

# RECLAMATION

*Managing Water in the West*

## San Diego Basin Study Final Presentation

San Diego IRWM RAC Meeting August 7, 2019



U.S. Department of the Interior  
Bureau of Reclamation

# Agenda

- **Study Purpose and Background**
- **Impacts Assessment**
- **Trade-off Analysis**
- **Key Findings**

# San Diego Basin Study Objectives

1. Determine how climate change will impact the water supply system
2. Develop structural and non-structural adaptation strategies to manage climate change impacts



# San Diego Basin Study Overview

- Project time frame April 2015 – September 2019
- Total project cost \$2.1 million
  - \$1 M Bureau of Reclamation
  - \$759,460 SD IRWM Program Prop 50
  - \$300,000 City of San Diego
- Project managed by the Bureau of Reclamation and City of San Diego



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# San Diego Basin Study Participants

- **Project Management**
  - Reclamation Southern California Area Office
  - City of San Diego
- **Technical Team**
  - Reclamation Lower Colorado Region Engineering Services Office
  - Reclamation Denver Technical Services Center
  - Reclamation Mid-Pacific Region Planning Group
  - City of San Diego
  - San Diego County Water Authority
  - CH2M/Jacobs
- **Study Technical Advisory Committee (STAC)**
- **Public Stakeholders**
  - IRWM RAC
  - IRWM Stakeholder List

# San Diego Basin Study Tasks & Status

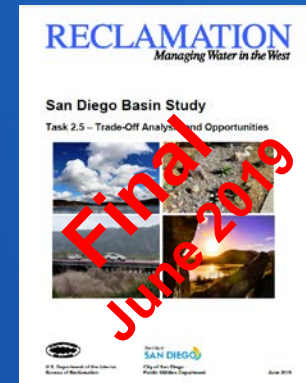
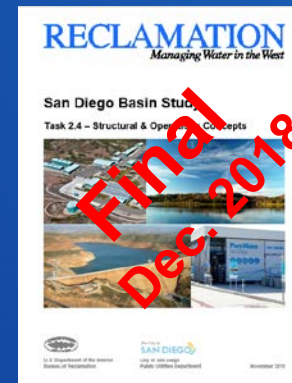
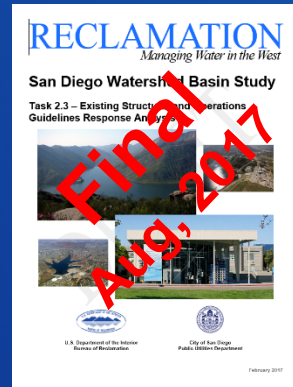
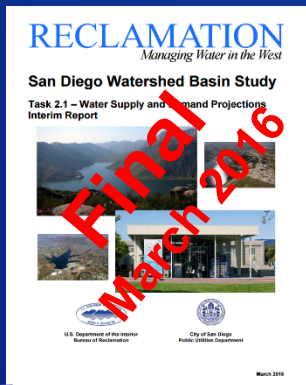
Water Supply and Water Demand Projections (Task 2.1)

Downscaled Climate Change and Hydrologic Modeling (Task 2.2)

Existing Structural Response and Operations Guidelines Analysis (Task 2.3)

Structural and Operations Concepts (Task 2.4)

Trade-Off Analysis and Opportunities (Task 2.5)



**Final Report and Executive Summary Report (Task 2.6)**  
**Complete Report & Submit for Approval**  
**August 2019**

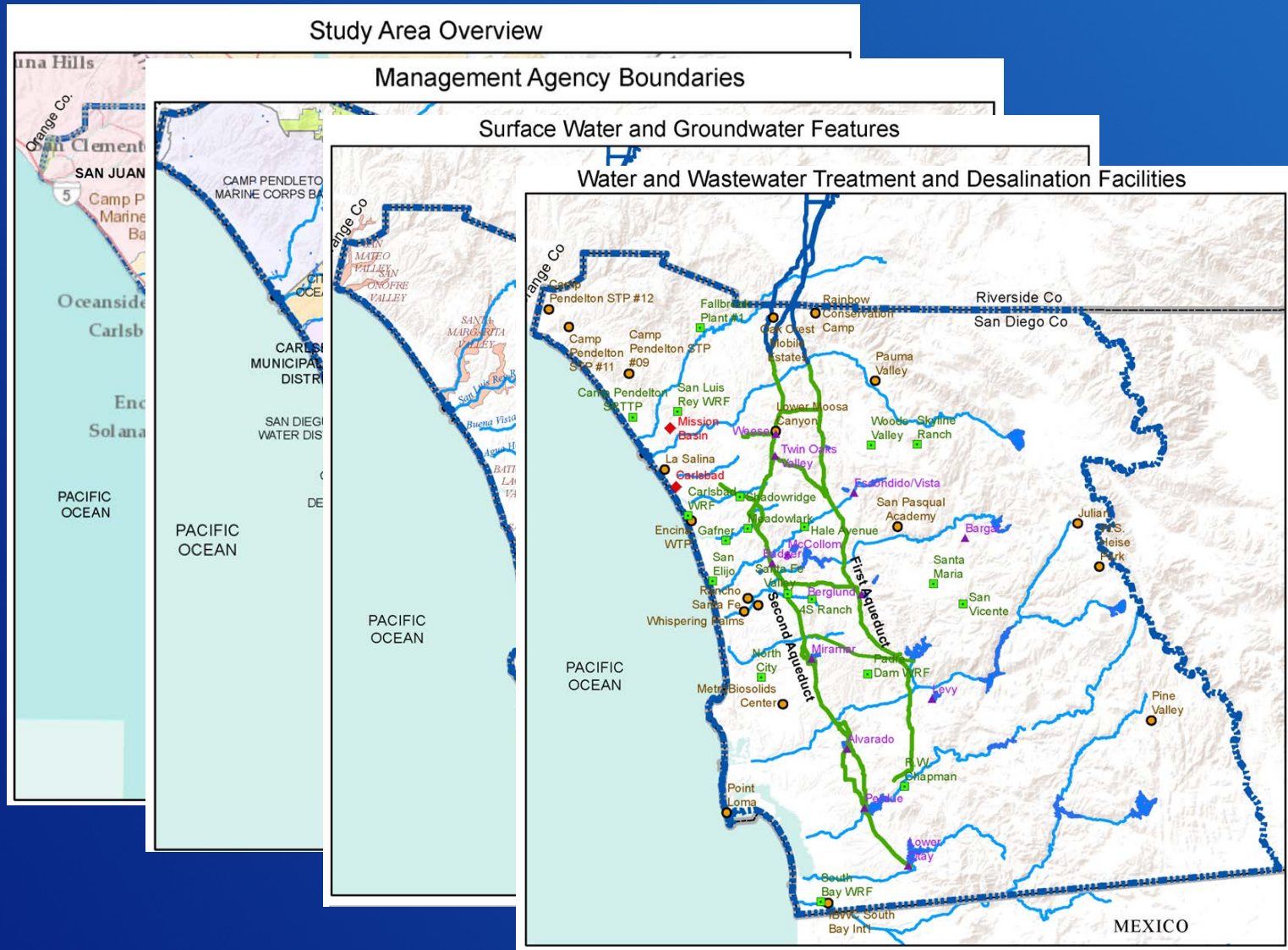
Final reports can be found at:  
<https://www.usbr.gov/lc/socal/basinstudies/SDBasin.html>

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# Planning for the Future

- **Basin Study Motivation: Complexities + Demands + Climate Change**
- **Do Nothing (Baseline) → Negative Consequences**
  - Increased water shortages
- **Do Something → Reduced Impacts**
  - Questions/Constraints
    - Cost
    - Complexity of implementation
    - Effects on environment, community
    - Effects on other aspects of water system (flooding, recreation, energy)
- **Basin Study Findings**
  - Strengths and weaknesses of various approaches
  - Diverse supply options can put the region on a positive path to the future

