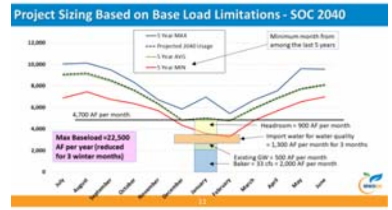
Item No. 1



2018 OC Reliability Study – Draft Report

P&O Committee

Municipal Water District of Orange County

October 1, 2018

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Today's Goals

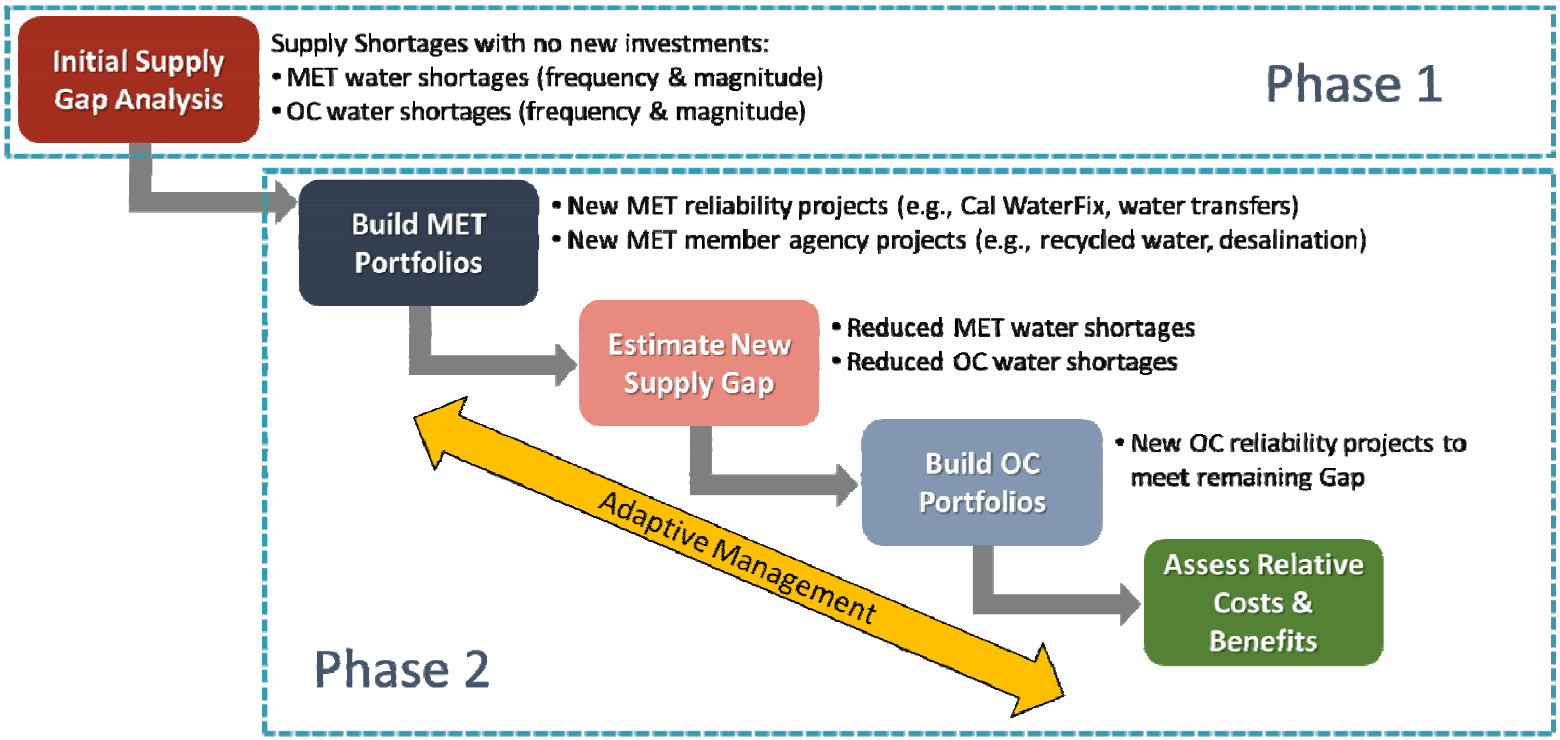
Overview Presentation

1) Describe the Study Methodology
2) Present the Reliability/Gap Results
3) Present Project Evaluations & Water System Integration
4) Discuss Study Findings

Today's Agenda

1) Background & Study Objectives
2) System Reliability
    1) Needs – Projects – Costs
    2) System Integration
3) Supply Reliability
    1) Demand – Supply – Scenarios
    2) Reliability Modeling & Gaps
    3) New Orange County Water Projects
    4) Project Financial Evaluations
    5) System Integration
4) Findings

Overview of 2016 OC Reliability Study



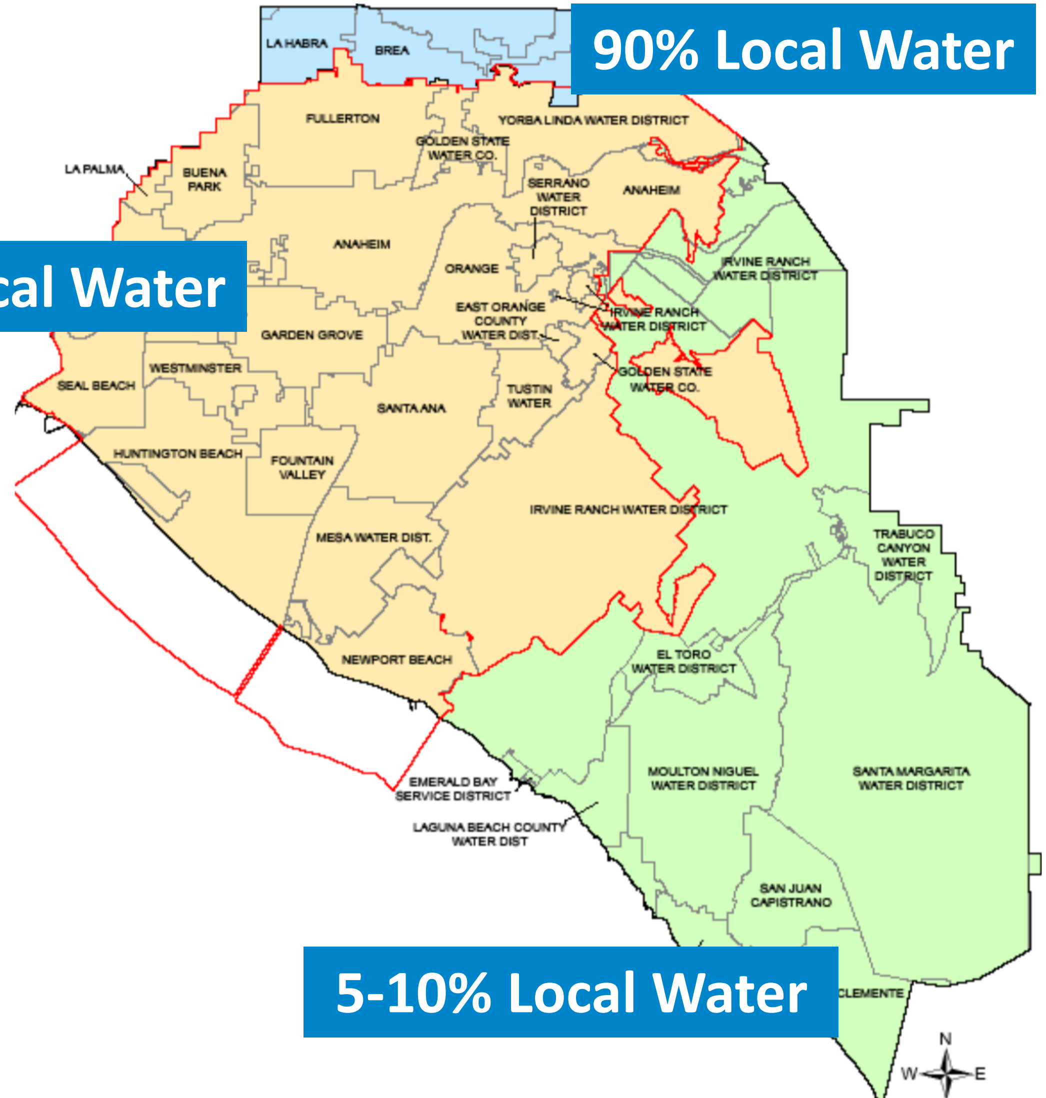
Selected for 2016 Study

Scenario 2: Moderate Growth and Climate Change

MET Portfolio B: New LRP Projects, Additional CRA & SWP Transfers, and Carson IPR project – **but without WaterFix**

Three Study Areas in OC

Reliability evaluations are conducted for three regions within OC because the dependence on local groundwater sources varies considerably



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Overview of 2016 OC Reliability Study: FINDINGS
Assuming Scenario 2, MET Portfolio B

OC Basin and Brea/La Habra Areas
Remaining supply needs relatively small, and could be achieved with targeted drought conservation and basin management

SOC Area
Remaining supply needs moderate, especially given emergency system needs, and could not be achieved with targeted drought conservation

SOC Local Project Assessment
Remaining supply needs could be achieved in cost-effective manner, with various combinations of local projects – **assuming no WaterFix**

Adaptive Management is key to addressing uncertainties, monitoring key outcomes and reducing risks

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Changed Conditions and Need for 2018 Study

- MET financially committed to WaterFix, assumed operational date 2035
- MET completed <u>detailed</u> feasibility report on Carson IPR project
- Newer set of global climate models (GCMs) indicate:
  - Future temperatures will be significantly greater than GCMs used in 2016 Study
  - Future precipitation will have significantly more variability & average values greater than those used in 2016 Study
- Implementation of Bureau of Reclamation's Draft Drought Contingency Plan for Colorado River results in greater MET shortages
- Several local Orange County projects have advanced
- Additional work completed on evaluating emergency needs in South Orange County (SOC)

Objectives for 2018 OC Study

NOT DICTATING MEMBER AGENCY DECISIONS

1) Provide unbiased, factual analysis of projects and the benefits they provide for decision-making purposes
2) Develop new planning scenarios, reflecting changed conditions for MET reliability (assumes WaterFix and newer climate models)
3) Determine new water **<u>supply</u>** gaps (reliability curves) for OC Basin and SOC areas under new planning scenarios
4) Determine new water **<u>system</u>** (emergency) gap for SOC based on newer assumptions on emergency water demand needs
5) Estimate cost-effectiveness of OC local projects in meeting supply reliability needs (Basin and SOC) and system reliability needs (SOC)

What is Water Reliability?

System Reliability

- How reliable is your system (can demands be met) under different emergency situations?

Supply Reliability

- How often are you short water supplies and how much are you short (Mandatory Reductions)

System Reliability (Emergencies)

System Reliability during unplanned outages is needed for basic health and safety and should be top priority for water agencies – immediate need

<u>For SOC where imported water represents >90% of total supply:</u>

Monthly indoor water demand (with little to no irrigation) plus business demands

minus

Existing local water supplies (including emergency reservoir storage)

equals

Need for New Local Projects

NOTE: Many Local Water Projects in SOC Provide Both System <u>and</u> Supply Reliability

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MET Seismic Performance Expectations
Estimated Outage Durations

Facility	Maximum Considered Earthquake
Metropolitan – CRA (Colorado River Aqueduct)	2-6 months
Dept. of Water Resources – SWP (State Water Project East & West Branches)	**6-24+ months (see next slide)**
Metropolitan - Conveyance & Distribution Pipelines	1 week to 3 months
Metropolitan - Treatment Plants	1-2 months (Partial flow) Up to 6 months (Full capacity)

60 days without MET

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Expectations when the BIG Earthquake happens!

- Local Agencies plan for up to 60-days without MET and 7 days or more without the power grid
- MET/DWR planning for greater than 60 days
  - MET retains minimum of 630,000 AF in emergency storage
    - MET is currently conducting an emergency storage review
  - DWR is working on Emergency Flow Pathway in Delta
  - MET/DWR/LADWP working on Resilience Planning
- Assume “reduced” consumer demand based on emergency situation and media outreach

Various Emergency Demand Scenarios for SOC

SOC Agency Potable Demand Scenarios in million gallons per day (MGD)									
	1	2	3	4	5	6	7	8	9
	Normalized Potable Demand 2017-18	Wet Potable Demand December 2014	Very Wet Potable Demand January 2017	Dry/Hot Potable Demand August 2012	75% Normalized Potable Demand 2017-18	2040 Potable Demand	SWRCB Potable Demand During Recent Drought	Summer 2015 Potable Demand	2040 Indoor at 55 gpcd + 2040 CII
El Toro WD	7.0	4.3	3.7	10.6	5.3	7.2	6.5	7.8	6.5
Moulton Niguel WD	22.0	15.6	13.8	32.2	16.5	22.7	20.0	23.7	19.2
San Clemente	7.1	4.6	3.9	10.5	5.3	7.5	6.2	7.3	6.1
San Juan Capistrano	7.2	3.7	3.1	10.0	5.4	5.2	5.4	7.0	4.7
Santa Margarita WD	21.5	13.5	9.9	33.6	16.1	17.8	18.9	23.5	18.0
South Coast WD	4.9	3.7	3.3	7.2	3.7	4.7	4.5	4.8	4.3
Trabuco Canyon WD	2.2	1.5	0.6	3.8	1.7	2.3	1.9	2.3	1.2
Total Potable Demand (MGD)	**72.0**	**46.9**	**38.3**	**107.9**	**54.0**	**67.4**	**63.4**	**76.5**	**60.1**

Recommended Scenarios

Summary of Emergency Reliability Needs in CFS and MGD for SOC Assumes NO Emergency Capacity from the SOC Interconnection								
	75% Normalized Potable Demands 2017-18 GPM	Recovery Needs from OC GAP Analysis at 75% of Normalized Demands GPM	Recovery Needs CFS	Recovery Needs MGD	Demands at 2040 Indoor at 55 gpcd + 2040 CII Demands GPM	Recovery Needs from OC GAP Analysis with 2040 Indoor at 55 gpcd + 2040 CII Demands GPM	Recovery Needs CFS	Recovery Needs MGD
El Toro WD	**3,673**	**194**	**0.4**	**0.3**	**4,557**	**1,195**	**2.7**	**1.7**
Laguna Beach CWD	**1,580**	**0**	**0.0**	**0.0**	**1,700**	**0**	**0.0**	**0.0**
Moulton Niguel WD	**11,518**	**4,708**	**10.5**	**6.7**	**13,361**	**6,794**	**15.1**	**9.7**
San Clemente	**3,704**	**2,473**	**5.5**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
San Juan Capistrano	**3,763**	**1,894**	**4.2**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Santa Margarita WD	**11,254**	**2,863**	**6.4**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
South Coast WD	**2,580**	**1,847**	**4.1**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Trabuco Canyon WD	**1,166**	**0**	**0.0**	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	37,657	**13,979**	**31.1**	**20.0**	**43,592**	**19,149**	**42.6**	**27.5**

