MARIN WATER

Strategic Water Supply Assessment

BOARD WORKING SESSION #1

April 26, 2022

Board Working Session Agenda

- Project Overview
- Assessment & Process
  - Water Supply Goals
  - Drought Scenarios
  - Decision Support Model
  - Water Management Alternatives
  - Evaluation Process
- Approach for Development of Strategic Roadmap
- Q&A

Preview of Board Engagement Schedule

- Periodic Updates and Board Discussions
- TODAY – **Overview of Water Supply Assessment** ★
- May
  - Demand Management
  - Drought Scenarios & Baseline Reliability
- June
  - Water Supply Alternatives
  - Evaluation Process

Project Overview

Project Overview

- Strategic Water Supply Assessment will be additive to past planning efforts and is designed to fill in the gaps on water supply alternatives
- Comparative analysis of water supply options available to MMWD and provide recommendations on a strategic water supply roadmap
- Respond to accelerated pace of climate change and greater hydrologic extremes than those that have occurred in the past

Project Overview

The Assessment will address the following questions:

1. What is the current risk to MMWD's water delivery reliability under recent and projected future droughts?

2. How much additional water supply is needed under different future hydrologic drought and demand scenarios?

3. What are the range of water supply alternatives that could increase resiliency of MMWD's system? And what are their strengths and weaknesses?

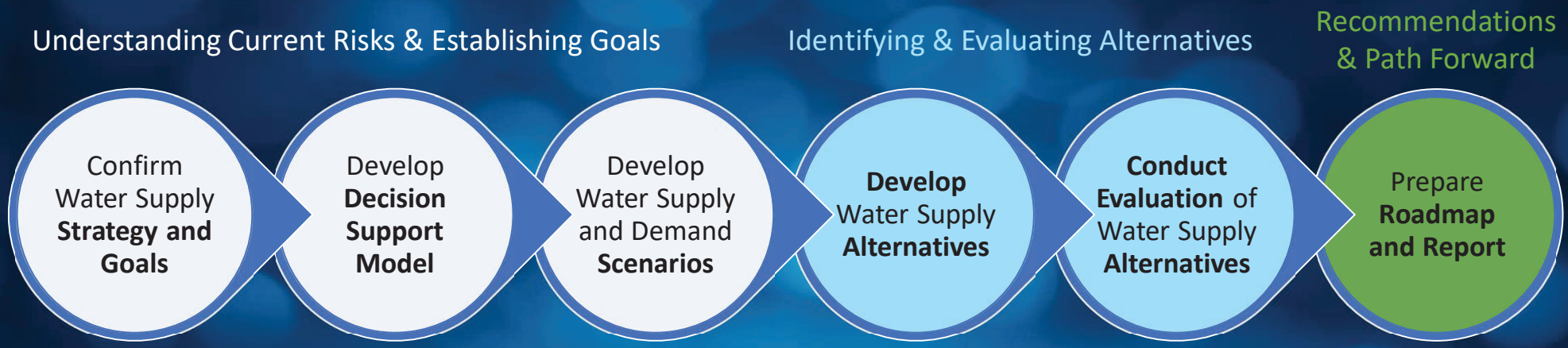
4. What recommendations can be developed to support MMWD's near-term investment in drought resiliency?

Strategy Considerations

- What is drought? How does it manifest itself?
- Future is uncertain … embrace it!
- Responding to uncertainty … how to best make decisions
- Consideration of supplemental supplies and demand management

Assessment & Process

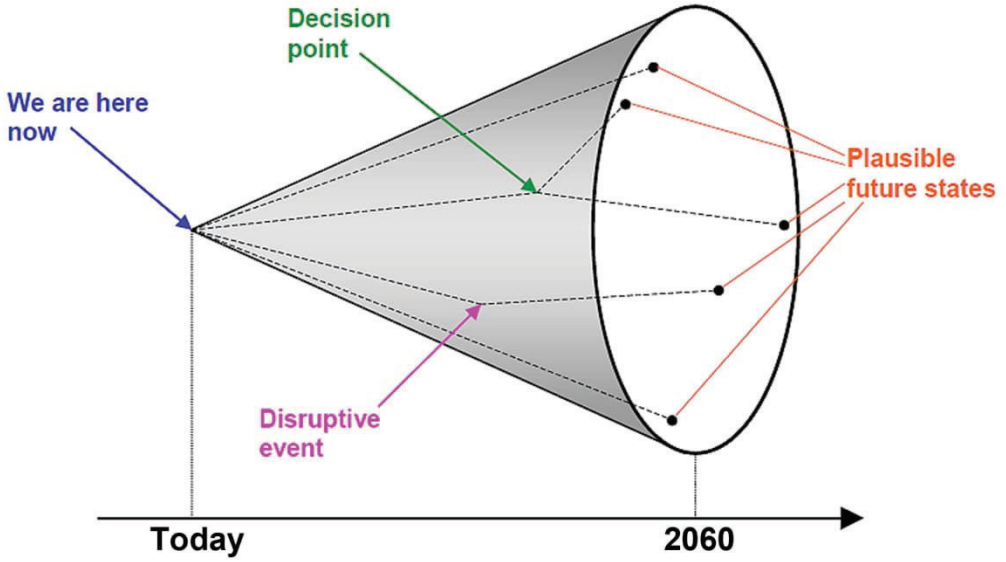
Key Project Scope Elements



Drought Scenarios

Water Supply and Demand Scenarios

- Recognizing that future is uncertain
  - Climate change
  - Drought variability
  - Demands
  - Policies and regulations
- Seeking robust solutions
- Scenarios allow us to explore plausible future conditions and identify promising solutions
  - Historical droughts
  - Climate projections
  - Paleo reconstructions
  - Stress tests

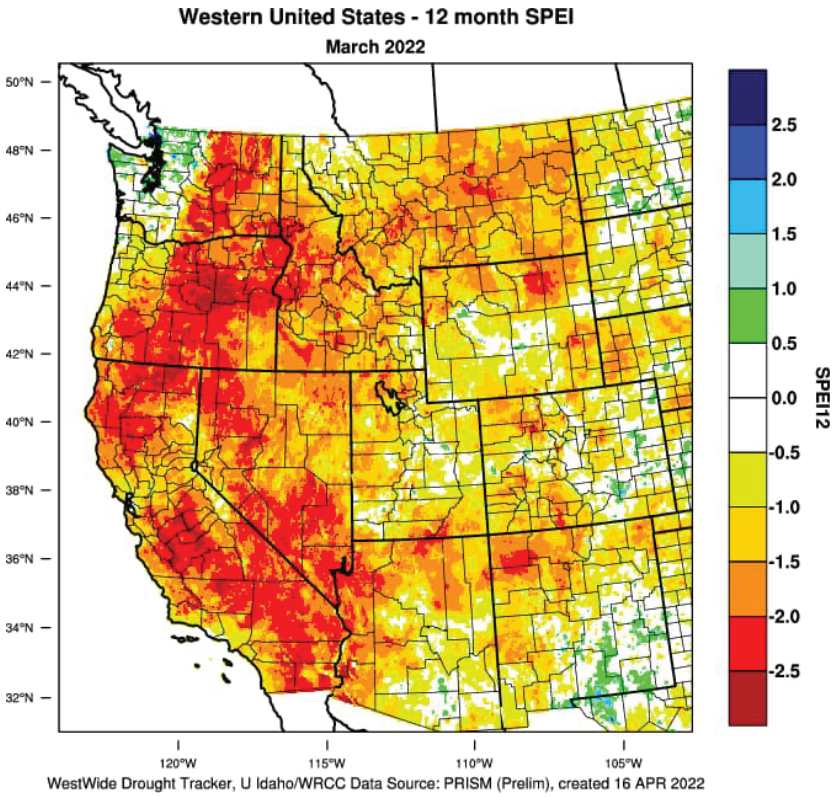


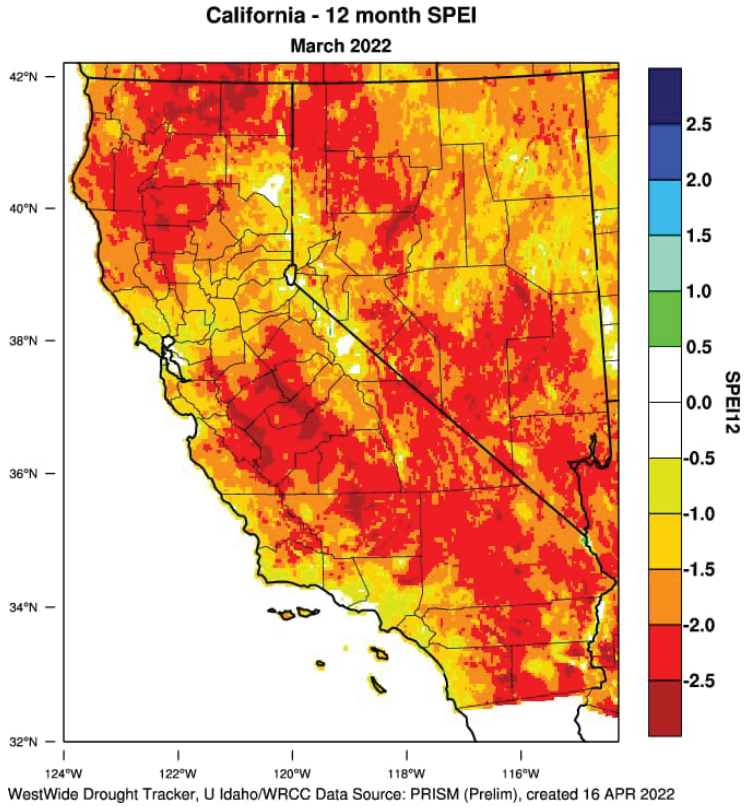
Scenarios are alternative views of how the future might unfold. Scenarios are not predictions or forecasts of the future

Scenarios

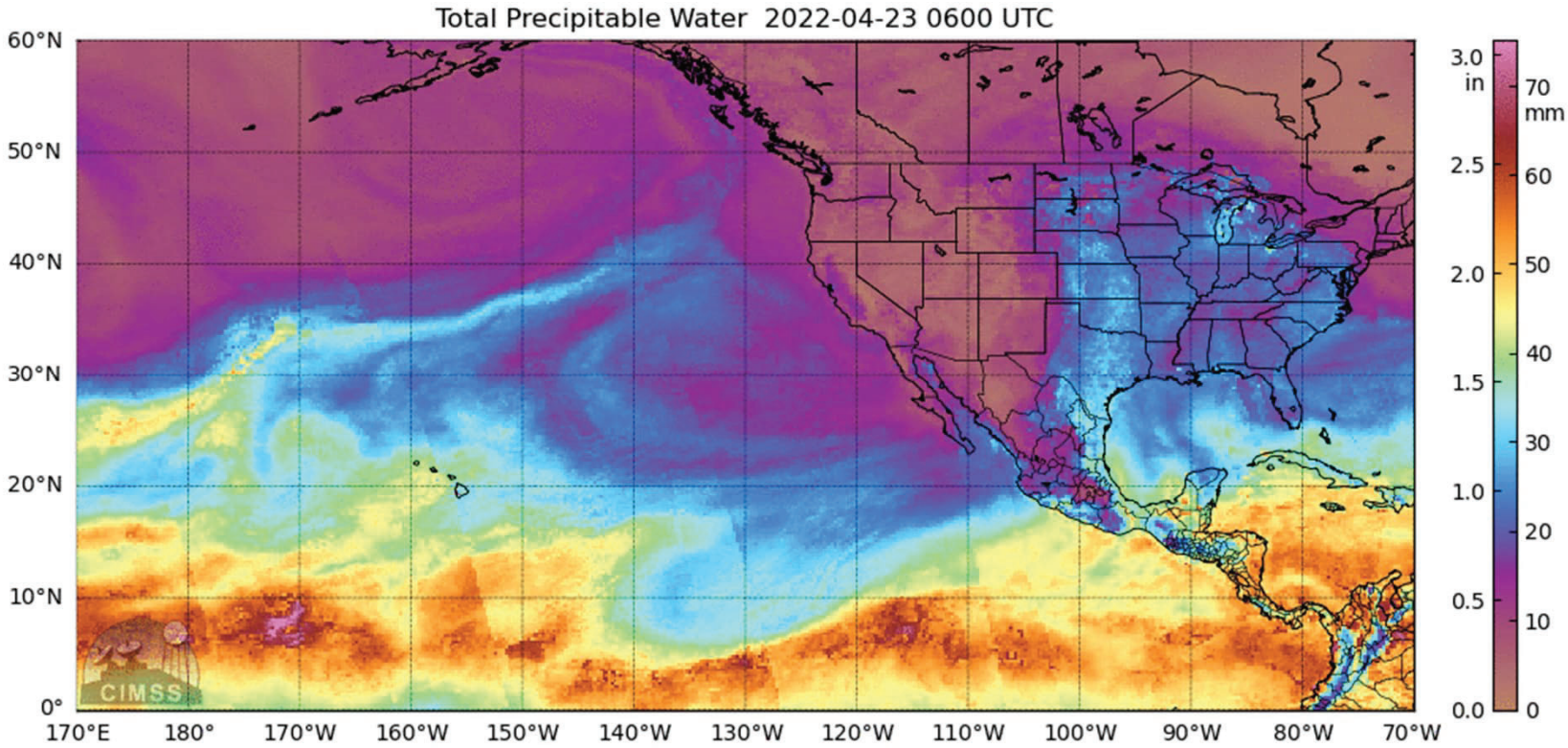
- Scenarios are intended to capture uncertainty that is NOT in management control for this decision
- Water Supply - Hydroclimate
  - Historical
  - Climate projections
  - Paleo reconstructions
  - Synthetic droughts
- Water Demand
  - Recent trends
  - Population growth and land use
  - Passive levels increasing water use efficiency

