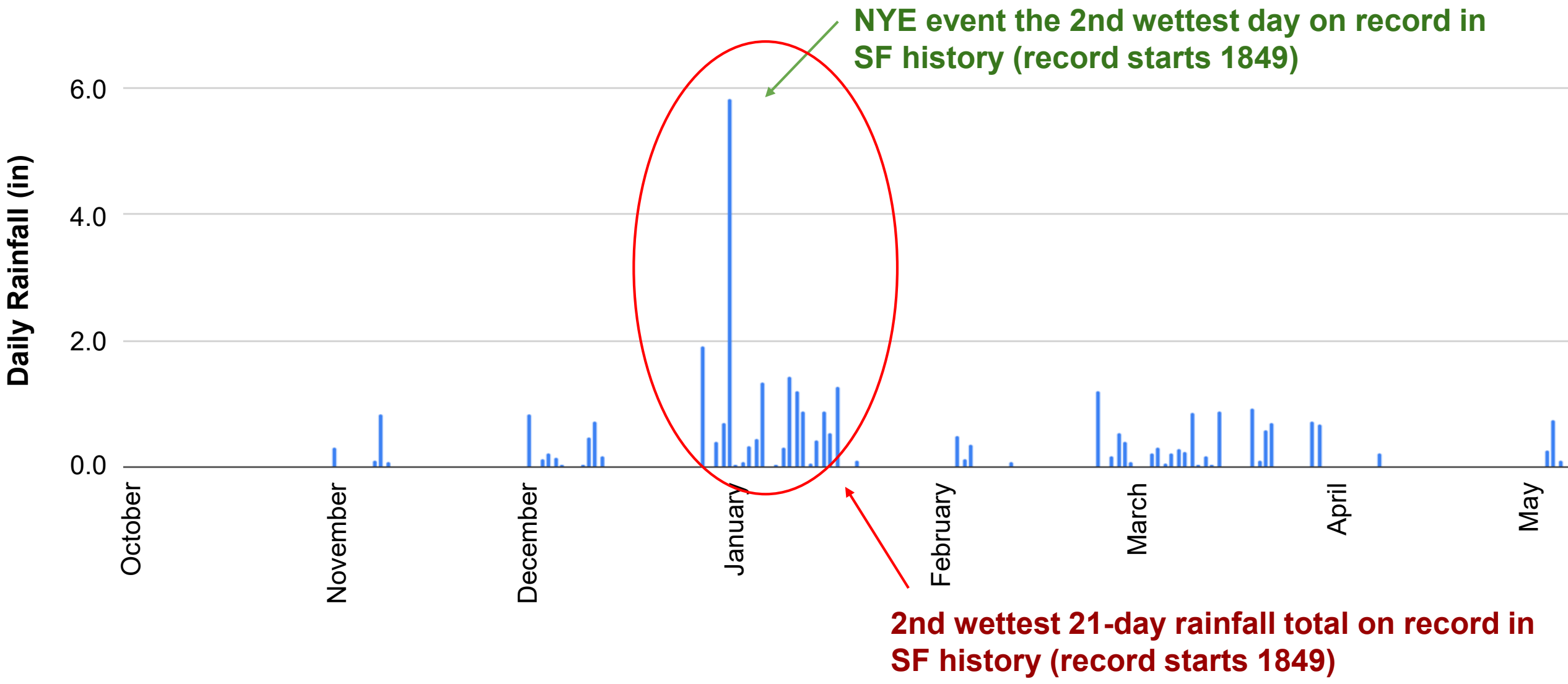
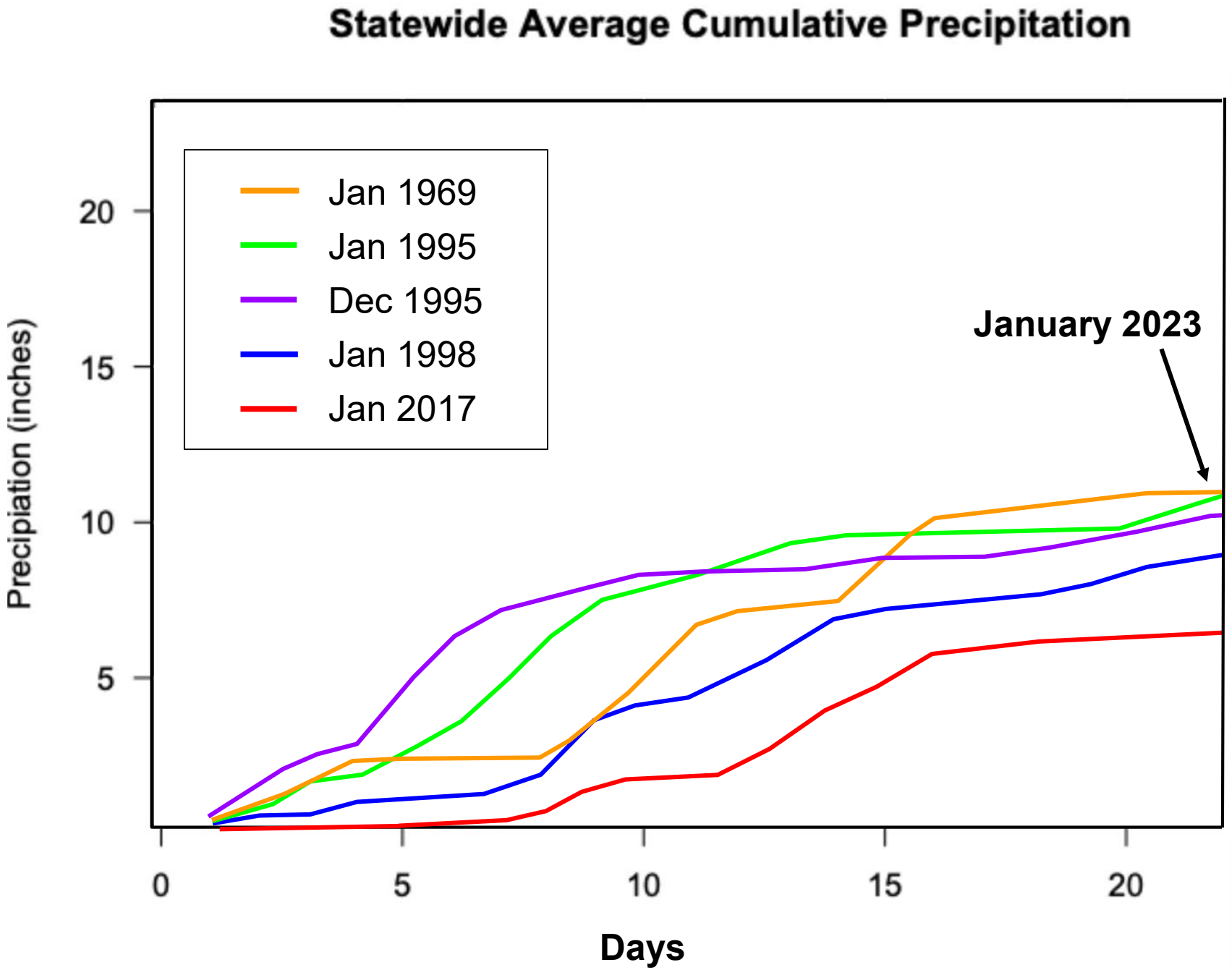
Sediment Loads at the Climate Extremes

Alicia Gilbreath (alicia@sfei.org) & Lester McKee

RMP Annual Meeting

SF Daily Rainfall WY 2023





Dr. Daniel Swain

California Mega Storms

Years
(AD)

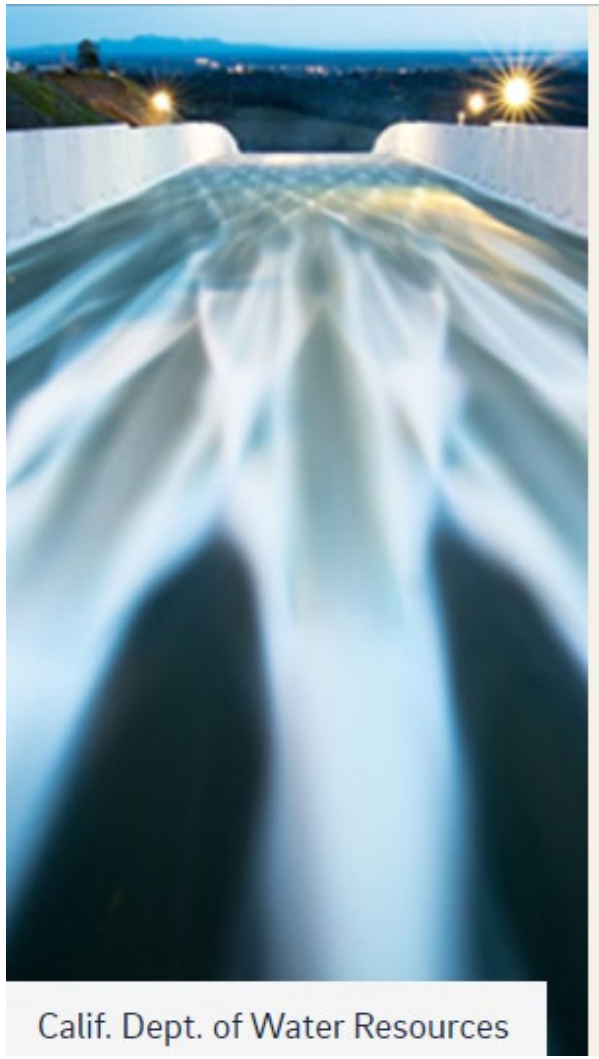
212
440
603
1029
1300
1418
1750
1810

and

1862

Sacramento, Great Flood of 1862; California State Library

Potential Future of Bay Area Rainfall -
Slightly wetter average, more of the extremes…



