DSD Conference: Applying the Triple Bottom Line in San Francisco

November 13th, 2014

Agenda

- Introduction to San Francisco's Sewer System Improvement Program
- San Francisco Triple Bottom Line Model
- Questions / Discussion



AECOM Sustainable Economics Group

Built on the principles of understanding the entire costs and benefits of a given investment to provide a better understanding of how these investments will change our built, natural, and social environments.

SAN FRANCISCO SEWER SYSTEM

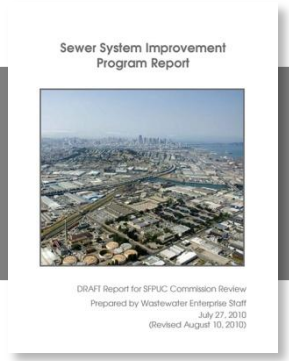
+ 1,000 miles of Sewers
+ 2 All-Weather Wastewater Treatment Plants
+ 1 Wet-Weather Wastewater Treatment Plant
+ 8 Transport/Storage Structures
+ 19 All Weather Pump Stations
+ 25,000 Catch Basins
+ 36 Combined Sewer Discharge (CSD) Structures
+ Green Infrastructure

Sewer System Improvement Program (SSIP)

- $6.8Billion Program
- 15-year Program - 30-year Implementation Schedule
- Includes entire system
  - Treatment plants
  - Collection system
  - MS4 separate areas

The Public Mandate

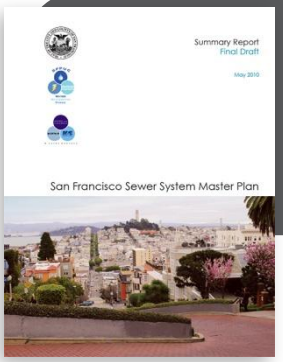
Sewer System Improvement Program
7 Public Workshops



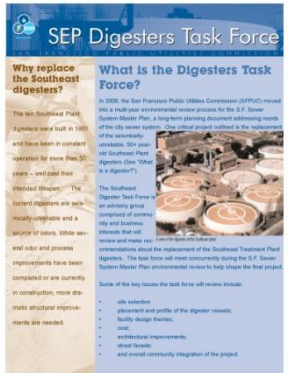
Sewer System Improvement Program Report

2005-2010 | 2009-2010 | June 2010 | July 2010

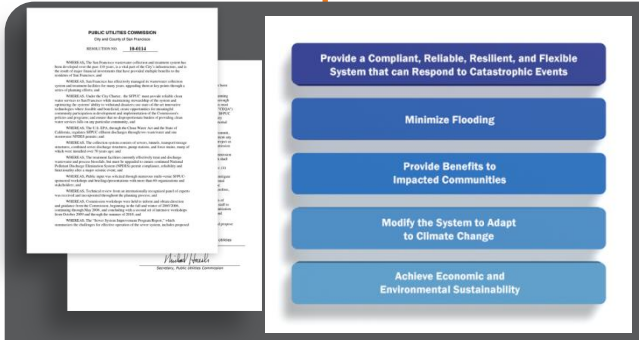
Stakeholder Input



Sewer System Master Planning Effort



Digester Task Force
18 months

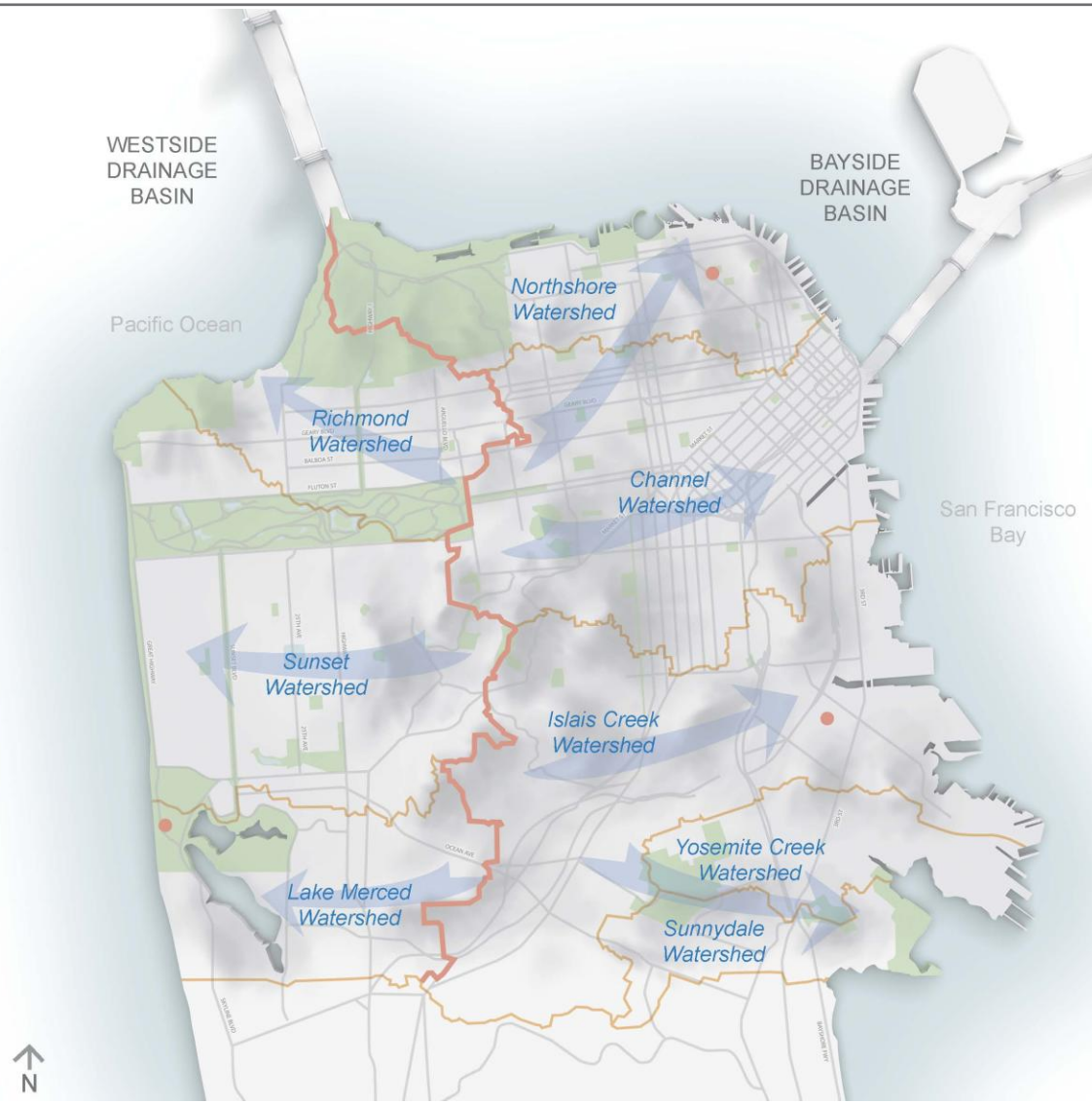


SSIP Levels of Service Goals Endorsed & Resolution Adopted

Sewer System Improvement Goals

- Provide a Compliant, Reliable, Resilient, & Flexible System that can Respond to Catastrophic Events
- Integrate Green & Grey Infrastructure to Manage Stormwater
- Provide Benefits to Impacted Communities
- Modify the System to Adapt to Climate Change
- Achieve Economic & Environmental Sustainability
- Maintain Ratepayer Affordability

URBAN WATERSHED ASSESSMENT



KEY ELEMENTS

+ Watershed approach to project planning
+ Collaboration with other city agencies
+ Public engagement
+ Triple Bottom Line (TBL) analysis

URBAN WATERSHED ASSESSMENT

Projects + Programs + Policies

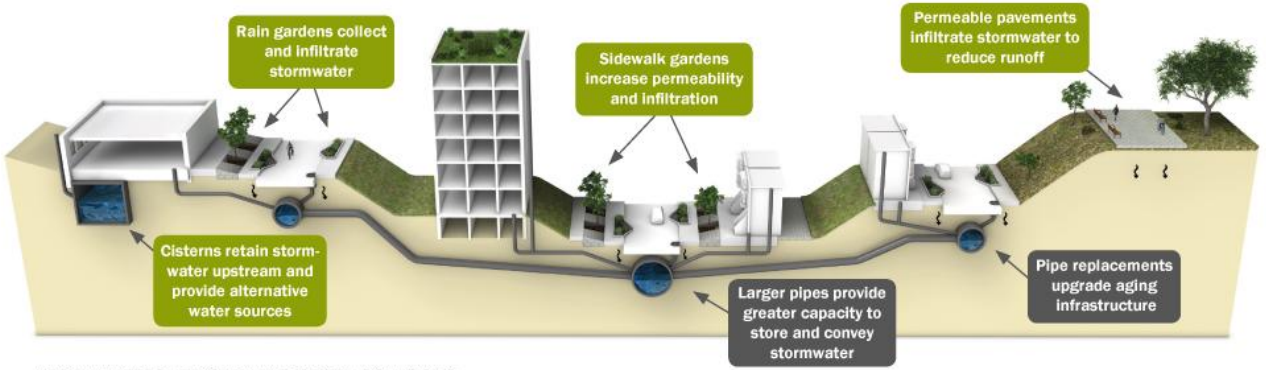
Green and Grey Infrastructure

Education, Grants, and Incentives

Stormwater Design Guidelines

GREEN AND GREY TECHNOLOGIES

GREEN



URBAN WATERSHED GREY AND GREEN SOLUTIONS

GREY

Pump Stations | Outfall Retrofit/ Replacement | Tunnels | Transport/Storage Structures | Pipe Upsizing/ Replacement

Recap of SSIP Validation

Categories of SSIP Capital Program	Phase 1 ($ Millions)	Phase 2 ($ Millions)	Phase 3 ($ Millions)	TOTAL
Treatment Plants	$2,233	$1,215	$407	**$3,855**
Collection System	$354	$1,928	$476	**$2,758**
City and Consultant Program Management	$125	$152	$43	**$320**
TOTAL SSIP	**$2,712**	**$3,295**	**$926**	**$6,933**

