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Integrated Water Management – Innovation Opportunities

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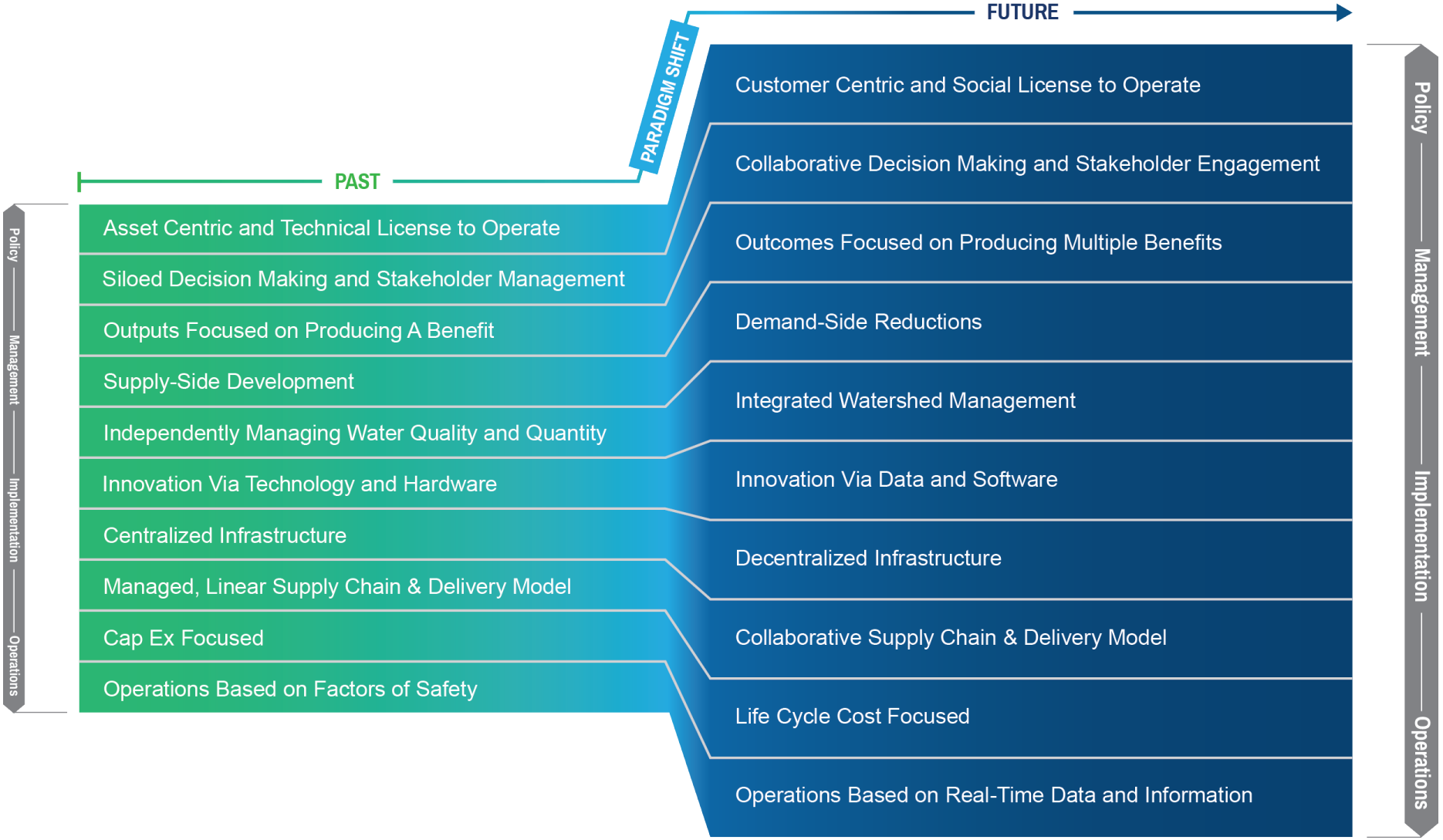
Industry Paradigms Are Undergoing a Significant Shift – We Are Now Focused on How Key Areas From Policy and Management to Implementation and Operation Can Be ***Optimized***

We Have Entered the Era of the "Great Optimization"



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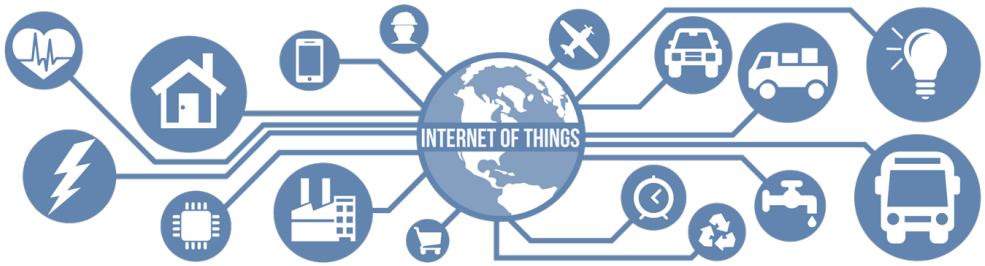
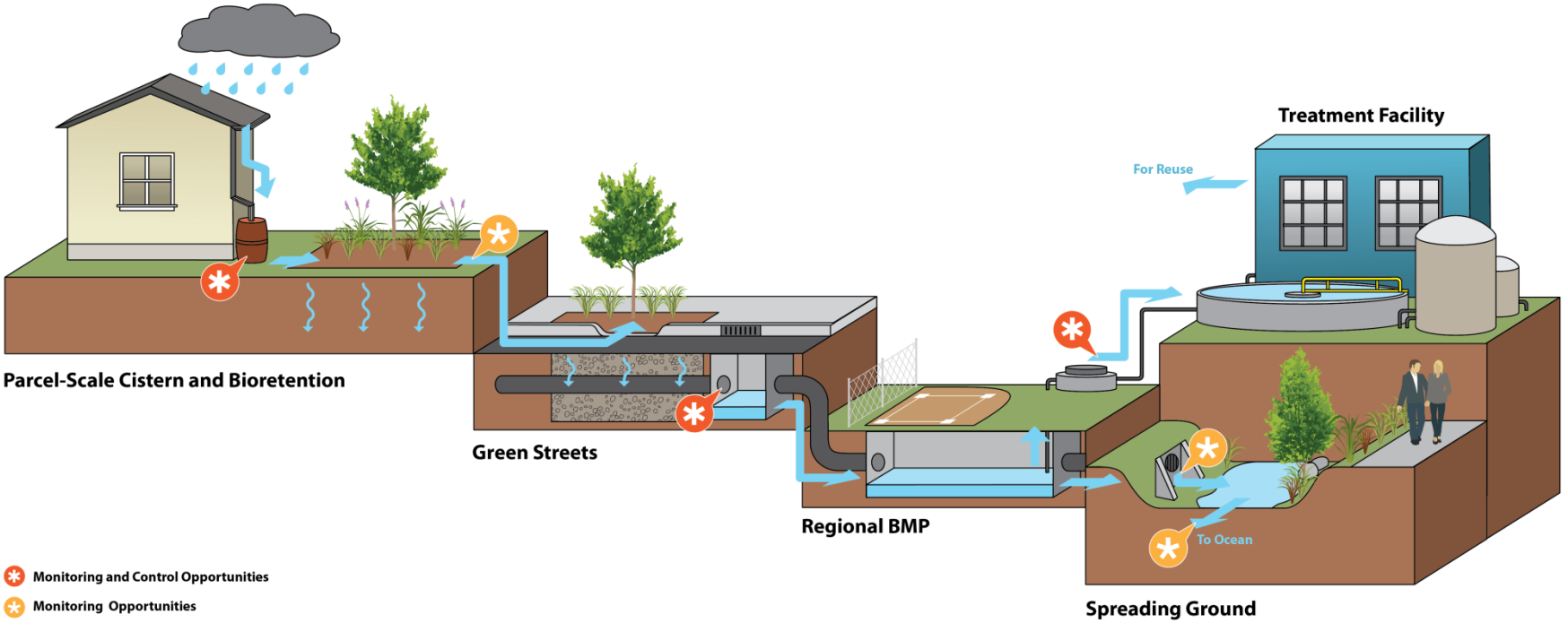
Advances in technology open new opportunitie

Internet of Things (IoT) & Water Management





Real Time Control Successfully Applied to Capture Overflows

- Long Term Control Plan (LTCP) capitol costs reduced from estimate by 25% to 75%
- Reduced infrastructure requirements

Cities	Conventional Solution	Intelligent Control	Cost Savings	
Quebec City, QC	$ 240 M	$ 150 M	$ 90 M	37 %
Montreal, QC	$ 840 M	$ 410 M	$ 430 M	51 %
Louisville, KY	$ 200 M	$ 83 M	$ 117 M	58 %
Wilmington, DE	$ 114 M	$ 27 M	$ 87 M	76 %
Paris, France	$ 3 000 M	$ 2 200 M	$ 800 M	27 %
Bordeaux, France	$ 139 M	$ 37 M	$ 102 M	73 %

