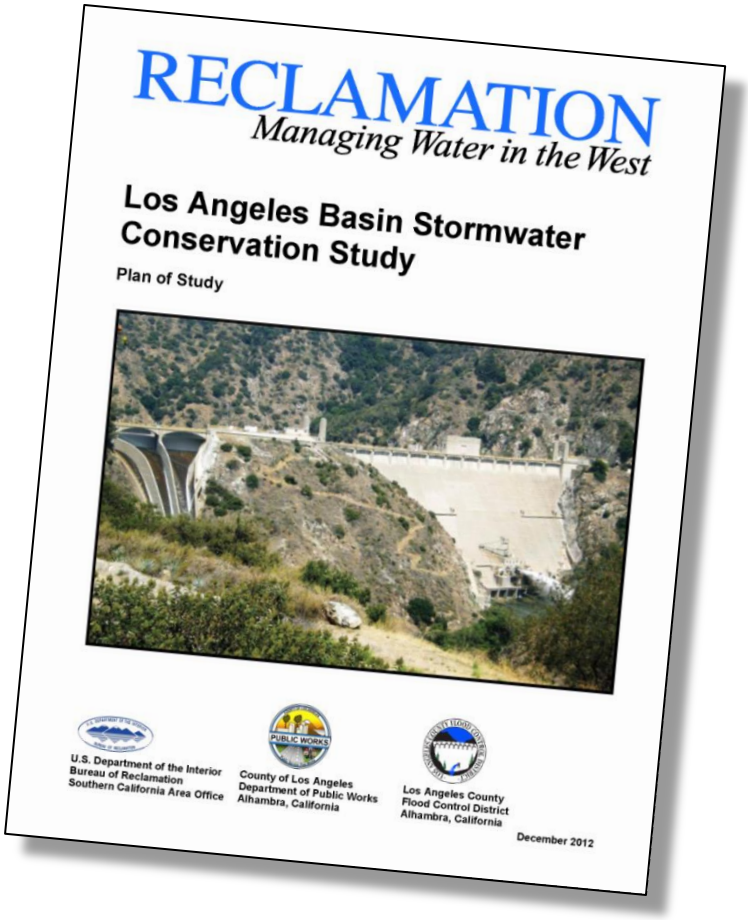
Los Angeles Basin
Stormwater Conservation Study

Los Angeles County Flood Control District
U.S. Department of the Interior – Bureau of Reclamation

TASK 5 – Infrastructure & Operations Concepts
TASK 6 – Trade-Off Analysis & Recommendations
Progress Meeting
September 30, 2015

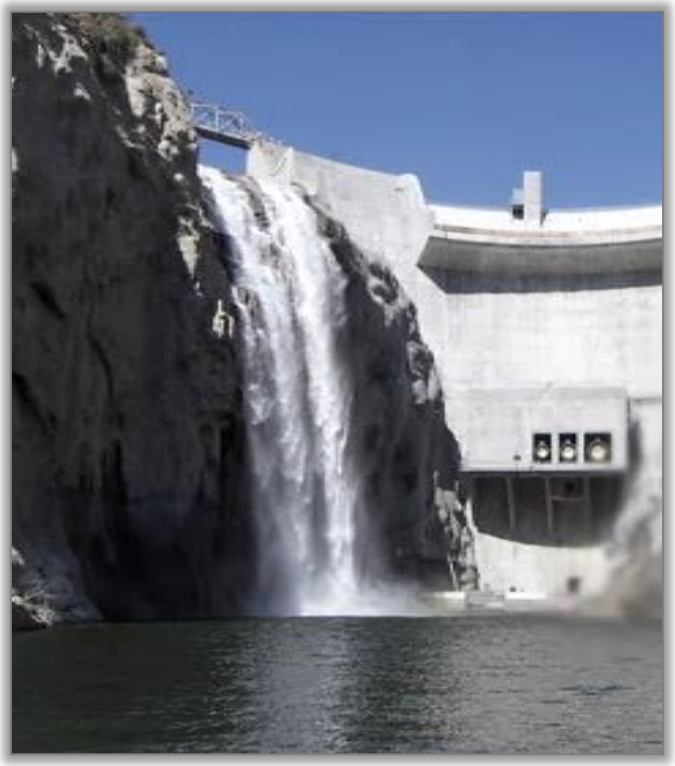
Overview

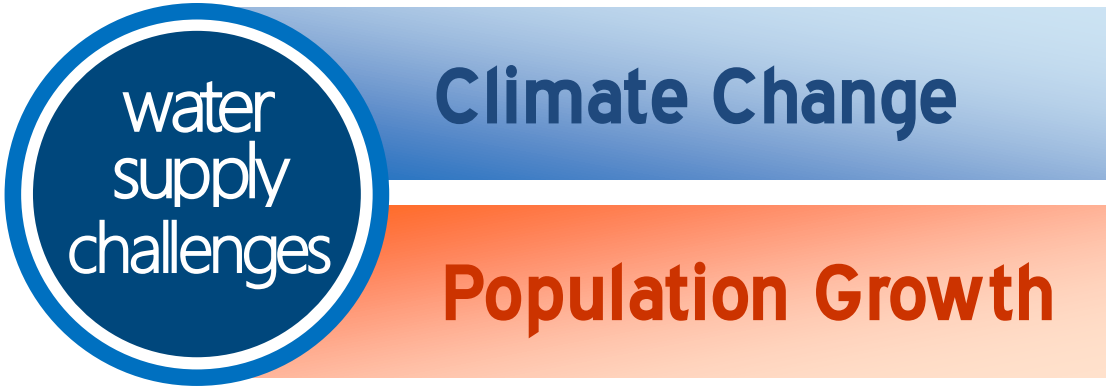
- LA Basin Study Update
- Preliminary Findings of Stormwater Capture Concepts
- Progress on the Trade-Off Analysis
- Next Steps



Study Objectives

- Evaluate existing water conservation under future conditions
- Evaluate potential new facilities & operational changes for climate change





