



Highlights from the Bay Regional Monitoring Program and the newly developed Regional Watershed Model

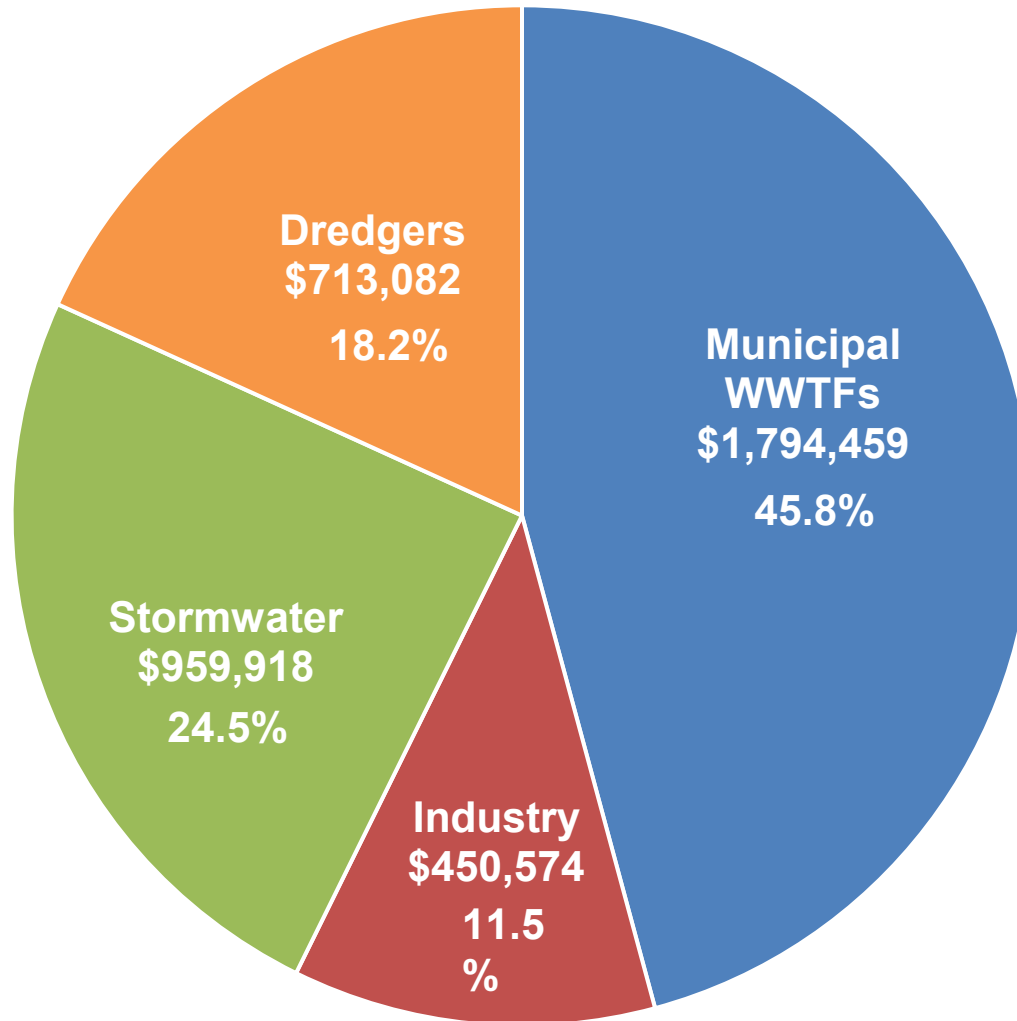
Dr. Melissa Foley and Dr. Tan Zi
San Francisco Estuary Institute
5 February 2021

Bay Regional Monitoring Program

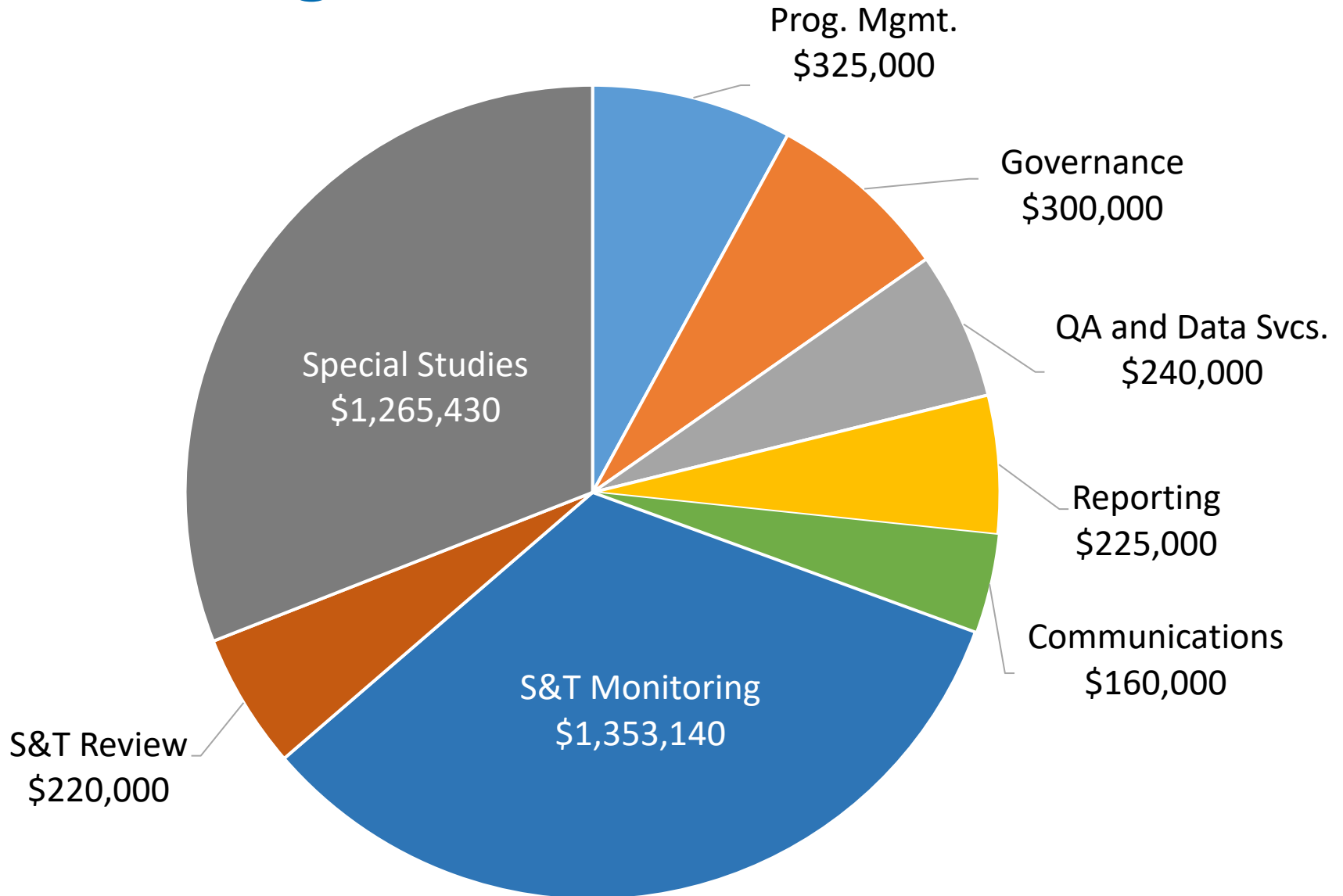
Collect data and communicate information about water quality in San Francisco Bay in support of management decisions

- ~ 68 entities in the Program
 - Municipal wastewater
 - Industrial wastewater
 - Municipal stormwater
 - Dredgers

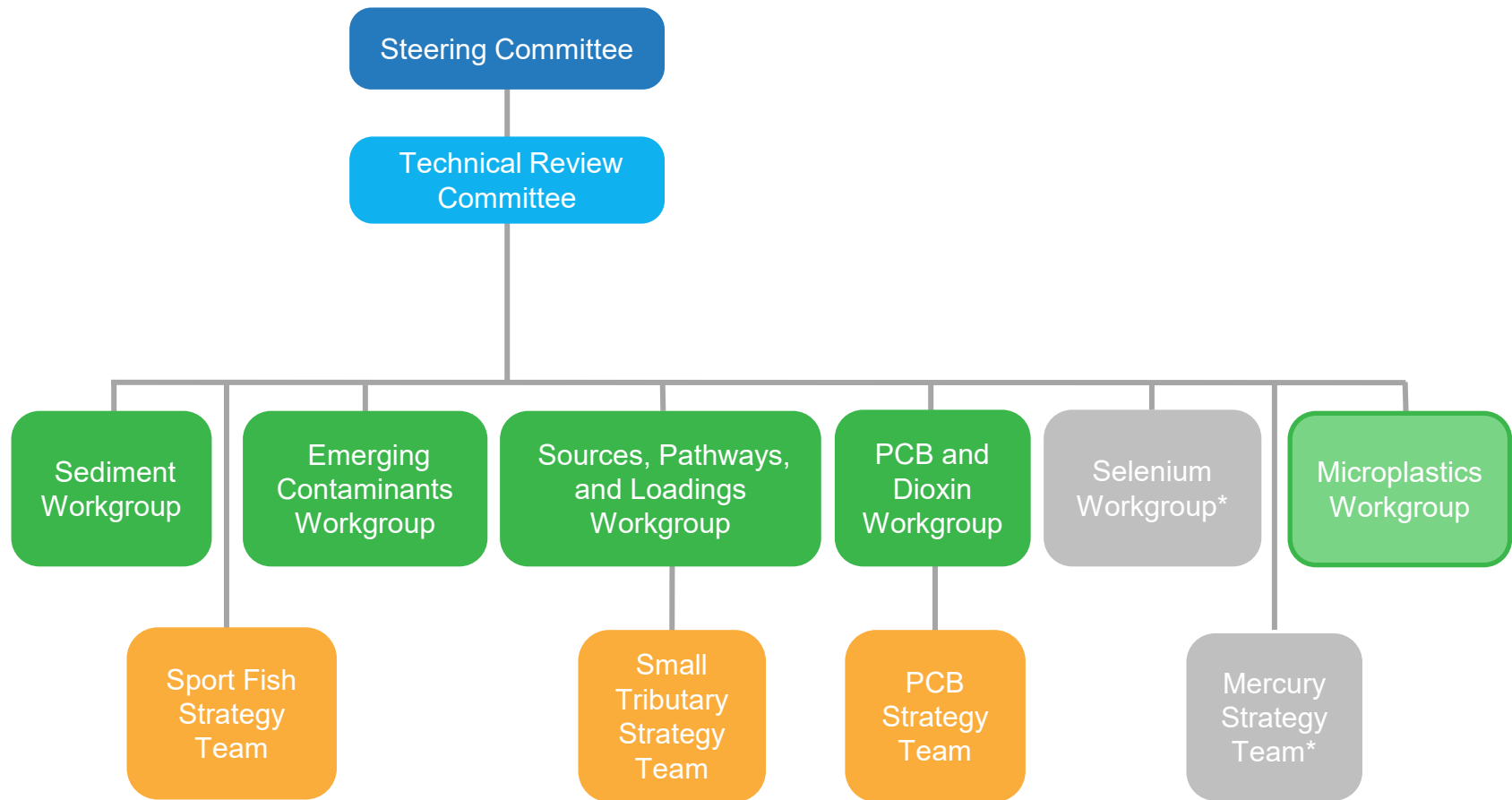
RMP participants & contributions



RMP Budget 2021



RMP governance structure



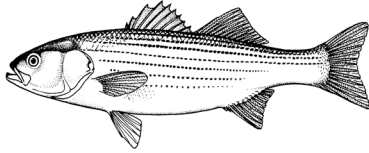
*currently inactive

A photograph of an offshore oil rig at sea. The rig's lattice structure is visible in the background against a cloudy sky. In the foreground, the churning water and white wake of a boat are visible, with a metal chain running across the bottom of the frame. A diagonal structure, possibly a crane or derrick, extends from the top right corner towards the center.