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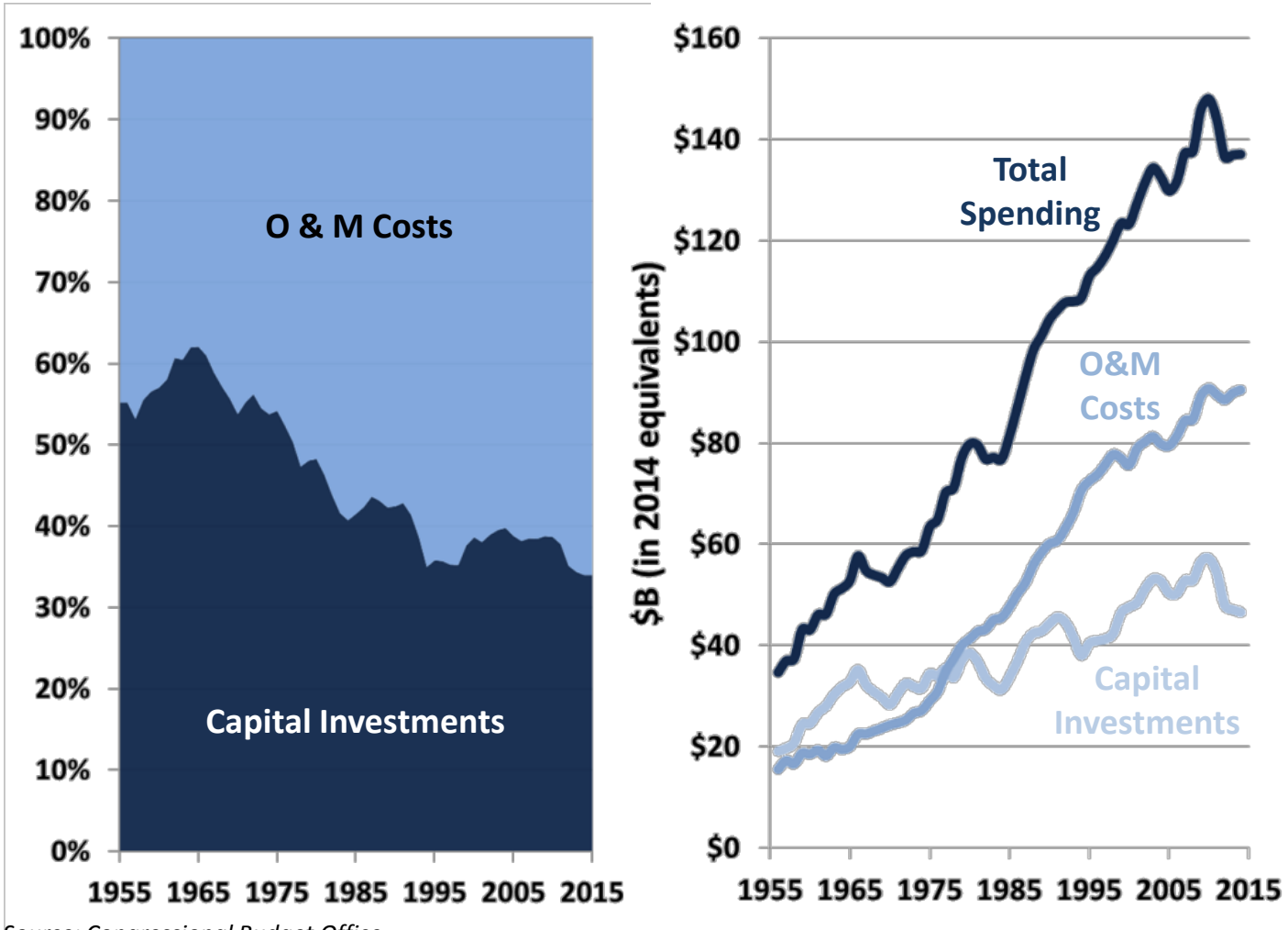
Optimization Is Also Being Driven By Fundamental Shifts in Funding and Financing

O&M Costs Have Become A Larger Budget Driver Than Cap Ex

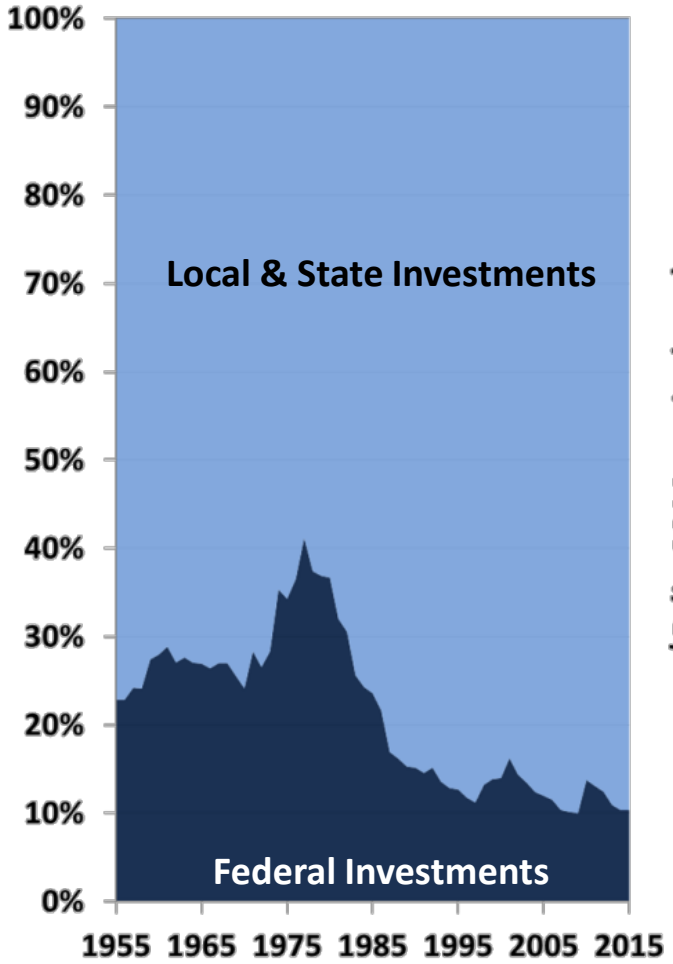
Historical Trends - Investments in U.S. Water & Wastewater Infrastructure