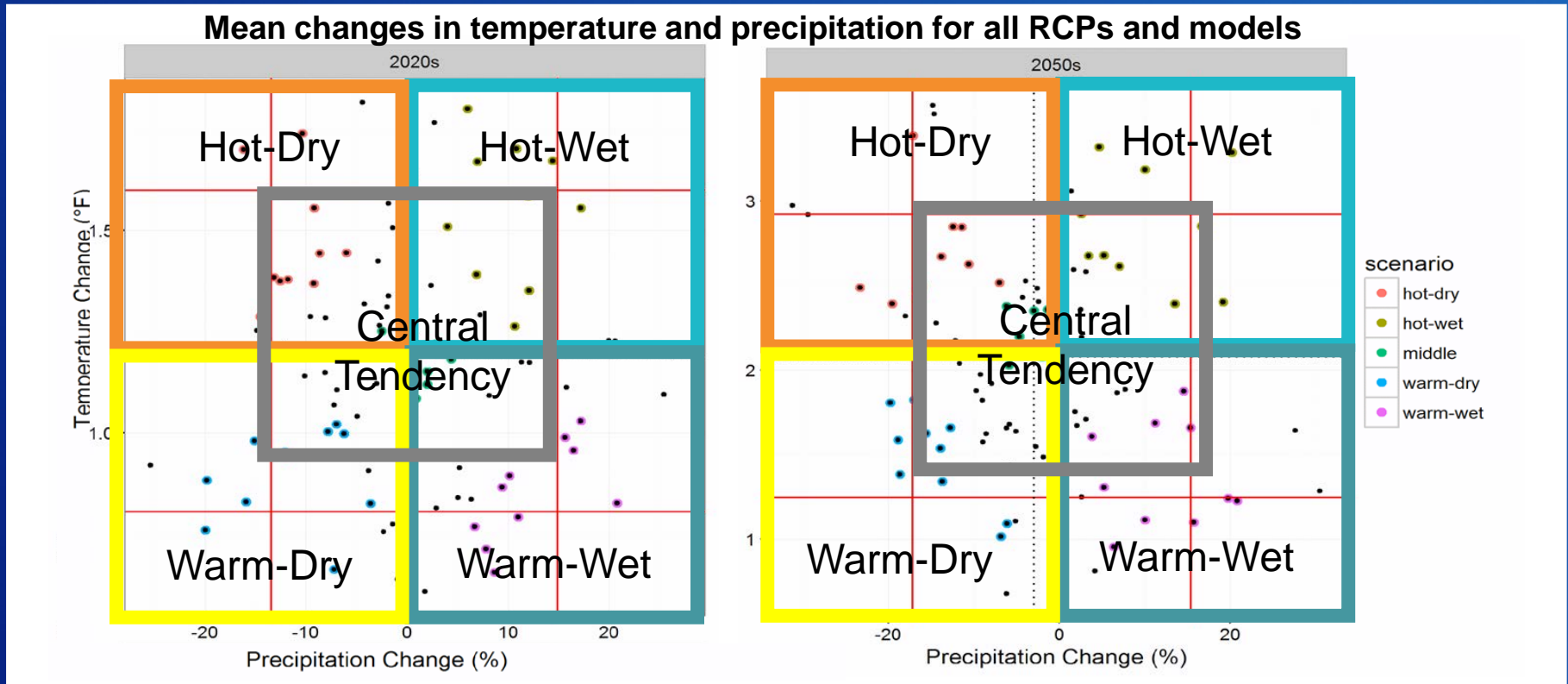
# Study Area: Many Complexities



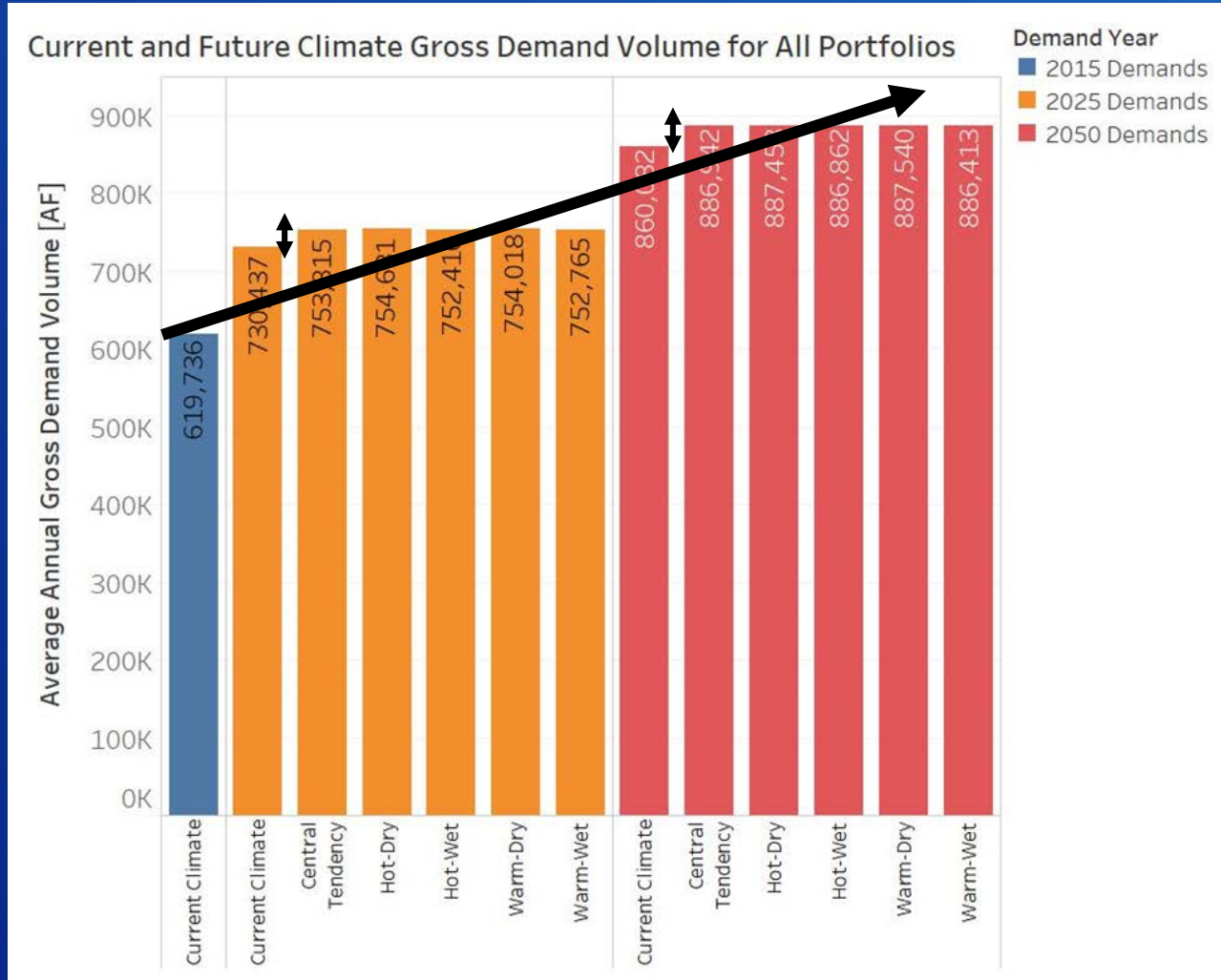


# Climate Change

	2020s		2050s	
	RCP 4.5	RCP 8.5	RCP 4.5	RCP 8.5
Median Temp.	+1.5°F to +1.8°F	+1.8°F to +1.9°F	+3°F to +3.4°F	+4.2°F to +4.5°F
Median Precip.	+ 2% to +8%	+ 1% to +8 %	0% to +10%	0% to +12%



# Water Demands

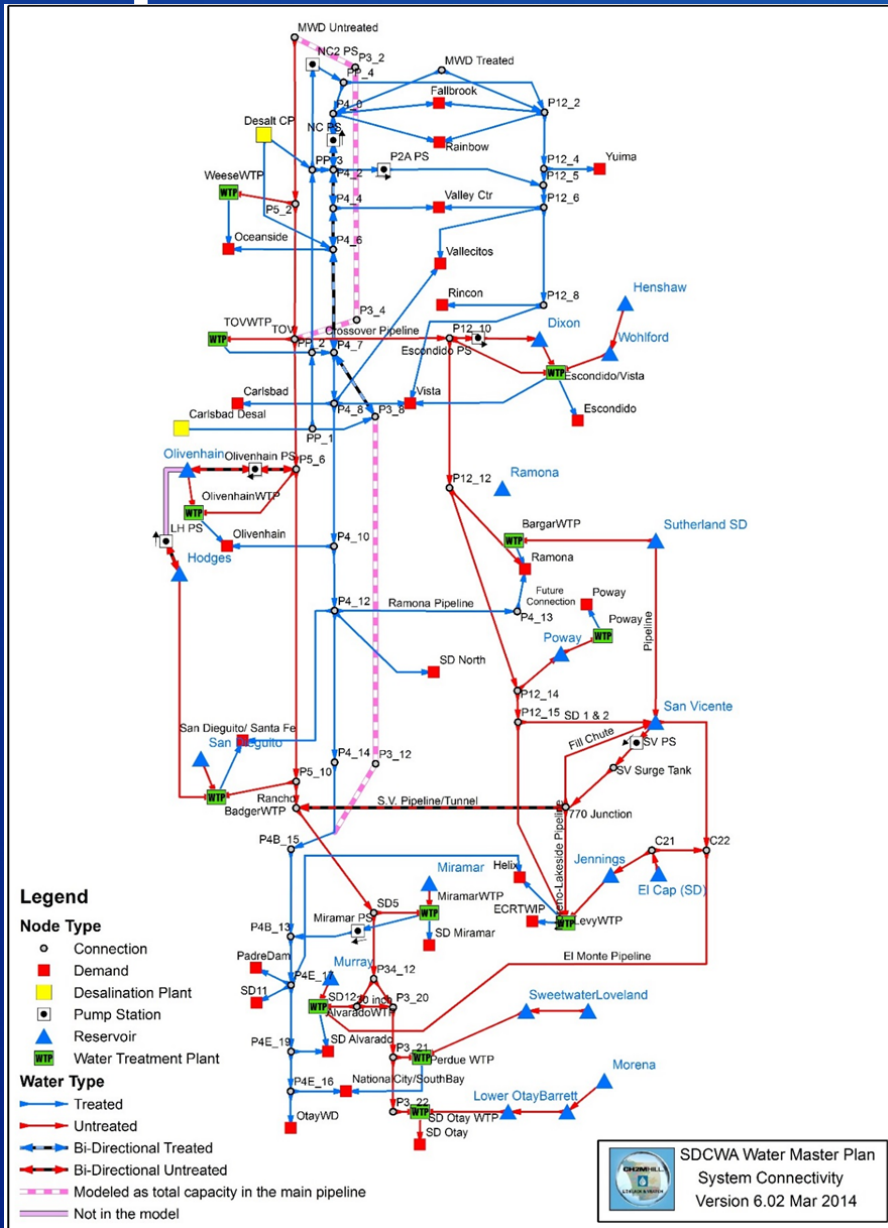


# Concepts for Water Supply/ Water Management

- **Conveyance Improvement**
- **Drought Restriction/Allocation\***
- **Enhanced Conservation**
- **Firm Water Supply Agreements\***
- **Gray Water Use**
- **Groundwater**
- **Imported Water Purchases**
- **Local Surface Water Reservoirs\***
- **Potable Reuse**
- **Recycled Water**
- **Seawater Desalination**
- **Stormwater BMPs**
- **Stormwater Capture**
- **Urban and Agricultural Water Use Efficiency**
- **Watershed and Ecosystem Management**

# Impacts Assessment Process

1. Simulate system operations with varying:
  - a) Demand and Climate scenarios
  - b) Portfolios of Water Supplies/Water Management Strategies
2. Compare metrics across Scenarios and Portfolios



# SDBS Demand and Climate Scenarios

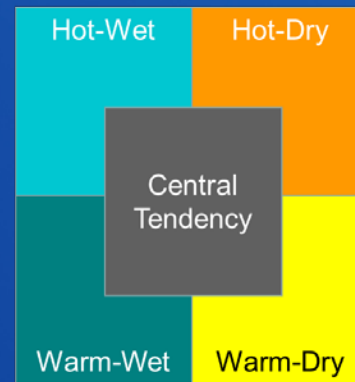
**2015  
Demands**

+



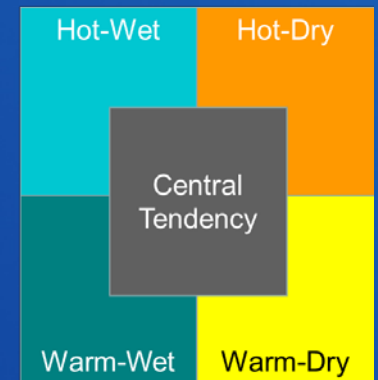
**2025  
Demands**

+



**2050  
Demands**

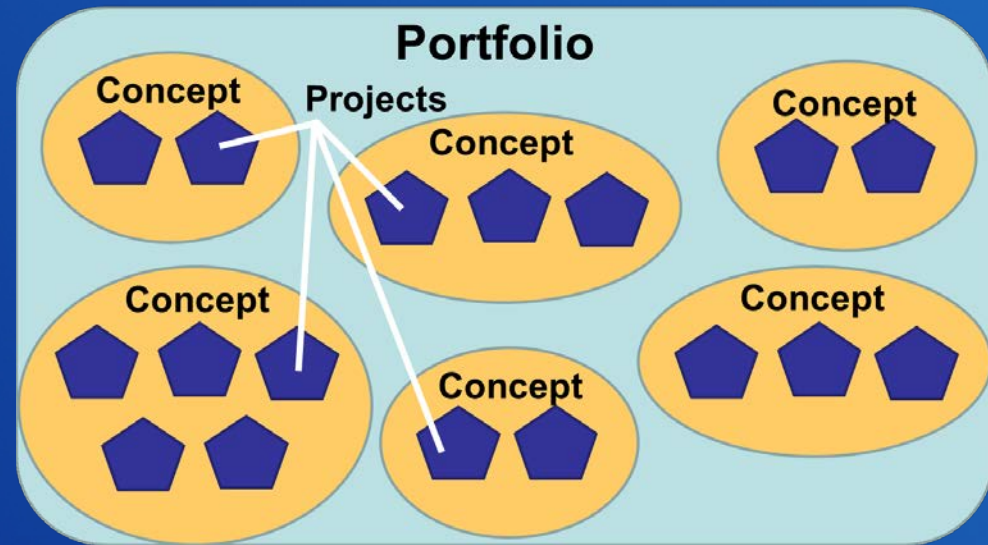
+



# Impacts Assessment Portfolios

## Portfolios

- **Baseline (B)**
- **Baseline Plus (B+)**
- **Increase Supplies (IS)**
- **Enhanced Conservation (EC)**
- **Optimize Existing Facilities (OEF)**
- **Watershed Health and Ecosystem Restoration (WE)**