Study Elements

Downscaled Climate Change & Hydrologic Modeling

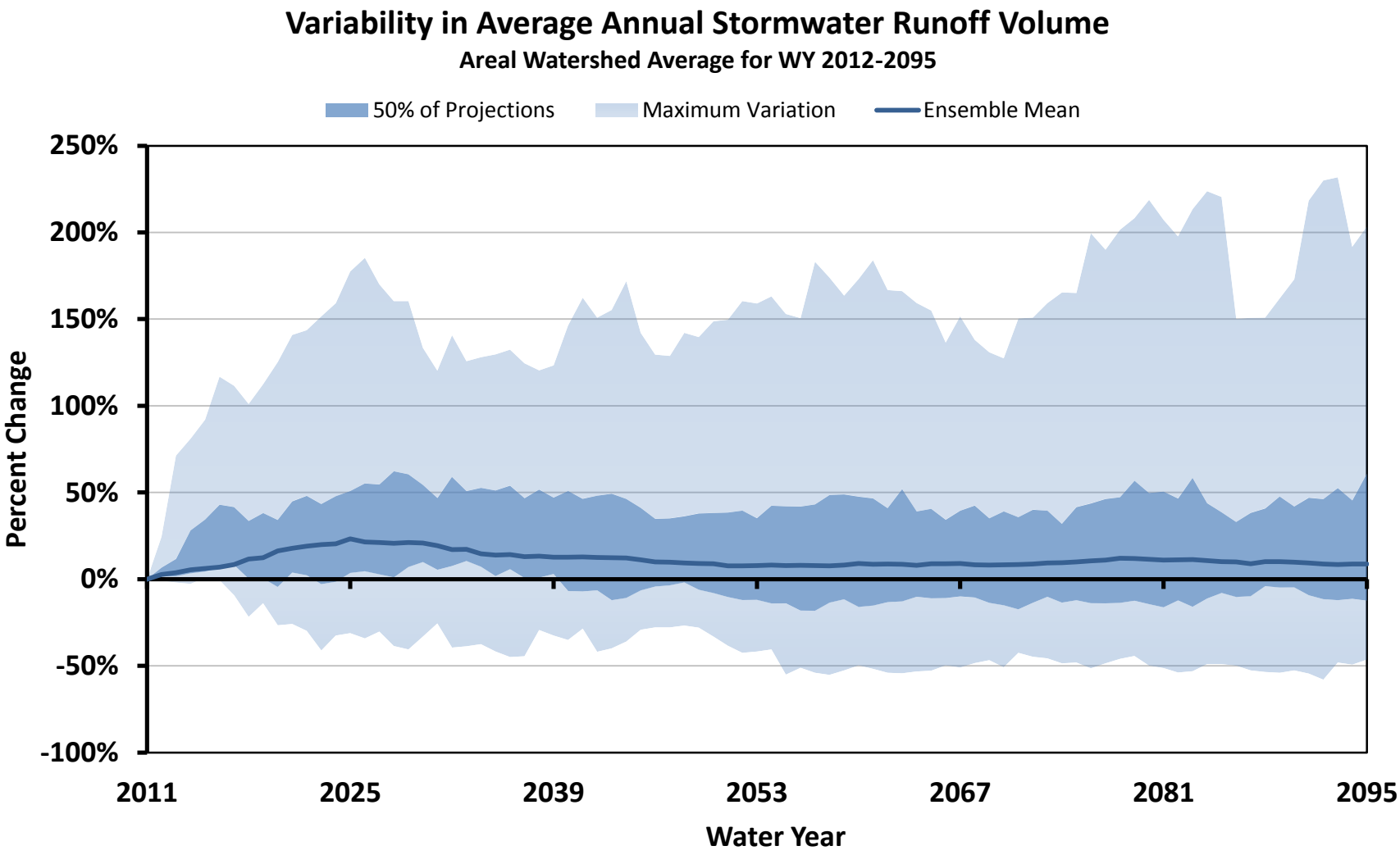
Water Supply & Demand Projections

Existing Infrastructure Response

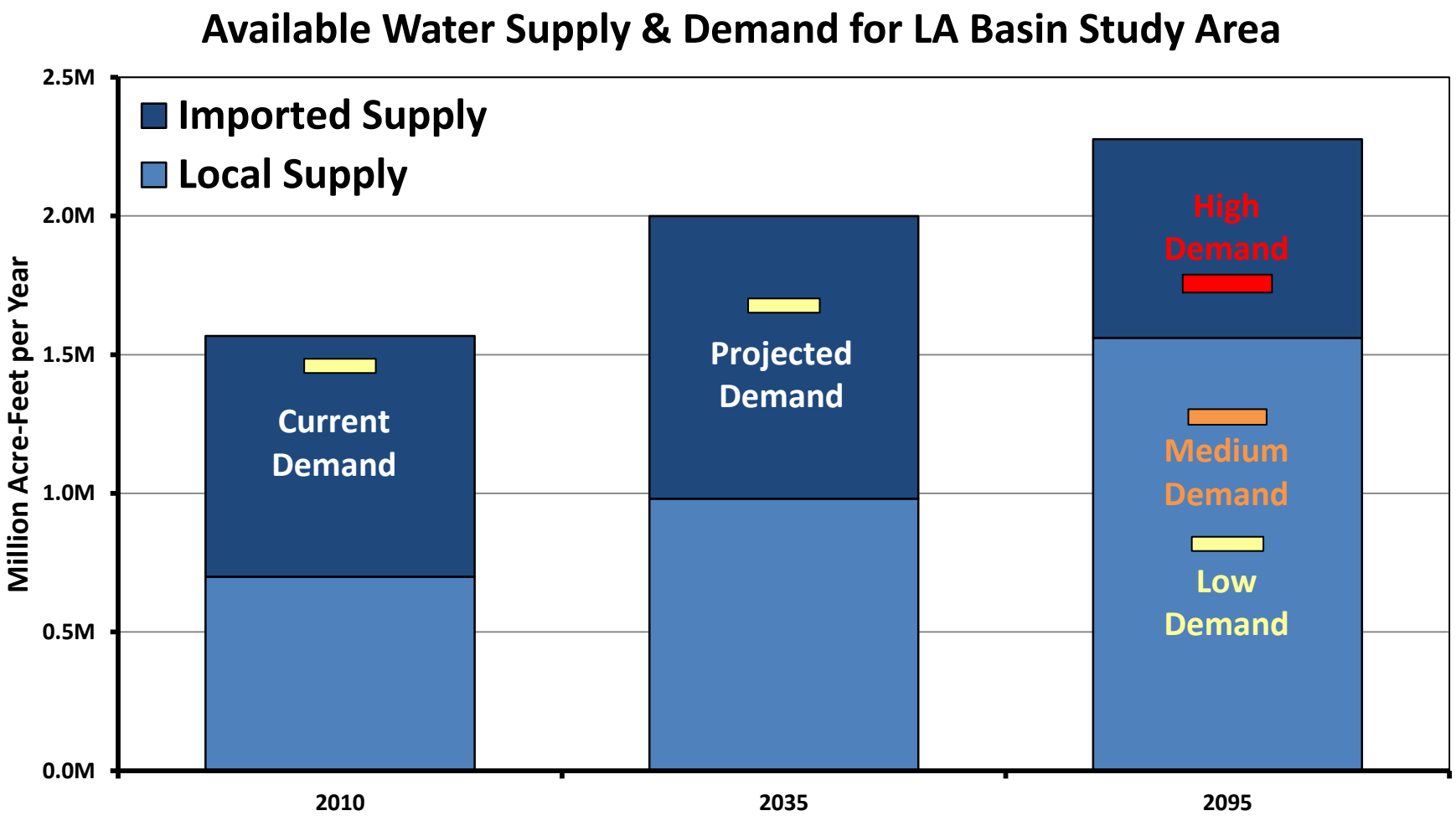
Develop Stormwater Conservation Concepts

