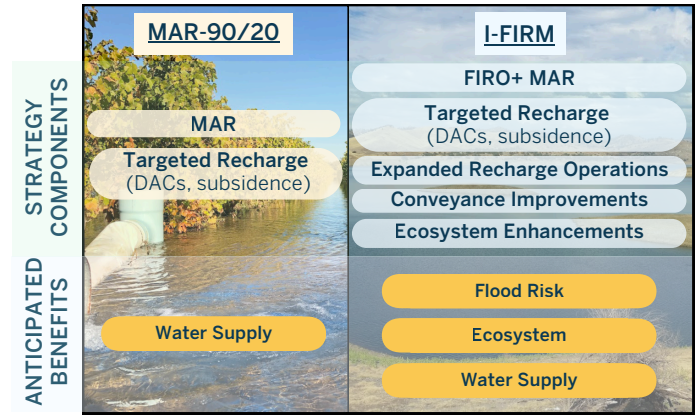




A CHANGING CLIMATE: By 2050, rising temperatures are expected to create more intense winter storms and limit snowpack in the Upper San Joaquin watershed, reducing runoff in the dry season when farms, communities, and ecosystems need it most. Warming will also increase evaporative demand and shrink surface water supplies, increasing reliance on groundwater. Without action, groundwater levels will fall, flood risks will intensify, and ecosystems will suffer.

FLOODWATER AS A RESOURCE: The San Joaquin Basin Flood-MAR Watershed Studies evaluated the opportunity for Flood-Managed Aquifer Recharge (Flood-MAR) and Forecast-Informed Reservoir Operations (FIRO) to mitigate the impacts of climate change. Working with growers, Flood-MAR can be scaled to capture more wet season flows in recharge basins and on farmland, thereby reducing flood risk and rebuilding groundwater stores for the dry season.



What is Impacted by Climate Change?

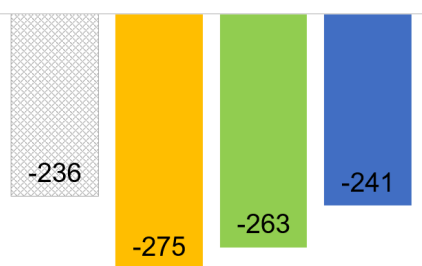
Groundwater Supply

By 2050, average annual groundwater overdraft is expected to increase by 17% to 275,000 acre-feet per year. Groundwater levels will fall by an average of 42 feet, and groundwater levels beneath Disadvantaged Communities (DACs) will fall by 1 foot.

What can Recharge Accomplish?

Compared to the baseline future scenario, MAR-90/20 would reduce annual groundwater overdraft by 4% and increase average groundwater levels by 14%. I-FIRM would reduce annual overdraft by 12%, increase average groundwater levels by 62%, and increase groundwater levels below DACs by 2 feet.

Average Annual Groundwater Overdraft [TAF/Y]



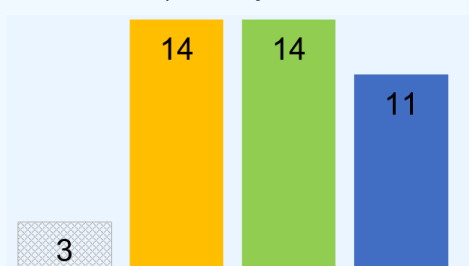
Flood Risk

By 2050, maximum peak flow of the Upper San Joaquin River is expected to increase from 36,400 cubic feet per second (cfs) to 51,400 cfs, greatly exceeding the 8,000 cfs channel capacity. The number of years, out of 100, in which flows exceed the design channel capacity increases more than fourfold, from 3 to 14.

What can Recharge Accomplish?

MAR-90/20 would have no impact on flood risk. With I-FIRM, maximum peak flow and frequency of flows exceeding design channel capacity are somewhat reduced, while the duration of flows exceeding design channel capacity are more than halved compared to the baseline future.

Years Exceeding Design Channel Capacity [per 100 years]



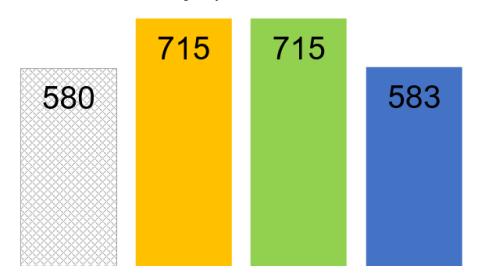
Ecosystems

By 2050, increased peak flows improve off-channel floodplain habitat, where salmon feed before out-migration to the sea. Instream habitat, where salmon need low flows to lay eggs and raise juveniles, is unaffected by climate change. Groundwater-dependent ecosystems (GDEs) face a dire situation in the region: suitable habitat shrinks from 5% to 4% by 2050.

What can Recharge Accomplish?




MAR-90/20 has no impact on salmonid habitat compared to the baseline future. With I-FIRM, instream habitat is slightly reduced, and gains in potential off-channel habitat from increased winter flows are canceled. Neither MAR 90/20 nor I-FIRM provide significant benefits for the GDE habitat. I-FIRM does create new shorebird and flow-through basin habitat in the watershed.

Potential Off-Channel Salmonid Habitat [acre-days per linear mile]






SCENARIO OUTCOMES




In a Baseline Future

-  GW overdraft increases greatly
-  Flood risk increases greatly
-  Ecosystems see mixed outcomes

With MAR-90/20

-  Increase in GW remains high
-  Flood risk remains high
-  Ecosystems see mixed outcomes

With I-FIRM

-  Increase in GW overdraft is lessened
-  Flood risk remains high
-  Ecosystems see mixed outcomes

PLANNING FOR THE FUTURE

The Upper San Joaquin watershed faces severe groundwater overdraft conditions that will worsen with climate change. Implementing I-FIRM can offset much of the expected increase in overdraft, but the watershed will still face nearly 250,000 acre-feet of overdraft annually in 2050, as well as the associated harm to ecosystems and dewatering of wells.

These studies help us envision how Flood-MAR can help shape California's water future, but they reflect one set of assumptions and focus specifically on what is possible with expanded recharge efforts. While I-FIRM is a valuable tool to help mitigate further climate impacts on the watershed, it alone will not solve the challenges faced in the Upper San Joaquin.



Alternate management approaches will produce different outcomes, and additional management actions, such as land repurposing, are not evaluated here but will be necessary to meet long-term groundwater sustainability goals. Collaboration between growers, water districts, Groundwater Sustainability Agencies, reservoir operators, flood control agencies, community groups, and environmental organizations will be essential to explore and implement multi-beneficial solutions.

Ultimately, local water and land managers, large- and small-scale growers, and residents of the Upper San Joaquin watershed will shape real-world outcomes for the region.

Whether you are a grower, water manager, community member, environmental advocate, or another interested party, you can play a role in building resilience to a changing water future in the Upper San Joaquin watershed. Sustainable Conservation has resources to help you learn more about Flood-MAR, and can connect you with partners to promote MAR in your area. Water managers can use a locally developed Groundwater Recharge Assessment Tool (GRAT) developed as part of the Watershed Studies toolset to plan recharge efforts that target benefits based on local priorities. Visit suscon.org and groundwaterrecharge.org for more information.

SCAN FOR MORE RESOURCES

Upper San Joaquin Watershed Full Report



..... Sustainable Conservation

Runoff to Recharge