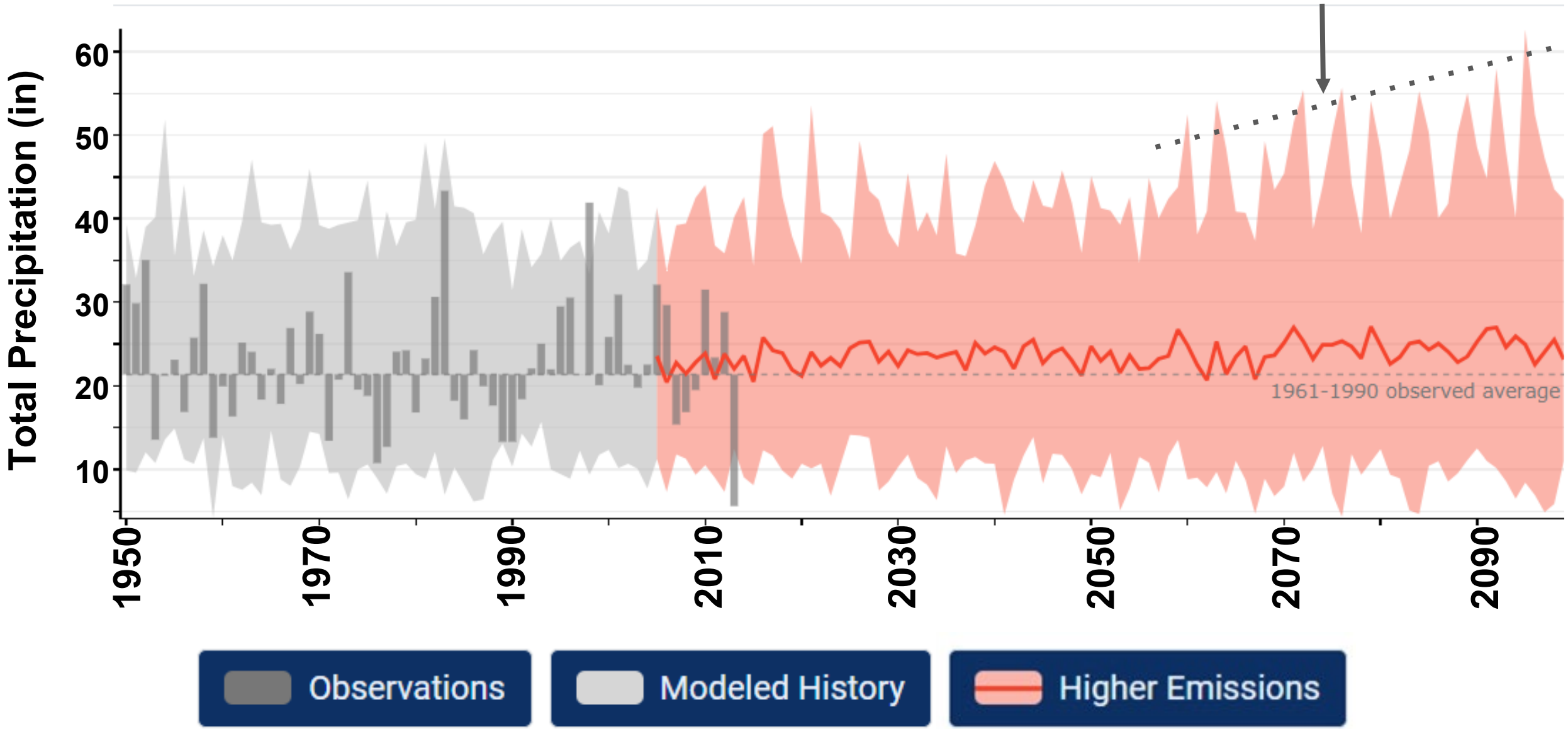
Calif. Dept. of Water Resources

Jul 08, 2019

ATMOSPHERIC RIVERS TO BECOME EVEN MORE DOMINANT SOURCE OF CALIFORNIA WATER RESOURCES AND FLOODING

Research projects that, as other storms decline, atmospheric rivers will strengthen, bringing greater proportion of annual precipitation

San Francisco Precipitation



U.S. Federal Government, 2023: U.S. Climate Resilience Toolkit Climate Explorer, crt.climate

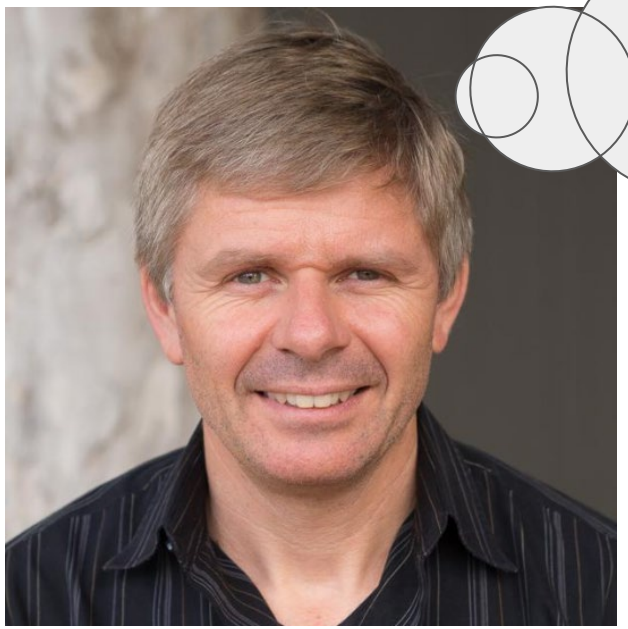
Why study sediment?

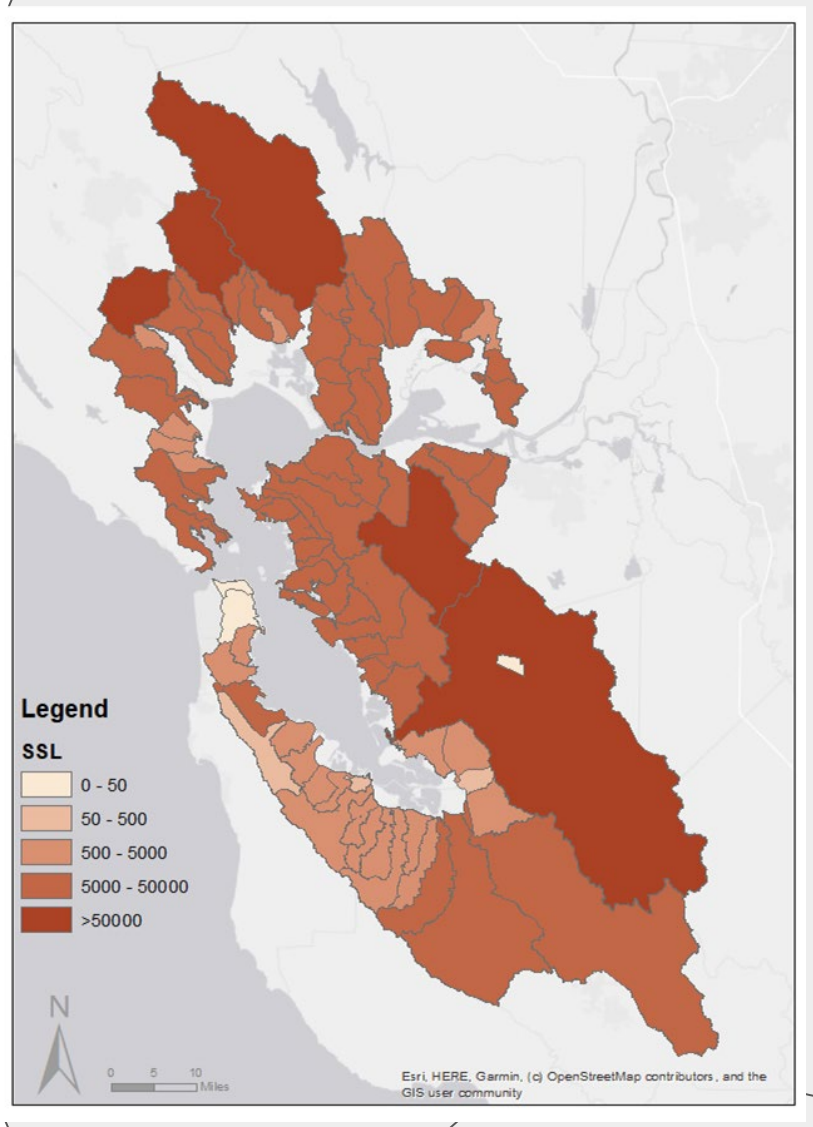
Sediment is a lifeblood of San Francisco Bay. It serves three key functions:

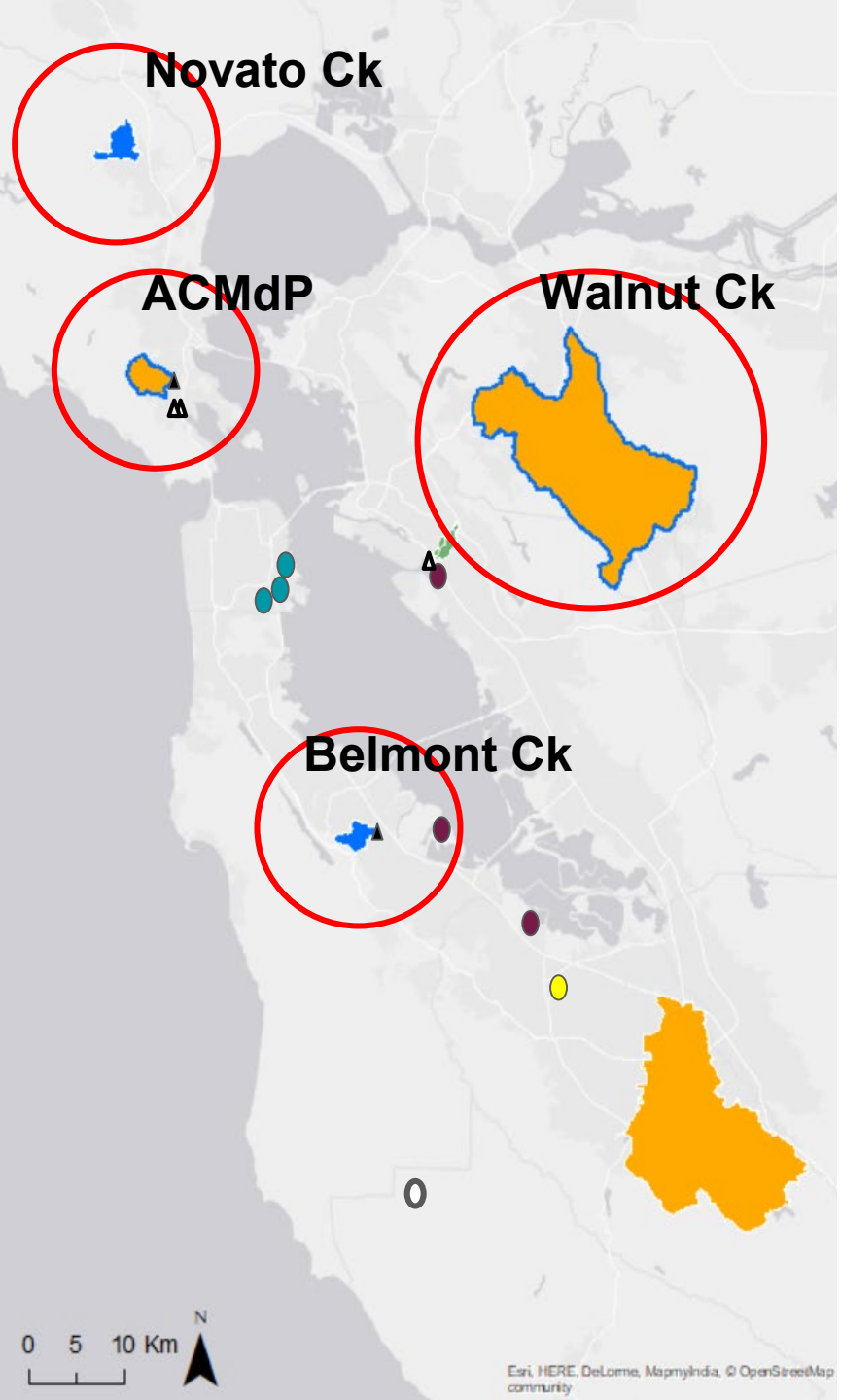
(1) create and maintain tidal marshes and mudflats,
(2) transport nutrients and contaminants, and
(3) reduce impacts from excessive human-derived nutrients in the Bay.

- McKnight et al., 2023. Conceptual Understanding of Fine Sediment Transport in San Francisco Bay.

Watershed Dynamic Model - Sediment Module

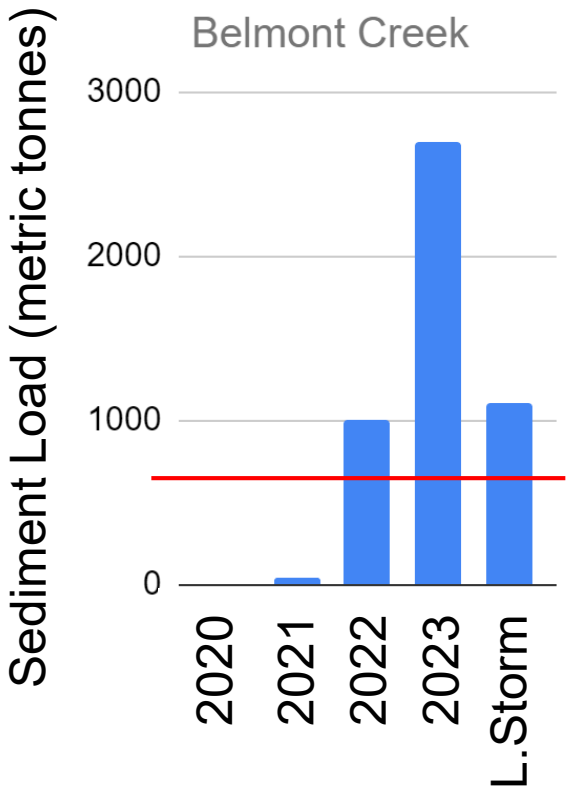


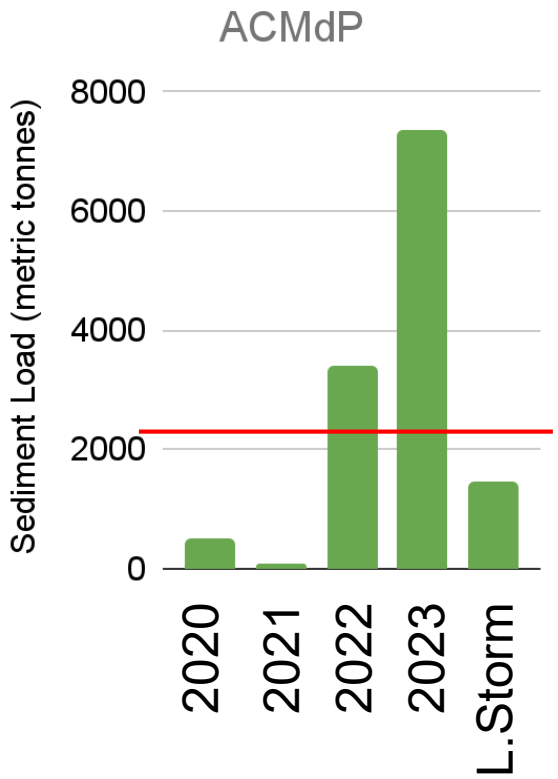


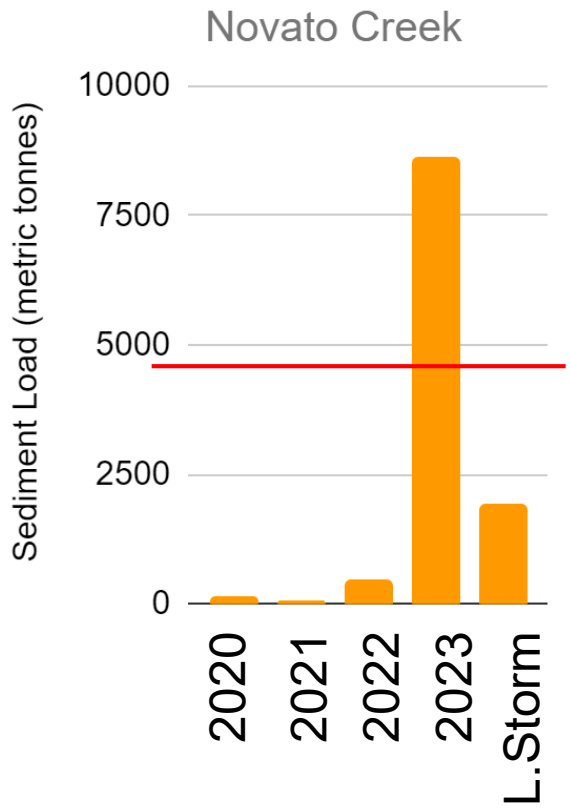


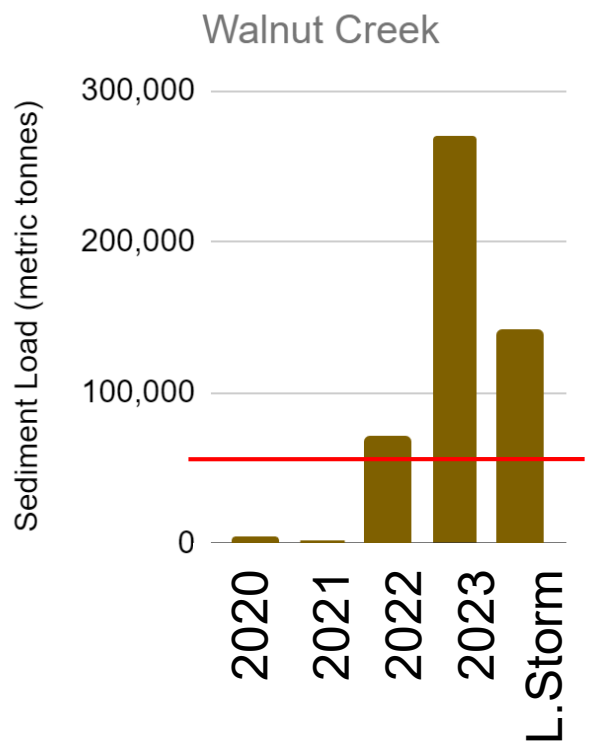
- 4 creeks monitored for sediment loads.
- 4 years. First 2 years were a historic drought, next year was average and last year was historic wet.
- Funded as a Supplemental Environmental Project (SEP) study.
- Study authors:
  - Alicia Gilbreath
  - Kyle Stark
  - Sarah Pearce
  - Lester McKee
  - David Peterson (*key field support)