Increased Granularity

PLANNING

Master Plan
Identifies needs and potential projects

Validation
Confirms and refines projects

- Level of Service
- Condition Assessment
- Modeling
- Refined Cost Estimates

Final List Of 85 Project Concepts

IMPLEMENTATION

Project Concepts

Design & Construction

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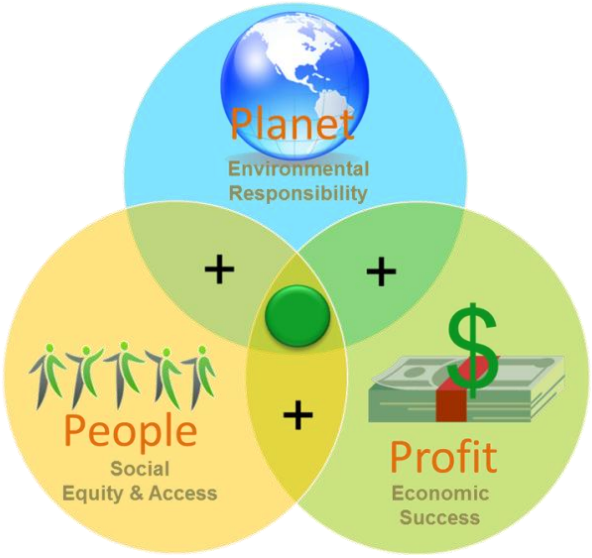
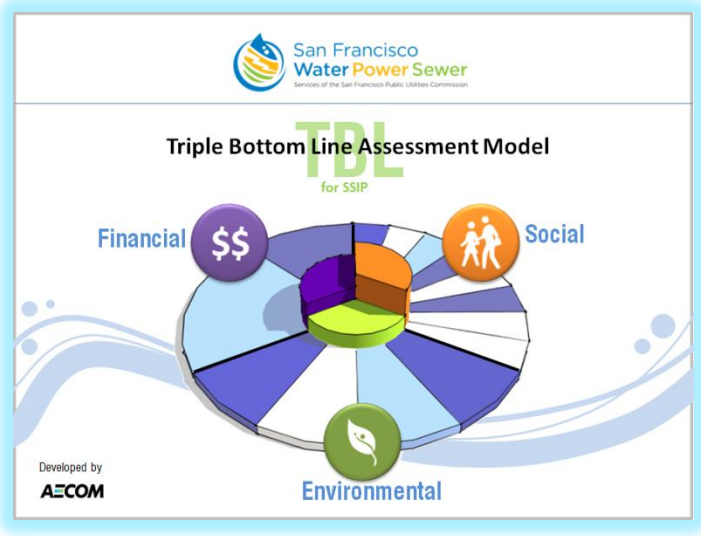
TBL Primary Objectives

1. To inform and support the analytical process for ***developing alternatives*** by considering social and environmental components in the process alongside performance and economic considerations

2. To provide ***decision-making support*** for SFPUC project leaders; and

3. To increase ***project selection transparency*** *and* ***facilitate a reporting-out*** of expected project benefits.





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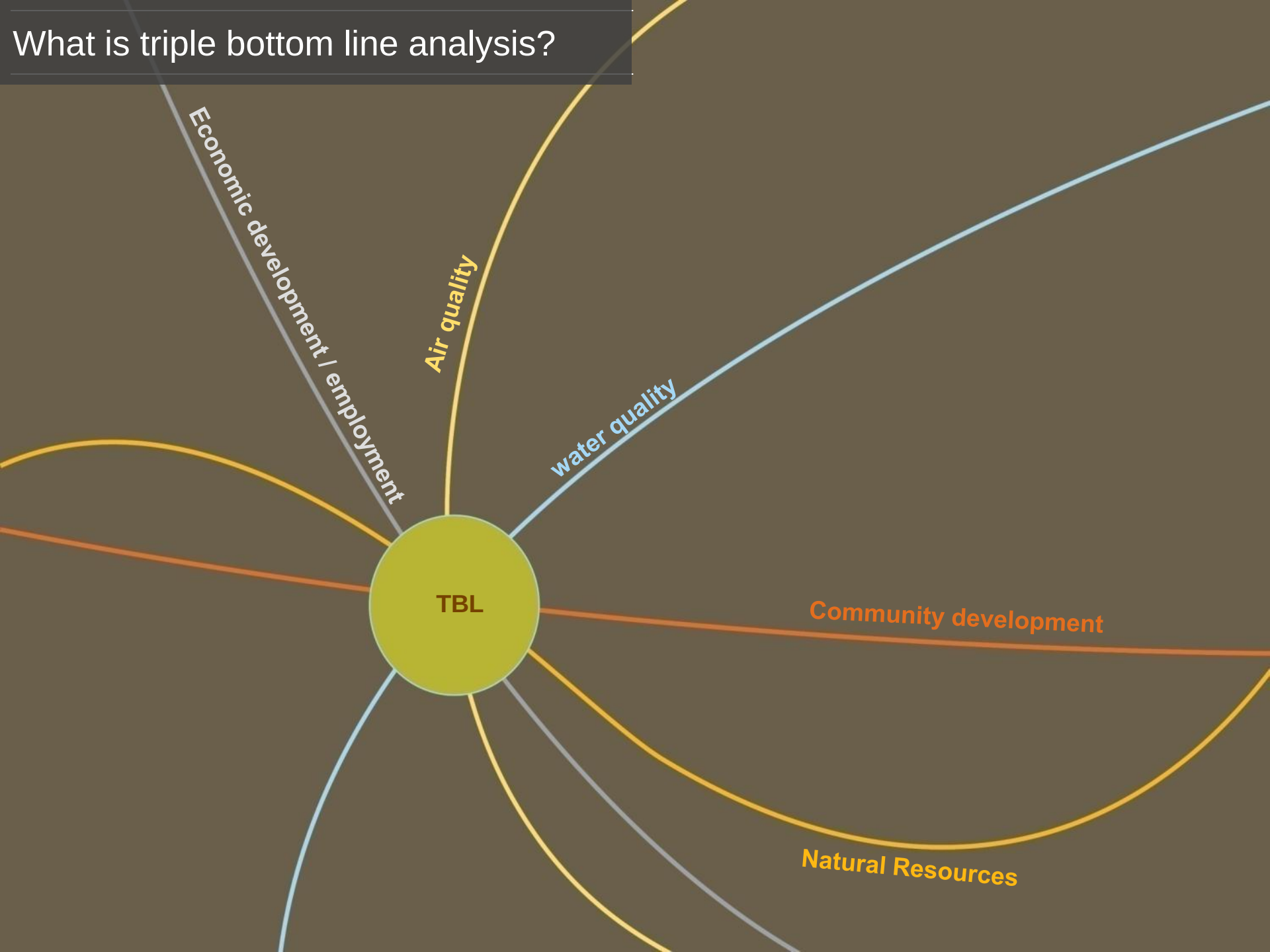
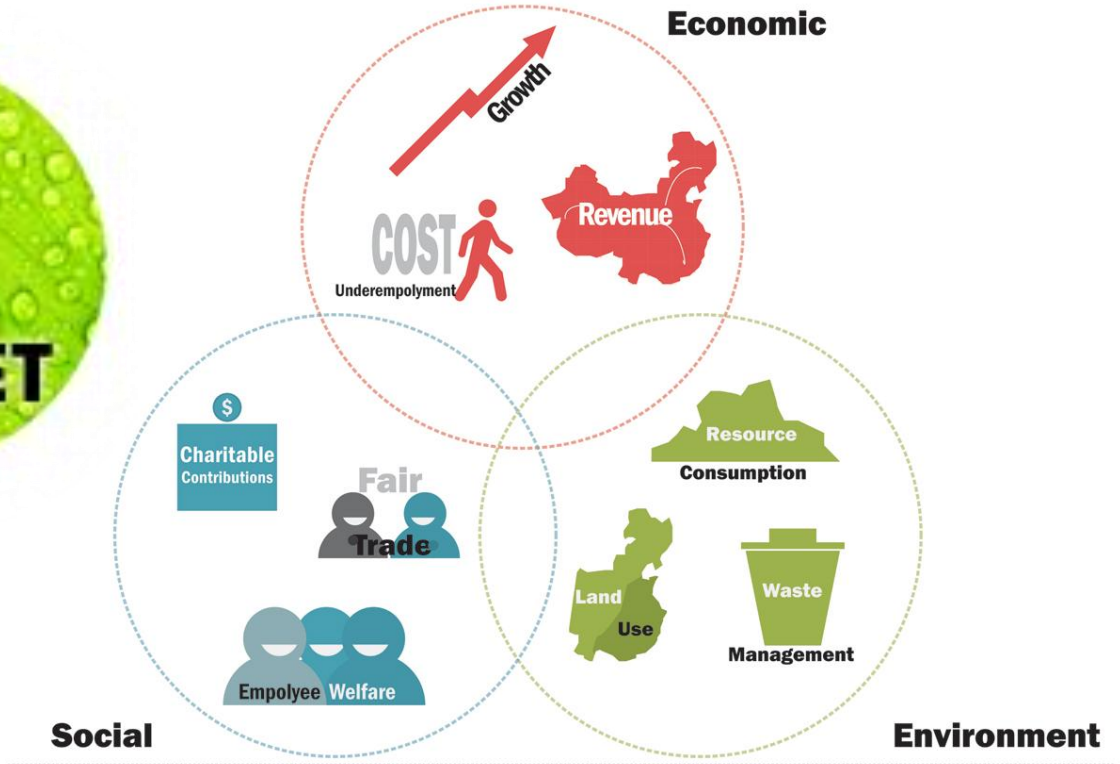
What is triple bottom line analysis?