Tradeoff Analysis & Recommendations

A Need for Climate Resiliency

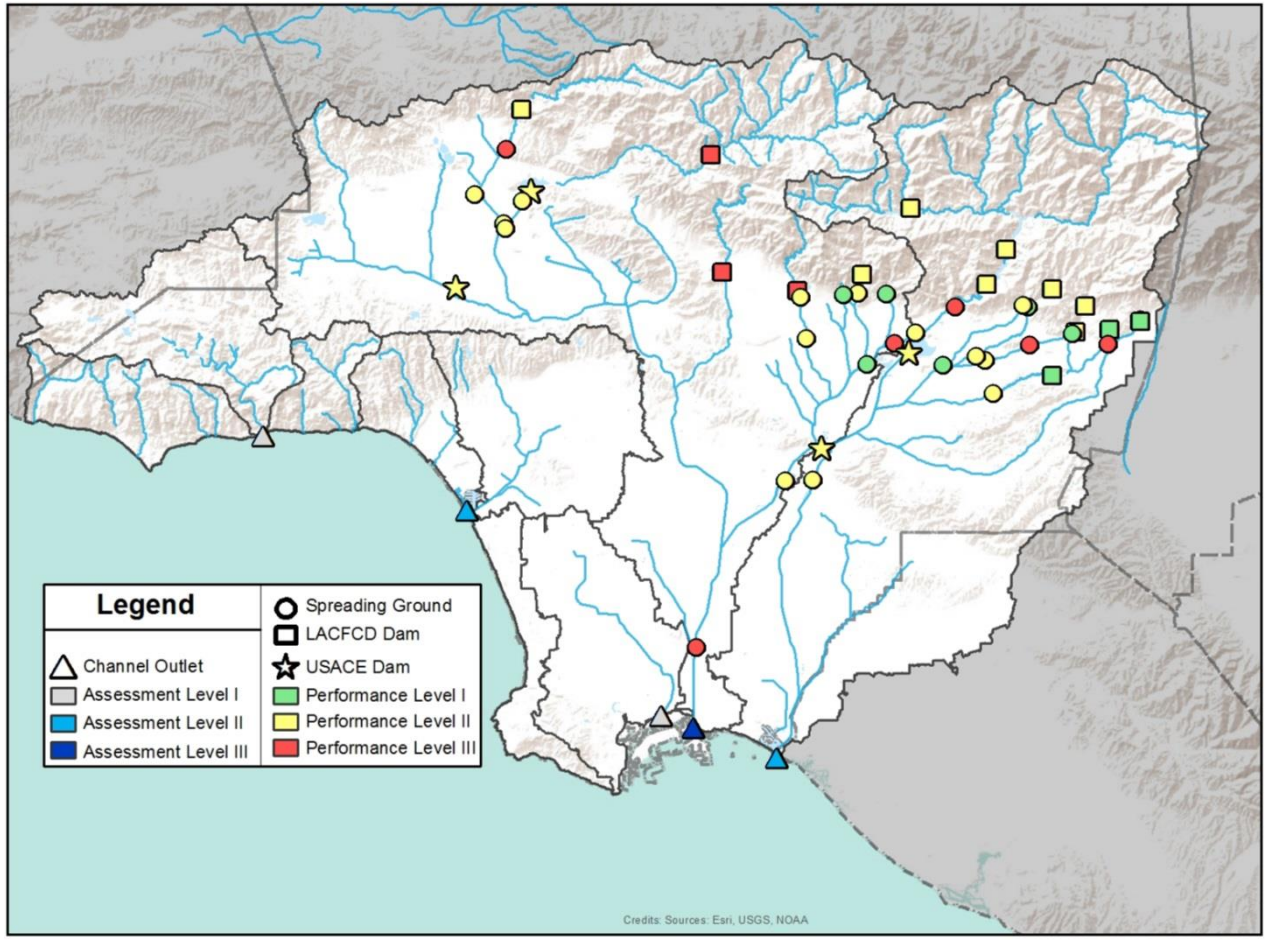


Future Water Supply & Demand

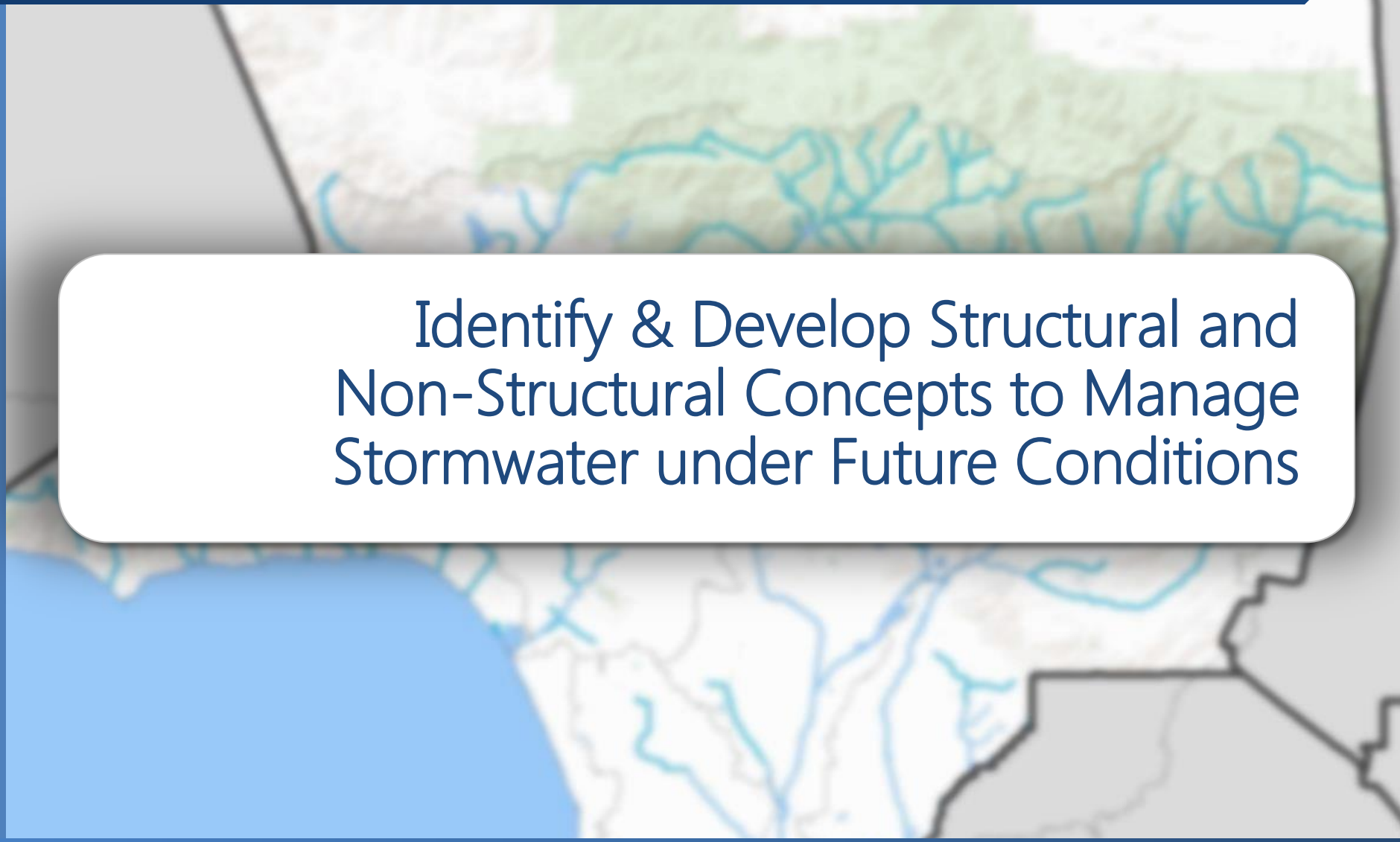


Evaluating the Infrastructure

- **18 Dams**
  - 14 LACFCD
  - 4 Army Corps
- **27 Spreading Grounds**
- **5 Major Channel Outlets**