PROGRAM **HIGHLIGHTS**

Status and
Trends

Status and Trends Monitoring



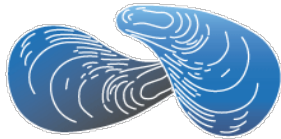
Sport Fish

Every 5 Years



Bird Eggs

Every 3 Years



Bivalves

Every 2 Years

Bioaccumulation
matrices



Water

Every 2
Years



Sediment

Every 4 Years

Core
matrices

Status and Trends Monitoring



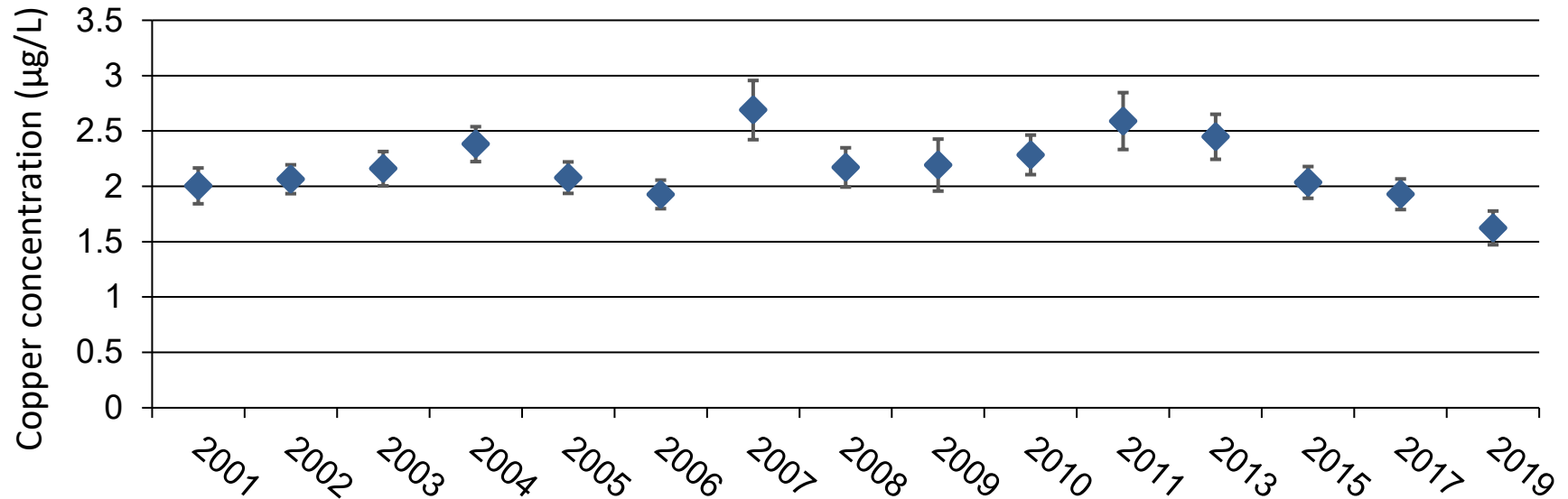
CEC Tiered risk-based framework

High Concern moderate or high impact	Studies to support TMDL or alternative management plan
Moderate Concern low impact	Consider including in Status and Trends monitoring Special studies of fate, effects, sources, pathways, and loadings
Low Concern limited impact	Conduct periodic screening level monitoring in water, sediment, or biota
Possible Concern uncertainty as to impact	Screening level monitoring to determine presence in water, sediment, or biota



Copper in water - below trigger levels

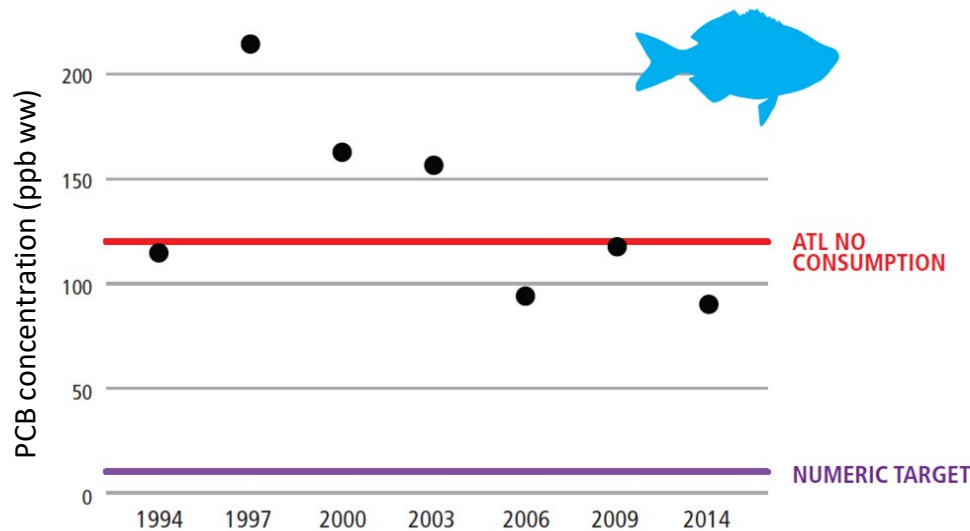
Dissolved Copper - Whole Bay



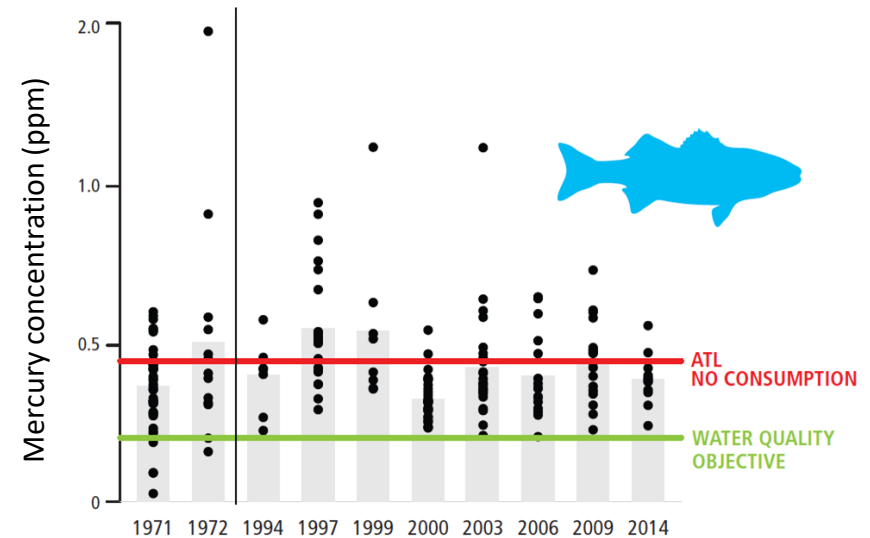
Bay Segment	Trigger (µg/L)	2013-2017 Rolling Average (µg/L)
Lower South Bay	4.2	3.0
South Bay	3.6	2.4
Central Bay	2.2	1.5
San Pablo Bay	3.0	1.8
Suisun Bay	2.8	2.1

No trends in PCBs and mercury in sport fish

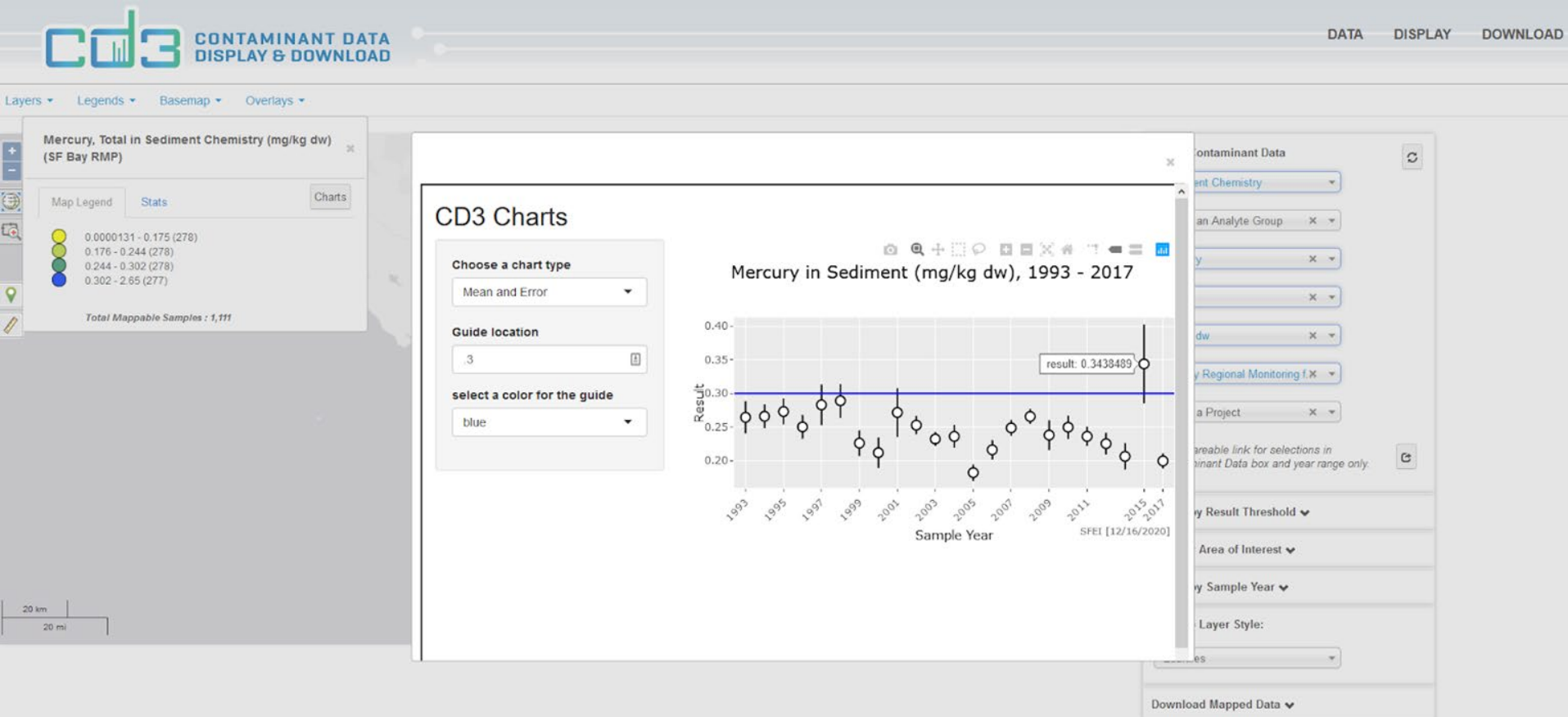
No trend: 1994-2014



No trend: 1971-2014



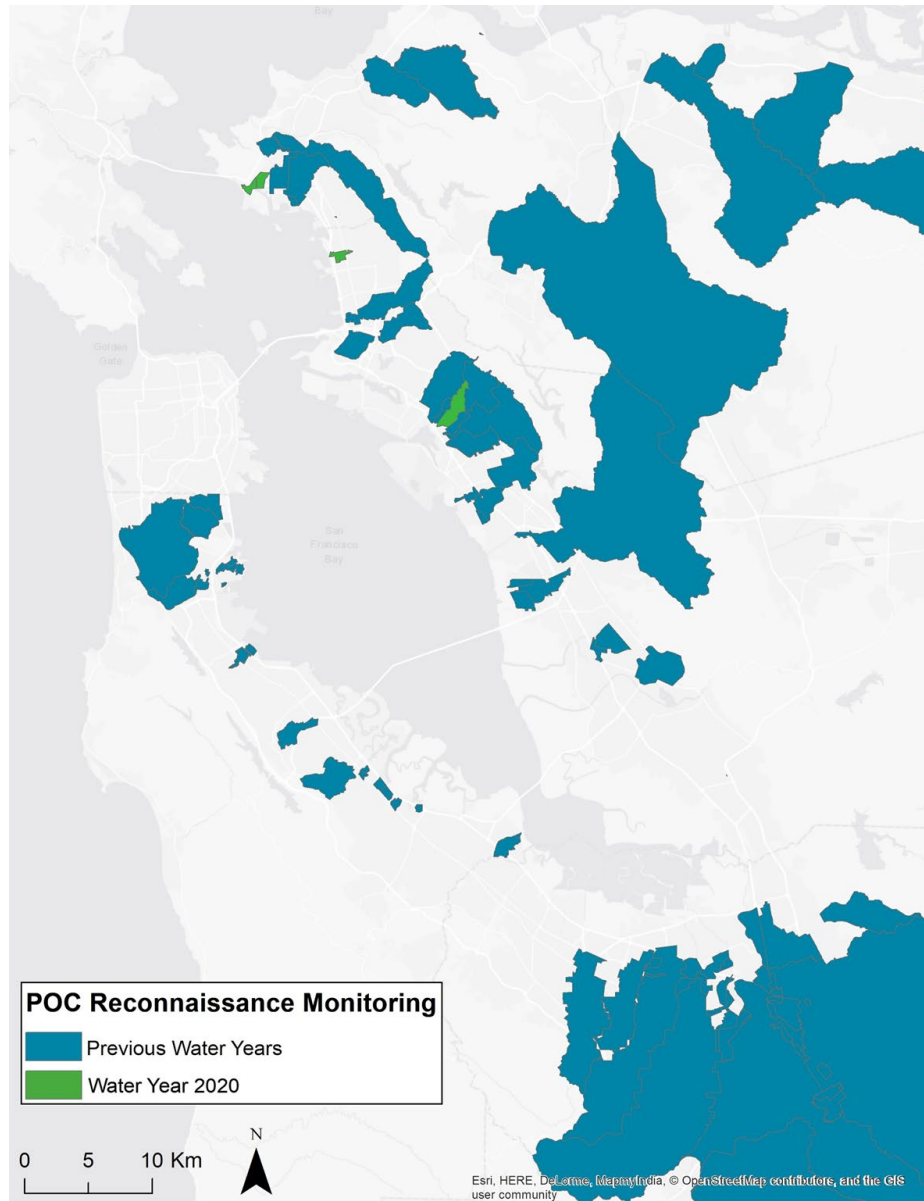
CD3 database – charts & guidelines



A photograph of a body of water, likely a river or lake, with a wake visible in the foreground. A metal chain runs across the bottom of the frame. In the background, several tall, white, lattice-structured towers or cranes are visible against a cloudy sky. A small figure of a person is standing on a platform near the water's edge.