Triple Bottom Line Principles



4 Typical TBL Assessment Techniques

Financial Analysis (SROI)

- Pure cash-flow analysis over the project lifetime (Sustainable Return on Investment)
- *?: Is this option commercially viable? Which option has the lowest lifetime cost?*

Benefit-Cost Analysis

- Economic valuation which tries to capture quantifiable costs and benefits
- Monetizes criteria; allows for direct comparison of environmental and social to economic criteria
- *?: Do alternative benefits outweigh the costs? How much should I invest to meet consumer demands?*

Cost Effectiveness Analysis

- Non-financial benefits expressed in units, not monetary terms
- Similar to BCA, but not monetized
- *?: Which option offers the leas cost alternative for reducing X emissions?*

Scoring and Ranking

- Used to compare costs that can't be monetized
- Allows for consideration of various stakeholders, government, community
- Limits false precision
- Simpler

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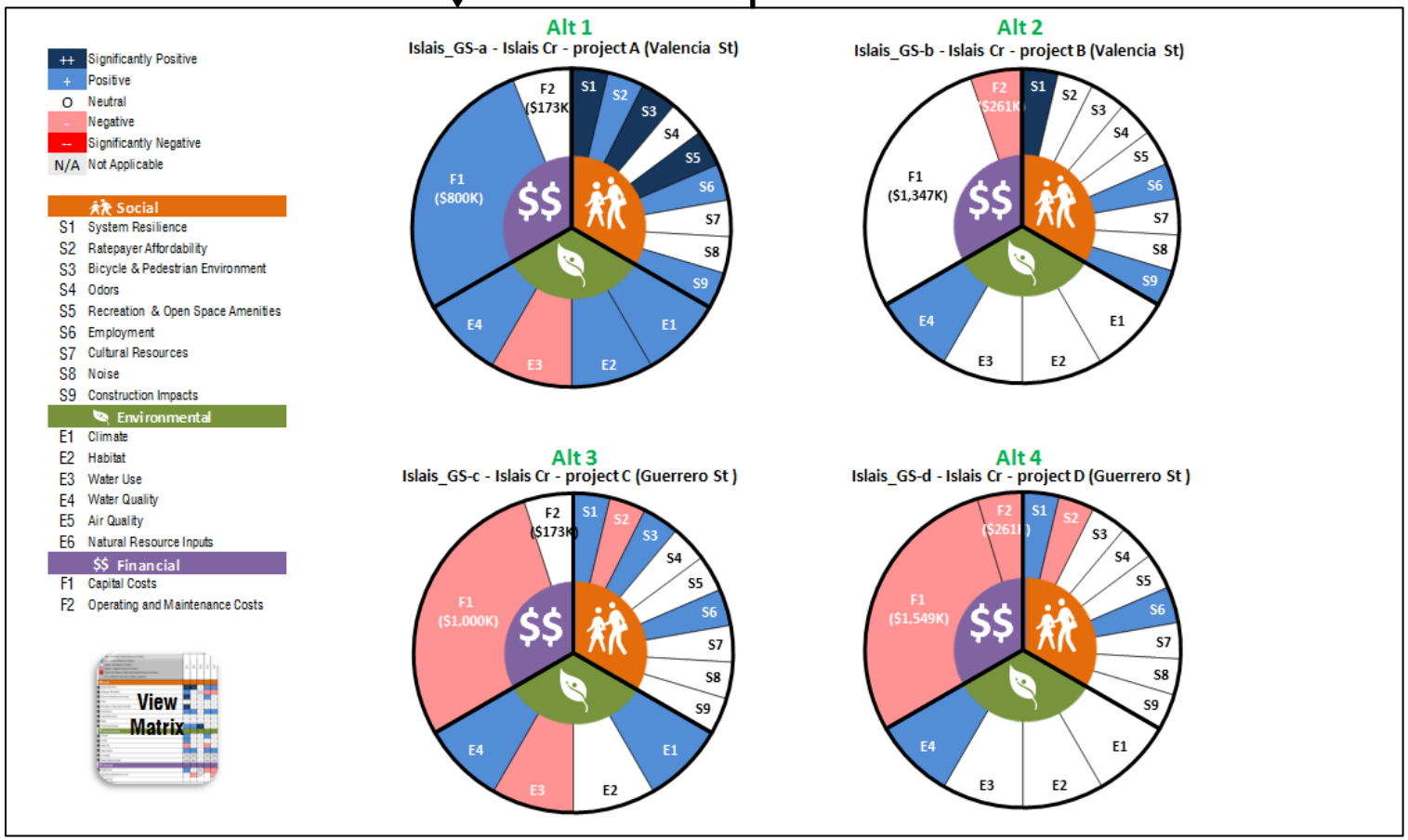
Implementation Plan: Tools for Efficient Delivery

Needs Assessment Report → Alternatives Analysis → Conceptual Engineering Report → Design → Construction



Triple Bottom Line Sample Output

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San Francisco Water Power Sewer
Services of the San Francisco Public Utilities Commission

Triple Bottom Line (TBL) Assessment Model

Environmental + Social + Financial Sustainability

Version 1.0

The TBL Assessment Model is a module within the Citywide Sewer System Improvement Program (SSIP). The purpose of a TBL assessment is to provide a decision-support platform that facilitates the selection of SSIP projects and project alternatives that generate the highest value in terms of environmental improvement, social-benefit, and economic gain relative to criterion established. The determination of 'value' is carried out through a system of measurement that has two main aspects – the first is a set of **Indicators** that are designed to measure certain attributes of value, and second, is a **Rating System** that applies a consistent set of rules that can normalize, interpret, classify, aggregate and represent the measured indicator values in order to make them useful for decision-making. While indicators are primarily designed for measuring and monitoring performance of a system component, the Rating System is primarily designed to aid multi-criteria decision-making (MCDM) – a foundation of the TBL process.

The TBL is essentially an Indicator-based Rating System that incorporates multi-criteria decision making.

The main components of a robust TBL module are:

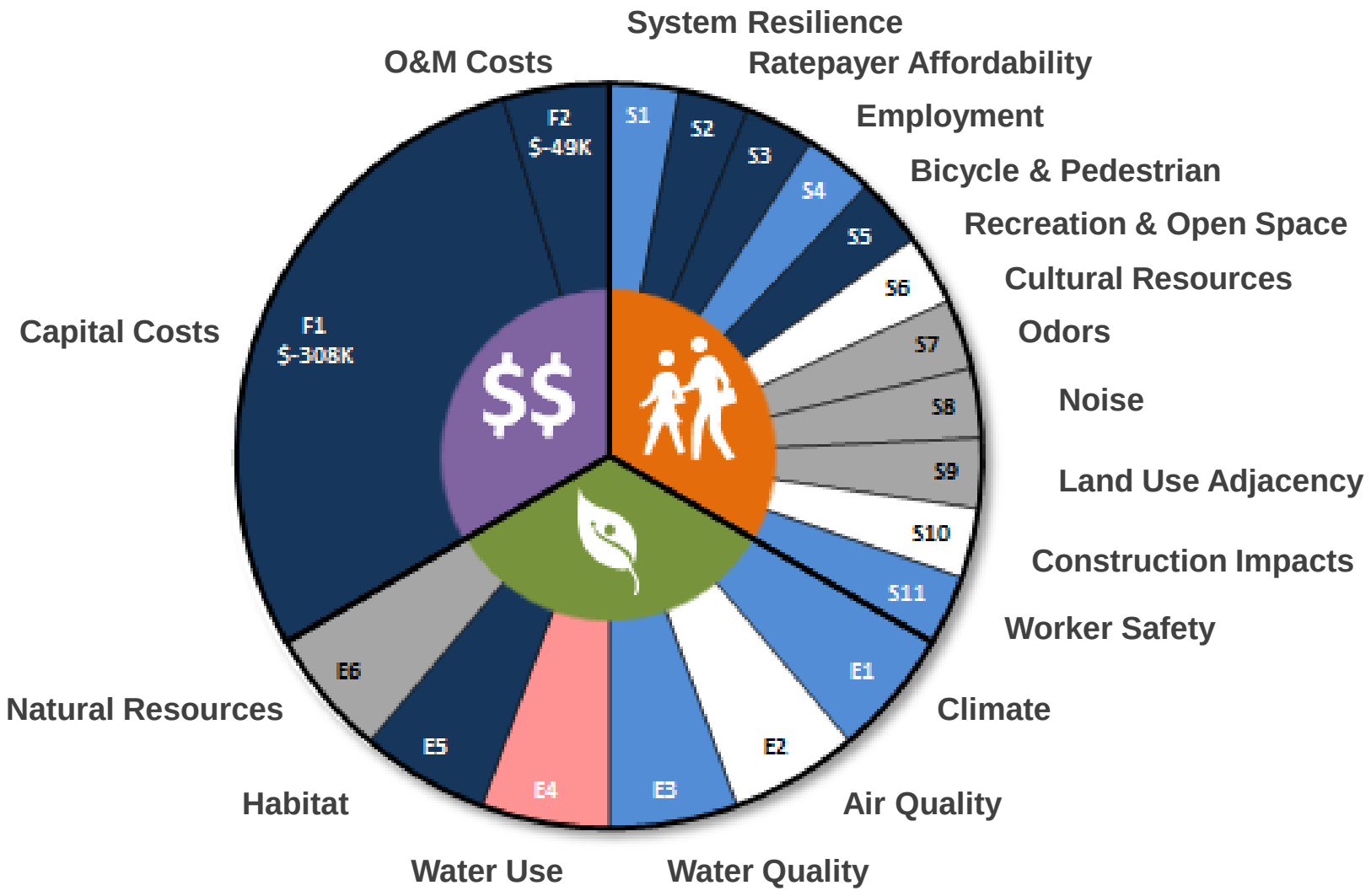
- A comprehensive list of indicators
- A collection of indicator measurement models and processes that utilize available data
- A scoring and representation model (Rating System) that makes sense of all the indicators and facilitates decision-making

Characteristics of a good TBL Rating System:

- Simple (easily understood but logically sound)
- Comprehensive (by topic/criteria and indicators)
- Consistent (across indicator types, project types)
- Structurally Unbiased between Indicators as a model (unless explicitly weighted)
- Computable/Measurable
- Scalable (expandable by number of indicators; can work at local, watershed, City scales)
- Aggregation capable (group indicators into indexes etc.)
- Visually Representable (in a compelling, easy to grasp way)

TBL follows a basic set of principles

TBL Output Example



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Triple Bottom Line (TBL) Assessment Model