Dry Conditions Persist Across the West, Most Pronounced in California

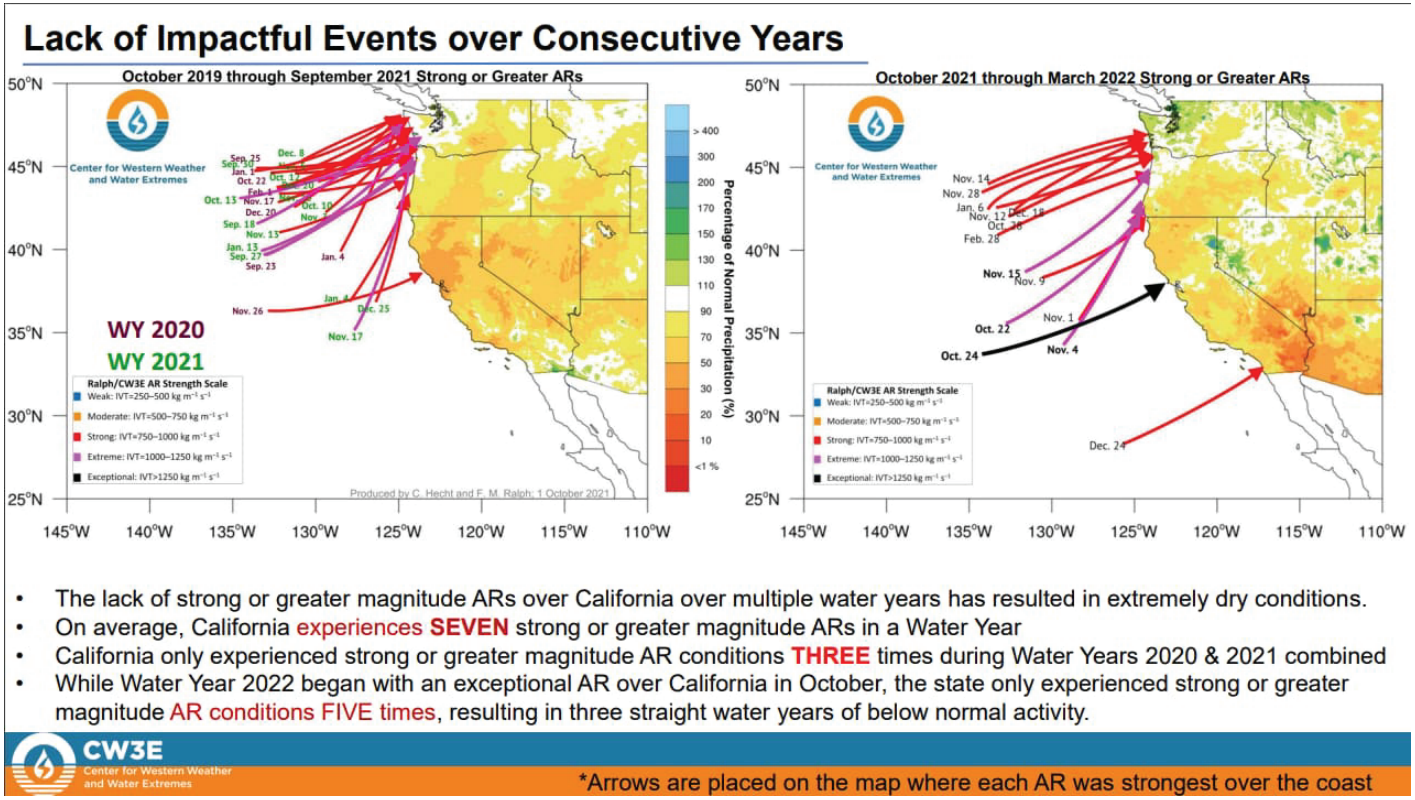




Atmospheric Rivers are Responsible for Most Precipitation in Northern California



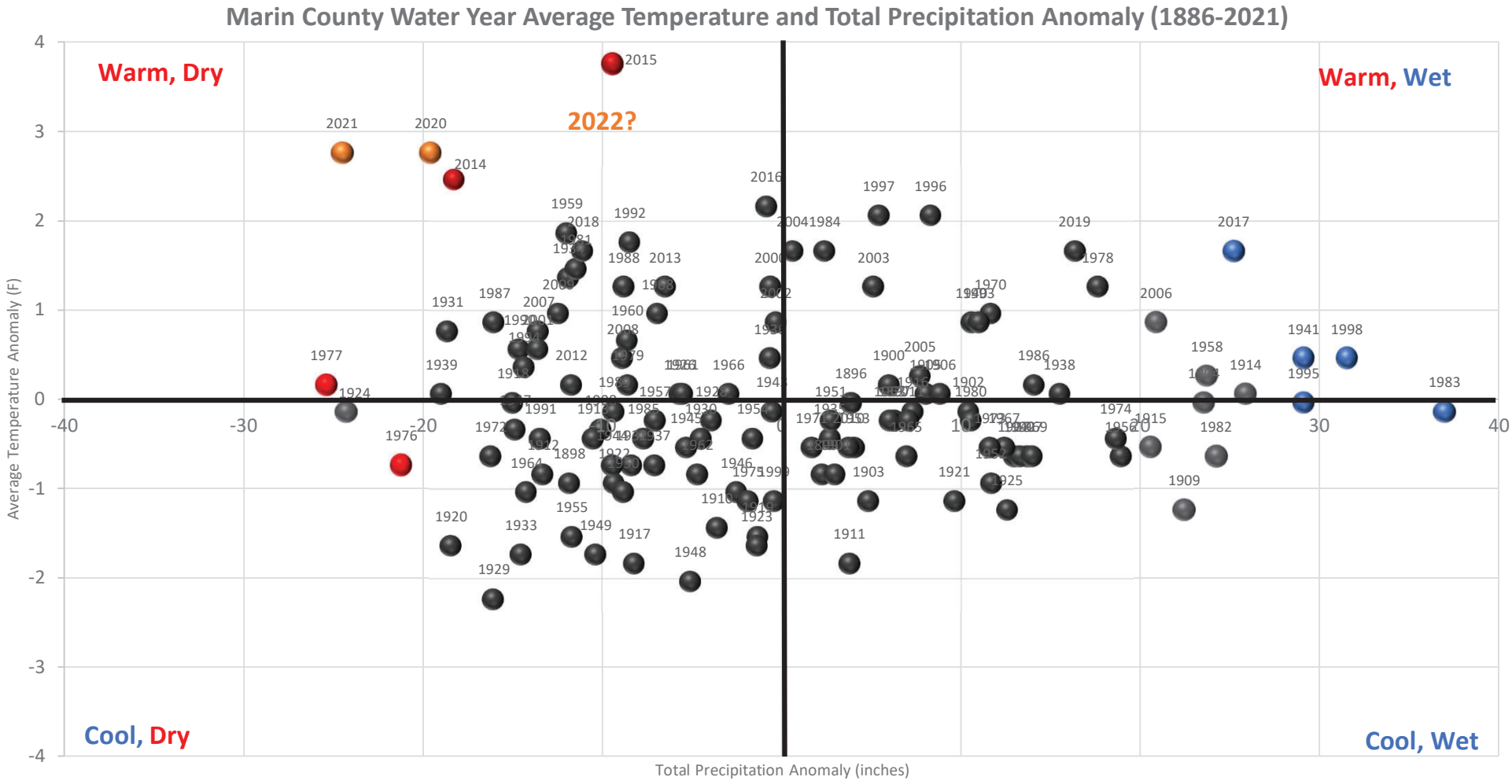
Drought – Often Defined by Lack of Significant Atmospheric Rivers



- The lack of strong or greater magnitude ARs over California over multiple water years has resulted in extremely dry conditions.
- On average, California experiences **SEVEN** strong or greater magnitude ARs in a Water Year
- California only experienced strong or greater magnitude AR conditions **THREE** times during Water Years 2020 & 2021 combined
- While Water Year 2022 began with an exceptional AR over California in October, the state only experienced strong or greater magnitude AR conditions FIVE times, resulting in three straight water years of below normal activity.

