

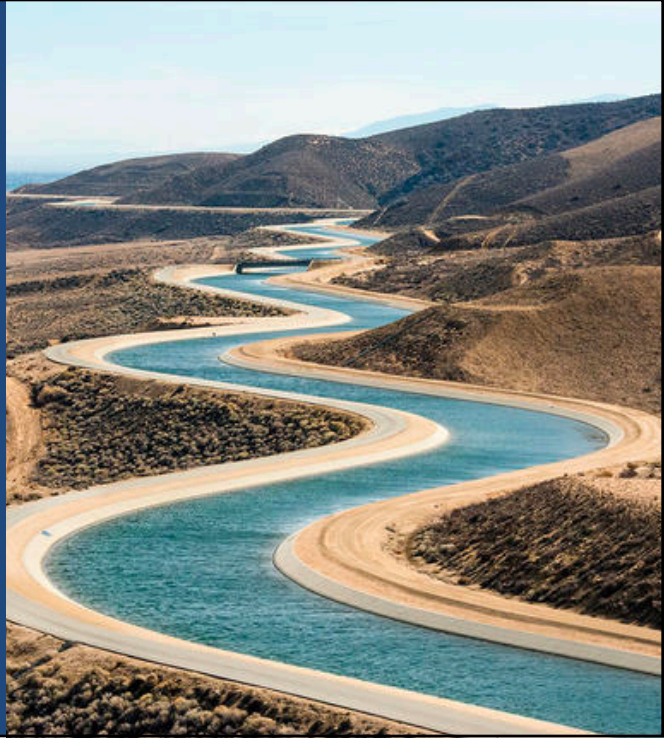
Identifying Signposts for Metropolitan Water District's Adaptive Integrated Resources Plan

David Groves, James Syme, and Brandon Goshi

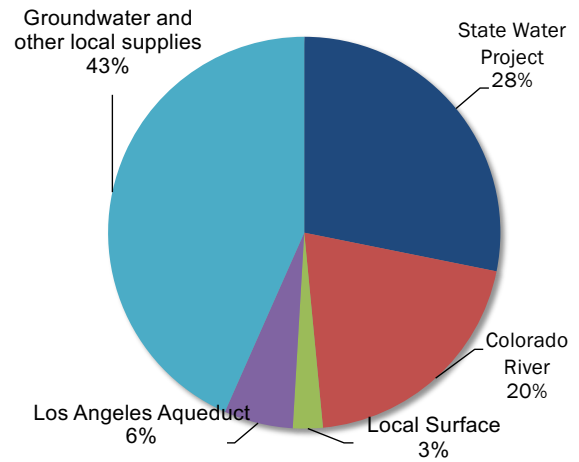
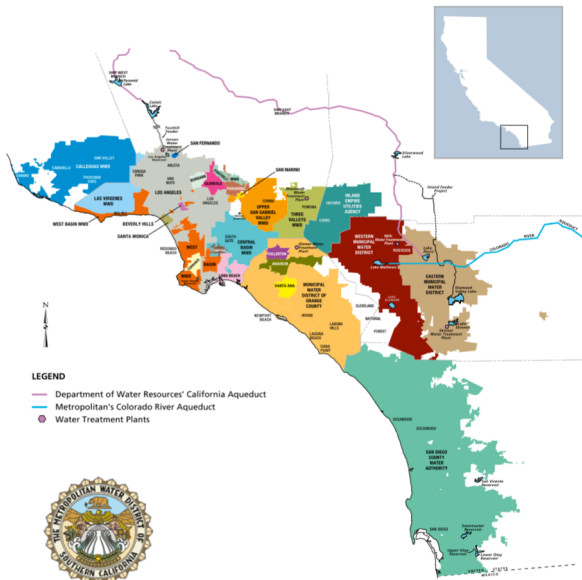
November 14, 2018



