can simulate as a fraction of sediment

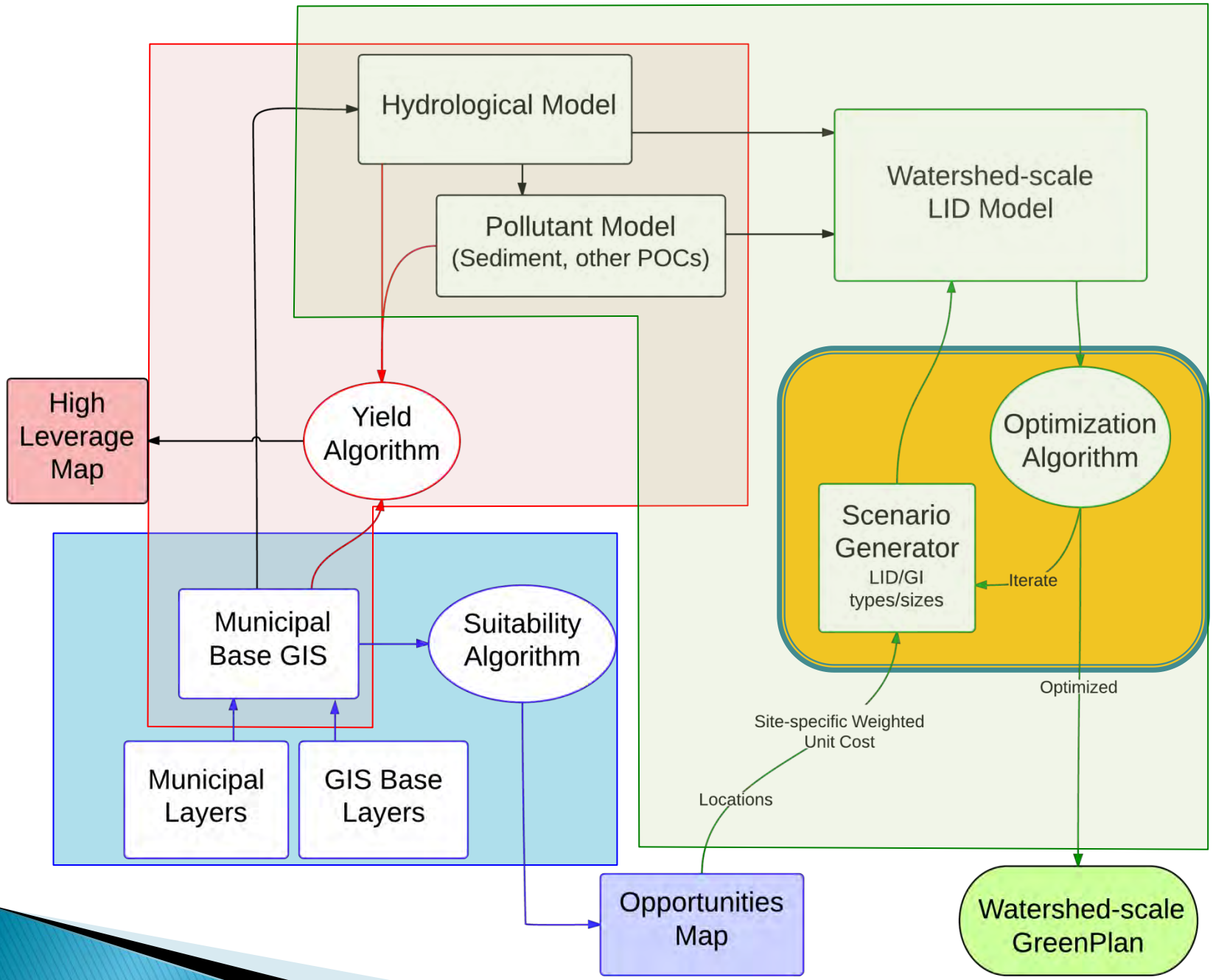
Optimization Tool Development

Green PlanIT TAC meeting

Jing Wu

June 17, 2014

Item #5


Hydrological Model
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(Sediment, other POCs)
Watershed-scale
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Iterate
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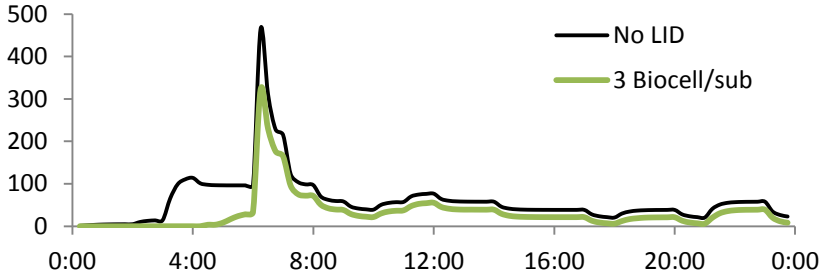
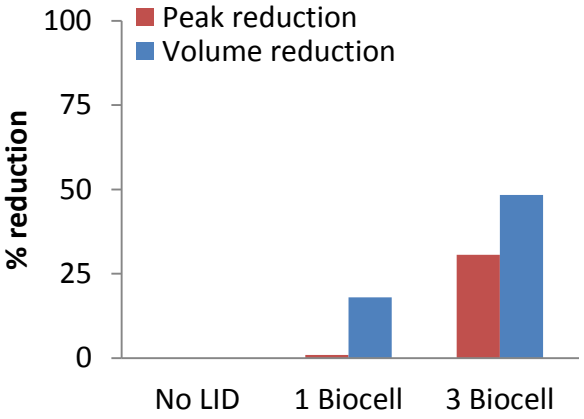
Base GIS
Suitability
Algorithm
Municipal
Layers
GIS Base
Layers
Optimized
Site-specific Weighted
Unit Cost
Locations
Opportunities
Map
Watershed-scale
GreenPlan