CW3E
Center for Western Weather and Water Extremes

*Arrows are placed on the map where each AR was strongest over the coast


Marin County Water Year Average Temperature and Total Precipitation Anomaly (1886-2021)
Warm, Dry
Warm, Wet
2022?
Cool, Dry
Cool, Wet
Average Temperature Anomaly (F)
Total Precipitation Anomaly (inches)
4
3
2
1
0
-1
-2
-3
-4
-40
-30
-20
-10
0
10
20
30
40
2015
2021
2020
2014
2016
1997
1996
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1992
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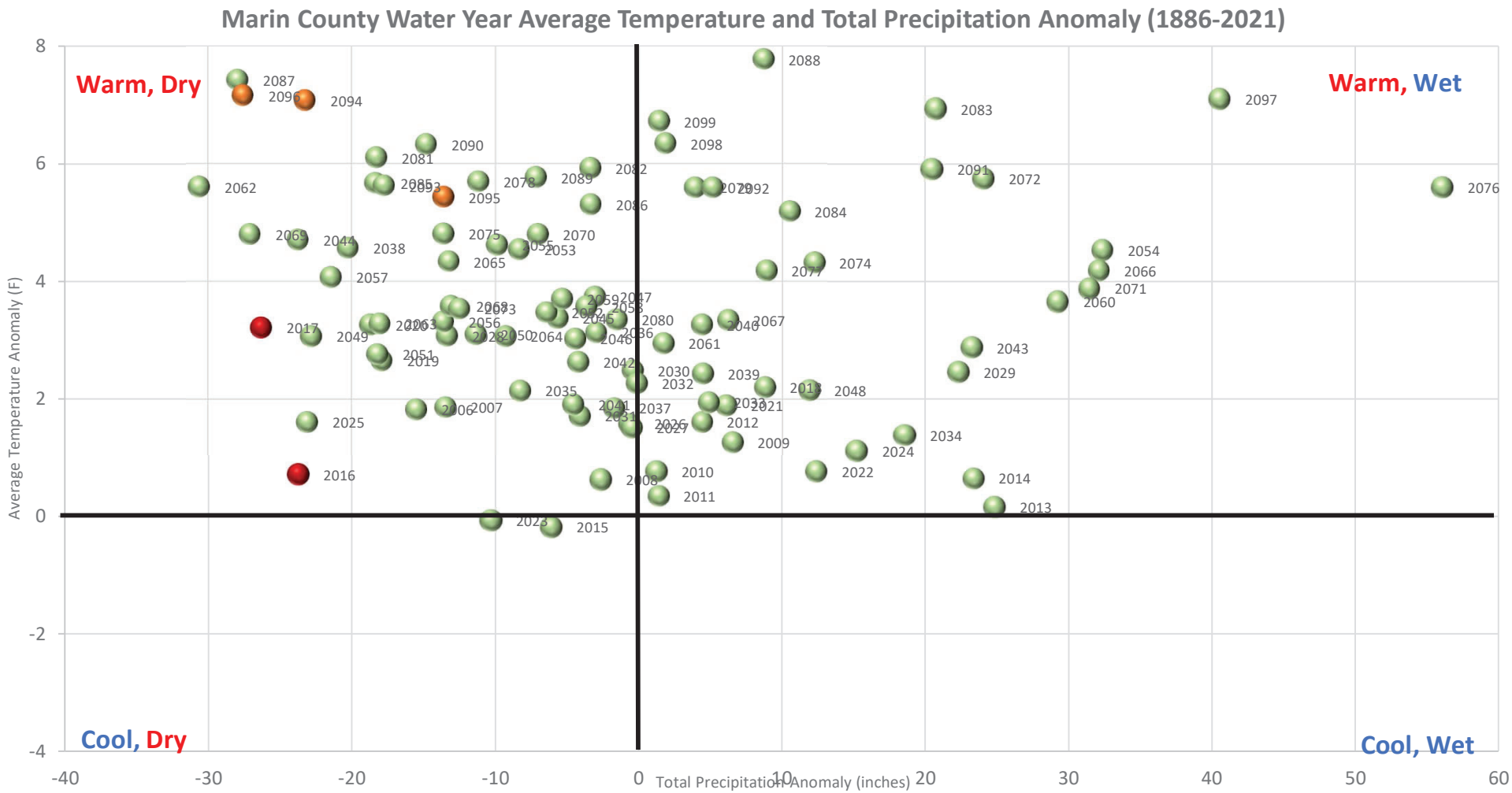
1929
1923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Warm, Dry
Warm, Wet
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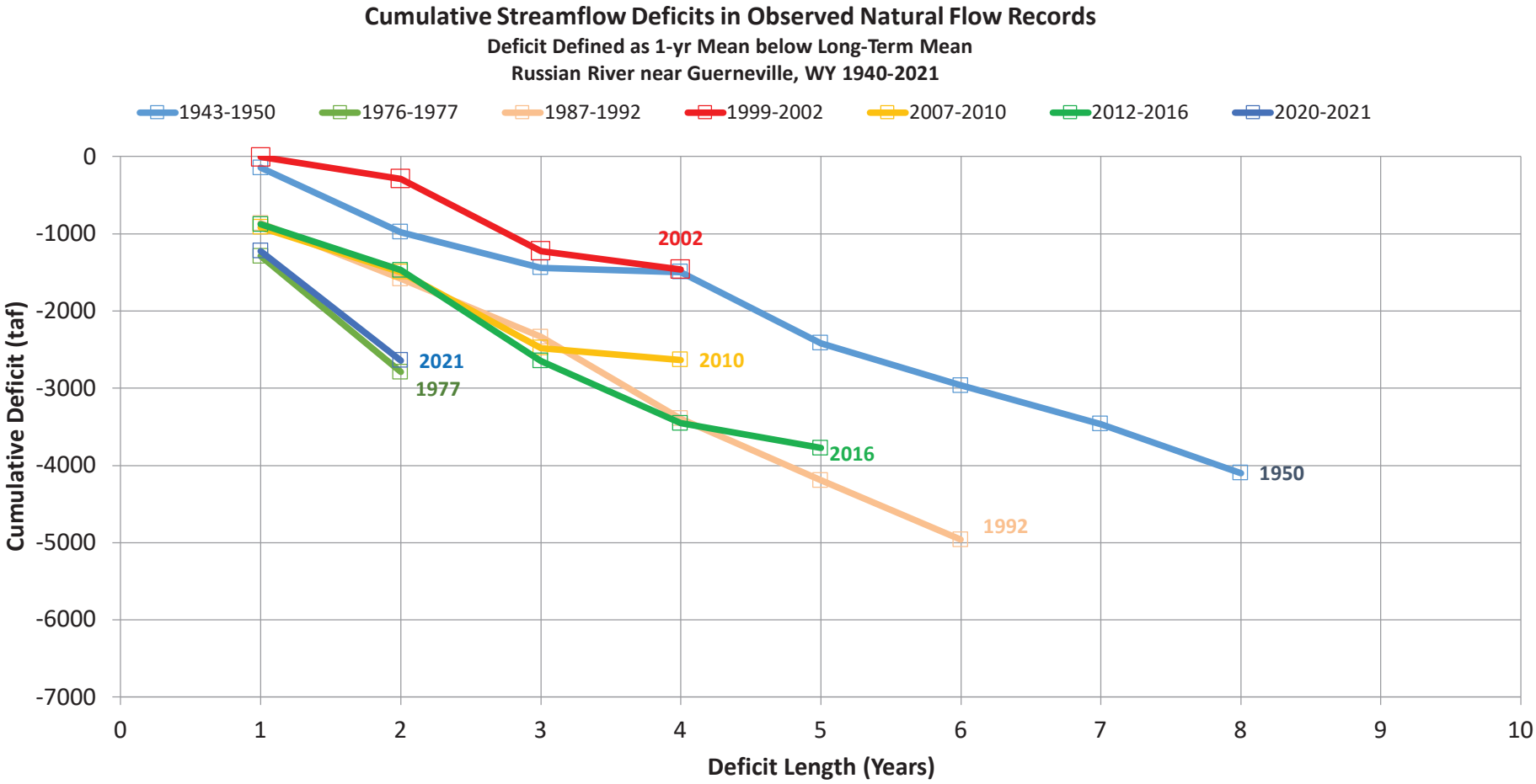
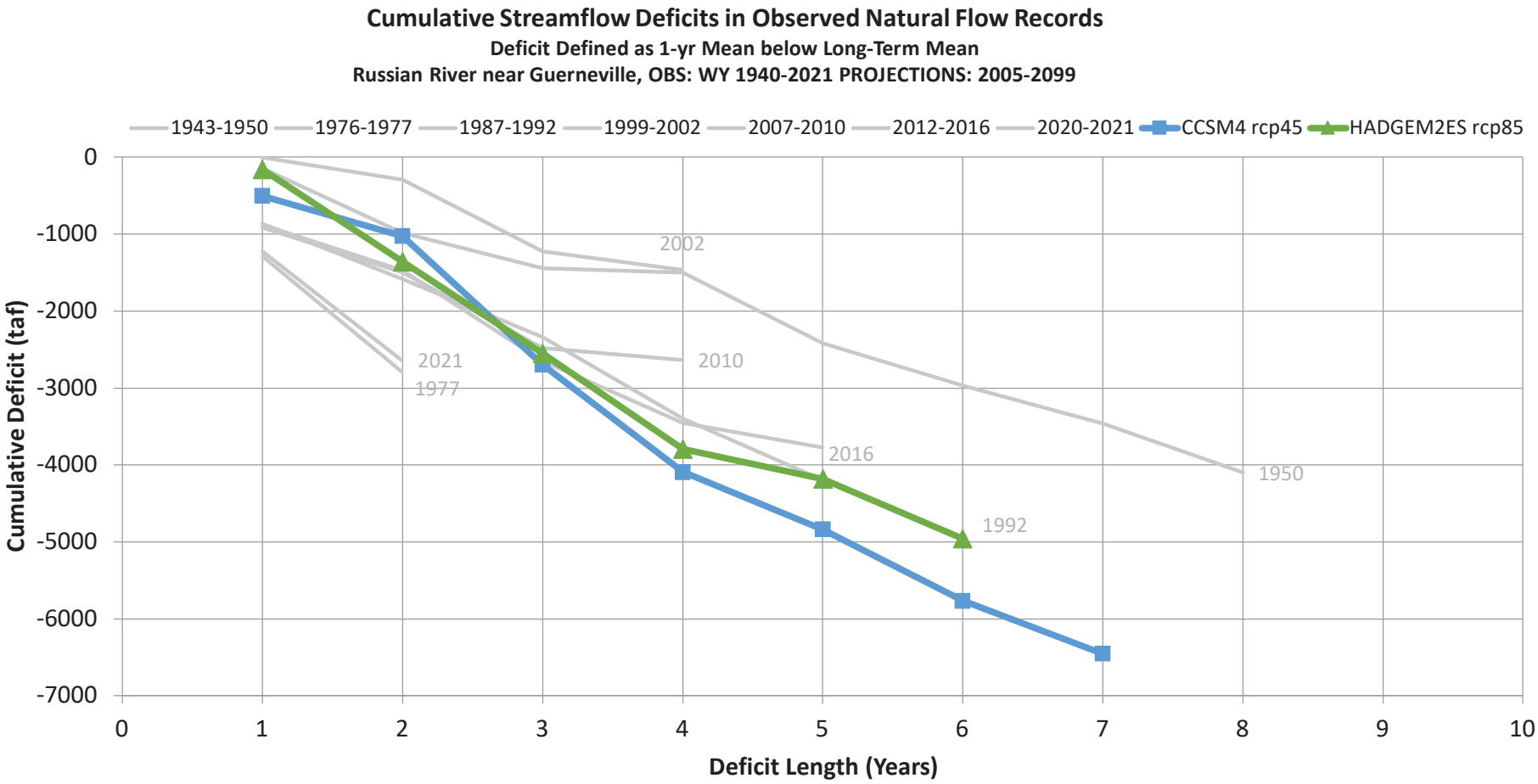
Cool, Wet
Average Temperature Anomaly (F)
Total Precipitation Anomaly (inches)
8
6
4
2
0
-2
-4
-40
-30
-20
-10
0
10
20
30
40
50
60

Historical Observed Droughts 1940 - 2021

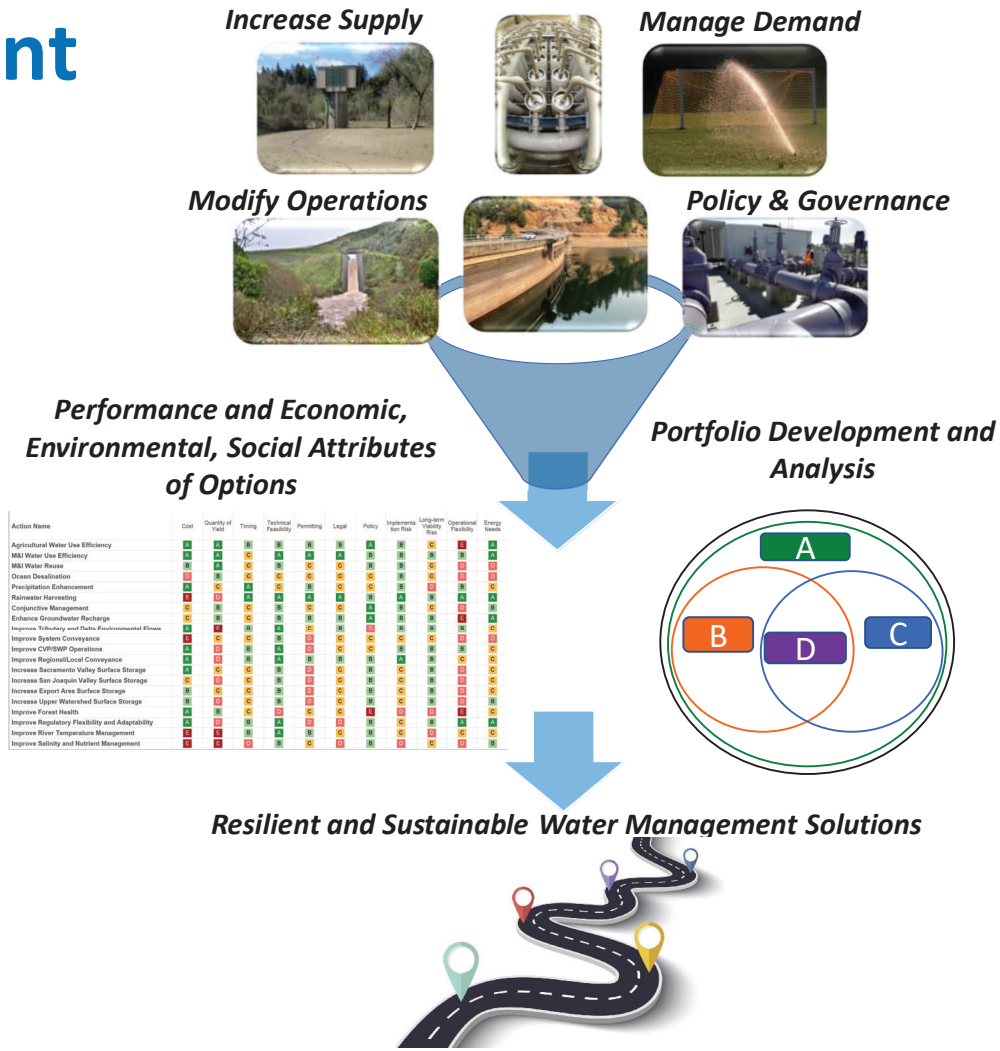


What do the Climate Projections Show?



Water Supply Assessment Process

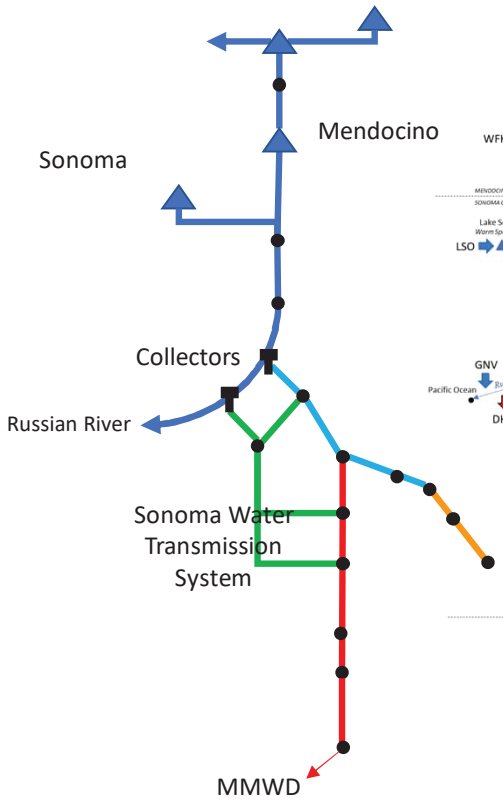
- Consider a broad range of water management alternatives
- Identify most promising alternatives
- Evaluate alternatives for performance and other economic, environmental, and social criteria
- Explore strategic combinations of alternatives
- Develop roadmap with specific project, pathways, and triggers to achieve resilient and sustainable solutions