Climate Resilience Center



Metropolitan Water District Serves 19 Million People in Southern California



Slide 2

Metropolitan’s Integrated Water Resources Plan (IRP) Lays Out Strategy for Meeting Projected Future Water Needs

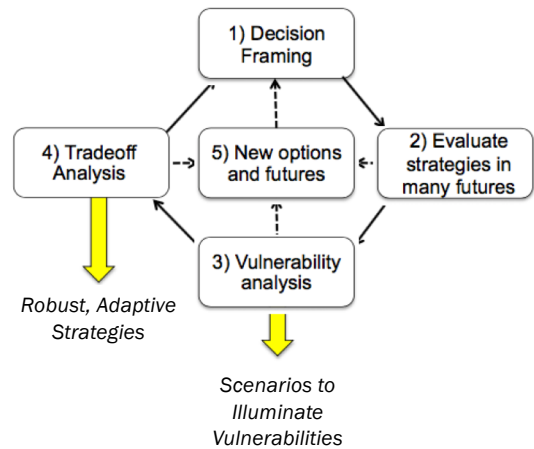
	2016	2020	2025	2030	2035	2040
Retail Demands before Conservation	4,878,000	5,219,000	5,393,000	5,533,000	5,663,000	5,792,000
Total Conservation Target	1,034,000	1,096,000	1,197,000	1,310,000	1,403,000	1,519,000
Retail Demands after Conservation	3,844,000	4,123,000	4,196,000	4,223,000	4,260,000	4,273,000
Minimum CRA Diversion Target	900,000	900,000	900,000	900,000	900,000	900,000
Average Year SWP Target	1,202,000	984,000	984,000	1,213,000	1,213,000	1,213,000
Total Local Supply Target	2,199,000	2,307,000	2,356,000	2,386,000	2,408,000	2,426,000
Total Supply Reliability Target	4,301,000	4,191,000	4,240,000	4,499,000	4,521,000	4,539,000

Slide 3

How Would Metropolitan Know if Additional IRP Augmentations Are Needed?

Robust Decision Making (RDM):

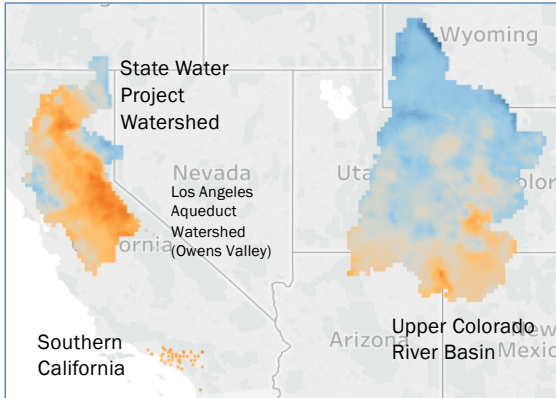
- Identifies vulnerabilities
- Defines signposts
- Informs monitoring approach



