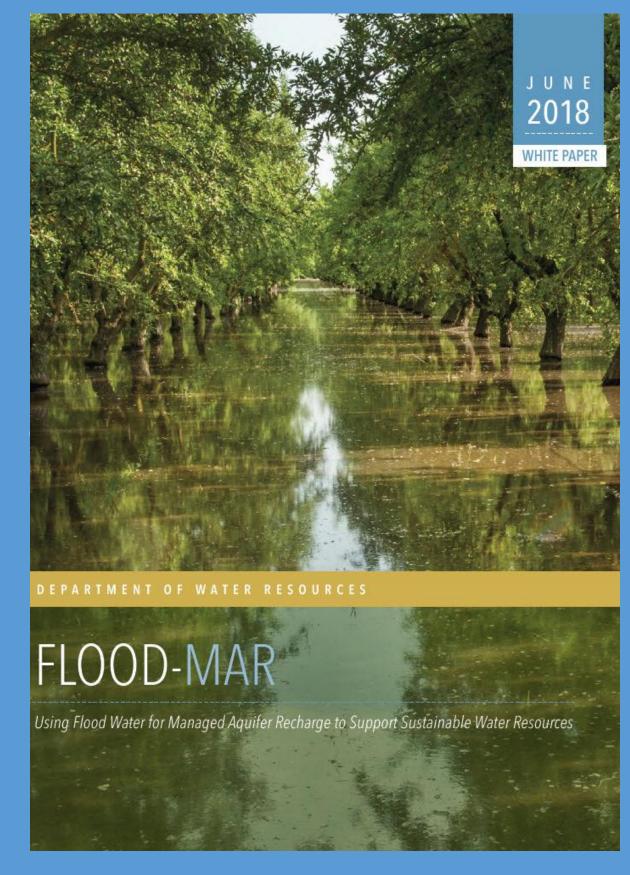
Flood-MAR

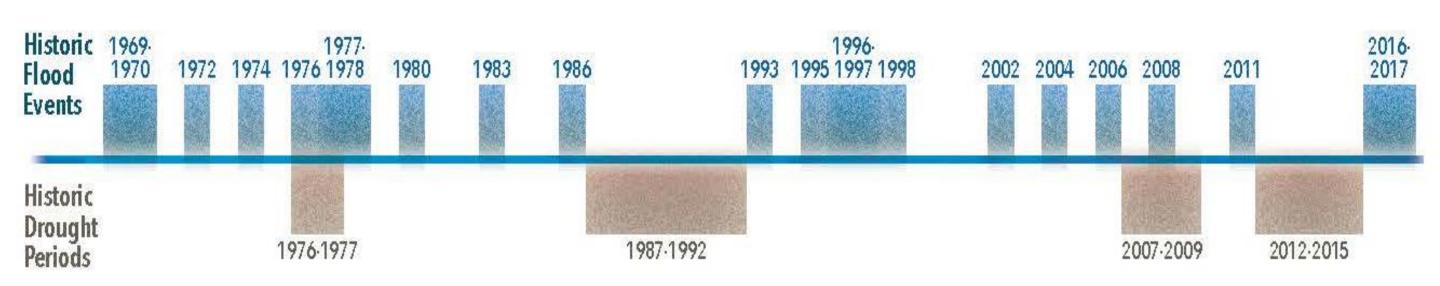
Using Flood Water for Managed Aquifer Recharge