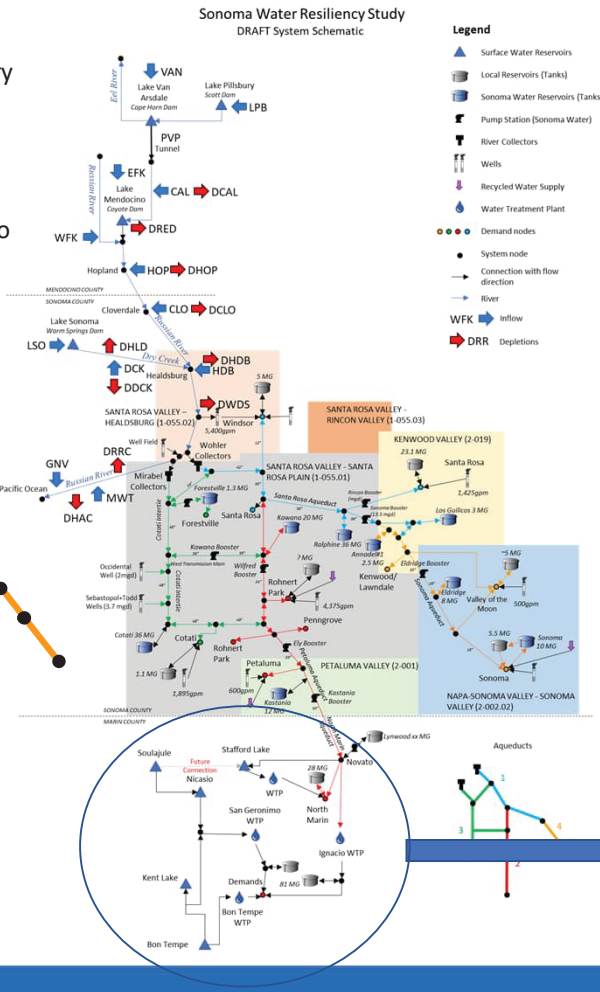
Decision Support Model

Decision Support Model

Simplified Model Domain

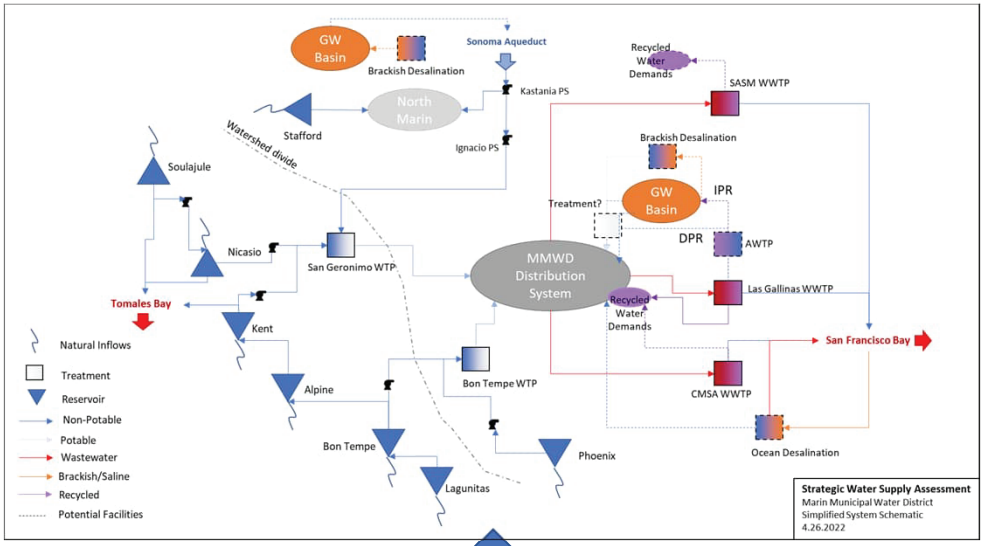


Model Schematic

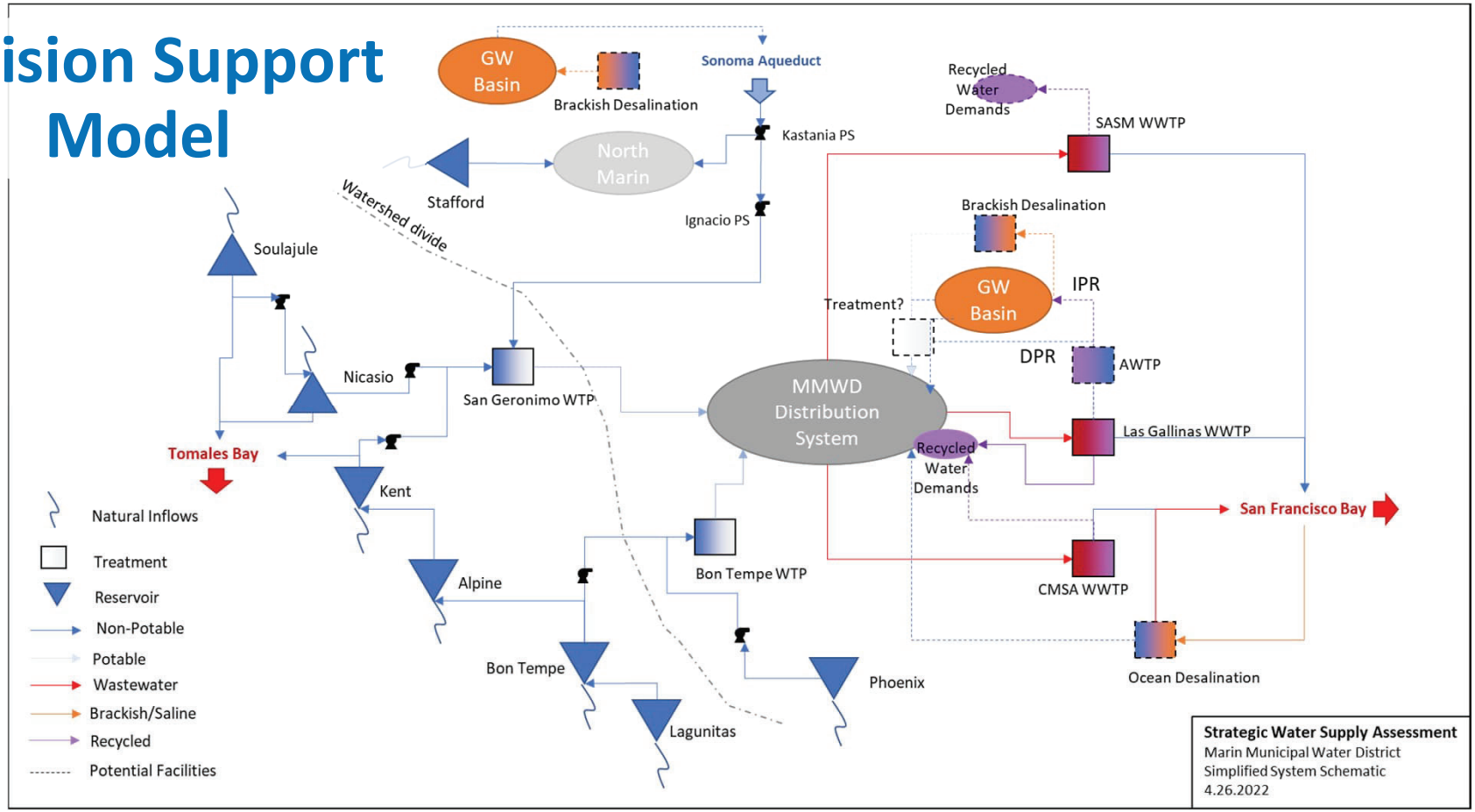


Top-Down model development approach, start with high level assumptions, add details as needed

Additional details for MMWD



Decision Support Model



Main Model Inputs:

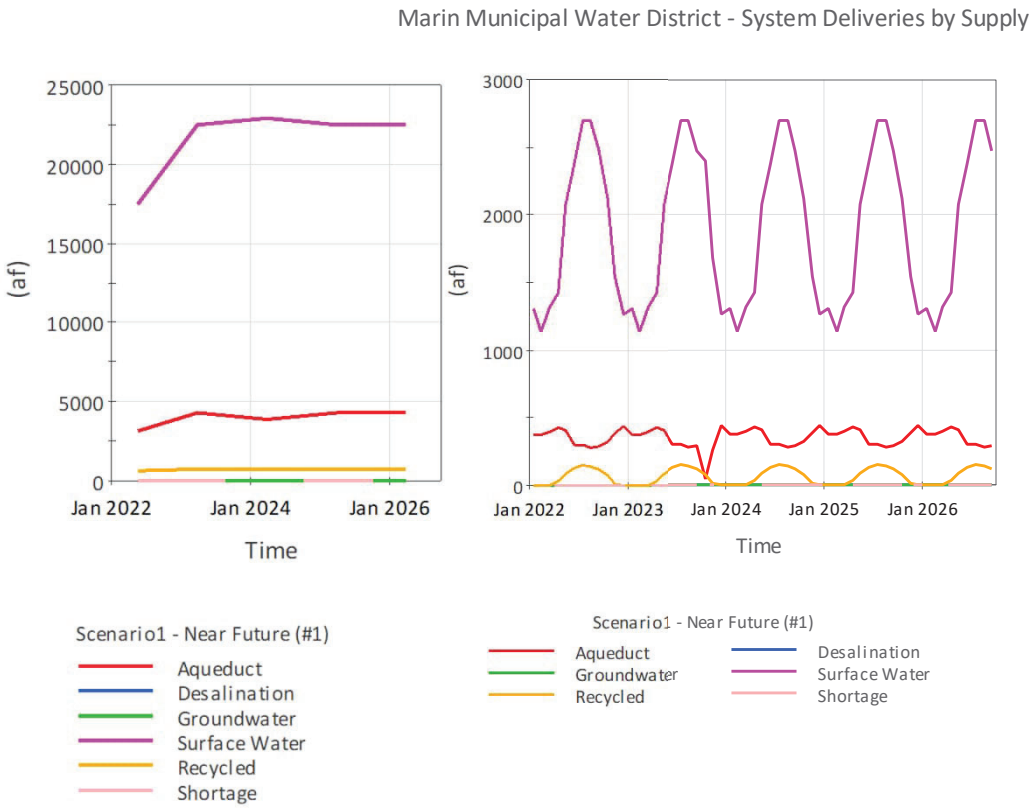
- River flows
- Reservoir inflows
- Local supplies
- System demands
- Flow limitations
- System operation

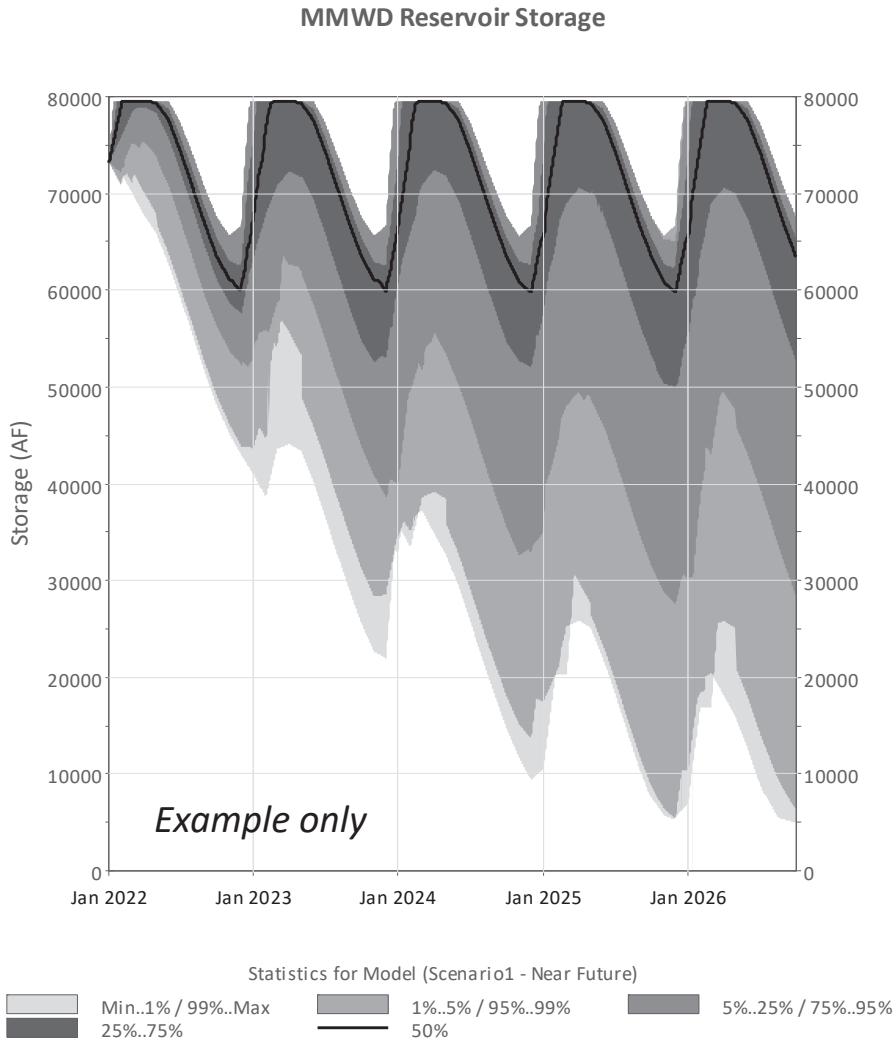
Main Model Outputs:

- Model scenarios
- System deliveries for different supplies
- Reservoir levels
- System flows

Decision Support Model

Example for illustration purposes only





Water Management Alternatives

Water Management Alternatives

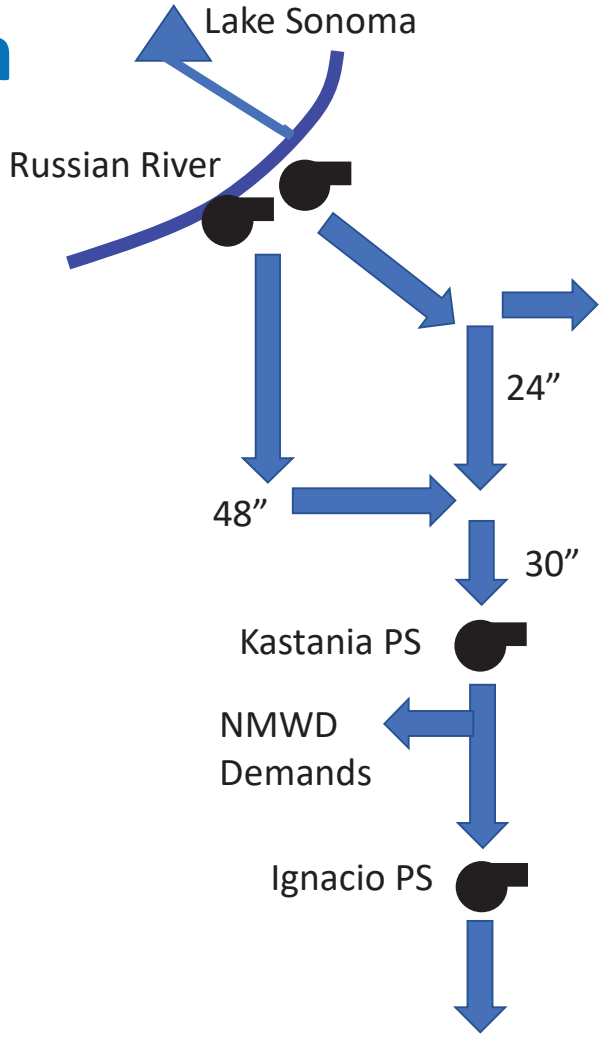
- Sonoma-Marin Partnerships
- Water Purchases with Conveyance through Bay Interties
- Desalination
- Reuse Options
- Surface Storage Augmentation
- Other Supply Options
- Demand Management