Environmental + Social + Financial Sustainability Version 1.5

San Francisco Water Power Sewer

TBL HOME | MODEL INPUTS | MODEL CALIBRATION | TBL RESULTS | ALTERNATIVES | DATA ARCHIVE

TBL Project Results | Project Results Comparison | Archive Result for Project

Generate Report for Printing | View Project Data Form

☑ Evaluate Financial Criterion Ratings based on cost-effectiveness

Ordinal ranking system limits impression of false precision

Have the option to show or hide those criteria not impacted

++ High (Significantly Positive Influence to Criteria)
+ Low (Positive Influence to Criteria)
O Neutral (No Influence to Criteria)
- Negative (Negative Influence to Criteria)
-- Significantly Negative (Significantly Negative Influence to Criteria)
N/A N/A (Insufficient Information to Make a Judgment)

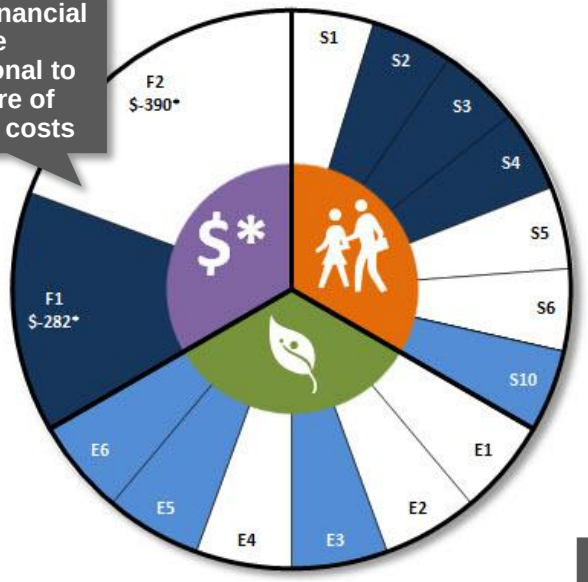
Details

	Social		
S1	System Resilience	O	
S2	Ratepayer Affordability	++	
S3	Employment	++	
S4	Bicycle & Pedestrian Environment	++	
S5	Recreation & Open Space Amenities	O	
S6	Cultural Resources	O	
S7	Odors	N/A	
S8	Noise	N/A	
S9	Land Use Adjacency	N/A	
S10	Construction Impacts	+	
S11	Worker Safety	N/A	
	Environmental		
E1	Climate	O	
E2	Air Quality	O	
E3	Water Quality	+	
E4	Water Use	O	
E5	Habitat	+	
E6	Natural Resource Inputs	+	
	$* Financial		
F1	Capital Costs	++	$-282*
F2	Other Costs	O	$-390*

TRIPLE BOTTOM LINE RESULTS 8/29/2013

Project Name:	Channel EIP Wiggle C - Partial Wiggle Alignment
Project Id:	CWWSIP-FC_DB_CHN_9
Primary Objective:	CSD Volume Reduction
Project Type:	Green Infrastructure
Location:	See Alternative C Figure
Description:	WNGC - Alternative C

Size of financial slices are proportional to their share of life cycle costs



Add/Remove N/A | Update Radial Chart

View Chart with Community Input

Size of radial slices can be sized according to community importance

TBL Alternatives Evaluation (Scoring)

TBL ALTERNATIVES COMPARISON SUMMARY

++ Significantly Positive
+ Positive
O Neutral
- Negative
-- Significantly Negative
N/A Not Applicable

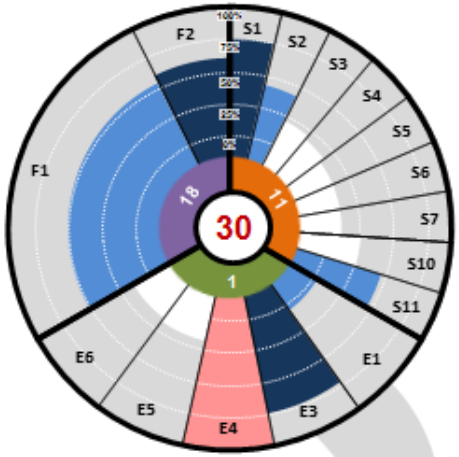
Social
- S1 System Resilience
- S2 Ratepayer Affordability
- S3 Employment
- S4 Bicycle & Pedestrian Environment
- S5 Recreation & Open Space Amenities
- S6 Cultural Resources
- S7 Odors
- S8 Noise
- S9 Land Use Adjacency
- S10 Construction Impacts
- S11 Worker Safety

Environmental
- E1 Climate
- E2 Air Quality
- E3 Water Quality
- E4 Water Use
- E5 Habitat
- E6 Natural Resource Inputs

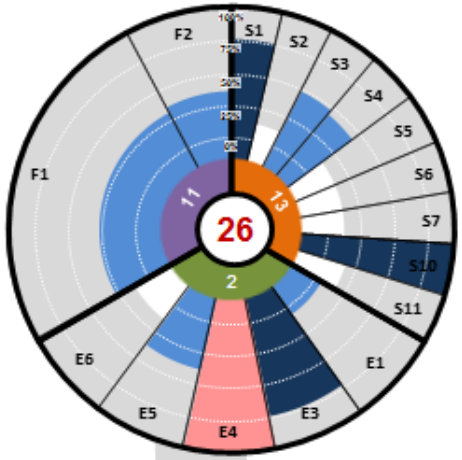
$$ Financial
- F1 Annualized Capital Costs
- F2 Annualized Other Costs

Add/Remove NA | Ranking View

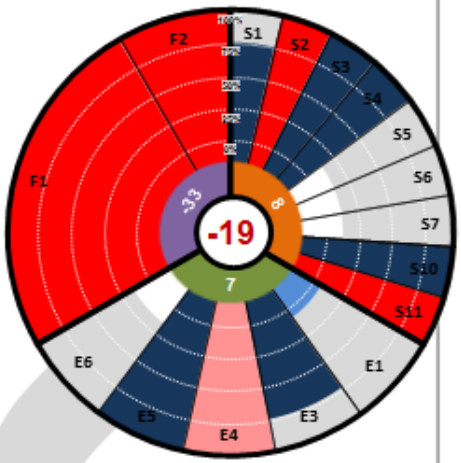
Alt 1
Zero Green DMA Scenario



Alt 2
100-Acre Green DMA Scenario



Alt 3
500-Acre Green DMA Scenario



CUMULATIVE BENEFITS SUMMARY				Ref. Alt
Total CSD Events Remaining (events/Year)	3	3	3	3
Total CSD Volume Reduced (MG/yr)	1	2	2	1
Total LCA NPV ($K)	(36,982)	(56,660)	(173,723)	(64,271)
NORMALIZED EFFICIENCY METRICS				**Ref. Alt**
CSD Events Reduced Per million $ Annual Investment	2	1	0.43	1
CSD Reduction Per million $ Annual Investment	0.67	0.65	0.24	0.38
Stormwater Managed Per million $ Annual Investment	0.67	0.65	0.24	0.24

TBL Evaluation Criteria

Financial (LCA)	Environmental	Social
Capital Costs	Climate	System Resilience
Operations and Other* Costs	Habitat	Ratepayer Affordability
	Water Use	Employment
	Water Quality	Bicycle and Pedestrian Environment
	Air Quality	Recreation / Open Space
	Natural Resources	Cultural Resources
		Odor
		Noise
		Land Use Adjacency
		Construction Impacts
		Worker Safety

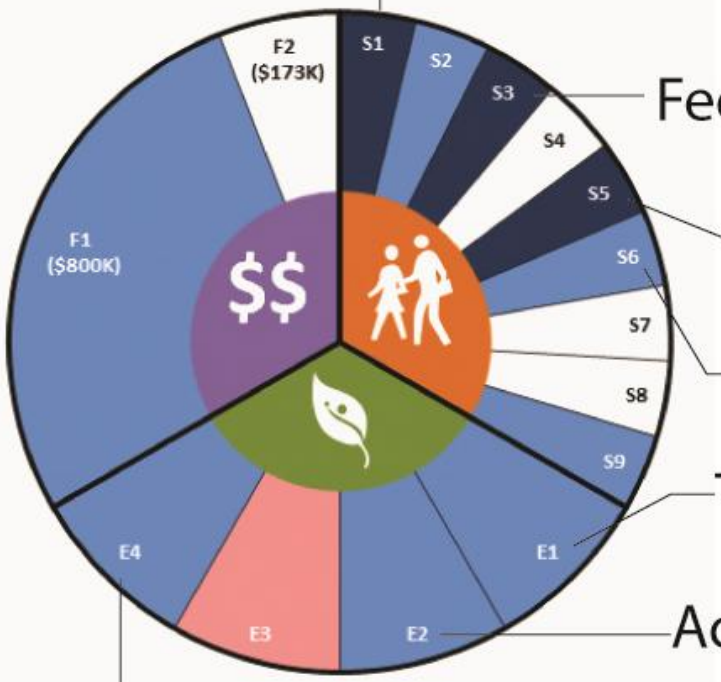
Mostly to address conditions at treatment plants

* Includes Operations & Maintenance, Replacement & Renewal, Decommissioning, Avoided Costs, and New Revenues