SOC needs between 20.0 to 27.5 MGD assuming NO capacity is available through the SOC Interconnection

(1) "Recovery needs" assumes use of wells, Baker Treatment Capacity, other local production and use of tank and reservoir storage over 60 da

(2) "Recovery needs" assumes NO emergency capacity is available from IRWD; this option is still under investigation

System Reliability Projects Being Discussed

Groundwater

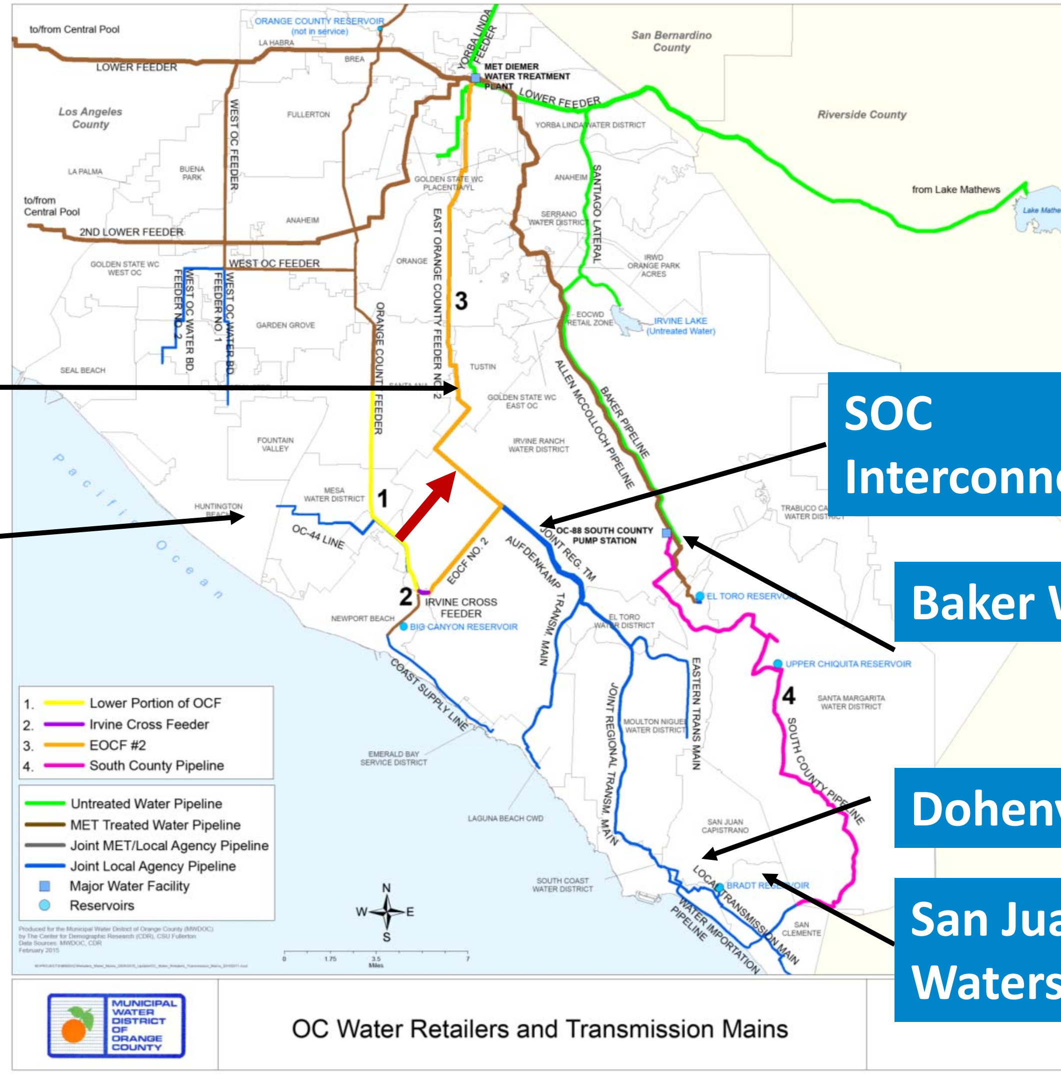
Poseidon Water

SOC Interconnection

Baker WTP

Doheny Water

San Juan Watershed



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Evaluating the New Local Projects

Evaluation Metric (EM)

System Reliability EM = Avoided annual MET water purchases **MINUS** local project capital and O&M costs over life of project, **DIVIDED** by project capacity (MGD). ***Positive numbers are better than negative numbers.***

Supply Reliability EM = *When there are no expected water shortages*, EM is avoided annual MET water purchases **DIVIDED** by local project costs (capital and O&M) over life of project; BUT *during water shortages,* EM is avoided annual MET water purchases **PLUS** avoided drought allocation surcharge, **DIVIDED** by local project costs. ***A ratio near or greater than 1.0 is better than a ratio less than 1.0.***

Ranking of SOC Local Projects for System Reliability

Project	Max Capacity (MGD)	EM [2] 1A	EM 1B	EM 2A	EM 2B	Average EM	Project Ranking [3]
Doheny Local (SCWD)	4.75	-$5.9	-$2.8	-$5.6	-$1.0	-$3.8	4
Doheny Regional	9.50	-$3.0	**$0.3**	-$2.7	**$2.3**	-$0.8	**1**
San Juan Watershed Project	8.50	-$5.1	-$2.3	-$4.9	-$0.6	-$3.2	3
Poseidon SOC	14.25	-$10.3	-$7.0	-$10.0	-$5.0	-$8.1	5
Emergency Groundwater [1]	9.70	-$2.3	-$2.3	-$2.3	-$2.4	-$2.3	2

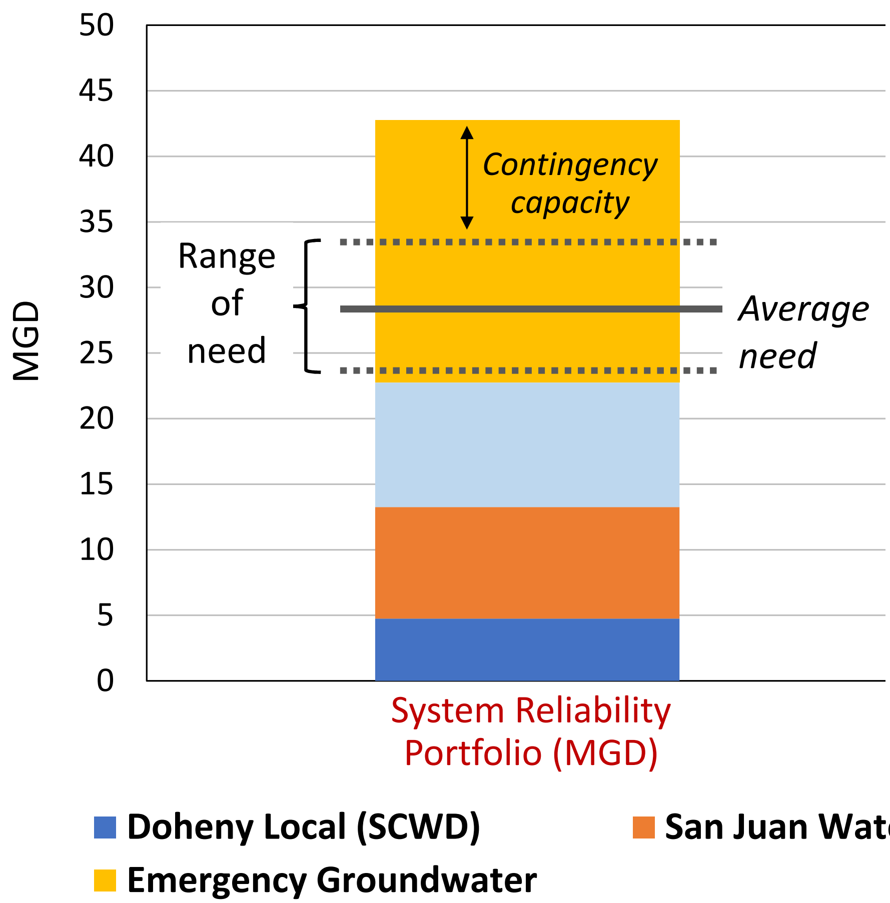
1) This project is scalable to fill remaining system reliability need.
2) Represents avoided discounted MET water purchases for different water rate scenarios LESS discounted project costs, DIVIDED by emergency capacity (MGD) = $/MGD. Positive numbers indicate that project is cheaper than purchasing MET water over the life of project. Negative numbers indicate that project is more expensive than purchasing MET water.
3) Ranking is based on average EM between four scenarios, converted to a rank score from 1 (best) to 5 (worst).

SOC Emergency Supply Portfolios

Project	Max Capacity (MGD)	High Benefit Portfolio (MGD)	Hedge Portfolio (MGD)
Doheny Local (SCWD)	4.8	4.8	4.8
Doheny Regional	9.5	9.5	4.8
San Juan Watershed Project	8.5	8.5	4.3
Subtotal	**22.8**	**22.8**	**13.9**
Additional Capacity (Emergency Groundwater)		4.7	10 – 20 (1)
Total		**27.5**	**24 - 34**

(1) Provides for near-term emergencies to allow service to larger geographic area; to be developed through Emergency Groundwater or pump-in to the EOCF#2 in cooperation with OCWD.

SOC Portfolio for System Reliability



- **Three most cost effective base loaded local projects form the base**
  - **Doheny Local**
  - **San Juan Watershed**
  - **Doheny Regional**
- **Additional capacity added with Emergency Groundwater Projects**
- **Opportunity to build contingency capacity with emergency groundwater**

Supply Reliability

Supply Reliability during dry years is needed for long-term economic vitality and quality of life

<u>For SOC and OC Basin:</u>

Annual total water demand

less

Existing water supplies and expected MET water supplies during wet, normal and dry hydrologic periods

equals

Need for New Local Projects, Extraordinary Supplies, Basin Management, and/or Demand Curtailment

NOTE: Many Local Water Projects in SOC Provide Both System <u>and</u> Supply Reliability

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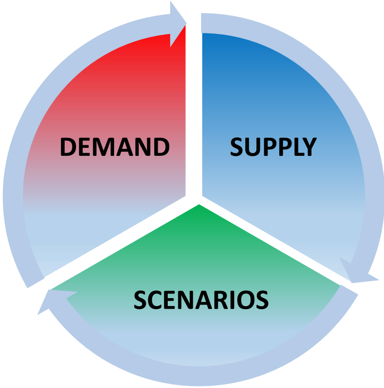
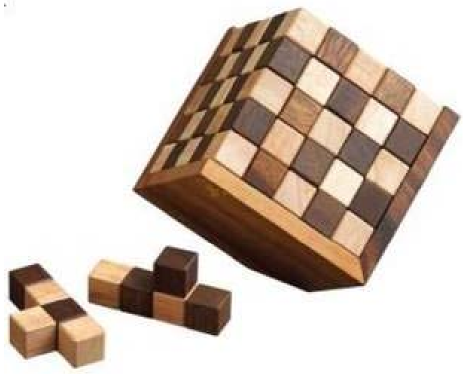
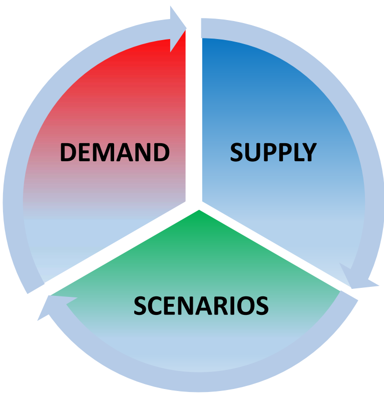
Supply Reliability Analysis Process





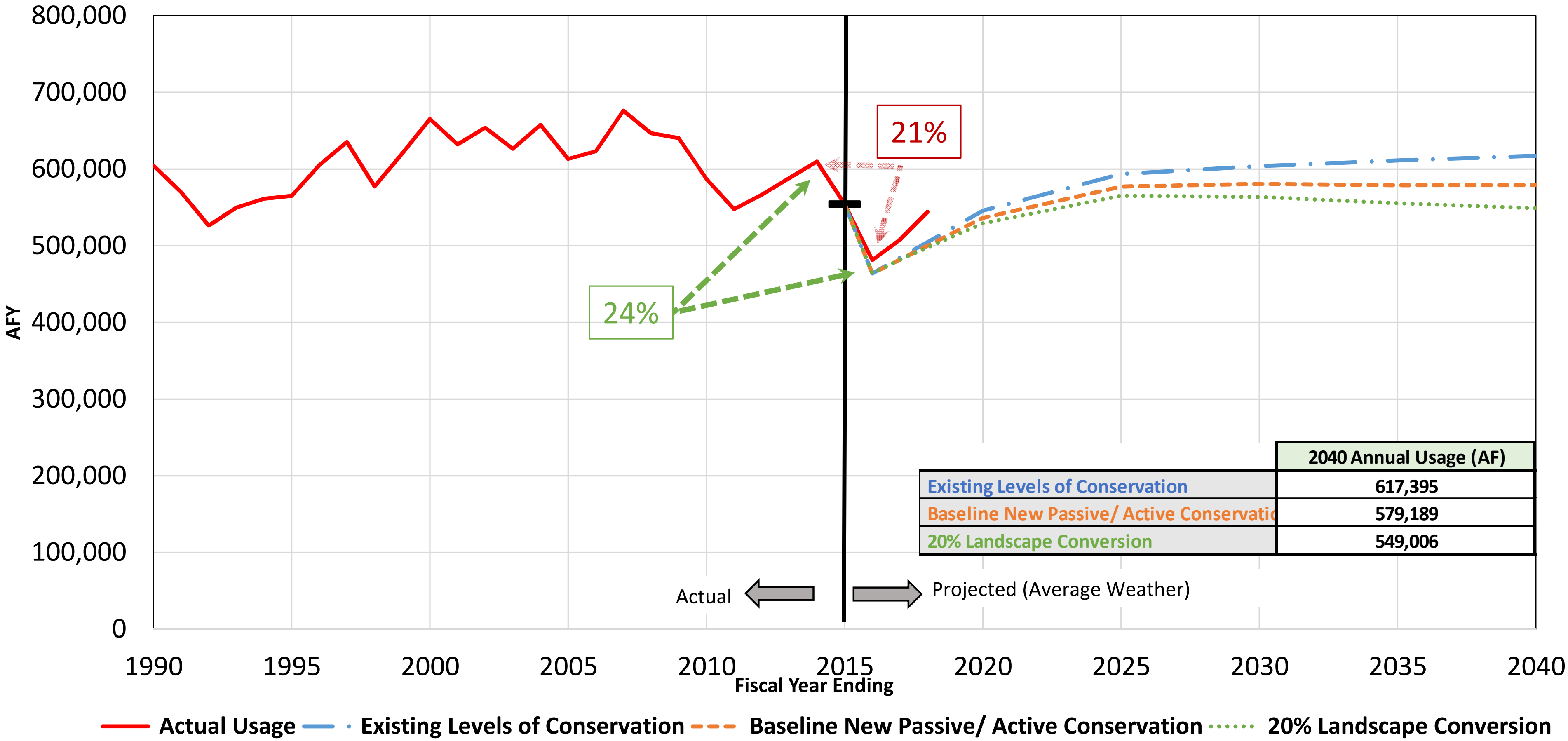
DEMAND, SUPPLY & SCENARIOS → RELIABILITY MODELLING & GAPs → NEW OC WATER PROJECTS → PROJECT FINANCIAL EVALUATIONS → SYSTEM INTEGRATION