# Impacts Assessment Metrics

Flood Control



Energy



Recreation



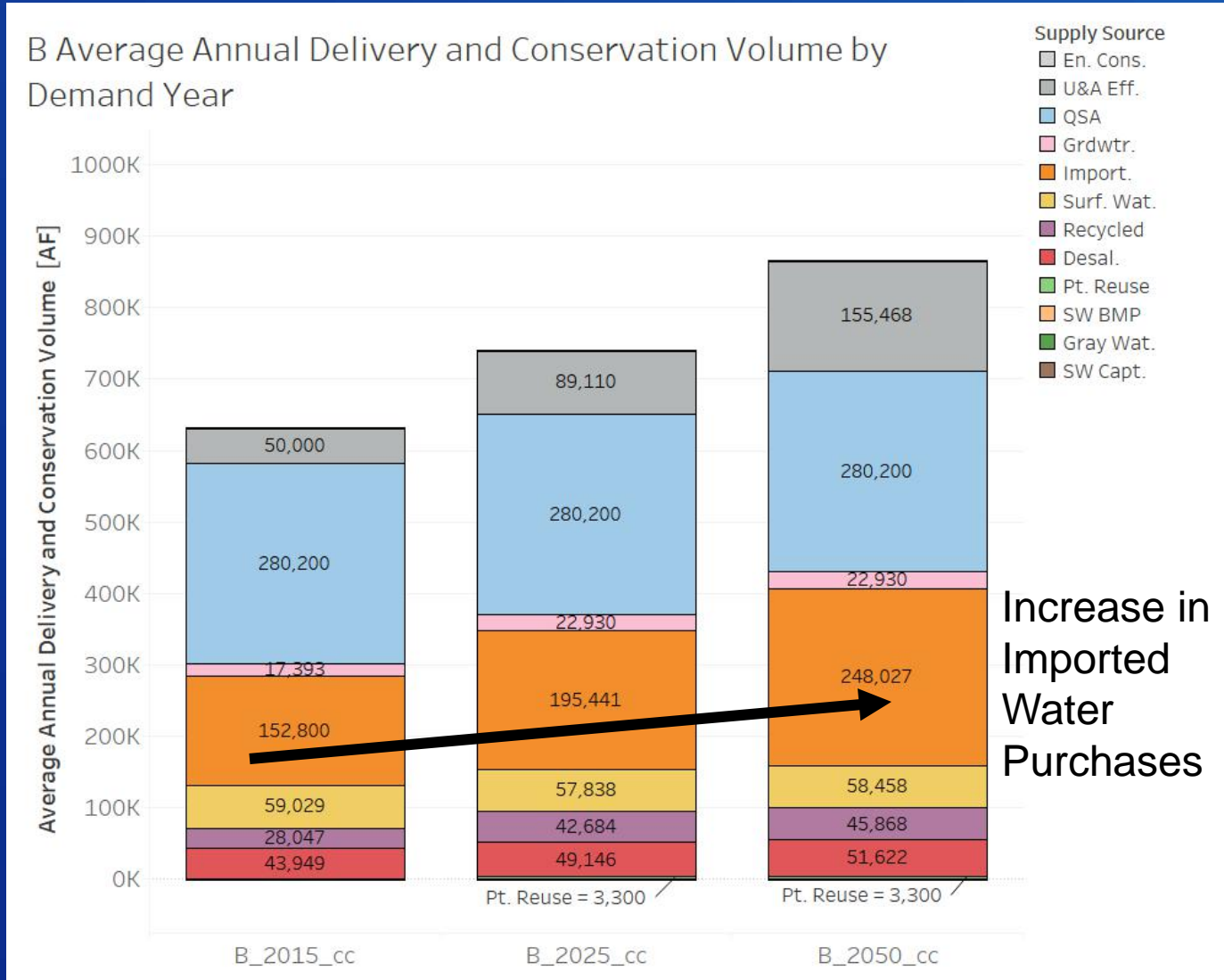
Water Delivery



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# Impacts Assessment Key Findings – Water Delivery

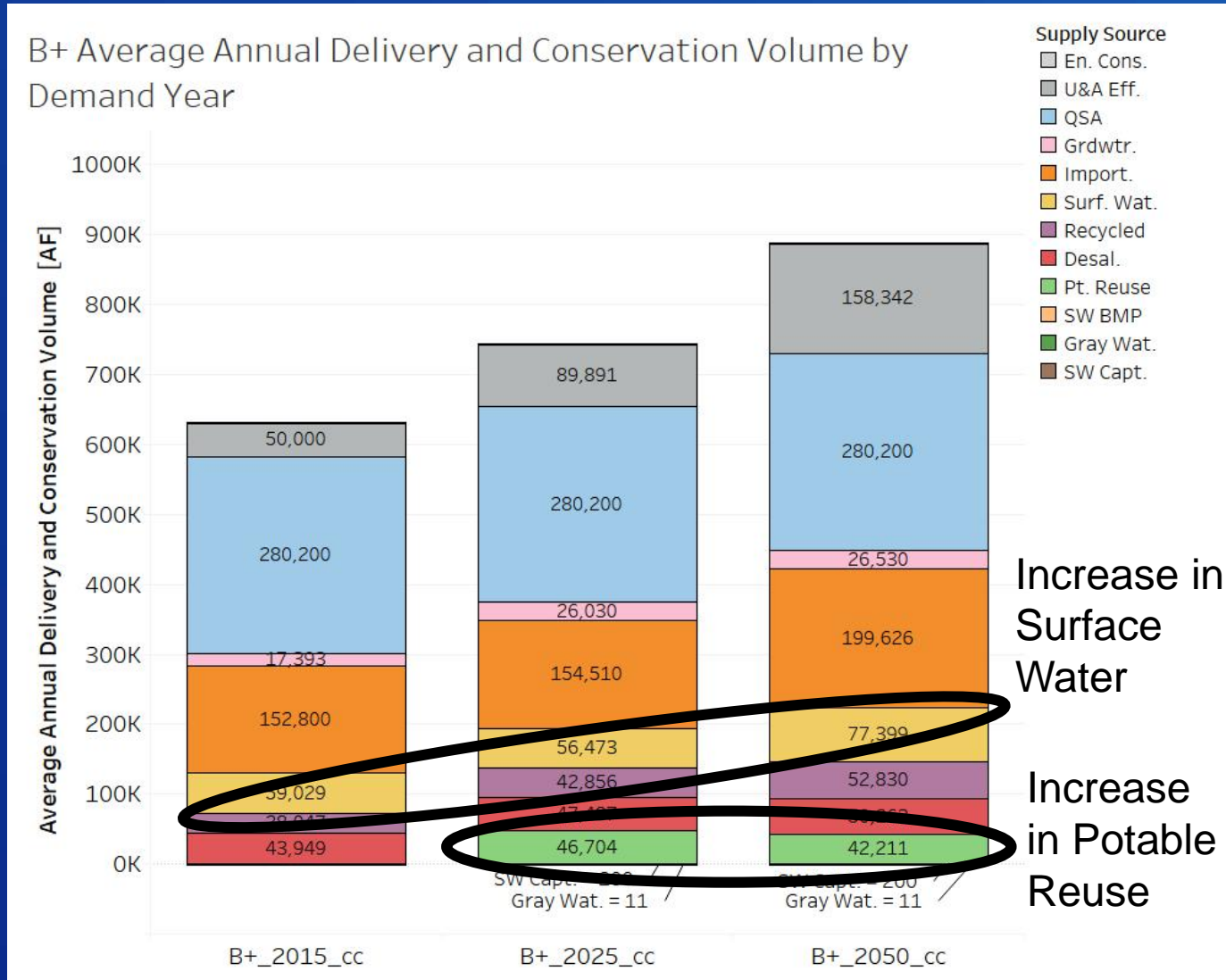
Sources of additional water deliveries to meet increasing demands vary by Portfolio. **Baseline: Increase in Imported Water Purchases**





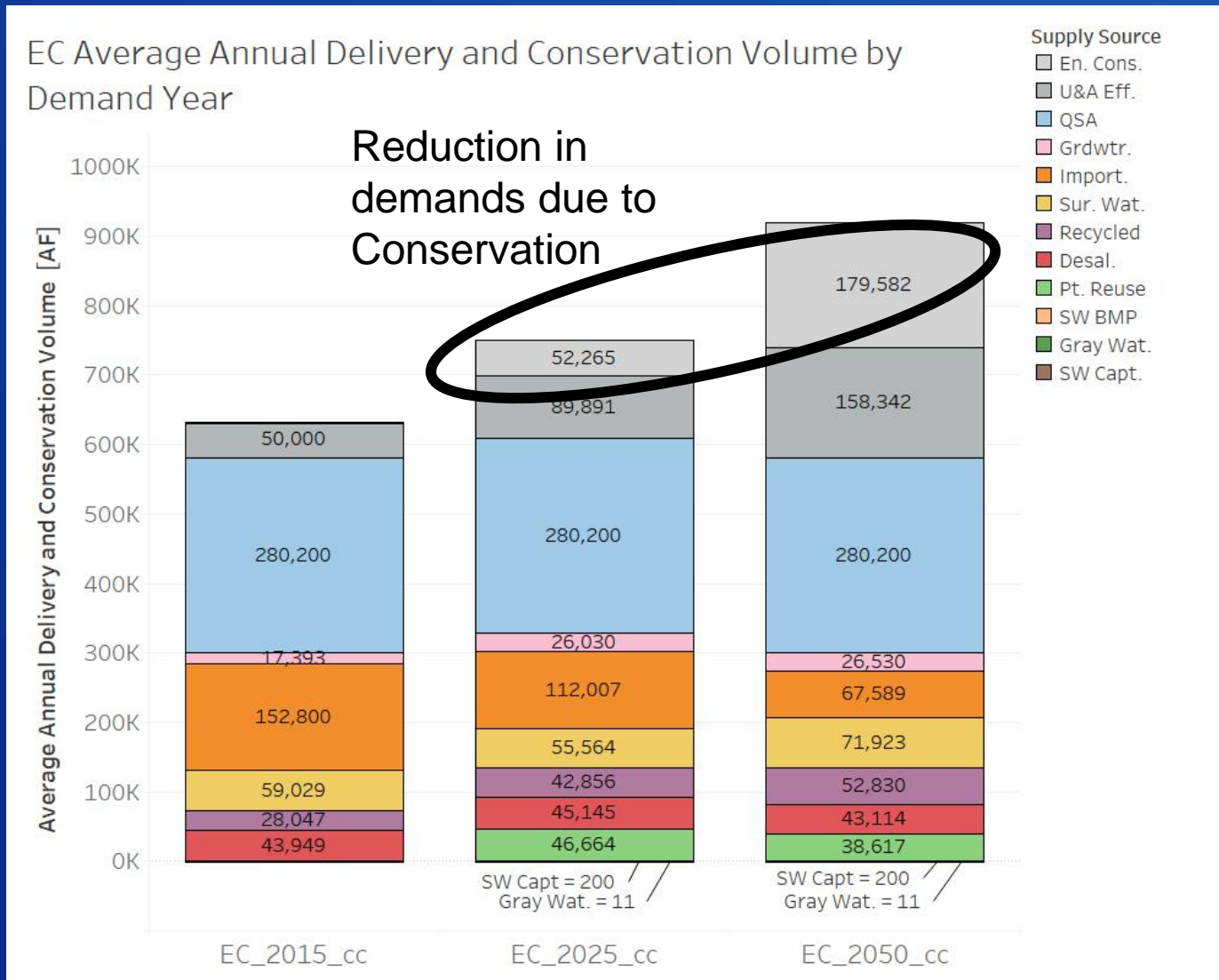
# Impacts Assessment Key Findings – Water Delivery

**Sources of additional water deliveries to meet increasing demands vary by Portfolio. Baseline+: Increase in Surface Water and Potable Reuse**