FIRO Workshop August 1, 2018



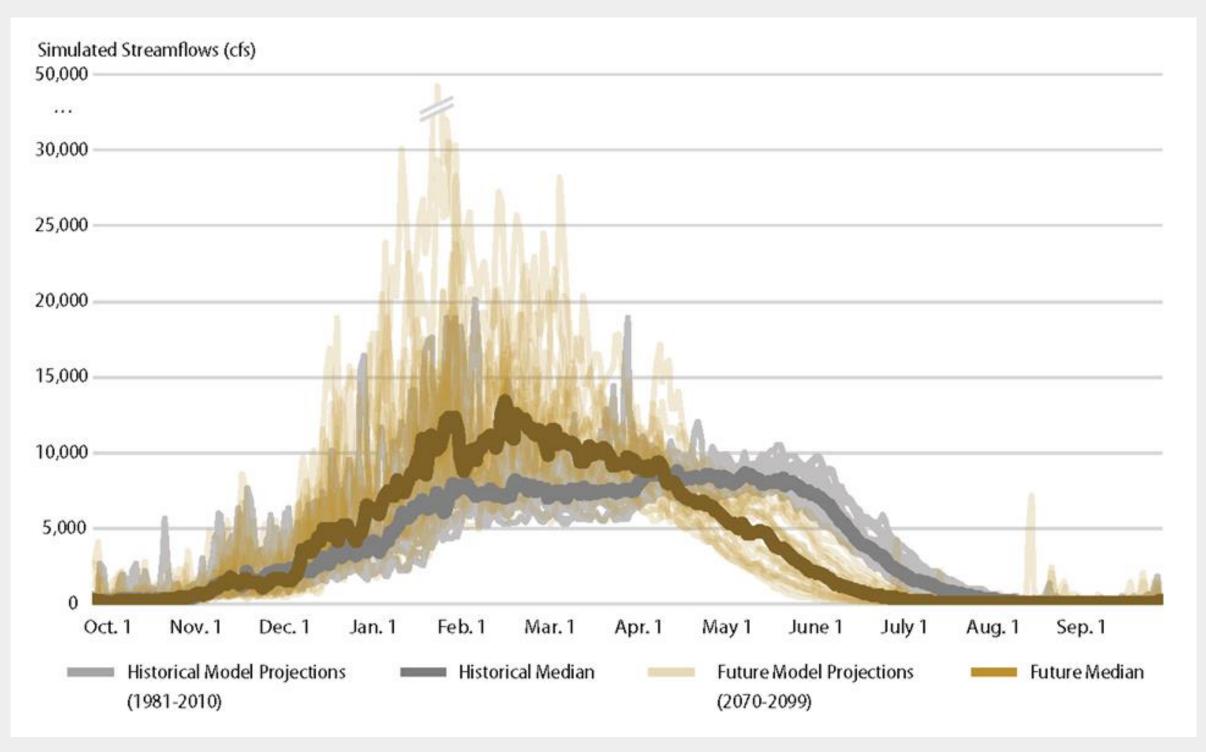


California's Water Management A Tale of Two Extremes





Effects of Climate Change Necessitate Wholesale System Changes



Systemic Challenges - Root Cause of Others Overcoming them Increases Return on Investment

Fragmented and uncoordinated decisions, initiatives & actions

Inconsistent, inflexible, & conflicting regulations

Insufficient capacity for data-driven decision-making

Insufficient & unstable funding



PROBLE

CAUSE

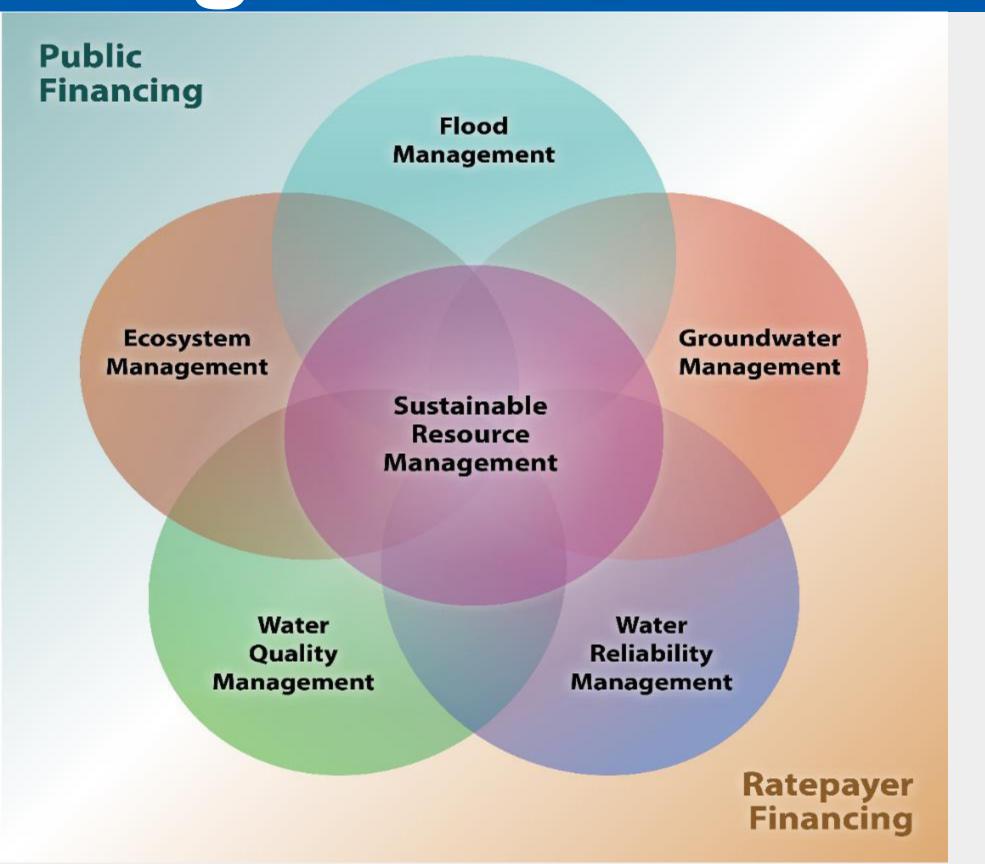
Sustainable and Integrated Water Resources Management

