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Managing Water in the West

San Diego Basin Study Public Meeting

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June 27, 2018

U.S. Department of the Interior
Bureau of Reclamation

Meeting Purpose

- ***Review the objectives and status of the San Diego Basin Study***
- ***Review the background information, methods, and preliminary results for Task 2.4 and Task 2.5***
- ***Request stakeholder input on the draft Task 2.4 and Task 2.5 Interim Reports (background information, methods, and selected results)***

Agenda

- Welcome & Introductions
- San Diego Basin Study Overview and Update
- Task 2.4 Background, Methods, & Preliminary Results
- Task 2.5 Background, Methods, & Preliminary Results
- Next Steps and Request for Review
- Adjournment

San Diego Basin Study Participants

- **Technical Team**

- **Study Technical Advisory Committee (STAC)**
- **Public Stakeholders**

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- Welcome & Introductions
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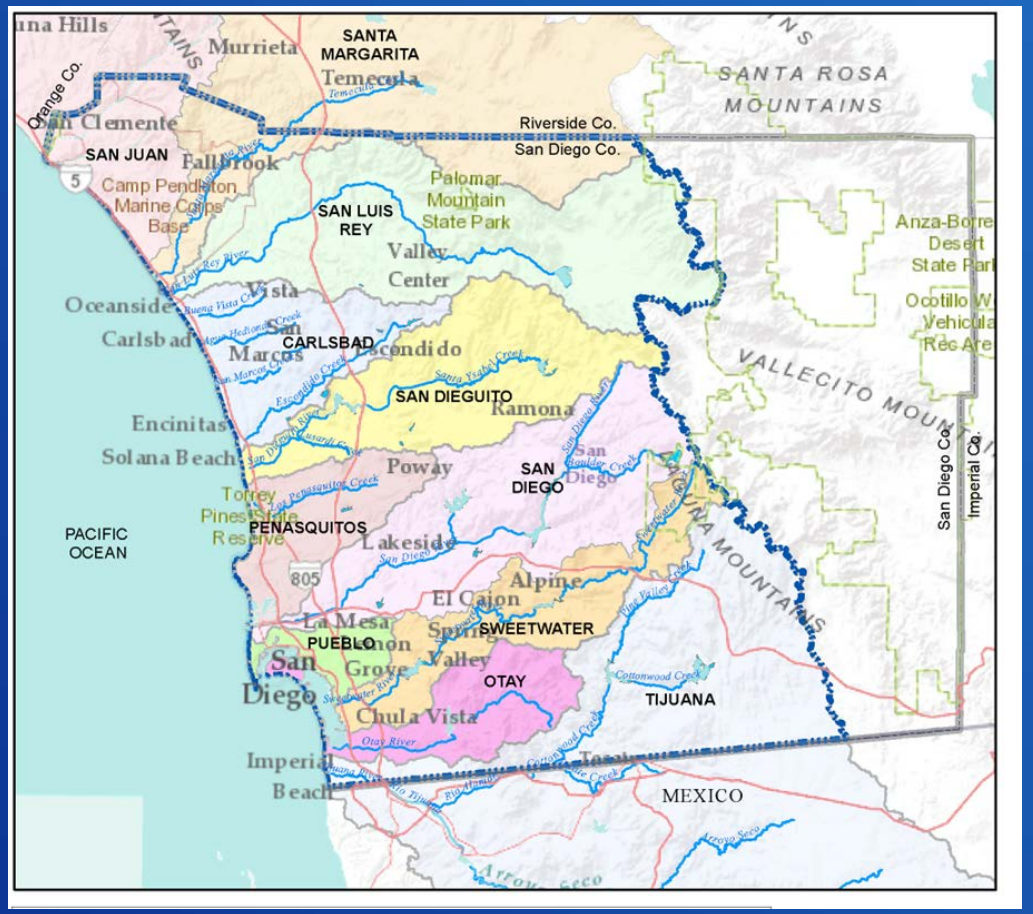
San Diego Basin Study Objectives

1. Determine how climate change will impact the water supply system

2. Develop structural and non-structural adaptation strategies to manage climate change impacts



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San Diego Basin Study Overview

- Project time frame April 2015 – April 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

The City of SAN DIEGO

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San Diego Basin Study Tasks & Status

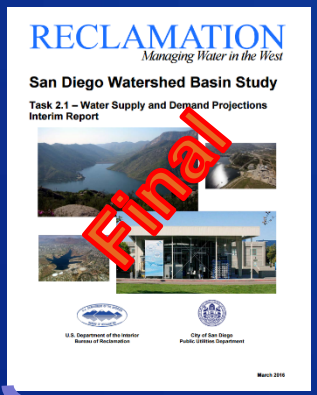
Water Supply and Water Demand Projections (Task 2.1)

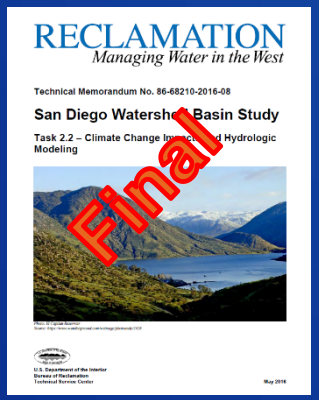
Downscaled Climate Change and Hydrologic Modeling (Task 2.2)

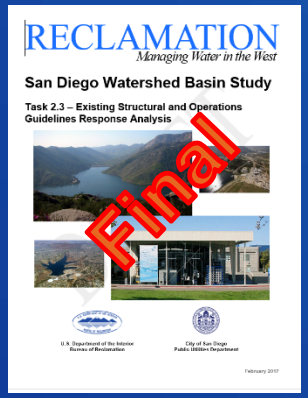
Existing Structural Response and Operations Guidelines Analysis (Task 2.3)

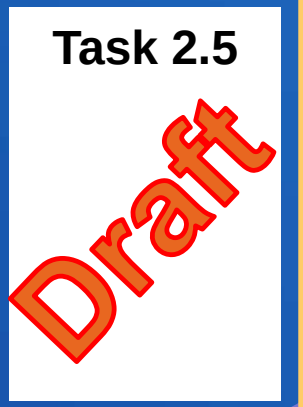
Structural and Operations Concepts (Task 2.4)

Trade-Off Analysis and Opportunities (Task 2.5)









Summary Report

(Task 2.6)

Feb 2019

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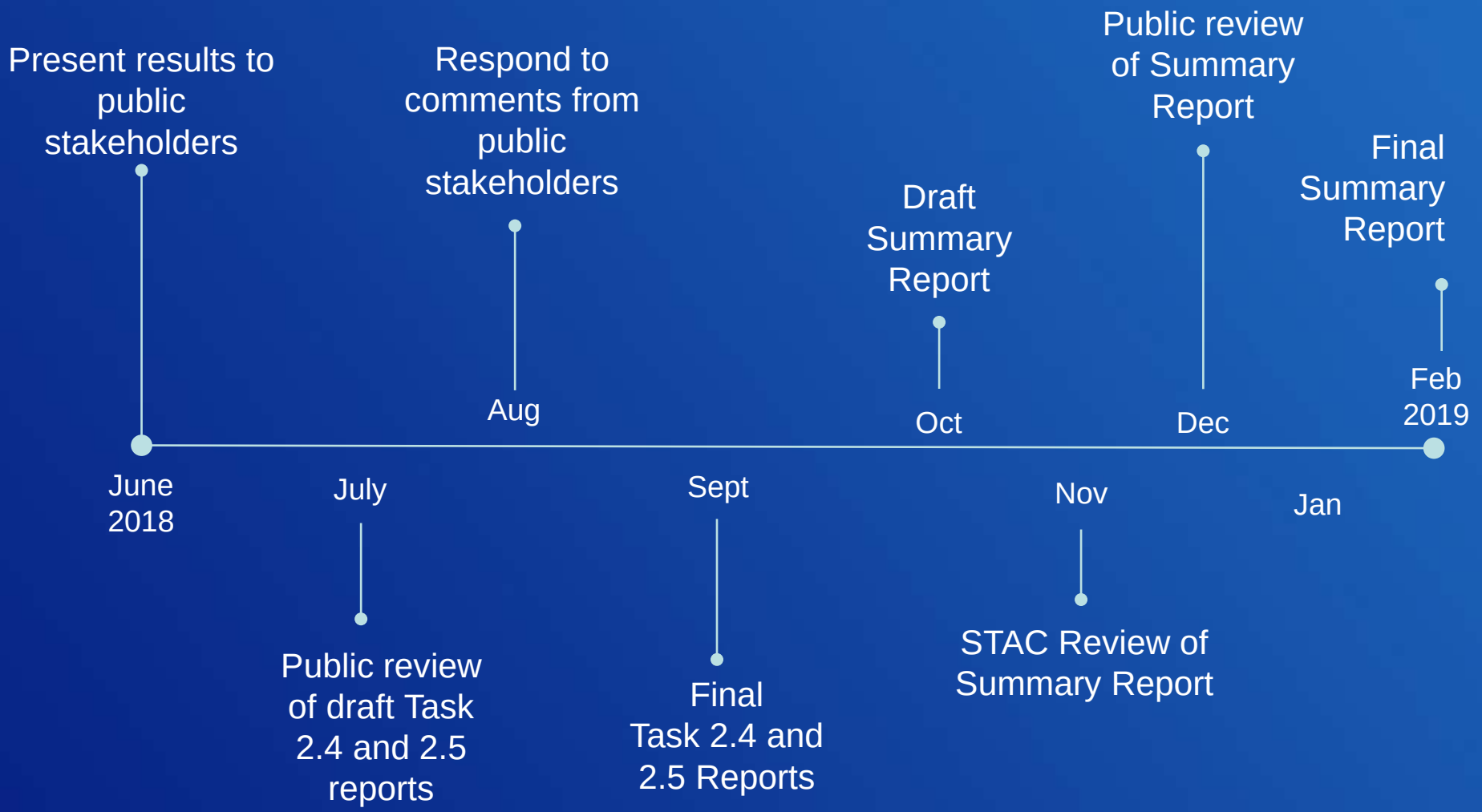
Study Status & Timeline



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Request for Review

- **Written Public Comments due by August 1, 2018**
- **Draft Interim Reports will be emailed today**
- **Email with draft will include a form and instructions for providing comments via email.**

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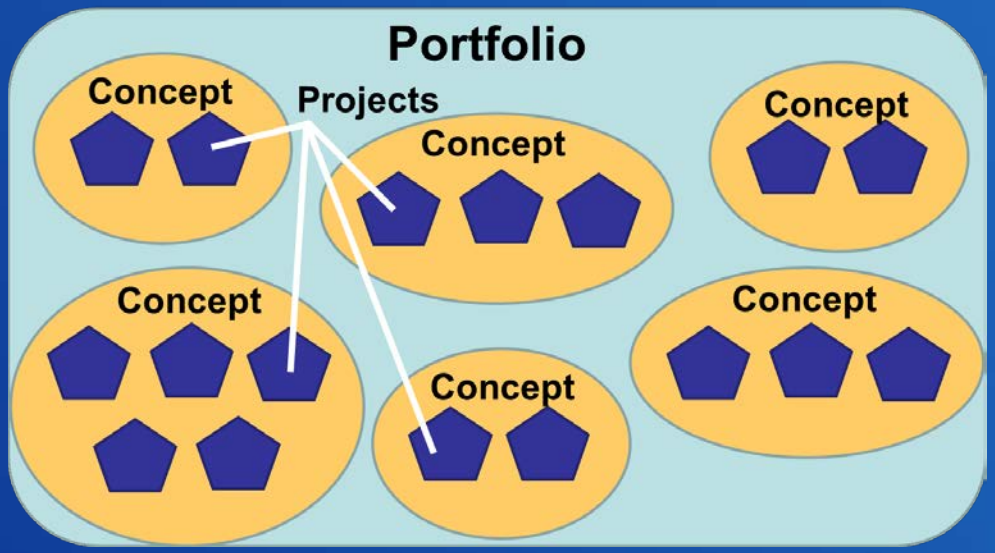
Task 2.4 Draft Interim Report

1. Introduction
2. Study Area
3. San Diego Basin Study Portfolios
4. CWASim Model
5. Portfolio Model Runs
6. Impacts Assessment Methodology
7. Impacts Assessment Results
8. Discussion of the Results by Concept
9. Conclusions

San Diego Basin Study Portfolios

Portfolios

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



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Baseline Portfolio (B)

Represents the system as it existed in 2015, with some minor modifications to include water supplies that have been or will be implemented (e.g., Carlsbad Desalination Plant and the full QSA annual transfer volume)

Concepts

- Conveyance Improvements
- Drought Restriction/Allocation
- Firm Water Supply Agreements
- Groundwater
- Imported Water Purchases
- Local Surface Water Reservoirs
- Recycled Water
- Seawater Desalination
- Urban & Ag. Water Use Efficiency

Baseline Plus Portfolio (B+)

Baseline projects and projects that are being actively pursued or have received funding as of 2017 (e.g. Pure Water San Diego Phase 1, Hodges Water Quality Improvement Program, and Sweetwater Reservoir Wetlands Habitat Recovery)

Concepts

- All Baseline Portfolio Concepts
- Modified or New Concepts
  - Conveyance Improvements
  - Gray Water Use
  - Groundwater
  - Potable Reuse
  - Recycled Water
  - Stormwater Capture
  - Urban & Ag. Water Use Efficiency
  - Watershed and Ecosystem Management

Increase Supplies Portfolio (IS)

Projects that focus on increasing regional water supplies (e.g. Camp Pendleton Desalination Facility, Pure Water San Diego Phase 2, Re-rating of Carlsbad Desalination, and Rosarito Desalination)

Concepts

- All Baseline Plus Portfolio Concepts
- Modified or New Concepts
  - Gray Water Use
  - Groundwater
  - Imported Water Purchases
  - Potable Reuse
  - Recycled Water
  - Seawater Desalination

Enhanced Conservation Portfolio (EC)

Looks at enhanced water conservation beyond currently planned levels (1% reduction in water demand per year, starting in 2020 when it is assumed that the 20x20 targets outlined in SBX7-7 are reached)

Concepts

- All Baseline Plus Portfolio Concepts
- Modified or New Concepts
  - Enhanced Conservation

Optimize Existing Facilities Portfolio (OEF)

Focuses on enhancing the efficiency of existing facilities by replacing, repairing, or maintaining existing infrastructure to maximize its operation (e.g. San Diego County Reservoir Intertie and Dulzura Conduit Replacement)