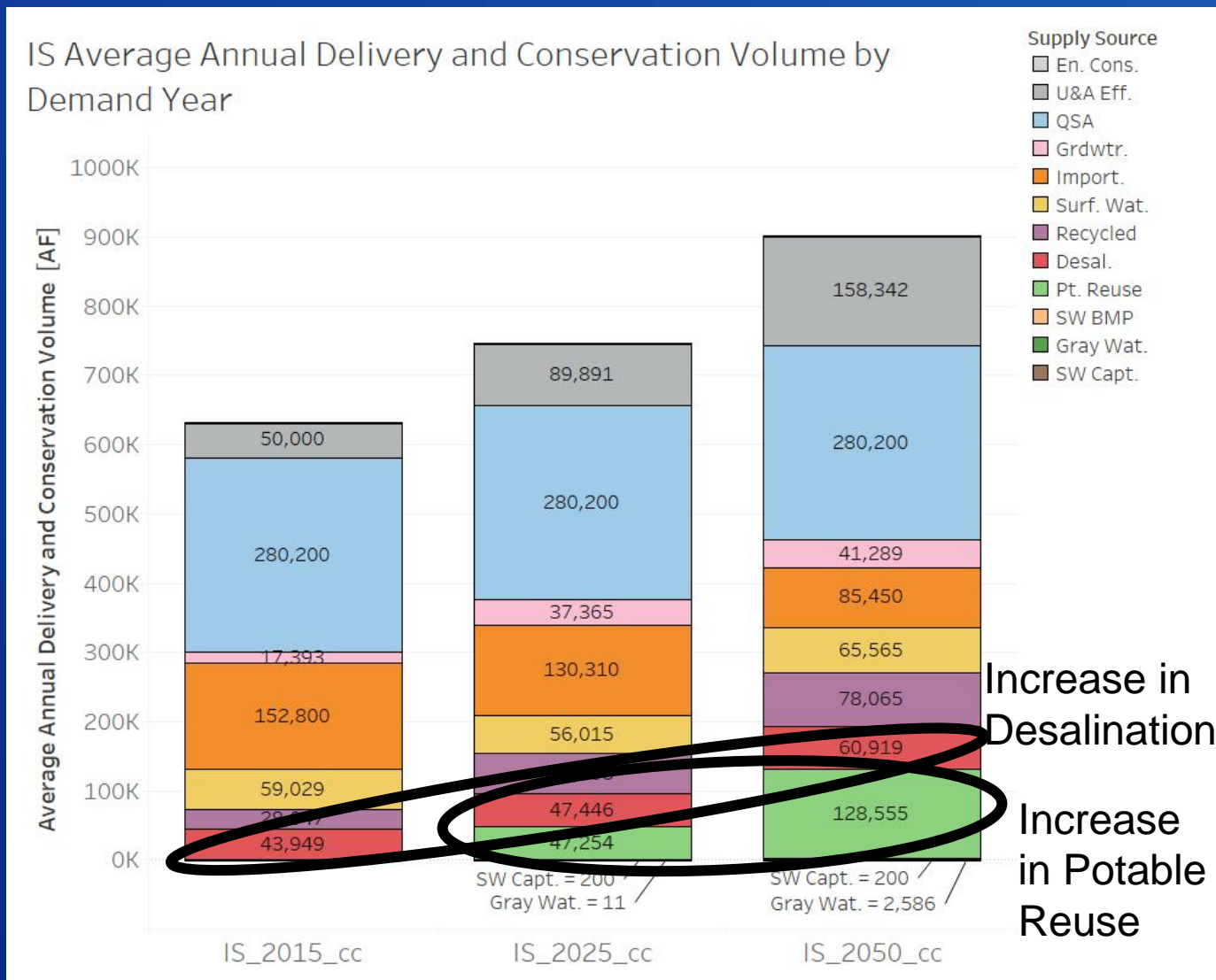
# Impacts Assessment Key Findings – Water Delivery

Sources of additional water deliveries to meet increasing demands vary by Portfolio. EC: Demand reduction by conservation



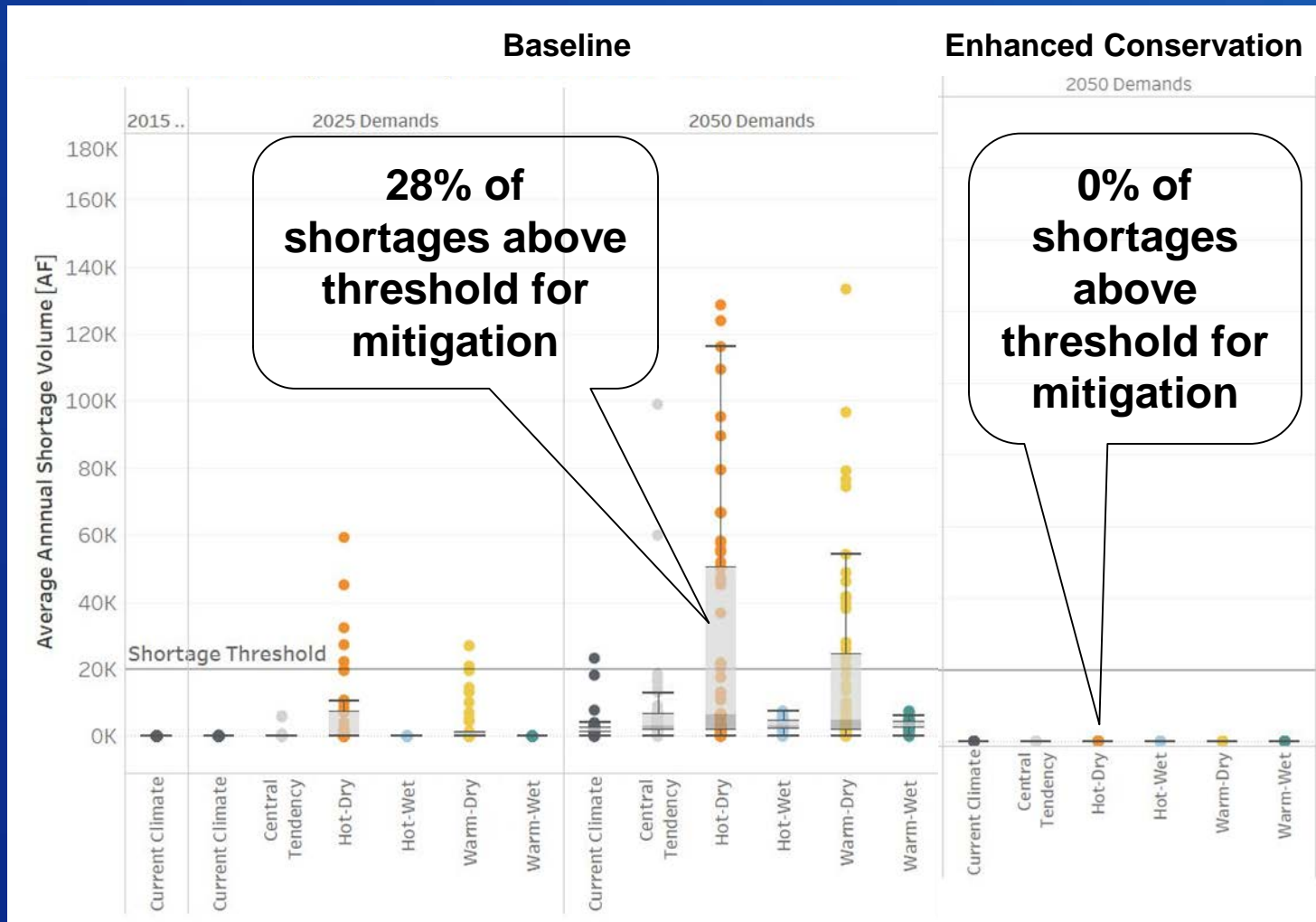
# Impacts Assessment Key Findings – Water Delivery

Sources of additional water deliveries to meet increasing demands vary by Portfolio IS Deliveries: Increase in Potable Reuse & Desalination



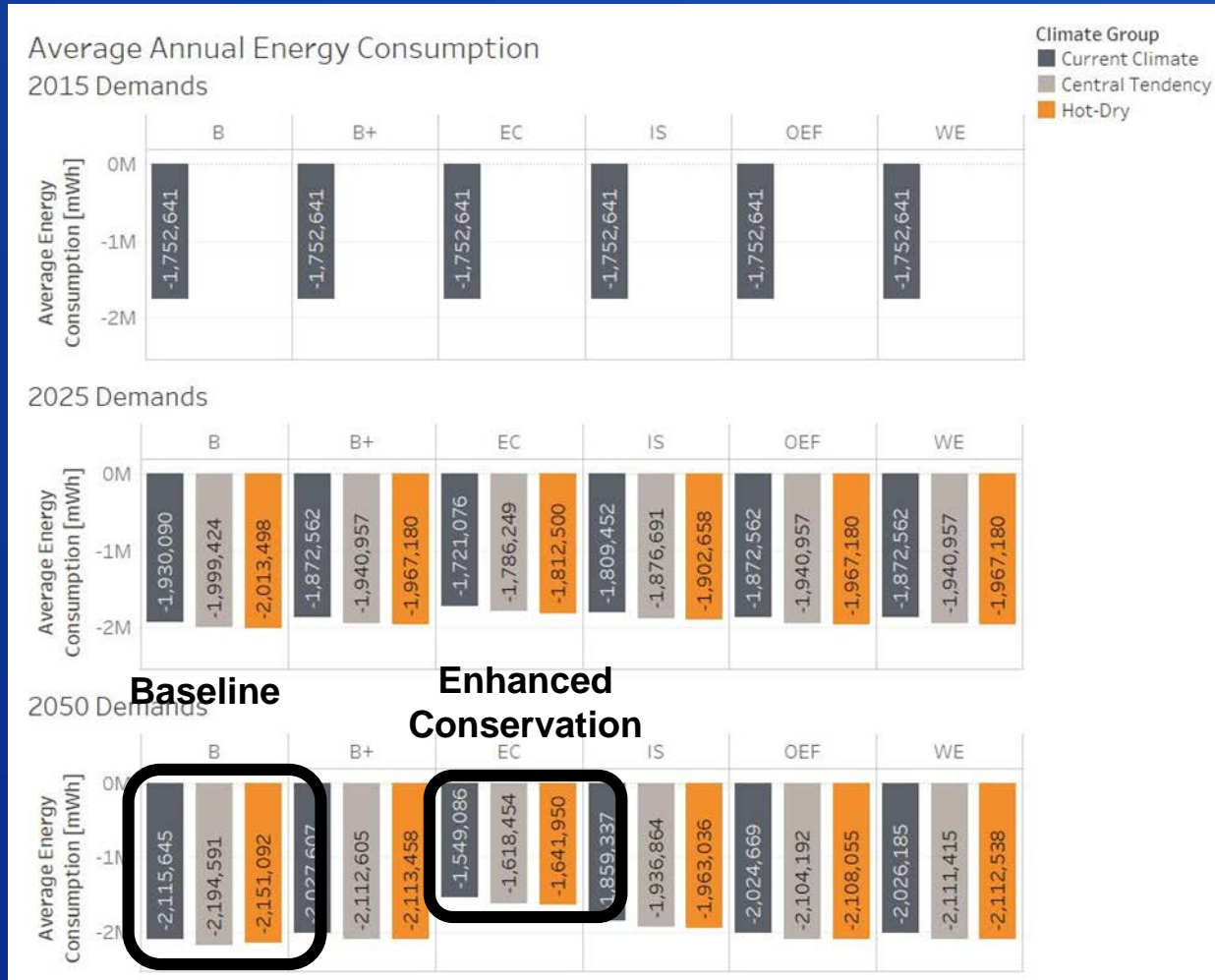
# Impacts Assessment Key Findings – Water Delivery