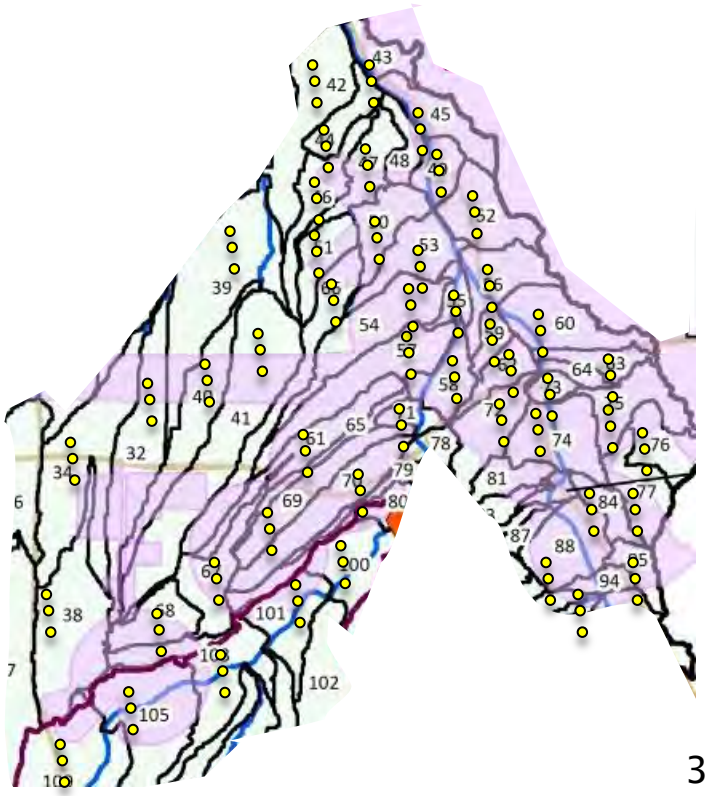
Item #5

Optimization tool

- What are the most cost-effective LID combinations for achieving certain reduction goal?