Supply Reliability Analysis Process



DEMAND, SUPPLY & SCENARIOS → **RELIABILITY MODELLING & GAPs** → **NEW OC WATER PROJECTS** → **PROJECT FINANCIAL EVALUATIONS** → **SYSTEM INTEGRATION**

O.C. Water Demand Forecast



	2040 Annual Usage (AF)
Existing Levels of Conservation	617,395
Baseline New Passive/ Active Conservatio	579,189
20% Landscape Conversion	549,006

CMIP5 RCP8.5 Climate Models and Impacts on Supplies

Less Impact on supplies

Greater Impact on supplies

GCMs with minimal impacts on SWP and *no* impacts on CRA

GCMs with *moderate* impacts on either CRA or SWP supplies (but not both)

GCMs with *significant* impacts on both CRA & SWP supplies

MINIMAL Climate Change

SIGNIFICANT Climate Change

Used for 2018 OC Study Scenarios

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2018 OC Study Update Planning Scenarios (through 2050)

Scenario Name	WaterFix	New CRA Transfers (AFY)	New SWP Transfers (AFY)	New LRP Supply (AFY)	Carson IPR Project (AFY)	New MET Reservoir (AFY)
1. Minimal Climate Change*						
A) Low-Cost MET investments	Yes (2035)	100,000 (2020)	0	88,000 (2025)	0	0
B) High-Cost MET Investments	Yes (2035)	100,000 (2020)	150,000 (2035)	88,000 (2025)	168,000 (2029)	0
2. Significant Climate Change**						
A) Low-Cost MET investments	Yes (2035)	180,000 (2030)	150,000 (2035)	162,000 (2030)	0	0
B) High-Cost MET investments	Yes (2035)	180,000 (2030)	300,000 (2035)	162,000 (2030)	168,000 (2029)	400,000 (2035)

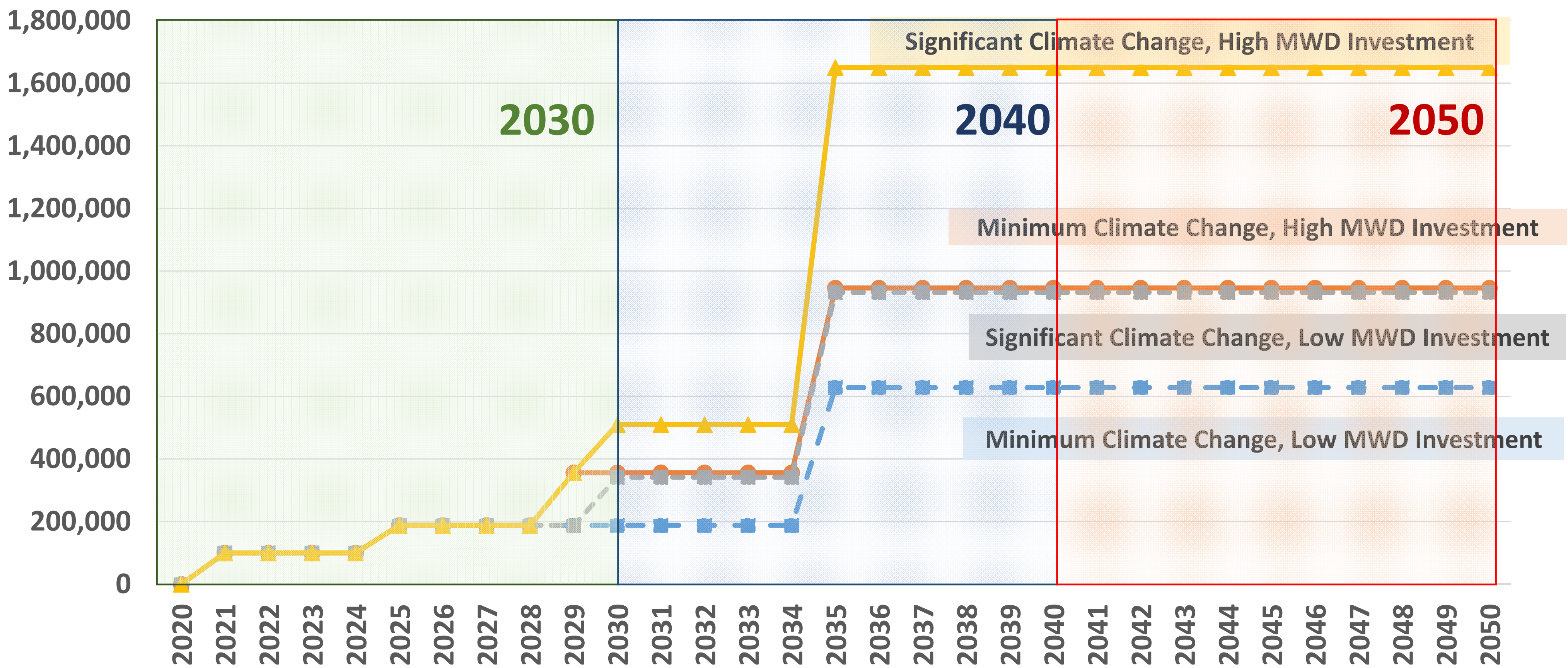
* Only includes minimal climate impacts on SWP supplies (as modeled by CA DWR, and defended by several CMIP5 GCMs)

** Significant climate change on SWP and CRA supplies, and moderate impacts on demands and SAR (based on CSIRO GCM)

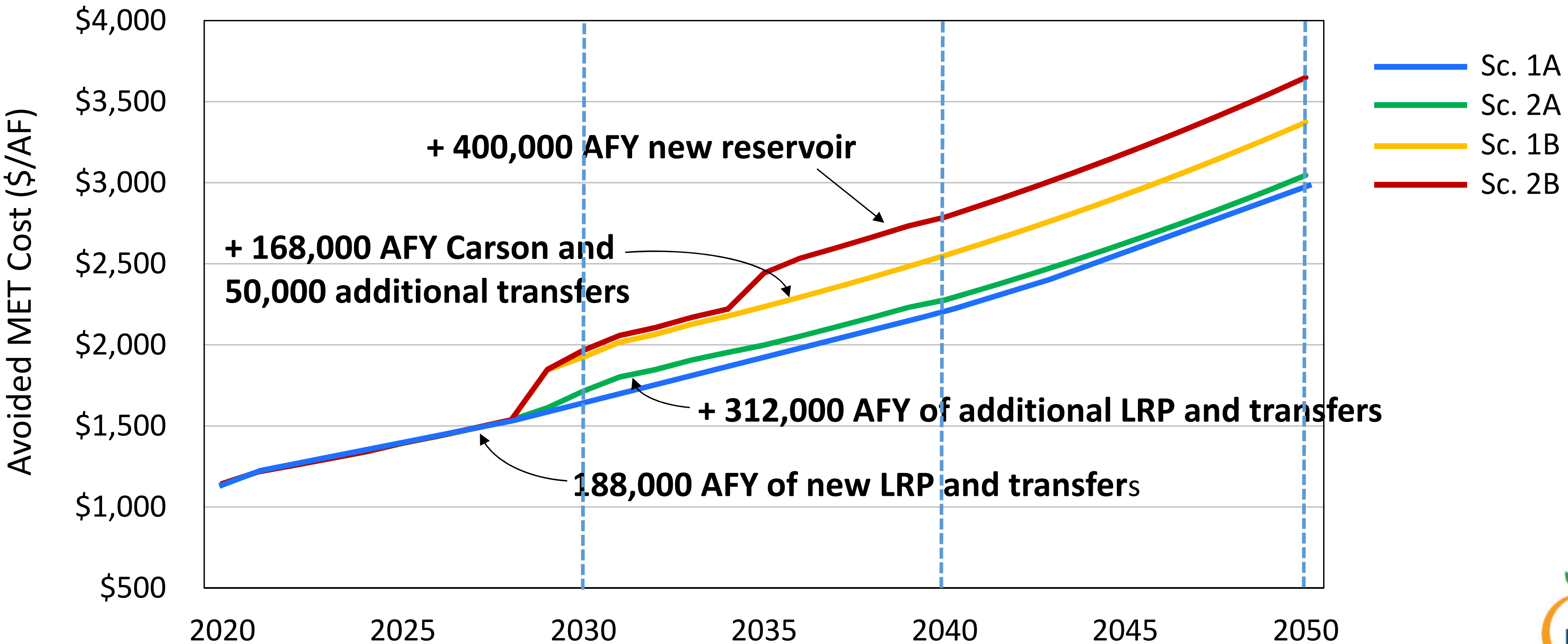
NEW Supplies Included Under the Various Scenarios (1,000's of AF per Year)

New Supplies Above MET's Current	Scenario			
	1A	1B	2A	2B
WaterFix (approved by MET Board)	440	440	440	440
CRA Transfers (base loaded)	100	100	100	100
LRP (base loaded)	88	88	88	88
Carson IPR (base loaded)	0	168	0	168
More LRP (base loaded)	0	0	74	74
More CRA Transfers (dry year)	0	0	80	80
SWP Transfers (dry year)	0	150	150	150
More SWP Transfers (dry year)	0	0	0	150
Regional Surface Reservoir (dry year)	0	0	0	400
Total Base Loaded and Dry Year	**628**	**946**	**932**	**1,650**

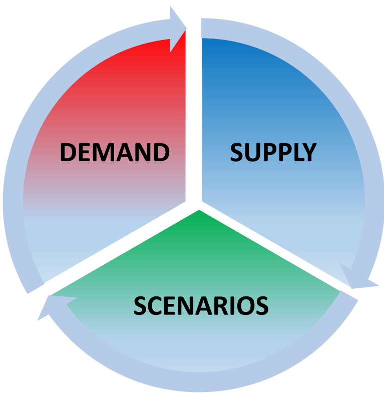
NEW MET Supplies - Combination of Transfers, Local Projects, Carson IPR, WaterFix, & Additional Surface Reservoir (for Sc 2B) in AF per Year

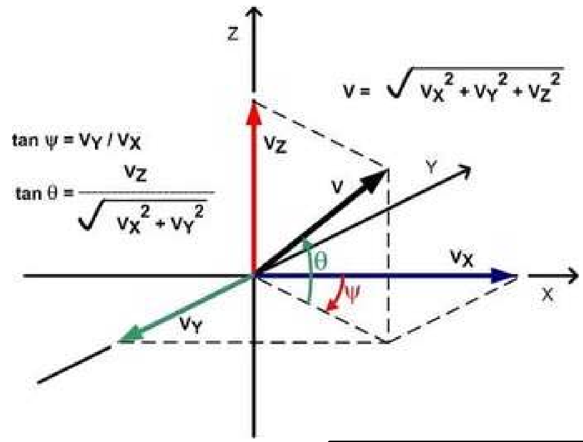


MET Rate Projections by Planning Scenario
(MET Tier 1 Treated Rate + MWDOC RTS/Capacity charge)