Triple Bottom Line (TBL) Community Benefits Assessment

Environmental + **Social** + **Financial** Sustainability

Sample Metrics / Outputs



Acres Mitigated Flood Risk

Feet Bike/Ped Enhancement

Acres Green Space Added

Labor Hours Generated

Tons GHG Reduced

Acres Urban Habitat

Tons Criteria Pollutants Reduced

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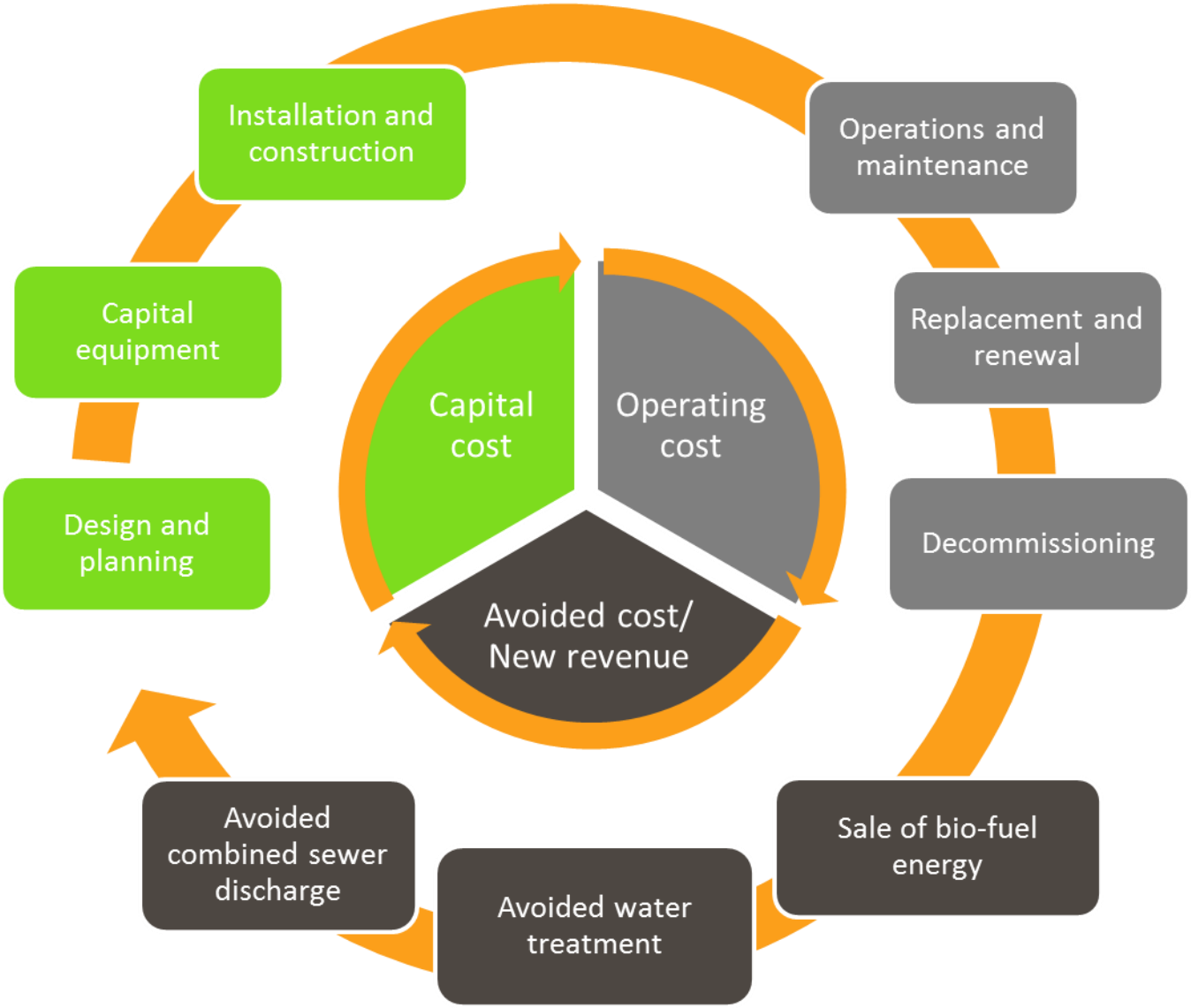
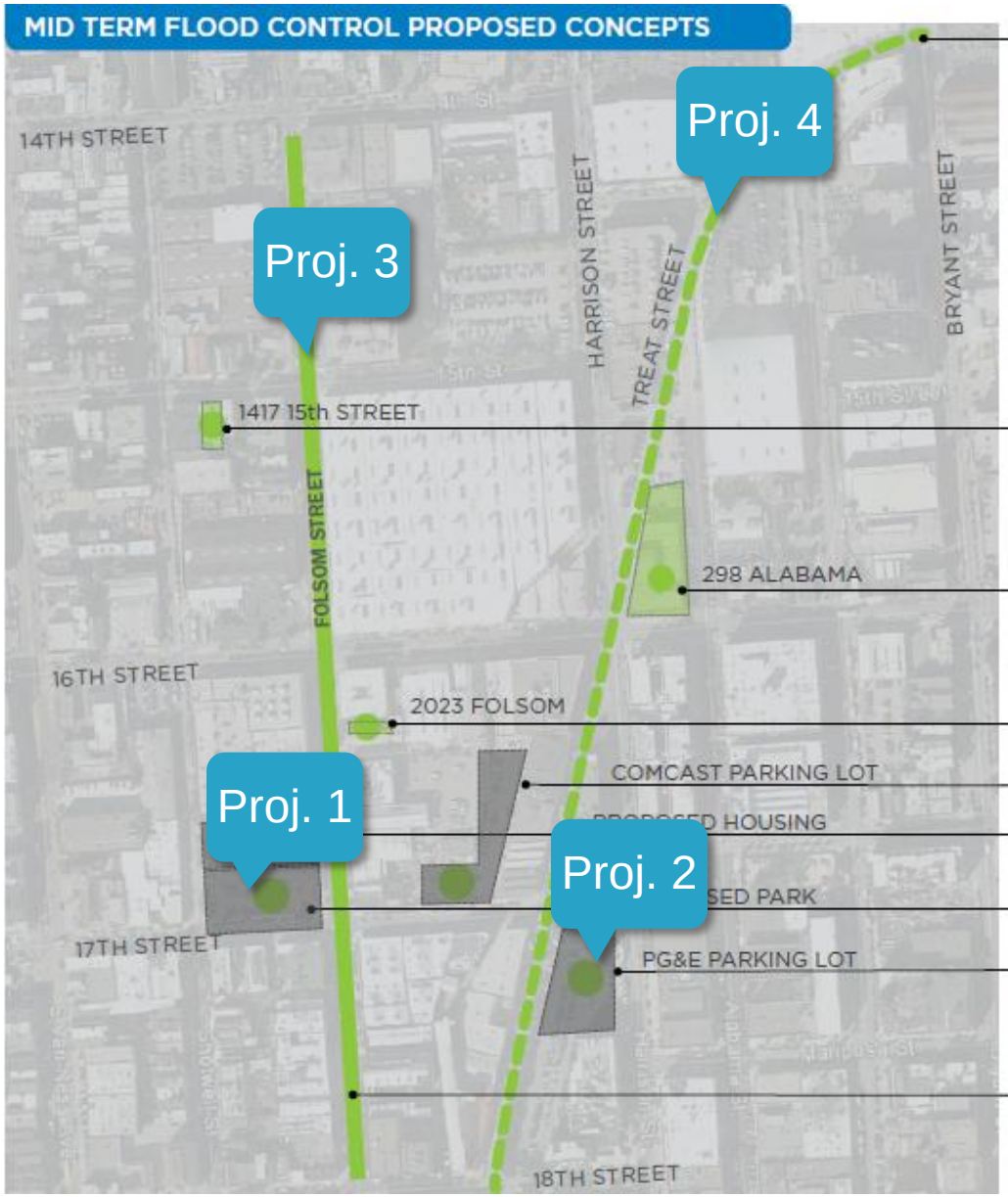
LCA Components



TBL Folsom & 17th Street Example

SURCHARGING MANHOLE: December 2, 2012 Flooding at 17th and Folsom in the Mission

17th and Folsom Street Alternative Analysis



MISSION CREEK STORMWATER PARKWAY

COST: $7.7 M

VOLUME DETAINED (5-yr, 3-hr storm): 0.5MG

PROPERTY ACQUISITION

COST: Approximately $300-400 per SF

1417 15th St = $2,995,000
2023 Folsom St= $1,900,000
268-298 Alabama= $3,500,000-4,000,000

SUBSURFACE STORAGE

COST: $60-85M

VOLUME DETAINED (5-yr, 3-hr storm): 5MG

*property acquisition not included

FOLSOM ST. 8' DIAMETER SEWER MAIN

COST: $5M

VOLUME DETAINED (5-yr, 3-hr storm): 0.75MG

17th and Folsom Street Alternative Analysis

++	Significantly Positive
+	Positive
O	Neutral
-	Negative
--	Significantly Negative
N/A	Not Applicable

Social

S1	System Resilience
S2	Ratepayer Affordability
S3	Employment
S4	Bicycle & Pedestrian Environment
S5	Recreation & Open Space Amenities
S6	Cultural Resources
S7	Odors
S8	Noise
S9	Land Use Adjacency*
S10	Construction Impacts
S11	Worker Safety*

Environmental

E1	Climate
E2	Air Quality
E3	Water Quality
E4	Water Use
E5	Habitat
E6	Natural Resource Inputs

$$ Financial

F1	Annualized Capital Costs
F2	Annualized Other Costs

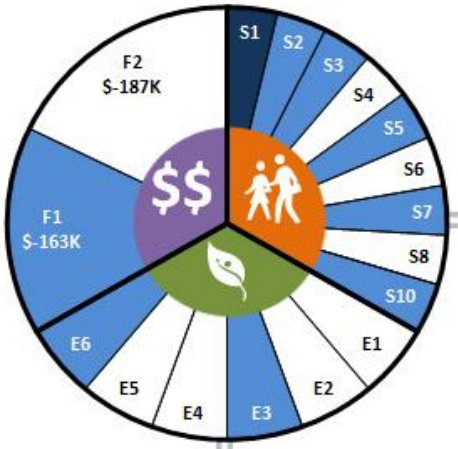
Note: Financial Criterion ratings are based on annualized costs NPV and select projects only

* This criteria are not showing up in the pie charts but are in the legend because they are not applicable to any case.