Sonoma-Marin Partnerships

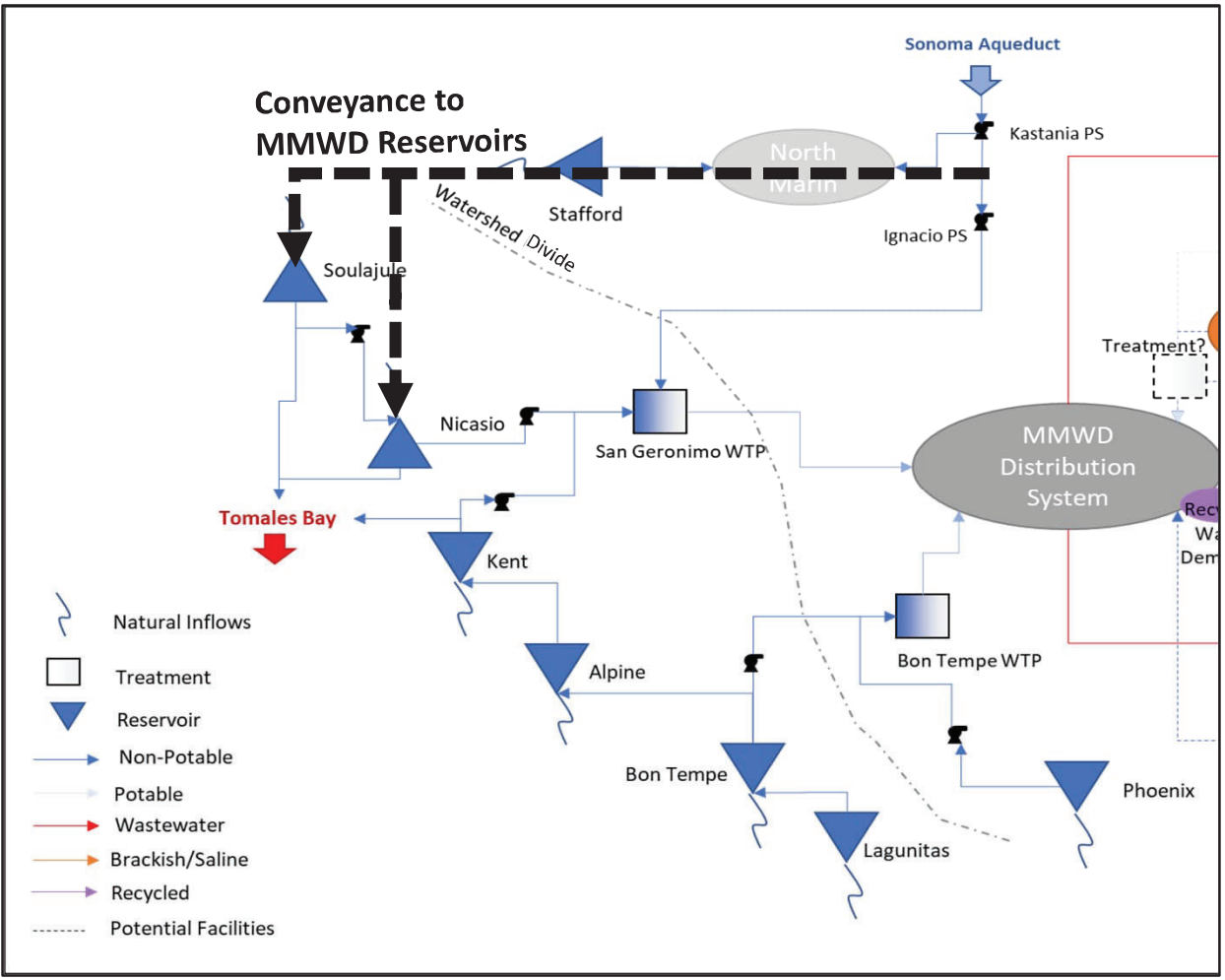
- Maximize Take of Winter Water with Existing Infrastructure
- Maximize Take of Winter Water with Modified Infrastructure
- Dedicated Conveyance to Reservoirs
- Support Rehabilitation of Sonoma Water Wells
- Participate in Regional Groundwater Bank

Maximize Take of Sonoma Water in Winter

- Operate to Maximize Take of Surplus Russian River Water in Winter
  - Maximize take of Sonoma Water up to contractual amount
  - Reduce take of MMWD reservoir water
- Develop Integrated Reservoir Operational Strategy
  - Optimize the balance of MMWD reservoir and Sonoma Water supplies dependent on hydrology, storage conditions, and demand
- Resolve Existing Conveyance Limitations
  - Kastania PS and Ignacio PS Improvements
  - Sonoma Water transmission system



Develop Dedicated Conveyance to Soulajule or Nicasio



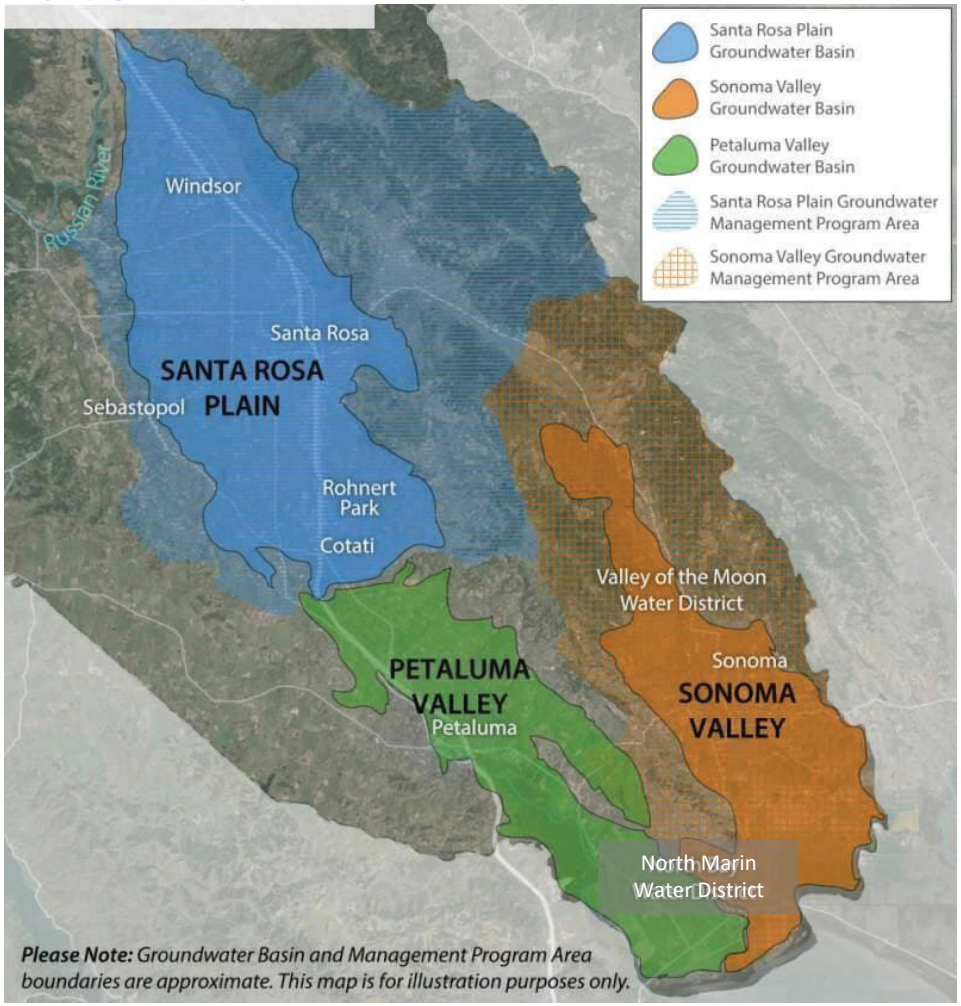
- Connection between Lake Stafford and Soulajule or Nicasio reservoirs
- NMWD seeking similar operation
- Pumping to watershed divide
- Potential risk of spill if prolonged wet period occurs
- Could be linked with storage augmentation

Support Rehabilitation of Santa Rosa Plain Wells

- Sonoma Water operates groundwater production wells in the San Rosa Plain
- Wells have not been activated in recent years
- Rehabilitation of wells is underway
  - Todd Road Well (1.4 mgd)
  - Sebastopol Road Well (2.1 mgd)
  - Occidental Road Well (2.0 mgd)
- Increasing production will provide more reliable delivery to MMWD

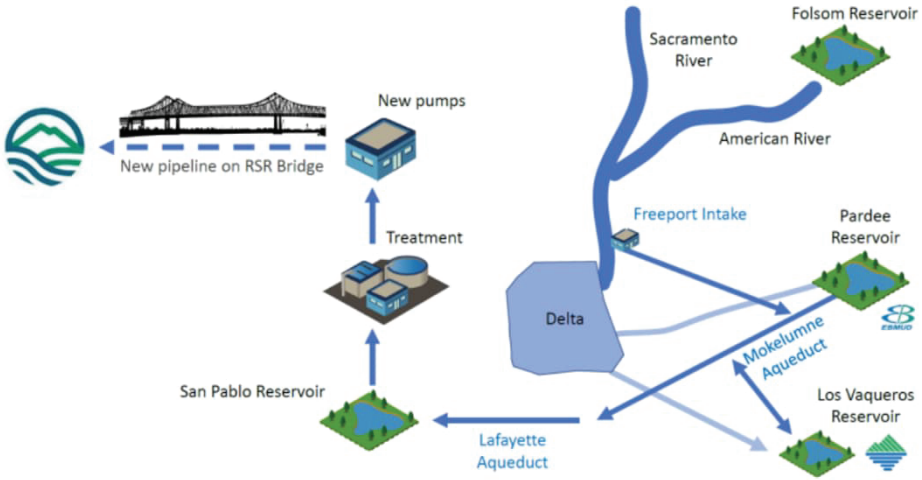
Participate in Regional Groundwater Bank

- Potential Regional Groundwater Bank
  - Santa Rosa Plain
  - Sonoma Valley
  - Petaluma Valley
- Facilities
  - ASR Wells in Each Basin
  - Connections to aqueduct
  - Treatment?
- Water Storage Operation
  - Put: Winter Water
  - Storage: Participant Pools + contribution to basin
  - Take: Drought year pumping
- Delivery
  - Direct delivery or in-lieu exchanges



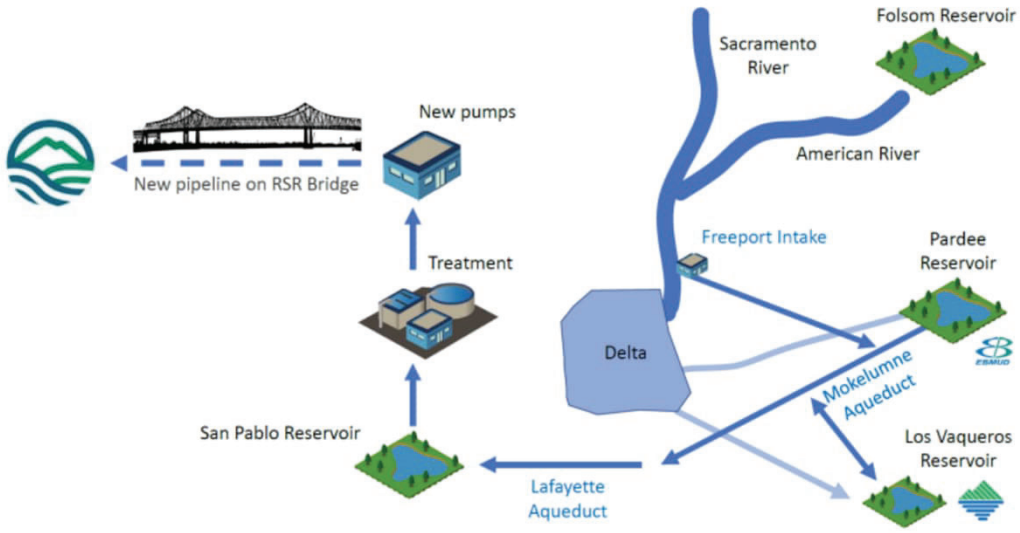
Water Purchases with Conveyance through Bay Interties

- EBMUD Intertie (Sac Valley purchases)
- CCWD Intertie (Sac Valley purchases)
- North Bay Aqueduct Intertie (Sac Valley purchases)
- SFPUC Intertie (Golden Gate Bridge)