- Shortages occurred in all Portfolios for some scenarios
- Largest shortages in B, Smallest in EC
- No shortages above shortage threshold in EC or IS



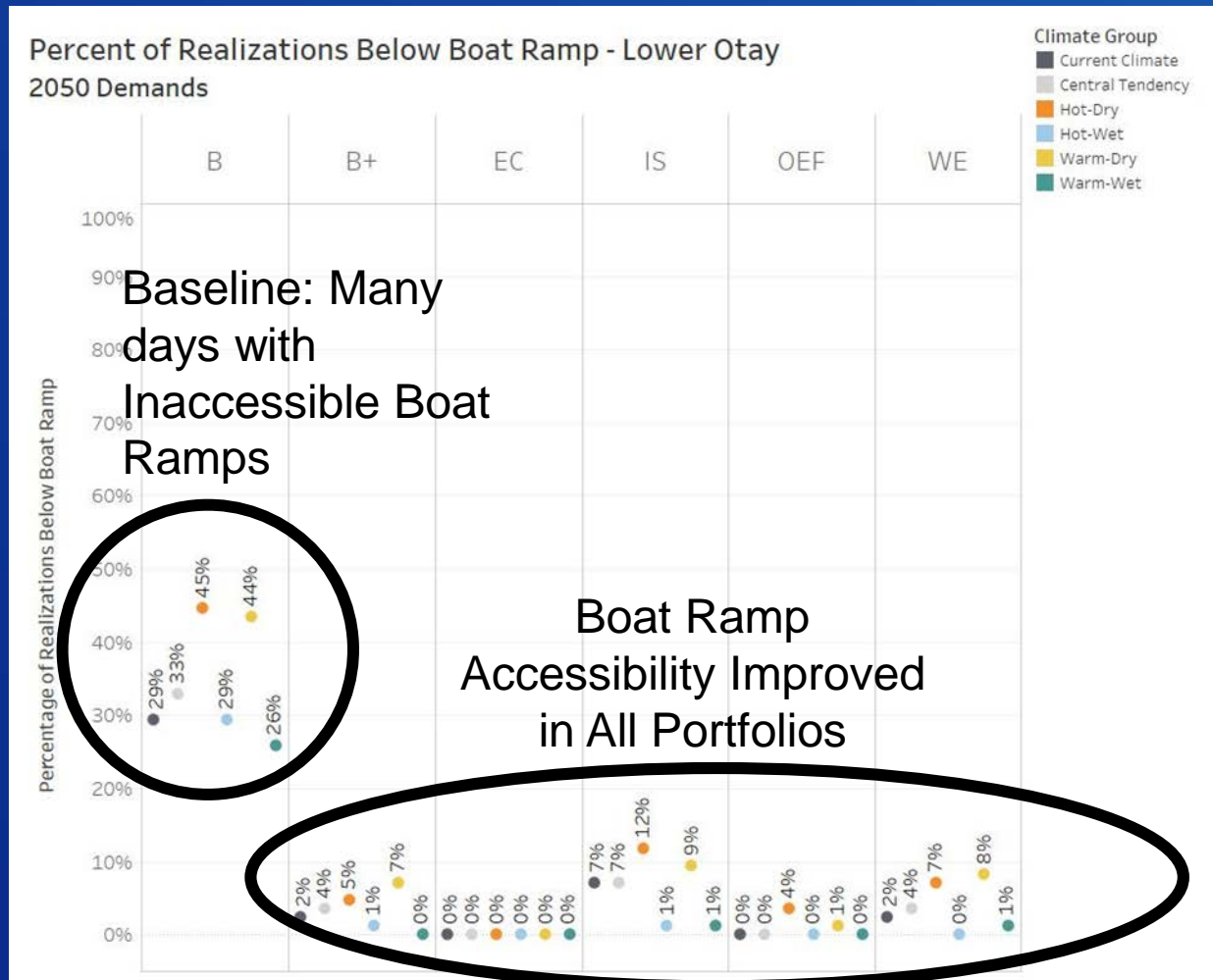
# Impacts Assessment Key Findings – Energy

## Highest consumption in B, lowest in EC



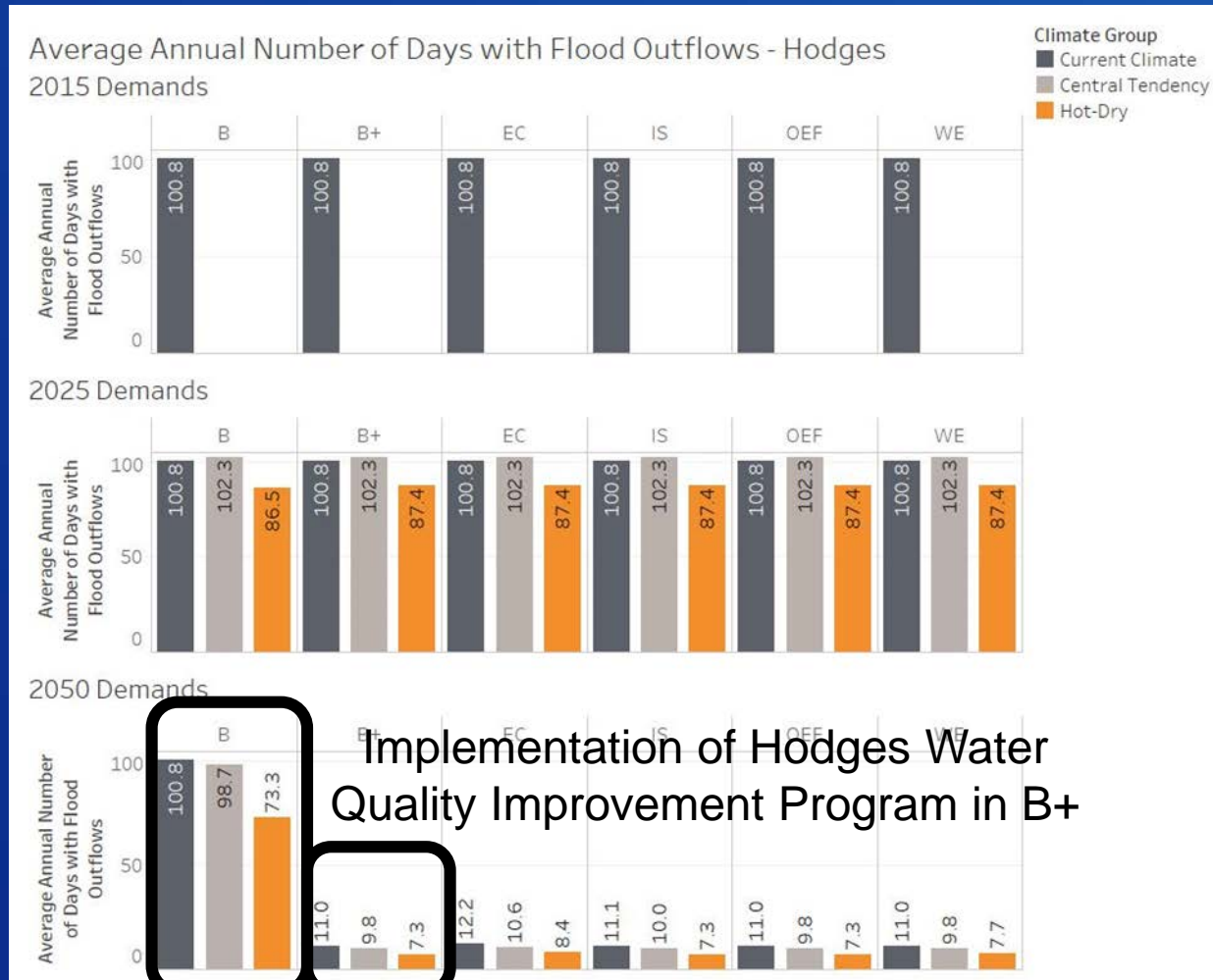
# Impacts Assessment Key Findings – Recreation

- Boat ramps generally available at Hodges and San Vicente
- Boat ramps frequently inaccessible at El Capitan, except in OEF
- Boat ramp accessibility improved at Lower Otay for all Portfolios beyond B



# Impacts Assessment Key Findings – Flood Control

- No flooding at San Vicente or Olivenhain
- More days with flood outflows at El Capitan for IS
- Days with flood outflows decreased at Hodges in B+ and beyond



# Trade-Off Analysis: Comparing Concepts

## The Challenge:

- Each Concept has a variety of benefits and costs
- Benefits and costs may be
  - direct and/or indirect
  - inside and/or outside the project area
  - quantifiable and can be monetized
- OR
- quantifiable but cannot be monetized
- OR
- unquantifiable and cannot be monetized.

**The Need:** A framework for comparing benefits and costs on a “level playing field”

**The Solution:** Trade-Off Analysis - provides a framework for comparing the effects of Concepts across different types of benefits and costs

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# Trade-Off Analysis Steps

1. Identify Evaluation Objectives
2. Determine the Relative Importance of Evaluation Objectives
3. Place Values on Evaluation Objectives using Performance Measures
4. Evaluate and Combine Evaluation Objective Scores for Each Concept

# Step 1: Identify Evaluation Objectives

- **Address Climate Change Through Greenhouse Gas Reduction**
- **Climate Resilience**
- **Cost Effectiveness**
- **Environmental Justice**
- **Optimize Local Supplies/Independence**
- **Project Complexity**
- **Protect Habitats, Wildlife, and Ecosystem Services**
- **Provide for Scalability of Implementation**
- **Provide Reliability and Robustness**
- **Quality of Life/Recreation**
- **Regional Economic Impact**
- **Regional Integration and Coordination**
- **Water Quality and Watersheds**

# Step 2: Relative Importance of Evaluation Objectives - Survey

San Diego Basin Study: Task 2.5– Tradeoff Analysis



## Optimize Local Supplies/Independence:

Adaptation Concepts that improve or support the region's ability to use local water supplies and/or reduce the reliance on imported water.

1  2  3  4  5  6  7  8  9  10

## Cost Effectiveness:

Adaptation Concepts that reduce the total present value capital, operation and maintenance costs to the region and/or have a strong potential for external funding.