View Matrix

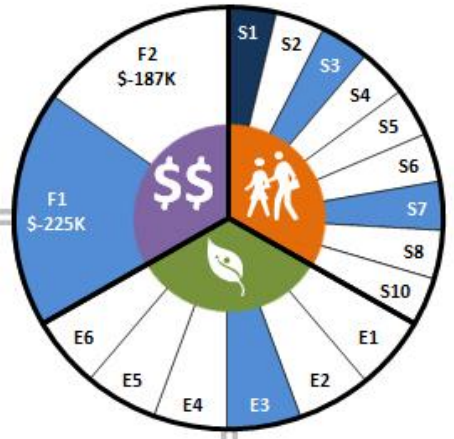
Project 1

17th and Folsom St (future park)



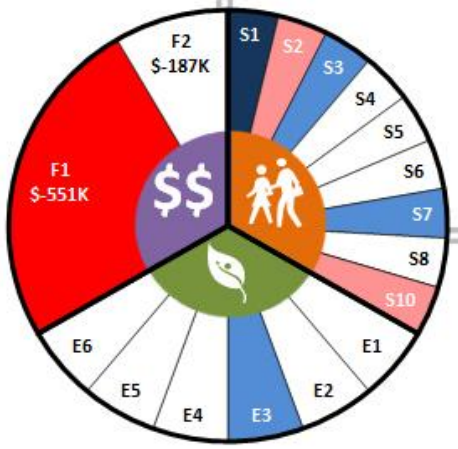
Project 2

Nearby Parking Lot Acquisition



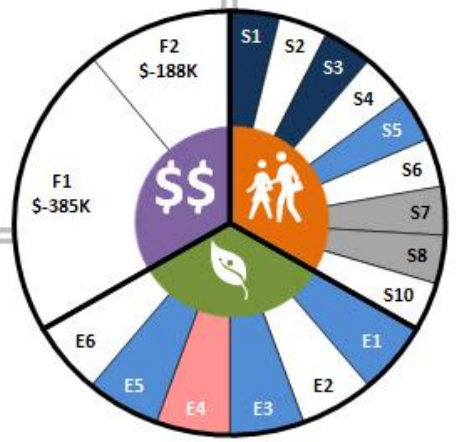
Project 3

Right-of-Way Storage Box



Project 4

Stormwater Parkway



17th and Folsom Street Alternative Analysis

++	Significantly Positive
+	Positive
0	Neutral
-	Negative
--	Significantly Negative
N/A	Not Applicable

Social

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S2	Ratepayer Affordability
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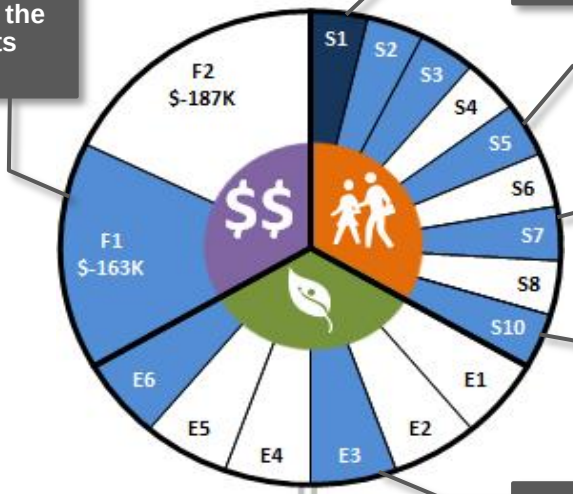
View Matrix

Project 1

17th and Folsom St (future park)

< 30% the cost performance of the mean of projects evaluated



Reduces flooding in high consequence area

Improves a new park in conjunction with the storage investment but not in an area of acute need

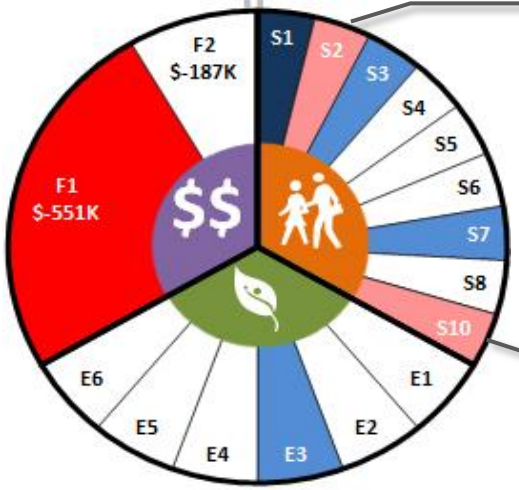
Reduces odor in small area, only during flooding events

Shortens construction schedule of 2 SF Public Works projects due to coordination

Reduction in CSD Volume as a result of storage volume

Project 3

Right-of-Way Storage Box



Ratepayer cost >30% of projects evaluated

Major boulevard disrupted during construction but not on arterial

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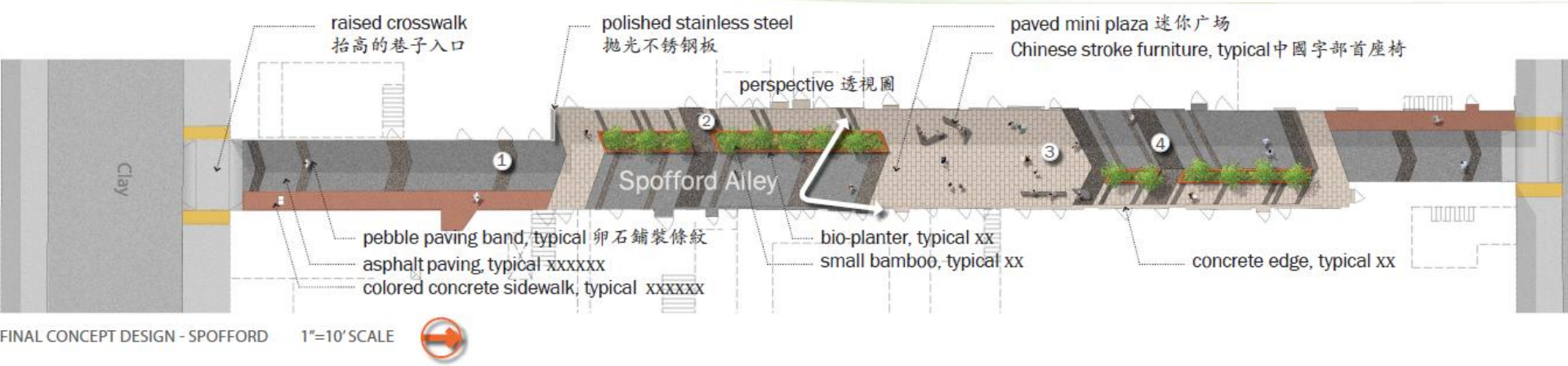
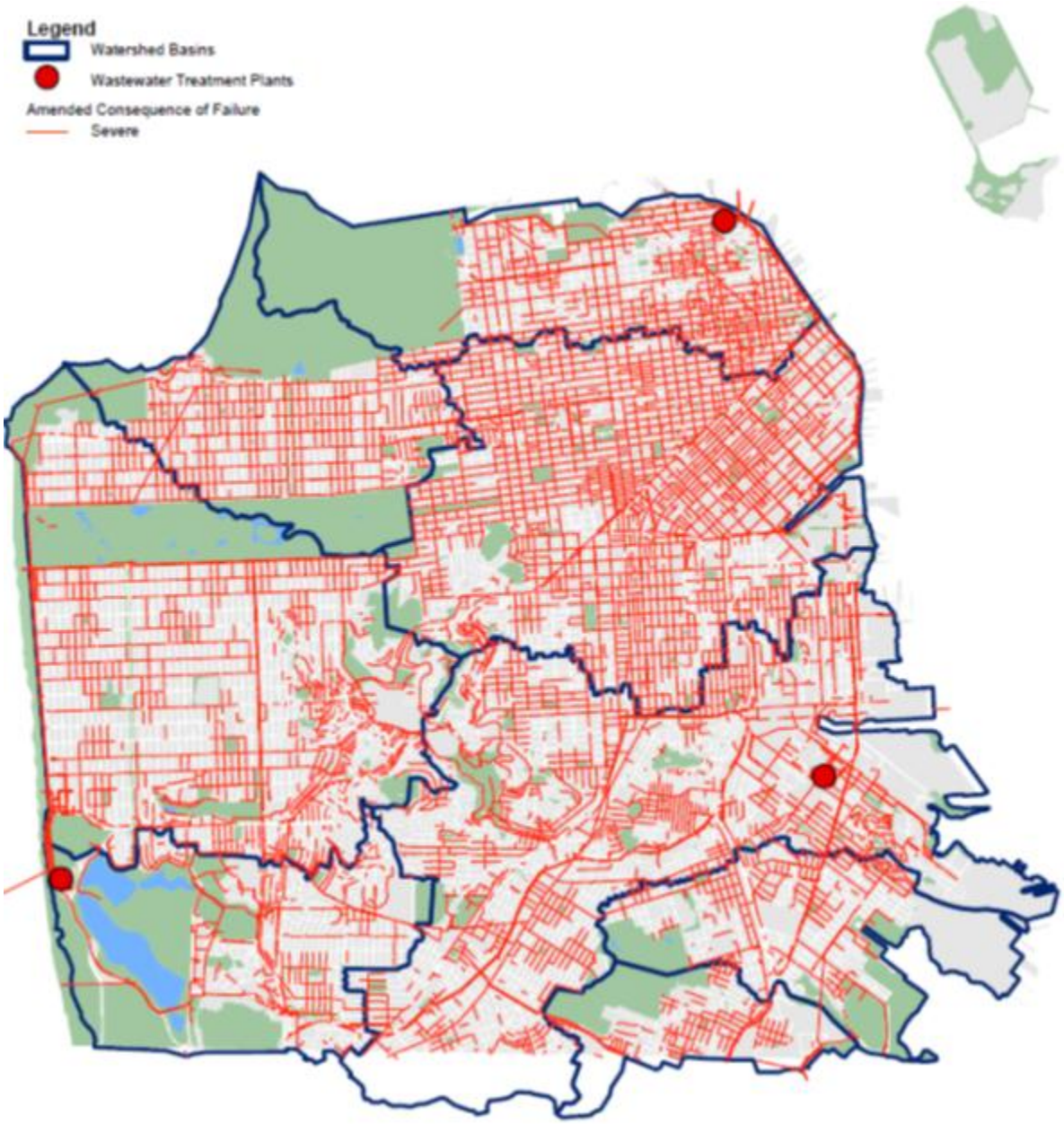
Criteria Development