Call for multiple benefit projects that include ecosystem enhancements to move California's water resources toward sustainability

- Governor's Water Action Plan
- Sustainable Groundwater
 Management Water Act
- 2017 Central Valley Flood Protection Plan Update
- California Water Plan Update 2018



Sustainability Requires Alignment



Multi-Sector Collaboration

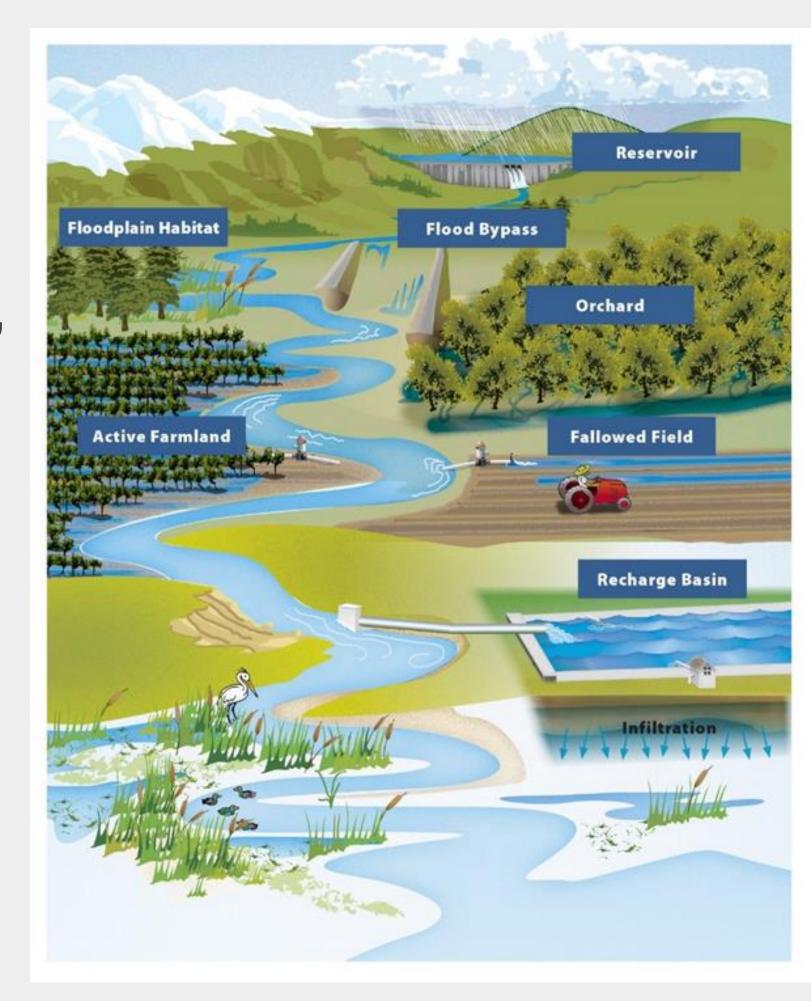
Multi-Discipline Planning

Multi-Benefit Projects

Multi-Fund Investments

What is Flood-MAR?

Using high flows from, or in anticipation of, rainfall or snowmelt, for managed aquifer recharge on agricultural lands and working landscapes





Flood-MAR is...