PROGRAM **HIGHLIGHTS** Special Studies

Stormwater Monitoring



PCBs and Mercury

Emerging contaminants

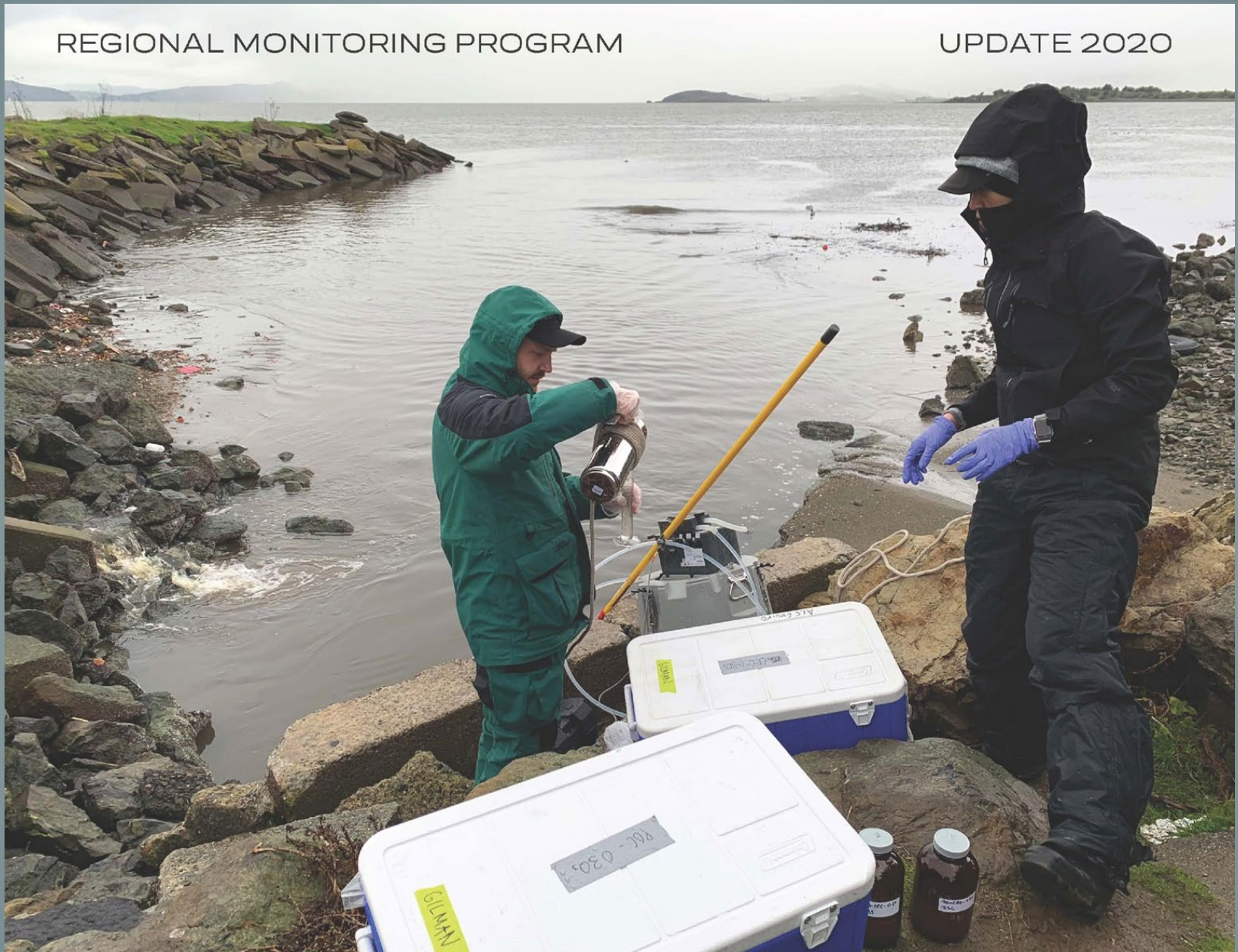
Microplastics



Sediment transport and deposition

- Sediment watershed transport
- Sediment conceptual model
- Sediment flocculation and settling velocity
- Sediment flux from shallows onto marshes





For More Information

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Modeling at SFEI

Historical Ecology

Monitoring Programs

Past

Present

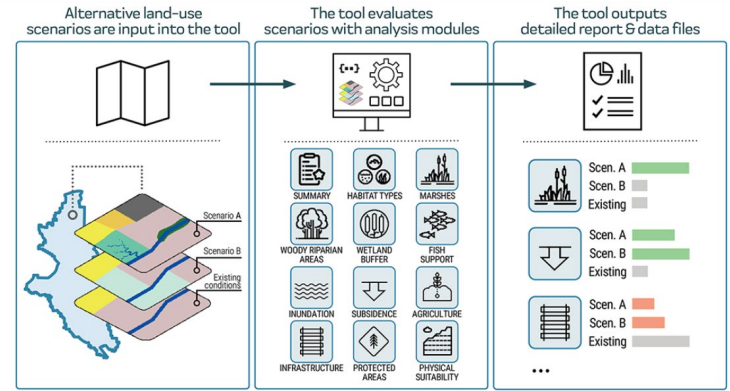
Future

Modeling

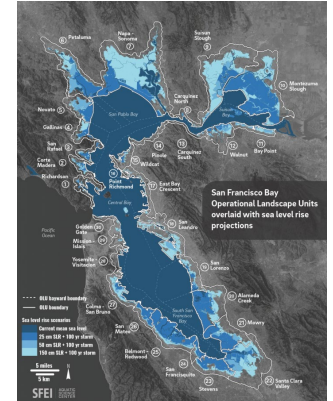
Regional watershed model

SF Bay model

Urban
Hydrology
model

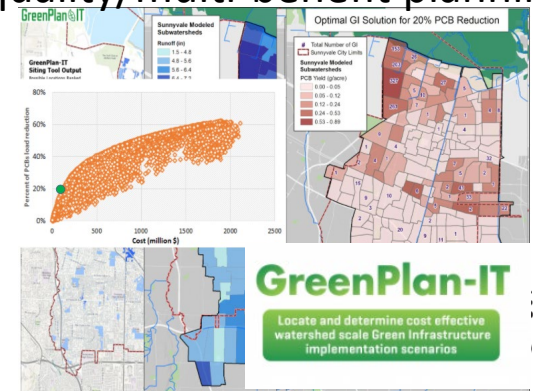


Land Use Planning

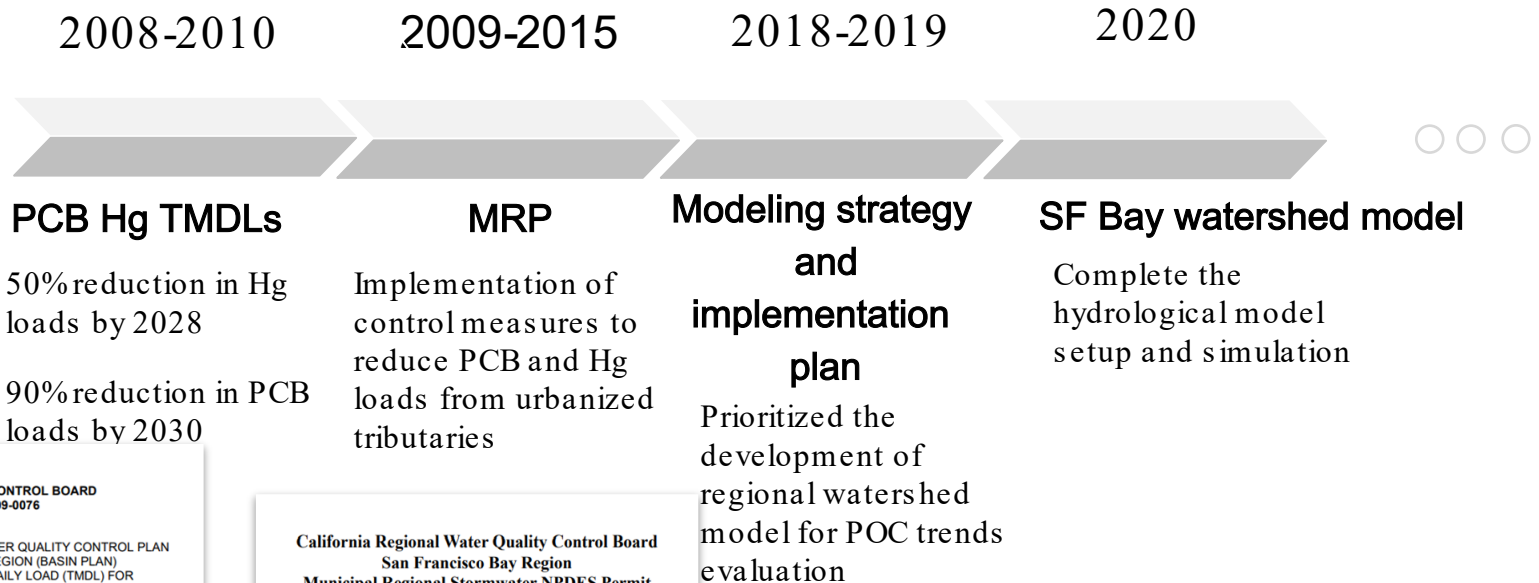


Climate Adaptation

Water quality/multi-benefit planning



Regional Watershed Model



**STATE WATER RESOURCES CONTROL BOARD
RESOLUTION NO. 2009-0076**

APPROVING AN AMENDMENT TO THE WATER QUALITY CONTROL PLAN FOR THE SAN FRANCISCO BAY REGION (BASIN PLAN) TO ESTABLISH A TOTAL MAXIMUM DAILY LOAD (TMDL) FOR POLYCHLORINATED BIPHENYLS (PCBs) IN THE SAN FRANCISCO BAY

**CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION**

RESOLUTION R2-2006-0052

AMENDING THE WATER QUALITY CONTROL PLAN FOR THE SAN FRANCISCO BAY REGION TO ESTABLISH NEW MERCURY WATER QUALITY OBJECTIVES AND TO AMEND THE TOTAL MAXIMUM DAILY LOAD AND IMPLEMENTATION PLAN FOR MERCURY IN SAN FRANCISCO BAY