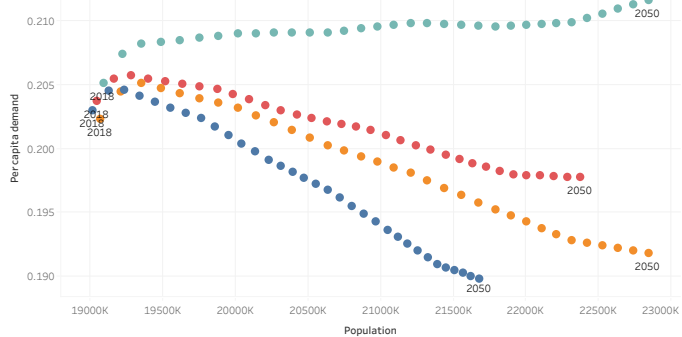
Slide 4

We Simulated How the IRP Would Perform Across a Wide Range of Futures

- Climate Change



- Demographic Growth

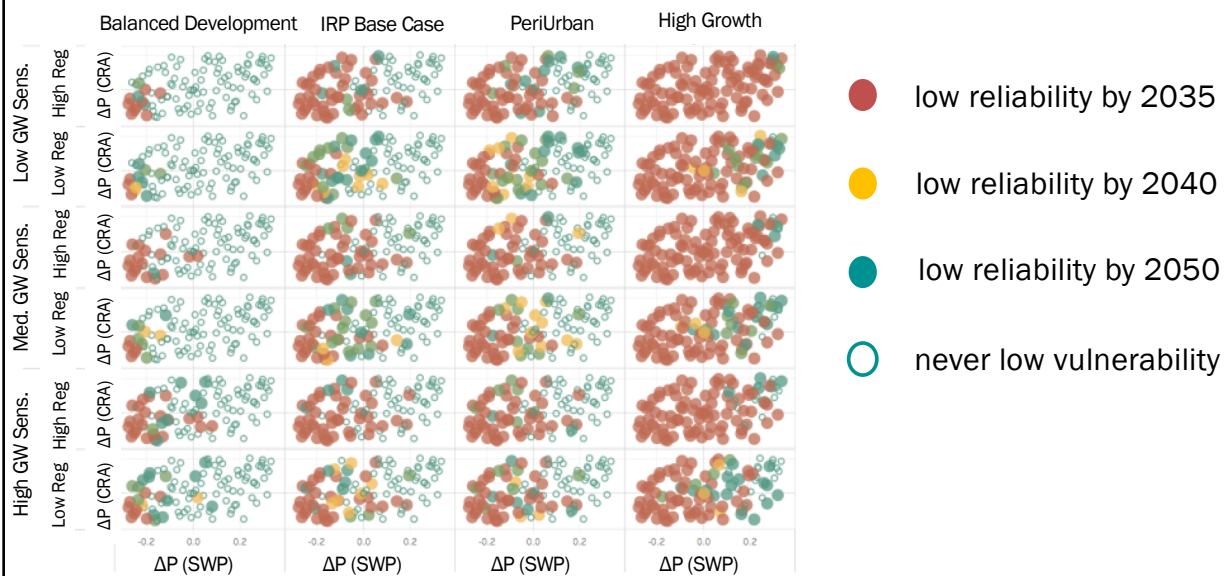


- Groundwater Sensitivity

- Bay-Delta Regulations

Slide 5

We Identified Vulnerabilities (Low Reliability) Around 2035



Slide 6

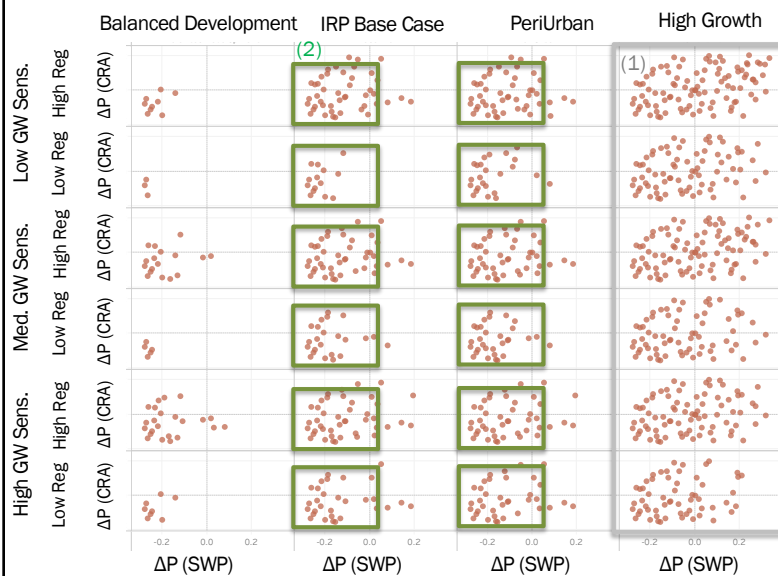
First Vulnerability Defined by High Demographic Growth