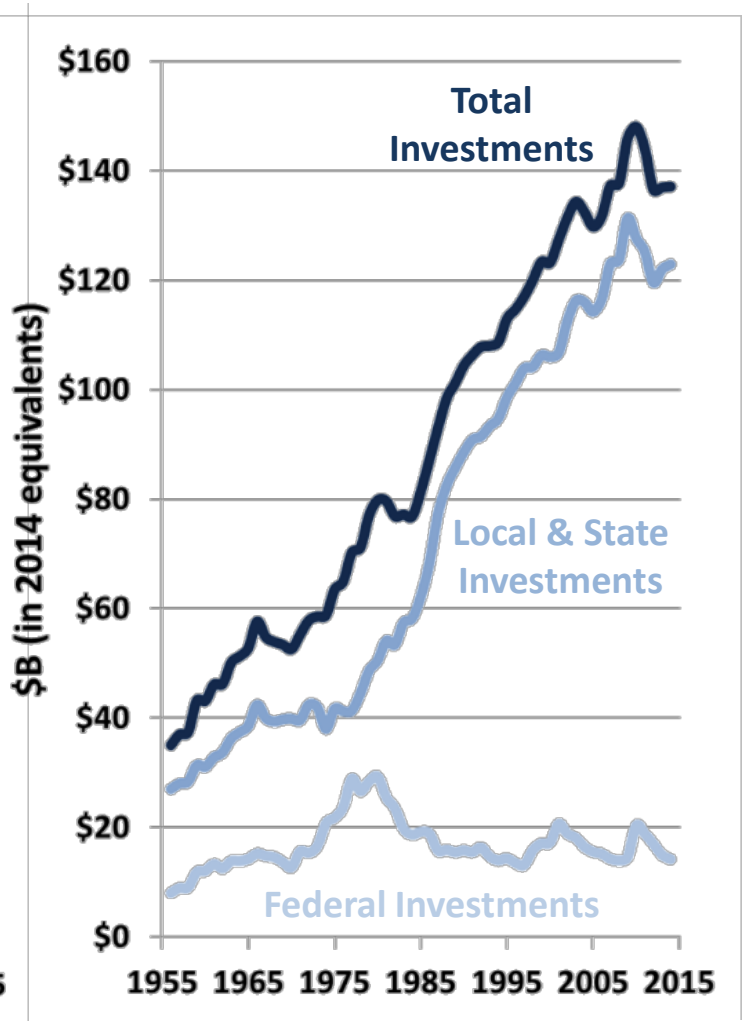


Source: Congressional Budget Office

Federal Funding Support Is At All Time Lows

Historical Trends - Investments in U.S. Water & Wastewater Infrastructure

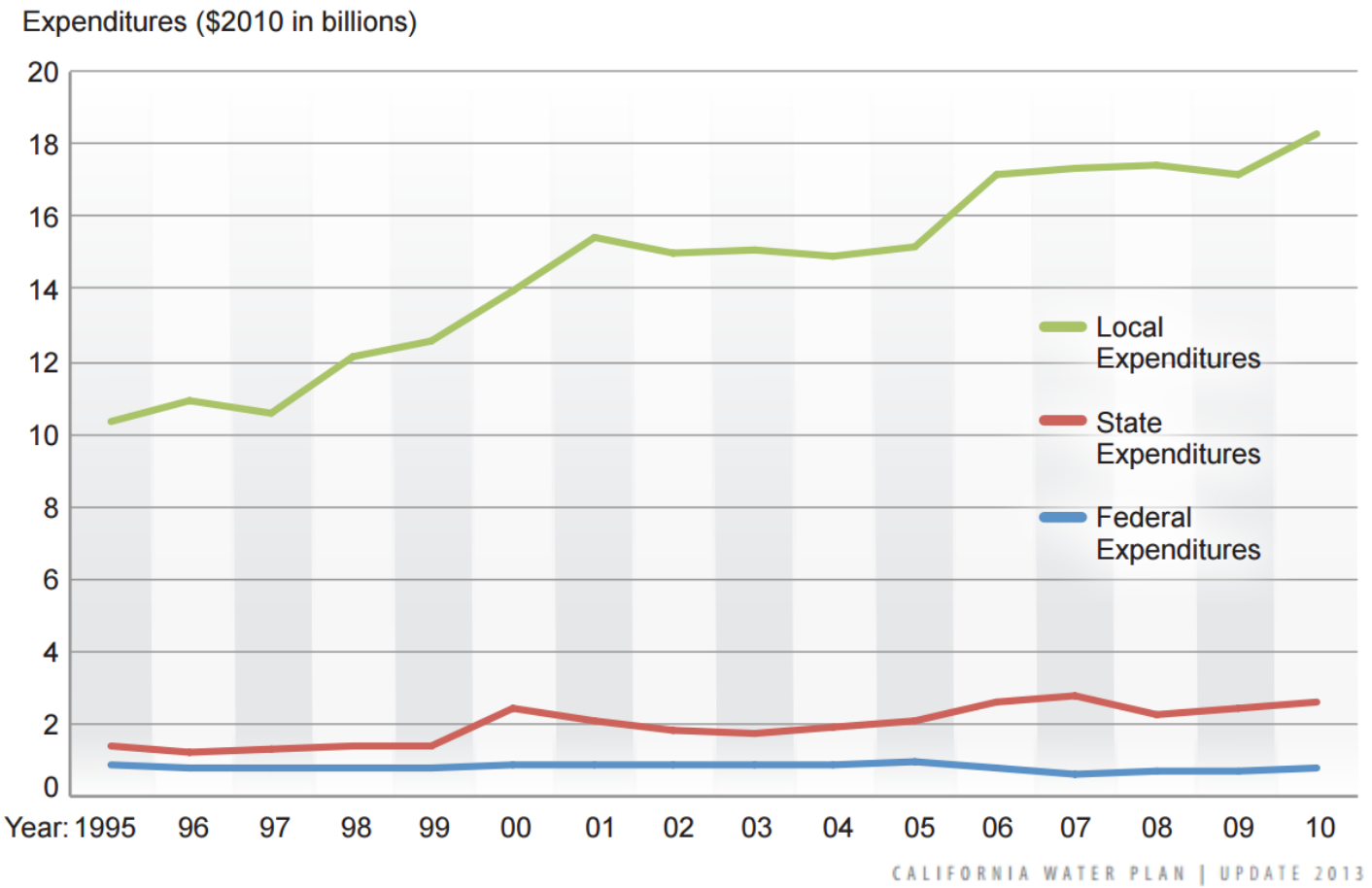




Source: Congressional Budget Office

And the Local Agencies, Not States, Bear Most of This Investment Responsibility

Figure 7-3 Recent Trends in Local, State, and Federal IWM Expenditures (in millions), 1995-2010



As A Result Water & Sewer Bills Are Increasing At Significant Rates

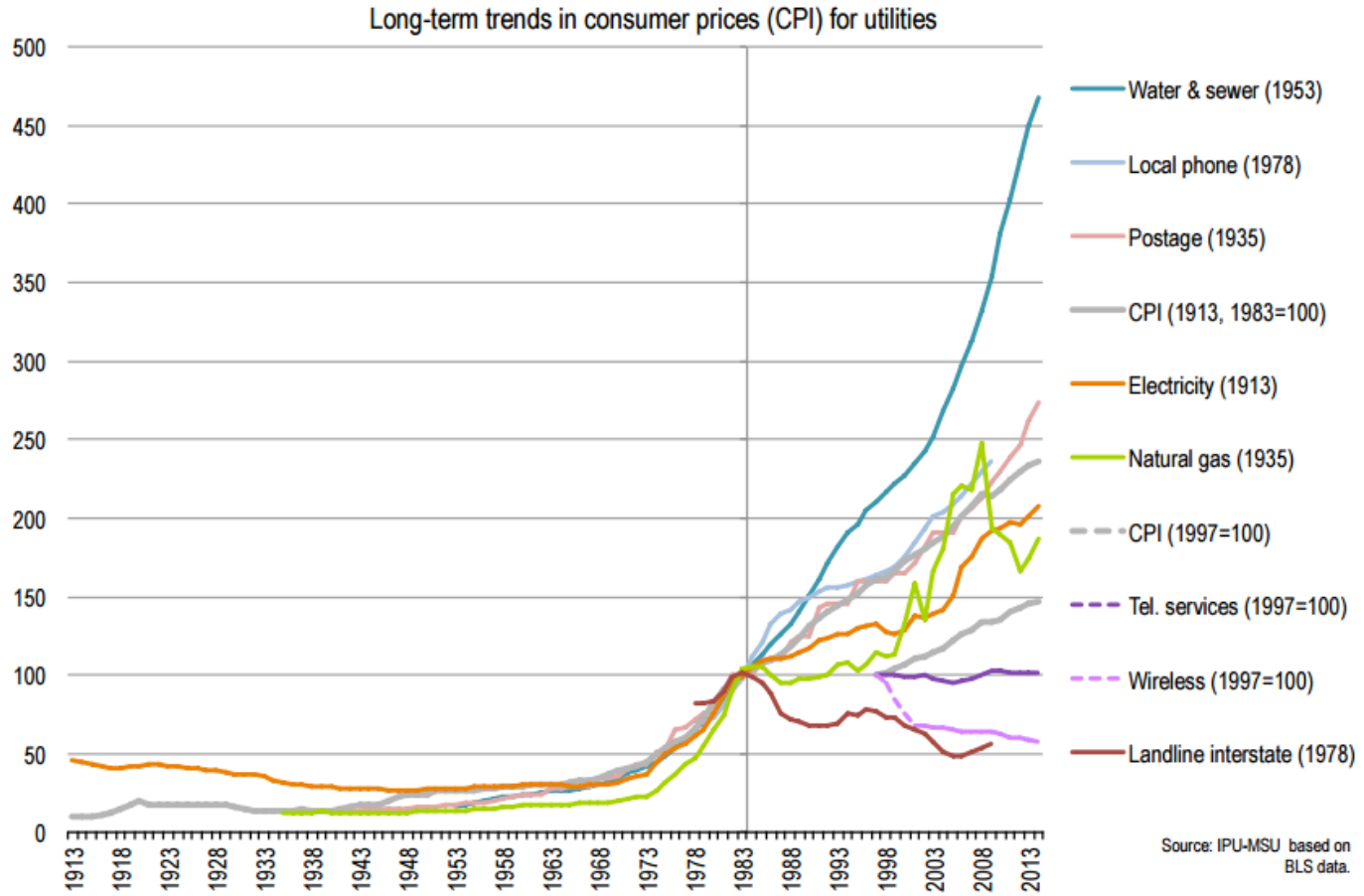
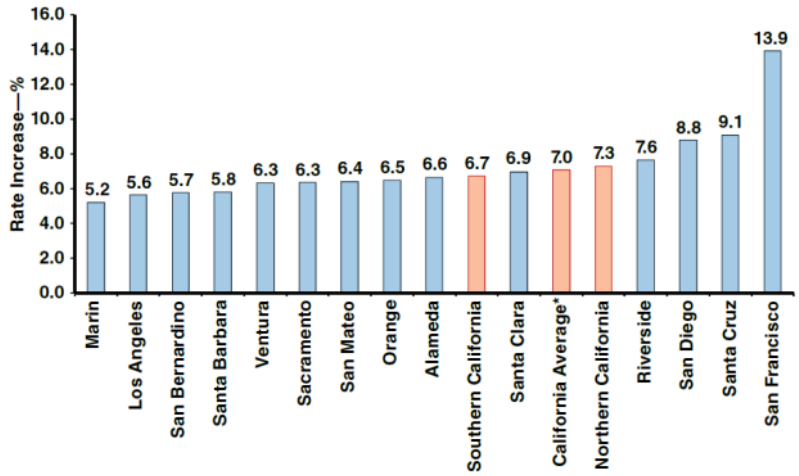


Exhibit 1. Long-term trends in the Consumer Price Index (CPI) for utilities (1913-2014). The index is set to 100 for 1982-1984 except for telephone and wireless services, where the index is set to 100 for 1997. Year (*) indicates start of series.