Concepts

- All Baseline Plus Portfolio Concepts
- Modified or New Concepts
  - Conveyance Improvements

Watershed Health/Ecosystem Restoration Portfolio (WE)

Seeks to restore or create natural habitats and minimize environmental impacts (e.g. Rainwater Harvesting and Sweetwater River Park Bioretention)

Concepts

- All Baseline Plus Portfolio Concepts
- Modified or New Concepts
  - Stormwater BMPs
  - Stormwater Capture
  - Watershed and Ecosystem Management

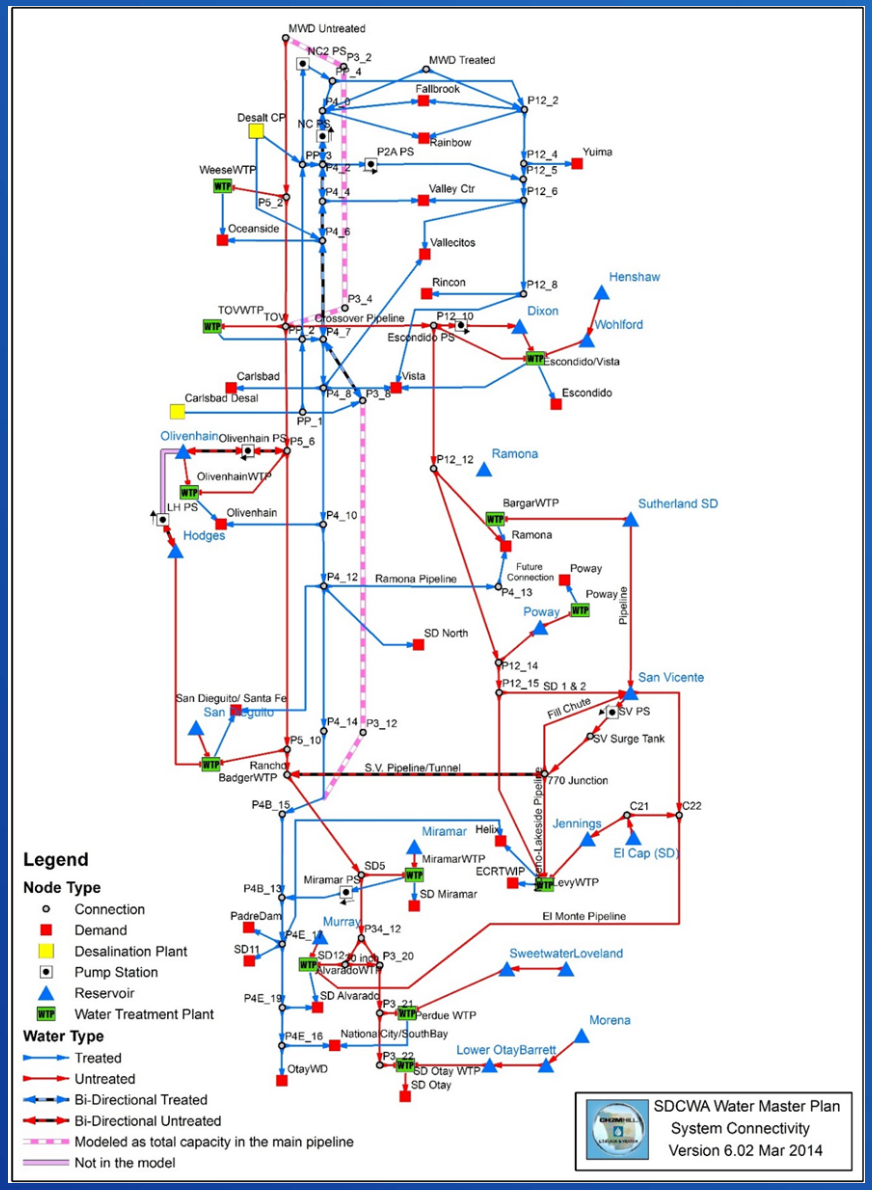
CWASim Model

Allows us to simulate future supply, demand, and infrastructure scenarios to identify impacts

Includes:

Demands for SDCWA member agencies except Camp Pendleton

Infrastructure and supplies that are connected to the SDCWA system



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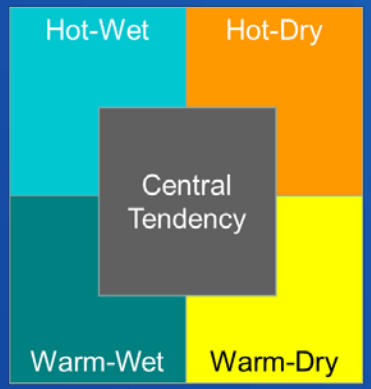
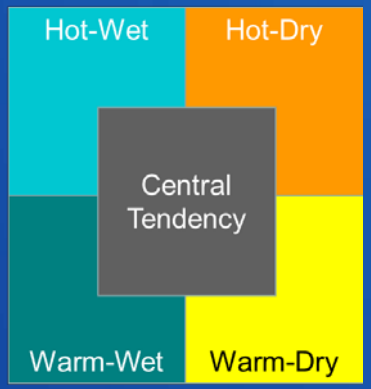
SDBS Demand and Climate Scenarios

2015 Demands + Current Climate

2025 Demands + Current Climate + 

2050 Demands + Current Climate + 

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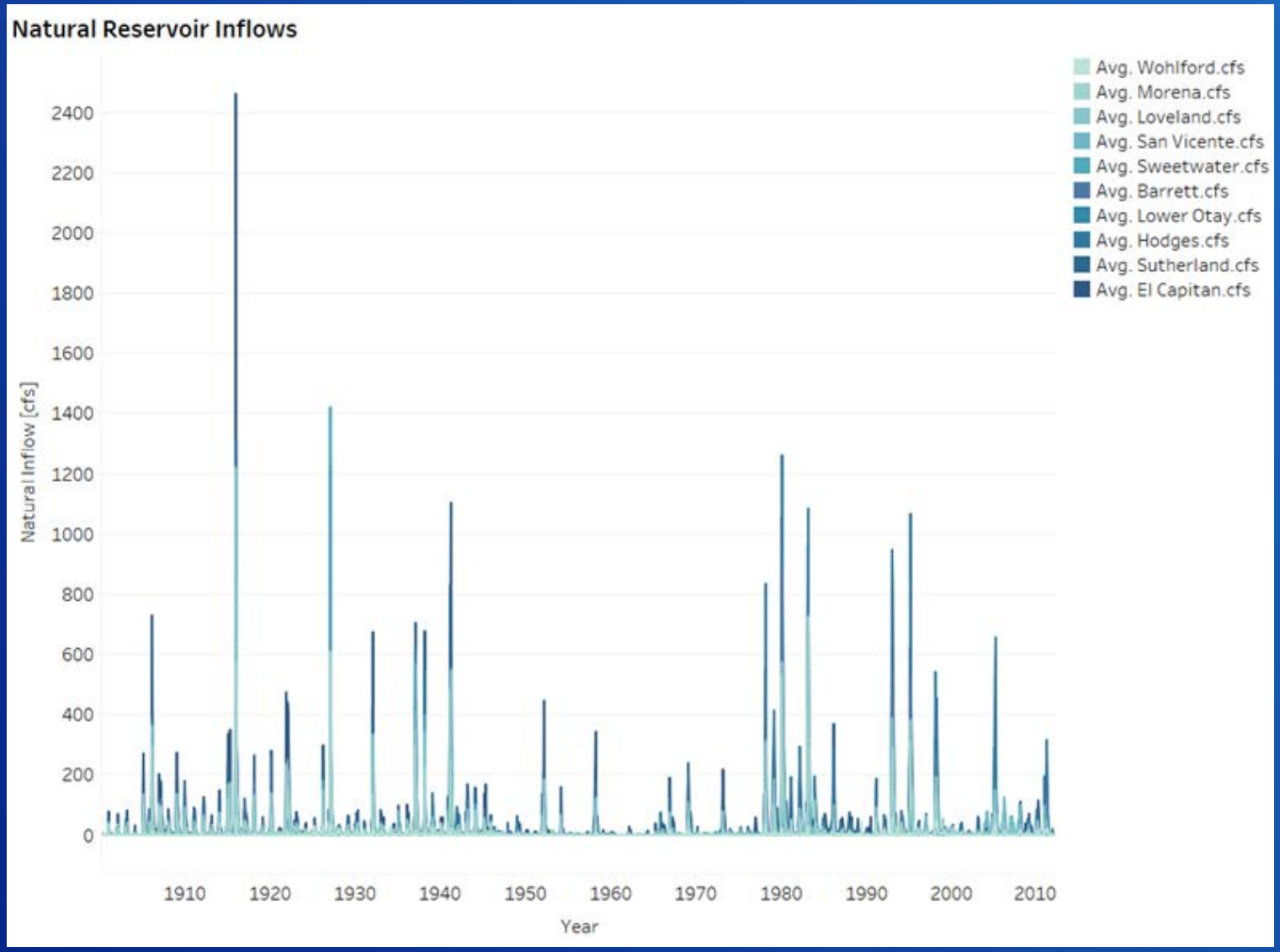
Water Supply Projections

- 85-year-long timeseries of surface water inflows to reservoirs and imported MWD supplies available for purchase
- Constant QSA water supply volumes for each time period
- Other water supply volumes, dependent on Portfolio
- Change factors used for climate change scenarios

Water Supply Projections



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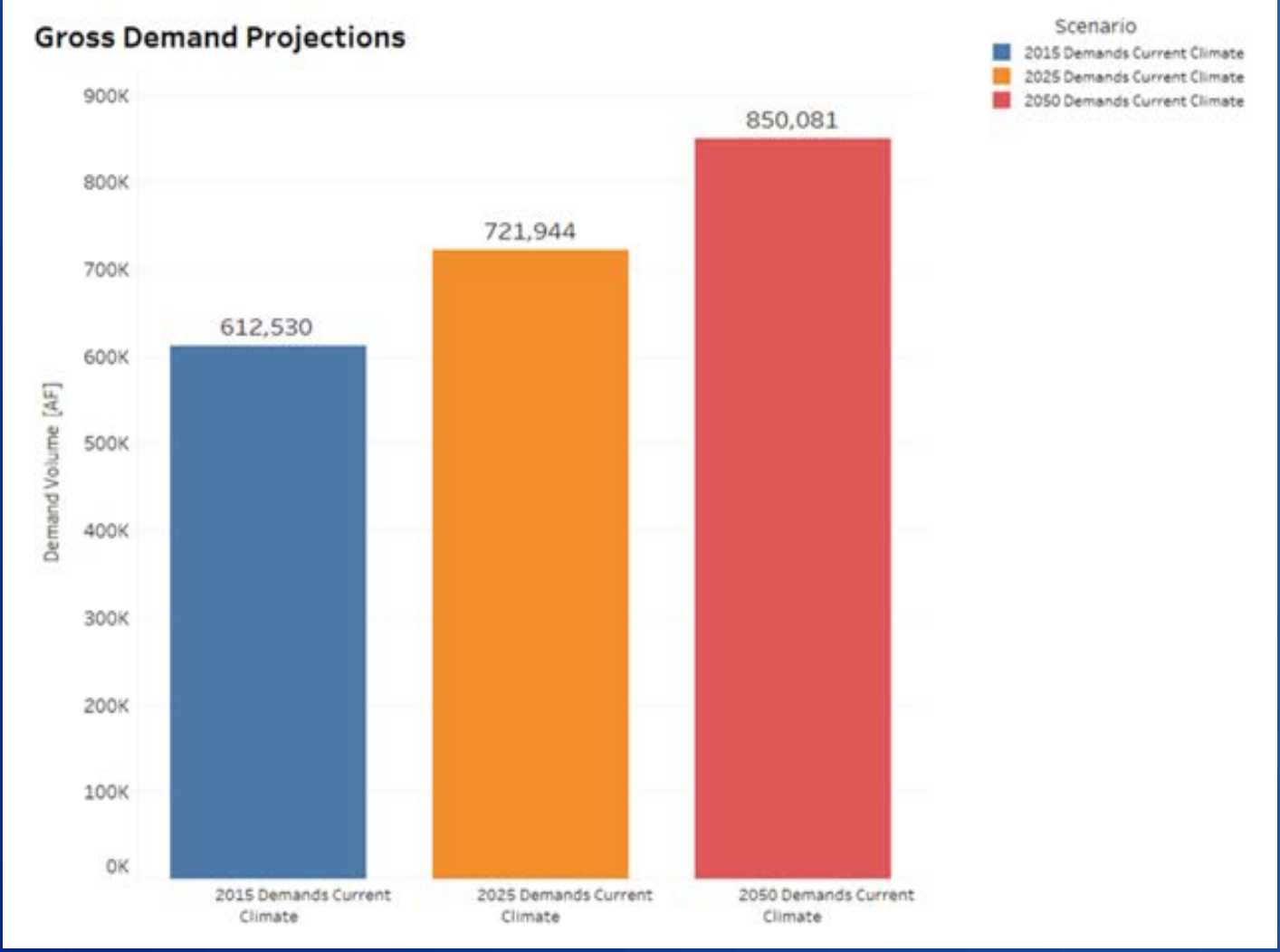
Water Demand Projections

- Annual projections of agricultural and M&I demands for five hydrologic year types for each of the 13 time period and climate change projection group combinations
  - 2015 gross demands from the SDCWA 2015 UWMP Annual Report
  - Gross demand projections for 2025 and 2050 based on demand projections in the 2015 SDCWA UWMP, extended to 2050 and adjusted for climate change
- Constant between Portfolios