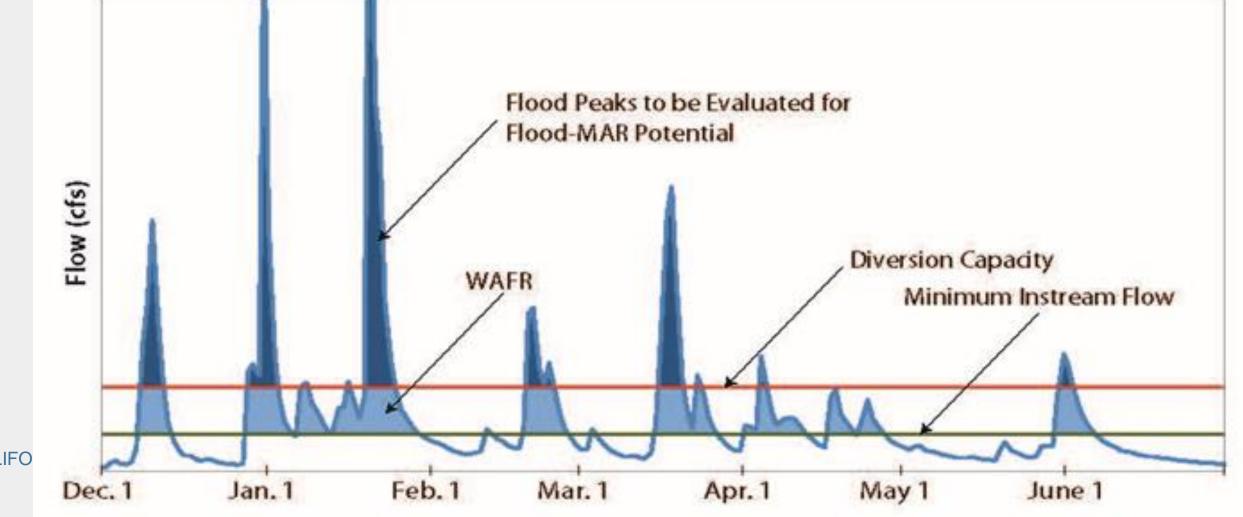
- ... an integrated & voluntary management strategy to improve water resources sustainability & climate resiliency
- ... multi-sector (flood, groundwater, ecosystem, quality)
- ... scalable (farm, GSA, basin, regional, watershed)
- ... multi-faceted (reoperation, conveyance, storage, recharge, banking, transfers, cultivation, restoration, etc)
- ... an untapped part of California's water portfolio





State Recommends Flood-MAR

- 2017 CV Flood Protection Plan Update (Aug. 2017)
- System Reoperation Study Phase 3 Report (Aug. 2017)
- State Board of Food & Agriculture letter (May 2018)
- CA Water Plan Update 2018 Public Draft (July 2018)





Public Benefits of Flood-MAR

- Flood risk reduction *
- Drought preparedness *
- ★ Public benefits defined in Proposition 1

- Aquifer replenishment
- **Green Infrastructure**
- Ecosystem enhancement *
- Groundwater remediation/water quality *
- Working landscape preservation and stewardship
- Climate change adaptation
- Recreation and aesthetics ★

Flood-MAR Implementation Factors

Governance and Coordination: How will project needs be coordinated?

- Landowner willingness
- Local or system needs and opportunities
- Partnerships and agreements
- Coord ination and operations decisions
- Legal/ regulatory framework

Funding and Incentives:

How will project be funded and landowners compensated?

- Available funding sources
- Landowner incentive or compensation programs
- Recharge quantification

Source Water:

Where will the surface water come from?

- High flows
- Reservoir reoperation
- Tim ing and quantity of flows
- How are flows expected to change in the future?

Conveyance:

How will surface water get to the site?

- Existing infrastructure
- New infrastructure

Site Suitability:

Where are good candidate sites for recharge?

- Soil suitability
- Crop suitability
- Aquifer suitability
- Aquifer capacity
- Aquifer water quality
- Vadose zone water quality

Recharge Method: How will the water get into the ground?

- On-farm
- Fallowed land
- Ded icated basin
- In-lieu
- Direct injection

Groundwater Use: How will groundwater be recovered or otherwise used?

- Groundwater extraction wells
- Beneficial Uses
- Augmentation of groundwater for replenishment/ restoration

Feasibility Analysis: Is the project feasible?