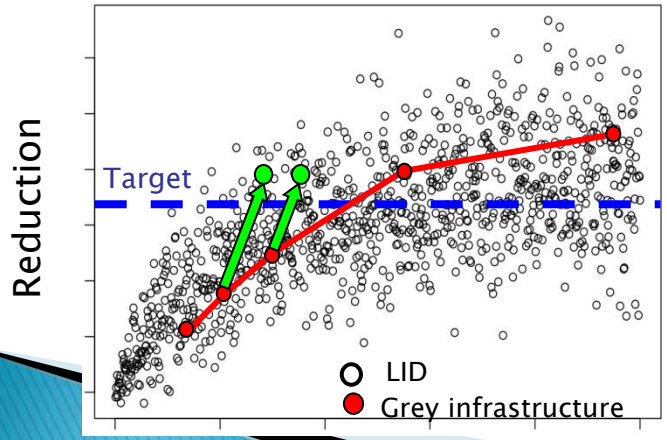


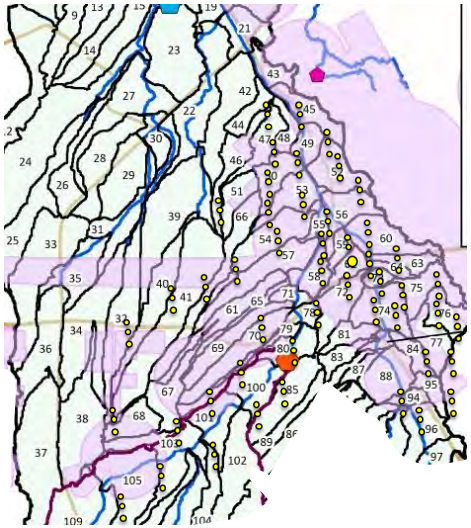




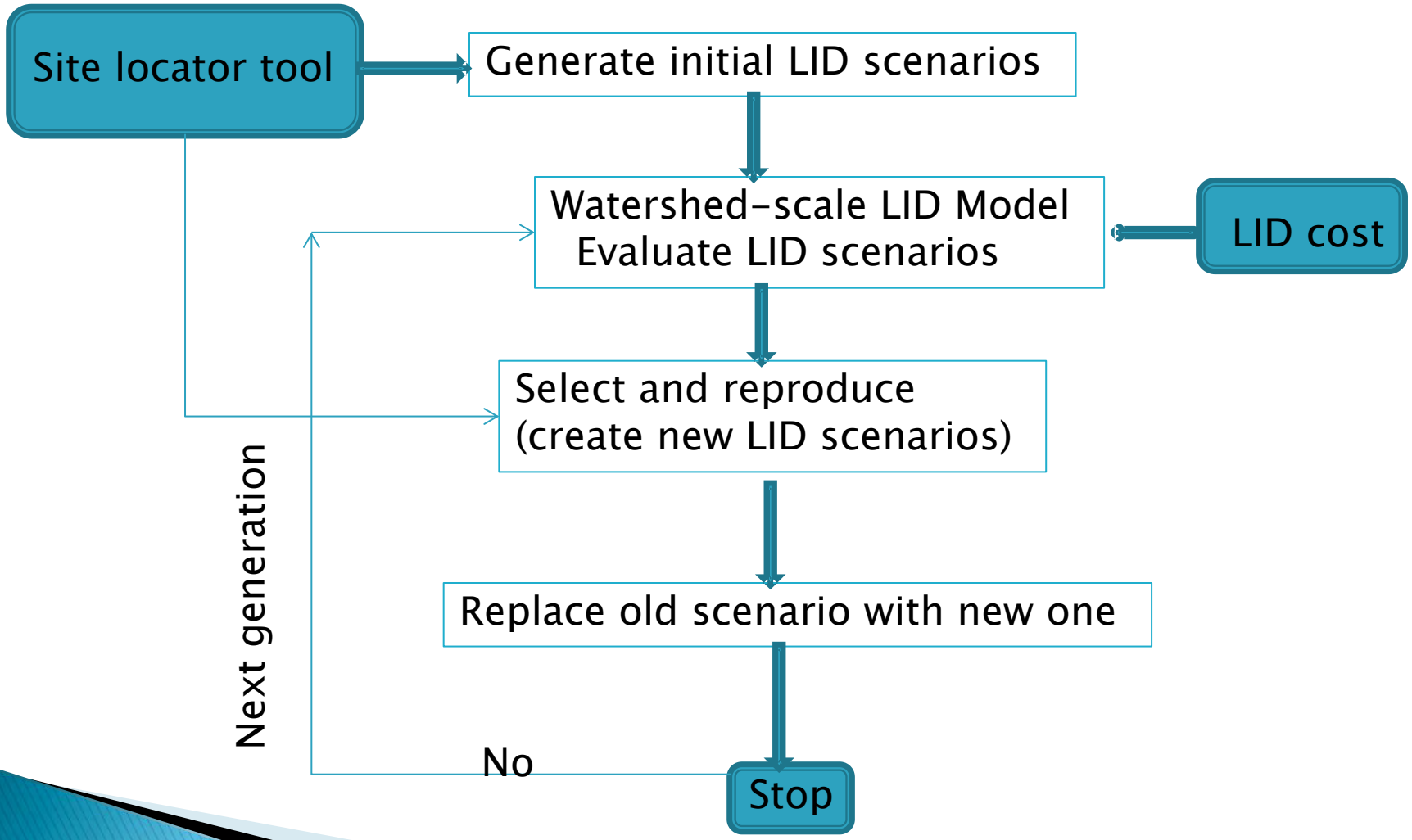
Optimization tool

- Used to evaluate and identify cost-effective LID placement and selection strategies for a preselected list of potential sites, applicable LID types, and ranges of LID size
- Utilizes information from other components of toolkit
  - Serve as an engine that calls modeling tool within each iteration
  - Use outputs from siting tool and LID cost information
- Outputs used for developing watershed-scale master plan





Flowchart of the tool

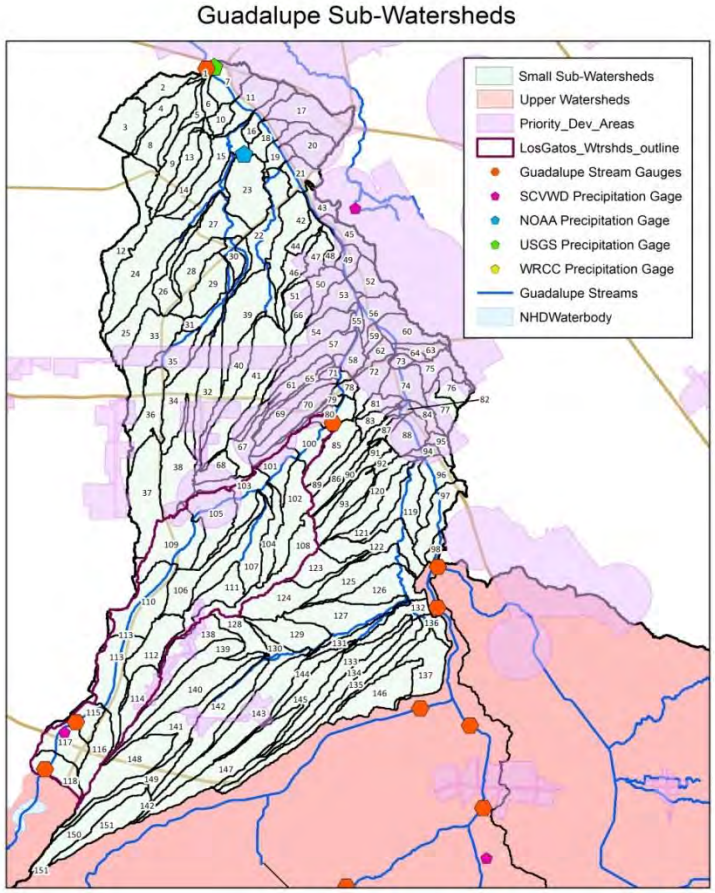


Optimization tool development

- Decide on optimization approach
- Formulate the problem
  - Decision variables
  - Assessment points
  - Evaluation factor, control targets
- Implement the approach (programming)
- Post-processing the simulation results for decision making

Optimization tool development

- Case study – San Jose development area

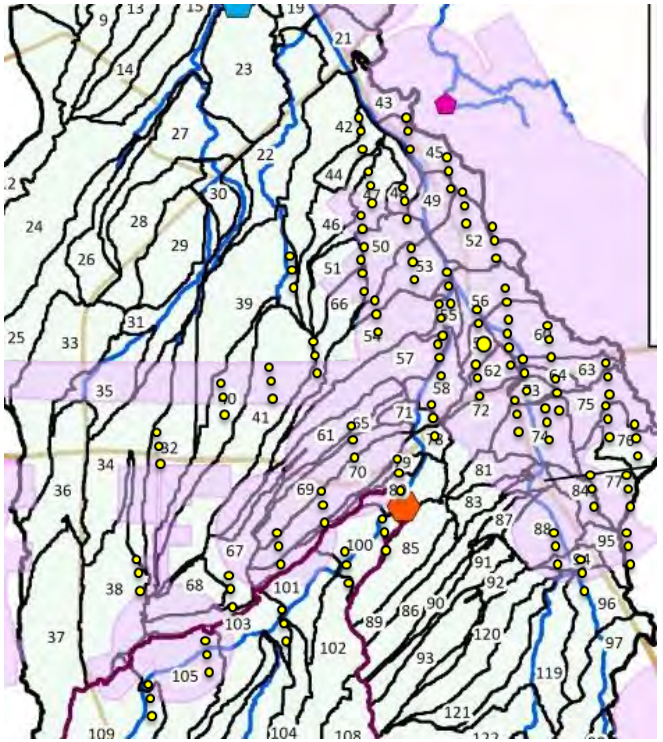


Key decision –Optimization technique

- Non-dominated Sorting Genetic Algorithm (NSGA-II)
  - One of the most widely used multi-objective optimization algorithms
  - Capable of producing optimal or near-optimal tradeoff solutions among competing objectives
  - Provides trade-off curves (optimal fronts) between pollutant reduction and total net cost increase, thereby offering a range of optimal LID solutions
  - One of two approaches used in EPA's SUSTAIN

Key decision –Scale

- San Jose development area = 4300 acre
- 53 sub-basins range from 20 ~ 150 acre
  too big to pinpoint exact LID locations
- Aggregated approach for LID simulation(EPA)
- Use site suitability tool to identify particular sites