Water Demand Projections



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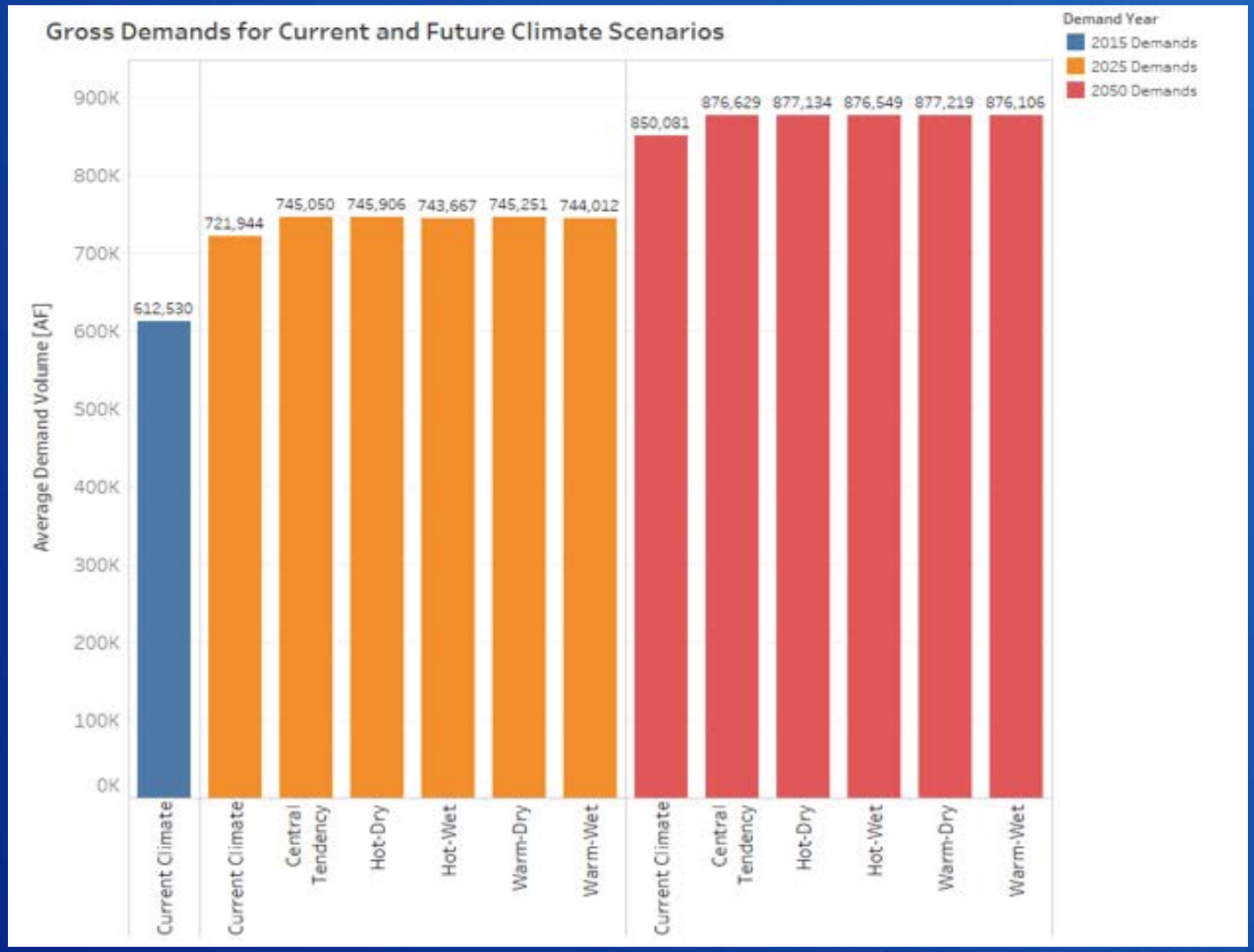
Water Demand Projections



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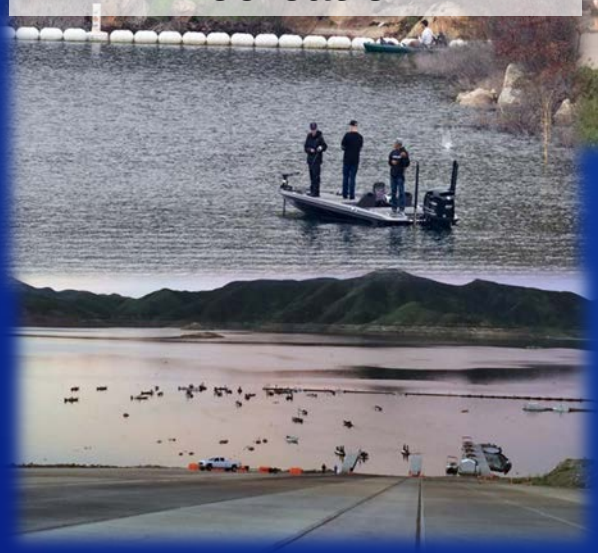
Impacts examined in Task 2.4 of the San Diego Basin Study (Environmental to be examined in Task 2.5)

Flood Control

Energy

Recreation



Water Delivery

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Analysis Methodology

- Observations verified using analysis of variance (ANOVA)
- Checks for statistical significance
- A threshold of a p-value less than 0.05 was selected to indicate statistically significant differences.

Water Delivery – Shortage Volume

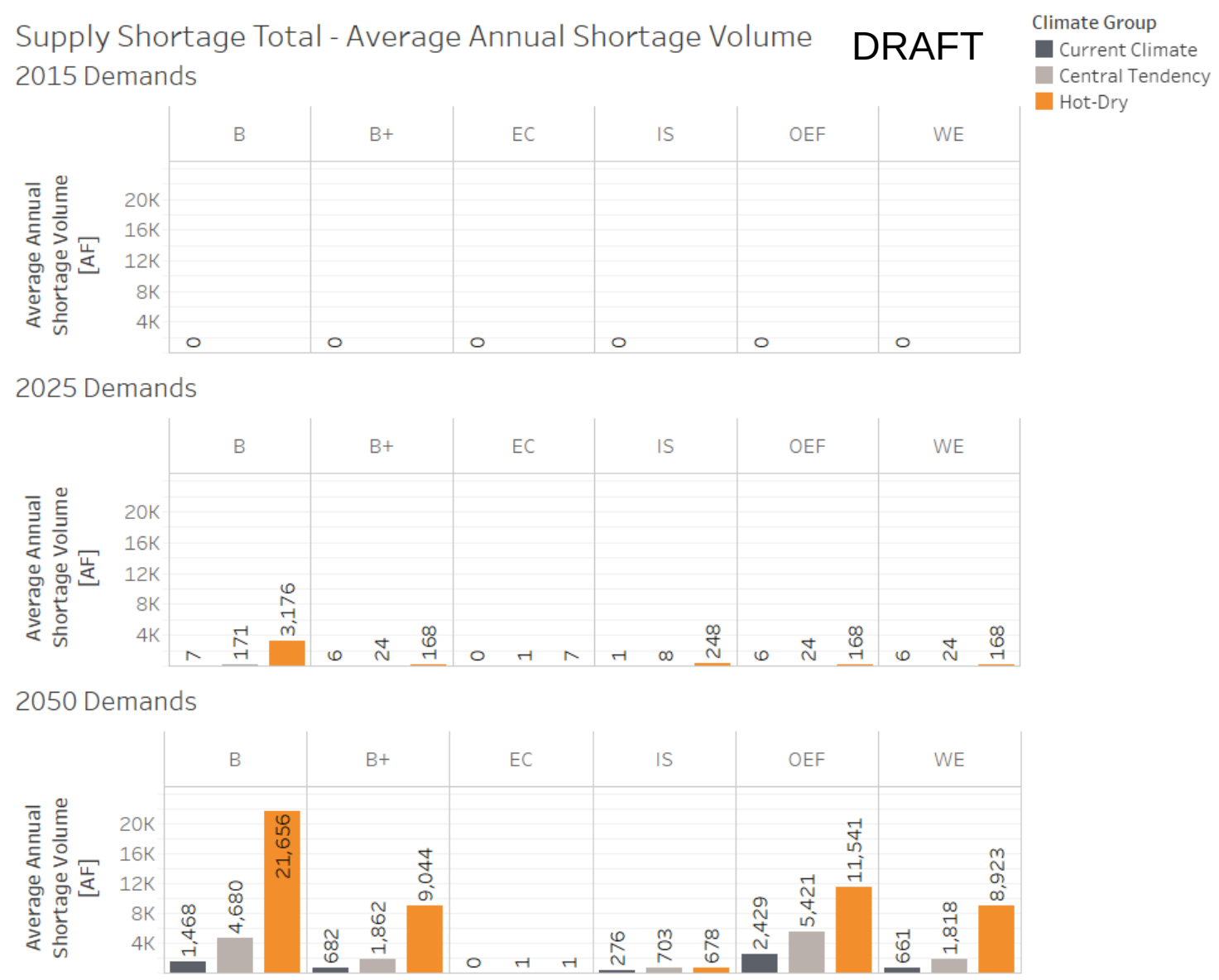
- **Measures the magnitude of regional demand that is unable to be met by the available supplies and/or limited by conveyance system capacity.**

- **Key Findings**
  - **Shortage Volumes are largest in the Baseline and Optimize Existing Facilities Portfolios for current climate and central tendency climate (Baseline is higher for hot-dry climate)**
  - **Shortage Volumes are lowest in the Enhanced Conservation Portfolio**

Water Delivery – Shortage Volume

- **Key Findings**
  - **Shortage Volume is higher for 2025 demands than for 2015 demands, and higher for 2050 demands than for 2025 demands in all Portfolios except Enhanced Conservation under current climate.**
    - **Shortage Volumes are very small for Enhanced Conservation**