Supply Reliability Analysis Process





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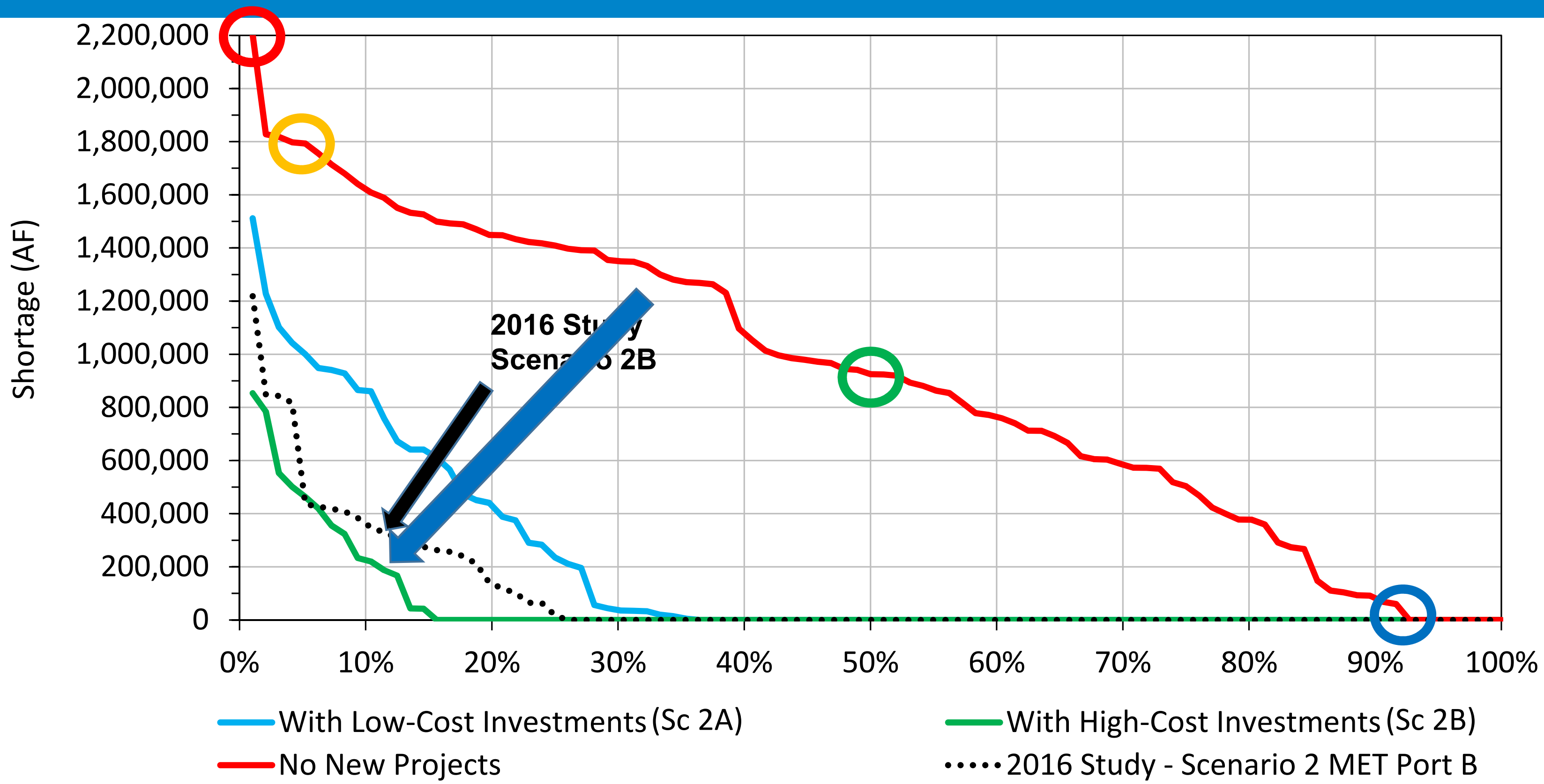
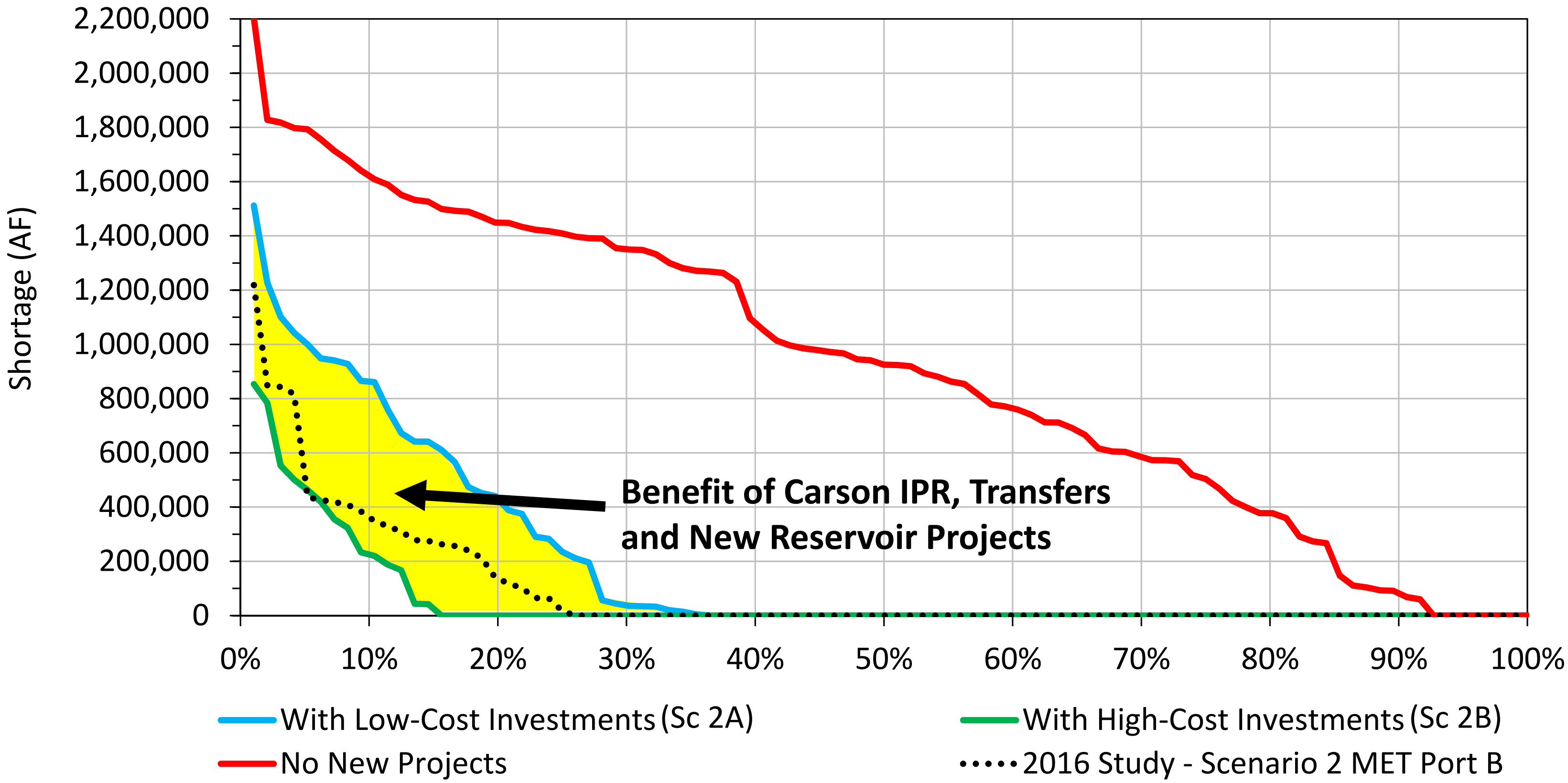
94 Hydrologies
Probability & Volume of Supply Shortages

MET Supply Gaps
With Significant Climate Change Impacts in 2050

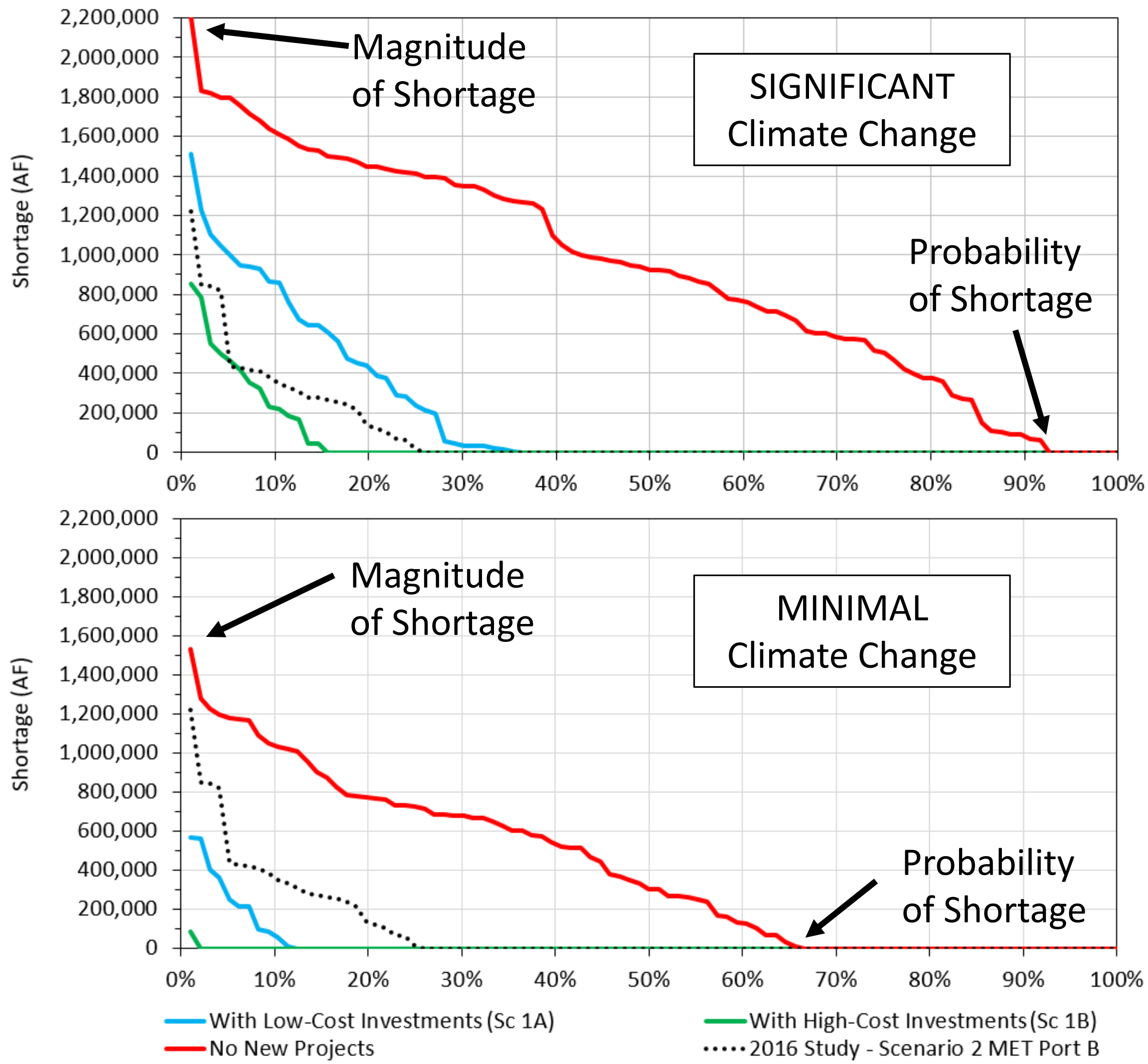


MET Supply Gaps
With Significant Climate Change Impacts in 2050

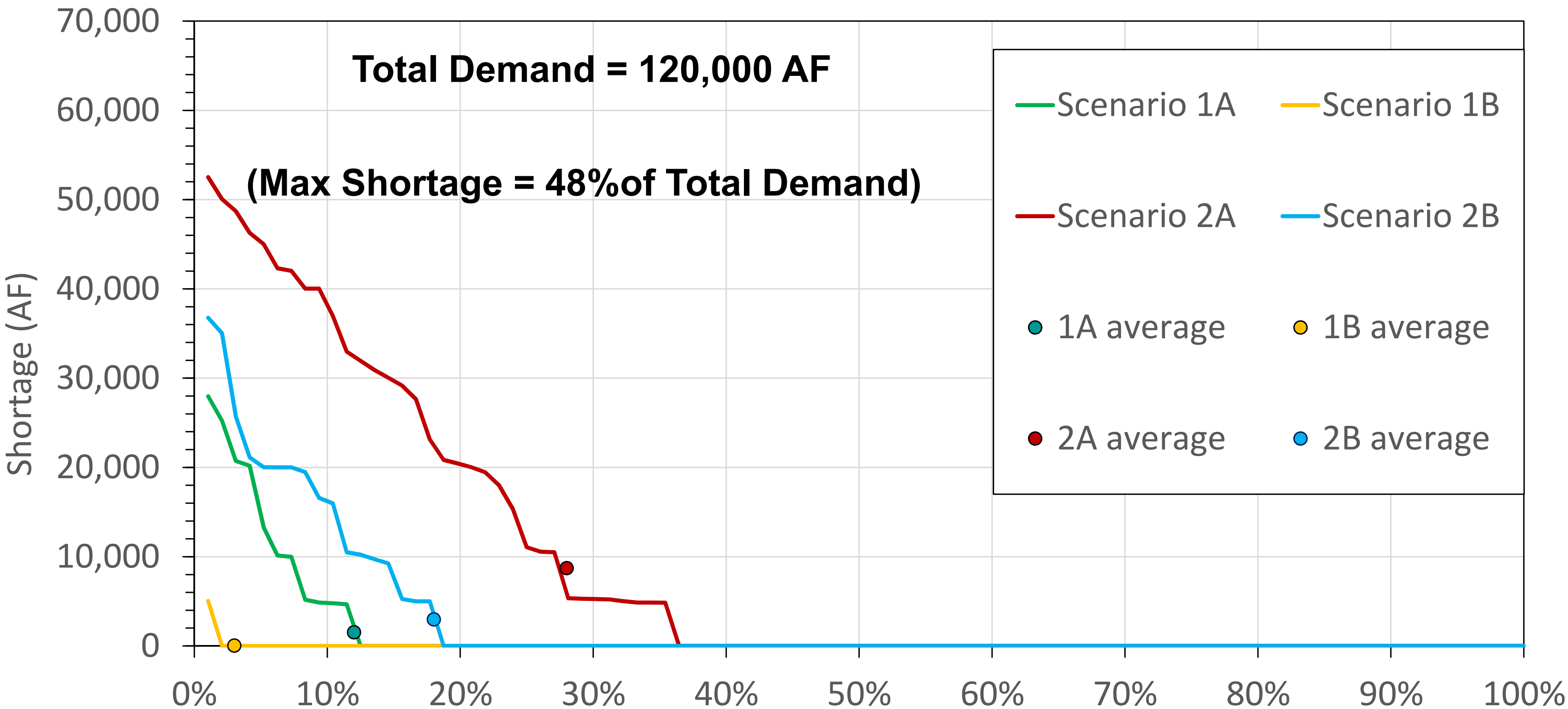


Comparison of MET Supply Gaps in 2050

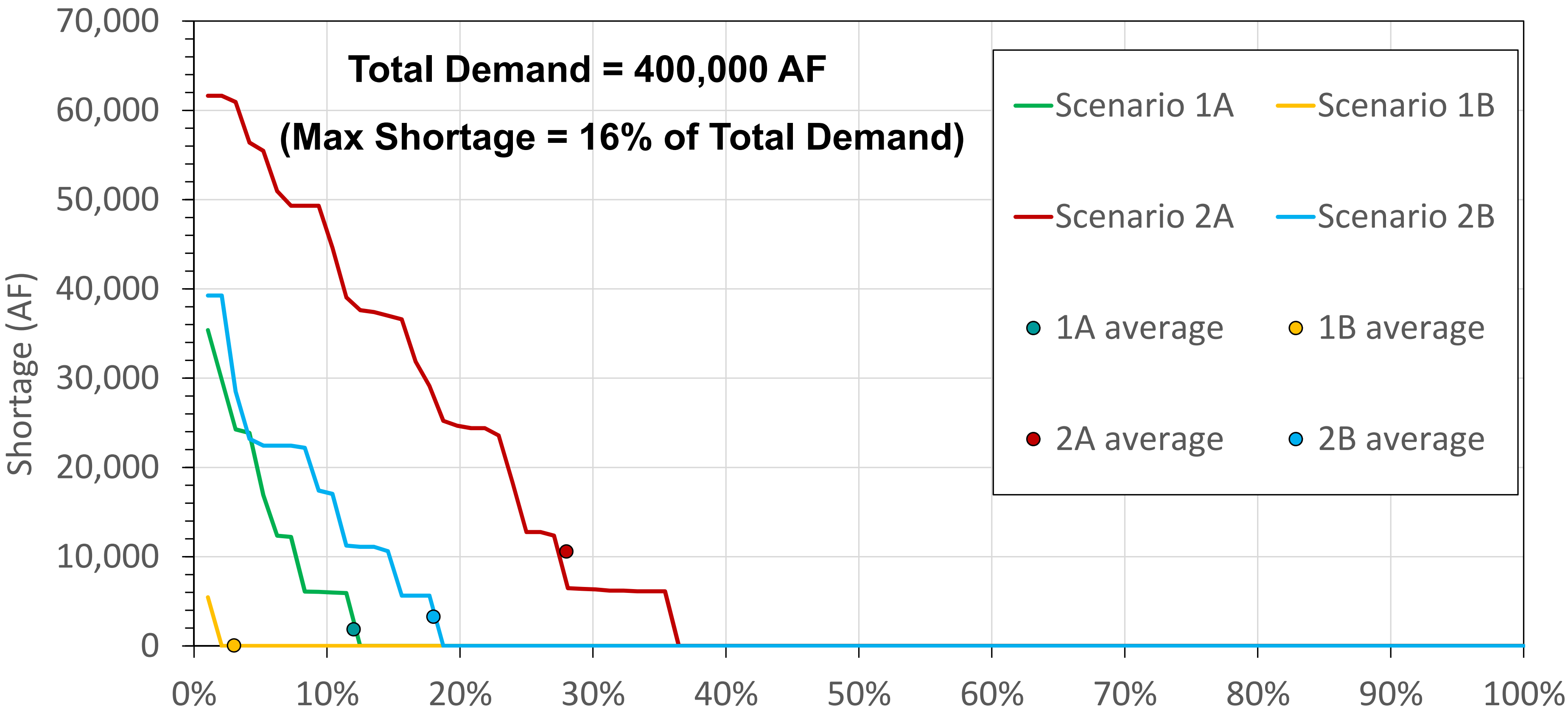
Minimal vs Significant Climate Change



South OC 2050 Without New OC Investments



OC Basin 2050 — Without New OC Investments



SOC Supply – Averaging Peak Gaps after Conservation

Scenario	2030 Max GAP AFY	2040 Max GAP AFY	2050 Max GAP AFY	Max Gap	Conservation at 10%	Remaining GAP
1 A) Minimal Climate Impacts with Low-Cost MET Investments	27,000	24,000	28,000	28,000	12,000	16,000
1 B) Minimal Climate Impacts with High-Cost MET Investments	22,000	0	5,000	22,000	12,000	10,000
2 A) Significant Climate Impacts with Low-Cost MET Investments	57,000	53,000	53,000	57,000	12,000	45,000
2 B) Significant Climate Impacts with High-Cost MET Investments	56,000	26,000	37,000	56,000	12,000	44,000
					Average	28,750