**California Regional Water Quality Control Board
San Francisco Bay Region
Municipal Regional Stormwater NPDES Permit**

Order No. R2-2015-0049
NPDES Permit No. CAS612008
November 19, 2015



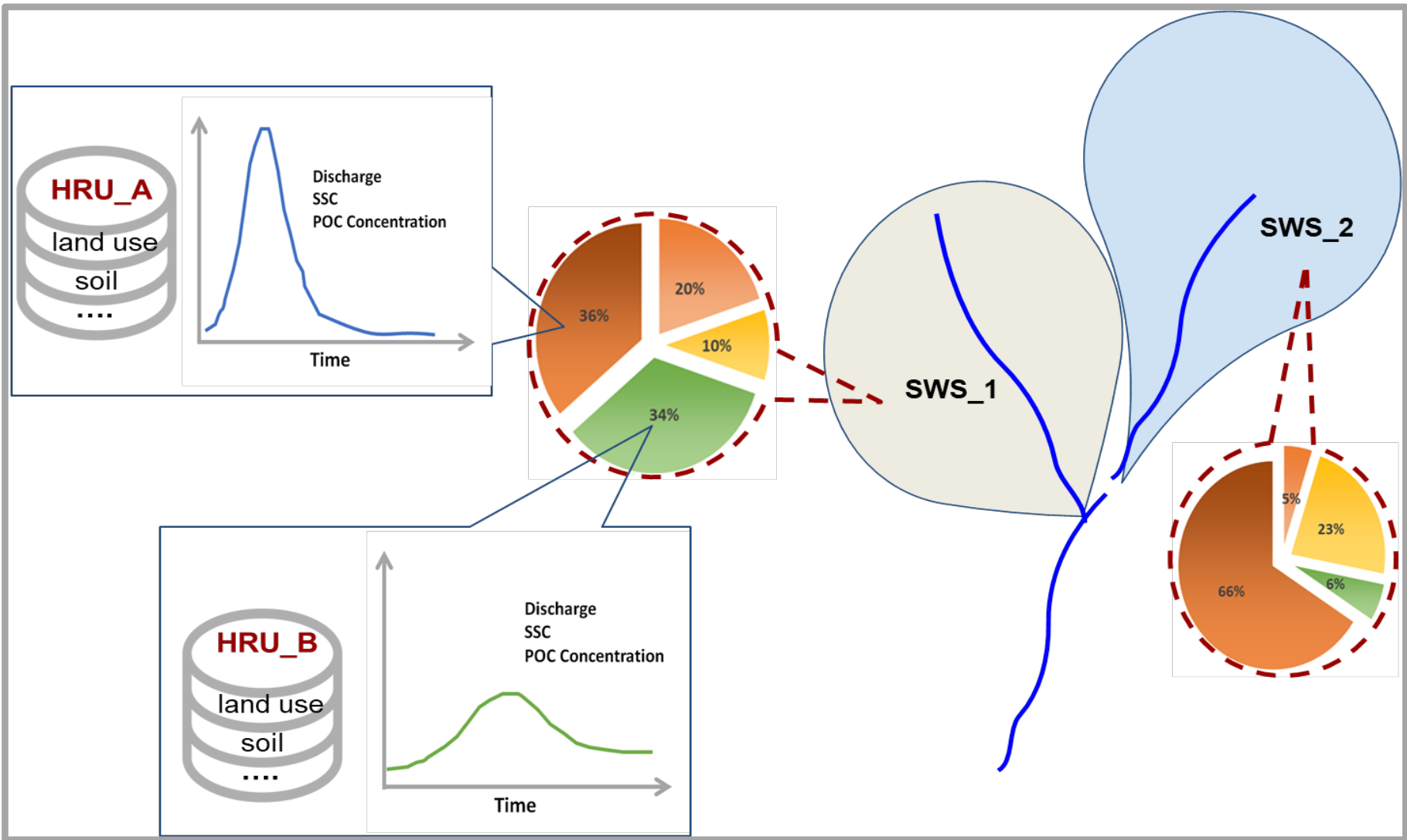
Model Implementation Plan



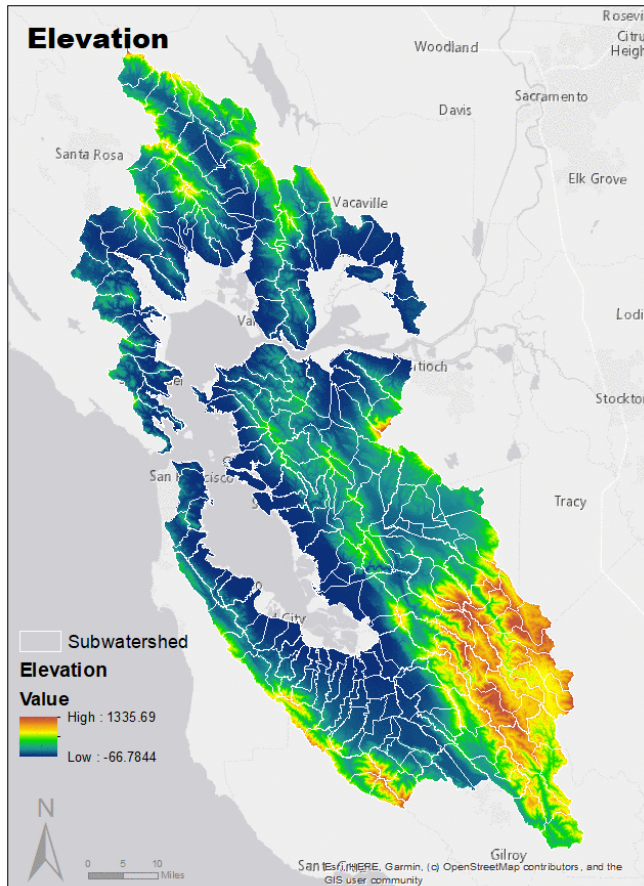
- Hydrology (2020)
- Sediment (2021)
- Water Quality
 - PCBs, Hg
 - Emerging Contaminants
 - Metals
 - Microplastics
 - Pesticide
 - Pathogen
 - Nutrients
- Stream Temperature



Model Setup



Model Setup



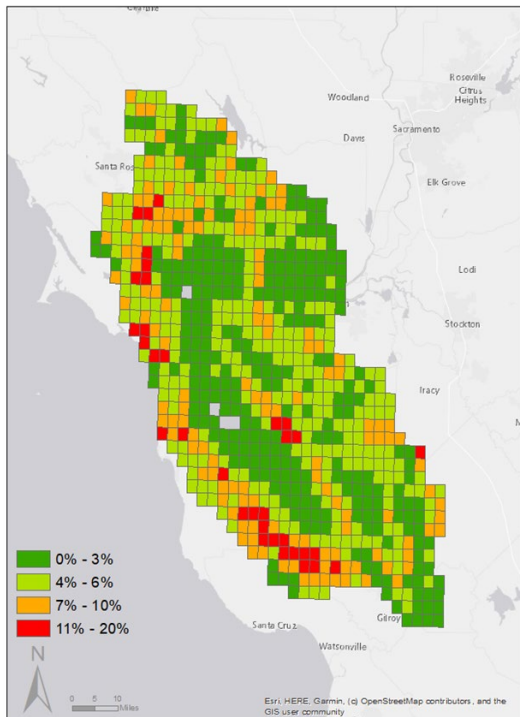
75 HRU types * 4 Geological groups

The model can represent 300 different types of hydrological processes.

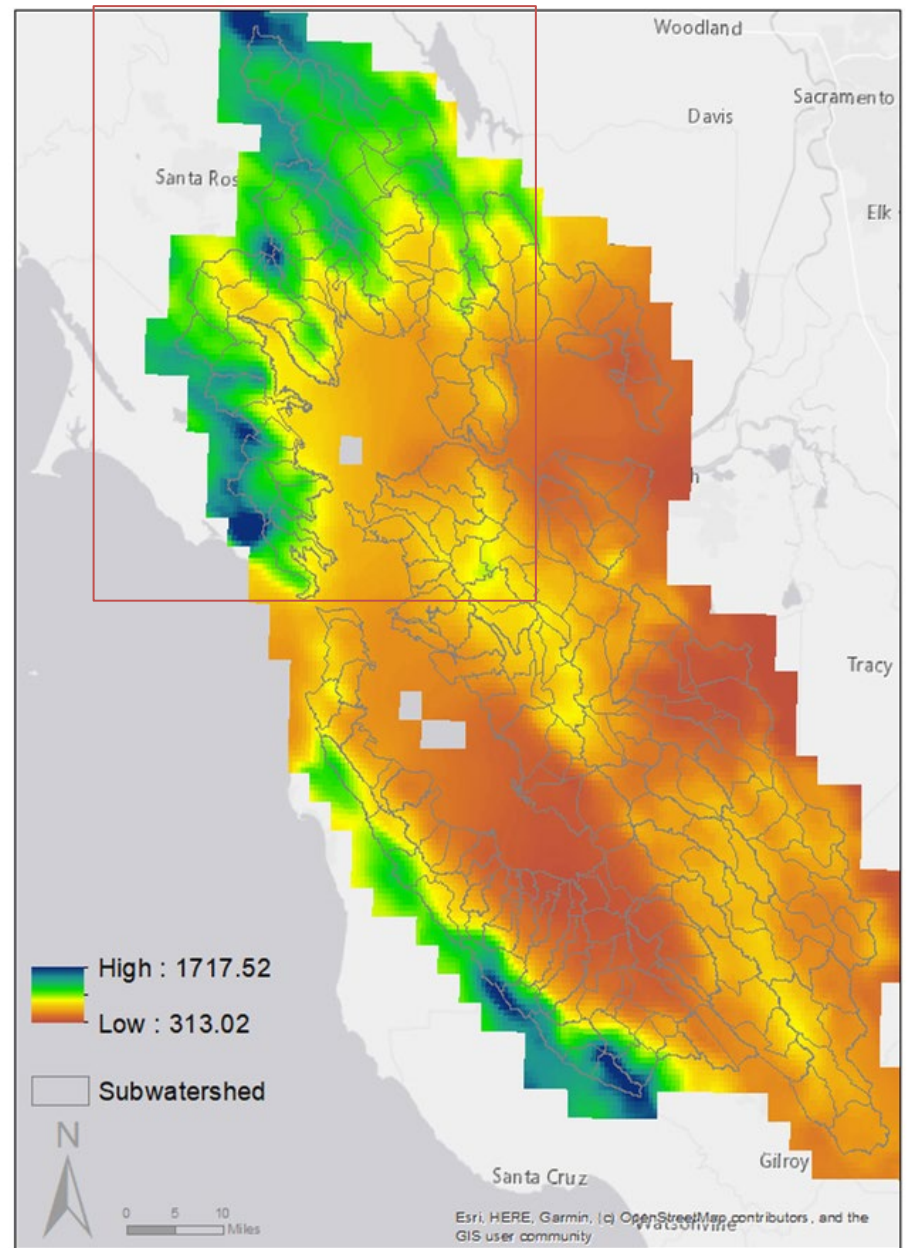


Model Setup

- Atmospheric river
- Orographic precipitation
- Large spatial and temporal variation

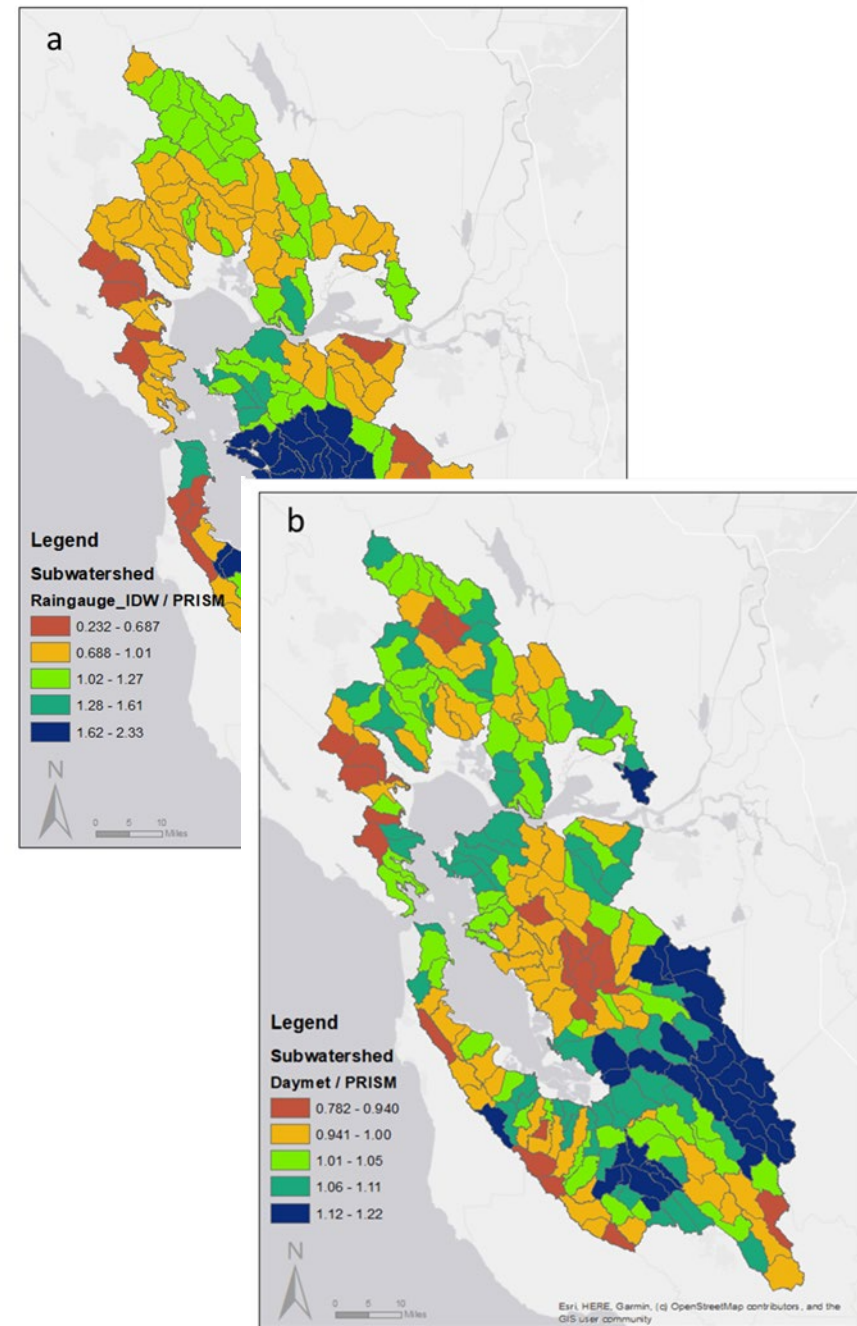
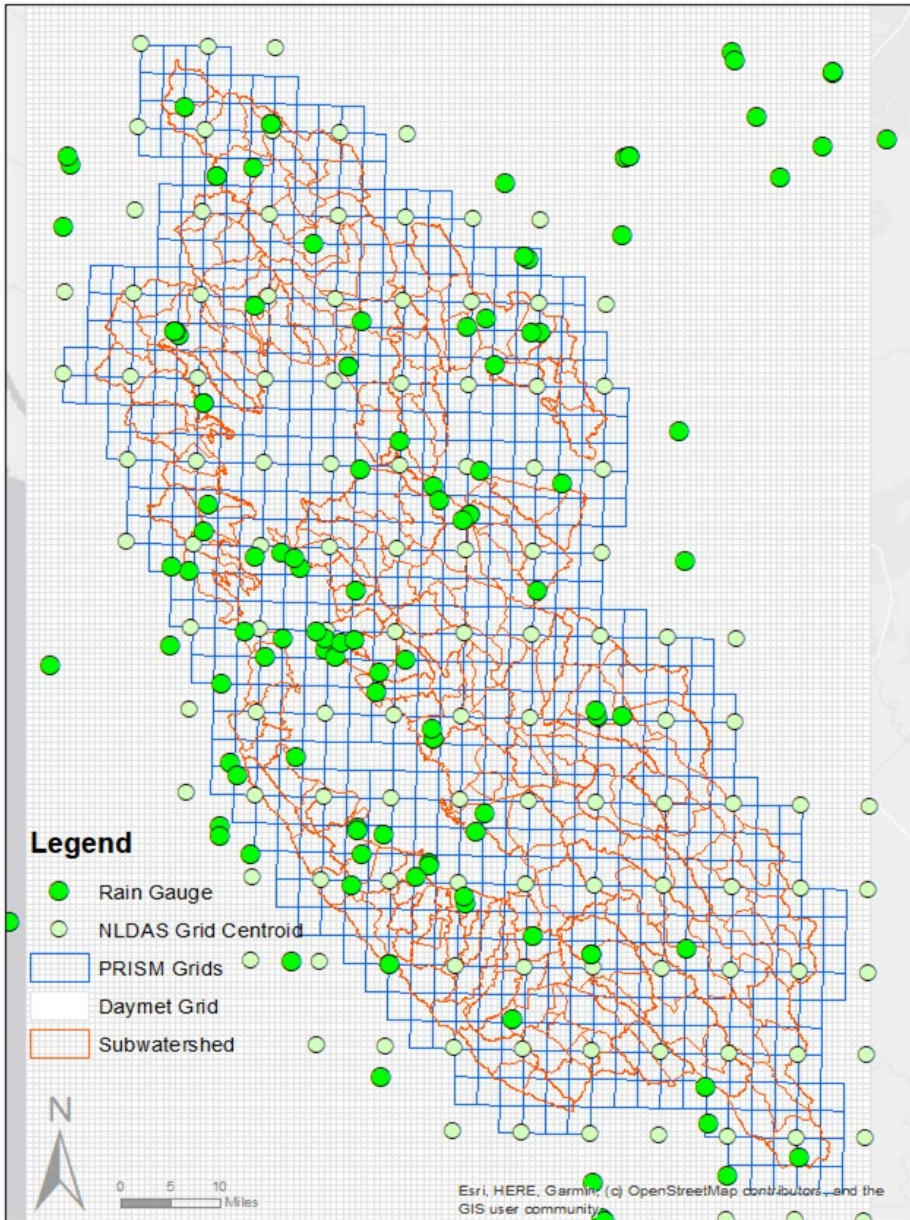