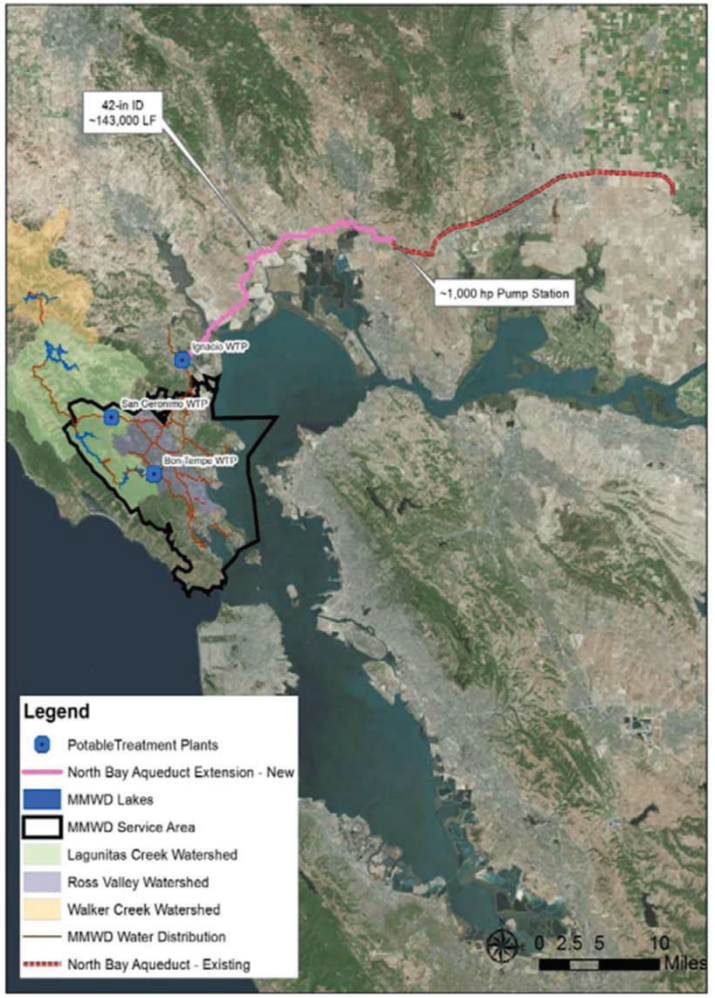
EBMUD or CCWD Intertie

- Sac Valley water purchases conveyed through EBMUD or CCWD systems
- Pipeline to connect to EBMUD or CCWD systems and across San Rafael Bridge (27”)
- MMWD tie in near CMSA
- Richmond distribution improvements for EBMUD customers
- Alternative to connect to CCWD, rather than EBMUD
- Significant permitting requirements



North Bay Aqueduct - Intertie

- Sac Valley water purchases conveyed through North Bay Aqueduct
- Pipeline and pump station to connect to MMWD system
- Potential connection to Sonoma Water system for regional supply



Water Reuse

- Recycled Water – expansion of existing system (Peacock Gap in design)
- Indirect Potable Reuse (IPR) – highly treated water pumped through reservoir system (e.g. Kent Lake)
- Direct Potable reuse (DPR) – highly treated water directly to customers
- Environmental releases – highly treated water to watershed

Non-Potable Reuse Expansion

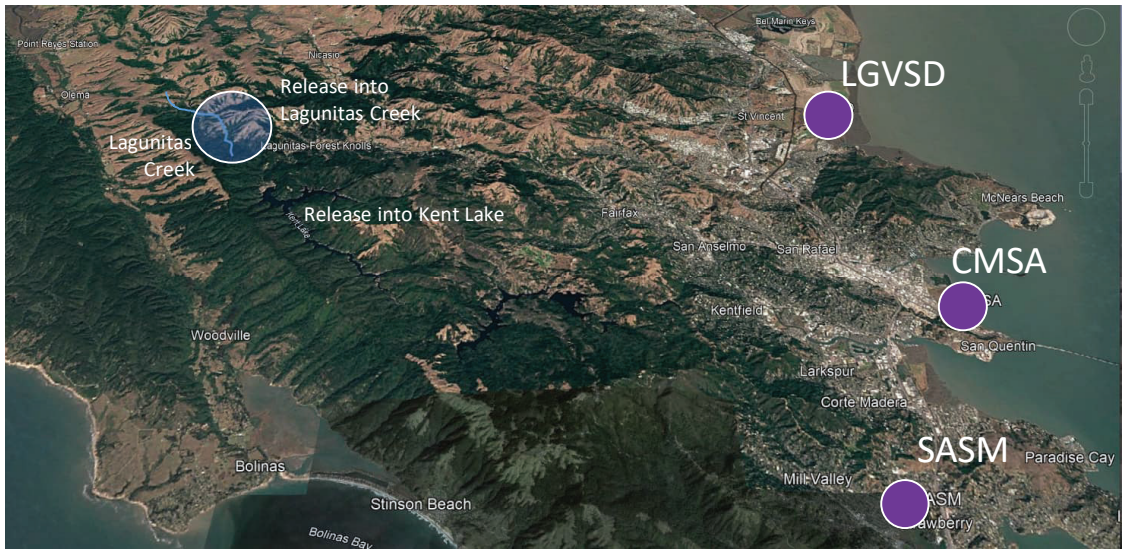
- Description
  - Expansion of LGVSD RW distribution system to provide disinfected tertiary RW to Peacock Gap Golf Course (166 AFY)
  - Installation of membrane (MF) at CMSA, provide disinfected tertiary RW to San Quentin Prison (154 AFY)
- Considerations
  - Demand is seasonal
  - Other non-potable reuse options considered are small yield (less than 150AFY)

Indirect Potable Reuse (IPR)

- Description
  - Collect secondary effluent from LGVSD and SASM to CMSA,
  - provide AWPF up to 8.8 mgd (7 mgd yield = 7,840 AFY),
  - convey purified water to Kent Lake.
  - Discharge RO reject to CMSA effluent
- Considerations
  - Discharge permit for RO reject

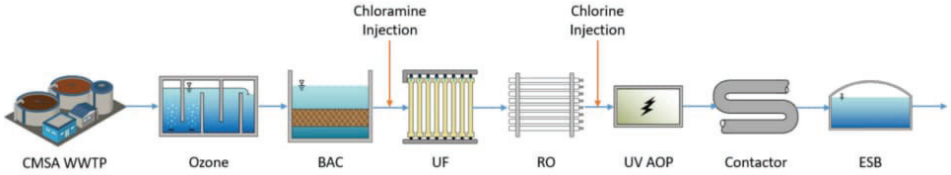
In-lieu for Streamflow Release

- Description of Concept
  - Provide disinfected tertiary RW, cool to adjust temperature, release to Lagunitas Creek, or
  - Provide IPR as described, discharge purified water to Kent Lake to provide both IPR and streamflow augmentation
- Considerations
  - Temperature
    (< 58F May 1-Oct 31,
    <56F Nov 1-Apr 30)
  - Instream flow requirements
    11,050 AFY wet/normal
    9,000 AFY dry year
  - 7 mgd IPR will provide 7,840 AFY



Direct Potable Reuse (DPR)

- Description
  - Advanced Water Purification Facility at CMSA
  - Only treat CMSA effluent, connection to exiting distribution (treated water augmentation) at up to 4 mgd, or
  - Convey secondary effluent from LGVSD and SASM, treat up to 8.8 mgd produce up to 7 mgd purified water and convey to Bon Tempe Lake (raw water augmentation)
- Considerations
  - DPR process at 3 plants, or regional
  - Direct connection to distribution system, or raw water augmentation
  - Discharge permit for RO reject

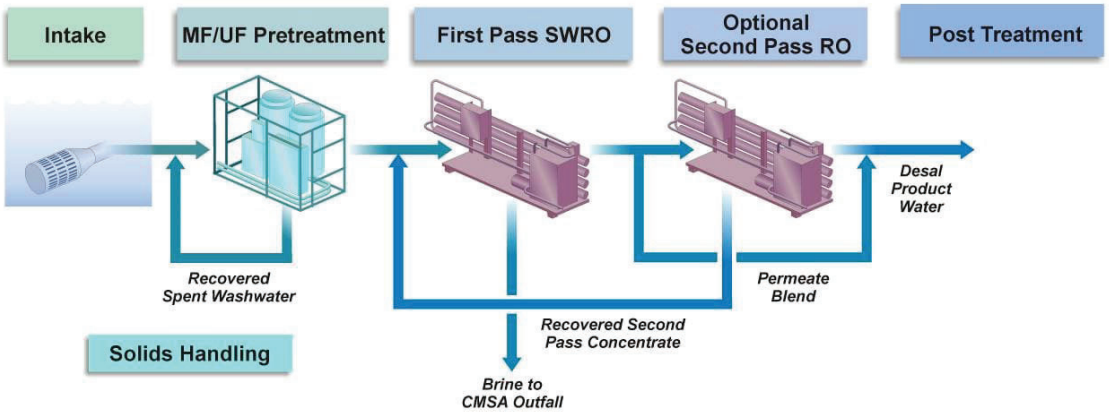


Desalination

- Containerized (Emergency) Desalination
- Permanent Marin Regional Desalination
- Bay Area Regional Desalination (East Bay)
- Petaluma Brackish Regional Desalination (North Bay)

Local Ocean (Bay) Desalination – 2005/2006 Piloting Program

- Pilot testing program conducted in 2005 and 2006 as part of *Evaluating a Drought Proof Source of Water for Marin* study
- Verified that Bay water could be successfully desalinated using MF/UF pretreatment followed by two-pass RO and post-treatment for remineralization and disinfection
- Demin water would be introduced into existing distribution system and blended with treated reservoir water
- RO concentrate would be blended with wastewater effluent in CMSA outfall

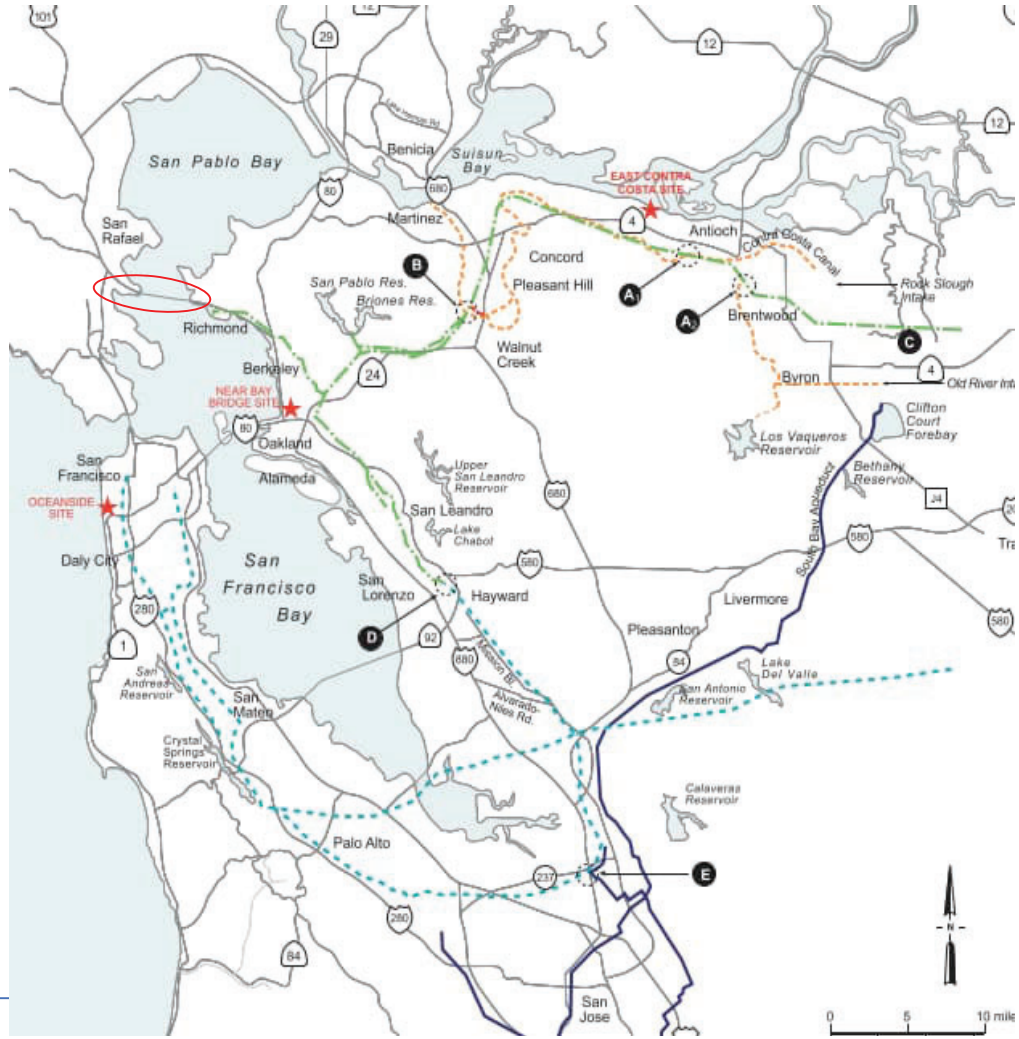


2021 Emergency Desalination Facility Study

- Two approaches evaluated:
  - Shore-based, containerized facility
  - Barge-mounted facility
- Barge-mounted dismissed due to permitting challenges/limited, short-term availability
- Containerized facility:
  - Three qualified bidders identified; two engaged for detailed proposals (MF/UF, RO, remineralization
  - Osmoflo 3.6-mgd system determined to be most suitable based on availability, footrpint, integrated design and ability to meet treated water quality goals