Key decision –Environmental goals

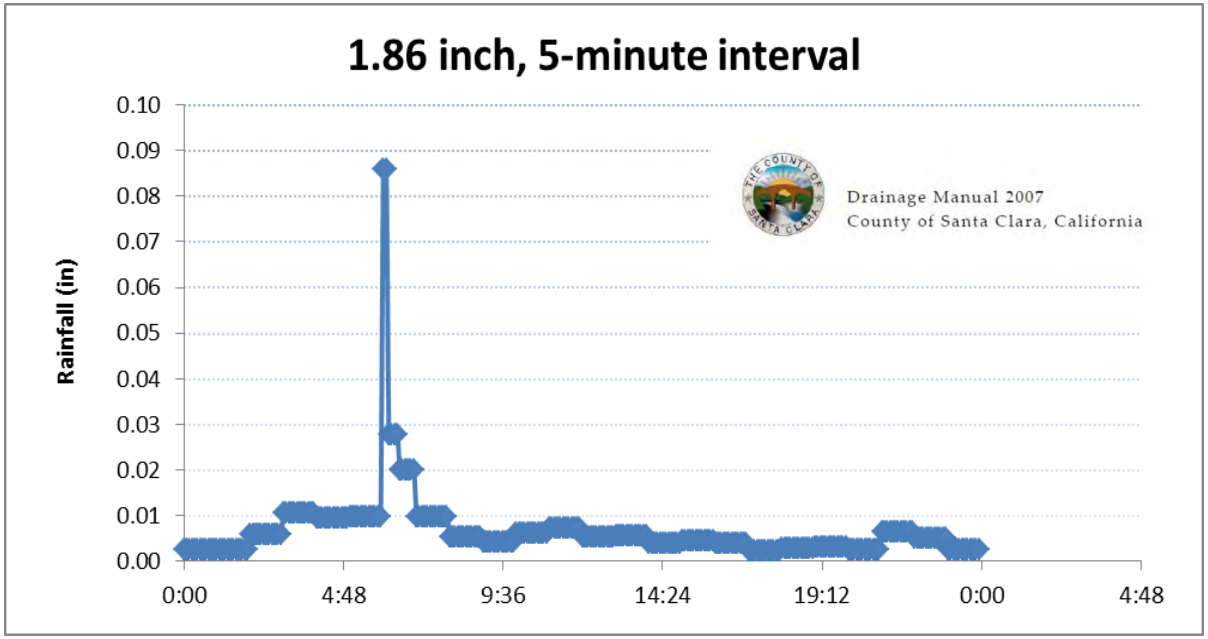
- What do we target?
  - Flow –volume or peak reduction?
  - WQ – POC?

    SWMM has no built-in mechanism to simulate pollutant reduction, how do we deal with it?

- What are the desired reduction goal?

Key decision – Design storm

- What storm should be used for sizing LIDs?
  - San Jose proposes a 2-year storm with 24-hour duration



  - LA requires to treat 0.75inch rainfall

Key Decision –LID types

- Five LID types in SWMM, which ones should be included for optimization?
  - Bioretention
  - Porous Pavement
  - Infiltration Trench
  - Rain Barrel
  - Vegetative Swale
- Grey Infrastructure(regional facility)
  - Should we consider?
  - What type? Enlarged bioretention with storage?

Key Decision –LID size

- Use a typical design/size for each LID
  - What are the typical design for each LID?
- Number of LIDs implemented as decision variable
  - Should we set upper limit for # of LID implemented or %impervious area treated?

Key Decision – LID cost

- LID cost largely determine the optimal scenario
- LID cost = capital + operation + maintenance, vary by LID type/size/location
- Limited cost info from San Jose. Some cost info from SUSTAIN applications.
- How to derive a realistic cost function?
  - Capital cost: $/sq feet surface area or $/volume treated (SUSTAIN applications)
  - O & M cost: how to quantify for various LID types?
  - Tiered cost: use certain matrix to break cost into tiers

Key Decision –Scenarios

- LID scenarios – need to test full range of possible options for decision making
  - Green Infrastructure only – may be too costly or infeasible
  - Grey Infrastructure only – not desired
  - Green + Grey Infrastructure – may be more realistic and one serves as supplementary to another
  - Other?

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Green Plan-IT Technical Advisory Committee (TAC)
June 17, 2014 Meeting Summary

Meeting attendance

TAC members: Matt Fabry (County of San Mateo), Sarah Sutton (PlaceWorks), Dino Marshalonis (Region 10 EPA), Keith Lichten (Region 2 Water Board)

SFEI: Lester McKee, Jennifer Hunt, Jing We, Patty Fontiera, Pete Kauhanen
SFEP: Jennifer Krebs, Jesse Mills, Josh Bradt

DCEC: Dan Cloak
BASMAA: Elaine Marshall (Sunnyvale); Jocelyn Walker (City of San Mateo); Jared Hart (San Jose); Bryan Apple (San Jose); Shannan Young (Fremont); Kristin Hathaway (Oakland); Ken Chin (City San Mateo); Peter Schultz-Allen (EOA representing San Mateo County Clean Water Program); Jill Bicknell (EOA representing Santa Clara County Clean Water Program)

Meeting Outcomes

- The toolkit concepts, functionality, and proposed outputs were presented to the TAC and generally supported the project
- The criteria for evaluating project success were proposed and supported by the TAC:
  - The toolkit strikes the right balance between "simple" to operate and complex enough to generate useful outcomes
  - The toolkit is locally applicable
  - The toolkit is regionally transferable
  - The toolkit is implementable
- The TAC provided detailed recommendations and implementation priorities on the site locator tool and the hydrological model calibration
- The TAC want further discussion of the optimization module and this will be done during a follow-up opt-in phone conference. A subgroup volunteered to be on the call.