Water Delivery – Shortage Volume

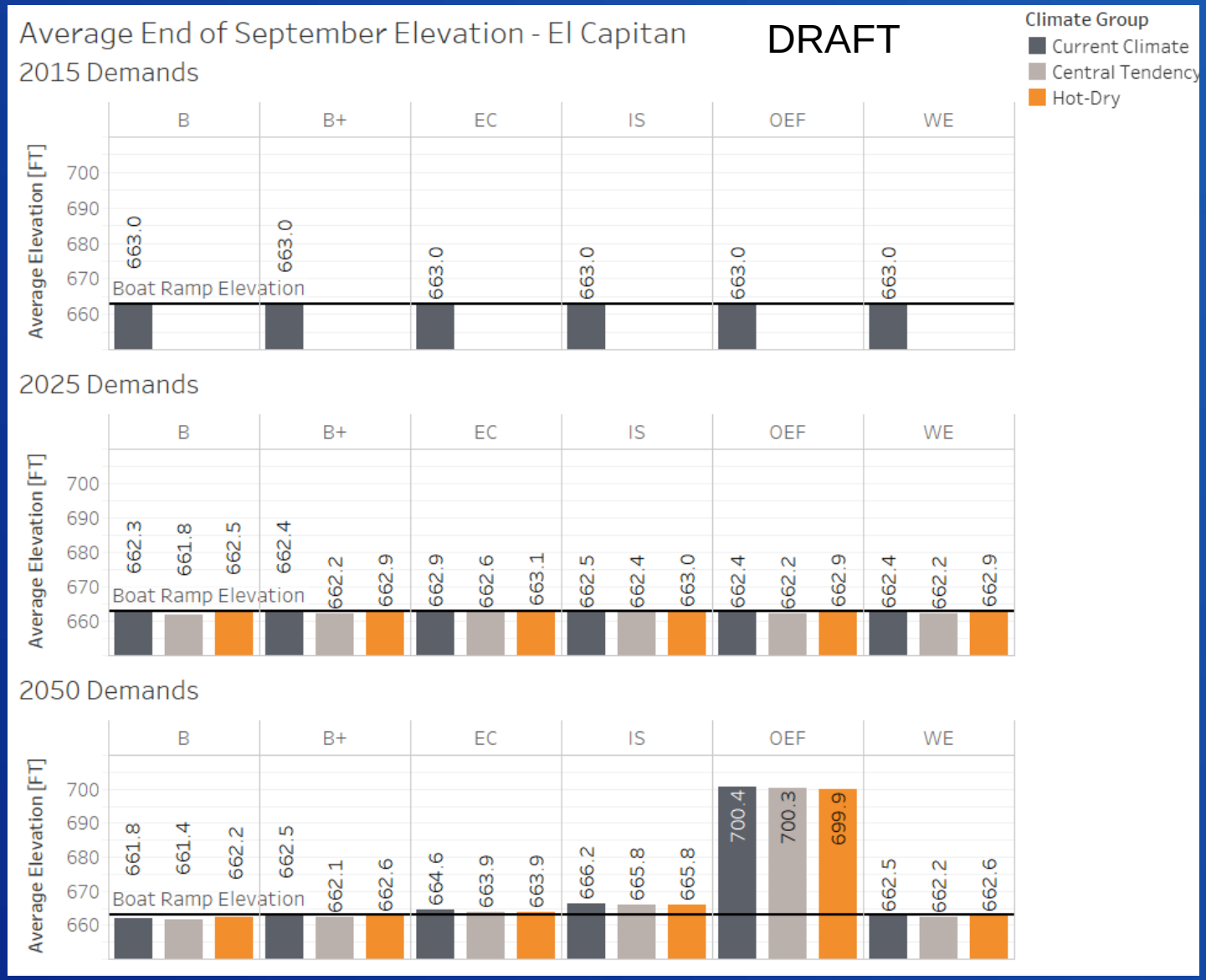


Recreation

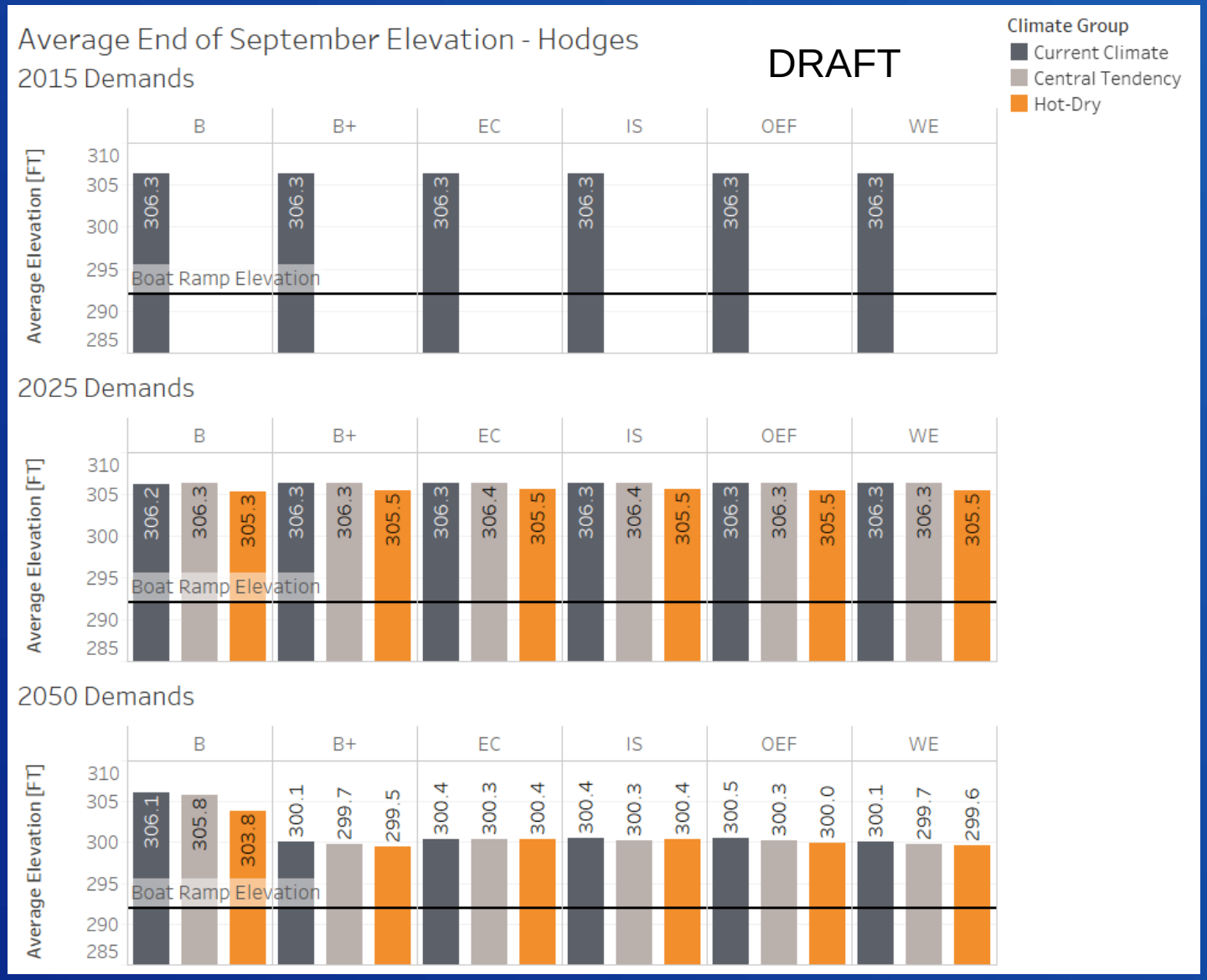
- **Impacts to Recreation are measured by boat ramp accessibility at the end of September. When End of September Elevation is greater than the boat ramp elevation, the boat ramp is considered accessible.**

- **Key Findings**
  - **The boat ramp at El Capitan is accessible on average in all Portfolios for 2015 demands, only for hot-dry climate in the Enhanced Conservation Portfolio for 2025 demands, and only in the Enhanced Conservation, Increase Supplies, and Optimize Existing Facilities Portfolios for 2050 demands.**
  - **The boat ramp at Hodges, Lower Otay, and San Vicente is accessible on average in all Portfolios for 2015, 2025, and 2050 demands.**

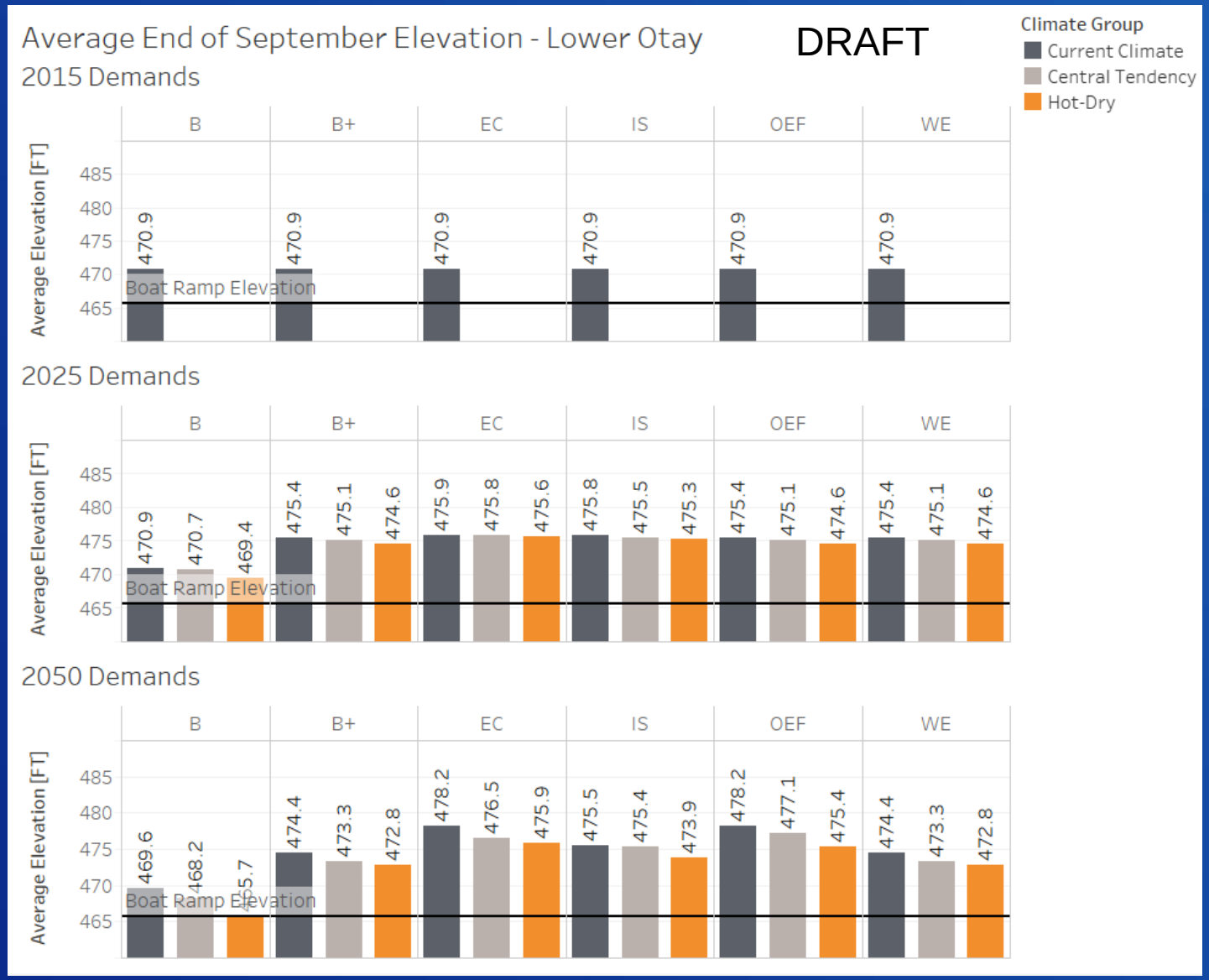
Recreation at El Capitan



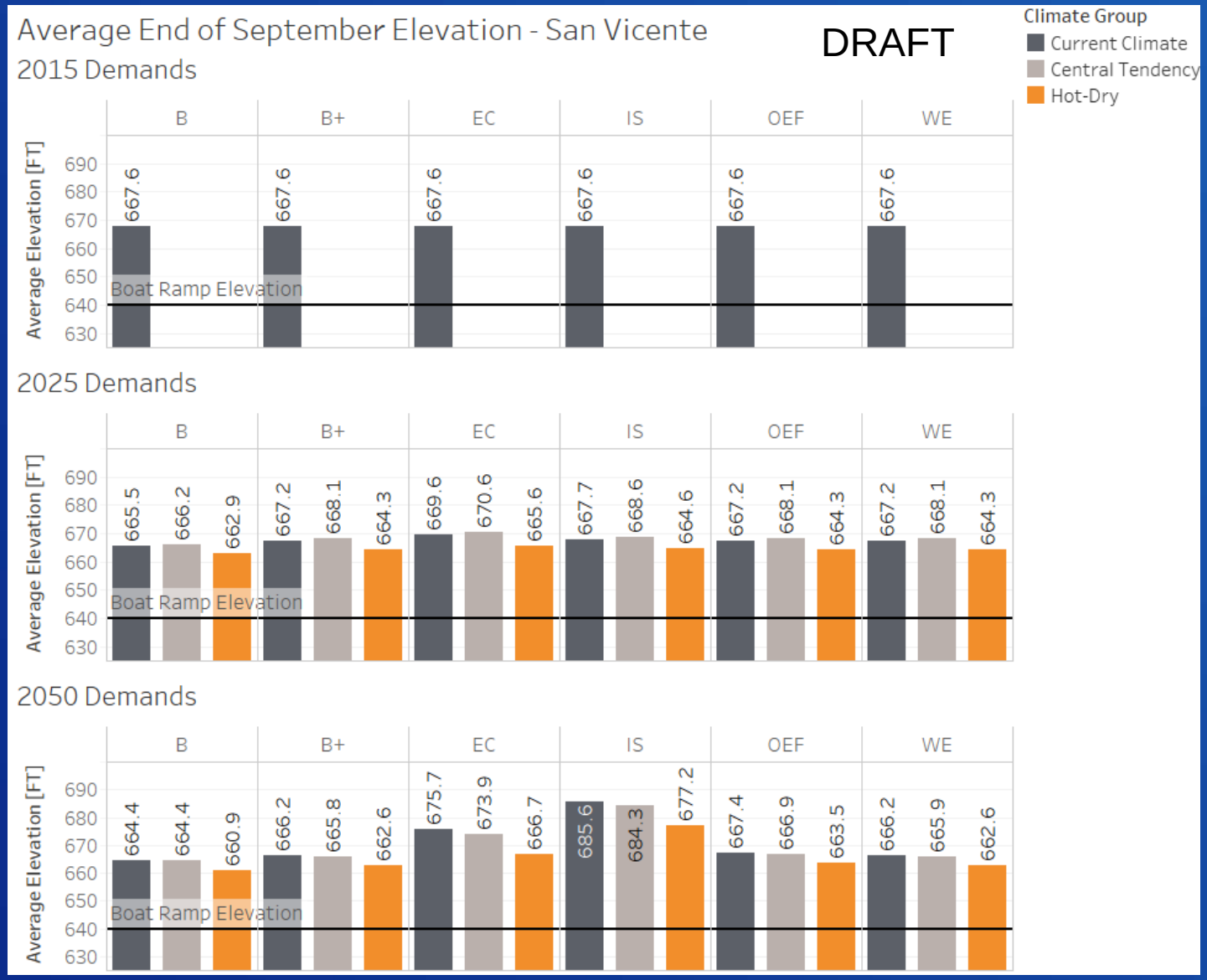
Recreation at Hodges



Recreation at Lower Otay



Recreation at San Vicente

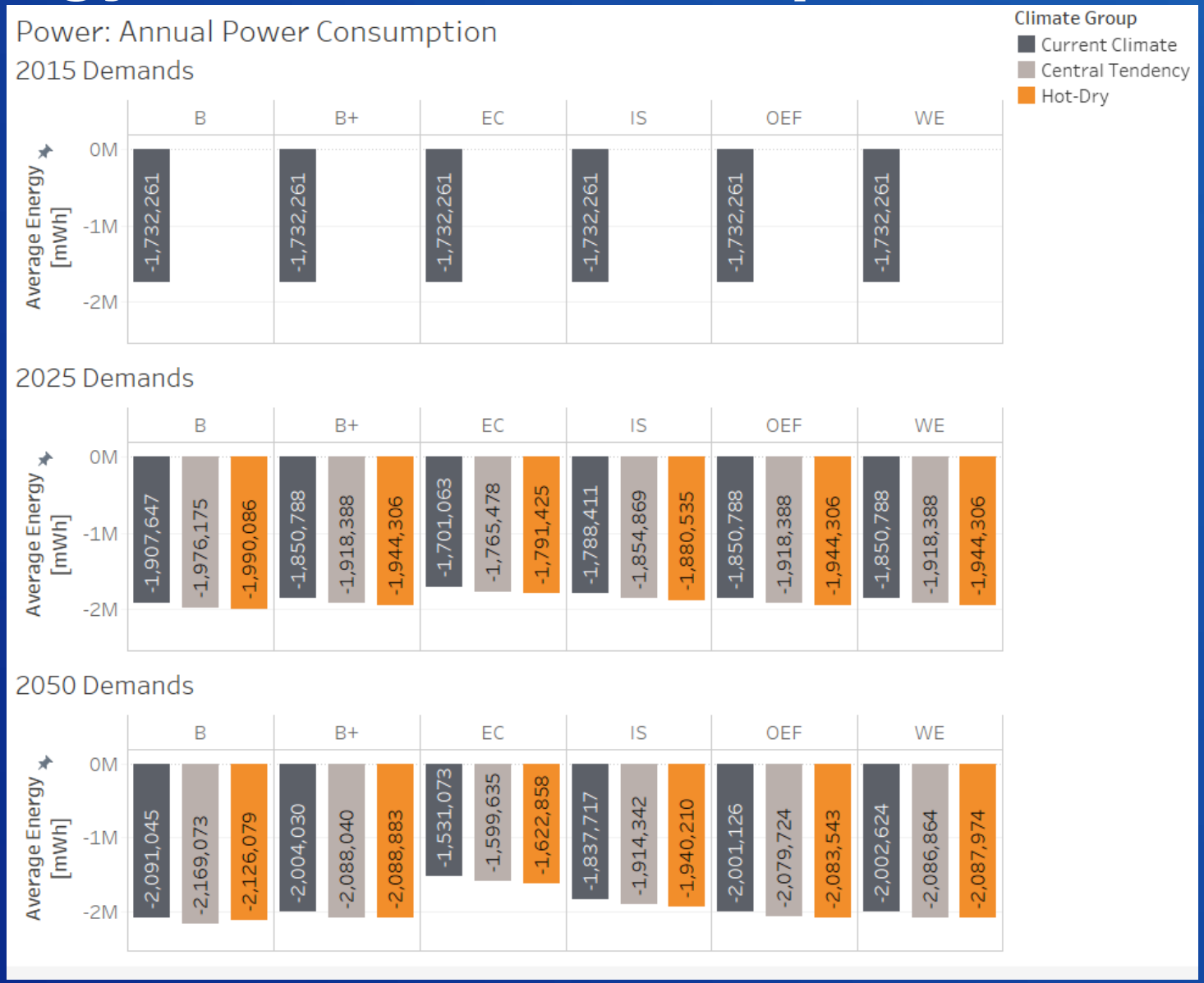


Energy

- Impacts to Energy are measured by power consumption to treat and convey water. Higher negative values of consumption indicate greater energy intensity of that Portfolio

- Key Findings
  - The highest consumption occurs in the Baseline Portfolio and the lowest occurs in the Enhanced Conservation Portfolio
  - No difference between Baseline and Baseline Plus
  - Consumption in Increase Supplies Portfolio is no different than Baseline Plus for 2025 and slightly lower for 2050, indicating that the additional supply projects do not increase energy consumption and that some supply projects may be less energy intensive

Energy - Power Consumption



Questions?