Task 5 Objectives



Identify & Develop Structural and Non-Structural Concepts to Manage Stormwater under Future Conditions

Task 5 Concept Development

Charrettes Identified Nearly 500 Concepts

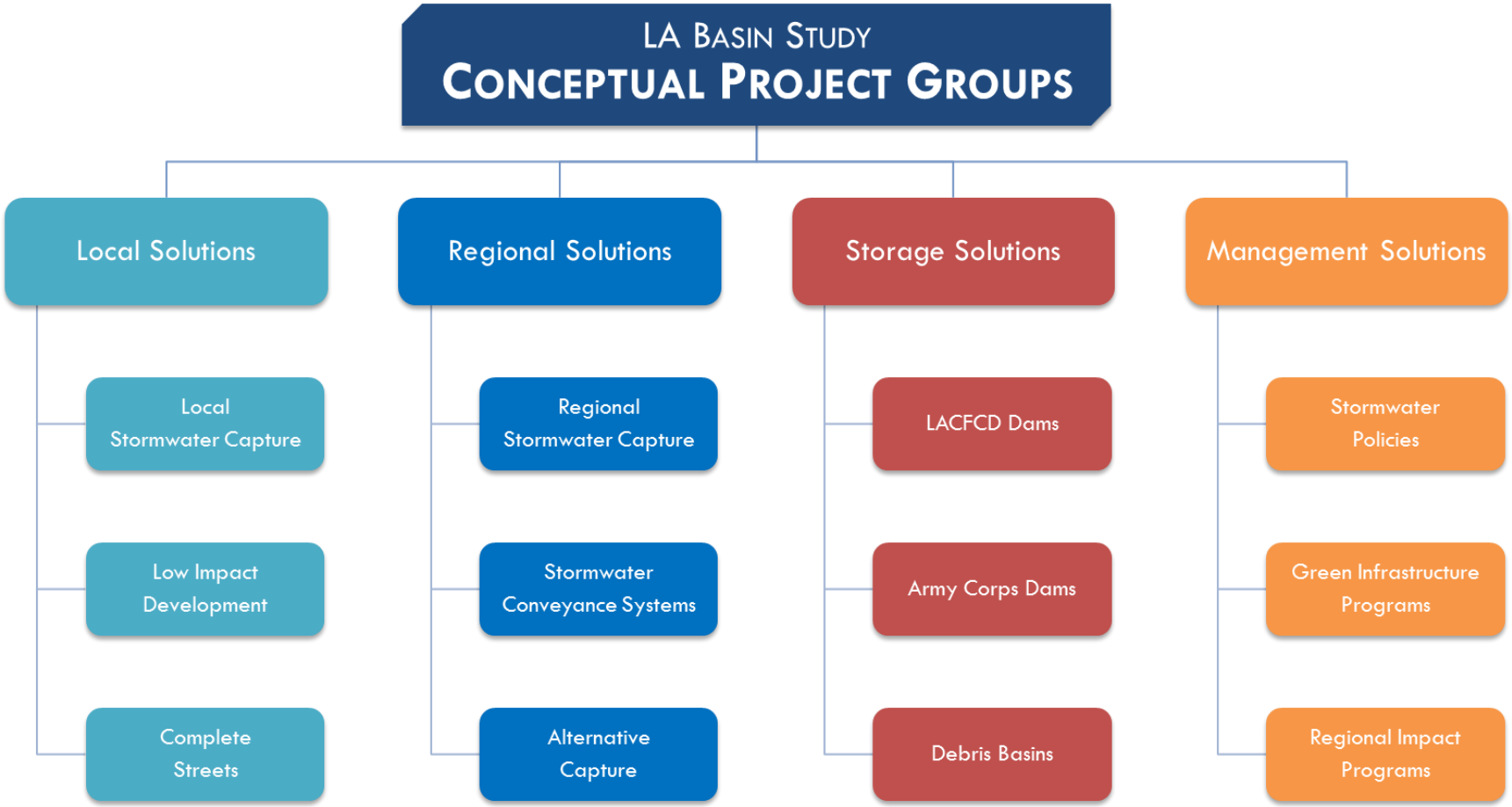
Concepts Reviewed for Focus on Stormwater Capture and Duplicates