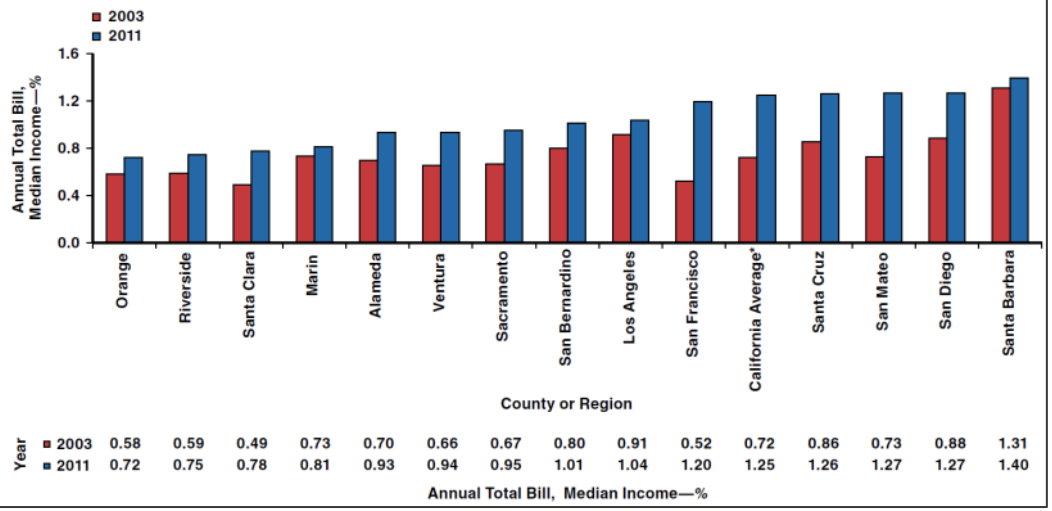
In California, Drinking Water Bills Have Doubled Over the Past Decade

FIGURE 2 Annualized rate increases of all counties 2003–2013



alized rate increases of all counties 2003–2013

FIGURE 10 Water affordability changes 2003 and 2011



- Drinking water utility bills have approximately doubled over the last decade from $29 to $58/month
- As a result, the average resident's drinking water bill increased 0.5%, as a percentage of their median income, during that same period

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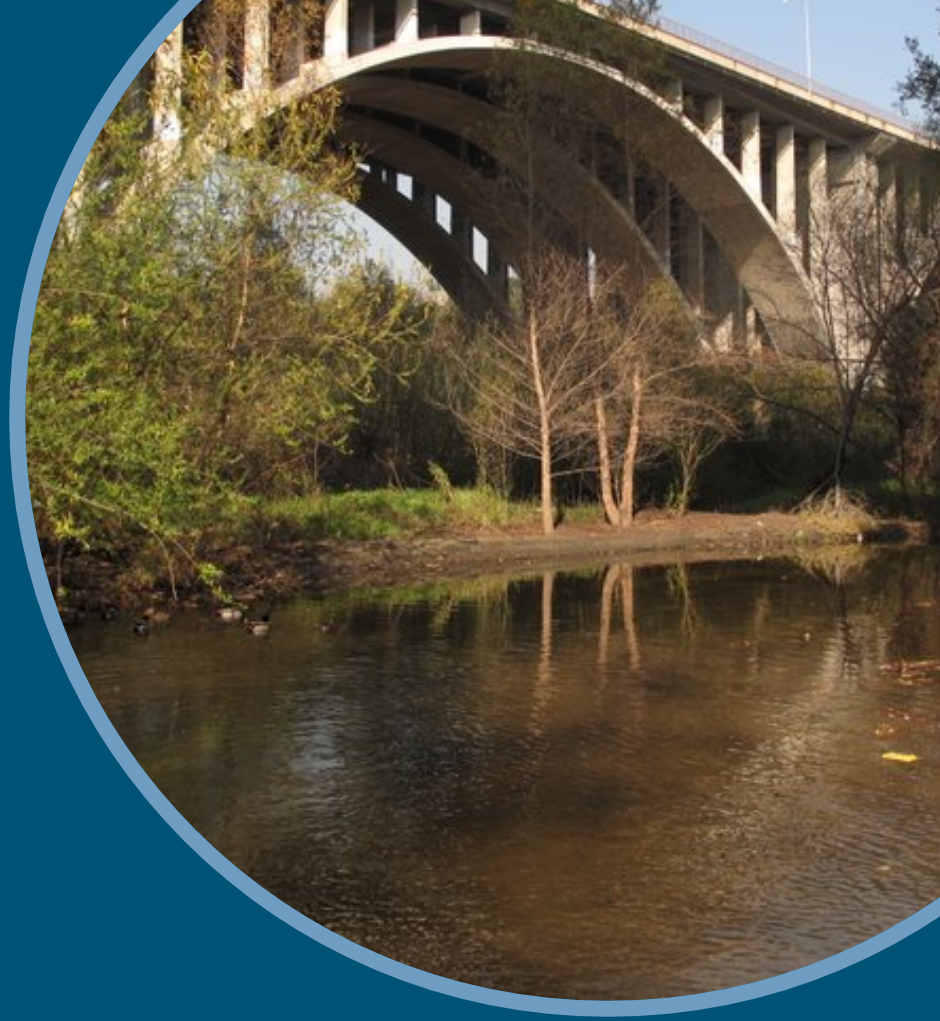
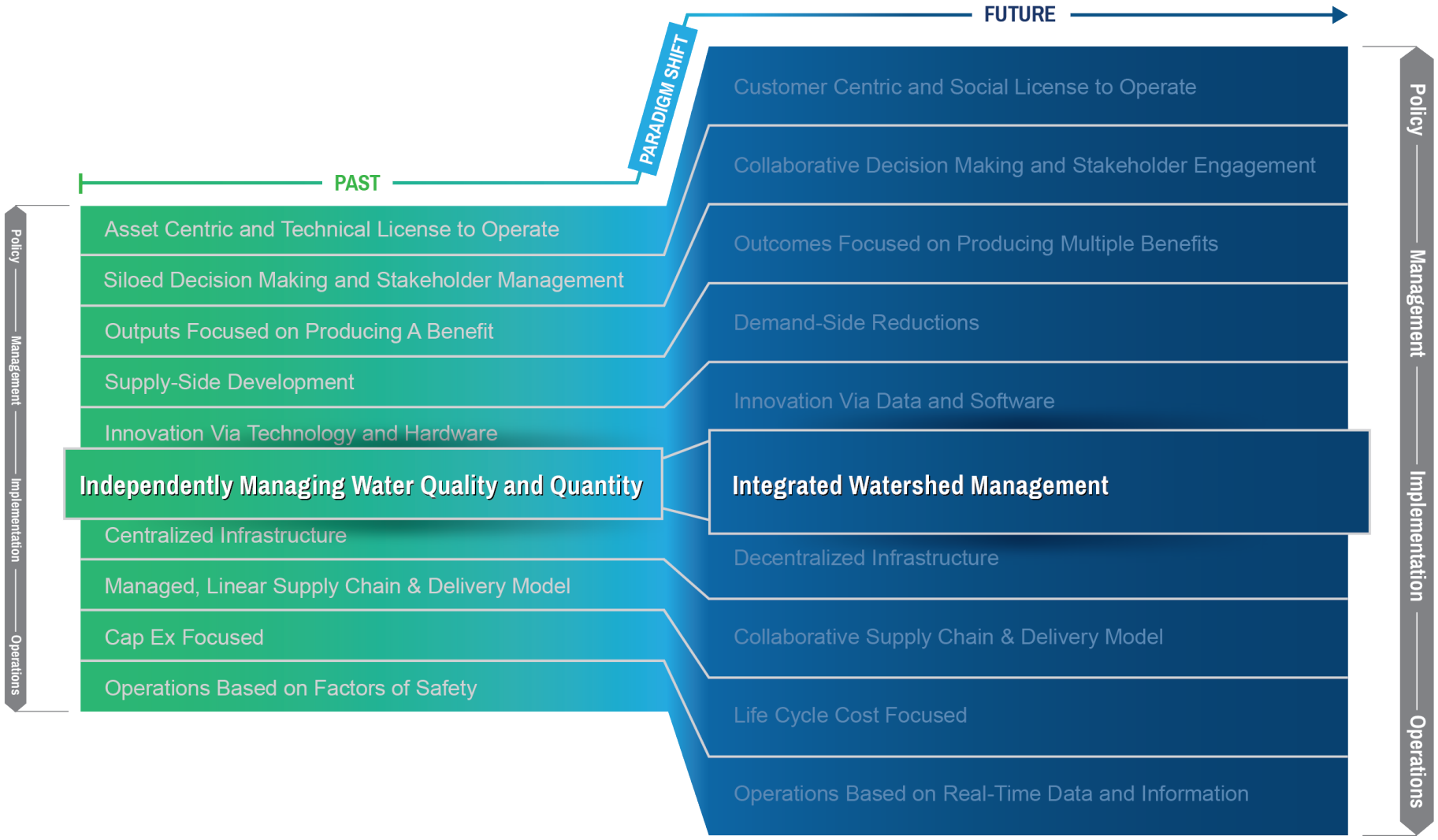
What Does Optimization Look Like in Practice?