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Task 2.5 Draft Interim Report

1. Introduction
2. Study Background and Study Area
3. Economic, Financial, and Trade-Off Analysis
4. Methodologies Used to Estimate Traditional Economic Benefits and Costs
5. Trade-Off Analysis Methodology
6. Trade-Off Analysis Results
7. Summary and Opportunities

Objectives of Task 2.5

- **“Traditional” economic/financial assessment using Concepts developed in Task 2.4.**
  - **A “traditional” assessment includes impacts that can be quantified and monetized.**

- **Trade-Off Analysis using Concepts developed in Task 2.4.**
  - **The trade-offs are based on evaluation objectives, which are potential impacts considered important to the region.**

- **Provide a framework for evaluating a variety of possible concepts and needs.**

What Information does a "Traditional" Economic/ Financial Assessment Provide?

A "Traditional" Economic/Financial Assessment Provides:

- **Estimates of the benefits and costs of a project, program, or action from the perspective of society as a whole.**
- **An evaluation of cash flows of a project or action from the perspective of individual businesses, households, and agencies. Project revenues and the financial resources available to pay for a project are considered.**
- **Indicates if society is better off with or without a project, program, other action.**
- **An evaluation of the impact of a project, program, or action on individuals/businesses income and revenues.**

What Information Does a Trade-Off Analysis Provide?

- **Allows for the simultaneous evaluation of quantitative and qualitative evaluation objectives for a variety of projects or concepts.**
  - **Each objective is evaluated on a relative scale (e.g. 1 to 10).**
  - **Qualitative factors are more subjective but are not less important than quantitative factors.**
  - **Simultaneous evaluation allows consideration of positive, negative, and neutral evaluation objective impacts for a specific project or concept (Trade-Offs).**
- **The results provide a clear, concise, and comparable summary of evaluation objective impacts across Concepts.**
- **Differences in specific evaluation objective impacts can be identified across Concepts.**

“Traditional” Economic/Financial Assessment Input Data

- Task 2.4 modeling results
- Concept Surveys distributed by the City of San Diego to the STAC and IRWM RAC.
- Input from Member Agency Project surveys distributed by the City of San Diego.
- Benefit values obtained from previously competed studies. Values include:
  - Water supply/Water reliability (reduced shortage)
  - Recreation
  - Ecosystem services
  - Power

“Traditional” Economic Analysis - Water Supply & Reliability Benefits

- **Water Supply/Reliability Benefits**
  - **Volume of water available/water shortage**
  - **Quantities based on Task 2.4 modeling results**
  - **Value based on previously completed studies of water values or avoided shortages**

Table X– Reported water supply reliability values

Study and date of study	Region	Value per household per month or value per acre-foot	
		Low	High
Barakat & Chamberlin (1994)	Southern California	$11.62	$16.92
Carson & Mitchell (1987)	Metropolitan Water District	$6.92	$21.50
Griffin & Mjelde (2000)*	7 cities in Texas	$2.20	$28.41
Koss & Khawaja (2001)	10 California water districts	$11.67	$16.92
Howe & Smith (1994)*	3 Colorado front range cities	$0.96	$16.06
Jenkins, Lund & Howitt (2003)**	Central and Southern California	$600	$1,220

*Griffen & Mjelde and Howe & Smith reported willingness to pay and willingness to accept payment values. The range of values include both willingness to pay and willingness to accept payment.
**Jenkins, Lund, & Howitt present water scarcity values in dollars per acre-feet per year in 1995 dollars.

“Traditional” Economic Analysis – Recreation Benefits

- Based on the elevation of four reservoirs
  - El Capitan
  - Hodges
  - Otay
  - San Vicente
- Elevation based on Task 2.4 modeling results
- Changes in Recreation Visitation are estimated using a recreation visitation model that includes elevation, climatic factors, and leisure time as explanatory variables
- The estimated influence of elevation ranges from change in visitation from 1,450 to 2,010 visits annually as a result of a 1% change in elevation
- Recreation values are estimated to be $23.90 per visit based on a California State Parks Department study

“Traditional” Economic Assessment – Energy Benefits

- Task 2.4 modeling results provide estimates of net energy usage associated with different Concepts.
- The value of power is based on the concept of avoided cost, which means the value of power is equal to the cost of generating an extra unit of power for the study area.
- The Locational Marginal Price (LMP) for power in the San Diego area is based on the California Independent System Operator (CAISO) current estimate of about $33 per megawatt hour (MWh).

"Traditional" Economic Assessment – Possible Ecosystem Benefits

- Information from project level survey question addressing Climate Change includes two questions that could be useful:
  - How many acres of habitat was conserved or restored by this project?
  - What is the habitat type?

Habitat Type	Mean as a percentage of maximum value	Most likely benefit per acre per year			
		Provisioning	Cultural	Regulating	Habitat
Coastal systems	16.3%	$579	$3,125	$2,315	$36
Coastal wetlands	16.3%	$637	$232	$10,300	$5,209
Inland wetlands	37.0%	$1,678	$1,447	$3,995	$602
Rivers and lakes	66.7%	$1,794	$868	$1,563	$0
Temperate forests	Midpoint	$405	$23	$104	$602
Woodlands	Midpoint	$203	$0	$255	$0
Grasslands	Midpoint	$220	$2	$498	$69

Sources: "Sustaining Environmental Capital: Protecting Society and the Economy" (Executive Office of the President, 2011) and "The Economics of Ecosystems and Biodiversity for Water and Wetlands" (D. Russi, et al., 2013).

Trade-Off Analysis – Data and Analytical Requirements

- Evaluation Objectives – What are the desired effects that are sought and undesired effects that should be avoided?
- Performance Measures – How can differences in the Evaluation Objectives be measured?
- Measures of Importance – What is the relative importance of various Evaluation Objectives to the affected population?
- A method for normalizing, comparing, and aggregating the range of effects to evaluate Concepts.

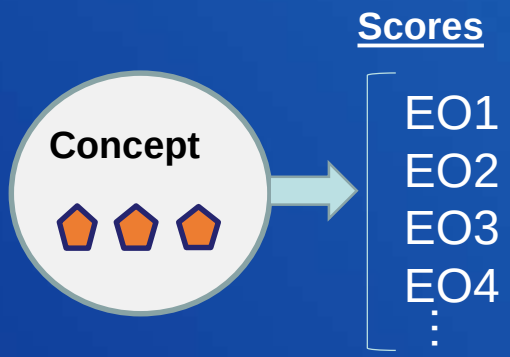
Trade-Off Analysis – Evaluation Objectives

The Tradeoff Analysis compares Concepts using 13 Evaluation Objectives (EO)

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

Tradeoff Analysis Approach

- **Concepts receive a score for each EO**



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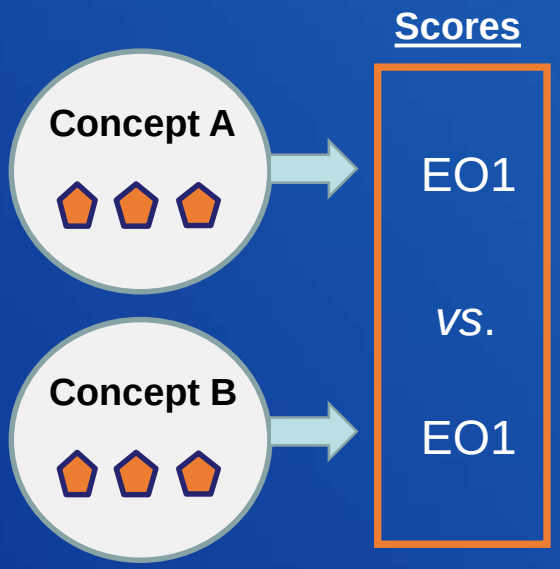
Tradeoff Analysis Approach

- **Concept EO scores will be compared**
  - **Across a single EO**
  - **Across *all* EOs**
  - **Across a subset of EOs**



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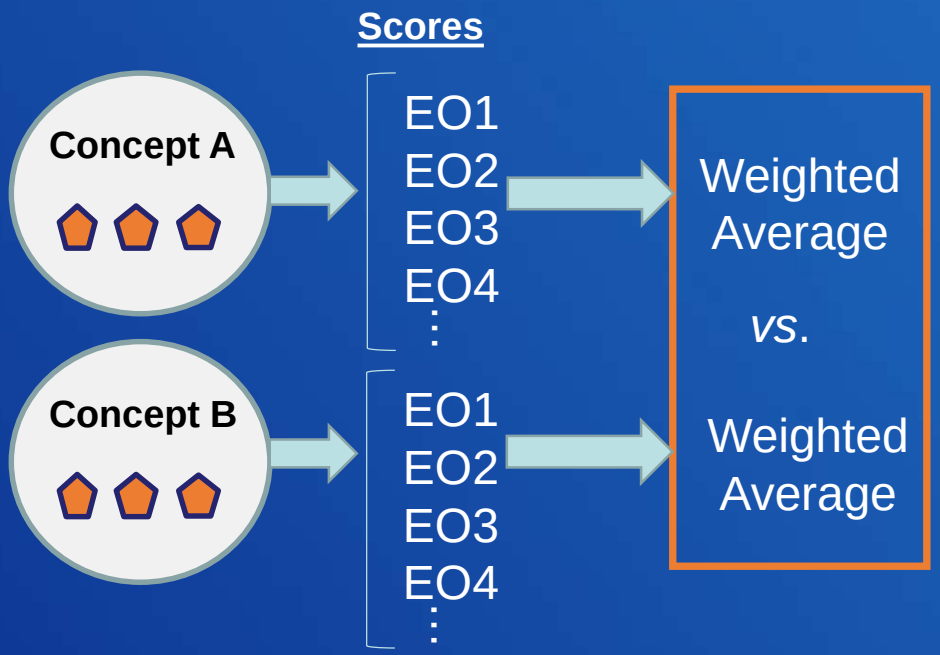

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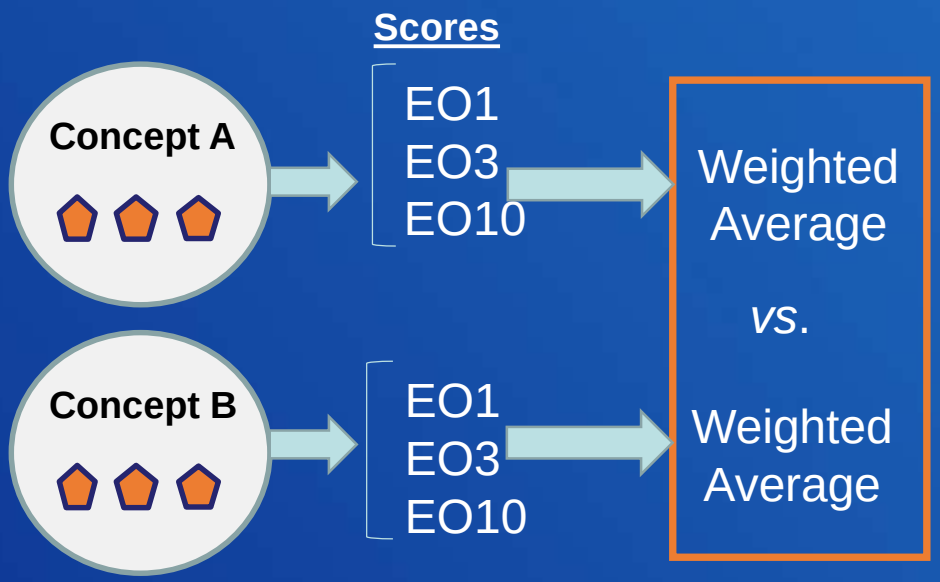

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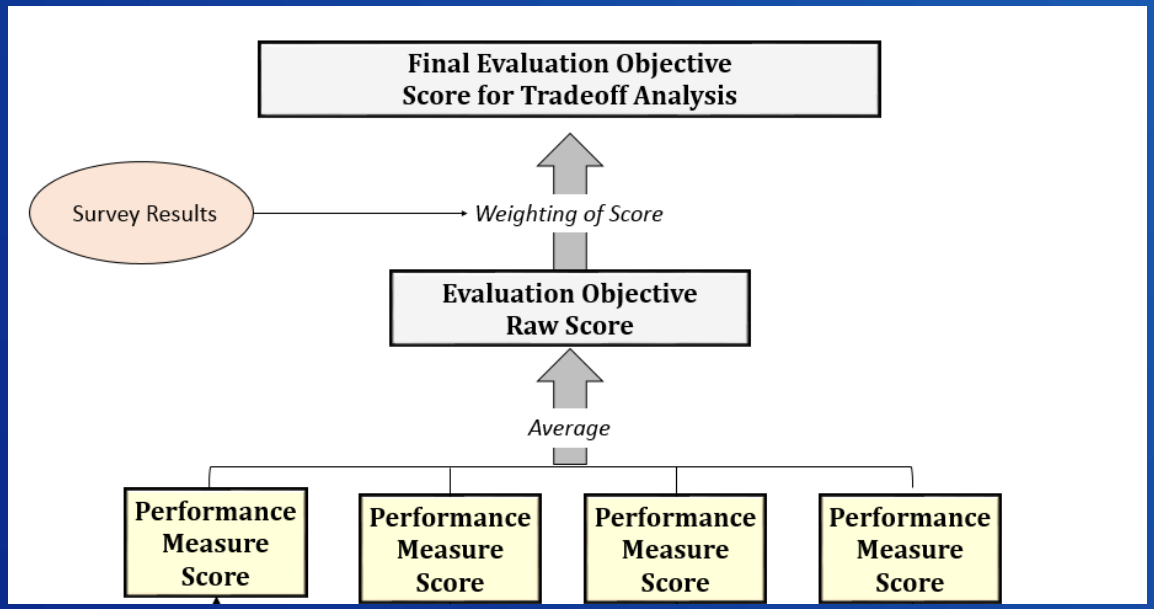
How are Evaluation Objective Scores Calculated?