- Benefits and beneficiaries
- Costs and impacts
- Agreements and assurances



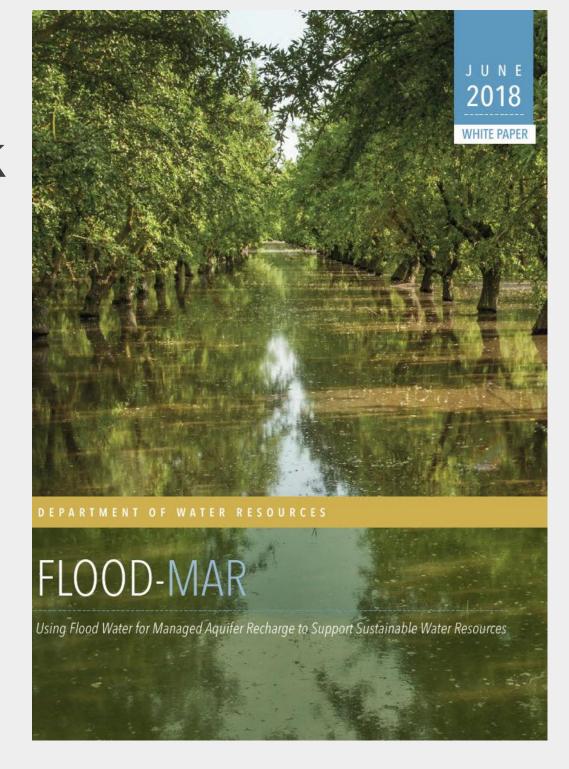
Potential Barriers to Flood-MAR Implementation

- Cooperation and Governance trust, sector coordination, operations agreements
- Legal water rights, regulations, permitting
- Policy public benefit, beneficial use, landowner compensation/incentives
- Implementation land use, recharge/recovery suitability, conveyance, reservoir operations, economics, funding



Current Plans and Activities

- Fact Sheet
- White Paper
- Draft Research & Data Development Framework
- Convening Research Advisory Committee
- Merced River Basin Conceptual Study
- Tuolumne River Climate Vulnerability Study





Research & Data Development Framework

- Assemble body of knowledge and a living inventory of technical research needs
- Inventory, develop, and coordinate technical expertise
- Convene Flood-MAR Research Advisory Committee -network of experts and advisors
- Develop an R&D Plan to frame long-term and continued research and data development
- Improve availability of research and technical expertise for all stakeholders
- Provide guidance and technical assistance to
 stakeholders to support project planning & implementation

Research Themes

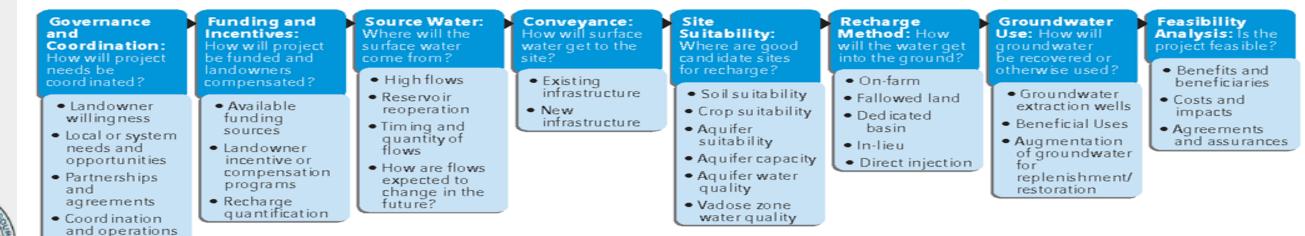
- Hydrology Observation and Prediction
- 2. Reservoir Operations
- Infrastructure
 Conveyance and
 Hydraulics
- 4. Crop Suitability
- 5. Soil Suitability
- Geologic and Aquifer Characterization

- 7. Land Use Management
- 8. Water Quality
- Recharge and Extraction Methods
- 10. Environment
- 11. Social Impacts
- 12. Economic Analysis
- 13. Local, State, Federal Policies and other Legal Constraints
- 14. Tool & App Development



Merced River Flood-MAR Study

- Investigate white paper concepts and research themes
- Integrates surface and groundwater modeling
- Multi-benefit analysis and economic assessment
- Analyze multiple scenarios within 3 Flood-MAR levels
 - Level 1 > Existing Water Operations & Existing Infrastructure
 - Level 2 > Revised Water Operations & Existing Infrastructure
 - Level 3 > Revised Water Operations & Expanded Infrastructure