- 25% of all cases included in vulnerability
- 78% of cases in vulnerability are low reliability

Slide 7

Second Vulnerability Defined by Modest Demographic Growth and Changing Climate Conditions

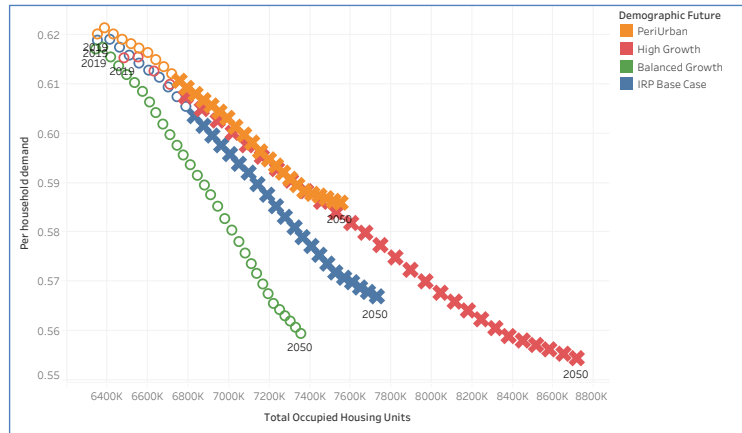


- 36% of all cases included in vulnerability
- 83% of cases in vulnerability are low reliability

Slide 8

RDM-Identified Vulnerabilities Suggest Thresholds for Additional IRP Augmentations

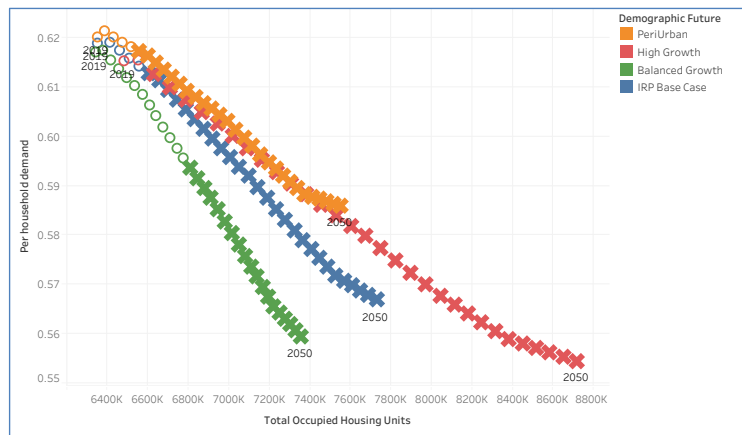
- Vulnerability 1:
 - Demand drivers:
 - Households
 - per household demand



Slide 9

RDM-Identified Vulnerabilities Suggest Thresholds for Additional IRP Augmentations

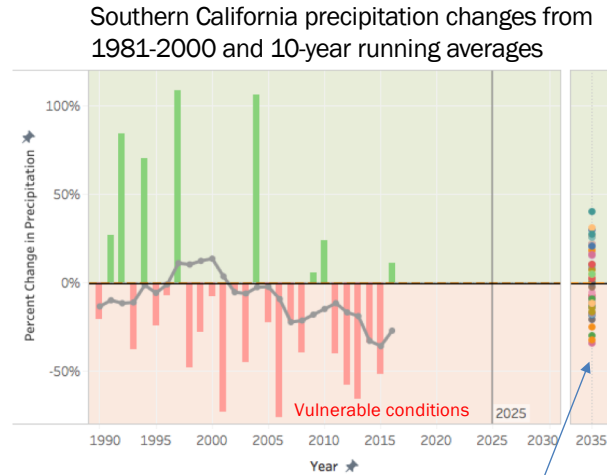
- Vulnerability 2:
 - Demand drivers:
 - Households
 - per household demand



Slide 10

RDM-Identified Vulnerabilities Suggest Thresholds for Additional IRP Augmentations