- **Each EO is measured by one or more Performance Measures**
- **EO scores are weighted by their importance**
- **SDBS Survey results determine EO weights**



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Survey Results– Relative Importance of Evaluation Objectives

- Normalized values (10 = highest relative value)

Evaluation Objective	"Importance" Score
Reliability and Robustness	10.0
Optimize Local Supplies/ Independence	9.4
Cost Effectiveness	8.5
Regional Integration and Coordination	8.5
Provide for Scalability of Implementation	7.7
Minimize Project Complexity	7.3
Promote High Quality of Life/Recreation	7.4
Promote Environmental Justice	8.7
Support Regional Economy	7.8
Enhance Climate Resilience	9.6
Protect Habitats, Wildlife, and Ecosystem Services	9.2
Protect Water Quality and Watersheds	10.0
Address Climate Change Through Greenhouse Gas Reduction	8.2

Trade-Off Analysis – Calculation of Weighted Evaluation Objective Scores

- **Weighted EO Score =**

  EO Impact Score X EO Importance Score ÷ 10

- **Example:**

  EO Impact Score = 4.5

  EO Importance Score = 8.5

  Weighted EO Score = 3.825

- **Note: An EO with an Impact Score of 3.825 and an EO Importance Score of 10 will have the same Weighted EO Score of 3.825**

Trade-Off Analysis – Performance Measures (PM) for Evaluation Objectives (EO)

PM's for Provide Reliability and Robustness EO

- Water Supply Volume
- Vulnerability of Water Supply Facilities and Infrastructure
- Carryover Storage and Augmentation

PM for Optimize Local Supplies/Independence EO

- Local Supply

PM's for Cost Effectiveness EO

- Capital Costs
- Operation and Maintenance Costs
- Potential for External Funding

Trade-Off Analysis – Performance Measures

PM's for Regional Integration and Coordination

- Coordination
- Education and Outreach

PM for Provide for Scalability of Implementation

- Project Phasing

PM's for Project Complexity

- Project Complexity and Feasibility

PM's for Quality of Life/Recreation

- Green Space/Open Space
- Recreation Opportunities

Trade-Off Analysis – Performance Measures

PM's Environmental Justice

- Environmental Justice
- Disadvantaged Communities

PM for Regional Economic Impact

- Regional Economic Impact

PM's Climate Resilience

- Sea Level Rise Vulnerability
- Flood Risk Management
- Warming and Fire Vulnerability

Trade-Off Analysis – Performance Measures

PM's Protect Habitats and Ecosystem Services

- Impacts to Endangered/ Threatened Species
- Impacts to Ecosystems

PM's for Water Quality and Watersheds

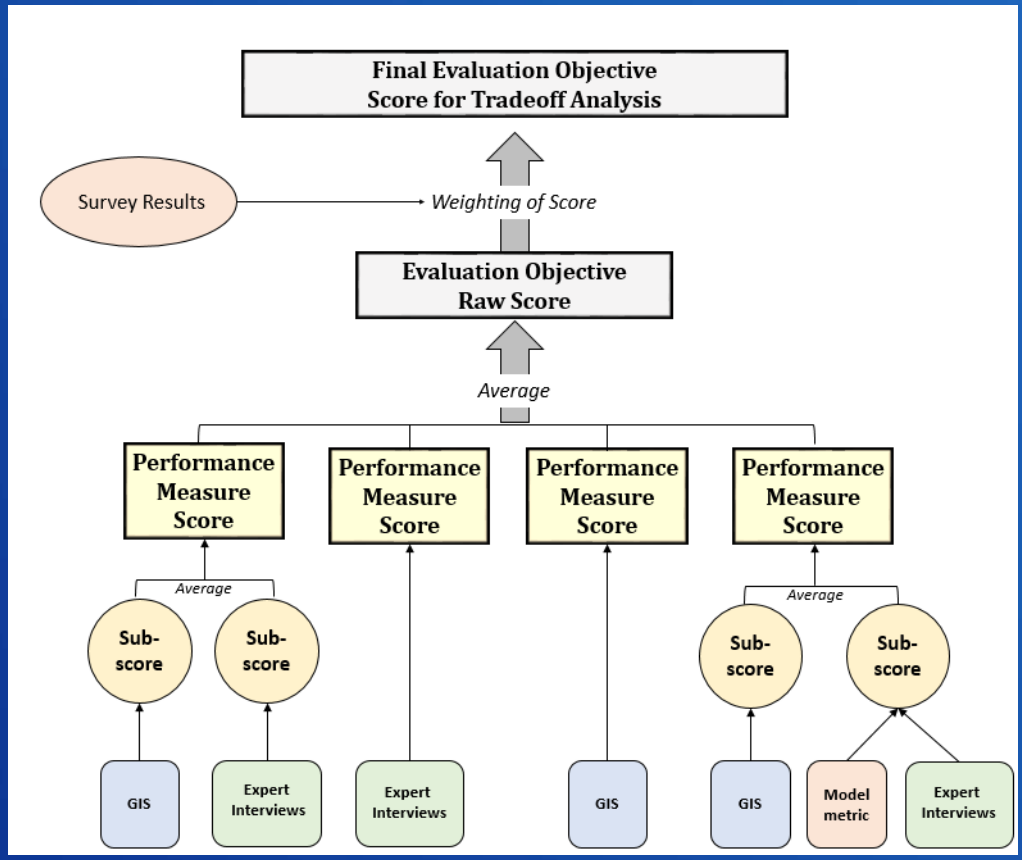
- Surface Water Quality
- Groundwater Quality
- Stormwater and Wastewater Discharges

PM for Address Climate Change Through GHG Reduction

- GHG Mitigation

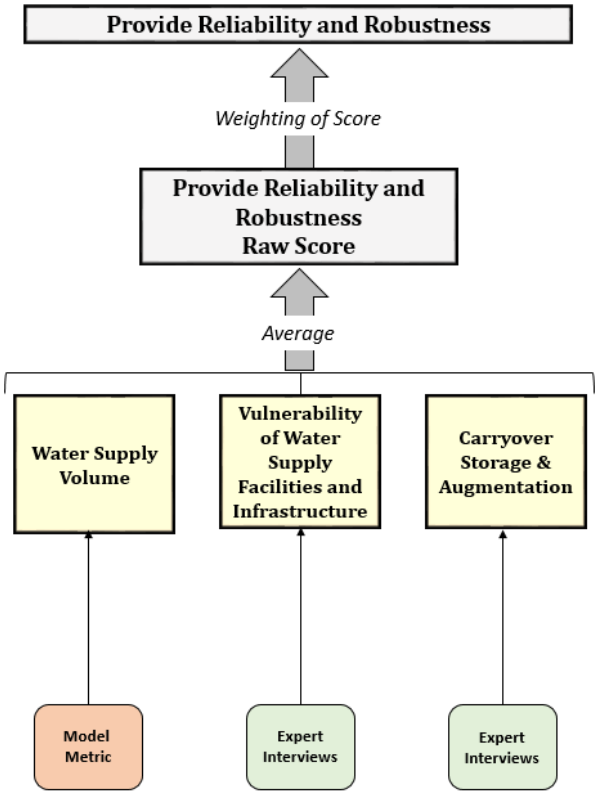
Trade-Off Analysis Input Data

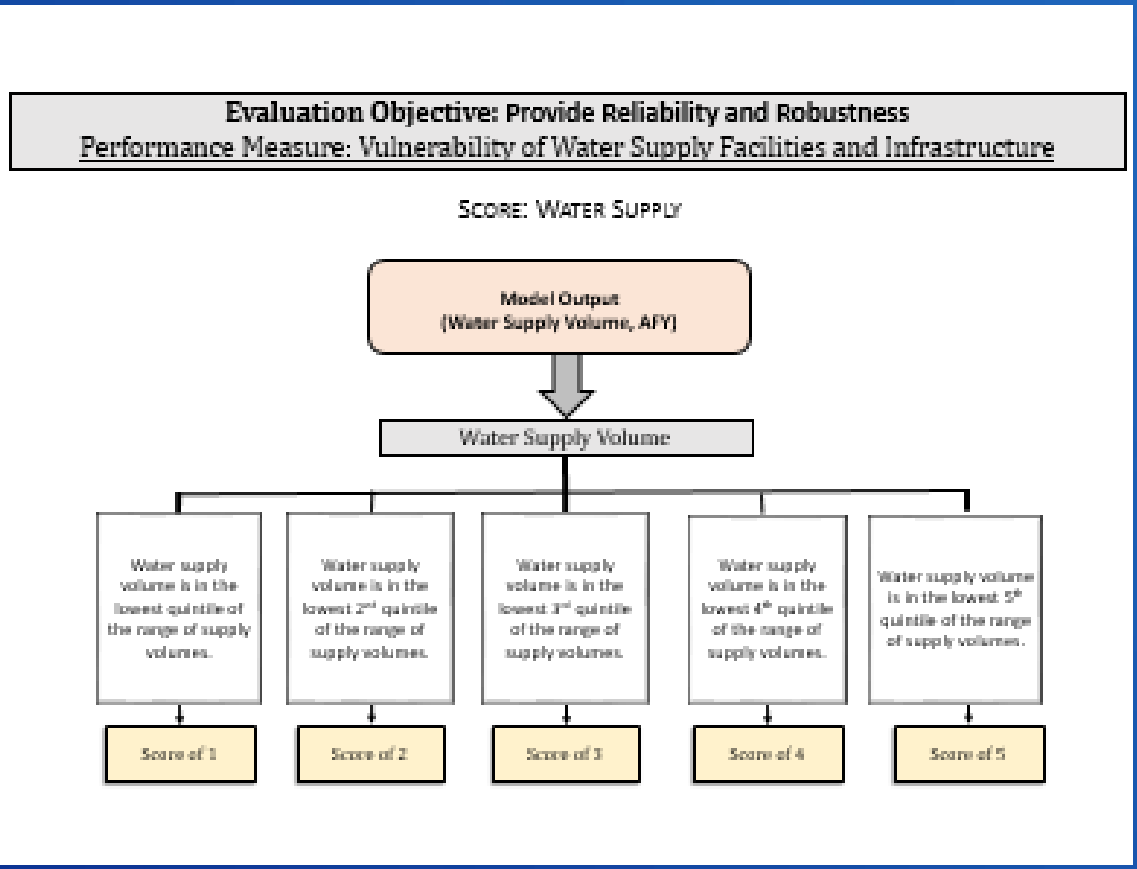
- **How are Performance Measures calculated?**
  - **Model Metric Results**
  - **Expert Interviews**
    - **Concept Questionnaire**
    - **Project Manager Surveys and Interviews**
  - **Geospatial analyses (GIS)**



RECLAMATION

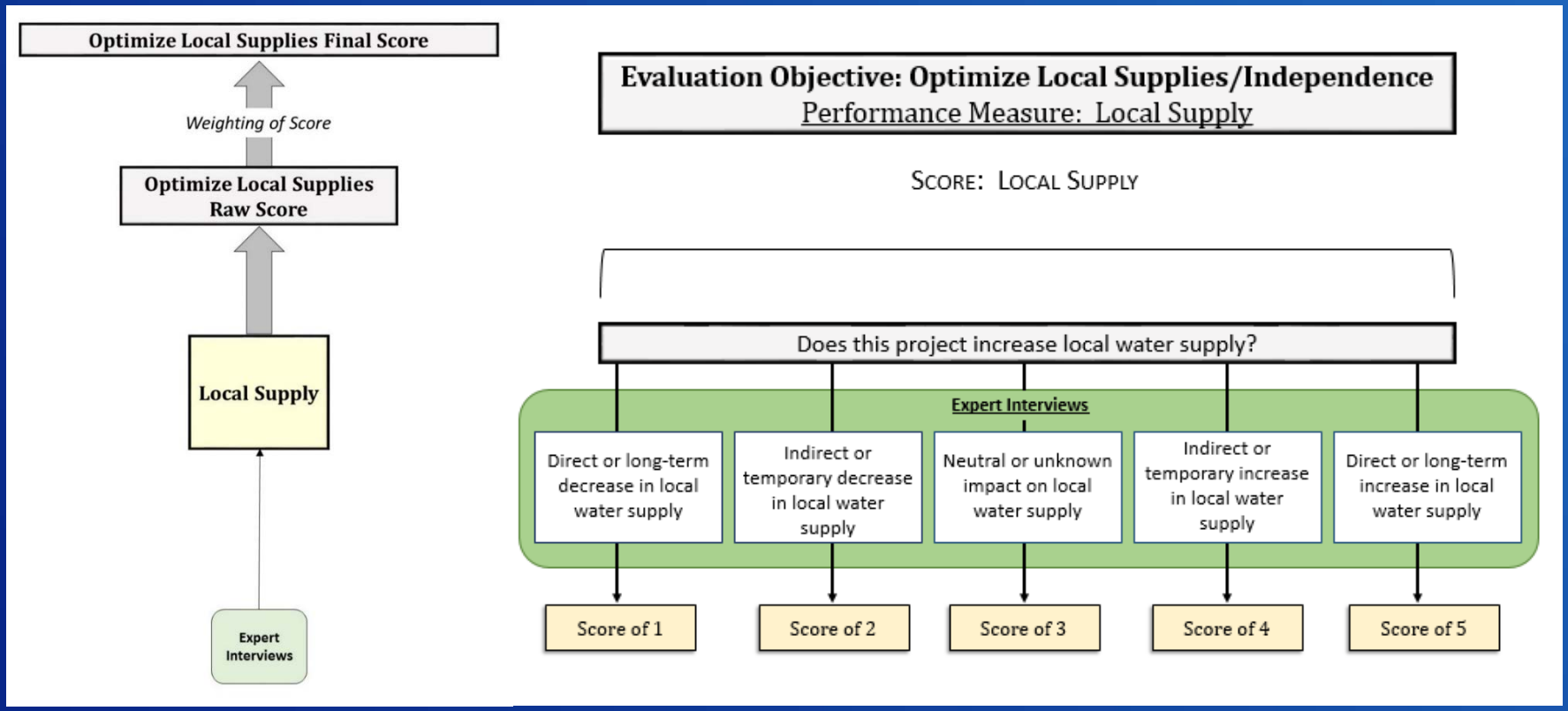
PM Calculation Example: Model output





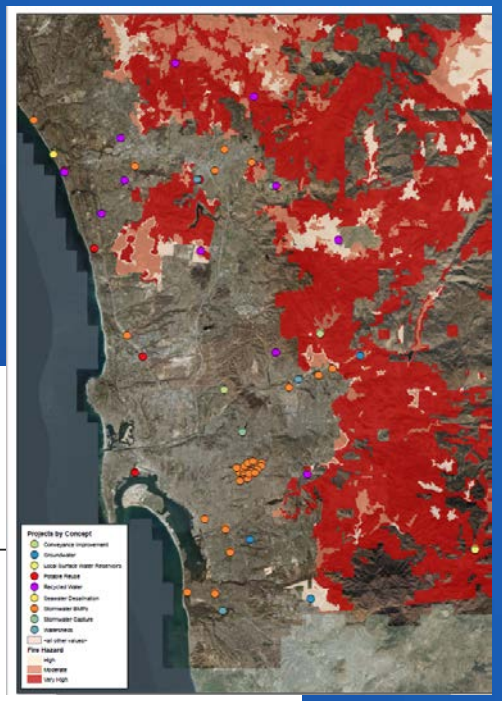
RECLAMATION

PM Calculation Example: Expert Interview



RECLAMATION

PM Calculation Example: GIS Analysis



Evaluation Objective: Climate Resilience
Performance Measure: Warming and Fire Resilience