Remaining Concepts Targeted for Further Evaluation

126 Stormwater Concepts Evaluated and Scored

Highest Scoring Concepts Placed into 12 Project Groups

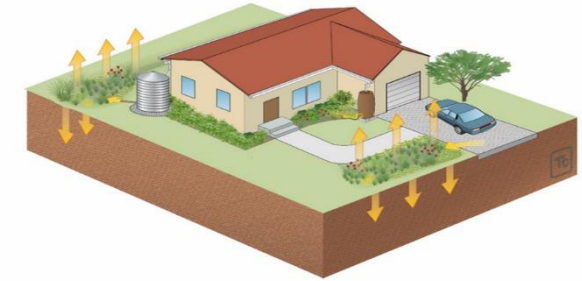
Task 5 Project Groups



Local Solutions

Local Solutions (Decentralized Projects)	Score
1.Local Stormwater Capture	
New park space (as green infrastructure)	96
Golf Course Stormwater Improvements	91
Infiltration at parks	91
Infiltration in Caltrans highway cloverleaf exchange open areas	91
Underground infiltration chambers	88
Recapture rights-of-way as small scale infiltration areas	87
2. Low-Impact Development	
Construct distributed BMPs upstream of lower efficiency spreading grounds	85
"Urban Acupuncture" (many small projects over the basin)	84
Rain gardens	84
Parking lot storage and connectivity	76
Green roofs	51
3. Complete Streets	
Green street stream tributaries	76
Prioritized green streets based upon capture potential	76
Use parkways and road medians to capture stormwater	76
County roads sub-surface (ala Elmer Avenue)	75
Under street infiltration	75

Local Stormwater Capture

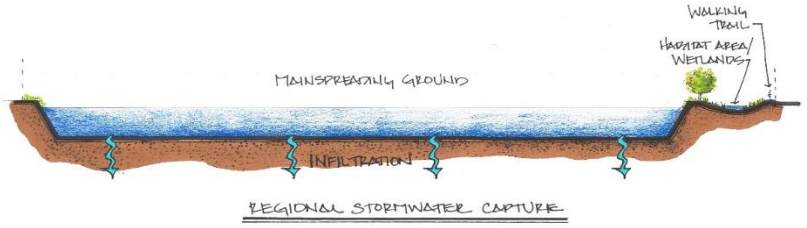


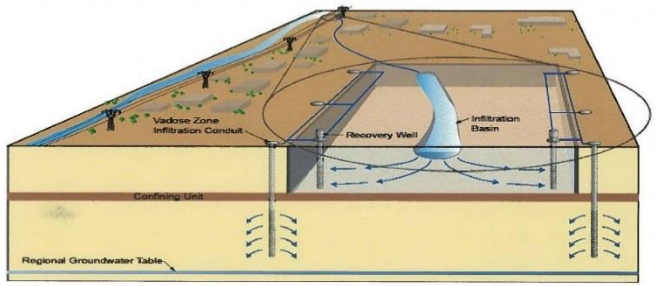
LID at Parcel Scale

Complete Streets

Regional Solutions

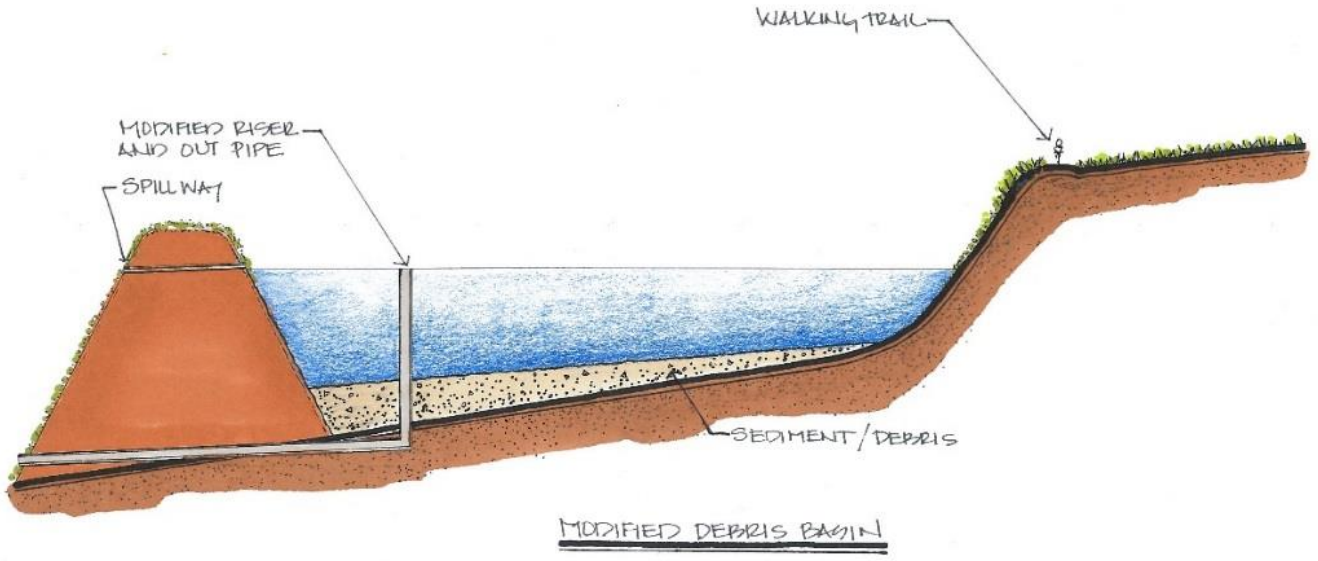
Regional Solutions (Centralized Projects)	Score
4. Regional Stormwater Capture	
Investigate potential recharge sites around Sepulveda Dam	77
New basins	77
Increased and enhanced maintenance at existing spreading grounds (e.g., remove top soil)	68
Construct the San Jose Spreading Grounds (adjacent to Cal Poly Pomona)	67
Abandoned Quarry Pits for storage	61
5. Stormwater Conveyance Systems	
Channel side-ponds	70
Improve stormwater capture and habitat along Tujunga Wash corridor	66
Increase soft-bottom channels	66
Alternative streams in unconfined aquifers (e.g., Tujunga Wash Greenway)	60
River speed bumps	43
6. Alternative Capture	
The Los Angeles Forebay – Big infiltration basins under everything	62
Consolidate less efficient systems (dams/watershed)	54