The coefficient of variation of PRISM 800-meter resolution 30 year (1981-2010) annual average data at each 4 km x 4 km grid cell

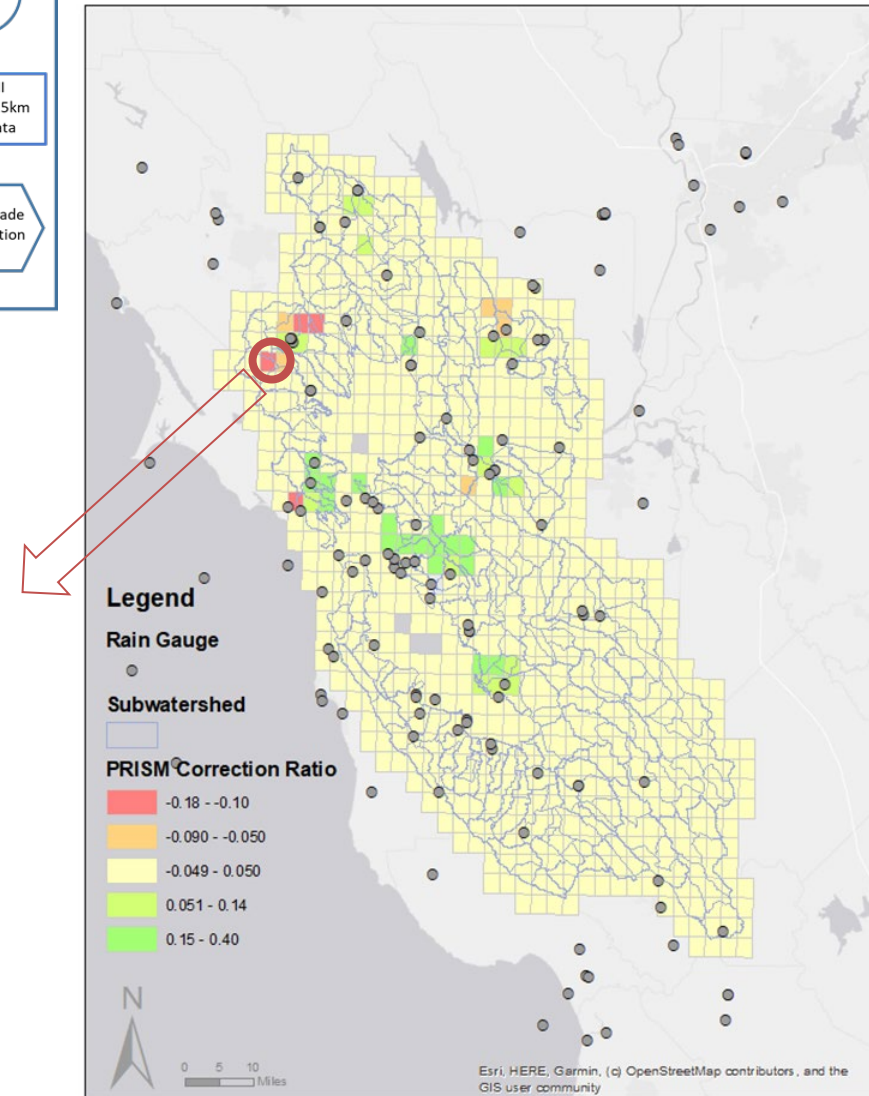
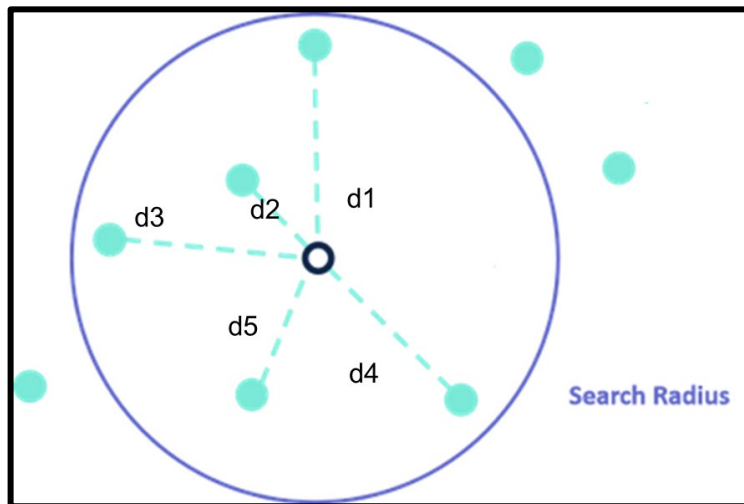
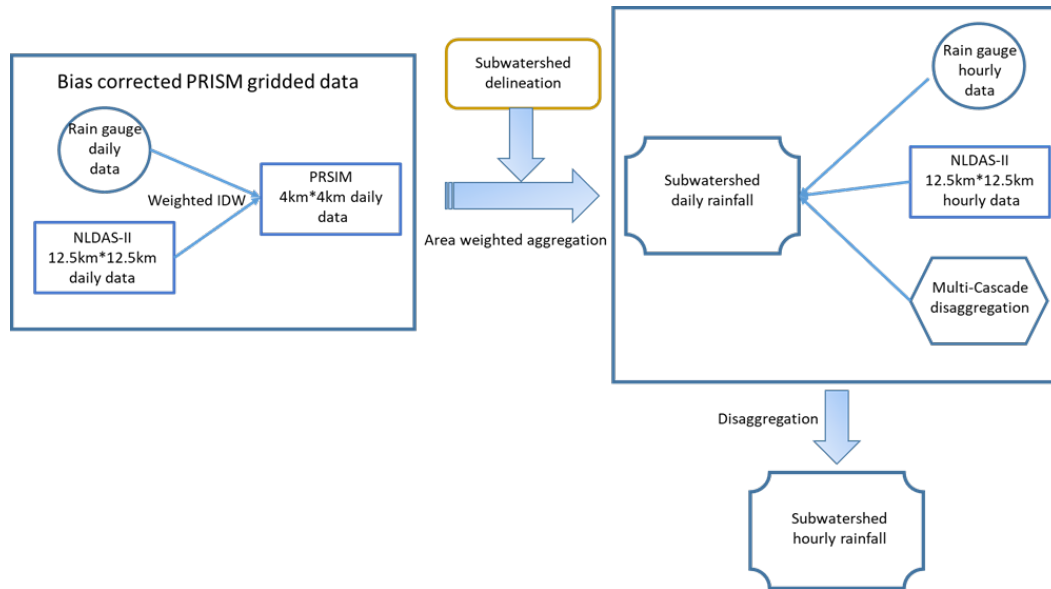


Thirty years (1981-2010) of average annual rainfall map (data source: PRISM 800-meter rainfall map)