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Interpreting GAP Results for SOC

1) Peak shortages (max gap) happen rarely (<2% of the time)
2) Given the timing of the WaterFix (operational in 2035) and impacts of significant climate change (for Scenario 2), the max remaining gap from 2030 to 2050 could be used to develop a target for new OC projects.
3) Assuming SOC retail demand of 120,000 AFY, peak shortages can be reduced by about 12,000 AFY with targeted drought conservation (or extra-ordinary water transfers) – leaving remaining shortages that range from 10,000 - 45,000 AFY, with average shortage of 29,000 AFY between now and 2050.
4) Remaining shortages can be achieved through purchases of MET water above drought allocation (*but with significant penalty and uncertainty of availability*) or through local water projects.

OC Basin Supply Gaps with No New OC Projects

Scenario	2030 Max GAP AFY	2040 Max GAP AFY	2050 Max GAP AFY	Max Gap	Conservation at 10%	Remaining GAP
1 A) Minimal Climate Impacts with Low-Cost MET Investments	56,000	35,000	41,000	56,000	40,000	16,000
1 B) Minimal Climate Impacts with High-Cost MET Investments	22,000	0	5,000	22,000	40,000	0
2 A) Significant Climate Impacts with Low-Cost MET Investments	62,000	62,000	62,000	62,000	40,000	22,000
2 B) Significant Climate Impacts with High-Cost MET Investments	56,000	28,000	39,000	56,000	40,000	16,000
					Average	**13,500**

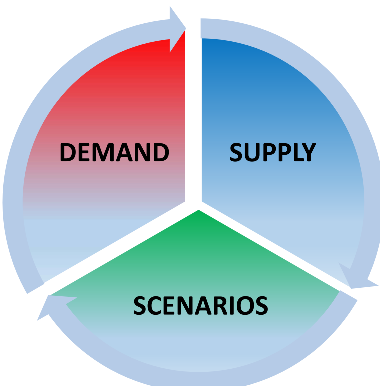
Interpreting GAP Results for OC Basin

1) Peak shortages (max gap) happen rarely (<2% of the time)
2) Given the timing of the WaterFix (operational in 2035) and impacts of significant climate changes (for Scenario 2), the max gap from 2030 to 2050 should be used as a target for new OC projects.
3) Assuming SOC retail demand of 400,000 AFY, peak shortages can be reduced by about 40,000 AFY with targeted drought conservation (or extra-ordinary water transfers) – leaving remaining shortages that range from **0 - 22,000 AFY**, with average shortage of **14,000 AFY** between now and 2050.
4) Remaining shortages can be achieved through purchases of MET water above drought allocation (**but with significant penalty and uncertainty of availability**) or through local water projects and/or improvements in basin management.

Potential Local Projects by OCWD NOT included in the modeling

Project	Amount (afy)
CADIZ for OCWD supplies	5,000 to 10,000
West Orange County Well Field	3,000 to 6,000
Prado Dam Operations to 505’ year round	≈7,000
Purchasing Upper SAR Watershed Supplies	?
Silting up of Prado Dam (loss of storage)	?
GWRS RO Brine Recovery	5,000 to 10,000
Purchase Land for Additional Replenishment Basins	?
SARCCUP – dry year yield	12,000
Chino Basin Water Bank	?
Capture Urban Runoff/Shallow GW for Recycling	?

Supply Reliability Analysis Process



DEMAND, SUPPLY & SCENARIOS → RELIABILITY MODELLING & GAPs → NEW OC WATER PROJECTS → PROJECT FINANCIAL EVALUATIONS → SYSTEM INTEGRATION

San Juan Watershed Project

Project proposes to increase capture and storage of urban runoff & stormwater, optimize use of recycled water for reuse, and augment San Juan Basin groundwater supplies

Phase I: Capture stormwater & urban runoff - 700 AFY (Avg) potable water

Benefits: Provides an additional local water resource and greater utilization of existing assets (CSJC GWRP).

Risks: Production uncertainty due to annual rainfall amounts and future climate hydrology.

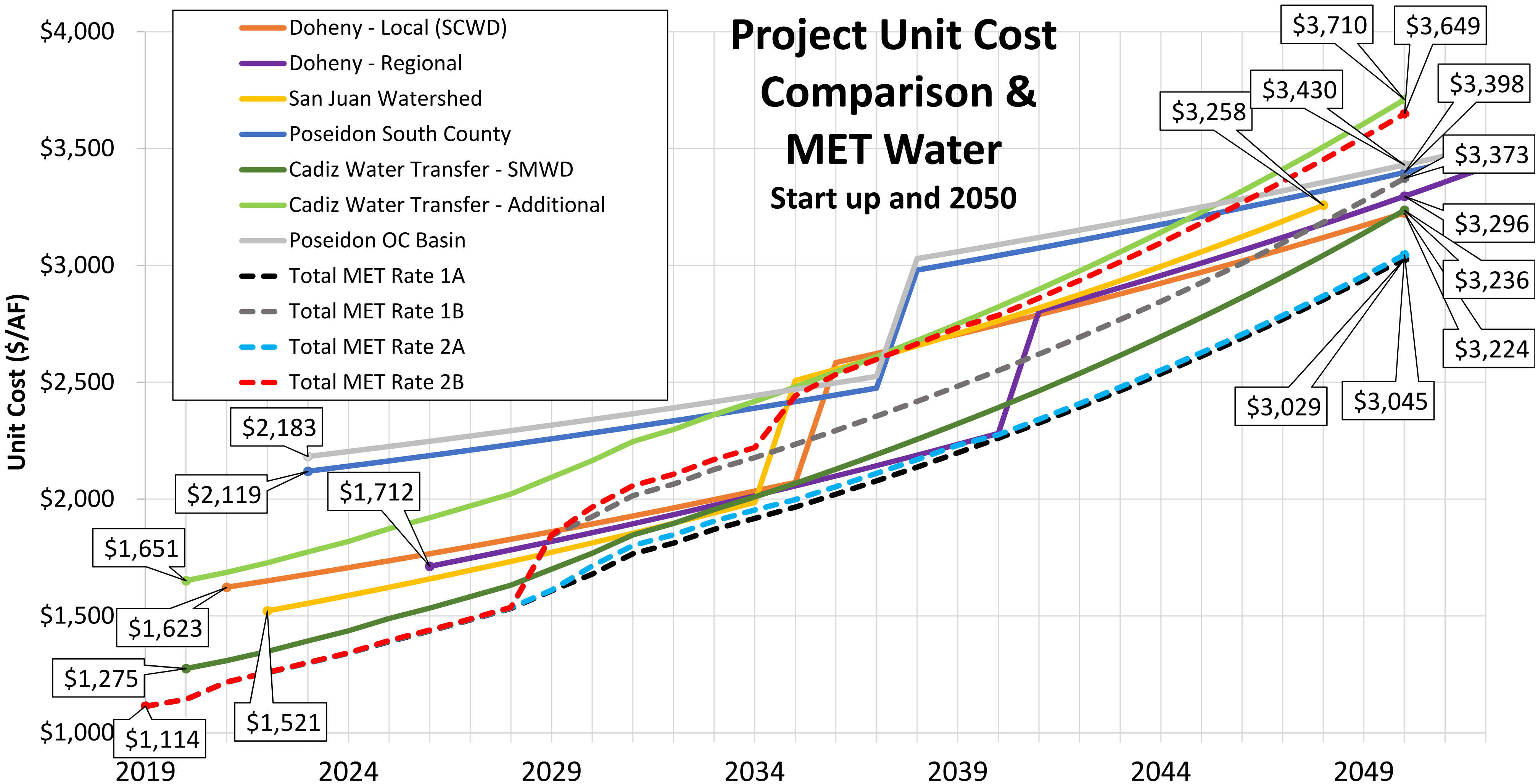
Phase	Startup Year	Capital Cost	Yield (AFY)	Cost/AF in Startup Yr. $
Phase I	2019	$2[illegible]3 M	700	$[illegible]198*
Phase II	2[illegible]22	$9[illegible]6 M	[illegible],120	[illegible],581
Phase III	2[illegible]22	$3[illegible]3 M	[illegible],660	[illegible],200
Total Project	2022	$148.5 M	9,480	$1,521

* Phase I Cost/AF can be considered interim or startup costs

OC Project Summary for Water Supply

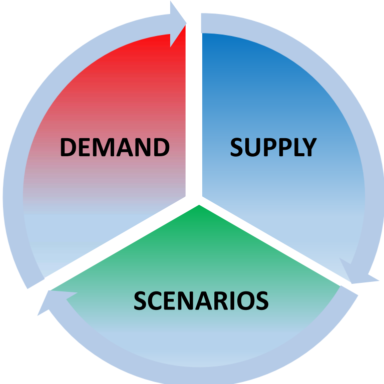
Project	Online Date	Yield (AFY)	Startup Year Cost/AF	Year 2030 Cost/AF	Year 2040 Cost/AF	Year 2050 Cost/AF
Cadiz Water Bank – SMWD	2020	5,000	1,275	1,768	2,391	3,236
Cadiz Water Bank – Retail	2020	5,000	1,651	2,165	2,822	3,710
San Juan Watershed Project[1]	2022	9,480	1,521	1,812	2,762	3,258
Doheny Local (SCWD)[1]	2021	5,321	1,623	1,894	2,746	3,224
Doheny Regional[1]	2026	10,642	1,712	1,856	2,281	3,296
Poseidon SOC[1]	2023	15,964	2,119	2,283	3,042	3,398
Poseidon OC Basin[1]	2023	36,164	2,183	2,341	3,177	3,430
Strand Ranch Water Bank - Pilot	2019	5,000				
MET Water – 1A				1,679	2,261	3,029
MET Water – 1B				1,925	2,551	3,373
MET Water – 2A				1,715	2,276	3,045
MET Water – 2B				1,967	2,787	3,649

1 – Year LRP funding ends for each project: San Juan Watershed - 2035; Doheny Local - 2036; Doheny Regional - 2041; Poseidon SOC - 2038; Poseidon OC Basin - 2038



Project Unit Cost
Comparison &
MET Water
Start up and 2050
Doheny - Local (SCWD)
Doheny - Regional
San Juan Watershed
Poseidon South County
Cadiz Water Transfer - SMWD
Cadiz Water Transfer - Additional
Poseidon OC Basin
Total MET Rate 1A
Total MET Rate 1B
Total MET Rate 2A
Total MET Rate 2B
Unit Cost ($/AF)
$4,000
$3,500
$3,000
$2,500
$2,000
$1,500
$1,000
2019
2024
2029
2034
2039
2044
2049
$3,710
$3,649
$3,398
$3,430
$3,258
$3,373
$3,296
$3,236
$3,224
$3,029
$3,045
$2,183
$2,119
$1,712
$1,651
$1,623
$1,275
$1,521
$1,114

Supply Reliability Analysis Process



DEMAND, SUPPLY & SCENARIOS → RELIABILITY MODELLING & GAPs → NEW OC WATER PROJECTS → PROJECT FINANCIAL EVALUATIONS → SYSTEM INTEGRATION

MWDOC

Economic Metrics Used for 2018 OC Study

1) <u>Net Present Value (NPV):</u>

Represents the stream of future dollar benefits, discounted* to present value **LESS** the stream of future dollar costs, discounted to present value.

How to interpret and limitations:

- Positive values are generally preferred over negative values.
- Very good at indicating the *absolute* magnitude of net positive or negative investment, which is especially good for assessing financial downside risk
- Does not indicate the *relative* cost-effectiveness among projects that are of differing size

***Why discount benefits and costs: A dollar in the future is worth less today because of opportunity to invest.**

Economic Metrics Used for 2018 OC Study Update

2) Unit NPV:

Represents the NPV divided by cumulative acre-feet of water produced.

How to interpret and limitations:

- Very good at indicating the *relative* cost-effectiveness between projects of differing size
- Not good at indicating the potential *absolute* magnitude of downside financial risk

***Why discount benefits and costs: A dollar in the future is worth less today because of opportunity to invest.**

Economic Metrics Used for 2018 OC Study Update

3) Evaluation Metric (EM): (Supply Reliability)

Represents the present value project benefits divided by the present value cost.

Avoided cost of annual MET water & any avoided surcharges (Benefit)

divided by

Local project capital and O&M costs over life of project, (Cost)

How to interpret and limitations:

- Positive numbers are better than negative numbers.
- Has limitations on quantifying all benefits or financial risks of a project

Limitations in Economic Metrics

This study included:

- **Estimates of capital and O&M costs (as representative of project costs) and;**
- **Avoided MET purchases, including penalty charges above allocations (as representative of project benefits).**

<u>However</u>, While the EM captures a significant portion of costs and benefits, it does not account for other factors that are important when assessing the merits of a local project, such as social/environmental, local control and system integration.