Sediment Loads Study





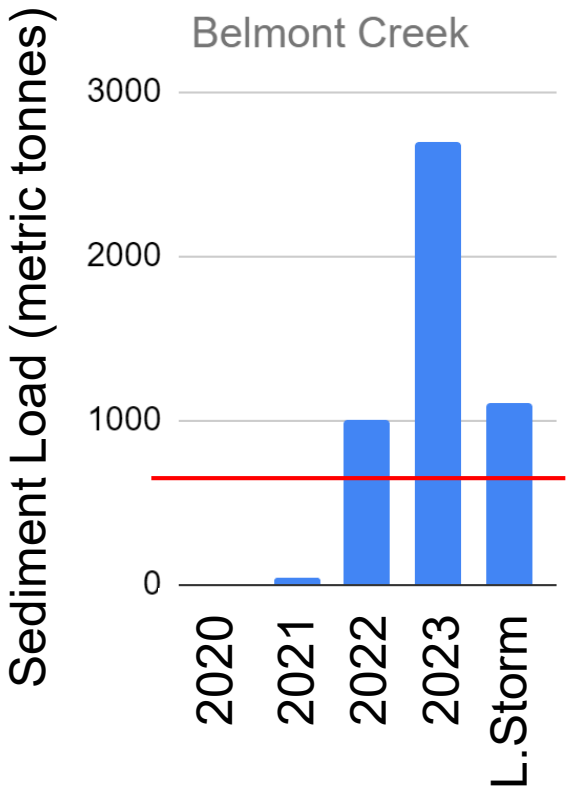


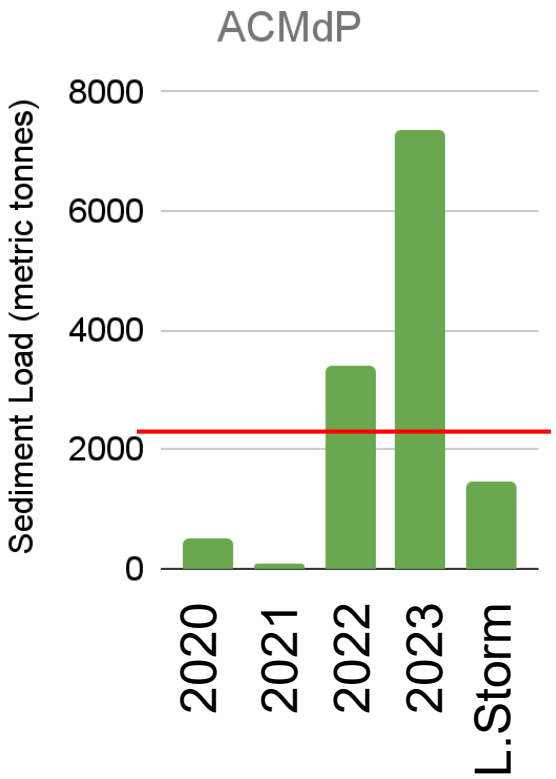


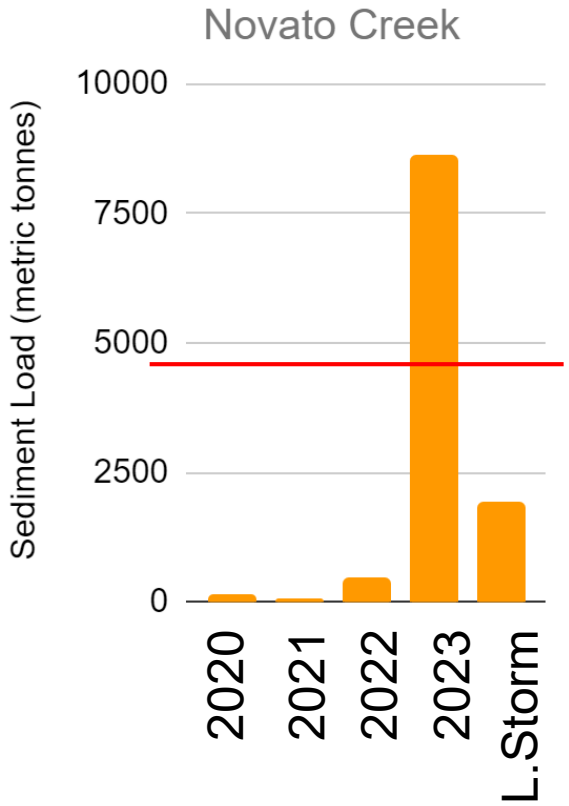
Middle of an average storm

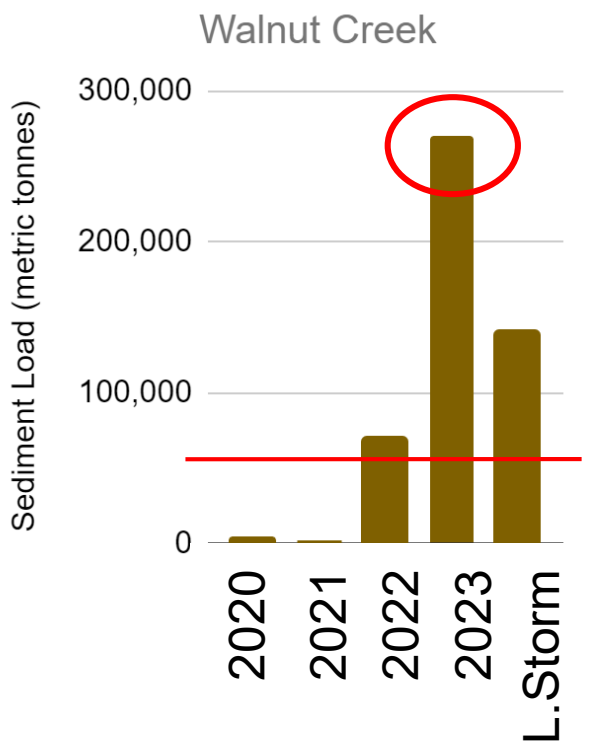
BELMONT CREEK

Sediment Loads Study



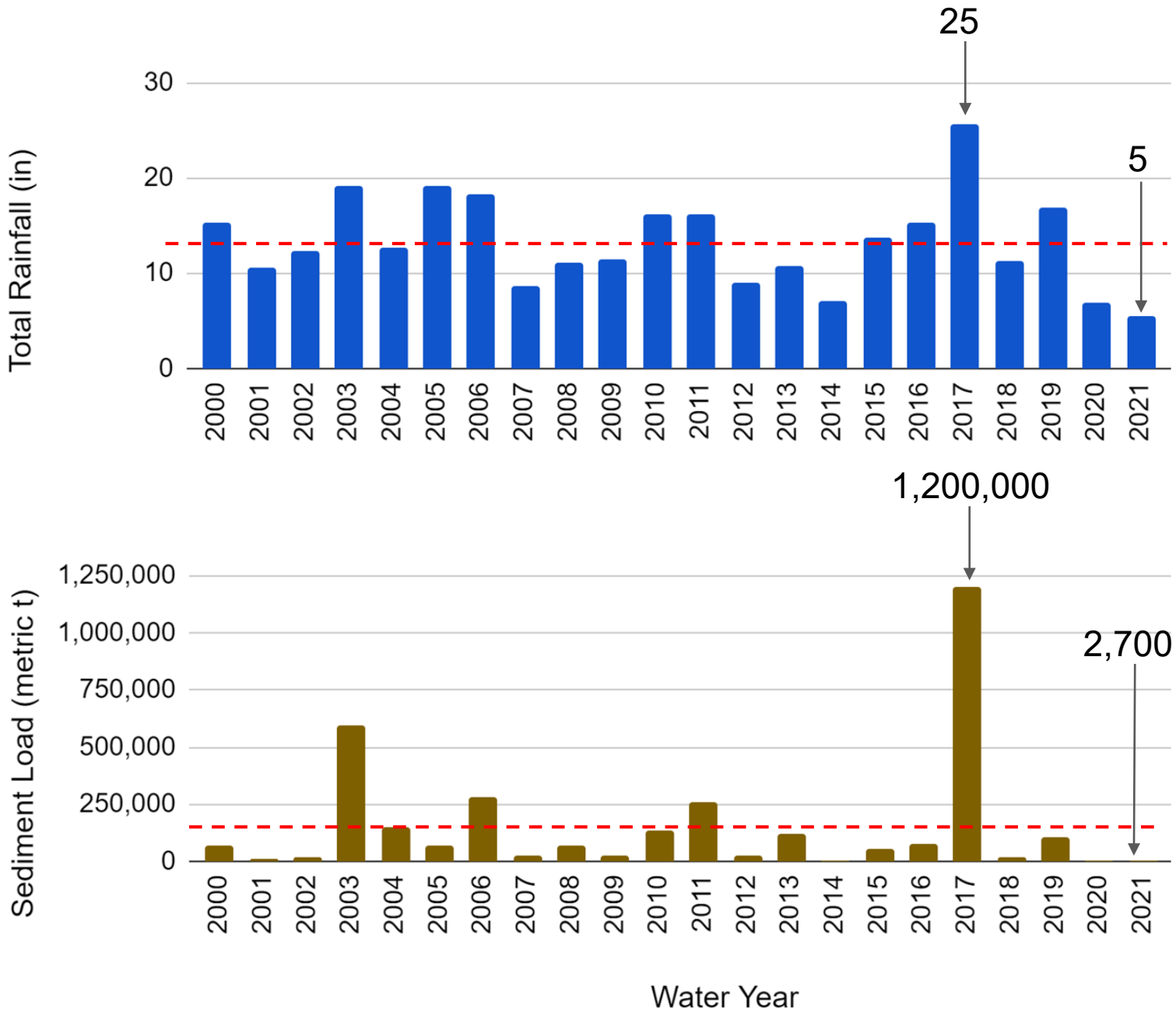






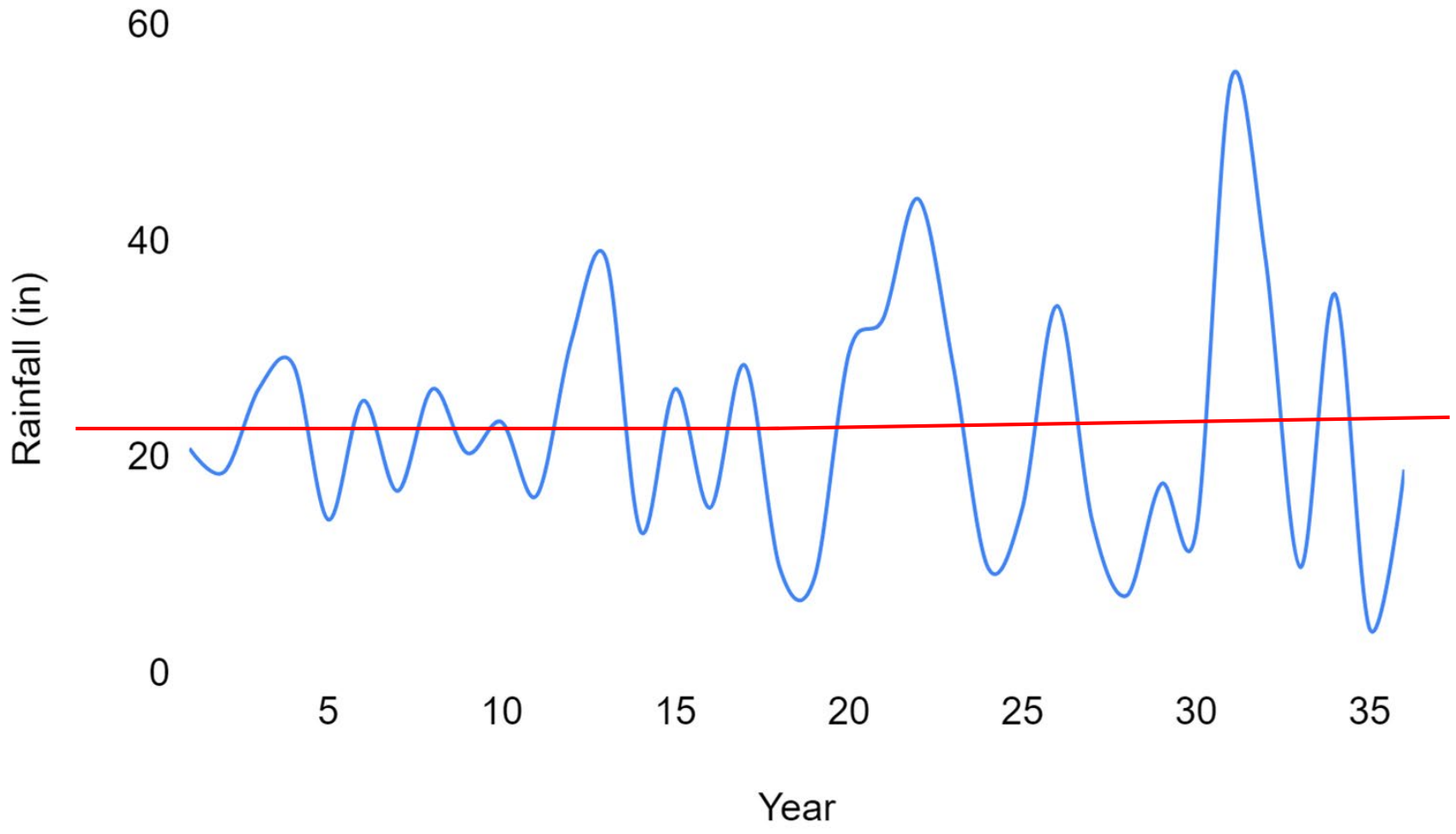