The California Water Plan Is Just One Example of This New Era

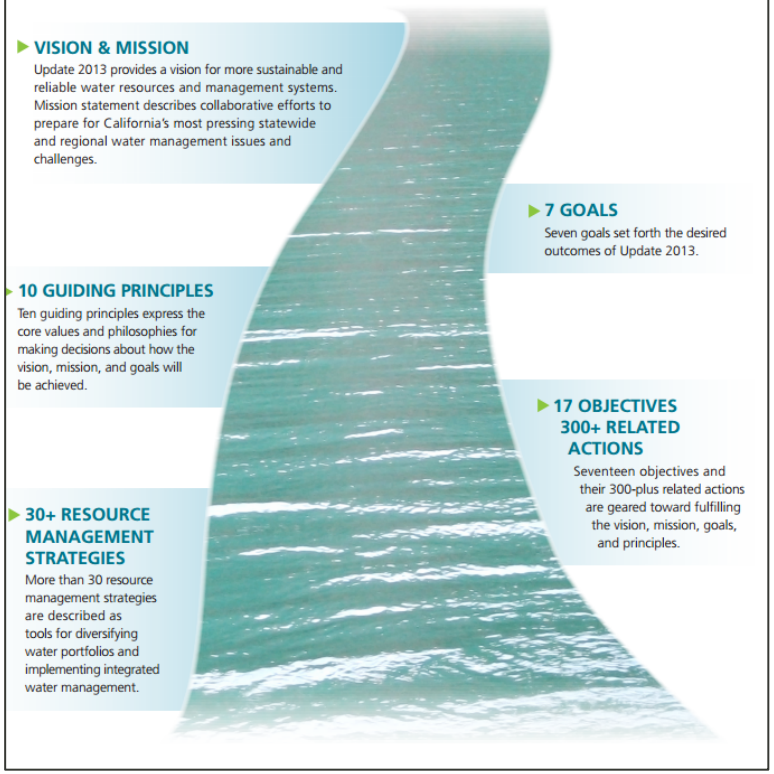


Many Simultaneous Actions to Achieve Integrated Water Management

Table 1-1 Resource Management Strategies and Management Objectives

Reduce Water Demand	Improve Water Quality
Agricultural Water Use Efficiency	Drinking Water Treatment & Distribution
Urban Water Use Efficiency	Groundwater / Aquifer Remediation
Improve Operational Efficiency & Transfers	Matching Quality to Use
Conveyance – Delta	Pollution Prevention
Conveyance – Regional / Local	Salt & Salinity Management
System Reoperation	Urban Stormwater Runoff Management
Water Transfers	**Practice Resource Stewardship**
Increase Water Supply	Agricultural Land Stewardship
Conjunctive Management & Groundwater	Ecosystem Restoration
Desalination — Brackish & Seawater	Forest Management
Precipitation Enhancement	Land Use Planning & Management
Recycled Municipal Water	Recharge Areas Protection
Surface Storage – CALFED	Sediment Management*
Surface Storage – Regional/Local	Watershed Management
Improve Flood Management	**People & Water**
Flood Management	Economic Incentives (Loans, Grants, & Water Pricing)
Other Strategies	Outreach and Engagement*
Crop idling, dew vaporization, fog collection, irrigated land retirement, rainfed agriculture, and waterbag transport	Water and Culture*
	Water-Dependent Recreation

Roadmap for Implementing Integrated Water Management



CALIFORNIA WATER PLAN UPDATE 2013
Investing in Innovation & Infrastructure

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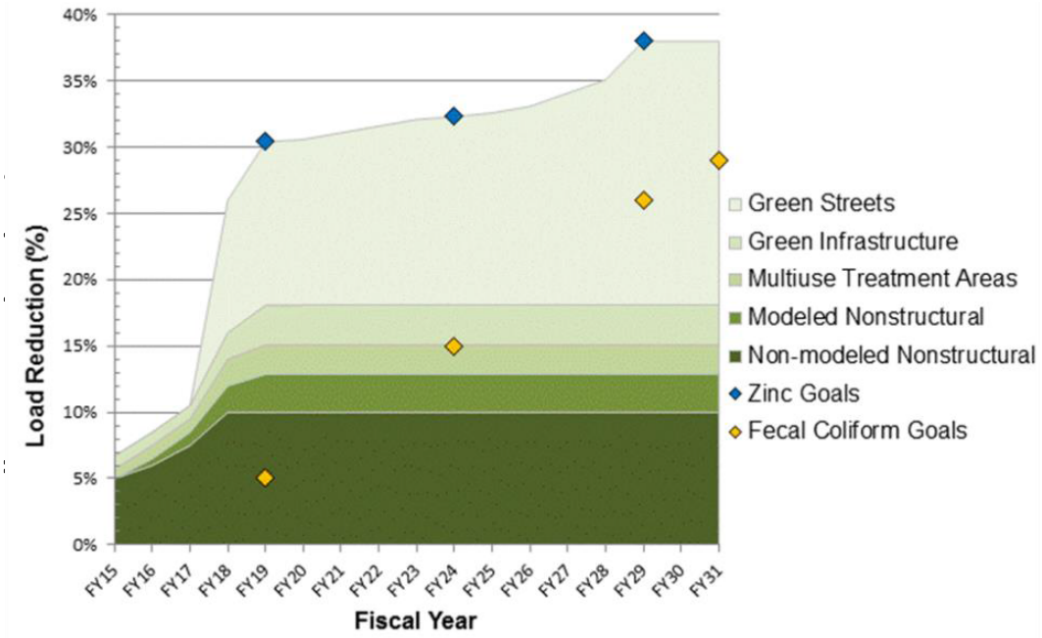
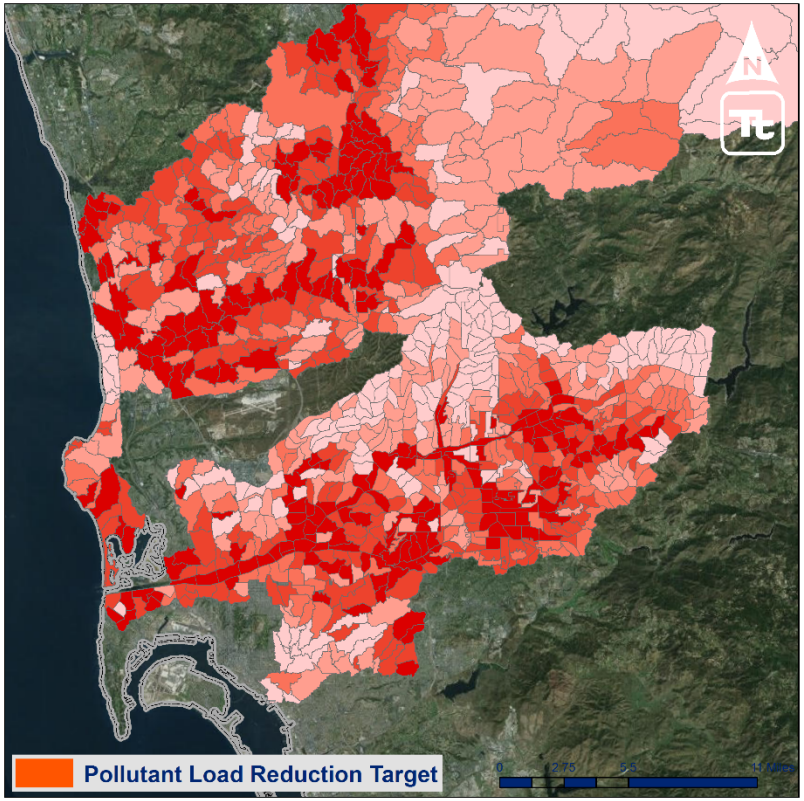
Case Study:

San Diego Stormwater Management Analysis and Optimization Pilot

Outcomes of San Diego's Reasonable Assurance Analysis (RAA)

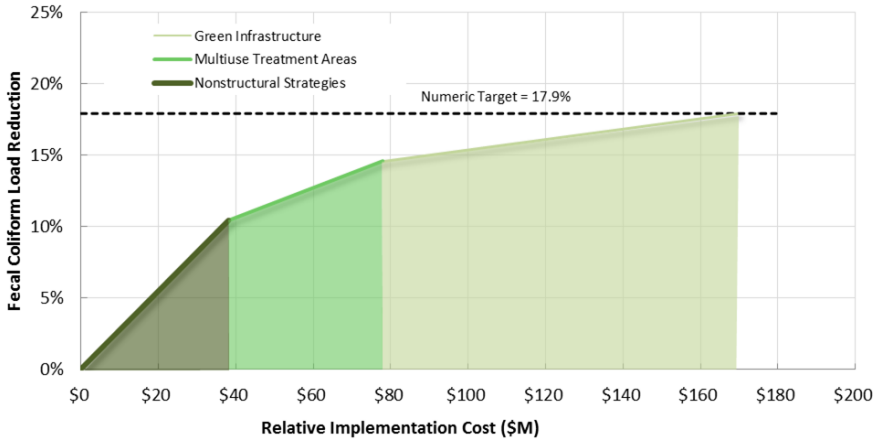
- Compliance targets optimized at the subwatershed-scale
- Generalized schedule of BMPs to attain compliance

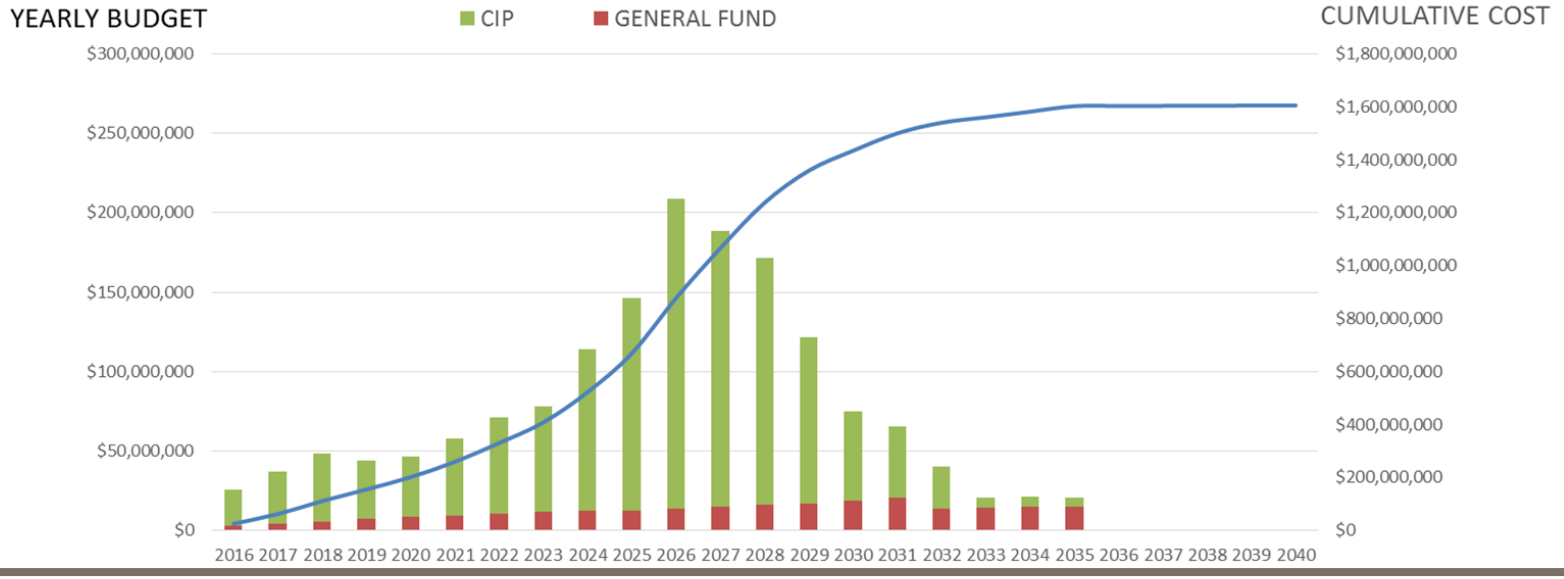




Outcomes of San Diego's Reasonable Assurance Analysis (RAA)