Meeting Action Items

- Dino to share detailed pollutant input parameters for WA state model
- Jesse, Jill, Matt, Peter, Josh, Sarah, Ken, Shannan, Keith, Dino for a follow-up conference call likely within 2 weeks post meeting

- Periodic conference calls to ensure the project "stays above ground for all to see"
- Later this summer/early Sept having a debut with San Jose and San Mateo – open this up to the group?
- TAC re-convene in Sept-Oct
- Would be helpful to know about all of the connective pieces to the project e.g. MRP related – not necessarily a SFEI task. Need to understand what is really coming out of this project that will help municipalities with GI planning.
- Consider project updates as a standing item on the Green Streets WG to disseminate project updates

Meeting Notes

Item #2 Project Overview

- Questions
  - Who is the user community?
    - Primary users are agencies regulated under the MRP for LID implementation.
    - Any municipality that has interest/need of LID implementation e.g. Phase II permitees, flood control agencies, Caltrans
    - BASMAA has a Phase II committee that could be explored as to their interest in the toolkit

Item #3 Site Locator Tool

- Discussion Items
  - Which treatment types? Bioretention (have any shape, linear and non-linear), bioswale, permeable pavement, can't do vegetated swale (non-engineered soil). Wet ponds or wetlands are also not allowable in the permit – no detention type facilities. Need soil for treatment purposes. Infiltration basins are allowable.
  - Consider lowering the minimum requirement from 1000 sq ft
  - What about blue roofs? Blue roofs not as important.
  - What about tree wells? Sized the same as a bioretention unit. Filtera? Would the RB allow them if they were sized appropriately with treatment soil?
  - What about large scale rainwater harvesting?
  - How are buildings defined? Do they include areas where the building is underground?
  - More analyses within the street tool will be needed.
  - What if a municipality doesn't have some of the opportunity or constraint data? Need to develop more assumptions with the data you have. San Mateo will be a good example of a city with fewer data layers available.
  - Smaller municipalities may not have the desired GIS teams to run the tool. City of San Mateo could incorporate GIS output into their Sustainable Streets plan. How to transfer the tool to private developers for their work.
  - Dino Summary: Any additions to increase the flexibility of the tool would be helpful. How to incorporate the local community into the tool (they can make or break a

project)? Weighting scheme – need a lot more discussion to set defaults. Data layers added will depend on the question e.g. water quality vs pollutants.
    - Matt: need to look at the distinction between filtration and infiltration. Need to know the opportunities in the private and public development realm. ID the key data pieces that would most benefit the tool so municipalities can prioritize data layer development. Tool needs to fit into muni master planning process. Municipalities need to be able to add data layers.
    - Sarah: Streets are the driver. Resilience in low lying communities is high priority areas, climate change connection. Also consider tight space implementation e.g. Emeryville.
- Questions
    - Does slope layer in the base model include cross slope or just longitudinal?
    - What is the drainage area for each of the outputs of the tool?
    - How is veg swale defined? Shallow vegetated channels that slow water to discharge area. Might want to update this to more current terms e.g. bio swale
    - Why start with suitability and then do the knock out analysis? Technical reasoning to avoid multiple erases. Do the results differ by changing the order? If so, need to understand why.
- Recommendations
    - **LID features**
        - Need base analysis LID features to be consistent with the MRP allowable LID feature types and sizes.
        - Consider renaming wet ponds to infiltration basin and updating the specs to be for infiltration
        - Divide bioretention into two types: infiltrative (no sub drain or higher sub drain and non-infiltrative (has sub drain)
        - Consider a schematic with each LID feature type so each type is clearly defined
        - What about green roofs, green walls for air quality (e.g. Oakland)? Consider adding green roofs.
    - **What additional analyses?**
        - Street analyses:
            - Travel lane can be 12 feet or more.
            - Calculation of % treatment required based on amount of impervious surfaces. This could also be in the opportunity analyses that weights high volume treatment more.
            - Calculate drainage areas
            - Analysis of each individual street segment to understand runoff volume.
            - Bulb outs at intersections are good opportunities for LID placement.

- Curb extension bulb outs are also opportunities to maintain existing mature trees on streets where LID is implemented.
- Other opportunities in addition to just including 2 lanes of traffic; need to consider other street types e.g. one way streets etc.

- Public V private property
  - What are the differences between public and private properties? Need to make explicit public vs. private property – maybe 2 different analyses or data outputs?

- **Constraints and Opportunities**
  - Constraints: private property, Bus stops and glide paths; Existing mature trees
  - Change red curbs from constraint to opportunity
  - Riparian buffers should be a constraint
  - Protection of native vegetation could be a constraint
  - Additional knock outs are bridges
  - Consider requirements for large truck turning radius
- **Additional Data Layers**
  - Include areas of flooding.
  - Layering with Complete Streets, especially bike lanes (avoid). Look at streets that could have road diet. Provide data that could enable funding e.g. disadvantaged communities
  - Lot of other data layers to incorporate – linking to planned pedestrian improvements, storm drain infrastructure walk path to schools.
  - Aging grey infrastructure layer
  - Incorporate ADV data into the toolkit. This will show oversized roads.
- **Other**
  - Be good to have a checklist of data needed to perform certain levels of analysis.
  - Make sure tool output distinguishes between treatment and drainage area
  - City of San Mateo would like some initial output by August

Item #4 Modeling

- Discussion Items
  - Hydrology and sediment calibration look good
- Questions
  - Why is sediment concentration under predicted?
    - Sediment is difficult to model especially due to the SWMM function of buildup and wash off process. Need to get input on what function to apply to build up/wash off process e.g. exponential or power etc.
  - Is sediment strongly correlated with impervious? If so can this be used as a surrogate for sediment? Or land use as a surrogate?

- Do we want to use SWMM generated pollutant loads or bring loads estimates in? Important to get the relative scale of pollution right rather than absolute.
- Dino: water calibration was exceptional – could try to improve model performance of peaks. Sediment calibration was decent – could spend some more money on this piece. Get the bias to about 0.7 from 0.4 were it current is (i.e. the results would still be 30% bias low but good enough to go forward. Doesn't like SWMM for sediment.
- How did WA state deal with the pollutant loading? Had pollutant decay functions within the pipe and in overland flow.
- Want to err on the side of under predicting pollutant reduction.
- What drainage detail is important for the desired output?
- County of San Mateo has more detailed storm drain maps.
- City of Berkeley has done some modeling to find pinch points where grey infrastructure is failing and where LID could help that.
- What is the ease of adding data layers to the model?