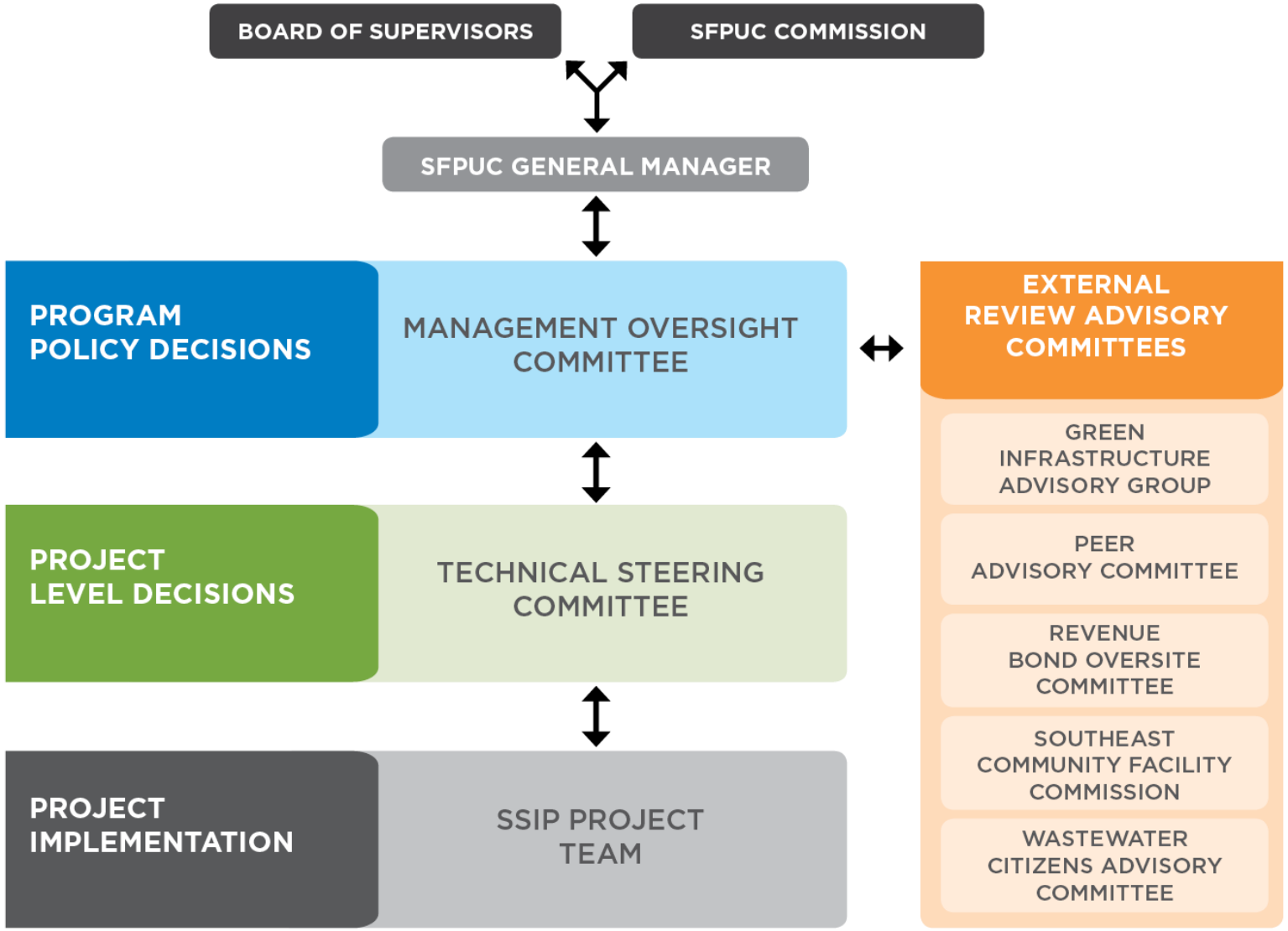


Example: System Resilience

- Sea level rise
- Flooding
- Redundancy
- Consequence of Failure



Governance Committees



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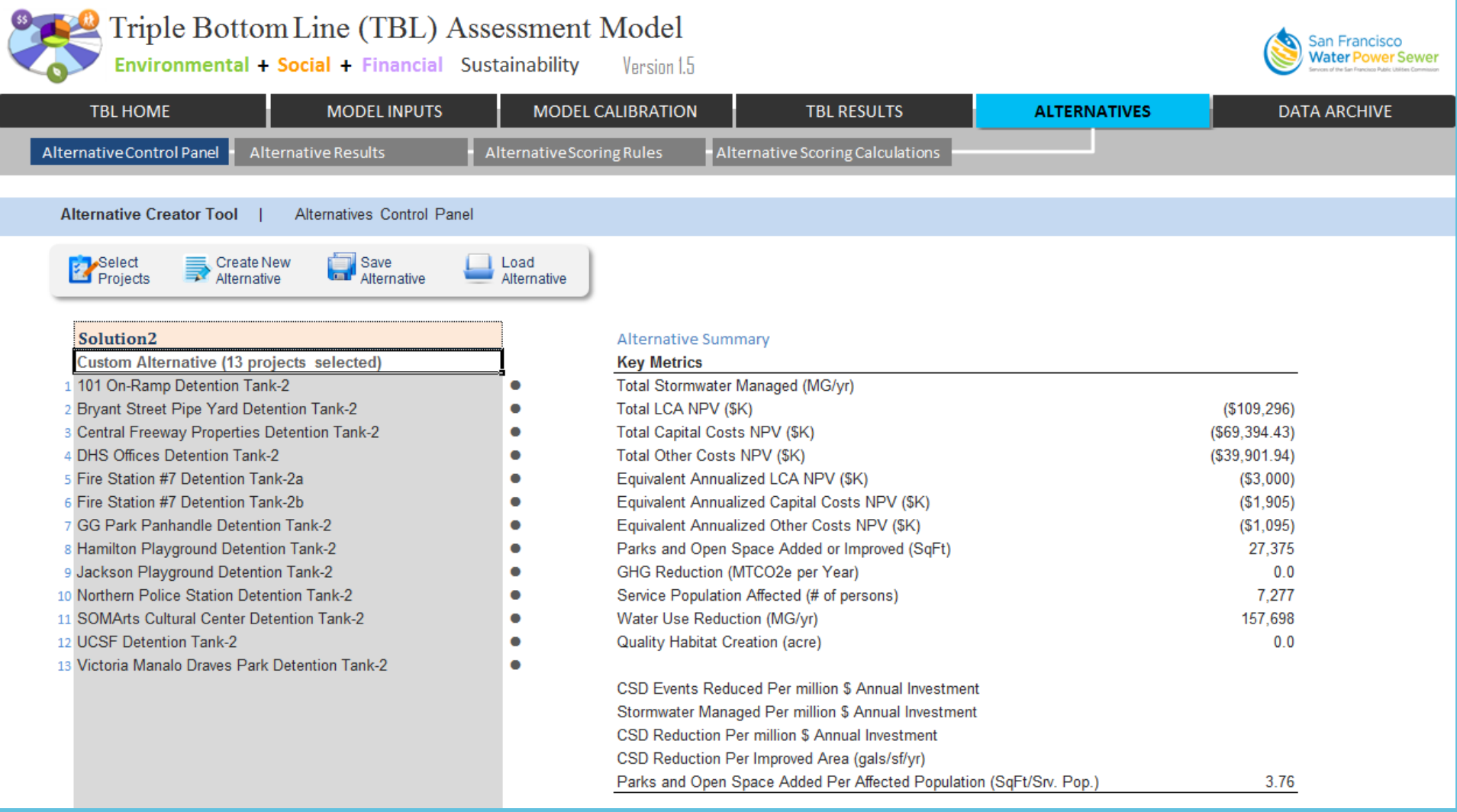
TBL Model Interface



Model Interface

San Francisco Water Power Sewer
Services of the San Francisco Public Utilities Commission

Triple Bottom Line (TBL) Assessment Model

Environmental + Social + Financial Sustainability

Initiate
SSIP Project

Define
Project Data & Details

Assess
TBL Results using TBL Model

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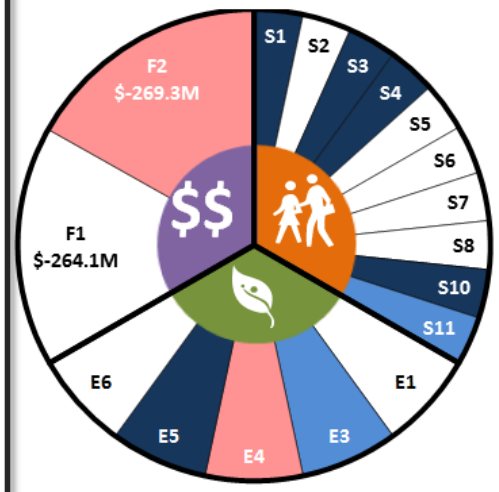
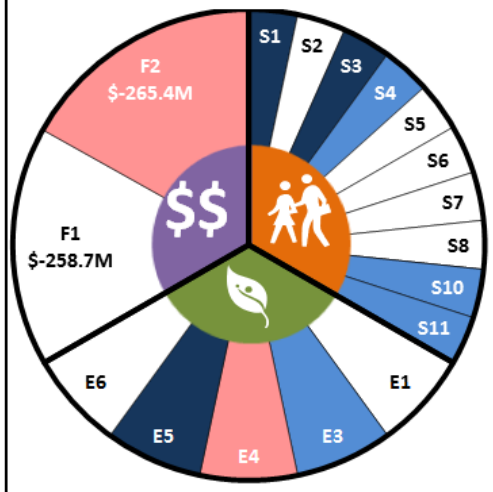
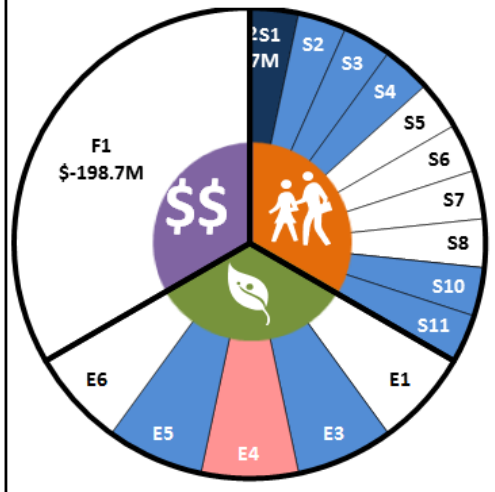
Social		++
S1	System Resilience	+
S2	Ratepayer Affordability	0
S3	Employment	-
S4	Bicycle & Pedestrian Environment	--
S5	Recreation & Open Space Amenities	N/A
S6	Cultural Resources	
S7	Odors	
S8	Noise	
S9	Land Use Adjacency	
S10	Construction Impacts	
S11	Worker Safety	
Environmental		
E1	Climate	
E2	Air Quality	
E3	Water Quality	
E4	Water Use	
E5	Habitat	
E6	Natural Resource Inputs	
$$ Financial		
F1	Annualized Capital Costs	
F2	Annualized Other Costs	