- Compliance targets optimized at the subwatershed-scale
- Generalized schedule of BMPs to attain compliance
- Macro-scale financial planning tools

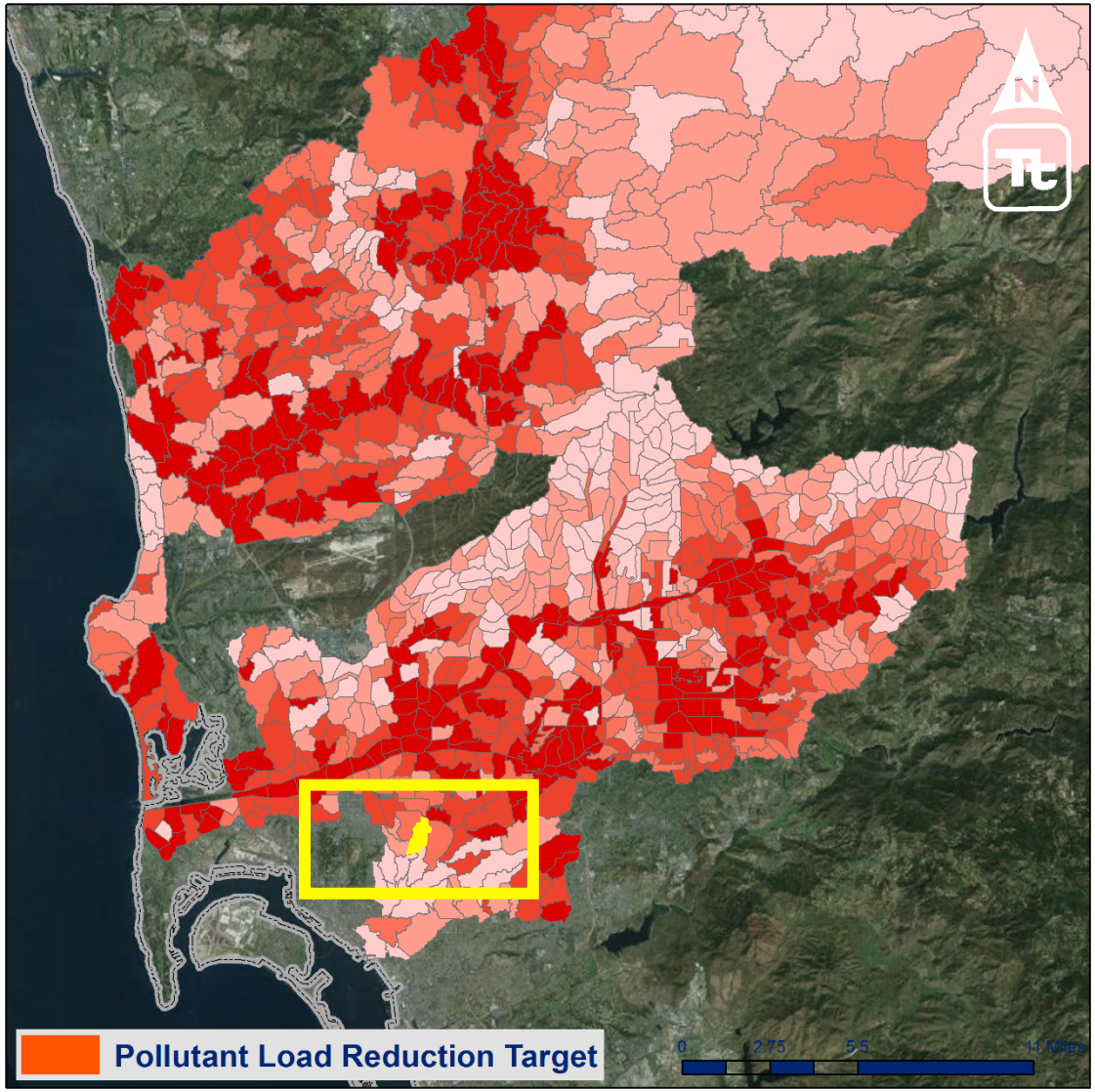




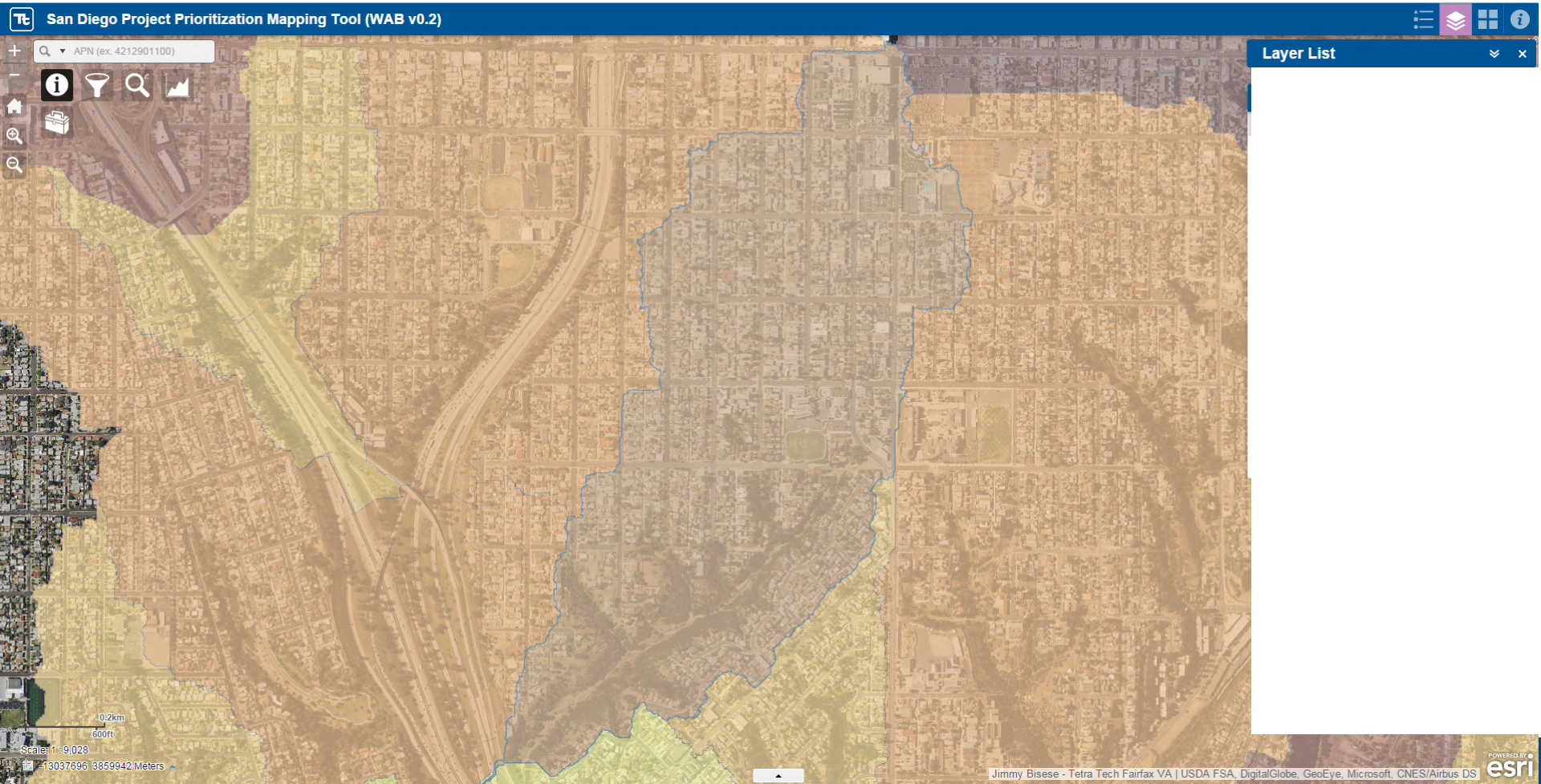
The Role of a Watershed Master Plan

- Watershed Master Plan is needed to:
  - Inform ***Data-Driven Decision Making*** using
    - **High-Resolution Data**
    - **Prioritization Logic**
    - **Specific Project Visualization**
  - Identify and Leverage **Program Synergies**
  - Enable ***Wise*** Spending
- Outcome: ***Specific*** Street-by-Street and Parcel-by-Parcel Compliance Action Plan and Schedule

What Does it Look Like?