OC Project Comparison:
Scenario 1A: Minimal Climate Impacts, Low-Cost MET Investments

Project	Project Cost (1) ($M)	Avoided MET Purchase (2) ($M)	Net Present Value (3) ($M)	Evaluation Metric (4)
Cadiz Water Transfer – SMWD	$163.1	$163.4	$0.3	1.00
Cadiz Water Transfer – Retail	$197.5	$163.4	-$34.1	0.83
San Juan Watershed Project	$300.0	$274.2	-$25.8	0.91
Doheny Local (SCWD)	$185.8	$169.5	-$16.3	0.91
Doheny Regional	$305.1	$298.8	-$6.4	0.98
Poseidon SOC	$613.3	$495.4	-$117.9	0.81
Poseidon OC Basin	$1,417.0	$1,088.9	-$328.1	0.77
Strand Ranch Water Bank – Pilot	$1.5	$1.3	-$0.2	0.84

1) Capital and O&M costs over life of project, discounted to present value terms.
2) Average of avoided MET water purchases + allocation surcharge (when shortages exist) and avoided MET purchases when shortages do not exist, discounted to present value terms.
3) Avoided discounted MET water purchases LESS discounted project cost.
4) Avoided discounted MET water purchases DIVIDED by discounted project cost.

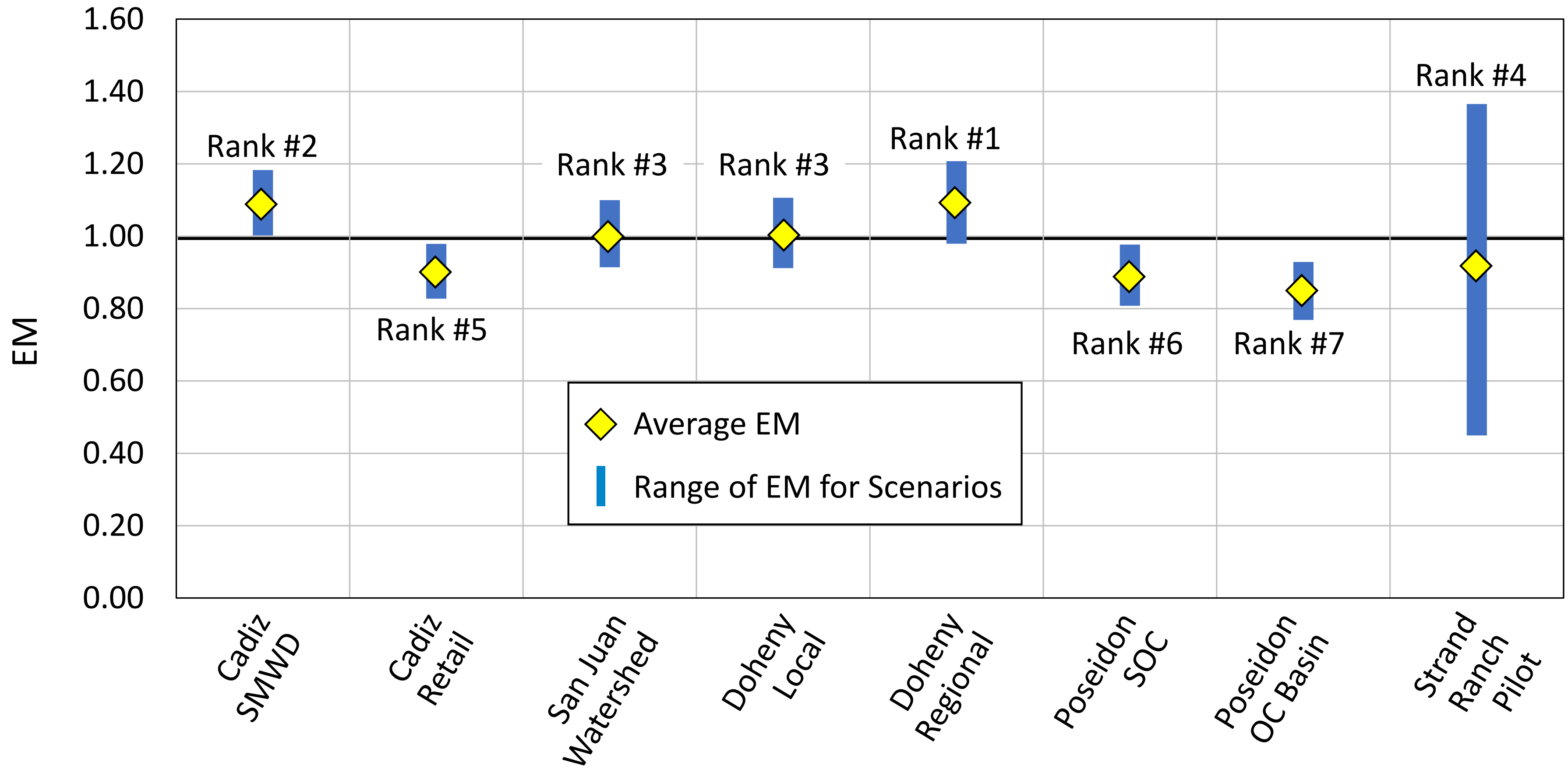
OC Project Comparison:
Scenario 2B: Significant Climate Impacts, High-Cost MET Investments

Project	Project Cost (1) ($M)	Avoided MET Purchase (2) ($M)	Net Present Value (3) ($M)	Evaluation Metric (4)
Cadiz Water Transfer – SMWD	$165.1	$195.3	$30.2	1.18
Cadiz Water Transfer – Retail	$199.5	$195.3	-$4.2	0.98
San Juan Watershed Project	$300.0	$329.9	$29.9	1.10
Doheny Local (SCWD)	$185.8	$205.6	$19.8	1.11
Doheny Regional	$305.1	$312.8	$7.7	1.21
Poseidon SOC	$613.3	$599.1	-$14.2	0.98
Poseidon OC Basin	$1,417.0	$1,316.2	-$100.7	0.93
Strand Ranch Water Bank – Pilot	$2.9	$3.5	$0.6	1.22

1) Capital and O&M costs over life of project, discounted to present value terms.
2) Average of avoided MET water purchases + allocation surcharge (when shortages exist) and avoided MET purchases when shortages do not exist, discounted to present value terms.
3) Avoided discounted MET water purchases LESS discounted project cost.
4) Avoided discounted MET water purchases DIVIDED by discounted project cost.

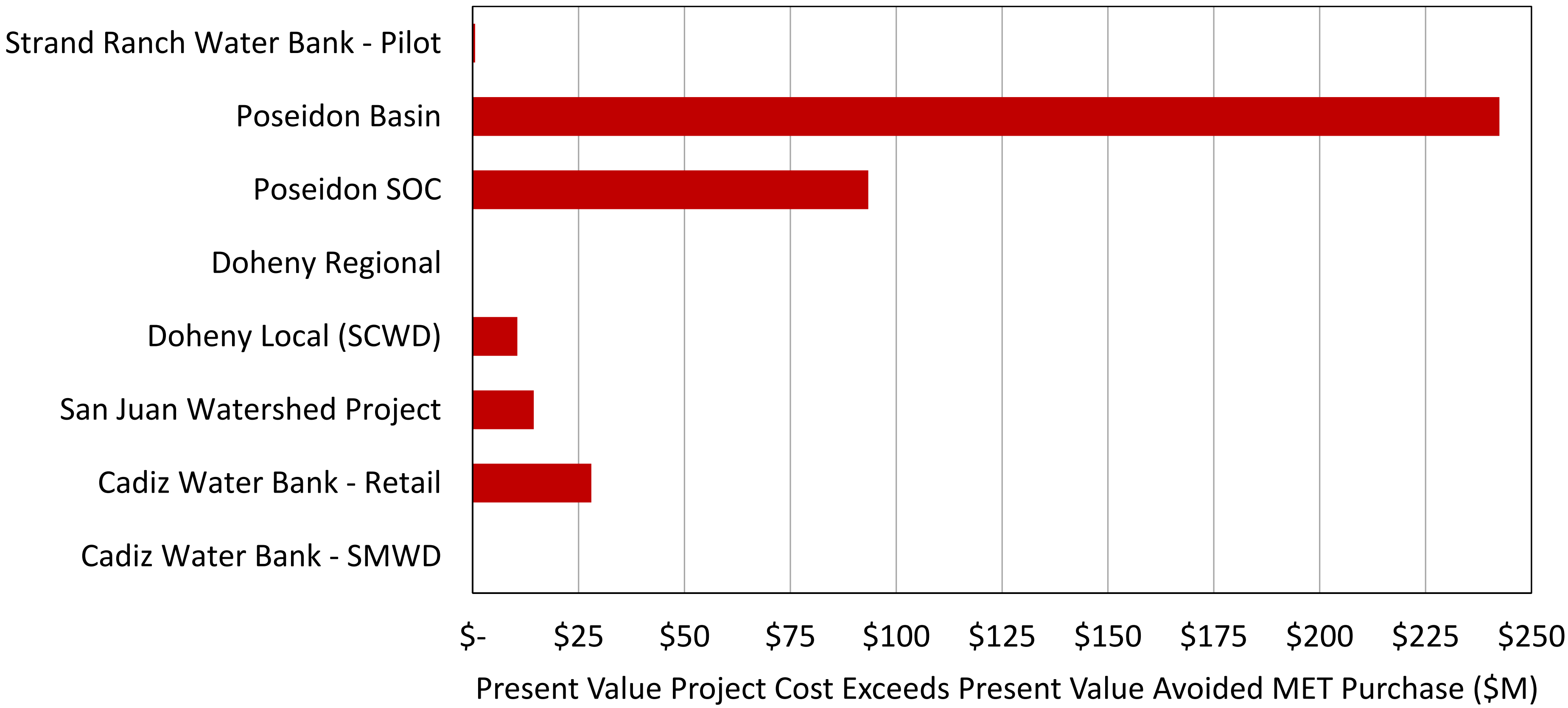
MWDOC

Comparing Water Supply Projects Using Evaluation Metric
(Avoided MET Water Purchases Divided by Project Costs)



Potential Downside Financial Risk

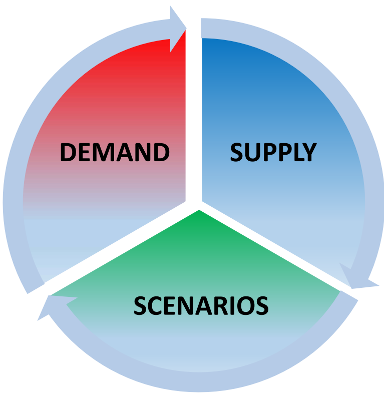
Local investment is made, but supply reliability is good (Scenario 1B)

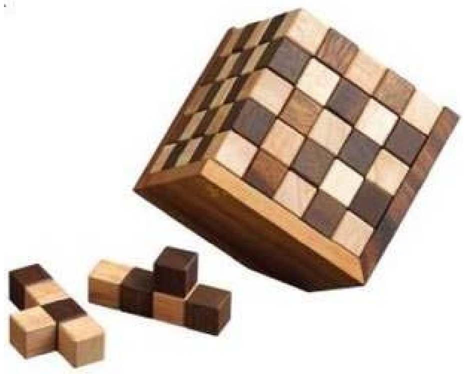


OC Projects Supply Economic Ranking:

Project	Scenario 1A		Scenario 1B		Scenario 2A		Scenario 2B		Average
	NPV	EM	NPV	EM	NPV	EM	NPV	EM	
	Rank								
Cadiz Water Transfer – SMWD	1	1	2	1	2	3	2	3	1.9
Cadiz Water Transfer – Additional	6	6	6	5	6	6	6	6	5.9
San Juan Watershed Project	5	3	5	3	3	5	3	5	4.0
Doheny Local (SCWD)	4	4	4	4	4	4	4	4	4.0
Doheny Regional	3	2	1	2	1	2	1	2	1.8
Poseidon SOC	7	7	7	6	7	7	7	7	6.9
Poseidon OC Basin	8	8	8	7	8	8	8	8	7.9
Strand Ranch Water Bank – Pilot	2	5	3	8	5	1	5	1	3.8

Supply Reliability Analysis Process





DEMAND, SUPPLY & SCENARIOS → **RELIABILITY MODELLING & GAPs** → **NEW OC WATER PROJECTS** → **PROJECT FINANCIAL EVALUATIONS** → **SYSTEM INTEGRATION**

SOC Supply – Averaging Peak Gaps after Conservation

Scenario	2030 Max GAP AFY	2040 Max GAP AFY	2050 Max GAP AFY	Max Gap	Conservation at 10%	Remaining GAP
1 A) Minimal Climate Impacts with Low-Cost MET Investments	27,000	24,000	28,000	28,000	12,000	16,000
1 B) Minimal Climate Impacts with High-Cost MET Investments	22,000	0	5,000	22,000	12,000	10,000
2 A) Significant Climate Impacts with Low-Cost MET Investments	57,000	53,000	53,000	57,000	12,000	45,000
2 B) Significant Climate Impacts with High-Cost MET Investments	56,000	26,000	37,000	56,000	12,000	44,000
					Average	28,750