1  2  3  4  5  6  7  8  9  10

## Regional Integration and Coordination:

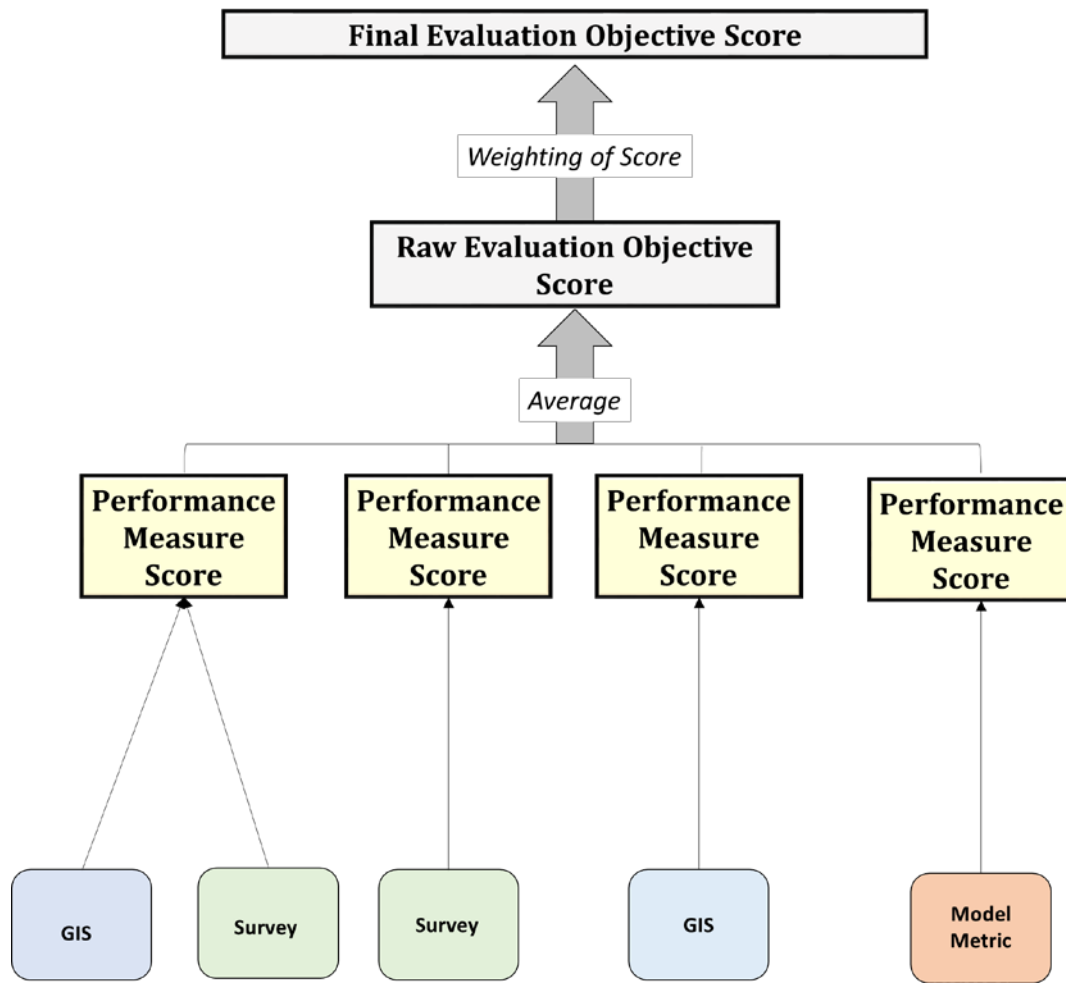
Adaptation Concepts that support community engagement, education, and coordination with regional partners to leverage existing assets and projects, reduce project barriers, and/or build community support and knowledge of water issues.

1  2  3  4  5  6  7  8  9  10

# Step 2: Relative Importance of Evaluation Objectives – Survey Results

<b>Evaluation Objective</b>	<b>Importance Weight</b>	<b>Rank</b>
<b>Water Quality and Watersheds</b>	10.0	1
<b>Reliability and Robustness</b>	10.0	1
<b>Climate Resilience</b>	9.6	3
<b>Optimize Local Supplies</b>	9.4	4
<b>Protect Habitats, Wildlife, and Ecosystems</b>	9.2	5
<b>Environmental Justice</b>	8.7	6
<b>Regional Integration and Coordination</b>	8.5	7
<b>Cost Effectiveness</b>	8.5	7
<b>Address Climate Change Through Greenhouse Gas Reduction</b>	8.2	9
<b>Regional Economic Impact</b>	7.8	10
<b>Provide for Scalability of Implementation</b>	7.7	11
<b>Quality of Life/Recreation</b>	7.4	12
<b>Project Complexity</b>	7.3	13

# Step 3: Place Values on Evaluation Objectives using Performance Measures

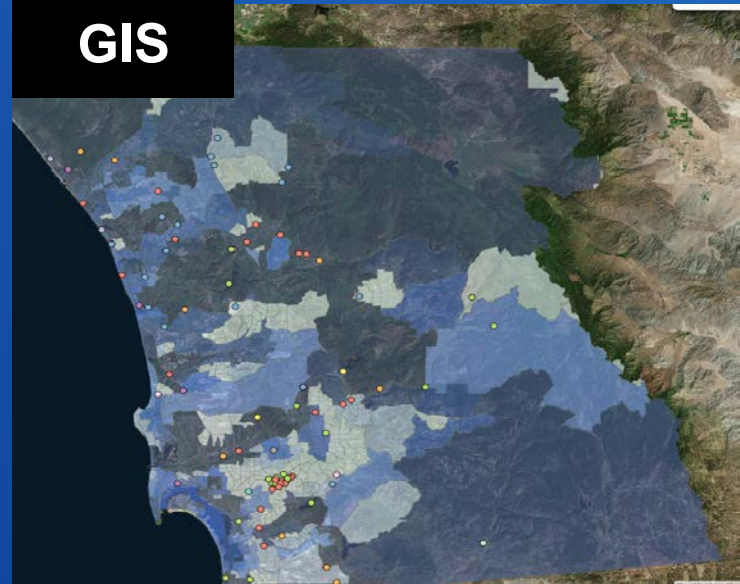


# Data for Calculating Performance Measures

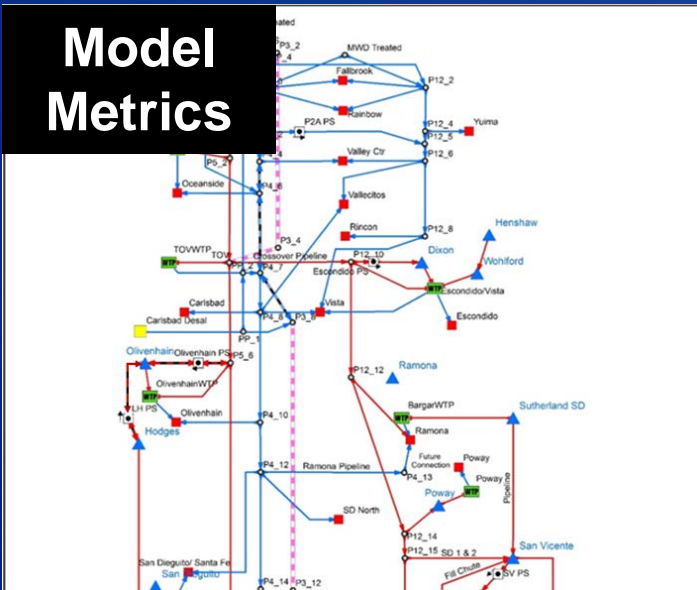
## Concept-Level Surveys

		Moderate education and outreach Significant education and outreach					
		al, how does the Adaptation Concept lend itself to project and expansions? Extreme difficulty to scale back, phase, or expand. Moderate difficulty to expand or phase the project. No or unknown difficulty to expand or phase the project. Project easily modified to accommodate a subsequent phase or expansion. Project currently planned and designed to accommodate a subsequent phase or expansion.	[SELECT ANSWER FROM DROPODOWN]	[SELECT ANSWER FROM DROPODOWN]	[SELECT ANSWER FROM DROPODOWN]	[SELECT ANSWER FROM DROPODOWN]	[SELECT ANSWER FROM DROPODOWN]
PROJECT COMPLEXITY	Project Complexity and Feasibility	al, what is the feasibility and/or complexity of project implementation within this Adaptation Concept? (Consider the following: complexity and feasibility related to regulatory compliance, number of agencies/approvers involved, property ownership, public opinion/acceptance/practicality of implementation) a. Highly complex and infeasible. Significant expertise, experience and collaboration among multiple partners or collaborators required in order for these types of projects to be successfully implemented. Projects regularly experience delays and/or must be altered due to project complexity, logistics, and/or competing interests. b. Moderately complex. Project implementation and/or approval requires multiple agencies/organizations to collaborate. c. Unknown complexity and/or feasibility d. Moderately simple. Projects within this Adaptation Concept are likely to experience a limited number of barriers to implementation. Achieving regulatory compliance is a routine procedure and is achievable. If multiple partners are involved, there are existing agreements in place to facilitate project approval and implementation. e. Simple. Projects are easily and regularly implemented with few barriers. Regulatory compliance is easily acquired and achieved.	[SELECT ANSWER FROM DROPODOWN]	[SELECT ANSWER FROM DROPODOWN]	[SELECT ANSWER FROM DROPODOWN]	[SELECT ANSWER FROM DROPODOWN]	[SELECT ANSWER FROM DROPODOWN]
		To what extent does the Adaptation Concept increase green space or					