- Recommendations
  - Adding the storm drain catchment areas could be an important addition to the hydro model?
  - Basin delineations may need to be manipulated since stream layer that created basins does not include storm drain information.
  - Consider using the Oakland museum creek and watershed maps as the drainage data layer.
  - Discuss the idea of developing non-modeling methodology for estimating WQ and hydro reduction.

Item #5 Optimization

- Discussion Items
  - Matt: Least connection to reality in terms of what the cities need. Land use is going to be a primary factor of where LID gets placed. Cost can be determined by looking at individual street segments and start to estimate the cost for treatment for that segment. Need to have flexibility within the tool for the cities to pick out priority areas. Might have a tiered cost factor e.g. downtown expensive…residential less expensive. Have far do we have to go to clean up PCBs.
  - What are the decisions that the optimization is trying to drive? Need to answer that before going through questions.
  - Estimate: $50k for treating an acre is an ideal cost for SW treatment. Maintenance would be 1/3 of the upfront cost per year.
  - Dino: Need to incorporate compliance costs – ensuring the features are functioning as designed.
- Questions
  - How do we prioritize sites within the toolkit? Can apply a weighting factor to the costs.

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Green Plan-IT Technical Advisory Committee (TAC)
Meeting Agenda

July 2, 2014, 10:00am – 11:30pm
913-227-1219
Guest Code: 671719

Item	Title	Time	Staff
1	**Introduction** • Introductions, • Goals for today's meeting	10:00	Lester McKee
2	**LID Site Locator Tool TAC Recommendations and Prioritization** • Review TAC recommendations • Discuss prioritization of recommendations and next steps Desired outcome: Ensure that all recommendations were recorded; discuss and finalize prioritization of recommendations	10:05	Lester McKee/Pete Kauhanen
3	**LID Modeling Tool development (Hydrologic model)** • Brief review of TAC recommendations • Summary of next steps	10:40	Jing Wu
4	**LID Optimization Tool development (linking site locator and modeling modules through statistical optimization)** • Discuss 3 key remaining questions on this module Desired outcome: Advice and review in relation to the key questions	10:45	Jing Wu
5	**Plan next meeting**	11:25	Jen Hunt

Questions for Discussion

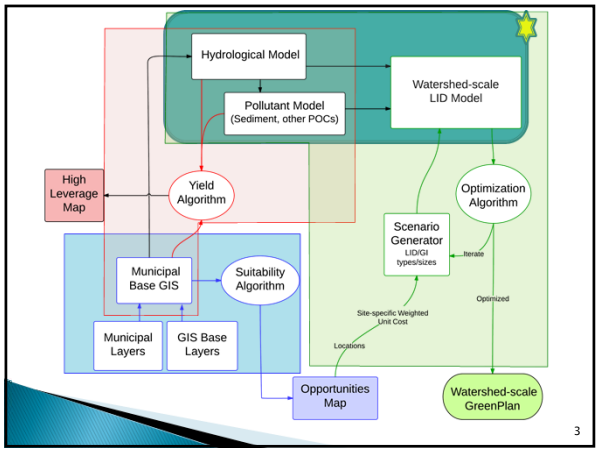
Green PlanIT TAC Conference Call

Jing Wu

July 2, 2014

1

High Leverage Tool – Model calibration



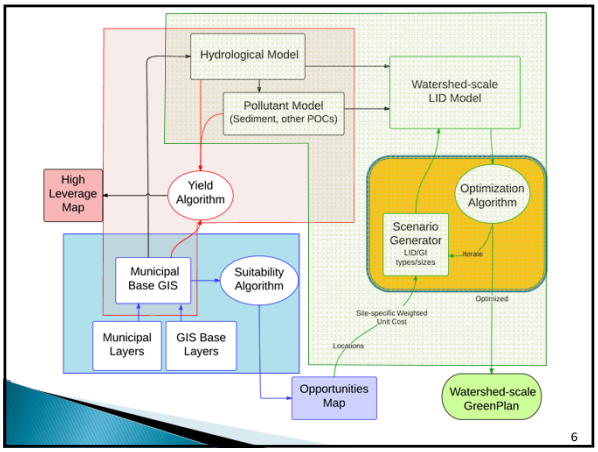
3

Modeling Tool Discussion

- Recommendation from TAC meeting
  - Further improve sediment calibration if possible
    - Success criterion: 70% of measured
- Proposed actions
  - Review recently identified additional SSC data in reservoir outfalls
  - Review WA SWMM model on sediment simulation
  - Further tweak model parameters
    - Check rating curves and possibly adjust
    - Adjust parameters in Buildup and Washoff functions

4

Optimization Tool to support Watershed Plans



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Optimization Tool Discussion

- Focus on three key decisions for tool development
  - Environmental goal
  - LID types
  - LID cost estimation

7

Key Decision –Environmental goals

- What do we target?
  - Hydomodification –Flow volume or peak reduction?
  - WQ improvement – which POCs?
- What are the desired reduction goal?
  - Could test full range – 0% to 100%
  - Use a specific goal to constrain simulation

8

Key Decision –LID types

- Five LID types in SWMM, which ones should be included for optimization?
  - Bioretention
  - Porous Pavement
  - Infiltration Trench
  - Rain Barrel
  - Vegetative Swale
- Grey Infrastructure(regional facility)
  - Should we consider?
  - What type? Enlarged bioretention with storage?

9

Key Decision – LID cost

- Key to optimal solution
- Unit cost approach
  - Total cost (construction, design, O & M cost) vary by the number and type of LIDs
- How to derive a realistic cost function?
  - Local cost data for LIDs
  - Build some reality into cost function – use weighting factors to differ cost, i.e inside Caltrain planning area
  - Other suggestions?