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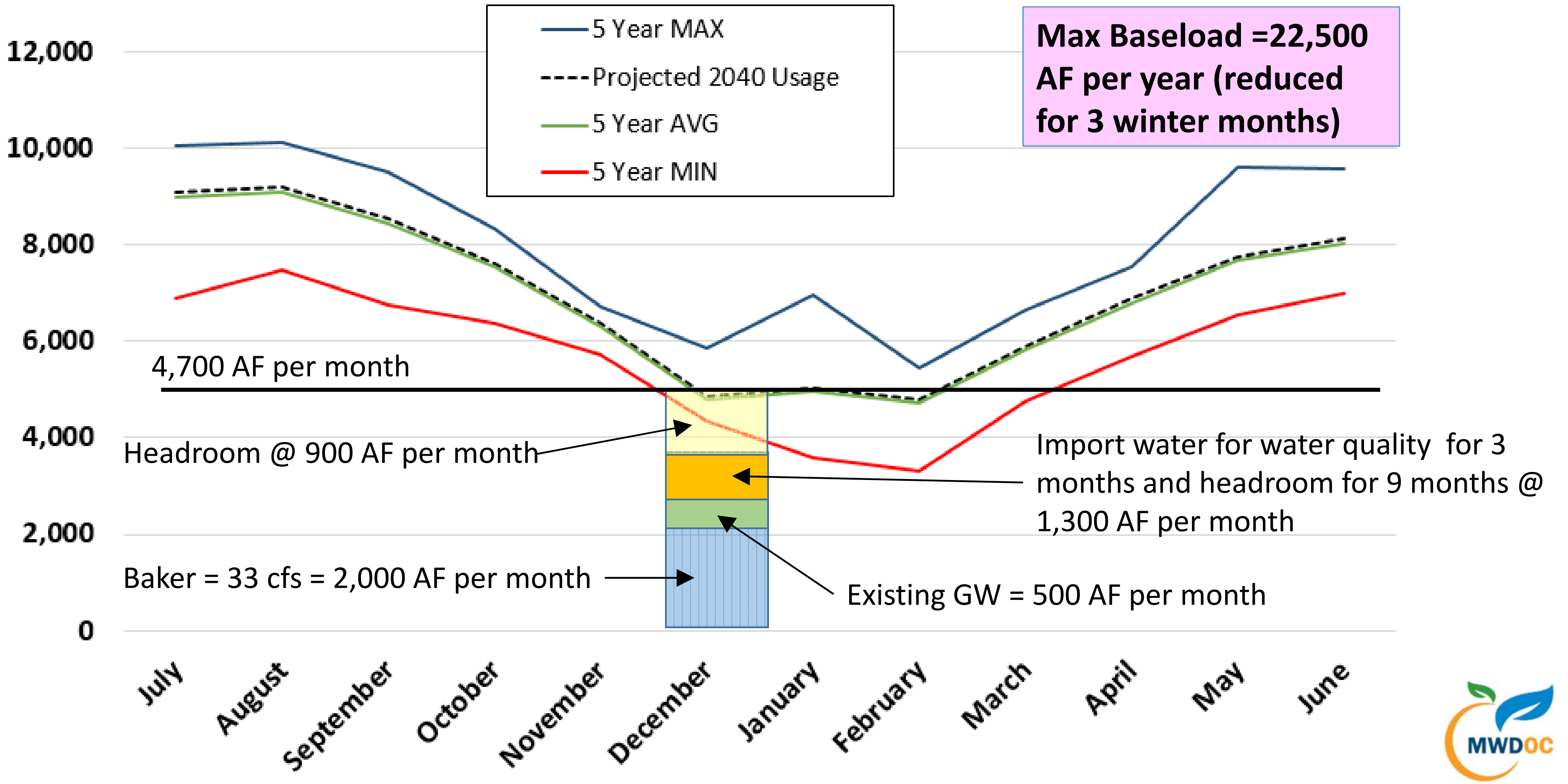
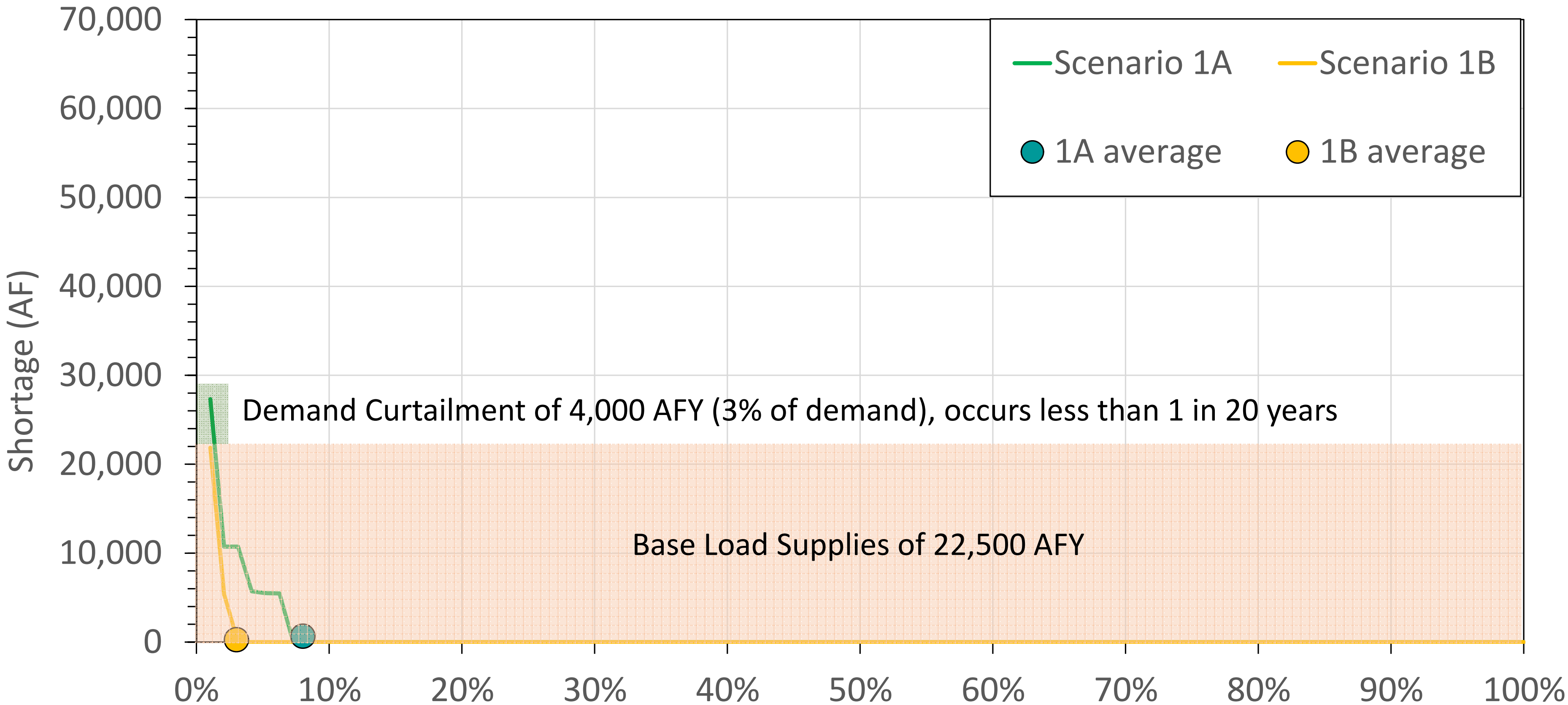
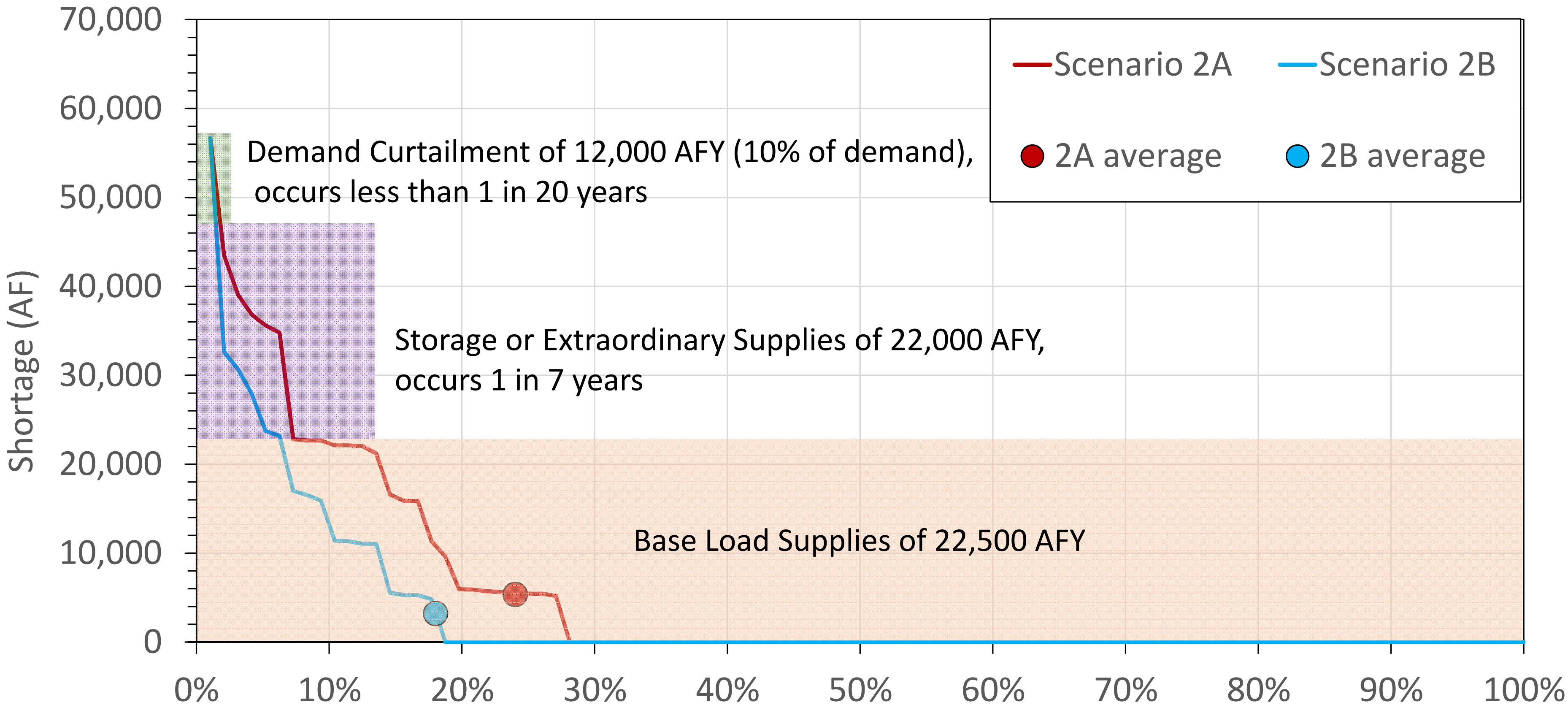
Project Sizing Based on Base Load Limitations - SOC 2040



SOC Building Blocks of Reliability Generalized for 2030

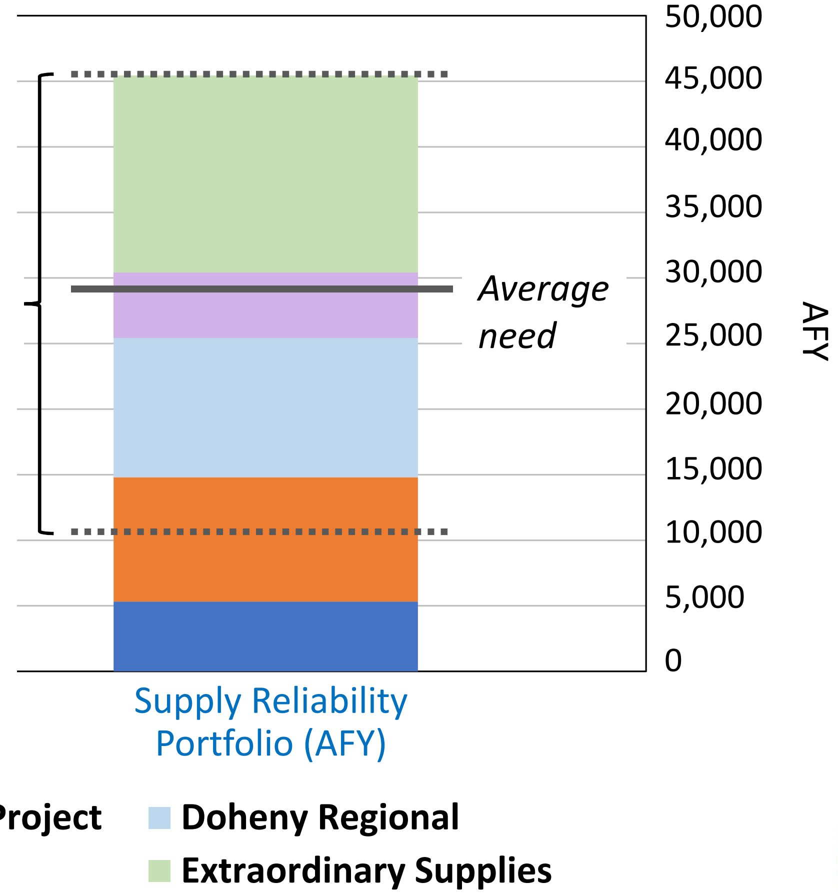


SOC Building Blocks of Reliability Generalized for 2030



SOC Portfolio for Supply Reliability

- **Four most cost effective local projects build the base**
  - **Doheny Local**
  - **San Juan Watershed**
  - **Doheny Regional**
  - **Cadiz SMWD**
- **Additional capacity added with Storage or Extraordinary Supply Projects**



OC Basin Supply Gaps with No New OC Projects

Scenario	2030 Max GAP AFY	2040 Max GAP AFY	2050 Max GAP AFY	Max Gap	Conservation at 10%	Remaining GAP
1 A) Minimal Climate Impacts with Low-Cost MET Investments	56,000	35,000	41,000	56,000	40,000	16,000
1 B) Minimal Climate Impacts with High-Cost MET Investments	22,000	0	5,000	22,000	40,000	0
2 A) Significant Climate Impacts with Low-Cost MET Investments	62,000	62,000	62,000	62,000	40,000	22,000
2 B) Significant Climate Impacts with High-Cost MET Investments	56,000	28,000	39,000	56,000	40,000	16,000
					Average	13,500