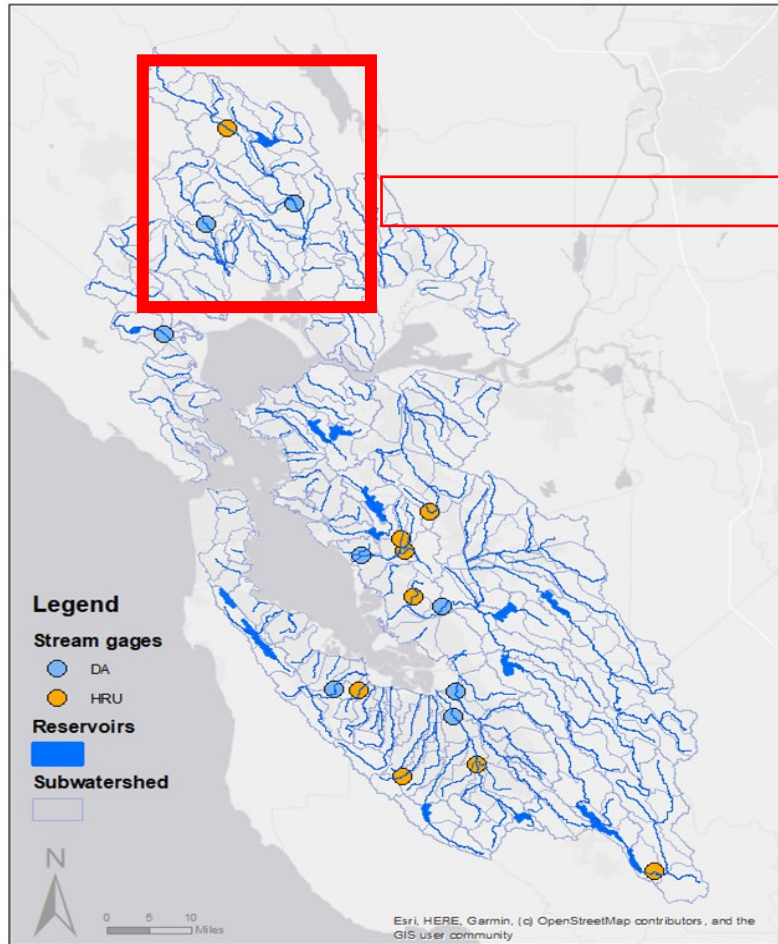
Model Setup



Model Setup



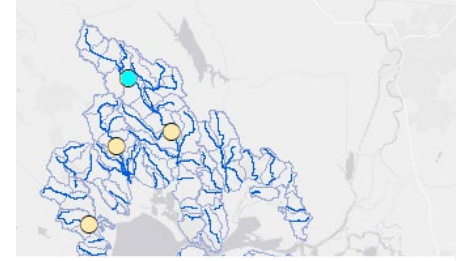
Modeling Results



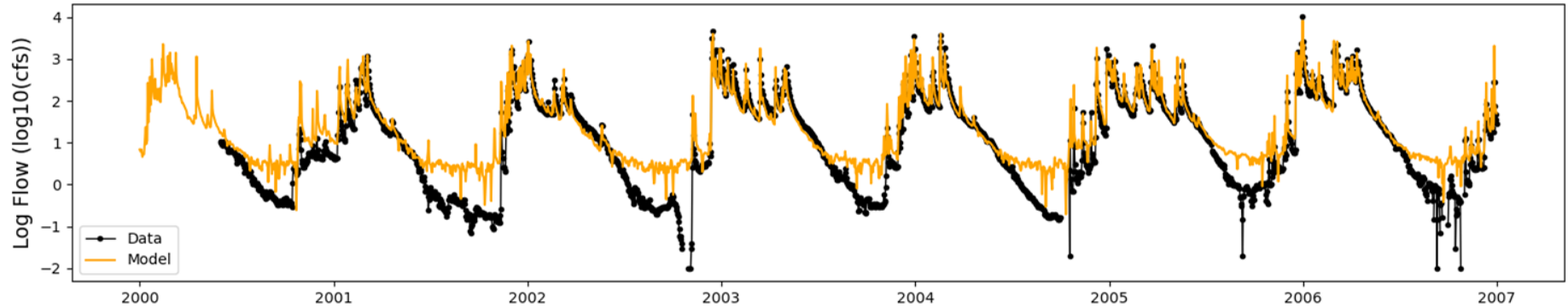
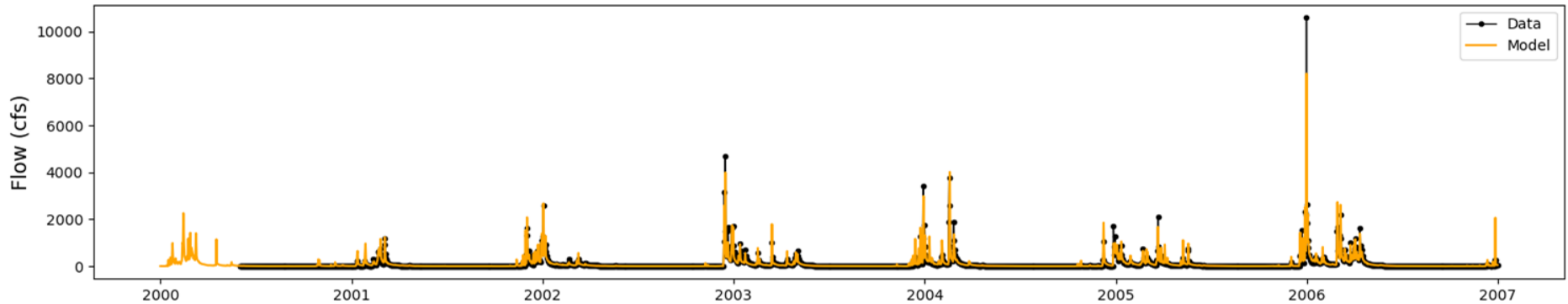
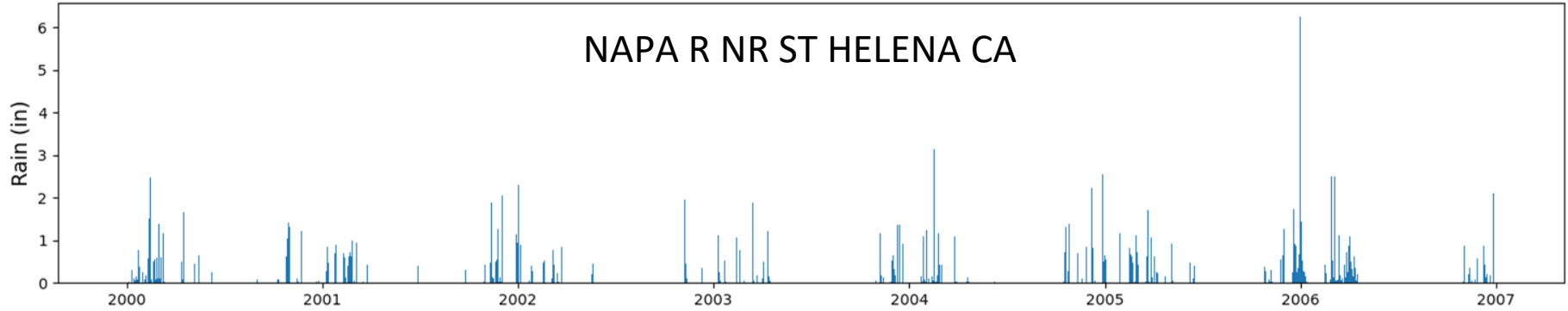
Station Name	DA (mi ²)	Elev (m)
SONOMA C A AGUA CALIENTE CA	58.4	94.28
NAPA R NR ST HELENA CA	78.8	191.37
NAPA R NR NAPA CA	218	24.74



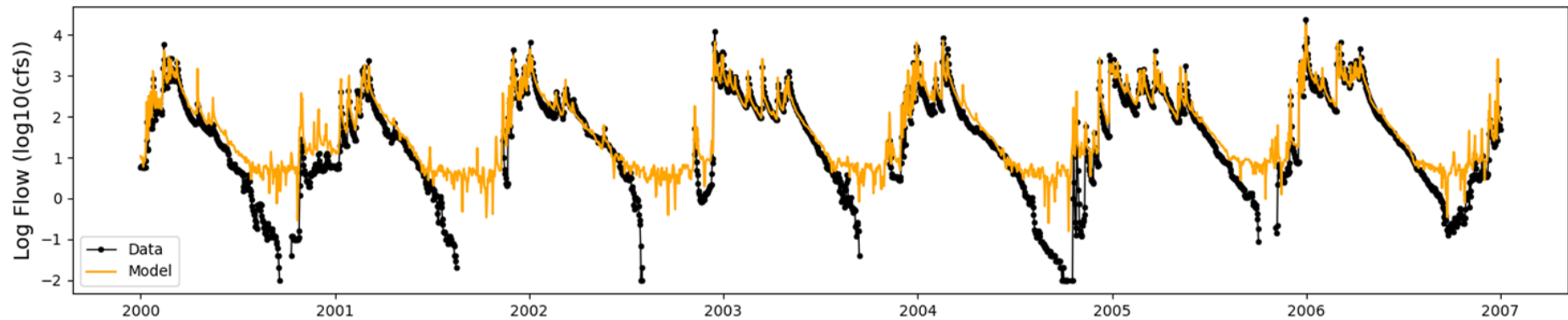
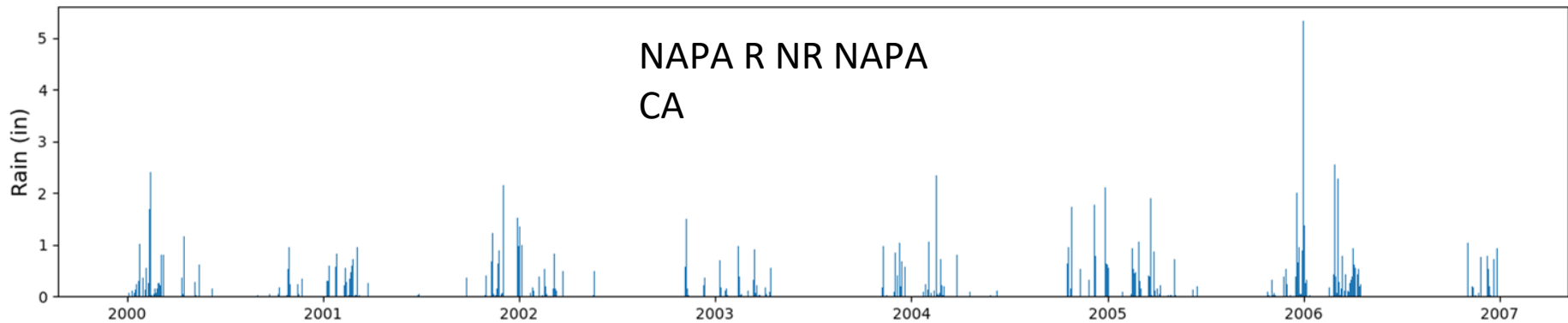
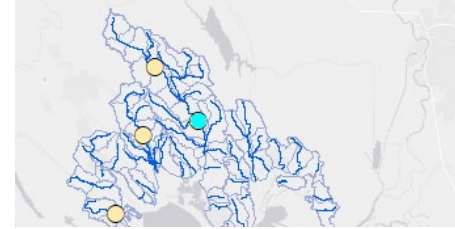
Modeling Results



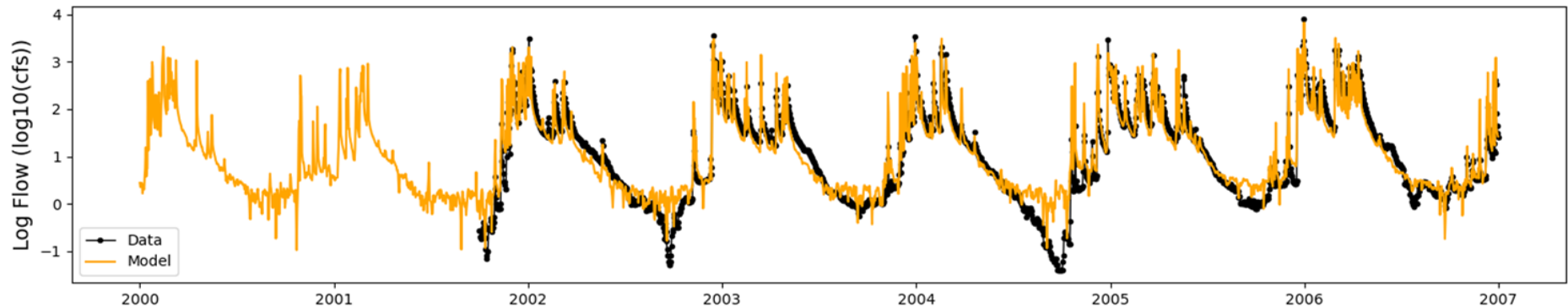
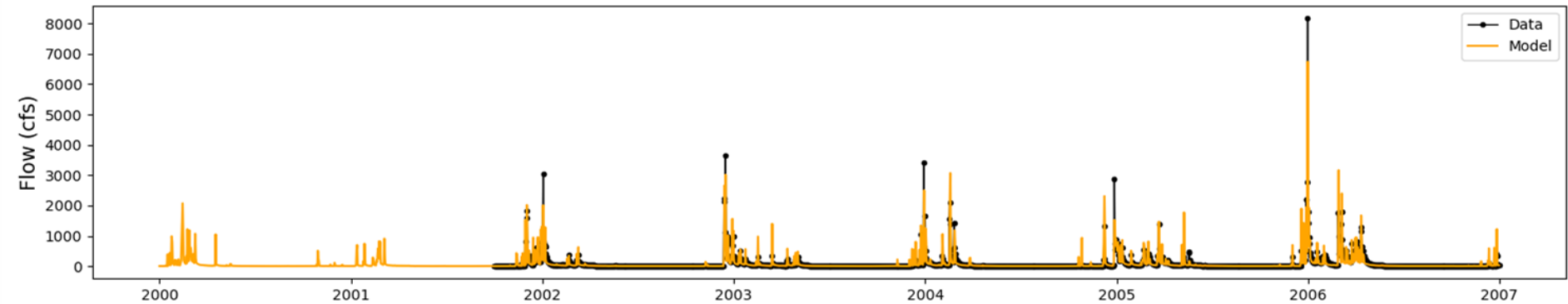
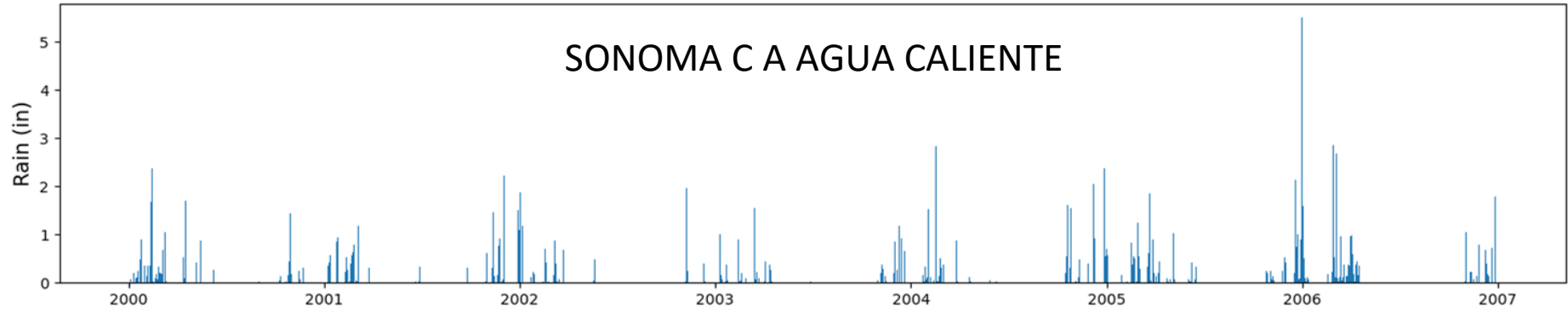
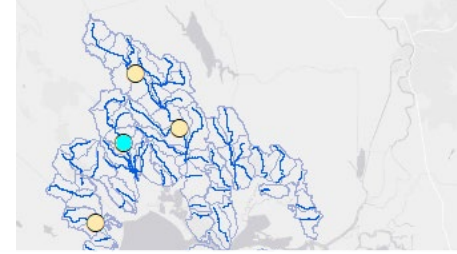
NAPA R NR ST HELENA CA