- Vulnerability 2:
 - Demand drivers:
 - Households
 - per household demand
 - Climate changes:
 - Temperature and precipitation across four basins

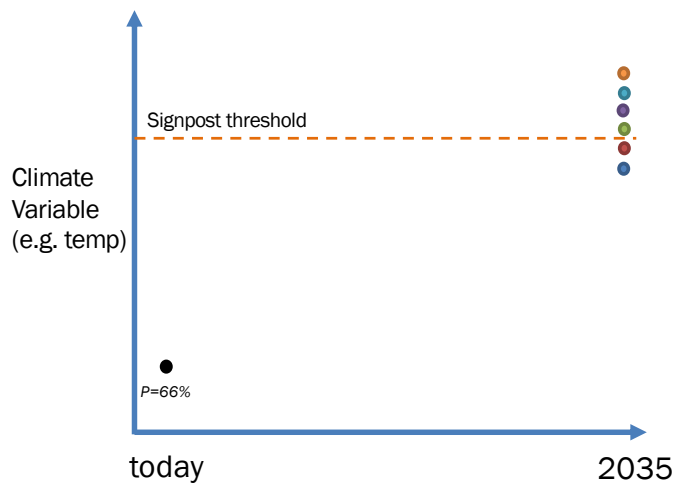


GCM
projections

Slide 11

Bayesian Framework Used to Revise Estimates of Likelihoods of Facing Vulnerable Conditions

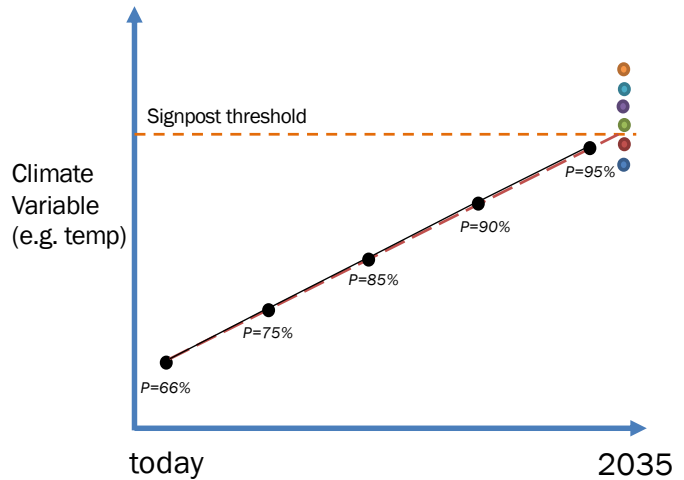
1. Prior estimate of likelihood of exceeding signpost value
 - Derived from GCM estimates and demographic projections



Slide 12

Bayesian Framework Used to Revise Estimates of Likelihoods of Facing Vulnerable Conditions

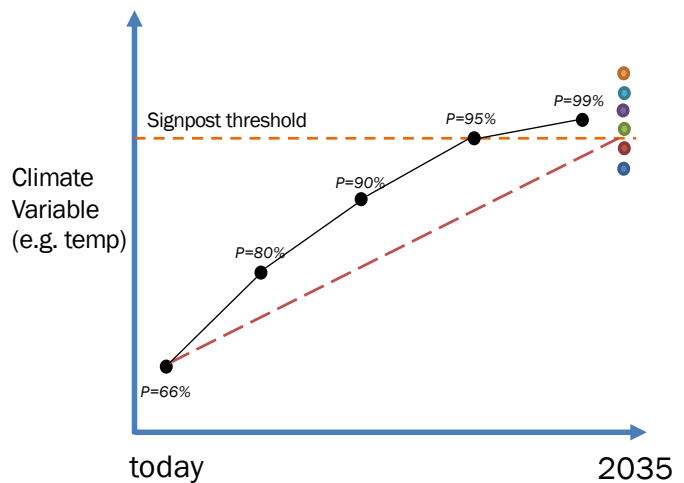
1. Prior estimate of likelihood of exceeding signpost value
 - Derived from GCM estimates and demographic projections
2. If conditions evolve consistent to vulnerability trend, then probability would increase towards 100%