Storage Solutions – Debris Basins

Storage Solutions (Centralized Projects)	Score
7. LACFCD Dams	
Restore capacities at LACFCD reservoirs by performing sediment removal	68
Raise dams	60
8. USACE Dams	
Reoperation of USACE Dams	83
Retrofit USACE dams for water conservation	79
9. Debris Basins	
Debris basin retrofit	73
Debris basin reoperation with forebay pre-treatment	48
Construct berms in the back of debris basins to help percolate water	40



Management Solutions

Management Solutions (Plans, Programs, & Policies)	Score
10. Stormwater Policies	
EWMPs for water conservation	81
Align regulatory and environmental plans with water conservation/supply goals	81
Advanced rainfall-hydrology modeling to quantify pre-storm capture	80
Streamline regulatory requirements for maintenance of existing and urbanize stormwater infrastructure	77
Remove invasive plants in system	71
Feed-in-tariff for groundwater infiltration	71
11. Green Infrastructure Programs	
LID/BMPs	93
Increase permeable space to balance water conservation goals	77
Increase urban permeability	71
Emphasize residential infiltration in high-density locations	71
Encourage residential land changes for promoting infiltration	61
12. Regional Impact Programs	
Open Space Stormwater Improvements	91
Utilize government parcels first for stormwater capture, storage, and infiltration	91
Investigate recharge along river embankments	88
County-wide parcel fee w/ mitigation rebate*	88
School Stormwater Improvements	81
Regional projects (e.g., public parks and schools to infiltrate flows)	77
Depress all sports fields for stormwater capture	71
Consider all open areas as a stormwater facility	61

Appraisal-Level Analysis

- WMMS Concept Modeling
- Determine Stormwater Conservation
- Multi-Benefit Assessment
- Cost Estimates

Task 5 Results & Findings

Summary of Project Group Benefits and Costs

Project Group	Stormwater Conserved/ Storage Capacity (AFY)	Recreation (miles of trail)	Habitat (acres)	ROW (acres)	Range of Costs ($/ac-ft)
Local Solutions					
Local Stormwater Capture[c]	17,900 to 29,300	204	266	2,655	$9,500 to $15,500
Low Impact Development[d]	81,400 to 131,600	0	0	0	$6,800 to $11,000
Complete Streets[d]	27,300 to 43,300	0	0	0	$12,100 to $19,200
Regional Solutions					
Regional Stormwater Capture[c]	26,100 to 59,900	12	42	682	$900 to $2,100
Stormwater Conveyance Systems[c]	8,000 to 10,000	3	8	31	$42,700 to $53,100
Alternative Capture[c]	3,800 to 6,900	2	2	34	$1,400 to $2,400
Storage Solutions					
LACFCD Dams[b]	57,400 to 264,100	0	0	0	$100 to $480
USACE Dams[a, b]	3,800 to 11,800	0	0	0	-
Debris Basins[c]	90 to 230	1	0	0	$13,100 to $35,900
Management Solutions					
Stormwater Policies[d]	155,300 to 235,000	0	0	0	$7,900 to $11,900
Green Infrastructure Programs[d]	106,400 to 171,800	0	0	0	$6,600 to $10,700
Regional Impact Programs[c]	21,800 to 36,900	204	266	2,655	$9,000 to $15,200

[a] Cost Information for USACE dams not determined for this study.

[b] Increased storage capacity or stormwater retention for potential reuse or recharge; costs exclude estimates for Santa Anita Dam

[c] Conservation through groundwater recharge

[d] Conservation through groundwater recharge or stormwater retention for potential reuse

Storage Solutions – Dams

Storage Solutions (Centralized Projects)	Score
7. LACFCD Dams	
Restore capacities at LACFCD reservoirs by performing sediment removal	68
Raise dams	60
8. USACE Dams	
Reoperation of USACE Dams	83
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Task 5 Results & Findings

LACFCD Dams and Hansen Dam

Structural Concepts Results – Mid 2 Scenario

Dam/Reservoir Name	Capture Ratio (%) *		
	Historical	Task 4	Task 5
LACFCD Dams:			
Big Tujunga	64.2%	47.3%	85.2%
Cogswell	75.5%	63.9%	97.8%
Devil's Gate	66.9%	51.4%	99.9%
Eaton Wash	86.6%	78.7%	99.8%
Morris	39.8%	29.7%	75.6%
Pacoima	87.0%	86.8%	98.4%
Pud. Diversion	94.9%	90.0%	99.9%
San Dimas	82.1%	69.5%	99.0%
San Gabriel	82.1%	71.1%	96.9%
USACE Dams:			
Hansen	49.8%	35.1%	49.6%

*Note: Volumes captured do not indicate volumes of water used for stormwater recharge. Volumes captured indicate total increased volume of storage available for potential water conservation use.

Task 5 Results & Findings

LACFCD Dams Summary of Estimated Costs
Structural Concepts - Mid 2 Scenario

Dam Name	Estimated Total Annual Cost	Change of Mean Annual Volume Captured (Mid 2 FCS) (ac-ft)*	Estimated Annual Cost per ac-ft of Additional Volume Captured (Mid 2 FCS)
Big Tujunga	$1,099,474	11,786	$93
Cogswell	$1,145,670	11,762	$97
Devil's Gate	$4,634,504	9,747	$475
Eaton Wash	$1,351,402	1,277	$1,059
Morris	$3,798,384	71,853	$53
Pacoima	$3,029,836	1,259	$2,407
Puddingstone Div'n.	$466,349	888	$525
San Dimas	$1,366,958	2,041	$670
San Gabriel	$10,550,903	39,404	$268
Totals	**$27,443,480**	**150,015**	**$183**

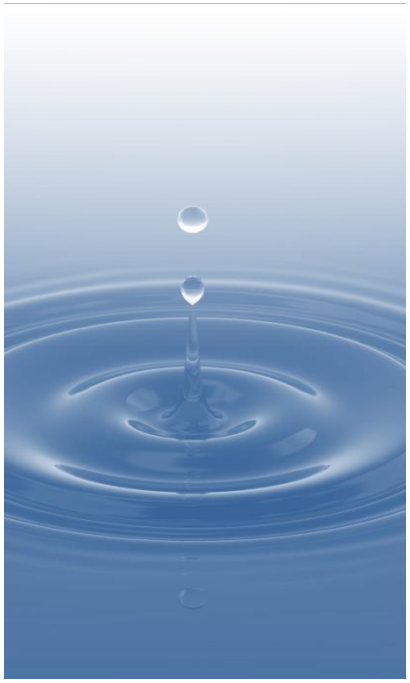
*Note: Volumes captured do not indicate volumes of water used for stormwater recharge. Volumes captured indicate total increased volume of storage available for potential water conservation use.