## GIS



## Model Metrics

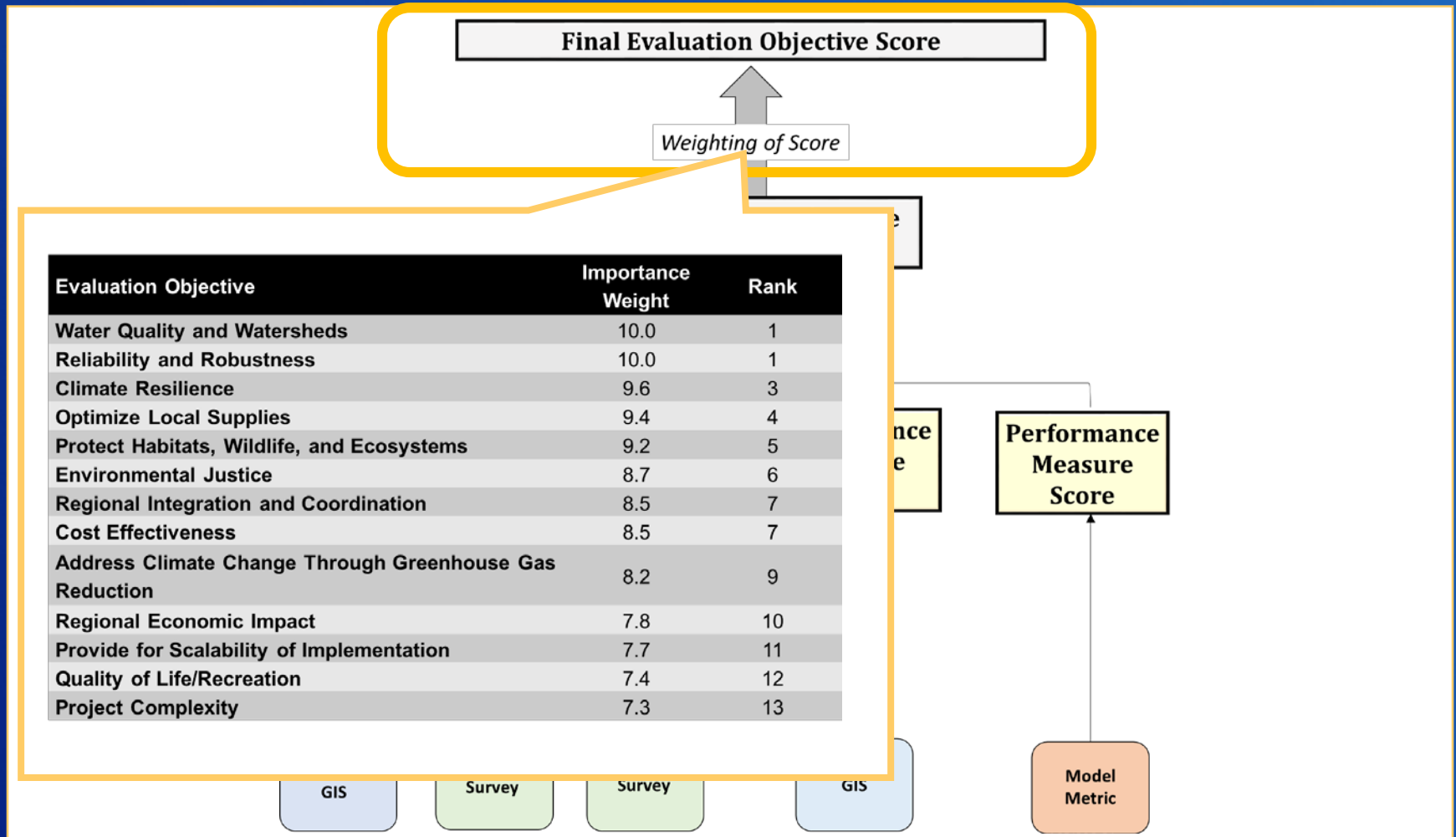


## Project-Level Surveys

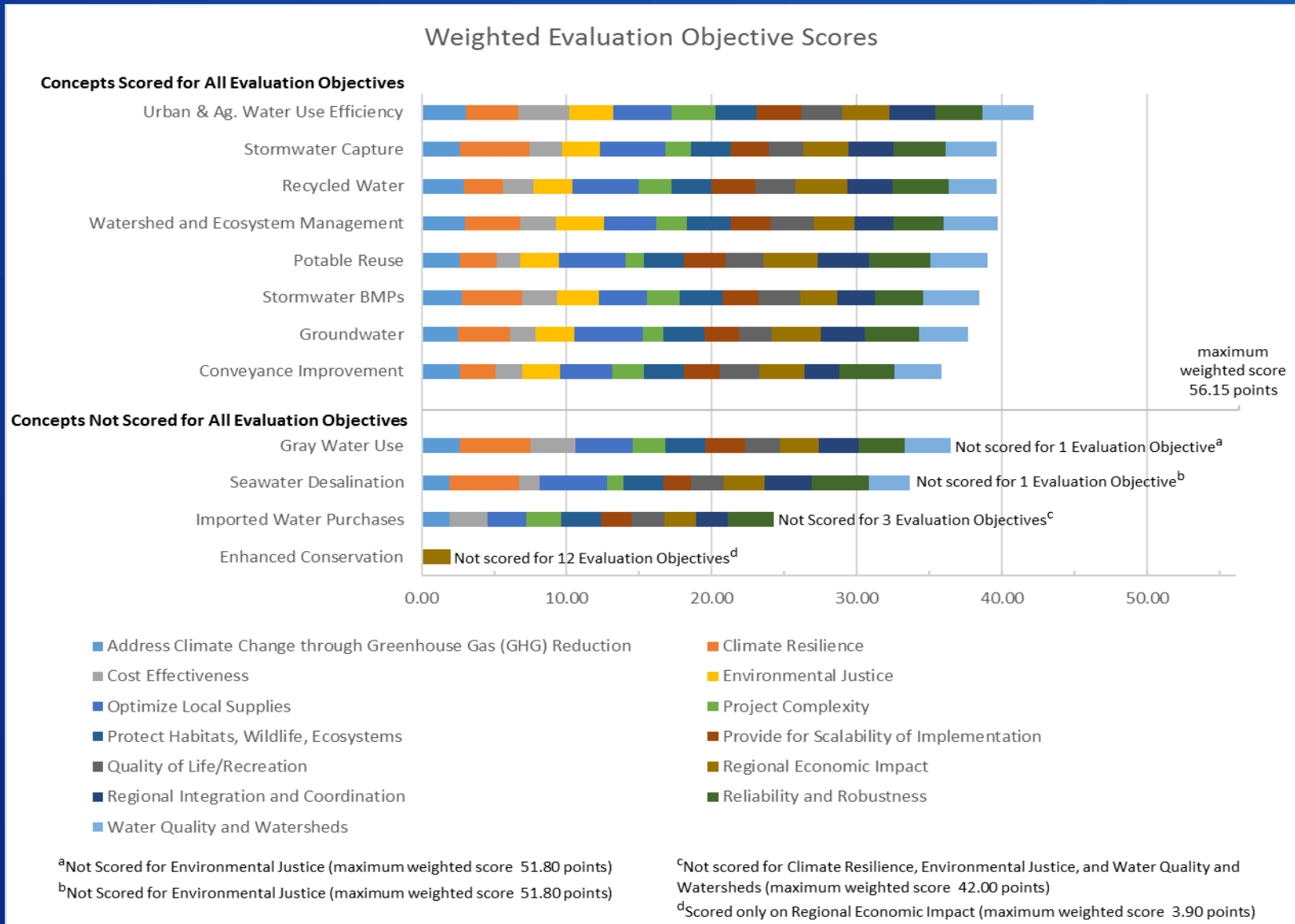
		Project Title:	Example Project 1
		Name:	John Smith
Member Agency Contact		Title:	Management Analyst
		Phone Number:	858-987-1234
		Email Address:	JSmith@agency.gov
Project Contact		Name:	Jane Johnson
		Title:	Utilities Administrator
		Phone Number:	858-987-5678
		Email Address:	JJohnson@agency.gov
		Does this project increase the diversity of water supply?	
		a. No, this project increases reliance on imported water (either directly or indirectly)	[SELECT ANSWER FROM DROPODOWN]
		b. N/A	
		c. No or unknown effect on diversity of supplies	
		d. Not necessarily, though the project indirectly supports other systems/project infrastructure that may have an impact on the diversity of water supplies	
		e. Yes, this project increases diversity of supplies	
		Does the project increase the resilience of the conveyance system (e.g., ability to withstand or recover from impacts, pipeline failures, etc.)?	
		a. No, the project reduces resilience of conveyance system	[SELECT ANSWER FROM DROPODOWN]
		b. N/A	
		c. Neutral or unknown impact on the resilience of the conveyance system	
		d. Not necessarily, though the project indirectly supports other systems/project infrastructure that may have an impact on the resilience of the conveyance system	
		e. Yes, the project increases resilience	
PROVIDE RELIABILITY AND ROBUSTNESS	Vulnerability of Water Supply Facilities and Infrastructure	How does the project impact aging infrastructure? (Consider structural integrity, safety, maintenance, etc.)	
		a. Project has a significant negative impact on infrastructure	[SELECT ANSWER FROM DROPODOWN]
		b. Project has a moderate negative impact on infrastructure	
		c. Neutral or unknown impact	
		d. Project has a significant positive impact on infrastructure	

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# Step 4: Evaluate and Combine Evaluation Objective Scores for Each Concept