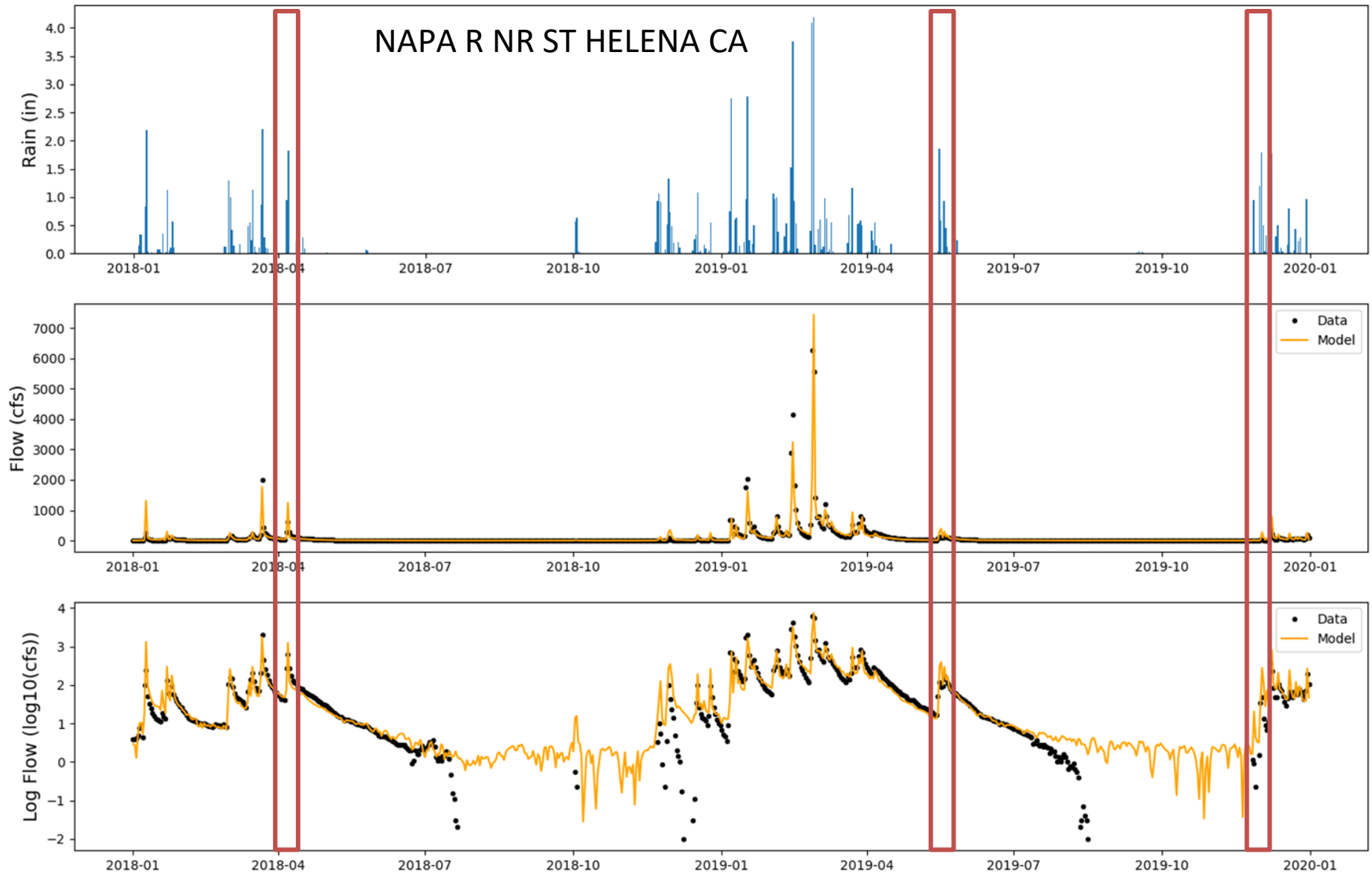
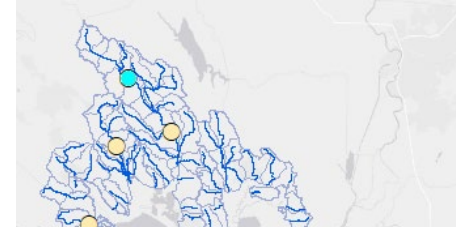
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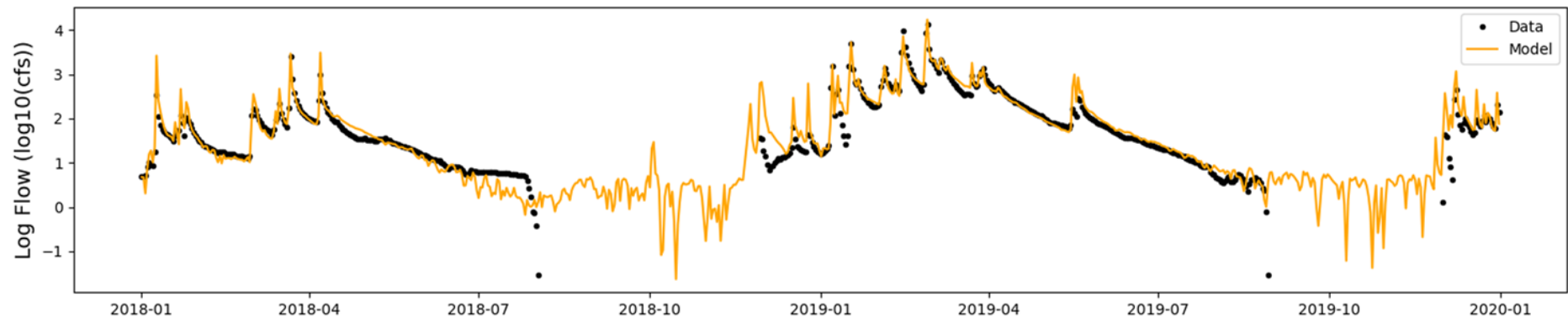
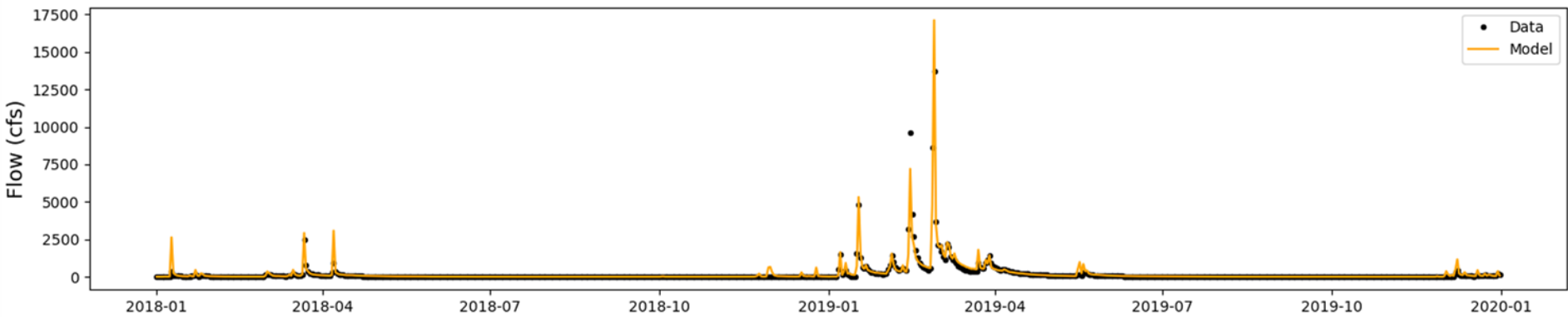
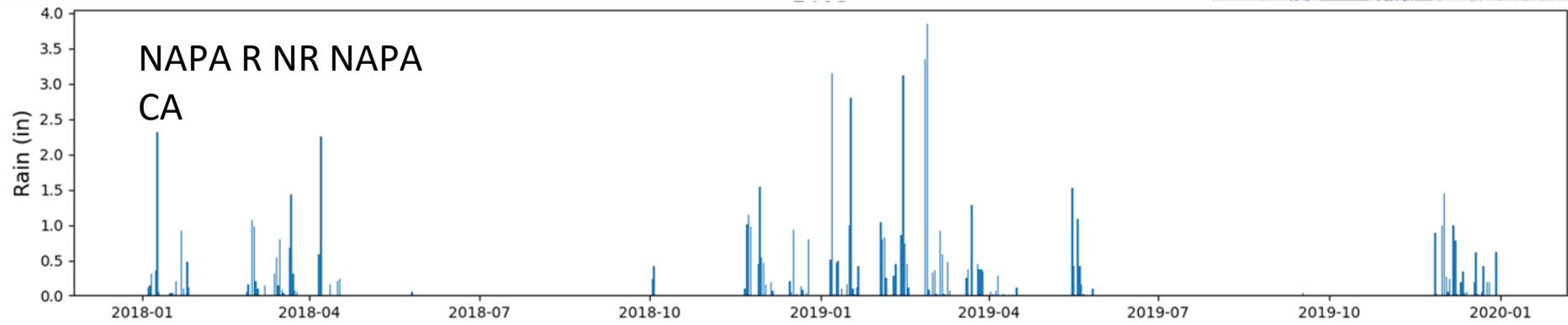
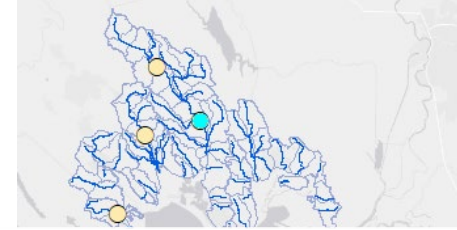
Modeling Results



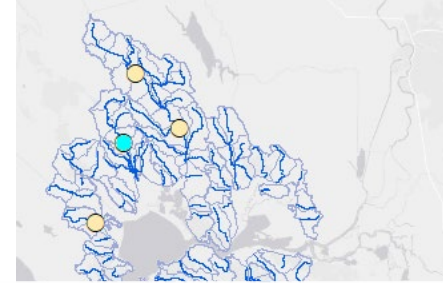
Modeling Results



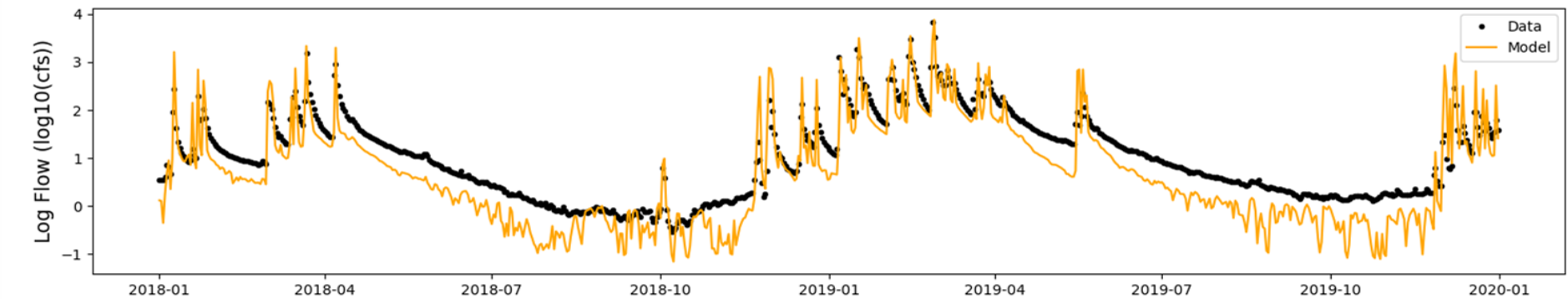
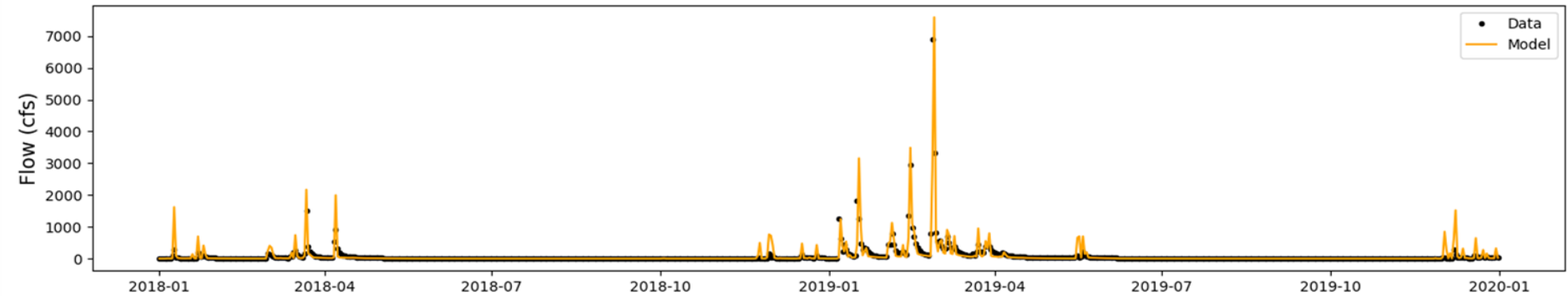
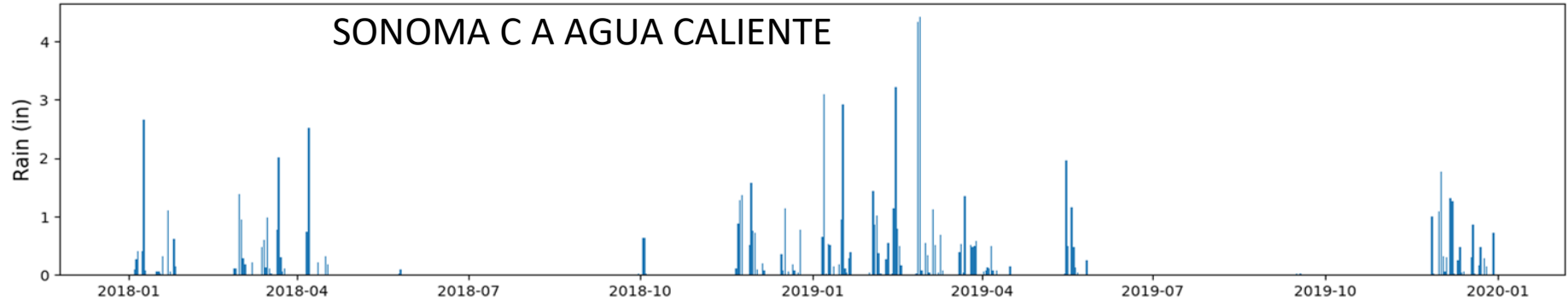
Modeling Results