10

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July 2, 2014, 10:00am – 11:30pm

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SFEI: Lester McKee, Jennifer Hunt, Jing We, Patty Fontiera, Pete Kauhanen
SFEP: Jennifer Krebs, Jesse Mills, Josh Bradt
BASMAA: Jocelyn Walker (City of San Mateo); Jared Hart (San Jose); Shannan Young (Fremont); Kristin Hathaway (Oakland); Ken Chin (City San Mateo); Peter Schultz-Allen (EOA representing San Mateo County Clean Water Program)

Item	Title	TAC Comments
2	**LID Site Locator Tool TAC Recommendations and Prioritization**	• A recommendation to put more time and focus into roads analysis • Question on 1.3 (Divide bioretention into two types: infiltrative (no sub drain or higher sub drain and non-infiltrative (has sub drain)): Its ok that this comment is addressed later as long as the tool doesn't exclude potential sites based on non-infiltrative soil types. We will look into this and make sure that sites aren't thrown out based on soil type. JW: soils are considered, type C or D would have underdrain and type A or B wouldn't. Also a ranking of soil types: good, better, best – doesn't throw out completely. • Road issues are very important – would like effort placed on the roads analysis o Analysis will be dependent on available data. o Can't digitize in the project e.g. driveways o **Roads discussion should be part of next phone conference** o **Could do some new data creation as a pilot proof of concept** • Locator tool will be operating at the watershed scale while trying to balance on the ground needs for finer spatial scales (LID implementation scale) o Matt would like more of a push to the implementation scale for water quality improvement. o Dino supports comment that it needs to be useful for implementation. Make as fine a scale as you can – but recognize the computation limitations. Could run many smaller scale models on small sub watersheds and then compare that to the larger scale model o Jing: PDAs in San Jose are being explored at

Item	Title	TAC Comments
		the watershed scale-moving forward (next round of funding) we can focus on sub basins. Cities can go to finer spatial scales with the model if data can support it. o Dino concurred with the last comment. Ensure that the tool can be used at any spatial scale.
3	**LID Modeling Tool development (Hydrologic model)**	• Presented TAC recommendations and resulting next steps. o May have to force calibration to account for processes that we can't include in the model o If we are using sediment as a proxy for contaminants then sediment from urban areas are important to quantify separately from upper watershed contribution. Jing: whole idea of the model is to be able to quantify urban contributions of both sediment and contaminants. • Calibrations under 20% range is excellent, 30-40% is good, less than 40% is moderate – Tony Donegan numbers
4	**LID Optimization Tool development (linking site locator and modeling modules through statistical optimization)**	• Output will be used to generate the watershed scale master plan • What do we target? o What are the problems? What are the regulatory requirements? o Each municipality will have their own drivers that they can target • What is the environmental reductions goal? o Treating polluted areas with a range of management actions that include LID (other management actions not included in this toolkit). Aim for 40% reduction in urban areas? o Public ROW work will not impact hydromod improvement. Could include data layer that shows hydromod. WQ – Hg and PCBs and trash are primary pollutants – don't quite have a goal yet for WQ reduction goals via LID. Municipalities are not individually tasked with reductions. o Don't need a target – use the optimization tool to show what reductions are gained through LID implementation. Use the 0-100% range for reductions. Will need to pick hydromod or WQ in the tool to optimize. Need to choose 1. o Focus on PCB reduction as the target and as budget allows look at WQ reductions as an ancillary piece of information. Consider trash reduction as well. Trash may be a future topic o Would be good to have flexibility to have municipalities chose their primary target

Item	Title	TAC Comments
		based on their drivers. o **Cities do have trash data layers available** o Could use a weighting factor for high leverage areas for trash • LID types o Use a subset of the 5 SWMM LID feature types in the optimization piece? ▪ Bioretention used most often ▪ Rain barrel not very useful; keep other 4 o Regional grey infrastructure ▪ Adds complexity. Berkeley modeled both grey with green. ▪ San Jose is interested in this option ▪ We will explore this option with San Jose ▪ Might be more regional specific ▪ New California law that changes the definition of water which is opening up alternative uses of stormwater o LID cost ▪ Cost is very important piece to optimization ▪ Unit cost approach is good – set up the optimization to account for fractional units ▪ Pilot green street report had cost estimates – high variability of costs for the 10 projects ▪ Parcel cost will vary by size; redevelopment projects are required to add LID so this will be part of redevelopment costs. Public right of ways are where the real costs will be incurred. Coming up with massive costs for large scale implementation. Cities are dealing with how to integrate LID implementation with other planned capital projects. These different costs should be factored in. Cost reduction factor in when LID included as a retrofit project (which is lower cost). This last piece would happen outside the toolkit. ▪ **Need to define what is meant by O&M.** ▪ Come back with some examples of cost for TAC input ▪ Unit cost could be per unit treated or implemented. Different feature types will have different costs. ▪ Will need to make assumptions about size

Item	Title	TAC Comments
		▪ Washington used specific size designs and the associated treatment area
5	**Plan next meeting**	

Project Assessment and Evaluation Plan – Final

Proposition 84 Stormwater Planning & Monitoring Grant

Bay Area Green Infrastructure Master Planning Project

Association of Bay Area Governments

Agreement Number 12-415-550

DATE OF SUBMISSION: August 15, 2014

Signature Page

Name	Title	Organization	Signature	Date
Judy Kelly	Director	ABAG/SFEP		
Lester McKee		SFEI		
Jennifer Krebs	Project Manager	SFEP		
Rachid Ait-Lasri	Grant Manager	SWRCB		

I. Project Summary

A. Funding Program: State of California (Prop. 84 Stormwater Planning and Monitoring).

B. Project Description: San Francisco Bay and most of its contributing tributaries are listed as impaired under Section 303(d) of Clean Water Act for a variety of pollutants, and experience problems related to high flow, sediment erosion, and water quality degradation. The Bay Area Green Infrastructure Master Planning Project will provide a Low Impact Development (LID) Toolkit and other planning assistance to help Bay Area municipalities strategically plan and implement LID projects at a watershed scale. The concept and LID toolkit developed through this project can be applied to any urbanized areas in California.

The Bay Area Green Infrastructure Master Planning Project will: 1) develop and demonstrate a portable GIS-based LID Siting Toolkit in 3 Bay Area pilot watersheds. The Toolkit will facilitate identification, evaluation and ranking of potential sites based on both their relative feasibility and potential effectiveness in reducing flow and pollutant loads and minimizing impacts on beneficial uses of Bay Area rivers, lakes, and streams. A cost/benefit analysis will be performed on the potential sites and the sites will be ranked according to the analysis. 2) The project team will collaborate with partnering Bay Area municipalities to develop Green Infrastructure Plans and conceptual designs of LID installations. These plans will be integrated into municipal planning efforts so that the plans are the basis for new and re-development in the municipalities. 3) The project will consider a variety of strategies to fund LID retrofits. 4) Education and outreach within the region and state expand the reach and impact of the project through a publically accessible project website.