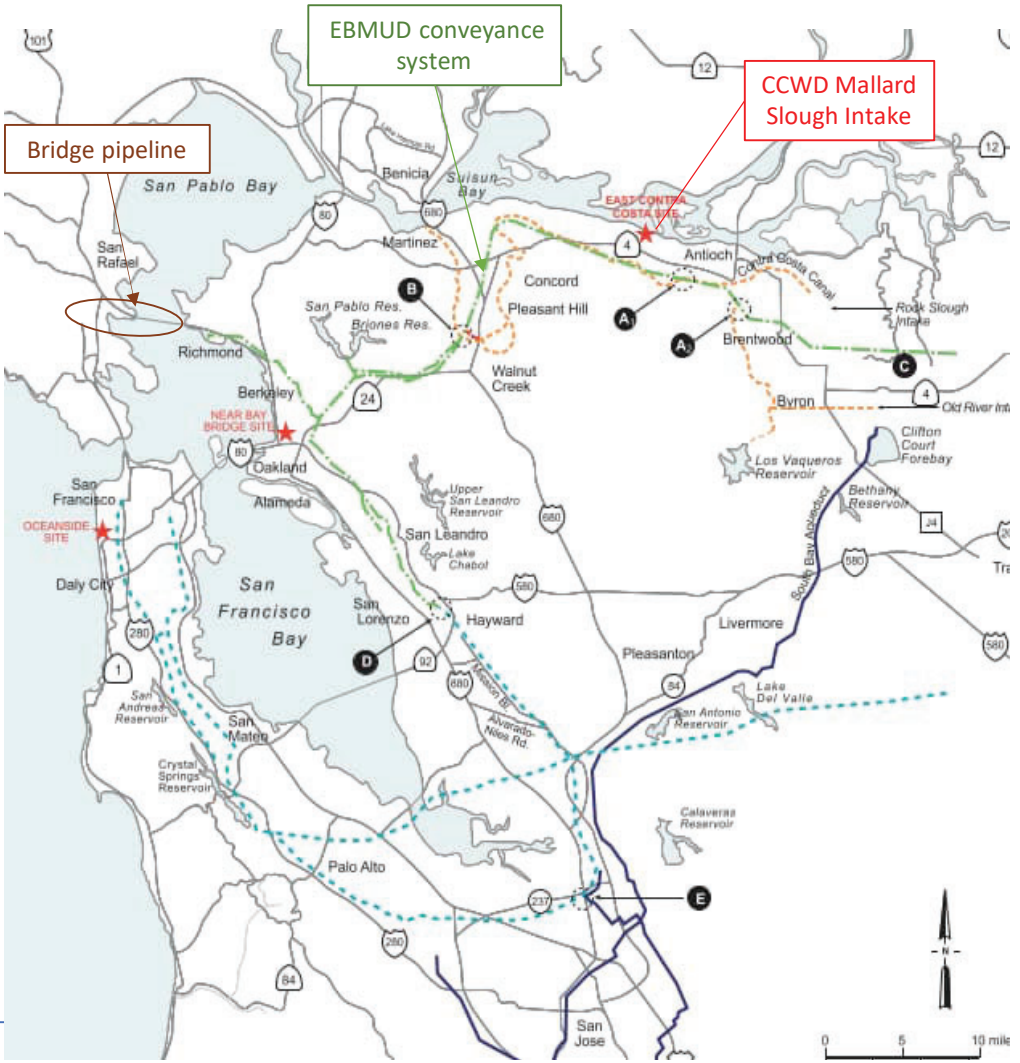
Bay Area Regional Desal Project (BARDP)

- Conceived in 2003; additional studies through 2014, including piloting
- Participating agencies:
  - Contra Costa Water District
  - EMBUD
  - SFPUC
  - Valley Water
  - Zone 7
- Several desal plant sites identified
- Initial proposed capacity of 65-70 MGD; capacities in flux
- SFPUC considering 5-15 mgd



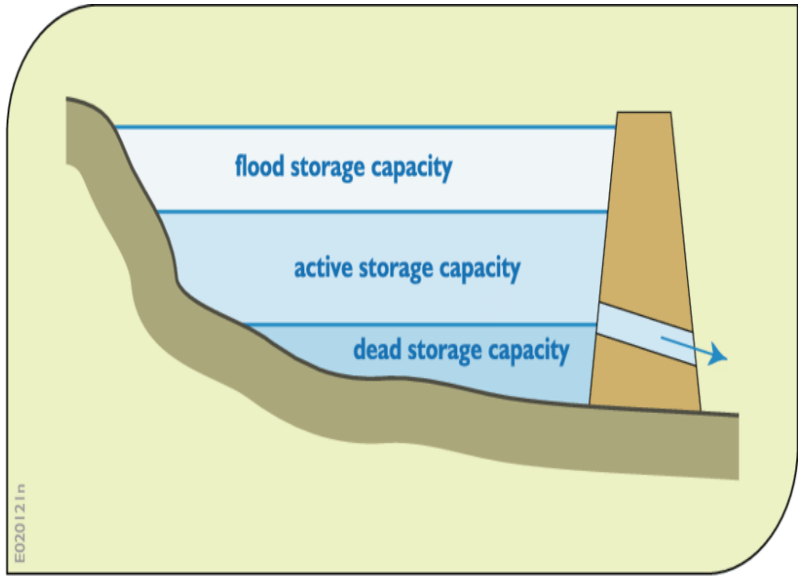
Bay Area Regional Desal Project (BARDP)

- Current preferred alternative
  - Brackish water pumped from Mallard Slough using CCWD intake
  - Desalinated water wheeled through EMBUD conveyance system
  - 25-mgd max. raw water abstraction producing 20 mgd of desalinated water
- Conjunctive operation of desal plant and Los Vaqueros Reservoir
- MMWD access to desalinated water:
  - Pipeline across Richmond-San Rafael Bridge
  - Agreements with SFPUC and EBMUD at a minimum
-

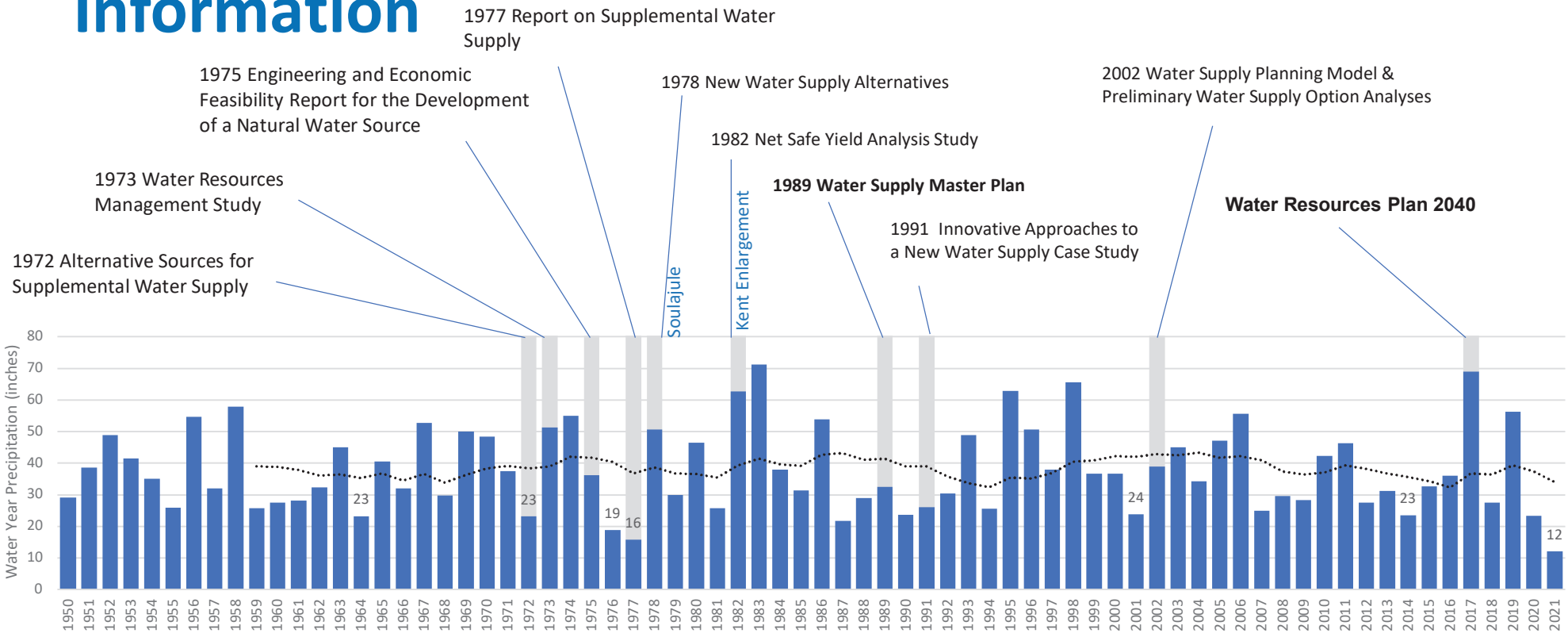


Local Storage Augmentation

- Review availability of watershed supply versus storage capacity
- Regulatory/environmental approvals for the dredging or excavation work
- Impacts and limitations
- Requires new water rights



Water Resources Studies with Surface Storage Information



Related Recent Projects Suggested

Water Resources Plan 2040 (2017)

- Local Surface Storage
  - Raising Soulajule dam (~ 4,000 AFY yield)
  - Dredging Nicasio Lake (~ 1,000 AFY)
  - Increasing usable storage in Nicasio Lake (Pumping improvements)

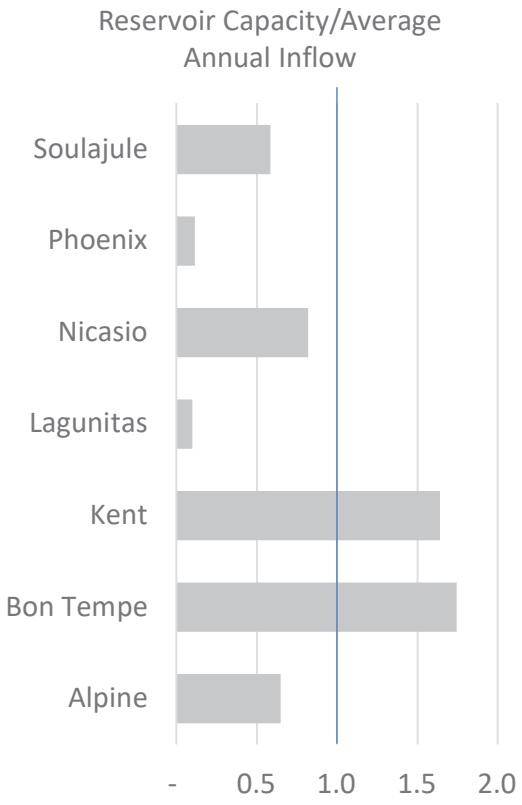
Table 5-4: Expand Storage Options - Unit Cost and Yield

Resiliency Option	Cost ($/AFY)	Yield (AFY)
Reservoir Excavation/Dredging	$15,500	1,000
Pump Station Improvements at Nicasio	N/A	0
Raise Soulajule Dam	$2,100	4,000
Local Groundwater Ross Valley	$2,600	400
Local Groundwater Lagunitas Watershed	$3,900	300
Petaluma Valley Conjunctive Use	$6,100	200
Santa Rosa Plain Conjunctive Use	$2,600	300
Expand Los Vaqueros	$7,200	1,400
Gravel Quarry Storage	$2,200	1,900

- Surface storage outside of MMWD's existing reservoirs
  - Storage in the gravel quarry
  - Implementing groundwater storage options

Reservoir Capacities vs Inflows

	Alpine	Bon Tempe	Kent	Lagunitas	Nicasio	Phoenix	Soulajule
Reservoir Capacity (AF)	8,891	4,017	32,895	350	29,000	411	10,572
average inflow (AFY)	13,776	2,305	20,069	3,582	35,399	3,665	18,125
Capacity/AVG inflow	0.65	1.74	1.64	0.10	0.82	0.11	0.58



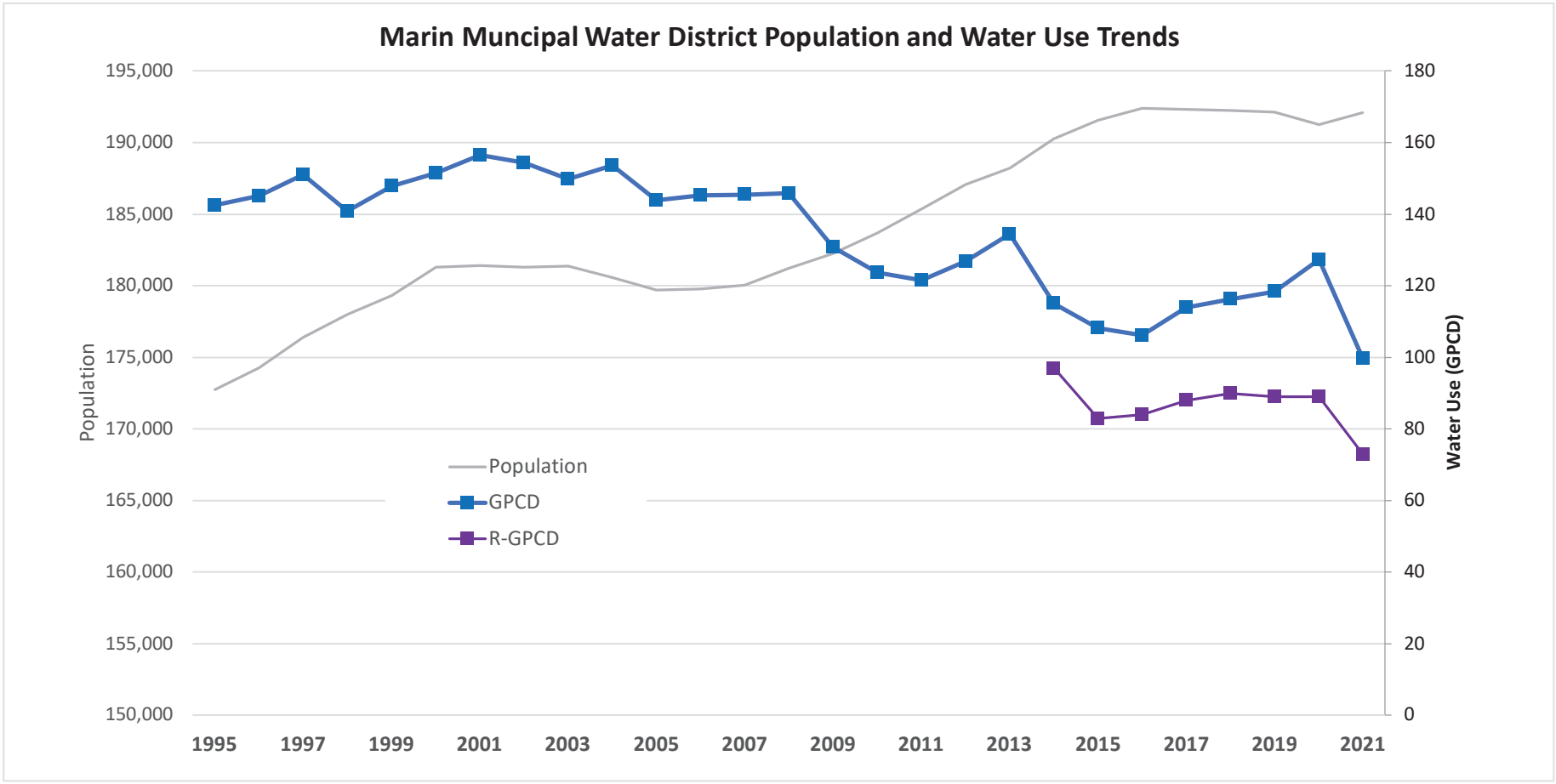
Other Water Supply Options

- Identify and evaluate alternate water supply technologies & innovative concepts:
  - Fog Capture
  - Cloud Seeding
  - Watershed Management