Task 6 Overview

Goal

Provide a transparent evaluation and ranking of concepts that meet a variety of identified benefits at a range of costs

Objectives



Improve understanding of the relative importance of various effects of study concepts

Develop a framework to rank concepts and determine how much must be given up to get more of a desired output

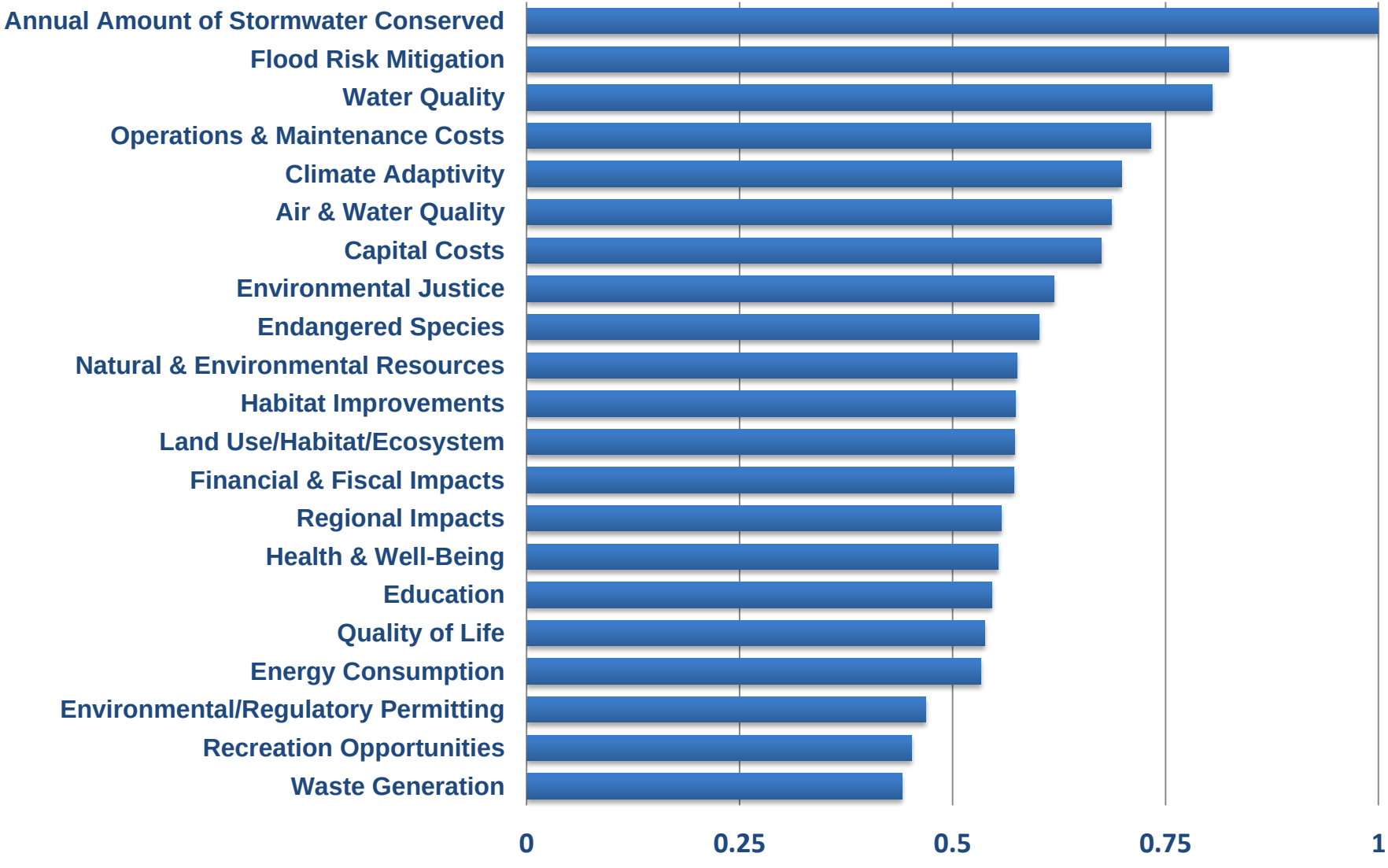
Develop weights that reflect the importance of various resources affected by concepts

Provide an objective and transparent ranking of concepts

Redundancy of Trade-Off Elements

- Are some trade-off elements redundant?
- Eliminating redundant elements can simplify analysis
- Potentially eliminated measures are not unimportant, but considered to be well represented by others
- Basis for evaluating redundancy is a comparison of how measures are defined and the correlation analysis of results from the STAC survey