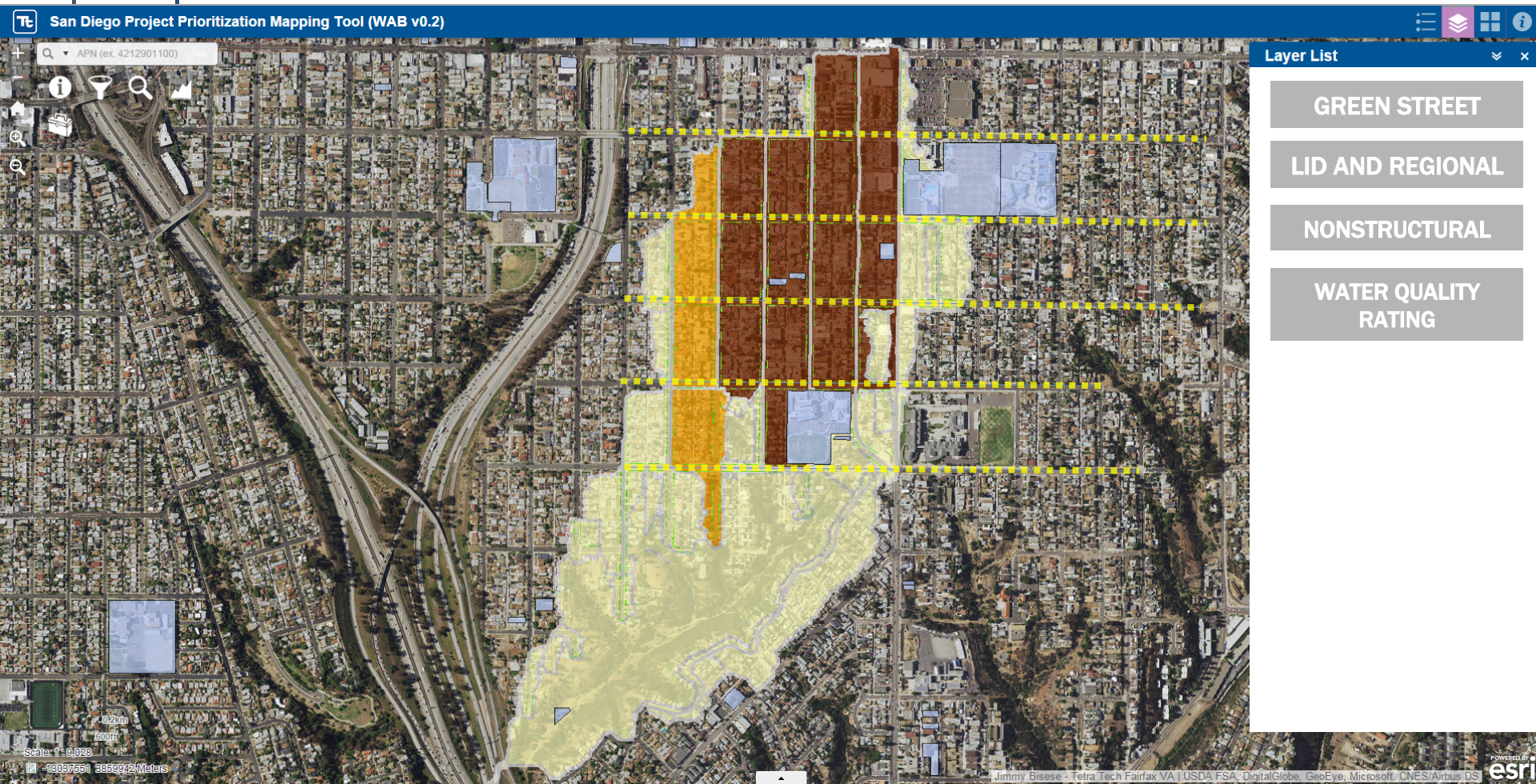
Example Application: Green Street Opportunity and High-Resolution Drainage Area Data



Step One: High-Resolution BMP Identification

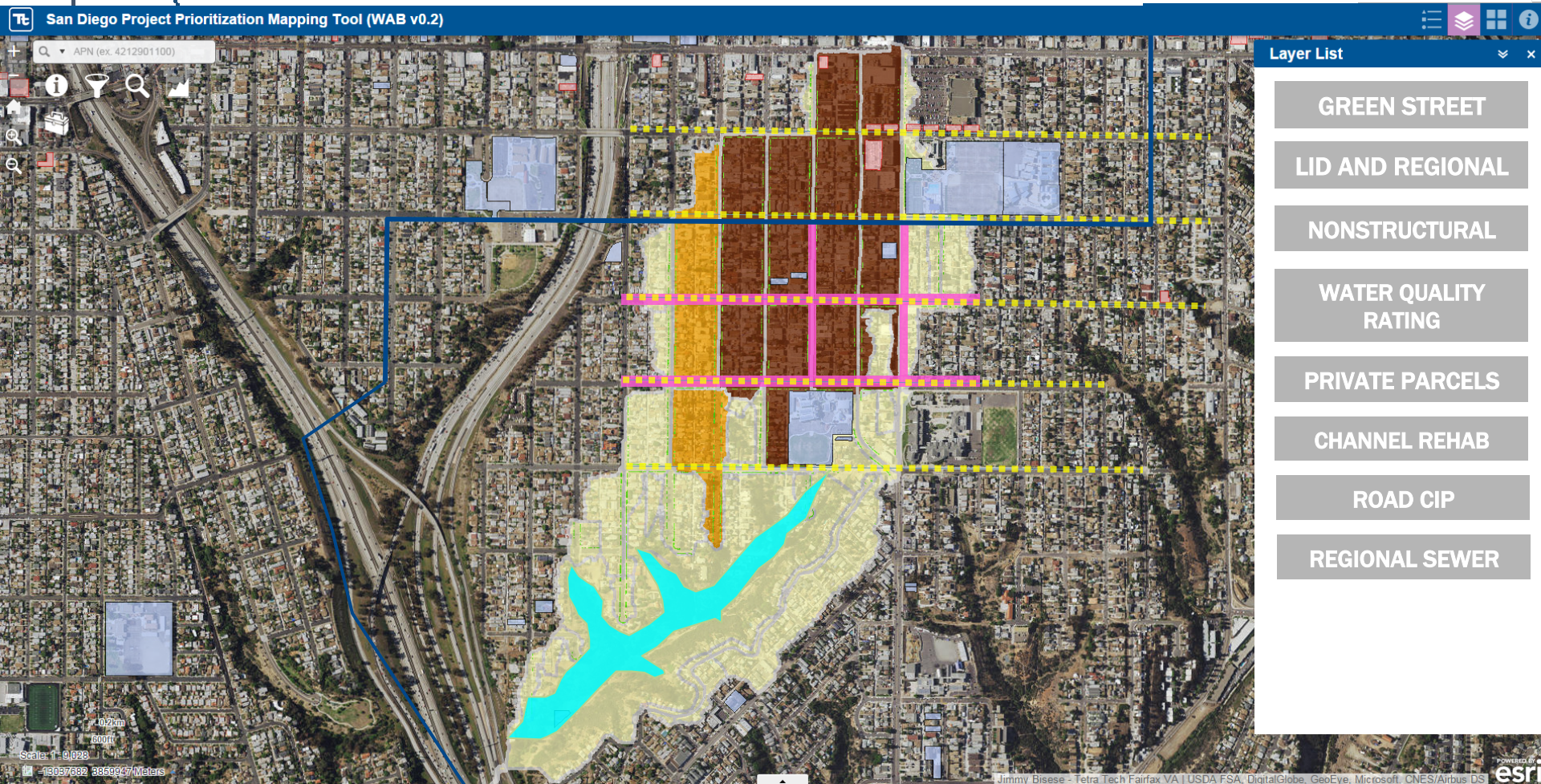
Step Two: Optimize at Fine Scale and Characterize with Water Quality Rating

Rank	Project	WQ Efficiency (lb/$)	WQ Effectiveness (lb/yr)
1	MUTA-1		
2	NS-1		
3	GS-1		
4	GS-2		