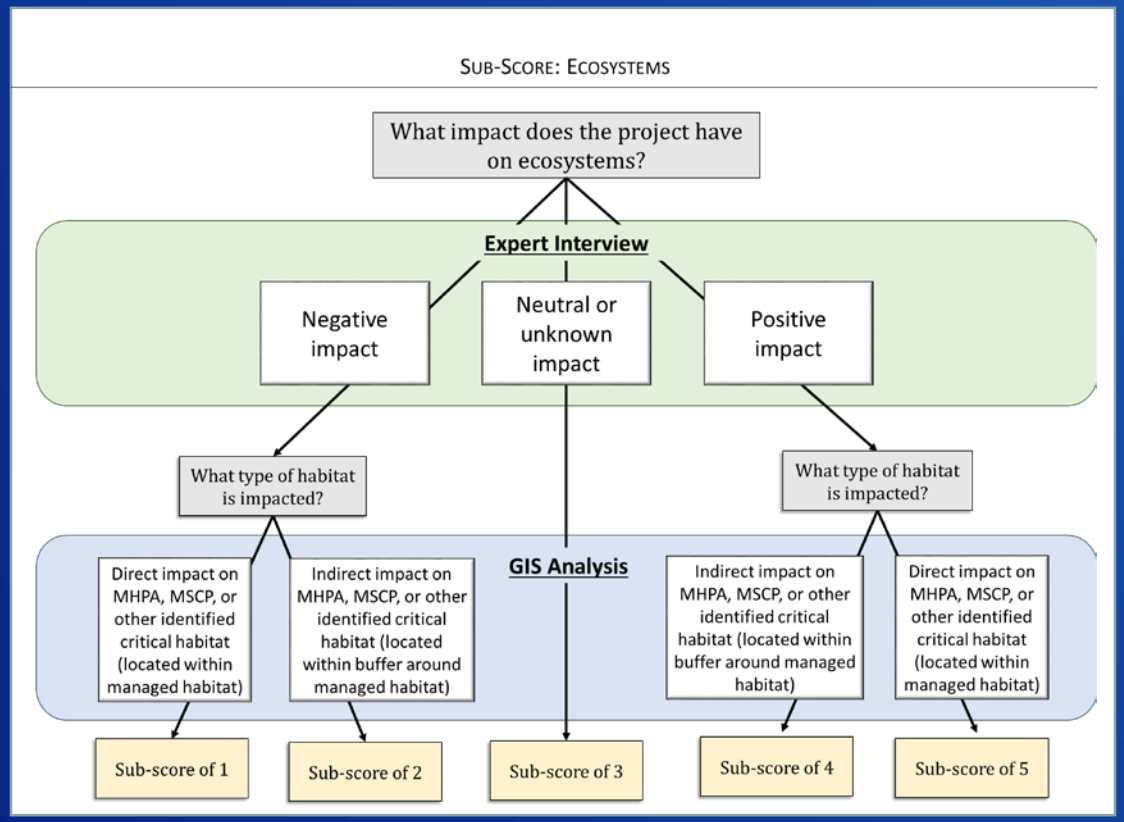
SCORE: WARMING AND FIRE RESILIENCE SCORE

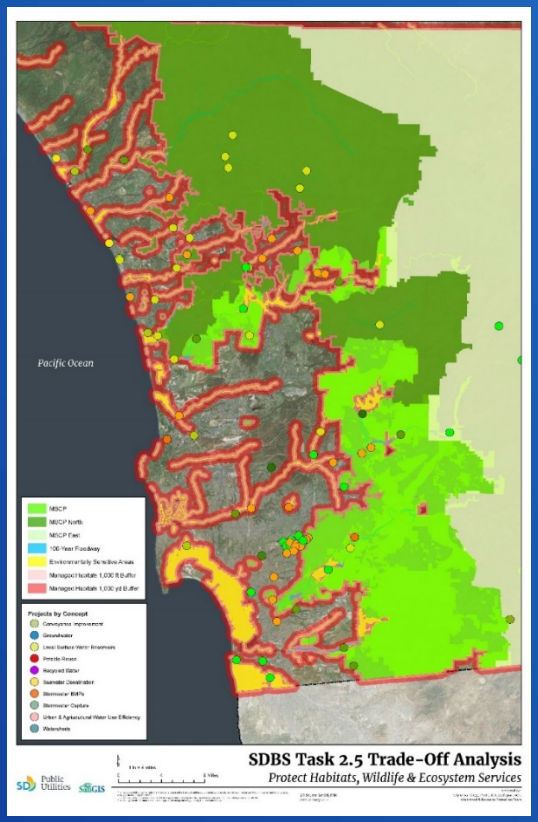
Is the project located within a fire hazard severity zone (FHSZ)?

GIS Analysis

Yes, located within a *very high* FHSZ	Yes, located within a *high* FHSZ	Yes, located within *moderate* FHSZ	No, located *outside* a FHSZ
Score of 1	Score of 2	Score of 3	Score of 5

PM Calculation Example: Expert Interview & GIS Analysis





RECLAMATION

“Traditional” Economic Assessment – Crossover Effects with a Trade-Off Analysis

- There is some crossover between the effects included in the trade-off analysis and a “traditional” economic assessment.
- Examples of crossover:

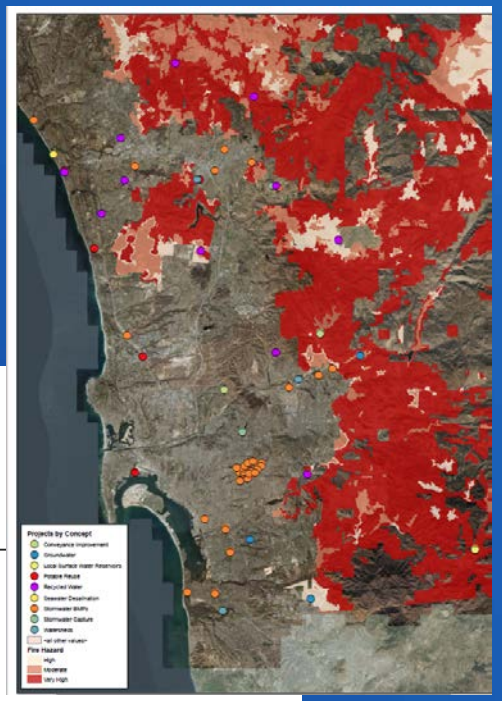
Model Metric	Trade-Off Analysis	“Traditional” Economic Analysis
Water supply volume	Acre-feet used as one performance measure under the Provide Reliability and Robustness Evaluation Objective.	Water Supply Volume in acre-feet is multiplied by an average per acre-foot water supply value to estimate benefits.
Reservoir elevation	Reservoir elevations at four reservoirs are input into recreation visitation models to estimate changes in visitation as one performance measure of the Quality of Life Evaluation Objective.	Reservoir elevations at four reservoirs are input into recreation visitation models to estimate changes in visitation, which is then multiplied by an average value per visit to estimate benefits.

- However, the “Traditional” Economic/Financial Assessment is separate from the Trade-Off analysis.

Examples of Some Preliminary Trade-Off Analysis Results

- **Climate Resilience EO - Warming and Fire Resilience Sub-Score based on GIS input**
- **Quality of Life/Recreation EO – Recreation Visitation Sub-Score based on Task 2.4 Modeling input**
- **Provide Reliability & Robustness EO – Task 2.4 Modeling input and Survey Results**

Preliminary Warming and Fire Resilience Sub-Scores – GIS based



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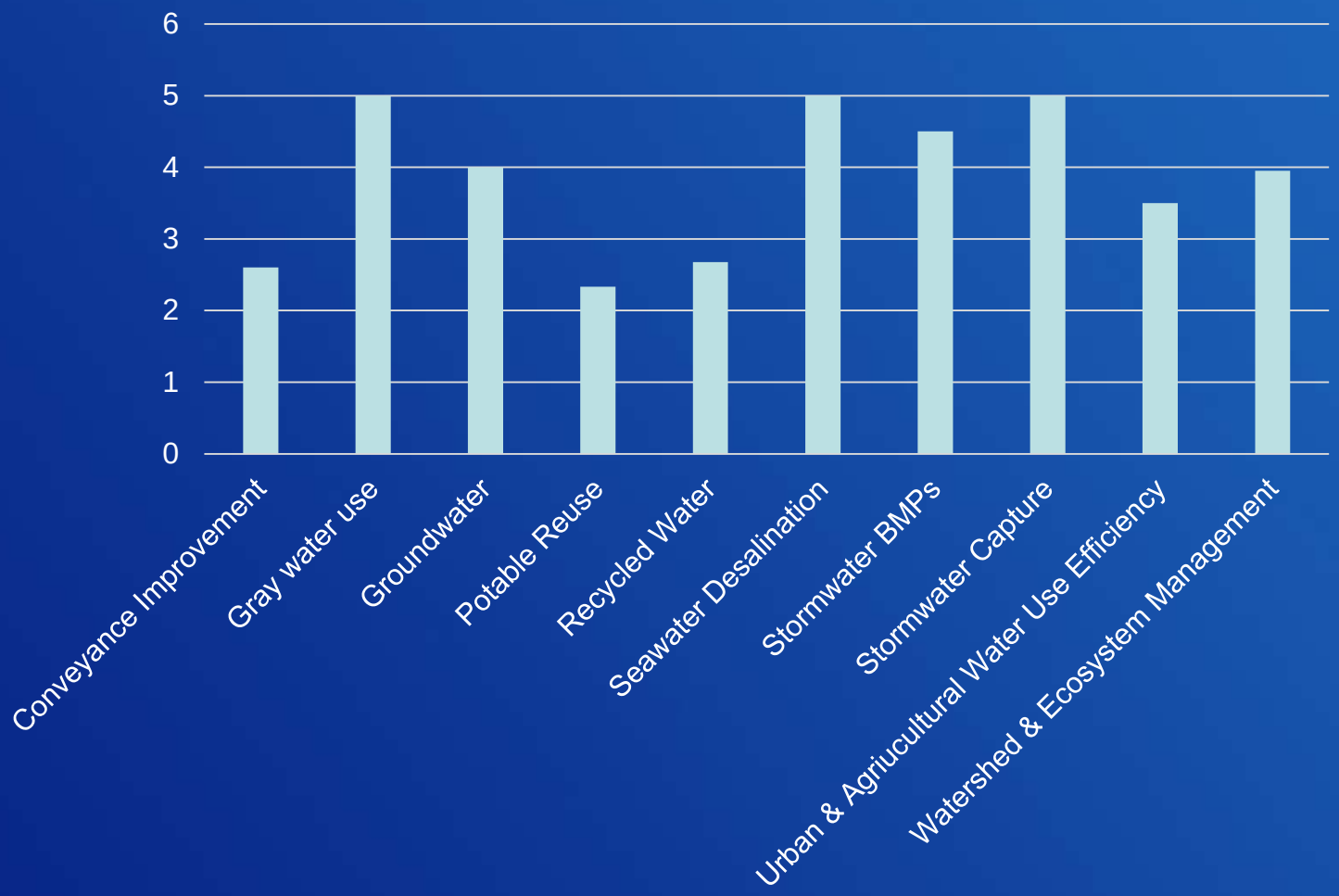
Score of 1	Score of 2	Score of 3	Score of 5

RECLAMATION

Preliminary Warming and Fire Resilience Sub-Scores – GIS based



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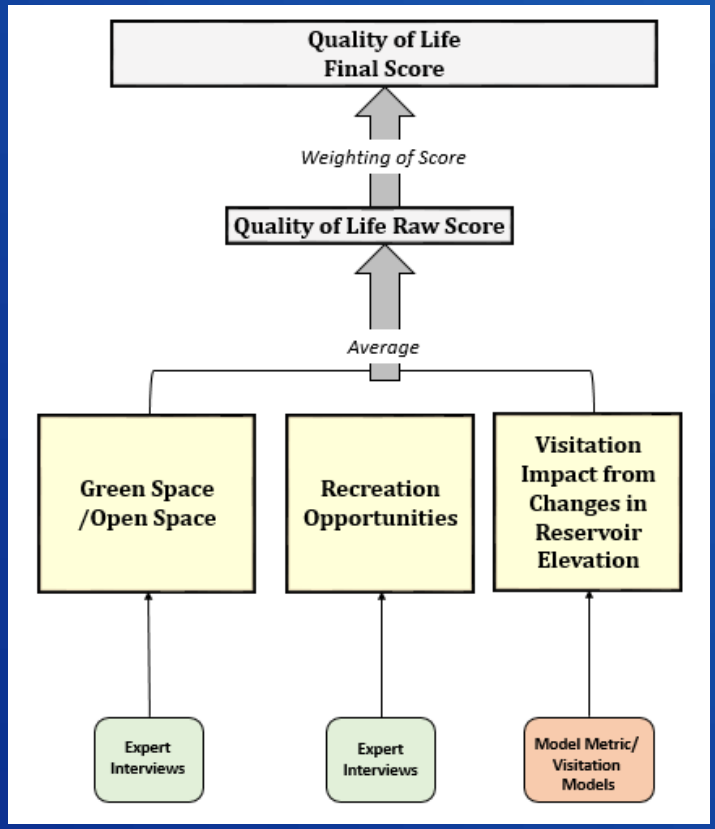
Preliminary Recreation Visitation Sub-Scores – Task 2.4 Model Output based