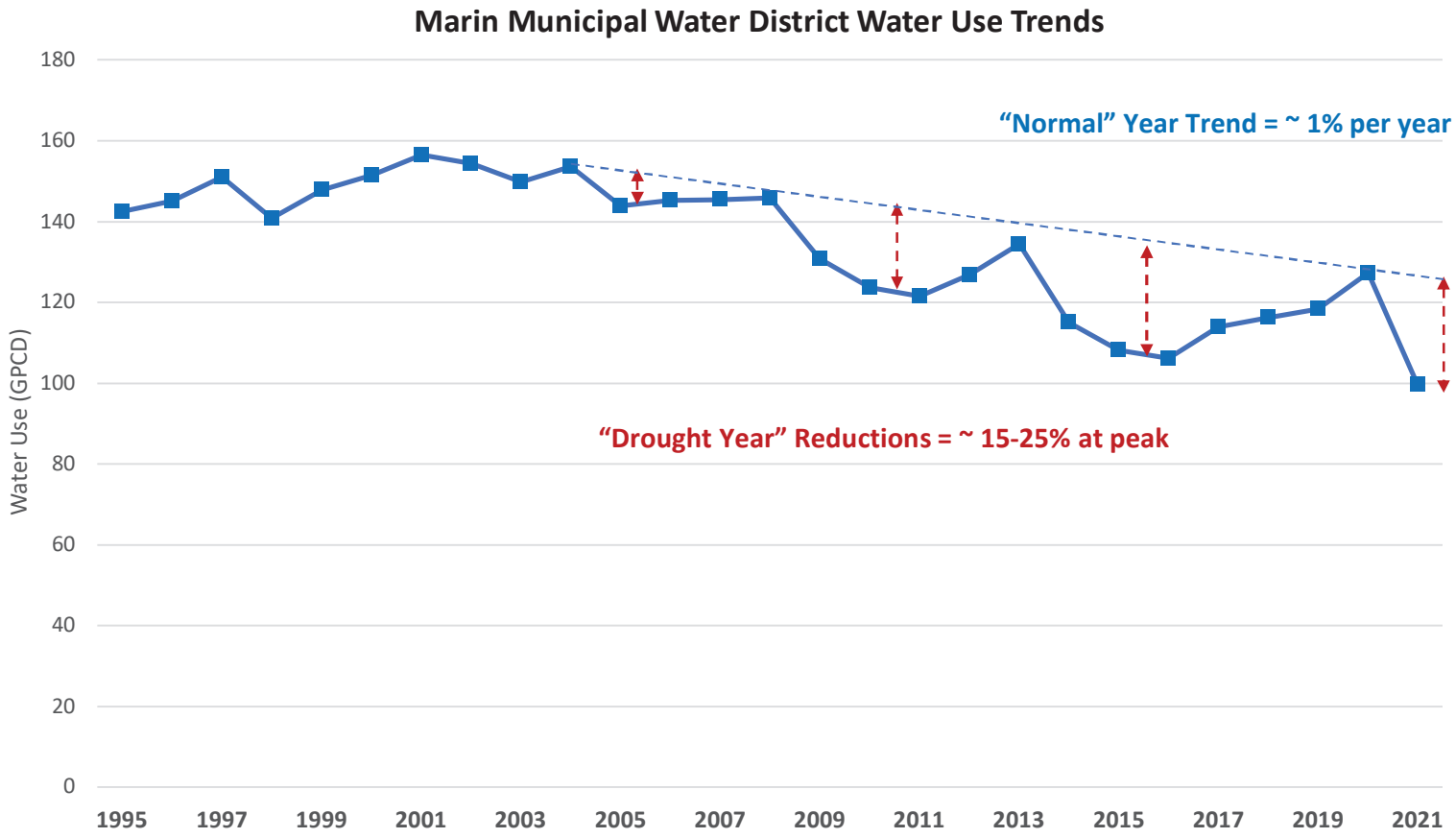
Demand Management

- Continue our long-term efforts in water use efficiency
- Enhanced programs and initiatives such as non-functional turf
- Leak Detection – Evaluate new technologies
- Continue to integrate water conservation for drought savings

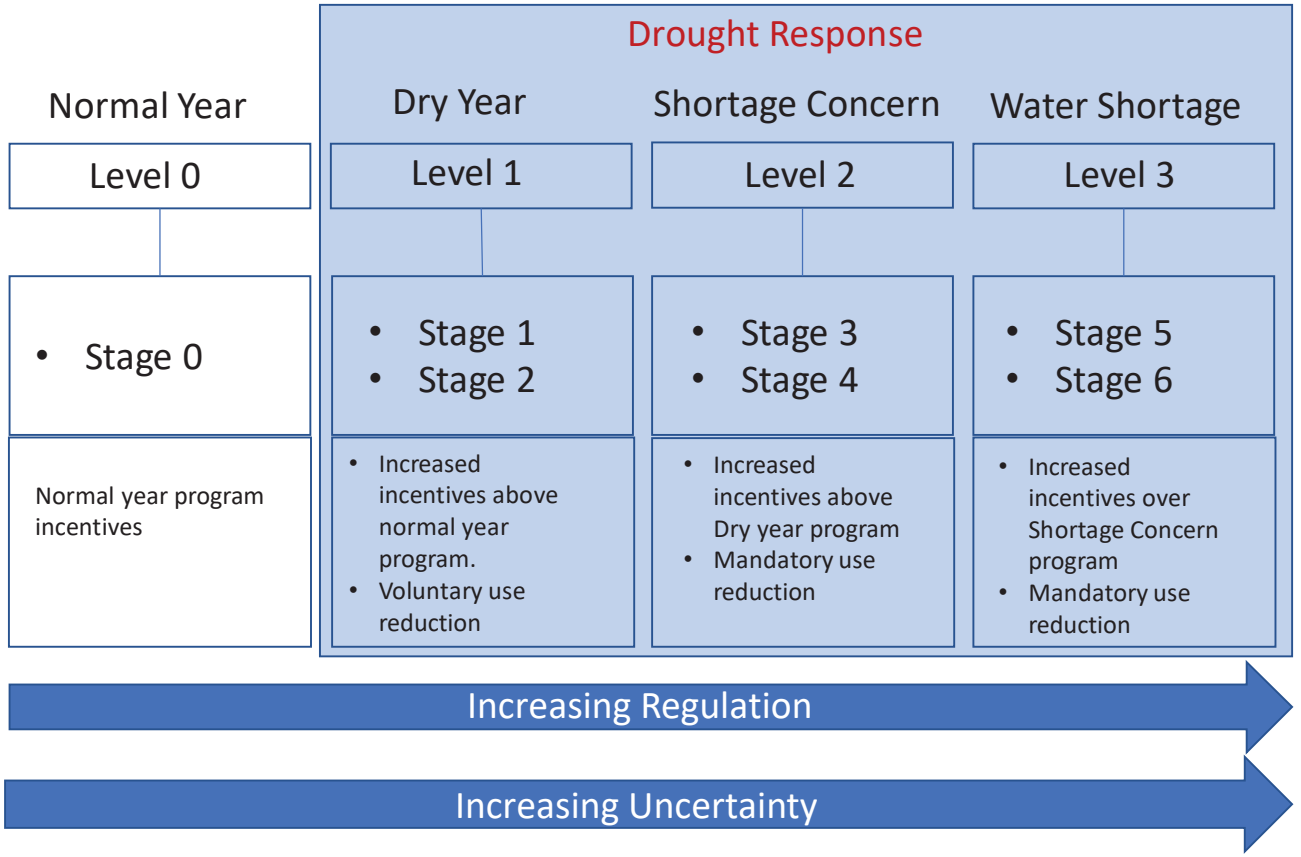
Population and Water Use Trends



Water Use Trends – Normal and Drought Year



Demand Management and Drought Response



Goals

Draft Goals

- Project Team Reviewed
  - Board Policies and Handbook 2021
  - Draft Board Resolution on Climate Change and Water Resiliency 2022
  - Strategic goals established by similar water districts
- Developed Draft Goals
  - Water Supply
  - Water Quality
  - Sustainability and Environmental
  - Economic and Financial

Draft Goals

- **Water Supply** *Provide a reliable and resilient water supply now and for the future*
- **Water Quality** *Assure that water produced is of high quality and protects public health from source to customer's tap*
- **Sustainability and Environmental** *Protect and enhance the biodiversity of the watershed and protect the environment for future generations*
- **Economic and Financial** *Maintain and improve the District's infrastructure and operations in a cost-effective manner*

Draft Goals: Water Supply

Water Supply: *Provide a reliable and resilient water supply now and for the future*

ACTIONS

- Reduce water demand
- Develop supplemental water supply
- Increase regional coordination
- Plan for a range of climate and climate change outcomes

METRICS

- Meet demand during a <<4-yr>> drought with up to <<20>> percent demand reduction
- Local storage does not fall below <<25,000>> acre-feet during most severe droughts
- Establish residential water use targets

Draft Goals: Water Quality

Water Quality: *Assure that water produced is of high quality and protects public health from source to customer's tap*

ACTIONS

- Invest in appropriate treatment levels for water supplies
- Operate and maintain District facilities to anticipate and meet all water discharge, air emission, and land disposal requirements to protect and enhance the environment
- Integrated new supplies into the system with little change in the customer's actual or perception of water quality

METRICS

- Water quality meets or exceeds all environmental and public health standards
- Source watersheds are protected, and natural functional processes are maintained

Draft Goals: Sustainability & Environmental

Sustainability and Environmental: *Protect and enhance the biodiversity of the watershed and protect the environment for future generations*

ACTIONS

- Provide responsible stewardship of land under district management, balancing existing mandates to safeguard ecological integrity, protect against wildfire, and maintain water quality
- Continue to utilize deep green power from Marin Clean Energy

METRICS

- Source watersheds are protected, and ecosystem benefits are maintained
- Use of environmental, social, and economic sustainability indicators

Draft Goals: Economic and Financial

Economic and Financial: *Maintain and improve the District's infrastructure and operations in a cost-effective manner*

ACTIONS

- Actively leverage state, federal sources of funding to offset capital costs of improving water supply.
- Ensure integrity, accountability and transparency in financial management.
- Provide a water rate structure that is fair and reasonable, and that adequately funds the long-term maintenance and capital needs of the District's supply and delivery systems.

METRICS

- State and federal grants form a significant portion of Marin Water's water supply resiliency alternatives funding.
- Integrity, Accountability and Transparency: provide clarity on full costs of alternatives

Evaluation Criteria

Evaluation Process

- Performance Criteria
  - Linked to water reliability and resiliency goals
- Evaluation Criteria
  - Additional criteria that help discern alternatives
- Application Approach
  - How do individual alternatives perform?
  - What combination of alternatives could be considered?
  - What portfolio strategy is most strategic?

Evaluation Criteria (DRAFT)	Description
Cost	Estimate of capital and annual costs.
Timing	Estimate of time required before project could be planned, designed, permitted, and implemented.
Environmental	Anticipated impacts on the natural environment
Feasibility	Maturity of the concept and technical ability to implement.
Energy	Estimated change in energy required to implement and operate.
Permitting/Legal	Anticipated permitting and legal challenges
Social	Description of positive or negative socioeconomic effects.
Jurisdiction	Primary jurisdiction for implementation

Status and Next Steps

Work in Progress

- Development of scenarios
- Updates to decision support model
- Development of water supply alternatives
  - alignments, cost, quality, feasibility, etc
- Development of demand approach

Schedule

- Proposed Upcoming Board Discussion Focus Areas
  - May
    - Demand Management
    - Drought Scenarios & Baseline Reliability
  - June
    - Water Supply Alternatives
    - Evaluation Process
- Public Meetings
  - May/June – Public Workshop #2
  - July/August – Public Workshop #3

Q & A