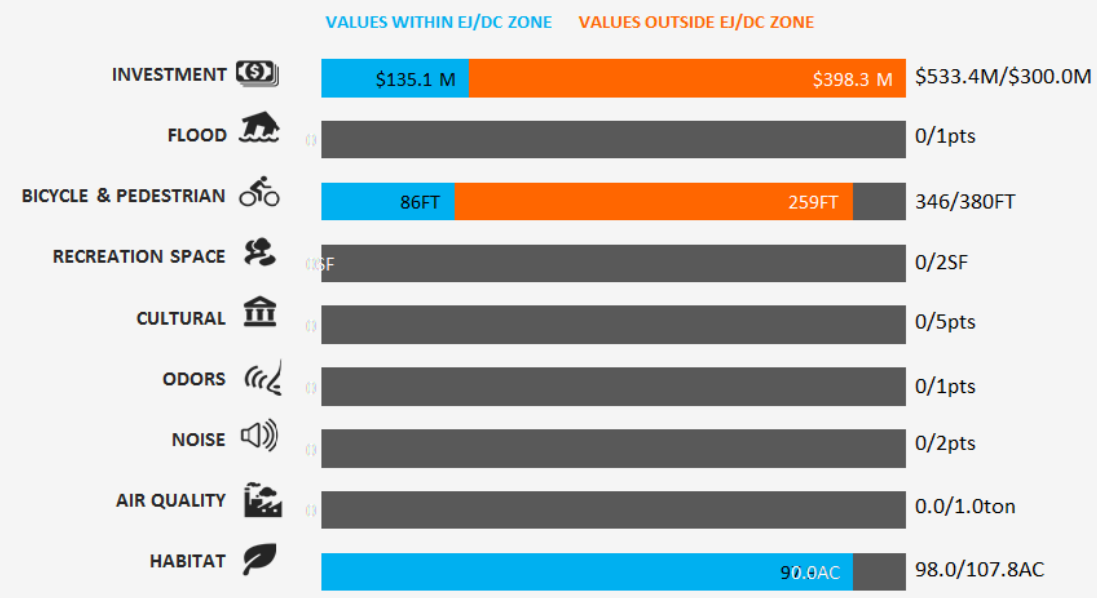
Test Alt 3	Test Alt 2	Test Alt 4
LP-137 Grey INFRA + Green Programs + Sample GI	LP-137 Grey INFRA + Green Programs	LP-137 Grey INFRA + 1 GI Project
8 Run-off Reduction Projects and 10 Conveyance/Pumping/Storage Projects	3 Run-off Reduction Projects and 10 Conveyance/Pumping/Storage Projects	1 Run-off Reduction Projects and 10 Conveyance/Pumping/Storage Projects



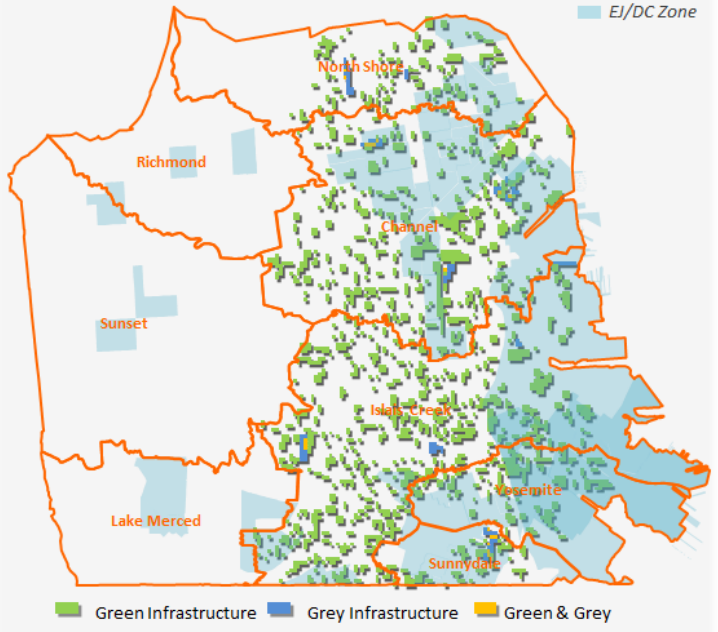




COMMUNITY BENEFIT SUMMARY



PROJECT LOCATIONS



TBL Output Example

Triple Bottom Line Model Objective: The TBL model is a decision support tool that transparently estimates the financial, social, and environmental consequences of SSIP projects in order to optimize and articulate the community benefits of SSIP investments.

TBL Uses

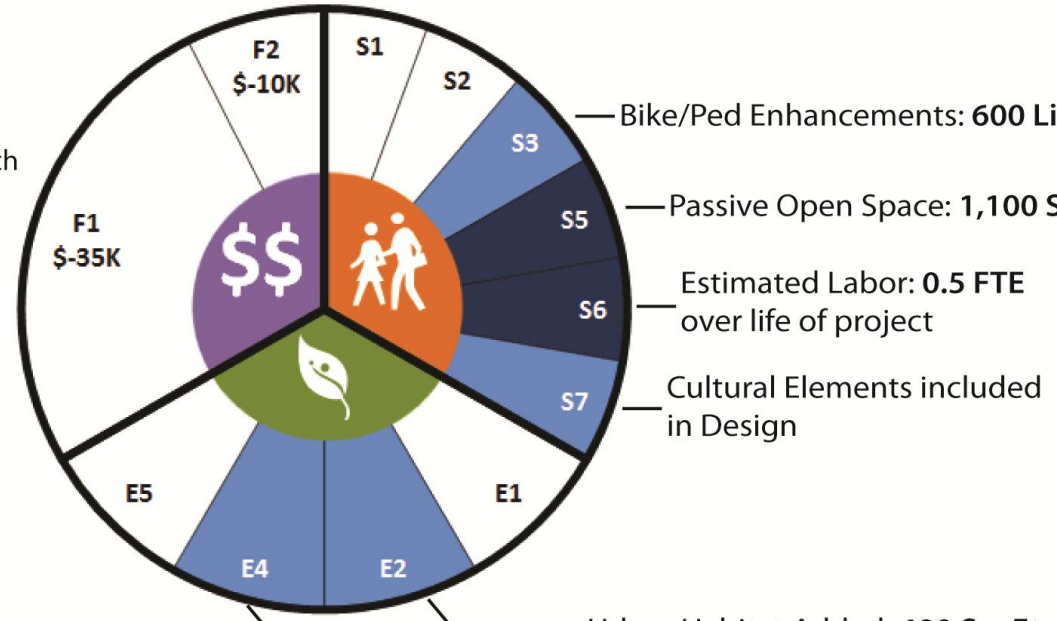
Estimation:

- Project Selection
- Alternatives Formation
- Community SSIP Outreach

Track System Performance:

- Design Reference
- Targets Achieved

Chinatown Green Street Retrofit (Spofford + Ross)



Bike/Ped Enhancements: **600 Linear Ft.**

Passive Open Space: **1,100 Sq. Ft.**

Estimated Labor: **0.5 FTE** over life of project

Cultural Elements included in Design

Urban Habitat Added: **400 Sq. Ft.**

Average Annual Contribution to CSD Volume Reduction: **50K gallons/year**

Social

S1	System Resilience
S2	Ratepayer Affordability
S3	Bicycle & Pedestrian Environment
S4	Odors
S5	Recreation & Open Space Amenities
S6	Employment
S7	Cultural Resources
S8	Noise
S9	Construction Impacts

Environmental

E1	Climate
E2	Habitat
E3	Water Use
E4	Water Quality
E5	Air Quality
E6	Natural Resource Inputs

$$ Financial

F1	Annualized Capital Costs
F2	Annualized Other Costs

++	Significantly Positive
+	Positive
O	Neutral
-	Negative
--	Significantly Negative
N/A	Not Applicable

Note: Financial Criterion ratings are based on annualized costs NPV and select projects only

Questions

You are invited to...

the **Watershed Planning Game**

COME PLAY

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San Francisco Water Power Sewer
Services of the San Francisco Public Utilities Commission

Alternative Triple Bottom Line Approaches

Summary of Non-monetary Benefit Scores

Criteria	Vehicle traffic	Safety & health	CO2e emissions	Criteria air pollutants	Net energy production	Site impacts	Level of complexity	Permitting challenges	Outside utility involvement	Maturity & reliability	Load variation adaptability	Overall Benefit Score
Criteria Weight	9.1	16.7	1.5	9.1	12.1	7.6	4.5	7.6	3.0	13.6	15.2	
	Scores											
1-Existing Cogeneration Engines	10	7	2	5	5	10	8	7	8	10	3	69
2-New IC Cogeneration Engines	10	8	10	5	10	7	8	8	8	10	9	85
3A-Microturbines	10	8	8	8	9	3	9	8	8	6	5	72
3B-Flex-Fuel Turbines	10	8	0	6	6	3	9	8	8	0	3	55
5-Fuel Cells	10	8	7	10	7	4	5	10	8	2	9	73
6-Biomethane into NG Pipeline	10	9	3	5	9	5	10	10	2	6	10	80
7-Biomethane CNG Vehicle Fuel	10	9	5	5	2	5	10	10	2	6	10	72
7B-Onsite Biomethane CNG Vehicle Fuel	0	5	0	5	1	2	8	10	7	6	5	45

Figure 4-2 presents a graphical summary of the results for the technology alternatives. The MUA results showed that new IC engines are the most beneficial with the highest combined benefit score of 85 followed by biomethane for NG pipeline injection with an overall benefit score of 80.

Alternative Triple Bottom Line Approaches