Slide 13

Bayesian Framework Used to Revise Estimates of Likelihoods of Facing Vulnerable Conditions

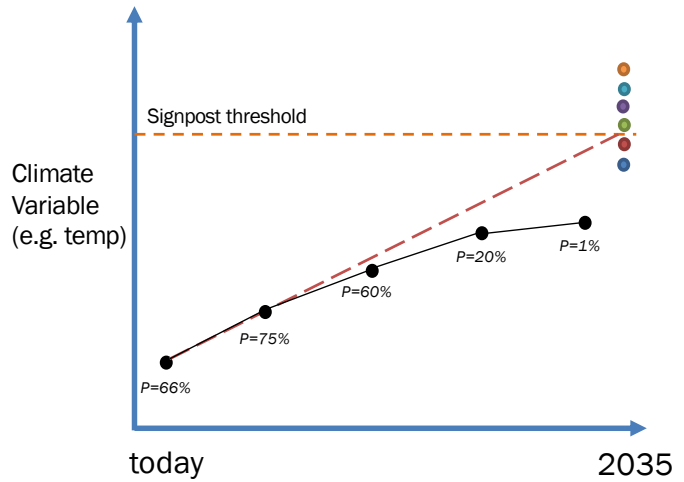
1. Prior estimate of likelihood of exceeding signpost value
 - Derived from GCM estimates and demographic projections
2. If conditions evolve consistent to vulnerability trend, then probability would increase towards 100%
3. Update priors based on new observations relative to vulnerability trend using Bayes' Law



Slide 14

Bayesian Framework Used to Revise Estimates of Likelihoods of Facing Vulnerable Conditions

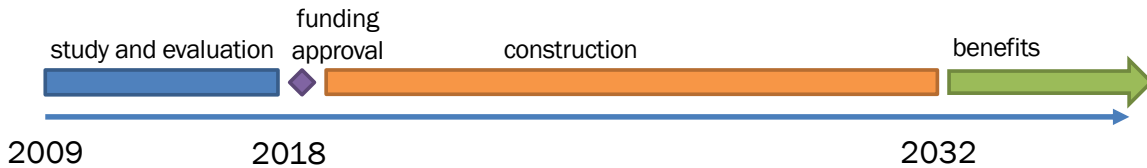
1. Prior estimate of likelihood of exceeding signpost value
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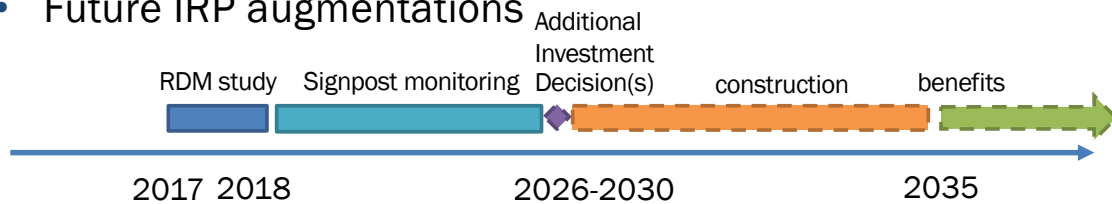
Slide 15

IRP Augmentation Planning Can Be Informed by RDM Analysis and Adaptation

- California Water Fix adaptation



- Future IRP augmentations



Slide 16

Approach is Straightforward and Can Be Applied In Other Contexts

1. Explore performance of strategy across futures
2. Identify vulnerabilities using scenario discovery
3. Define triggers as thresholds of conditions that can be monitored
4. Establish prior beliefs about reaching triggers – use best available information
5. Collect monitoring data and update prior belief in consistent way
6. Add additional investments when probability of triggering is high

Slide 17



Climate Resilience Center

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