Alameda Creek

- Largest Bay Area tributary (1640 sq km) and 8% of total sediment load to Bay (Schoellhamer et al, 2018)
- Rainfall extremes = 5x difference
- Sediment extremes = 400x difference



Potential Future of Bay Area Rainfall -

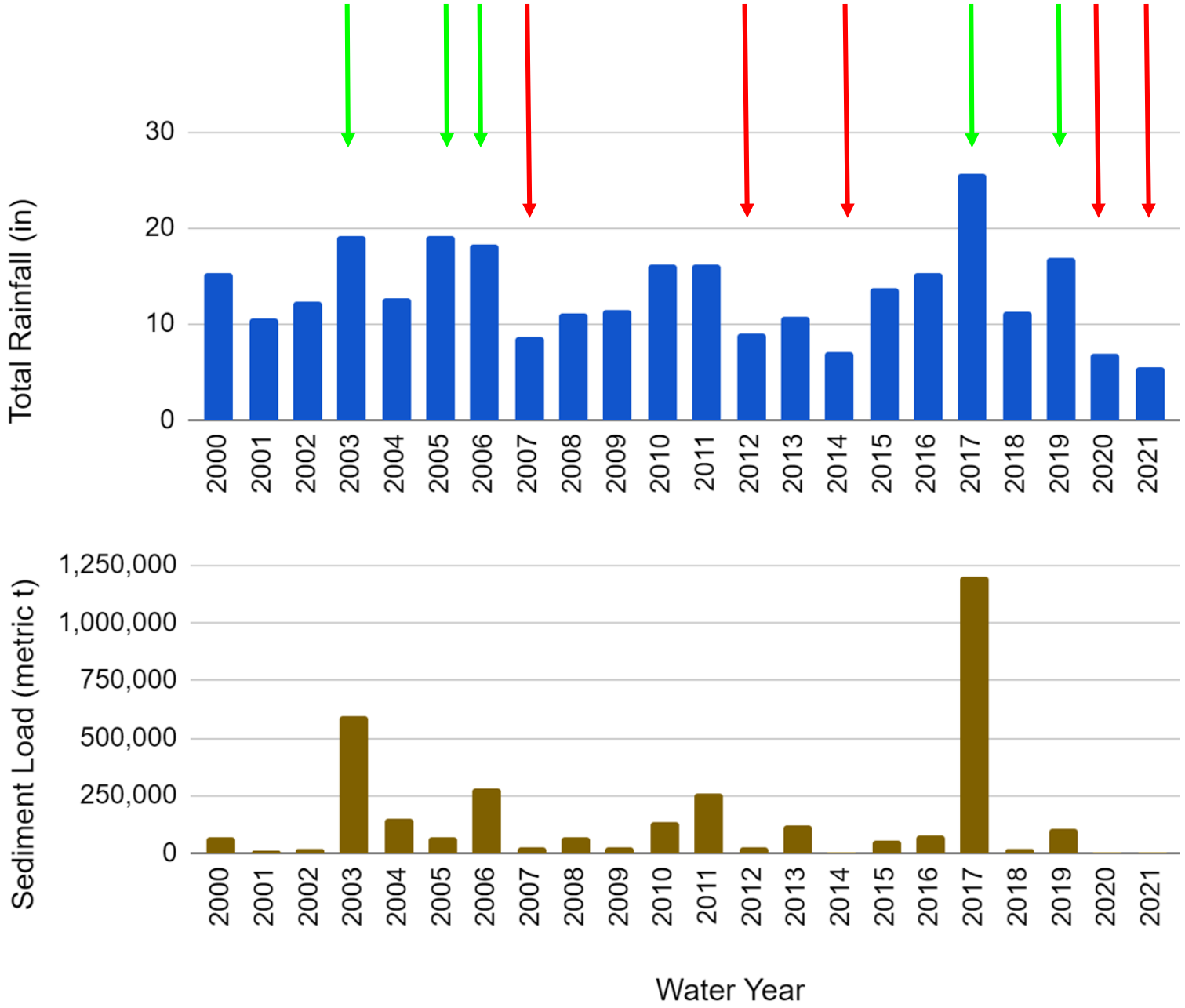
Slightly wetter average, more of the extremes…