C. Problem Statement: Municipal governments do not know where to site effective LID treatments. This project aims to develop and provide tools and technical assistance to help municipal governments incorporate Green Infrastructure Plans into current municipal planning initiatives.

D. Project Activities or Tasks:

1. Quarterly invoicing and progress reports
2. Draft and final PAEP
3. Annual PAEP status update(s)
4. Final Report PAEP Evaluation
5. Analyze existing LID tools and summarize findings and recommendations for toolkit development.

6. Develop list of |GIS data layers used for LID Toolkit and identification of watersheds selected for analysis.
7. Develop feasibility module and identify relevant issues/challenges and questions to inform further LID Toolkit development.
8. Develop the effectiveness module and identify relevant issues/challenges and questions to inform further LID Toolkit development.
9. Develop the cost/benefit analysis and identify relevant issues/challenges and questions to inform further LID Toolkit development.
10. Select the sites identified through toolkit for verification through field visits and/or remote sensing. Based on findings from site verification, update the list of priority sites and if necessary or feasible update the Toolkit.
11. Complete report presenting the demonstration of LID Toolkit in at least three local watersheds with list and ranking of LIDs at various sites within each watershed.
12. Convene a Technical Advisory Committee for 3 meetings to discuss development of technical products, peer review, and toolkit outputs
13. Complete documentation of LID Toolkit (including user's guide and technical memo) for web posting.
14. Assist in the development of public outreach materials including meeting handouts, PowerPoint presentation(s), and other materials pertaining to the LID Toolkit, site verification, and Conceptual Designs of selected LID types.
15. Complete the final synthesis document summarizing the development and demonstration of the LID toolkit
16. Complete conceptual designs for a minimum of 8 LID projects

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

#	Task	Category
1	Quarterly invoicing and progress reports	*Planning, Research, Monitoring and Assessment*
2	Draft and final PAEP	*Planning, Research, Monitoring and Assessment*
3	Annual PAEP status update(s)	*Planning, Research, Monitoring and Assessment*
4	Final Report PAEP Evaluation	*Planning, Research, Monitoring and Assessment*
5	Analyze existing LID tools and summarize findings and recommendations for toolkit development.	*Planning, Research, Monitoring and Assessment*
6	Develop list of GIS data layers used for LID	*Planning, Research, Monitoring and*

	Toolkit and identification of watersheds selected for analysis.	*Assessment*
7	Develop feasibility module and identify relevant issues/challenges and questions to inform further LID Toolkit development.	*Planning, Research, Monitoring and Assessment*
8	Develop the effectiveness module and identify relevant issues/challenges and questions to inform further LID Toolkit development.	*Planning, Research, Monitoring and Assessment*
9	Develop the cost/benefit analysis and identify relevant issues/challenges and questions to inform further LID Toolkit development.	*Planning, Research, Monitoring and Assessment*
10	Select the sites identified through toolkit for verification through field visits and/or remote sensing. Based on findings from site verification, update the list of priority sites and if necessary or feasible update the Toolkit.	*Planning, Research, Monitoring and Assessment*
11	Complete report presenting the demonstration of LID Toolkit in at least three local watersheds with list and ranking of LIDs at various sites within each watershed.	*Planning, Research, Monitoring and Assessment*
12	Convene a Technical Advisory Committee for 3 meetings to discuss development of technical products, peer review, and toolkit outputs	*Planning, Research, Monitoring and Assessment*
13	Complete documentation of LID Toolkit (including user's guide and technical memo) for web posting.	*Education, Outreach, and Capacity-building*
14	Assist in the development of public outreach materials including meeting handouts, PowerPoint presentation(s), and other materials pertaining to the LID Toolkit, site verification, and Conceptual Designs of selected LID types.	*Education, Outreach, and Capacity-building*
15	Complete the final synthesis document summarizing the development and demonstration of the LID toolkit	*Planning, Research, Monitoring and Assessment*
16	Complete conceptual designs for a minimum of 8 LID projects	*Planning, Research, Monitoring and Assessment*

II. Project Goals & Desired Outcomes

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.

III. Project Performance Measures Tables

Table 1
GIS Toolkit

Project Goals	Desired Outcomes	Output Indicators	Outcome Indicators	Measurement Tools and Methods	Targets
1. Develop and demonstrate a GIS-based LID planning Toolkit in pilot watershed/municipalities to prioritize LID Siting.	Piloting of toolkit in two municipalities to determine the effectiveness of the tool in siting potential LID sites.	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 5. Complete site verification of a subset of potential LID locations 6. Develop at least 8 conceptual designs for planned LID projects	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	<u>TOOLS</u> 1. GIS locator tool 2. hydrologic modeling tool 3. benefit-cost data analysis tool <u>METHODS</u> 4. Identification of potential LID sites 5. Quantification of potential pollutant contamination reductions from the sites 6. Identification of prioritized LID sites	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

Table 2
Green Infrastructure Master Planning

Project Goals	Desired Outcomes	Output Indicators	Outcome Indicators	Measurement Tools and Methods	Targets
2. Develop and complete Green Infrastructure Master Plans for participating municipalities	1. 2 municipalities adopt Green Infrastructure Master Plans – either stand alone or incorporated into current planning documents	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	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	1. Development of draft plans and conceptual designs 2. Tracking review/adoption process by municipality 3. Formal consideration by municipalities	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

Table 3
Education, Outreach, and Capacity-building

Project Goals	Desired Outcomes	Output Indicators	Outcome Indicators	Measurement Tools and Methods	Targets
3. Develop and disseminate outreach and education materials to stakeholders to ensure understanding and use of the LID Toolkit.	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	1. Development of outreach and educational materials 2. Webinar presenting and demonstrating the LID toolkit	1. Municipal and interested party participation in Webinar 2. SFEP Implementation committee or ABAG executive board, CASQA and BASMAA members participation in outreach presentations	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	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