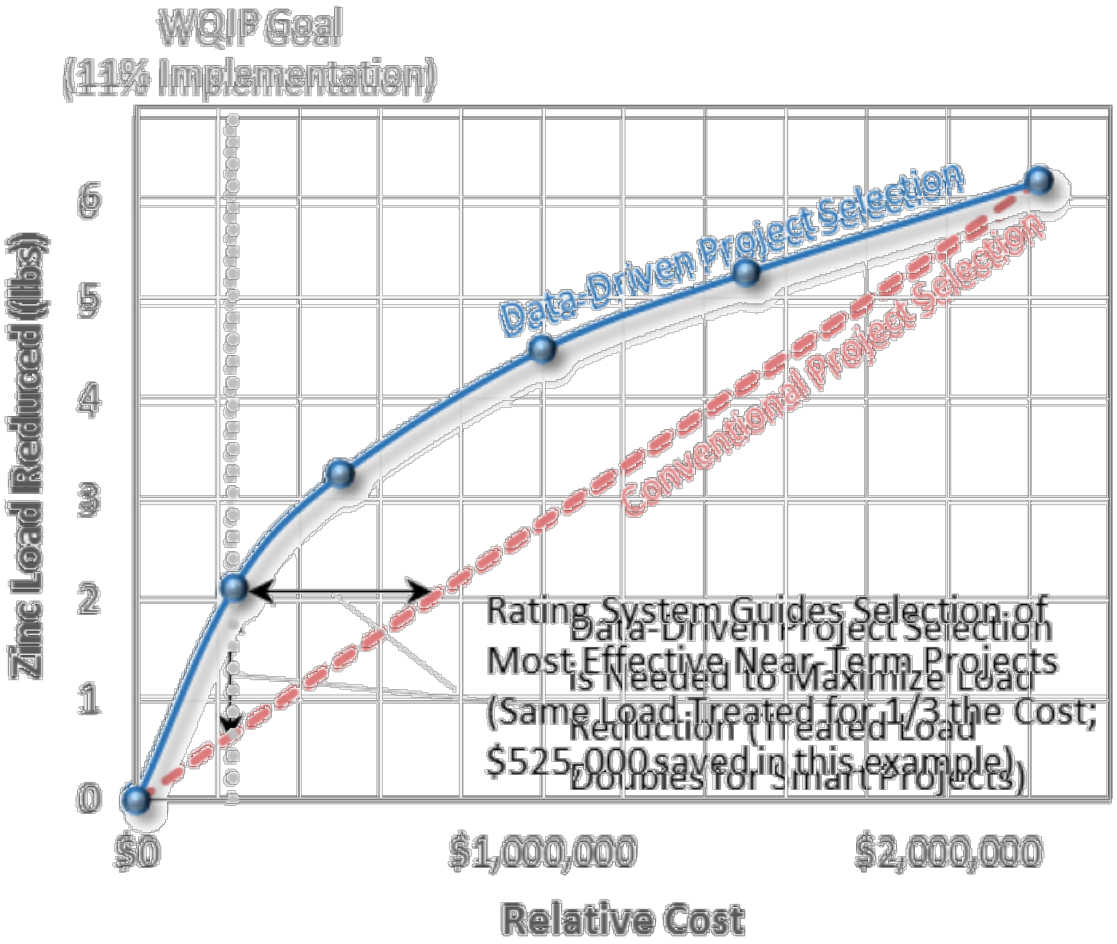


Step Three: Use High-Resolution Methods to Identify Specific Coordination Opportunities with Other Programs

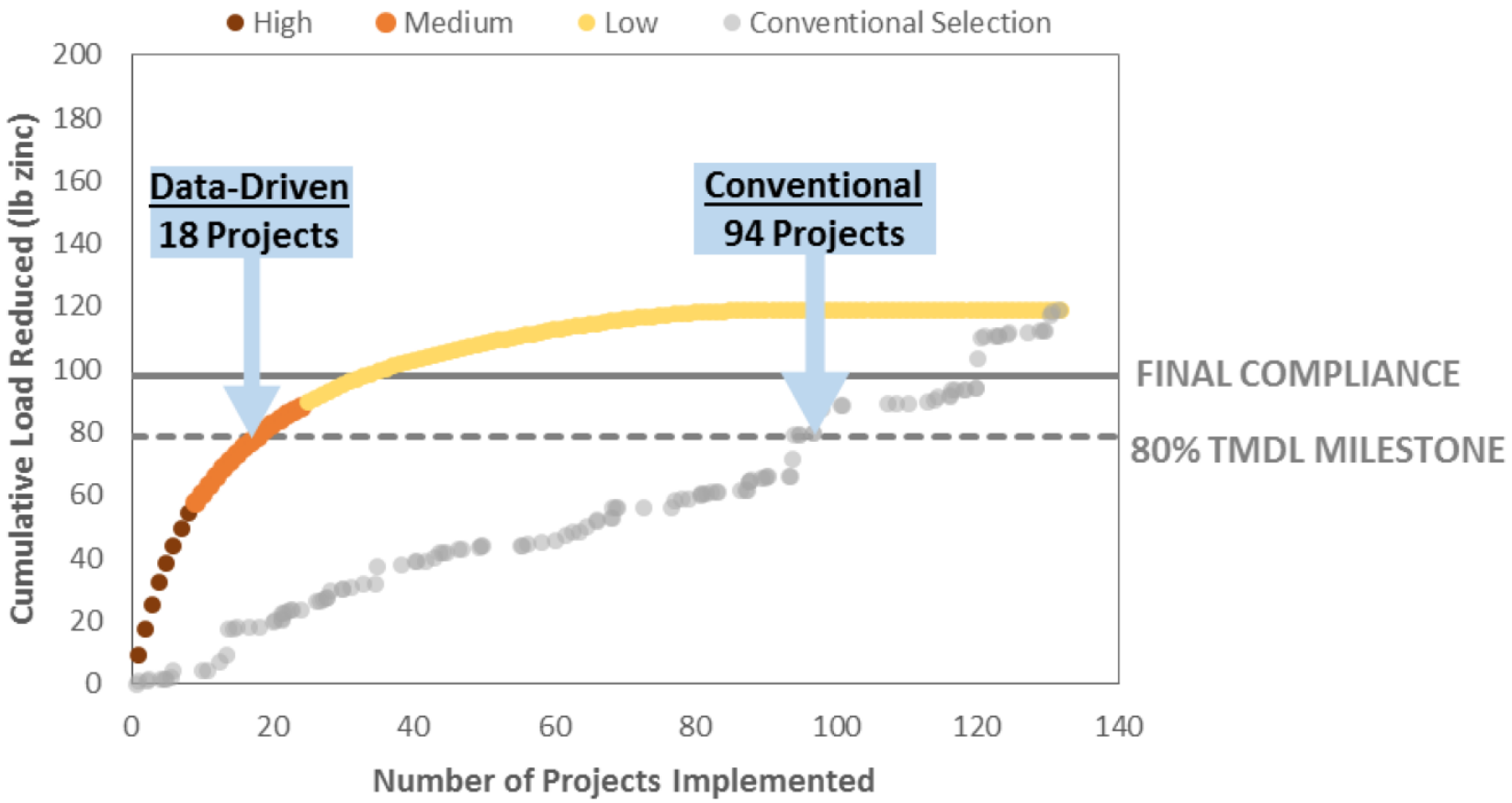
Rank	Project	WQ Efficiency (lb/$)	WQ Effectiveness (lb/yr)	Private Parcel Incentive Program	Integrated Water Rating	Trash Capture Rating	Coordination Rating
1	MUTA-1						
2	NS-1						
3	GS-1						
4	GS-2						
5	PR-1						



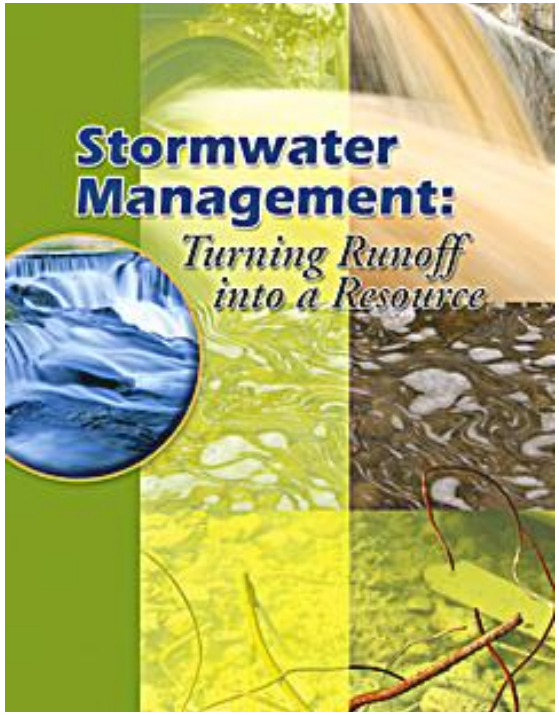
Project Level Implications for Tracking and Adaptive Management



Programmatic Level Implications for Tracking and Adaptive Management



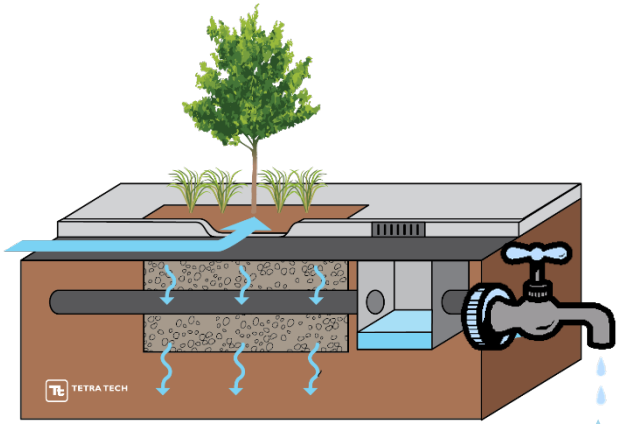
How Can Southern California Work To Change the Paradigm of Stormwater Runoff?



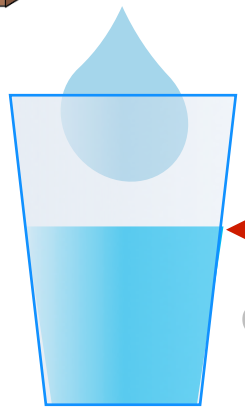
- Key Driver
  - Water Quality Regulatory Compliance
- Fundamental Challenge
  - Compliance Investment Estimated At Tens of Billions in Cap Ex
- Opportunity
  - Optimize the Approach, Look For Multi-Benefit Solutions, Challenge Funding Paradigms, and Develop Non-traditional Strategies
- Synergies
  - Stormwater Runoff as a Water Resource

One Step Further…Stormwater as a Resource

If stormwater capture required by the EWMPs (50%) were used as a resource…



= 150 Billion Gallons



55% of residential demand

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Thank You