Alameda Creek

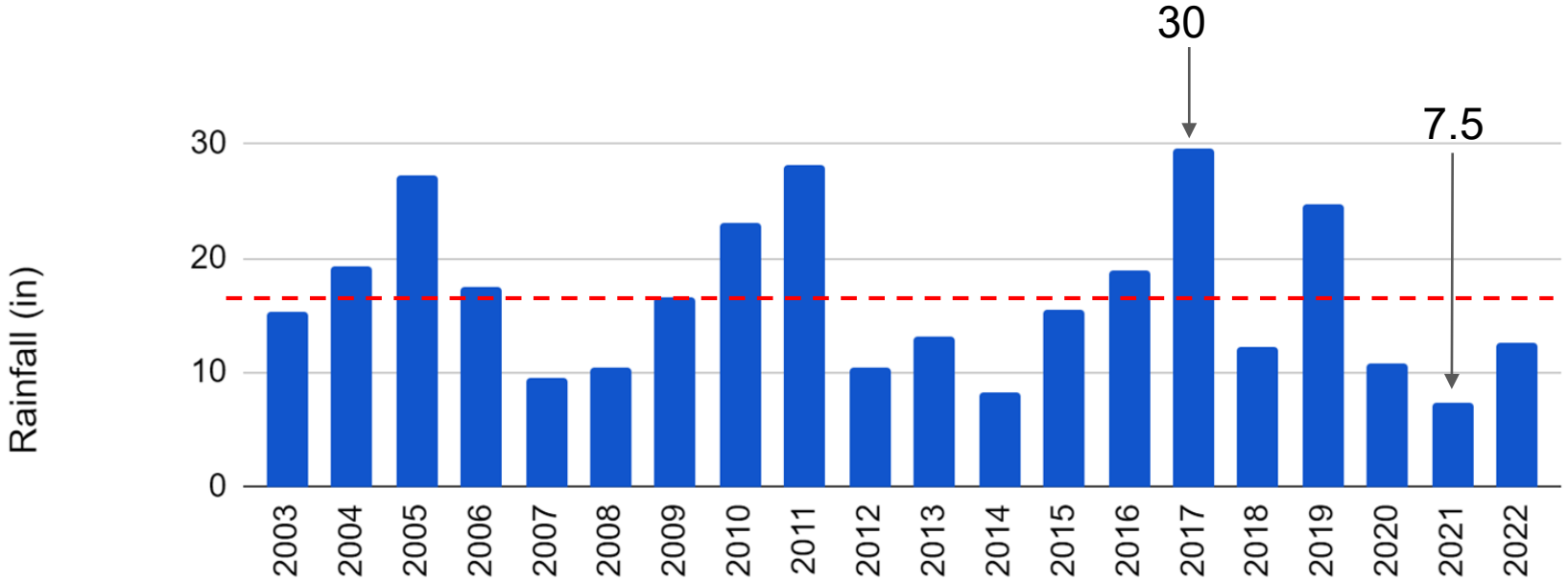
- Average Sediment Load for last 22 years = 150,000 metric tons

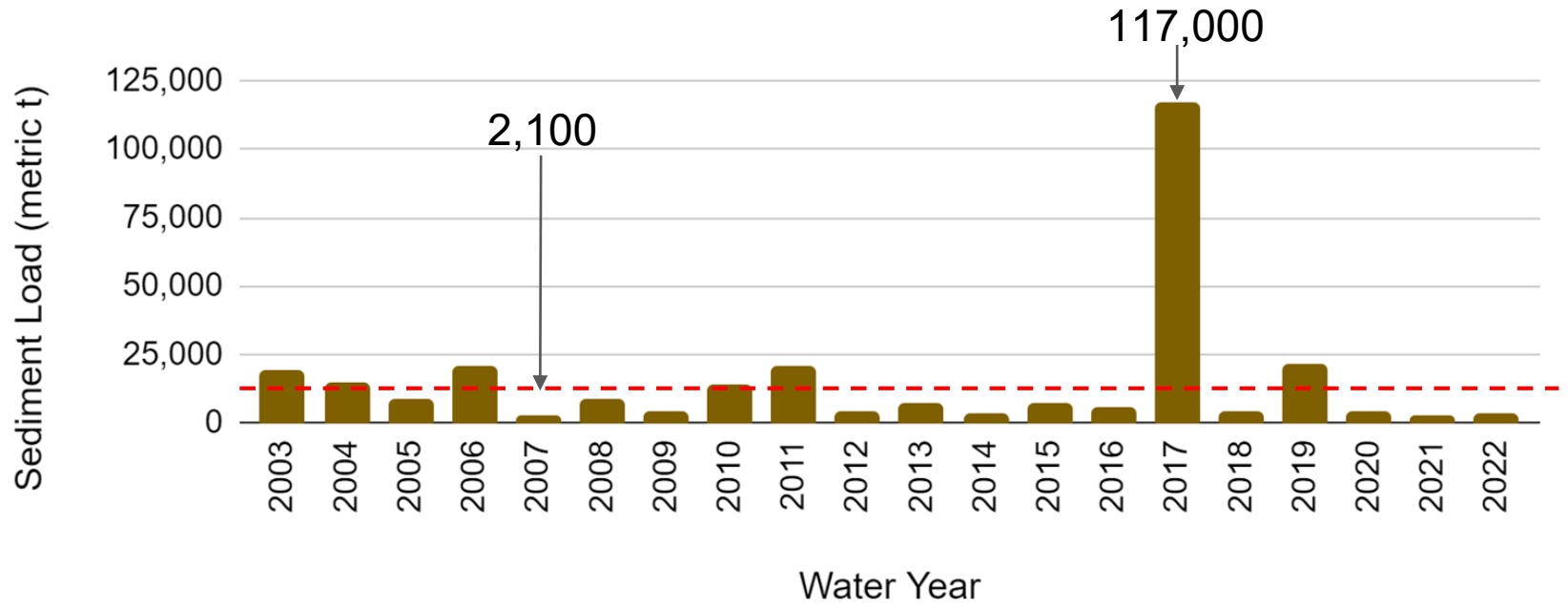
- Average Sediment Load for 5 wettest years and 5 driest years = 230,000 metric tons



Guadalupe River

- 4th largest Bay Area tributary (232 sq km)
- Rainfall extremes = 4x difference
- Sediment extremes = 55x difference