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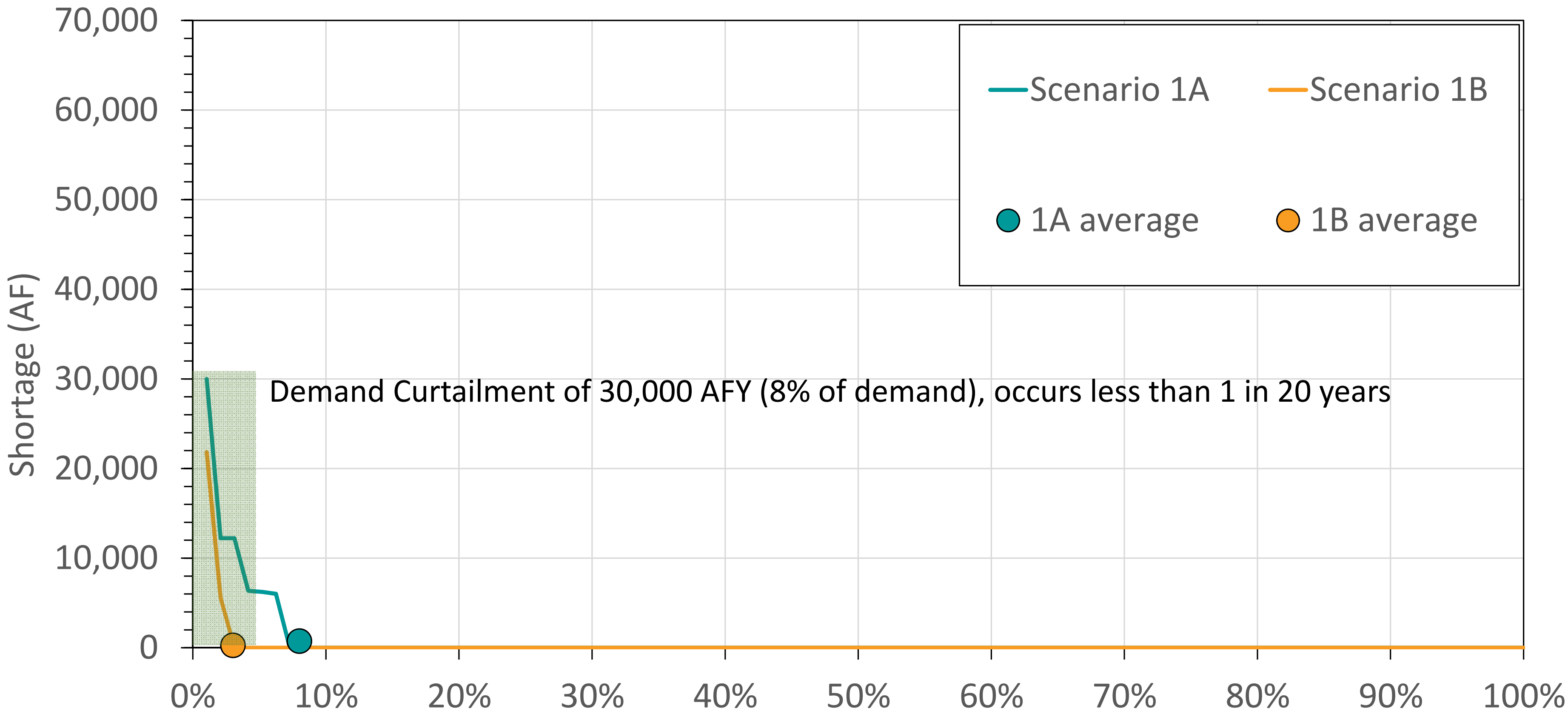
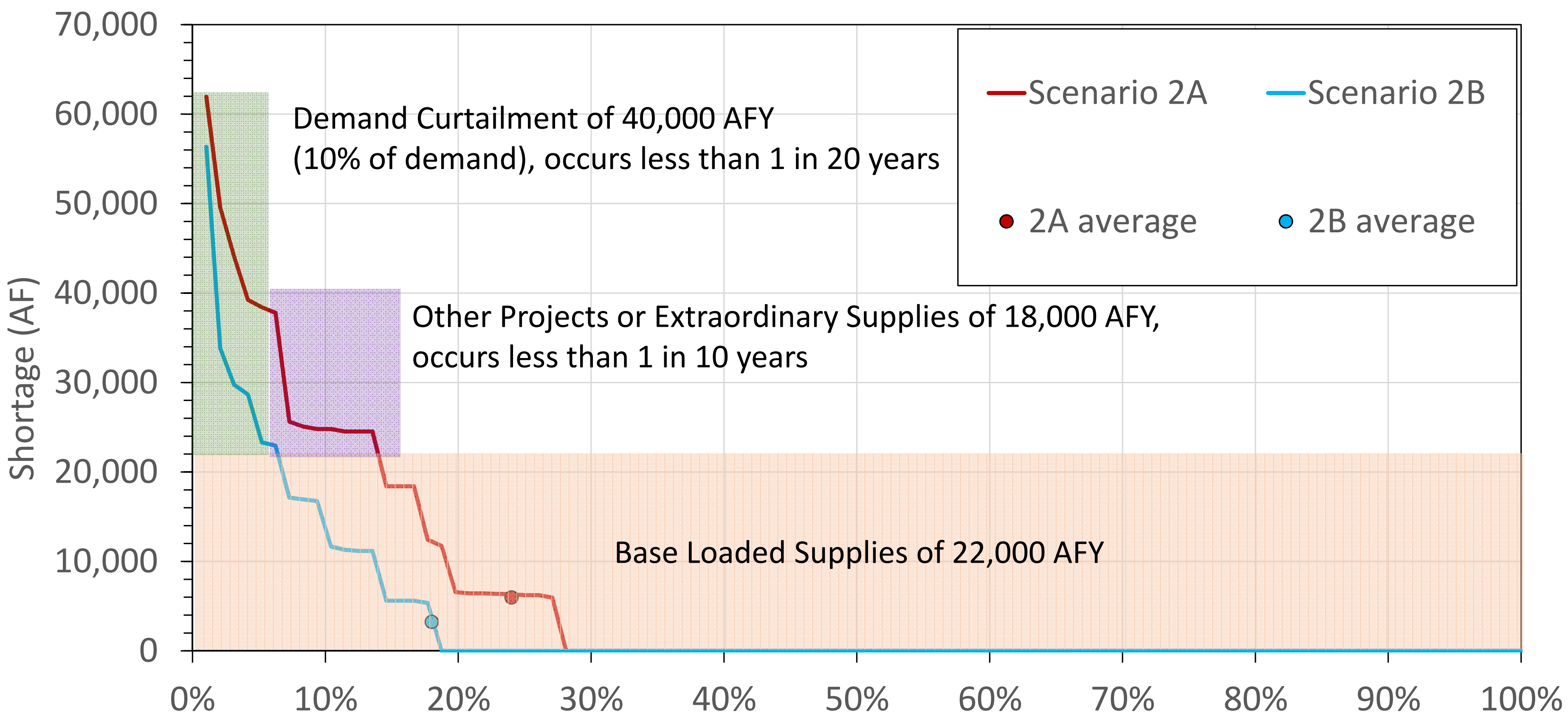
OC Basin Building Blocks of Reliability Generalized for 2030



OC Basin Building Blocks of Reliability Generalized for 2030



Agencies Can Take Different Paths to be Reliable

- Decide on the role of Demand Curtailment, at what level and frequency
- Account for integration of base loaded supplies, to minimize shutting down projects in low demand months
- Optional Paths:
    1) Base load supplies for the peak shortages (max gap); concern is over-investing
    2) Base load supplies for the average shortages; concern is under-investing
    3) Demand curtailment and use of extraordinary supplies; concern is not as reliable
    4) Middle ground: combinations of demand curtailment for rare events, extraordinary supplies for less rare but significant shortage events, and base loaded supplies for more dependability

Primary Findings – 2018 OC Reliability Study

1) In the OC Basin area, with 10% demand curtailment once every 20 years, the need for additional water supplies is projected to be fairly small under all four scenarios.
   - There are a number of projects that can provide more than sufficient additional supplies to the basin to meet the supply gap including SARCCUP, additional spreading basins, participation in Carson IPR, West OC wellfield and others.
   - This study did not evaluate the cost-effectiveness of these or other basin management options.
   - These projects should be fully analyzed and implemented if they are demonstrated to be cost effective.

Primary Findings – 2018 OC Reliability Study

2) Emergency supply needs in the event of a MET system outage exist today in the South Orange County (SOC) area and is the major driver or need for new local projects in SOC.
3) SOC needs additional supply projects, beyond the emergency supply needs, even with the demand curtailment of 10% every 20 years.
4) There are number of projects that can meet both the emergency and supply reliability needs of SOC but the differ significantly in cost, cost-efficiency, yield and ability to integrate into the existing system.

Primary Findings – 2018 OC Reliability Study

5) The San Juan Watershed Project and the Doheny Project both provide cost-effective annual and emergency supplies. Therefore, they should make up the core reliability improvement strategy in SOC. Collectively, These projects can provide the following supply volumes:

	Maximum Supply (AFY)	Peak Supply (MGD)
Doheny	**15,963**	**14.25**
San Juan Watershed	**9,480**	**8.50**
Total	**25,443**	**22.75**
Maximum Need	**45,000**	**27.50**
Remaining Need	**19,557**	**4.75**

Primary Findings – 2018 OC Reliability Study

	Maximum Supply (AFY)	Peak Supply (MGD)
Doheny	15,963	14.25
San Juan Watershed	9,480	8.50
Total	25,443	22.75
Maximum Need	45,000	27.50
Remaining Need	19,557	4.75

- SOC Emergency needs were estimated at 27.5 MGD and the peak supply GAP after accounting for 10% demand curtailment once every 20 years, is 45,00 AFY. With the two projects, the remaining emergency GAP is 4.75 MGD and the supply GAP is 19,557 AFY.

Primary Findings – 2018 OC Reliability Study

	Maximum Supply (AFY)	Peak Supply (MGD)
Doheny	15,963	14.25
San Juan Watershed	9,480	8.50
Total	25,443	22.75
Maximum Need	45,000	27.50
Remaining Need	19,557	4.75

- Rather than simply providing 4.75 MGD of additional emergency needs, it is recommended that an additional 10 to 20 MGD of emergency supplies be provided to provide additional operational flexibility during emergency situations. This can most easily be accomplished via the emergency groundwater project (EOCF#2 Pump-In or SOC Regional Interconnection Project).

Primary Findings – 2018 OC Reliability Study

6) There are several issues with developing base loaded local supplies:

- **Operational constraints include those ensuring full project delivery during winter month demands and maintaining minimum imported water deliveries to maintain adequate water quality in the distribution system**
- **Local projects can result in the stranding of MET assets**
- **MET's Water Supply Allocation Plan (WSAP) does not provide a 1:1 supply benefit for local projects during allocations**
- **These base load supply issues could be addressed by changes to MET WSAP policies, changes in operations of existing and new supplies during winter months, or by seeking drought protection by way of water storage or extraordinary supplies.**

Primary Findings – 2018 OC Reliability Study

7) Additional study is recommended to determine the appropriate sizing of Doheny and Phases 2 and 3 of the San Juan Watershed projects, reflecting system integration and operational issues during winter months.

8) The Strand Ranch drought protection program was evaluated as a seven year pilot program. MWDOC should use the methods and results available from the 2018 study to further structure the pilot program and to develop terms and conditions for a potentially expanded program with Strand Ranch or other extraordinary supply programs (e.g., SARCCUP). The potential term would extend beyond the start-up of the WaterFix.

Additional Findings – 2018 OC Reliability Study

A. The Carson IPR Project may be the least cost supply available to the OC Basin, pending final terms and conditions. MWDOC and OCWD should work together to fully evaluate the opportunity.

B. OCWD is pursuing the SARRCUP Project which could provide significant benefits in the form of extraordinary supply. If not needed by the OC Basin, the utilization by others in OC should be evaluated. MWDOC and OCWD should work together on this effort.

Additional Findings – 2018 OC Reliability Study

C. Given that the Poseidon SOC Project was not cost-effective relative to other SOC options, a full 56,000 AFY Poseidon project for the OC Basin would incur greater system integration costs than included in this study, thereby resulting in lower cost-effectiveness than presented.

Additional Findings – 2018 OC Reliability Study

D. Given the scenarios examined, the Poseidon Project is not cost effective to augment the OC Basin when compared to MET water (including purchases with the allocation surcharge). However Poseidon would be beneficial to OC under the following circumstances:

- **MET implements Poseidon as a regional project**
- **Climate change is even more extreme than the Significant Climate Change Scenarios (low probability) resulting in low reliability from MET, and OC decides to impellent the project**
- **OC decides that we want a higher degree of independence from MET and that the Poseidon Project should be implemented in spite of cost impacts.**

Additional Findings – 2018 OC Reliability Study

E. MWDOC should use the information developed herein to support efforts at MET regarding:
   - **The clarity of MET's development and presentation of their IRP for 2020, especially with respect to future investments needed for full reliability under a range of alternatives including adverse climate change.**
   - **Need for changes in MET's LRP program and MET's WSAP to provide opportunities for improved drought protection by the Member Agencies.**

F. While the 2016 and 2018 study results indicated minimal emergency supply needs for the OC Basin and Brea/La Habra areas, there remains a critical need for backup generators throughout Orange County.

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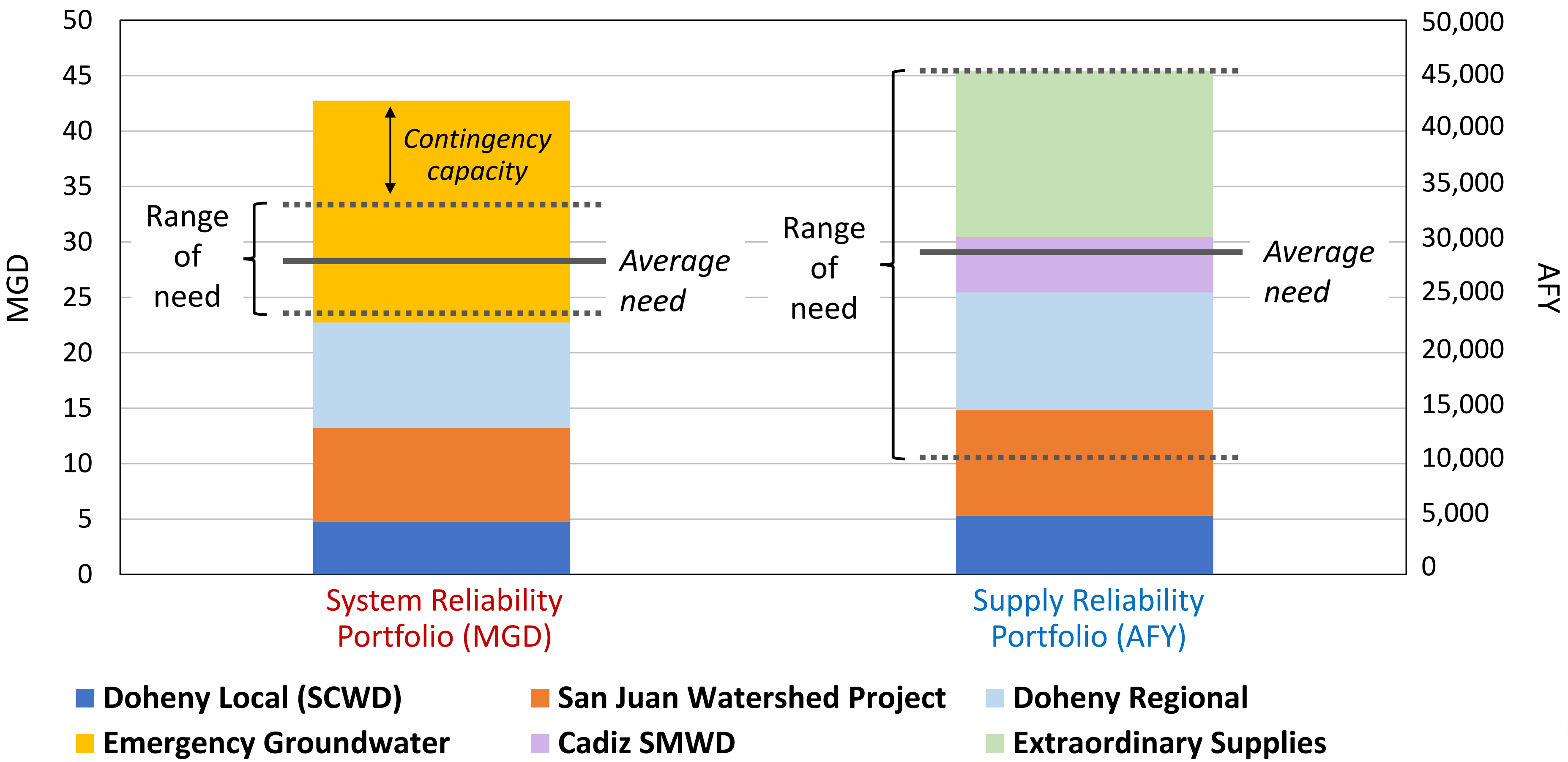
SOC Portfolio for System and Supply Reliability



MWDOC