

SEDIMENT SOLUTIONS

Integrated Sediment Management for Watershed-Bayland Ecosystem Resilience



Petaluma Watershed Collaborative Meeting
January 18, 2024

SFEI | AQUATIC
SCIENCE
CENTER

Goals for Today

- Provide an overview of the project tasks and outputs
- Share progress on riparian condition and sediment source assessments
- Receive input on analyses and management priorities
- Solicit information on additional relevant datasets



Project Background

As climate continues to change, management approaches need to change

- Baylands will need more sediment to survive as sea level continues to rise
- Increasing air temperatures and large storm frequency will impact watershed ecosystems
- We need to develop management solutions that support the resilience of both baylands and watersheds



Project Background

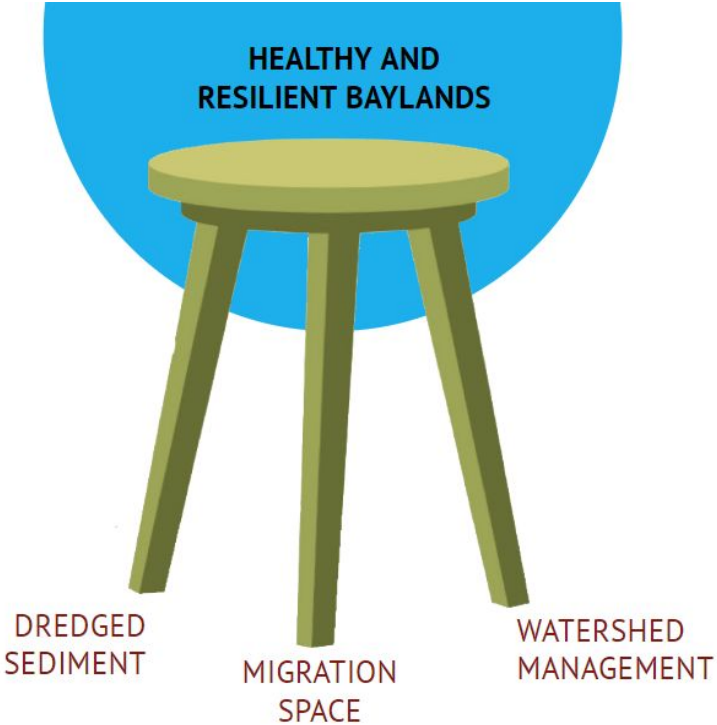
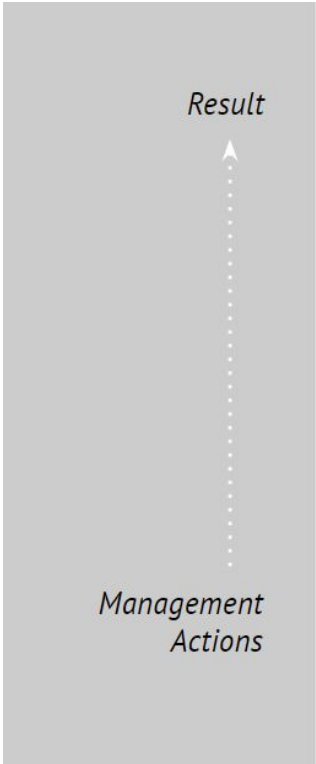
Volume of sediment