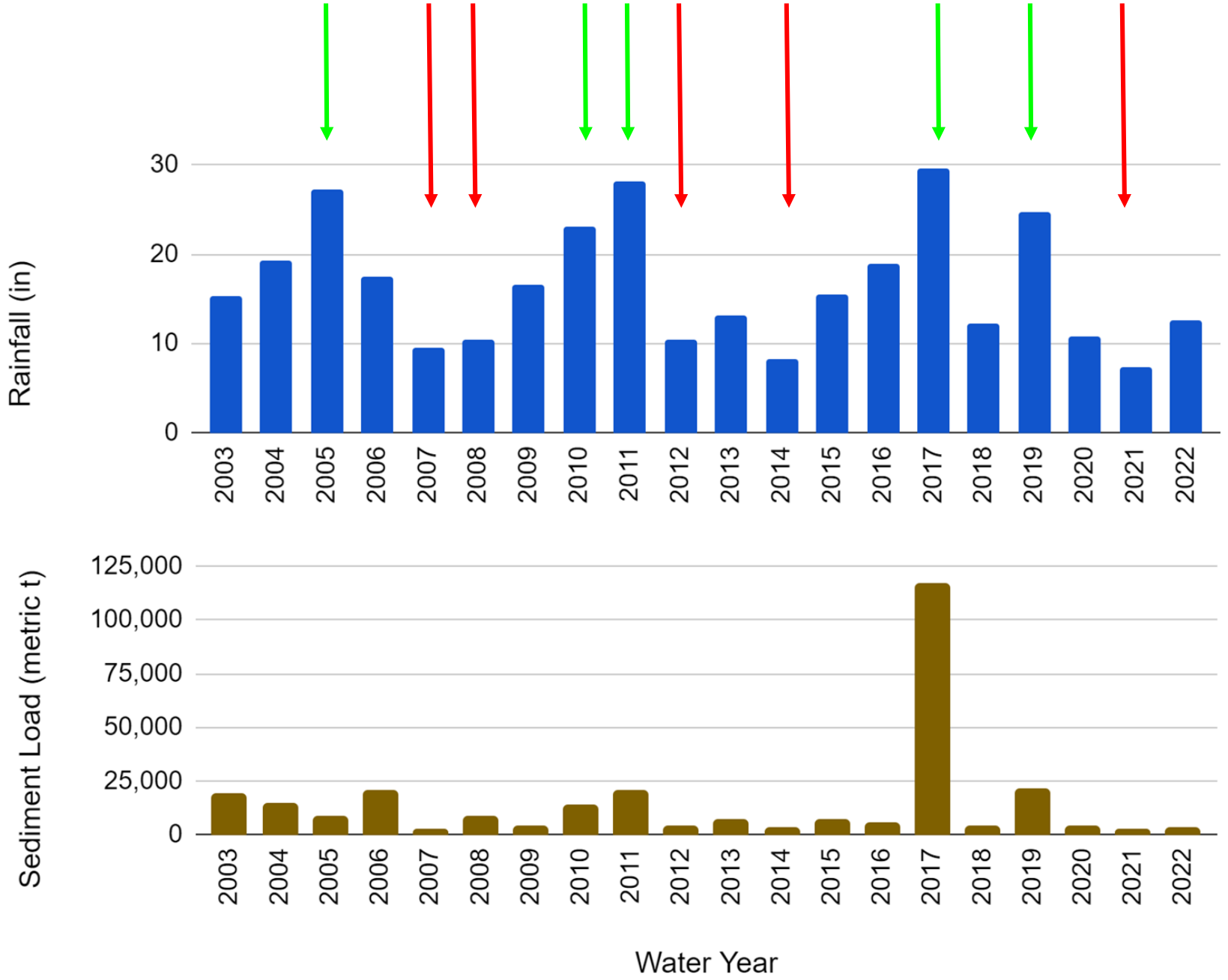


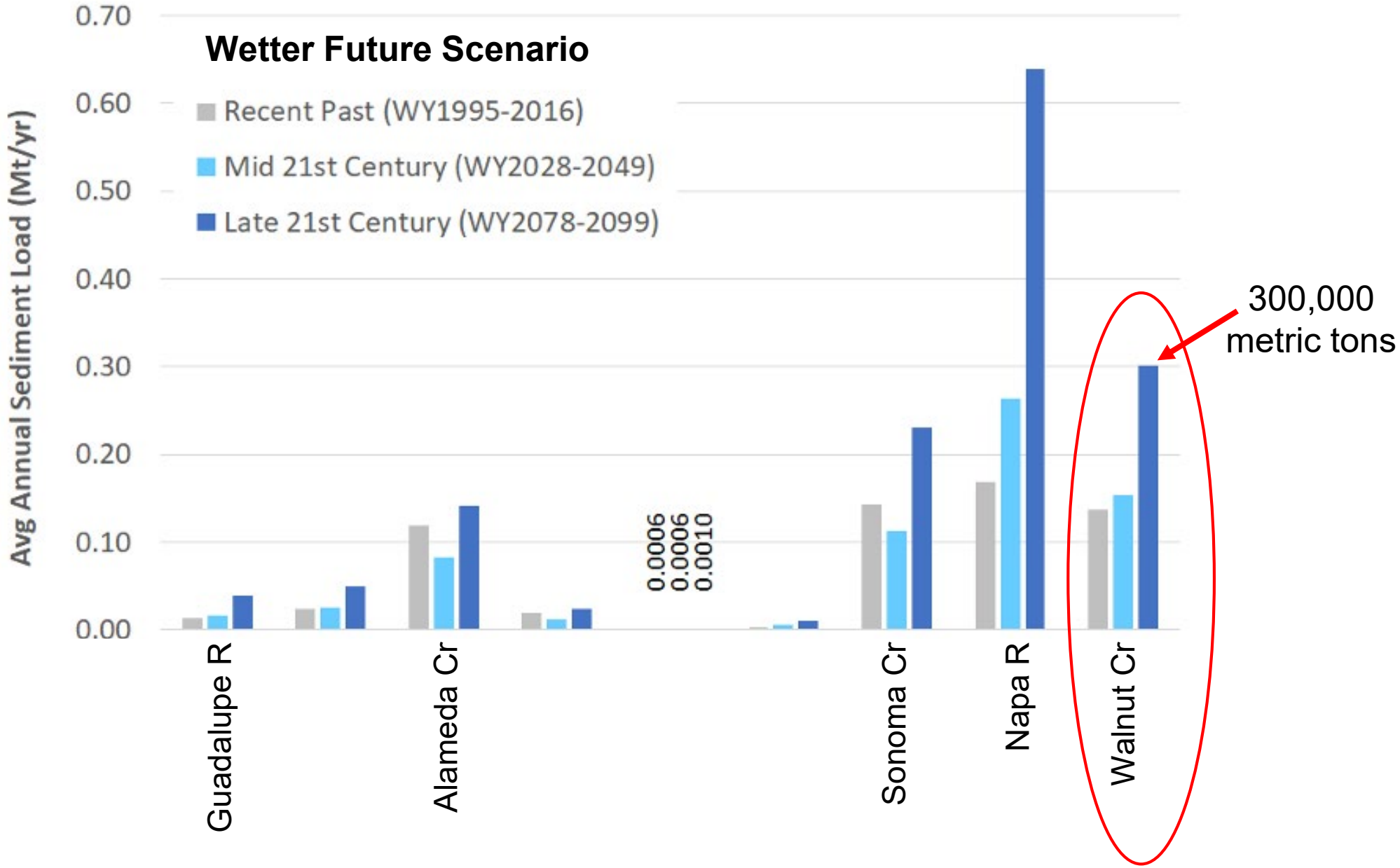


Guadalupe River

- Average Sediment Load for last 20 years = 14,000 metric tons

- Average Sediment Load for 5 wettest years and 5 driest years = 20,000 metric tons





Dusterhoff et al., 2021. Sediment for Survival

Potential Future of Bay Area Rainfall -

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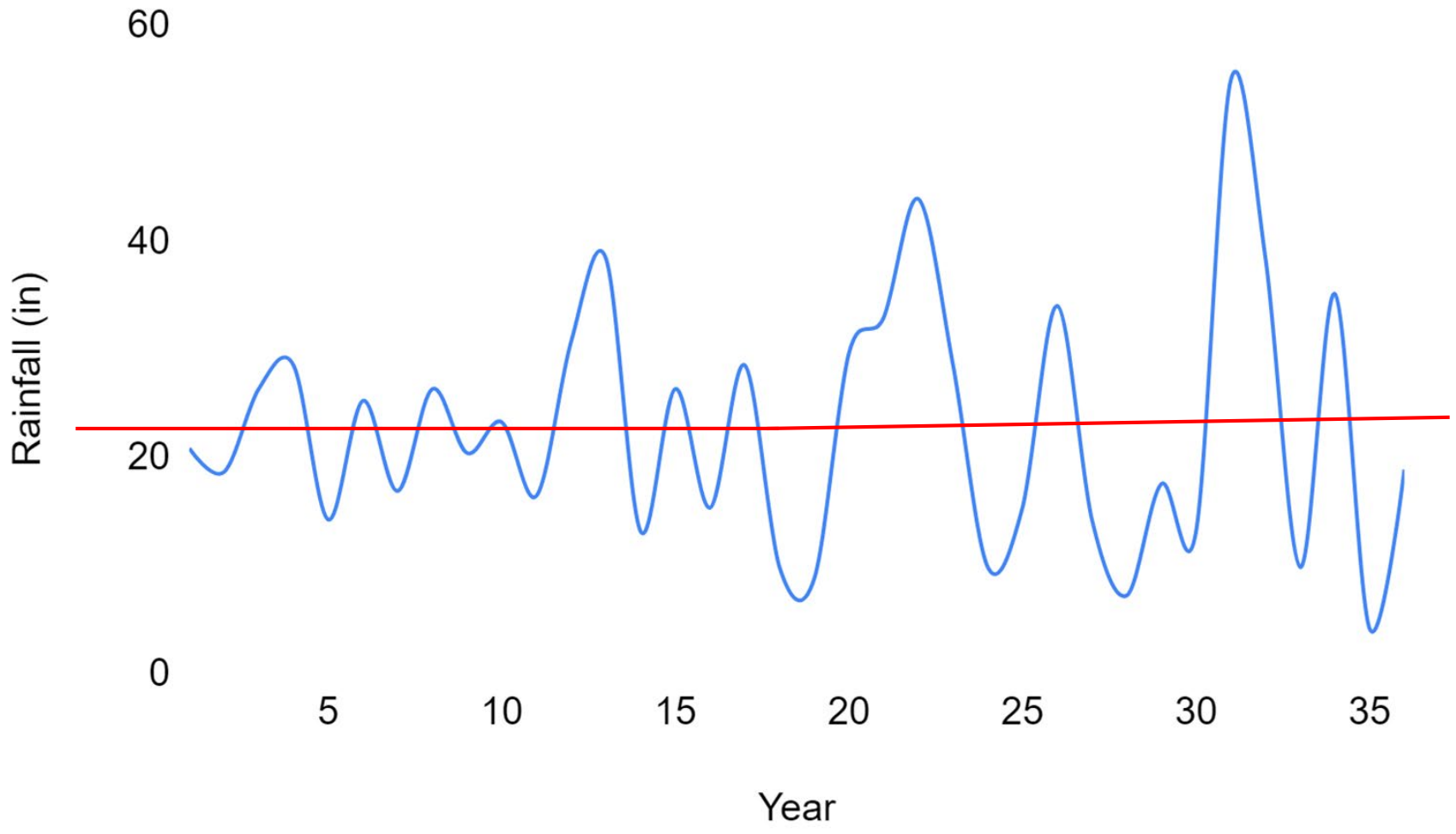


Recent RMP & SFEI Sediment Studies

https://www.sfei.org/documents

Dusterhoff, S.; McKnight, K.; Grenier, L.; Kauffman, N. 2021. **Sediment for Survival: A Strategy for the Resilience of Bay Wetlands in the Lower San Francisco Estuary**. SFEI Contribution No. 1015. San Francisco Estuary Institute: Richmond, CA.