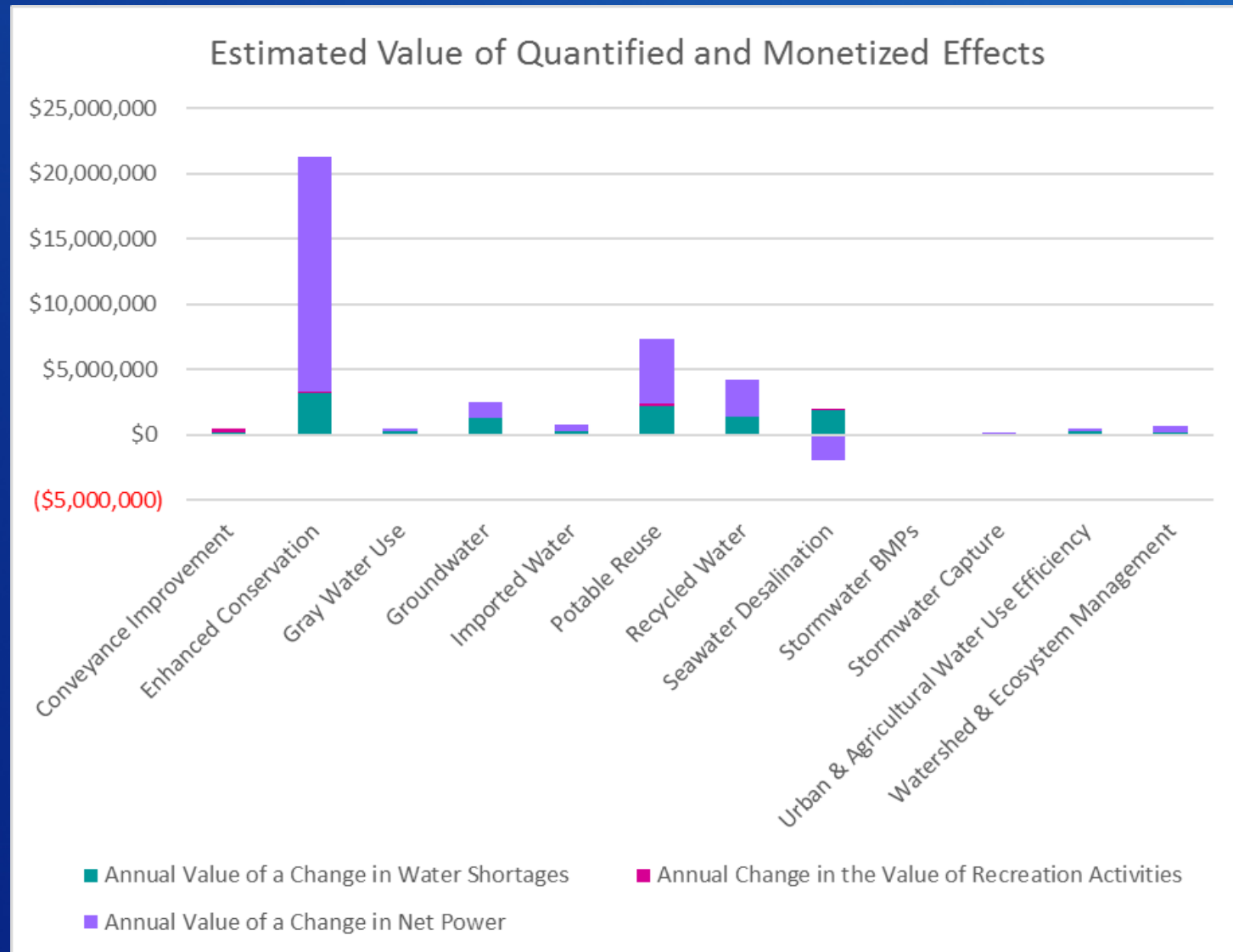


# Trade-off Analysis Results Using All Evaluation Objectives





# Economic Assessment



# Customized Trade-Off Analysis Tool

**Trade-off Analysis**

Customization Name

Customization Notes

Evaluation Objective Weights

Type of Weights:   
 Stepped Weight High   
 Stepped Weight Low

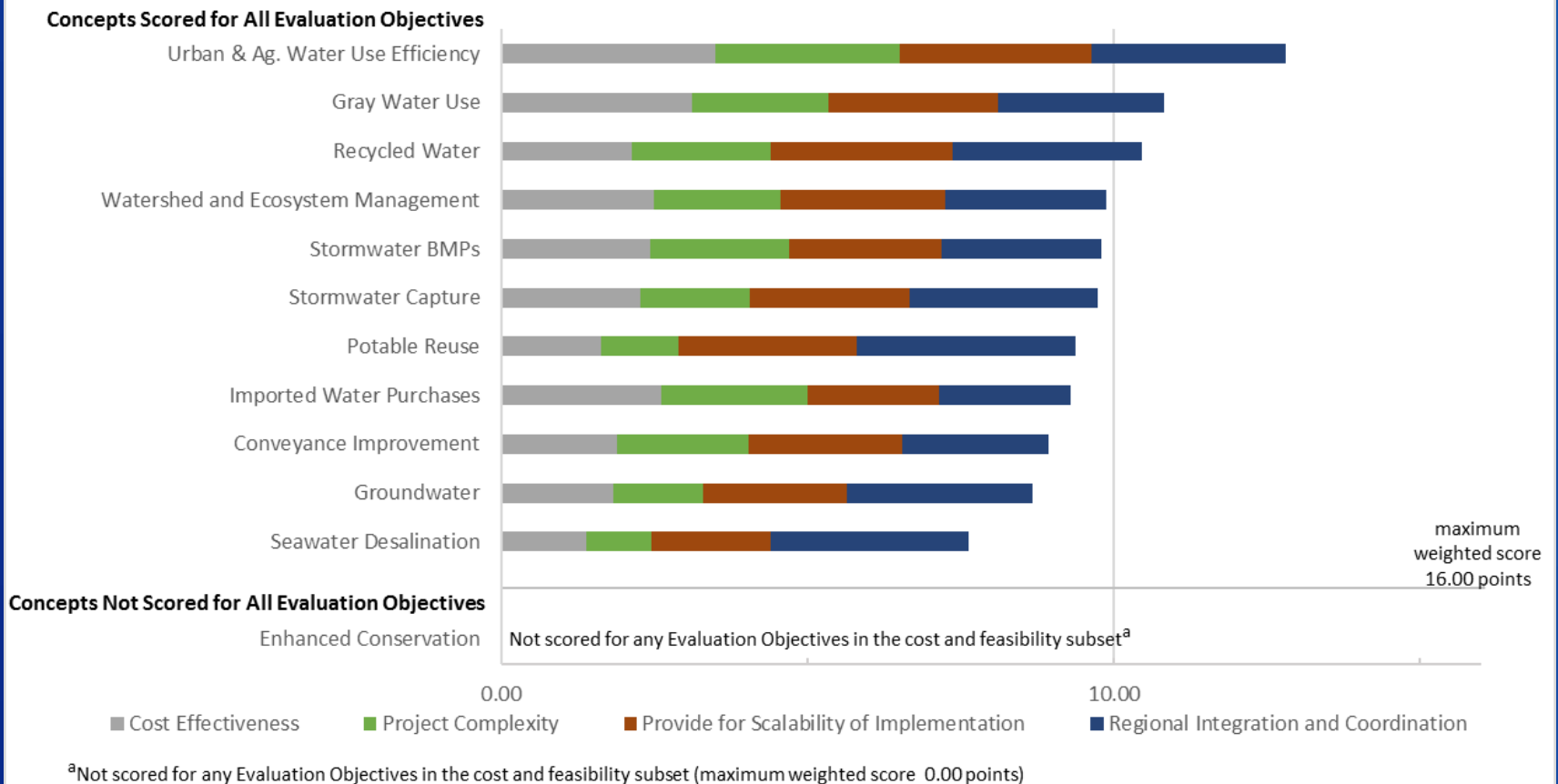
Evaluation Objective	Custom Weights	Stepped Rankings	Default (Values from SDBS Importance Weight Survey)	Weights Used in Trade off Analysis
Address Climate Change Through Greenhouse Gas Reduction	8.2	13	8.2	8.20
Climate Resilience	9.6	10	9.6	9.60
Cost Effectiveness	8.5	3	8.5	8.50
Environmental Justice	8.7	8	8.7	8.70
Optimize Local Supplies	9.4	2	9.4	9.40
Project Complexity	7.3	6	7.3	7.30
Protect Habitats, Wildlife, and Ecosystem Services	9.2	11	9.2	9.20
Provide for Scalability of Implementation	7.7	5	7.7	7.70
Quality of Life/Recreation	7.4	7	7.4	7.40
Regional Economic Impact	7.8	9	7.8	7.80
Regional Integration and Coordination	8.5	4	8.5	8.50
Reliability and Robustness	10.0	1	10.0	10.00
Water Quality and Watersheds	10.0	12	10.0	10.00

Evaluation Objectives to Use	Include in calculation?
Address Climate Change Through Greenhouse Gas Reduction	Yes
Climate Resilience	Yes
Cost Effectiveness	Yes
Environmental Justice	Yes
Optimize Local Supplies	Yes
Project Complexity	Yes
Protect Habitats, Wildlife, and Ecosystem Services	Yes
Provide for Scalability of Implementation	Yes
Quality of Life/Recreation	Yes
Regional Economic Impact	Yes
Regional Integration and Coordination	Yes
Reliability and Robustness	Yes
Water Quality and Watersheds	Yes

Concepts to Use	Include in calculation?
Conveyance Improvement	Yes
Enhanced Conservation	Yes
Gray Water Use	Yes
Groundwater	Yes
Imported Water Purchases	Yes
Potable Reuse	Yes
Recycled Water	Yes
Seawater Desalination	Yes
Stormwater BMPs	Yes
Stormwater Capture	Yes
Urban and Agricultural Water Use Efficiency	Yes
Watershed and Ecosystem Management	Yes

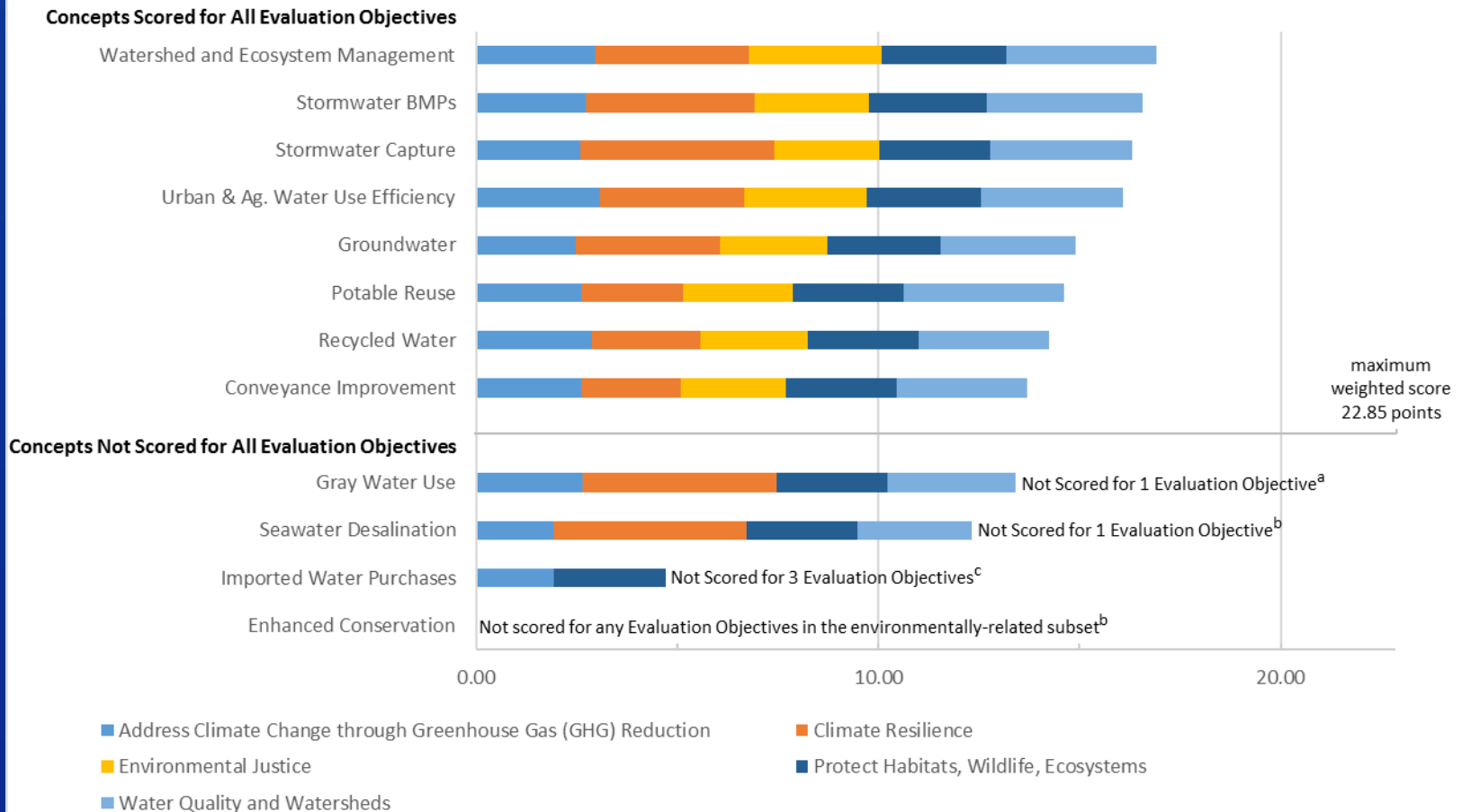
# Trade-Off Analysis for a Subset of Evaluation Objectives: Cost/Feasibility

Weighted Evaluation Objective Scores for the Trade-Off Analysis with Cost and Feasibility Evaluation Objectives



# Trade-Off Analysis for a Subset of Evaluation Objectives: Environmental

Weighted Evaluation Objective Scores for the Trade-Off Analysis with Environmentally-Related Evaluation Objectives



<sup>a</sup>Not scored for Environmental Justice (maximum weighted score 18.50 points)

<sup>b</sup>Not scored for Environmental Justice (maximum weighted score 18.50 points)

<sup>c</sup>Not Scored for Climate Resilience, Environmental Justice, and Water Quality and Watersheds (maximum weighted score 8.70 points)

<sup>d</sup>Not scored for any Evaluation Objectives in the environmentally-related subset (maximum weighted score 0.00 points)

# Key Findings

**Continuing the region's active investments (as simulated in the Baseline Plus Portfolio) will have a number of benefits:**

- Improvements in water supply reliability, as indicated by a decreased occurrence of shortages (although shortages may not be completely eliminated)
- Less dependence on imported water



# Key Findings

**There are promising options for future investments to further secure reliable water supplies while supporting other aspects of water management such as flood control, recreation, and energy**



# Key Findings

**Conservation and Water Use Efficiency (analyzed in the Enhanced Conservation and Urban and Agricultural Water Use Efficiency Concepts) would have a number of positive benefits for the region:**

- Reduced energy consumption
- Fewer pipeline capacity issues
- Increased reservoir storage, providing a direct benefit to recreation
- Less dependence on imported water
- Cost effective and scalable
- Potentially large energy cost reduction

# Key Findings

**Increasing supply volumes through Potable Reuse would have a variety of potential benefits:**

- Reduced shortage volumes
- Lower dependence on imported water
- Lower energy consumption





# Key Findings



**Concepts such as Stormwater Capture, Watershed and Ecosystem Management, and Stormwater BMPs may have significant benefits and would be worth considering for implementation as part of the overall water system in the San Diego region.**

- Enhanced quality of life/recreation**
- Reduced vulnerability to climate change**
- Support environmental justice**
- Support healthy watersheds and improved water quality**

# Key Findings

**Many Concepts and projects are complementary and could be implemented as part of a suite of strategies to benefit the region in many ways**

Example:      Water Use Efficiency (Lower energy costs)  
+ Potable Reuse (Higher energy costs)  
= Improved supply reliability  
Minimized energy cost impacts

# Basin Study Products

- **Interim Reports (Tasks 2.1 through 2.5):** Details of methods and results for each task of the Basin Study
- **Customized Trade-Off Analysis Tool:** Spreadsheet tool for performing trade-off analyses
- **Final Report:** Comprehensive report covering final version of all Basin Study tasks including details of methods and findings
- **Executive Summary Report:** Short overview of Basin Study focusing on key findings

# How to Use the Basin Study

- **Gain insight into the impacts of Concepts or projects being considered for implementation**
  - What positive impacts can be expected?
  - What negative impacts will need to be mitigated?
- **Understand strengths and weaknesses of Concepts**
- **Compare Concepts to help guide future investments**
  - Use customized trade-off analysis tool to make comparisons based on your organization's preferences

# Questions?

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<https://www.usbr.gov/lc/socal/basinstudies/SDBasin.html>