decisions

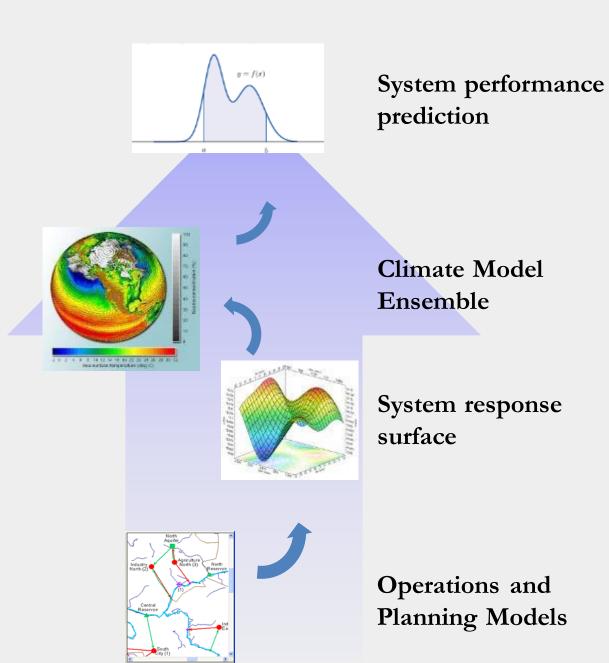
regulatory framework

Tuolumne Climate Vulnerability

- Quantify deep uncertainties in flood prediction, water supply and ecosystem vulnerability under climate change
- Formulate a systematic framework for assessing future risks and developing economically efficient, robust, and flexible plans to mitigate risk
- Inform other projects and planning efforts

CALIFORNIA DEPARTMENT OF WATER RESOURCES

Bottom Up Systems Analysis (Study Approach)



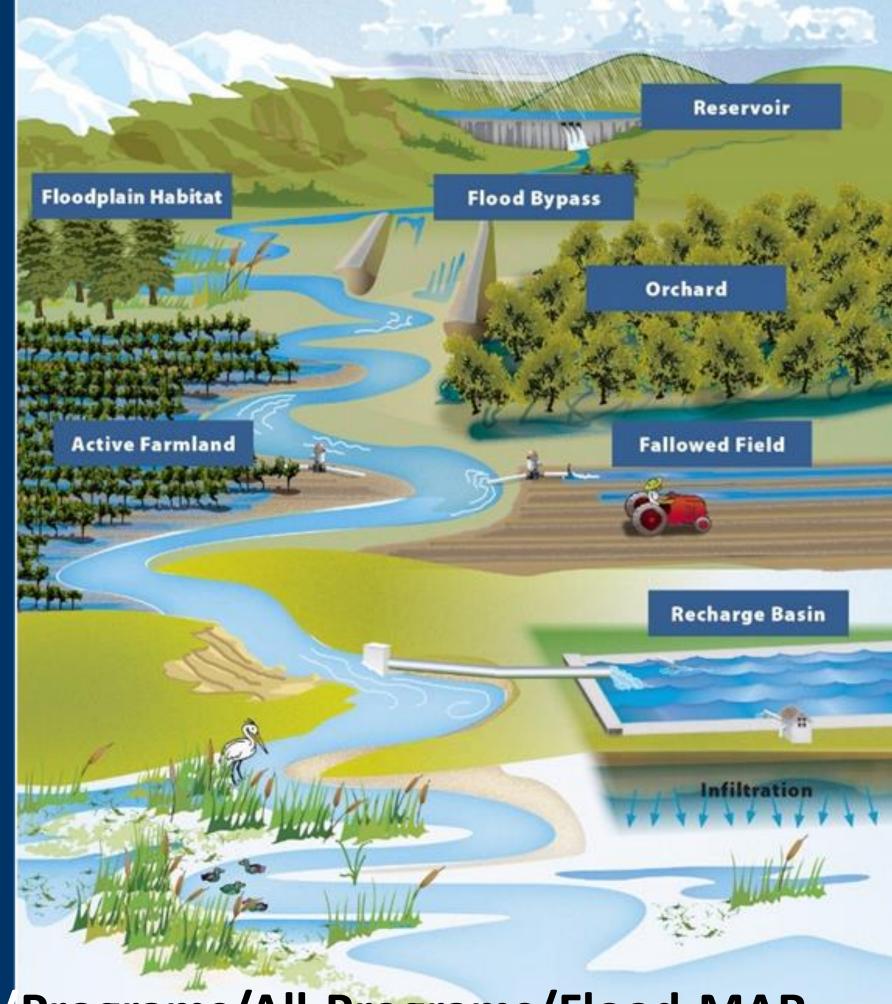
Next Steps

- Roll-out White Paper and draft
 Research & Data Development Framework
- Engagement RAC, stakeholders, public
- Incorporate comments on R&D Framework
- Complete Merced River Study & Tuolumne R. Climate Vulnerability Study
- Planning and Implementation Guidance
- Identify and implement Flood-MAR studies, pilots, and projects

Questions?

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www.water.ca.gov/Programs/All-Programs/Flood-MAR