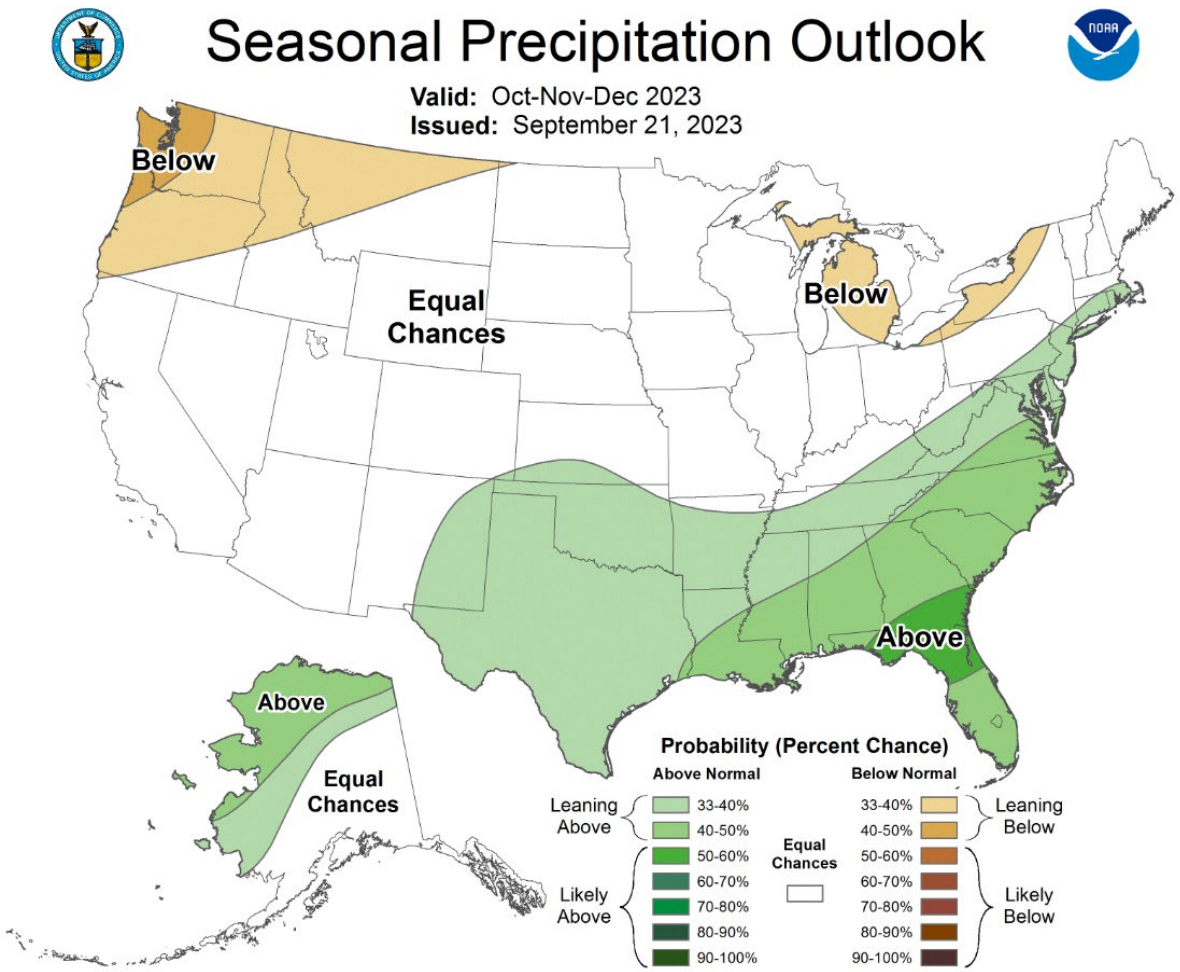
McKnight, K.; Braud, A.; Dusterhoff, S.; Grenier, L.; Shaw, S.; Lowe, J.; Foley, M.; McKee, L. 2023. **Conceptual Understanding of Fine Sediment Transport in San Francisco Bay**. SFEI Contribution No. 1114. San Francisco Estuary Institute: Richmond, CA.

McKee, L.J., Zi, T., Pearce, S.A., Grosso, C., Wong, A., Weaver, M., Dusterhoff, S., Lowe, J., Elias, E., Roelvink, F., 2023. Sand Budget and Sand Transport in San Francisco Bay. A report prepared by SFEI-ASC for the State Coastal Conservancy (SCC), and the San Francisco Bay Conservation and Development Commission (BCDC). SFEI Contribution #1125. Richmond, CA.

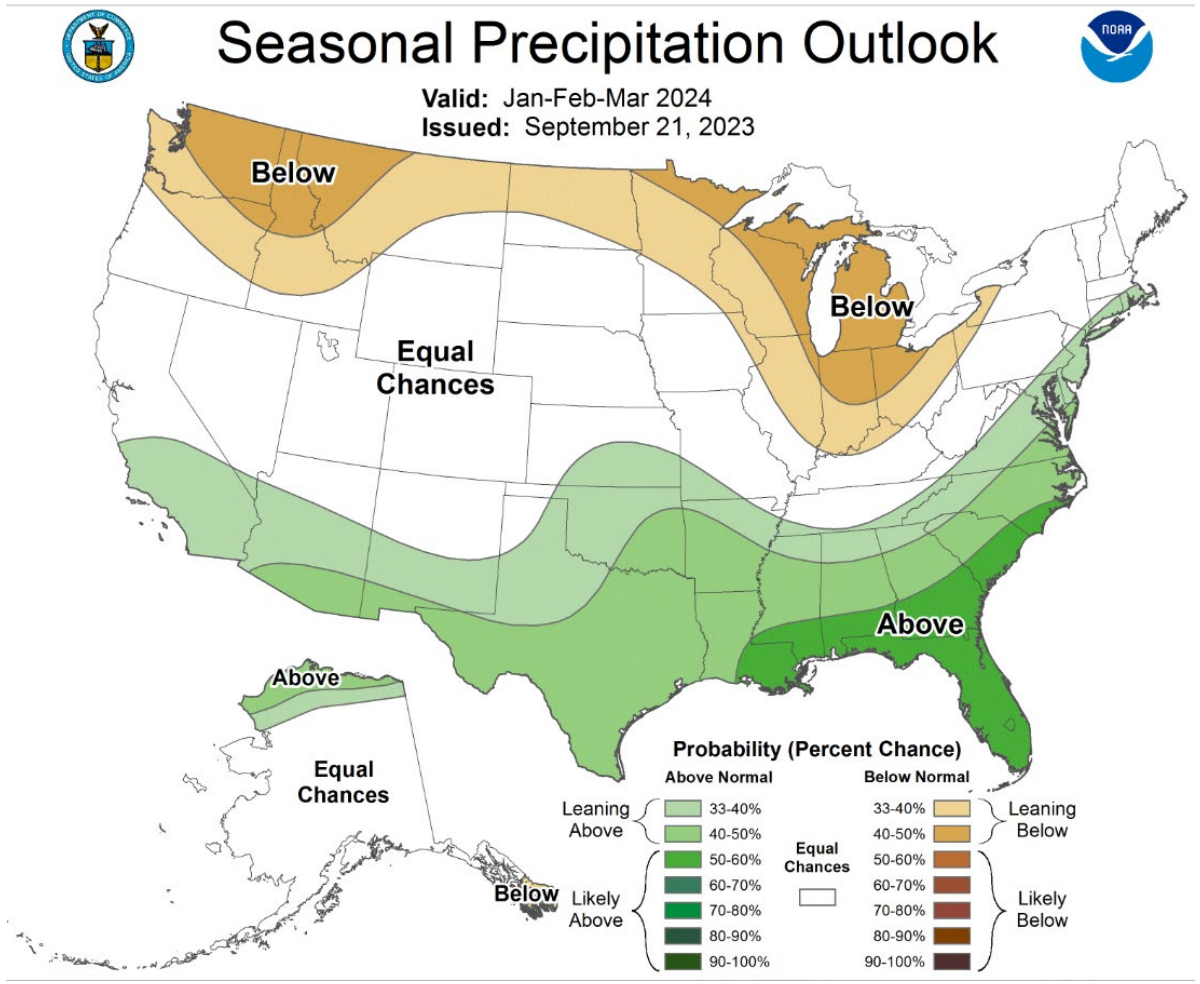
Zi, T.; Braud, A.; McKee, L. J.; Foley, M. 2022. **San Francisco Bay Watershed Dynamic Model (WDM) Progress Report, Phase 2**. SFEI Contribution No. 1091. San Francisco Estuary Institute: Richmond, California.

Gilbreath, A. N.; Stark, K.; Pearce, S.; Mckee, L. 2023. **Suspended Sediment Loads Analysis of Four Creeks in the San Francisco Bay Area**. SFEI Contribution No. 1134. San Francisco Estuary Institute: Richmond, CA.

Upcoming season predictions



Oct-Dec 2023



Jan-Mar 2024

Upcoming season predictions

“The bottom line is that I think we should be guardedly optimistic that California will get at least a normal amount of precipitation, but (we) should not be too surprised if for whatever reason that does not work out.”

-Washington State climatologist Nick Bond

THANK YOU TEAM!

SFEI Stormwater Sampling Team 2023

Leads

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- Ezra Miller
- Kyle Stark
- David Peterson
- Don Yee
- Diana Lin

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