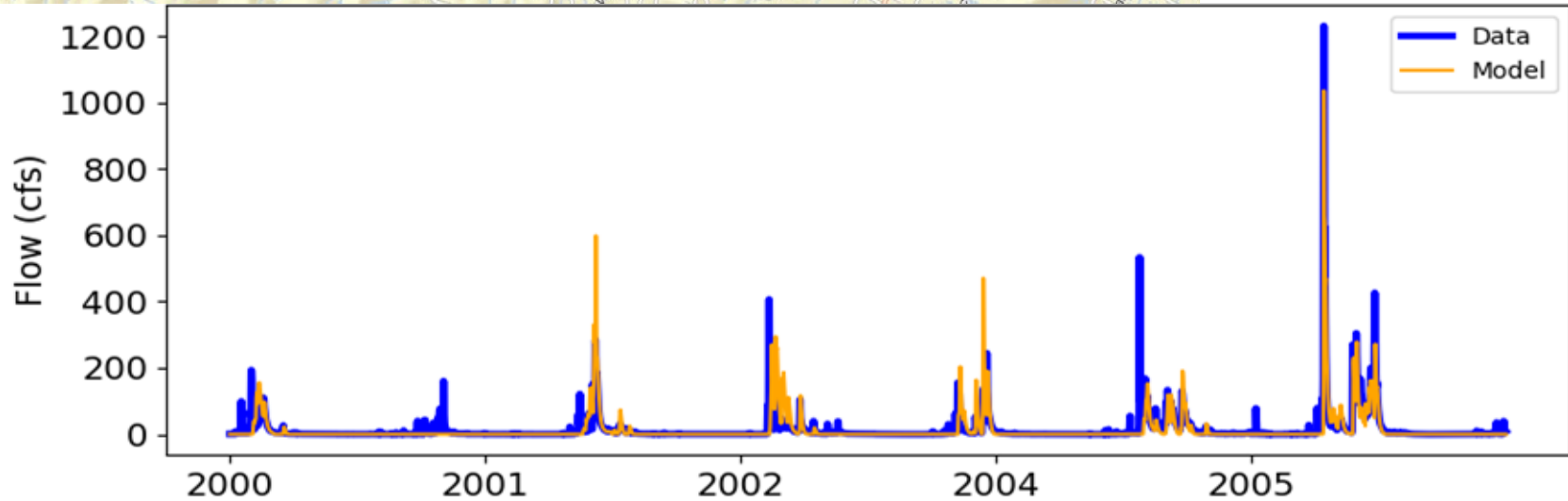
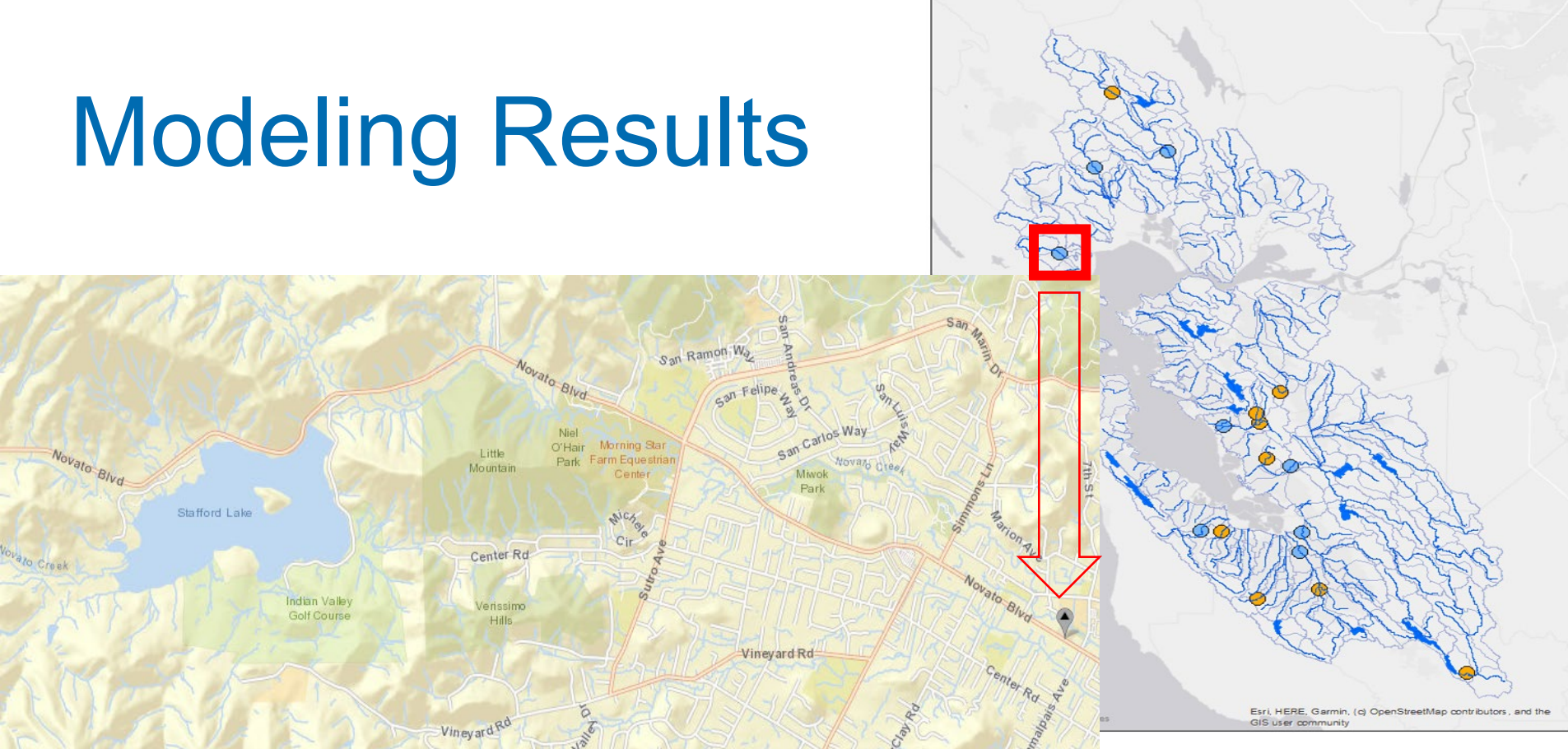
Modeling Results



SONOMA C A AGUA CALIENTE



Modeling Results

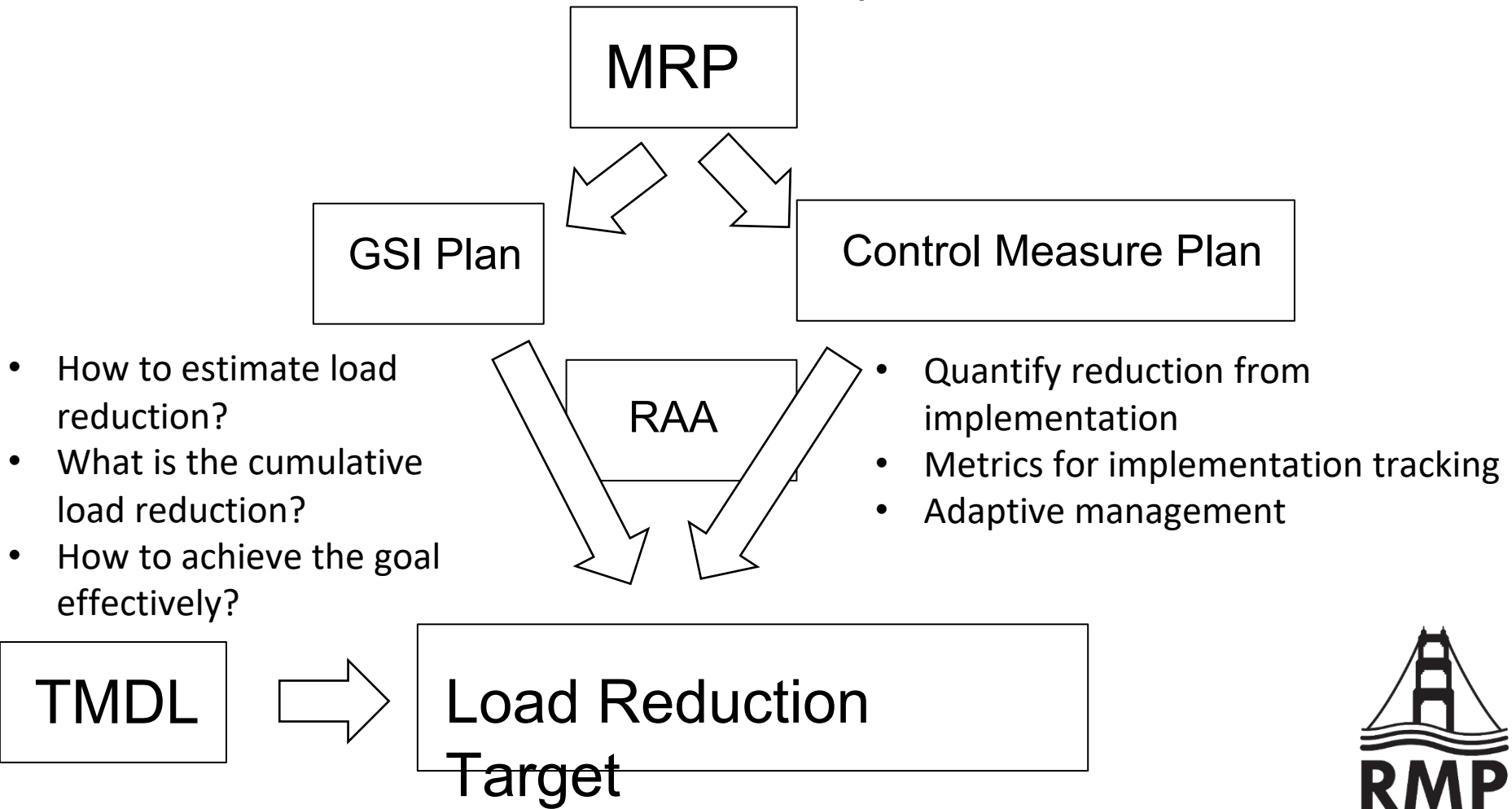


Modeling Results

	Calibration (2000-2006)			Validation (2018-2019)		
Calibration Flow Gage	Upstream Napa	Downstream Napa	Sonoma	Upstream Napa	Downstream Napa	Sonoma
NSE	0.95	0.95	0.95	0.94	0.97	0.95
RSR	0.21	0.21	0.22	0.24	0.17	0.21
PBIAS	2%	1%	0%	-8%	8%	9%
Highest 10% flow PBIAS	-8%	-12%	-9%	-14%	-4%	-5%
Wet Season flow PBIAS	0%	-1%	-1%	-10%	6%	9%

Potential Model Application

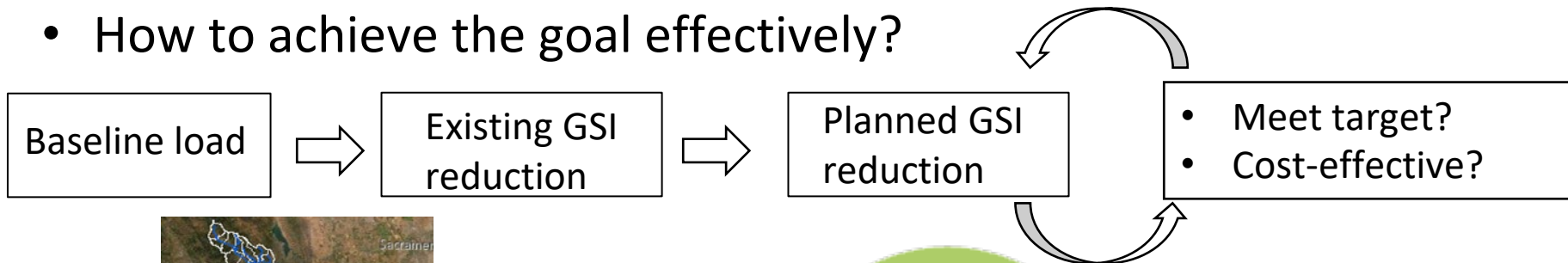
- Reasonable Assurance Analysis



Potential Model Application

- Reasonable Assurance Analysis

- How to estimate load reduction?
- What is the cumulative load reduction?
- How to achieve the goal effectively?



<http://greenplanit.sfei.org/>

- Baseline load
- Unit area load from HRUs
- Modeling tool-> GSI load reduction
- Site Locator Tool->GSI opportunities
- Optimization tool -> Cost-effective GSI solution
- Tracking tool -> GSI implementation tracking

Potential Model Application

- **Climate Adaptation**
 - Climate change -> ensemble bias correction
 - Land use change -> detailed HRU representation
- **Reservoir operation**
 - Water supply
 - Flood control
- **Flood control**
 - Watershed model + 1D/2D Hydraulic model



Questions?

For More Modeling Information and Updates

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