needed for tidal marshes and tidal flats by 2100



~450 Million cy

Project Background



Project Background

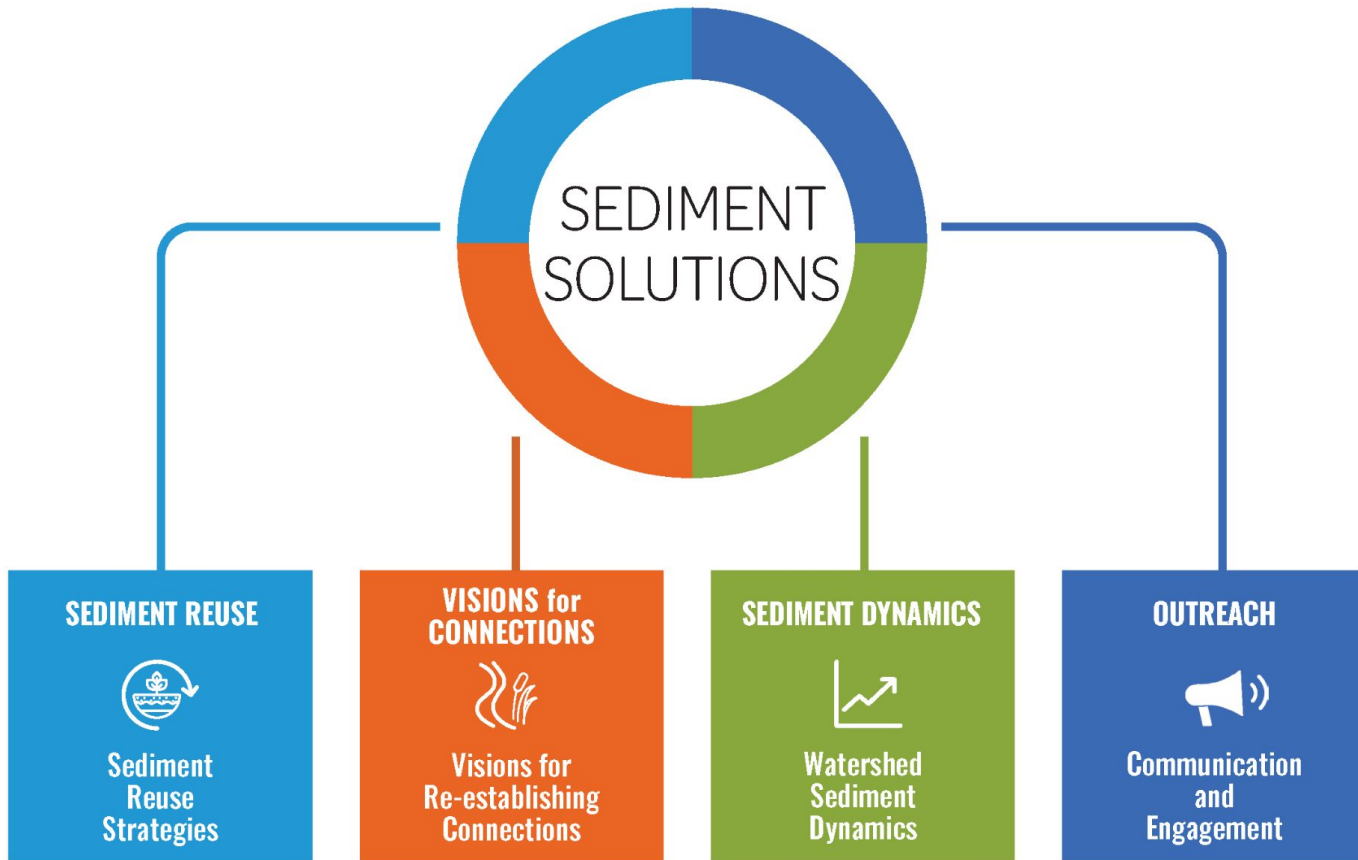


Integrated Watershed-Baylands Management

Getting more watershed sediment onto baylands

- Bayland-watershed reconnection
- Direct placement

Supporting the health and resilience of watershed channel-riparian corridors

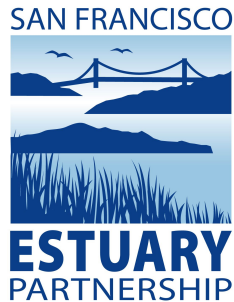


Funded by the San Francisco Bay Regional Water Quality Improvement Fund, EPA Region IX