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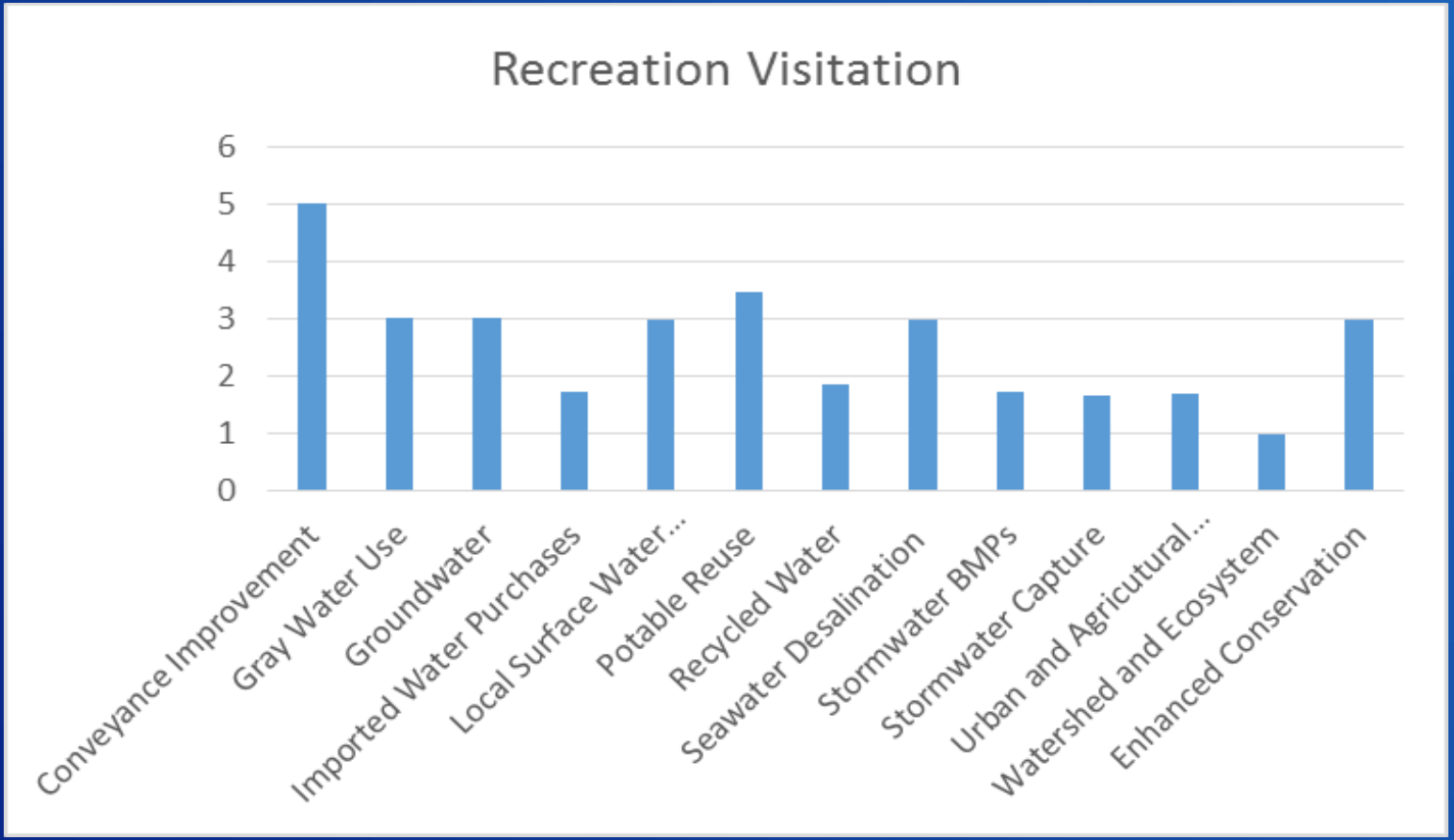
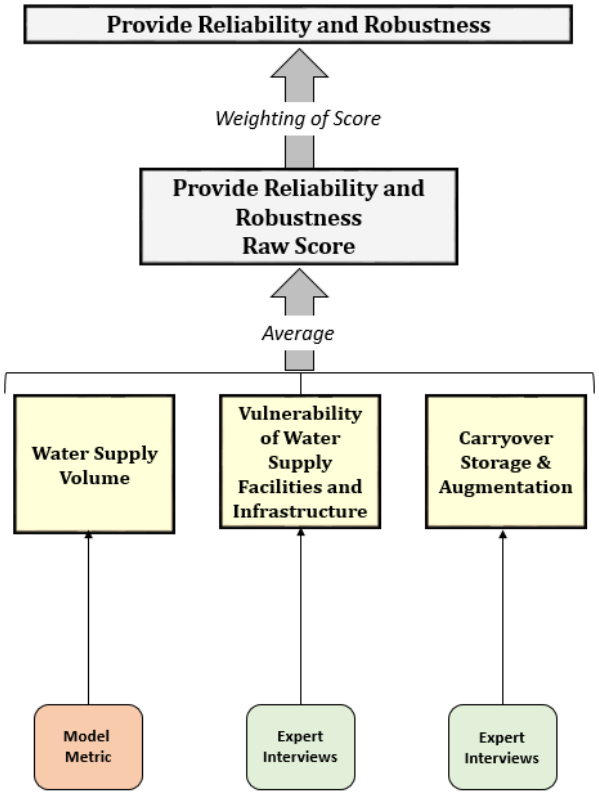
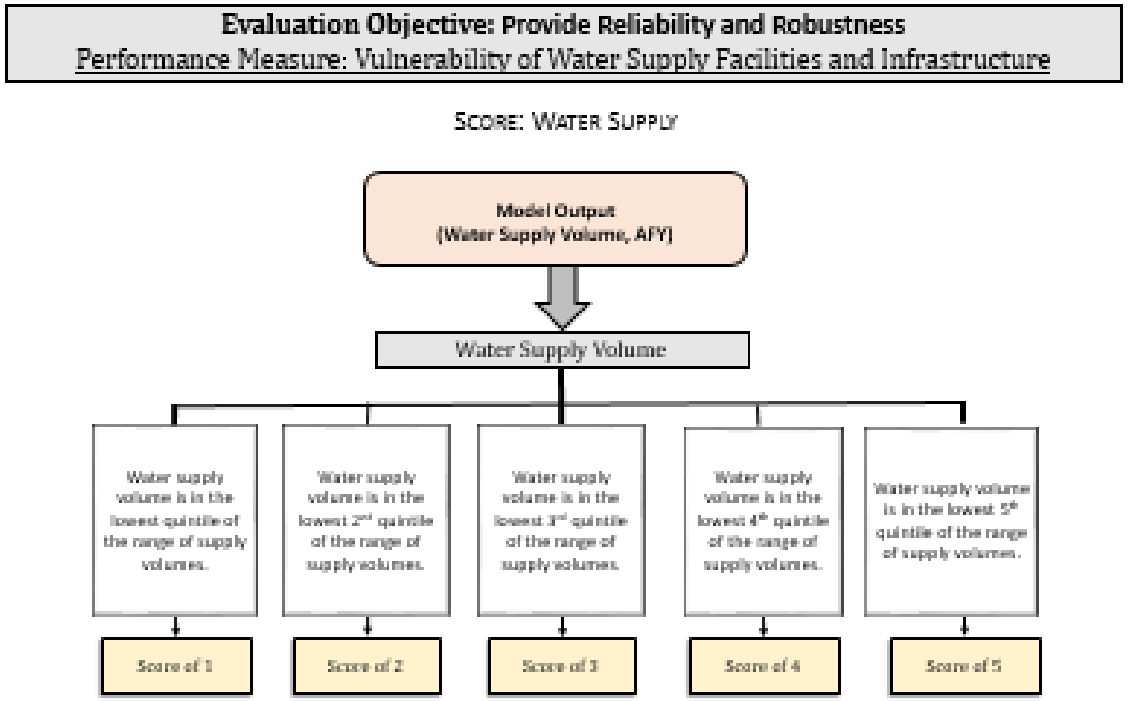
Preliminary Recreation Visitation Sub-Scores – Task 2.4 Model Output based



RECLAMATION

Preliminary Reliability & Robustness Scores – Survey and Task 2.4 Model Output based





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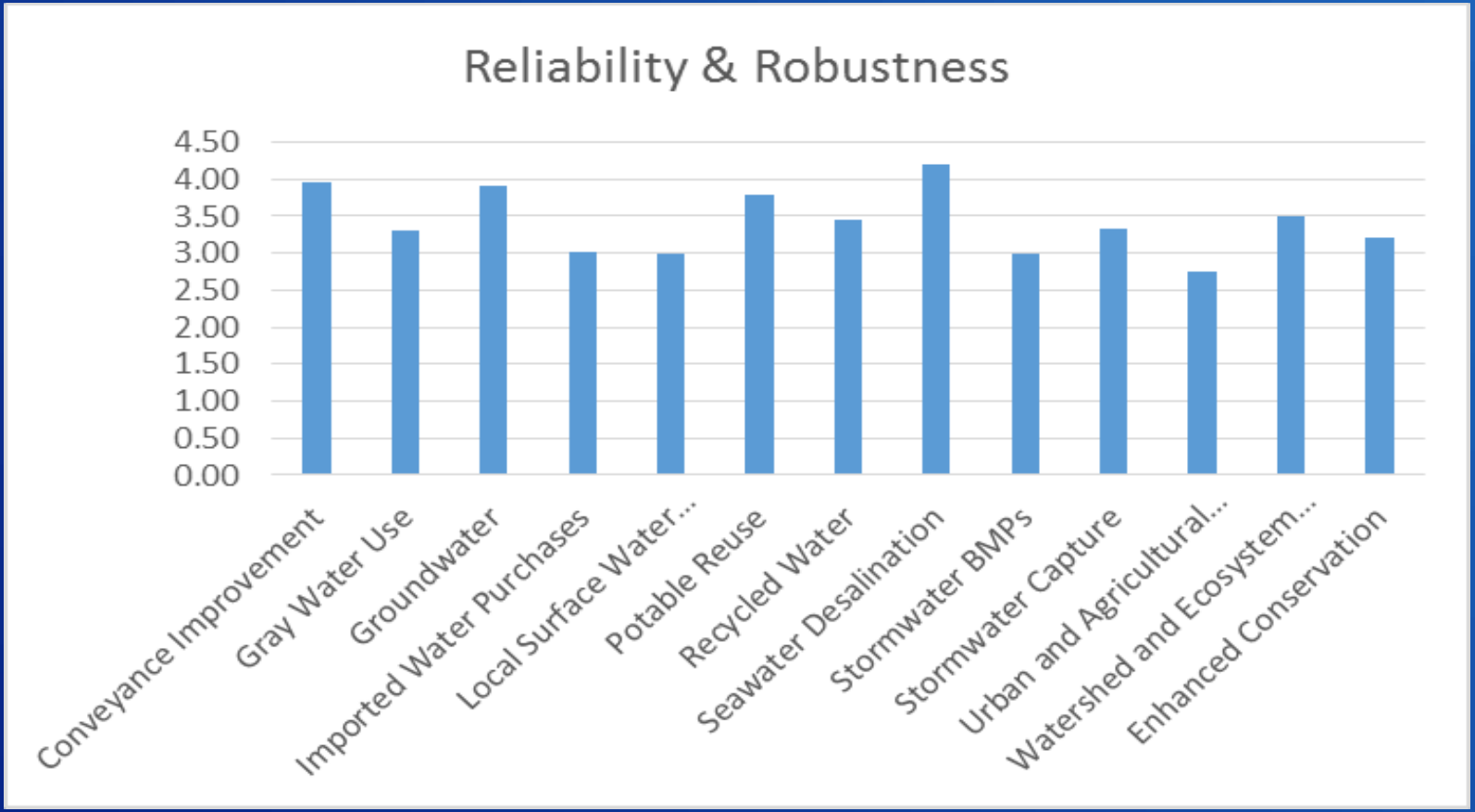
Preliminary Reliability & Robustness Scores – Survey and Task 2.4 Model Output based



RECLAMATION

Future Trade-Off Analysis as a Tool to Develop Your Own Criteria

- Continue evaluating Task 2.4 modeling data and analyzing survey and GIS data
- Estimating Weighted Scores for Individual Concepts
- Complete Chapter on Trade-Off Analysis as a Tool to Develop Your Own Criteria
- Complete Summary and Opportunities Chapter

Agenda

- Welcome & Introductions
- San Diego Basin Study Overview and Update
- Task 2.4 Background, Methods, & Preliminary Results
- Task 2.5 Background, Methods, & Preliminary Results
- **Next Steps**
- Adjournment

Next Steps

- **August 1, 2018 – Comments Due on Task 2.4 and Task 2.5 Interim Reports**
- **September 2018 – Task 2.4 Interim Report Finalized**
- **September 2018 – Task 2.5 Interim Report Finalized**
- **January 2019 – Draft Summary Report available for Public Review**
- **February 2019 –Study Summary Report Finalized**

Request for Review

Documents to Review

- Draft Task 2.4 Interim Report Chapters 1-6
- Task 2.4 Selected Preliminary Results
- Draft Task 2.4 Appendix XX: Projects Spreadsheet
- Draft Task 2.4 Appendix XX: CWASim Detailed Model Implementation Write-ups
- Draft Task 2.5 Interim Report Chapters 1-5
- Draft Task 2.5 Appendix XX: Scoring Rubrics and Decision Trees

Review Due Date: Monday August 1, 2018

- Documents for review will be emailed today
- Email will include a form and instructions for providing comments.

Request for Review

Submitting Comments/Feedback

- **Preferred Option: Use the review form** sent with the draft reports to provide comments.
- **Use Track Changes** in Microsoft Word to provide your comments.
- **Use the comment feature of Adobe Acrobat** to make comments directly on the PDF
- **Type your comments in the body of an email or as an attached document.** Provide as much detail as you can to help us locate the applicable area of the report (e.g. section numbers, page numbers, line numbers).

Send Feedback To: adanner@usbr.gov, sbrower@sandiego.gov, and spiper@usbr.gov

Agenda

- Welcome & Introductions
- San Diego Basin Study Overview and Update
- Task 2.4 Draft Interim Report
- Task 2.5 Draft Interim Report
- Next Steps
- **Adjournment**

RECLAMATION

Questions?

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