Trade-Off Survey Results



EVALUATION OF TRADE-OFF ELEMENTS

EVALUATION OF CORRELATION COEFFICIENTS

	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6	Column 7	Column 8	Column 9	Column 10	Column 11	Column 12	Column 13	Column 14	Column 15	Column 16	Column 17	Column 18	Column 19	Column 20	Column 21
Column 1	1																				
Column 2	0.495434	1																			
Column 3	-0.02952	0.500479004	1																		
Column 4	-0.3686	-0.25427381	0.0363596	1																	
Column 5	-0.21851	-0.14249164	-0.156454	0.775247	1																
Column 6	-0.08928	-0.10297793	0.0312911	0.703493	0.739963339	1															
Column 7	0.486358	0.218503278	-0.327729	0.012883	0.266870488	0.5263281	1														
Column 8	-0.19854	-0.57186277	-0.252056	0.608077	0.465632364	0.3760881	0.013582	1													
Column 9	-0.11516	-0.19628351	-0.292676	0.763532	0.874812298	0.8547916	0.472069	0.465906561	1												
Column 10	-0.38448	-0.27272794	-0.059449	0.563801	0.636407051	0.7637739	0.240137	0.423624439	0.5703666	1											
Column 11	0.261364	-0.12385842	0.1180734	0.214625	0.145672551	0.4634202	0.172579	0.418541034	0.1620758	0.5629942	1										
Column 12	0.255455	-0.18430628	-0.191777	0.499885	0.29209891	0.2731689	0.055029	0.599707199	0.3066824	0.2977397	0.676683736	1									
Column 13	-0.38531	-0.55199239	-0.113922	0.831532	0.639428186	0.6721542	0.044331	0.78694092	0.7078122	0.5526625	0.331272023	0.46897294	1								
Column 14	-0.10204	0.066935654	0.2632134	0.58828	0.297662306	0.611877	0.226967	0.299799786	0.4510661	0.4041494	0.312489757	0.21826401	0.5350277	1							
Column 15	-0.41979	-0.36974161	-0.145946	0.595432	0.296876294	0.4331057	-0.090742	0.402459603	0.4392648	0.4611534	0.152652045	0.21092717	0.6329737	0.709151078	1						
Column 16	-0.17171	-0.15076382	0.1626167	0.590452	0.211651075	0.556771	0.128411	0.290540541	0.3893744	0.3250669	0.31122282	0.27376078	0.6360613	0.886015439	0.73684146	1					
Column 17	-0.39327	-0.33713468	-0.109042	0.93798	0.788665409	0.7571706	0.103711	0.513284785	0.8474913	0.5980231	0.12593372	0.3677439	0.8057755	0.499269727	0.64634744	0.5174578	1				
Column 18	-0.24543	-0.2192645	-0.122801	0.773111	0.700247979	0.8083427	0.294404	0.397065822	0.9196542	0.4472812	0.086502482	0.21360536	0.7386716	0.538895124	0.51495233	0.5243549	0.849512515	1			
Column 19	-0.13652	-0.24800459	-0.082325	0.508492	0.562532507	0.8135995	0.329851	0.269374629	0.6807769	0.7895002	0.472951329	0.24020442	0.50807	0.353897557	0.48032085	0.2854911	0.690122112	0.6231961	1		
Column 20	-0.05432	-0.29819973	-0.227313	0.483195	0.571307133	0.8218903	0.495764	0.253628169	0.7905402	0.562991	0.325893071	0.20494568	0.6263735	0.368044295	0.42562386	0.4331627	0.67585526	0.7628205	0.8312158	1	
Column 21	-0.07971	-0.28041902	-0.198026	0.518994	0.595149526	0.8383789	0.452447	0.243170668	0.8011668	0.6024065	0.375791641	0.25902012	0.6288882	0.392442755	0.4291779	0.4492981	0.690776601	0.7821818	0.8404057	0.9898228	1

CRITICAL VALUE IS .76

Assessing Redundancy of Elements

Assessing redundancy of measures used in Trade-Off Analysis

Uncorrelated Measures	Retained Measures	Potentially Discarded Measures
Annual Amount of Stormwater Conserved	Recreation Opportunities	Habitat Improvements
Capital Costs	Air & Water Quality	Water Quality
Operations & Maintenance Costs	Energy Consumption	Waste Generation
Flood Risk Mitigation	Land Use/Habitat/Ecosystem	Education
Financial & Fiscal Impacts	Environmental Justice	Health & Well-Being
Environmental/Regulatory Permitting	Quality of Life	
Natural & Environmental Resources	Climate Adaptivity	
	Endangered Species	
	Regional Impacts	

Economic and regional impact analysis

Economic Effects

- Benefits and Costs

Method of Estimation

- Benefits Transfer

Updated Principles, Requirements and Guidelines for Federal Investments in Water Resources

- Includes a wider range of effects than the previous Principles and Guidelines

Recreation Benefits

- Recreation values that will be used to estimate recreation benefits were obtained from Recreation Use Values Database maintained by the Oregon State University College of Forestry http://recvaluation.forestry.oregonstate.edu/
- Estimated benefits range from about $10 to $70 per recreation day (2010 $'s)
- Value depends on recreation activity and valuation method

Water Supply Benefits

- **The results from previous water supply reliability studies have been obtained to place an economic value on water supplies.**

  - **Barakat and Chamberlin (1994)**
  - **Spectrum Economics (1991)**
  - **Goddard and Fiske (2005)**
  - **Bay Area Economic Forum (2002)**
  - **Koss and Khawaja (2001)**

Regional Impact Analysis

Regional impact analysis is an evaluation of the effect of an action on income, employment, and the value of output produced on the immediate region.

- **Regional impacts include:**
  - Short-term impacts from construction expenditures.
  - Long-term impacts from operation, maintenance, and replacement expenditures.
  - Long-term impacts from changes in water supply that supports commercial businesses and industry
  - Long-term impacts from changes in expenditures associated with any changes in recreation visitation compared to no action.

Regional Impact Analysis

- The regional impact area defined for this analysis is Los Angeles County
- The impacts associated which each of the alternatives are measured in terms of changes in industry output, employee compensation, and employment.

  - Industry output is a measure of the value of industry's total production.
  - Labor income represents wages and benefits paid to employees.

Regional Impact Analysis

- **The estimated regional impacts from various activities are shown below**

Type of Impact	Value of output per $1 spent	Labor income per $1 spent	Employment per $1.0 million spent
Construction impact	$0.85	$0.20	5
O&M impact	$0.80	$0.25	5
Recreation impacts	$0.70	$0.25	7

FISCAL IMPACT AND ENVIRONMENTAL JUSTICE ANALYSIS

- **A fiscal impact analysis is closely related to a regional impact analysis, but is focused on the effects of a project on government finances and services.**

Impact category	Total impact or annual impact	State and local tax impact per dollar spent	Federal tax impact per dollar spent
Construction	Total	$0.07	$0.08
Project O&M	Annual	$0.07	$0.11
Recreation	Annual	$0.06	$0.06

- **An environmental justice analysis requires Zip Code data to compare the project area to the larger region to understand the distribution of income, poverty, unemployment, and ethnic backgrounds**

Next Steps

- **Task 5**
  - Distribute Draft Task 5 Interim Report
    - 3 Week Review Period
  - Revise Report with Comments
- **Task 6**
  - Perform Preliminary Analysis Based Upon Task 5 Findings
  - Distribute Draft Task 6 Interim Report
    - 2 Week Review Period
  - Revise Report with Comments
- **Final Report – December 2015**

Contact Information

Los Angeles Basin Stormwater Conservation Study

http://www.usbr.gov/lc/socal/basinstudies/LABasin.html

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