Project Funders & Partners



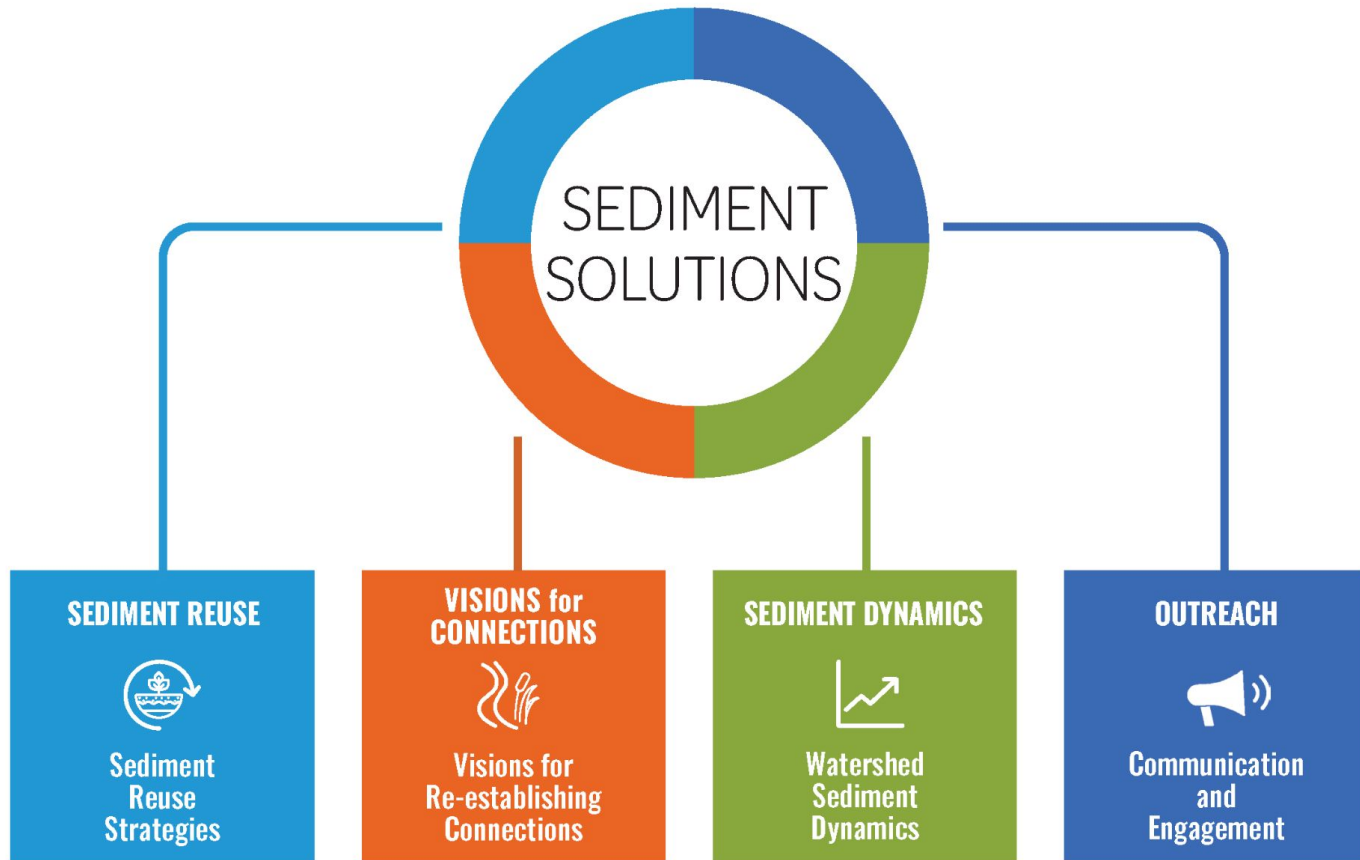
Valley Water



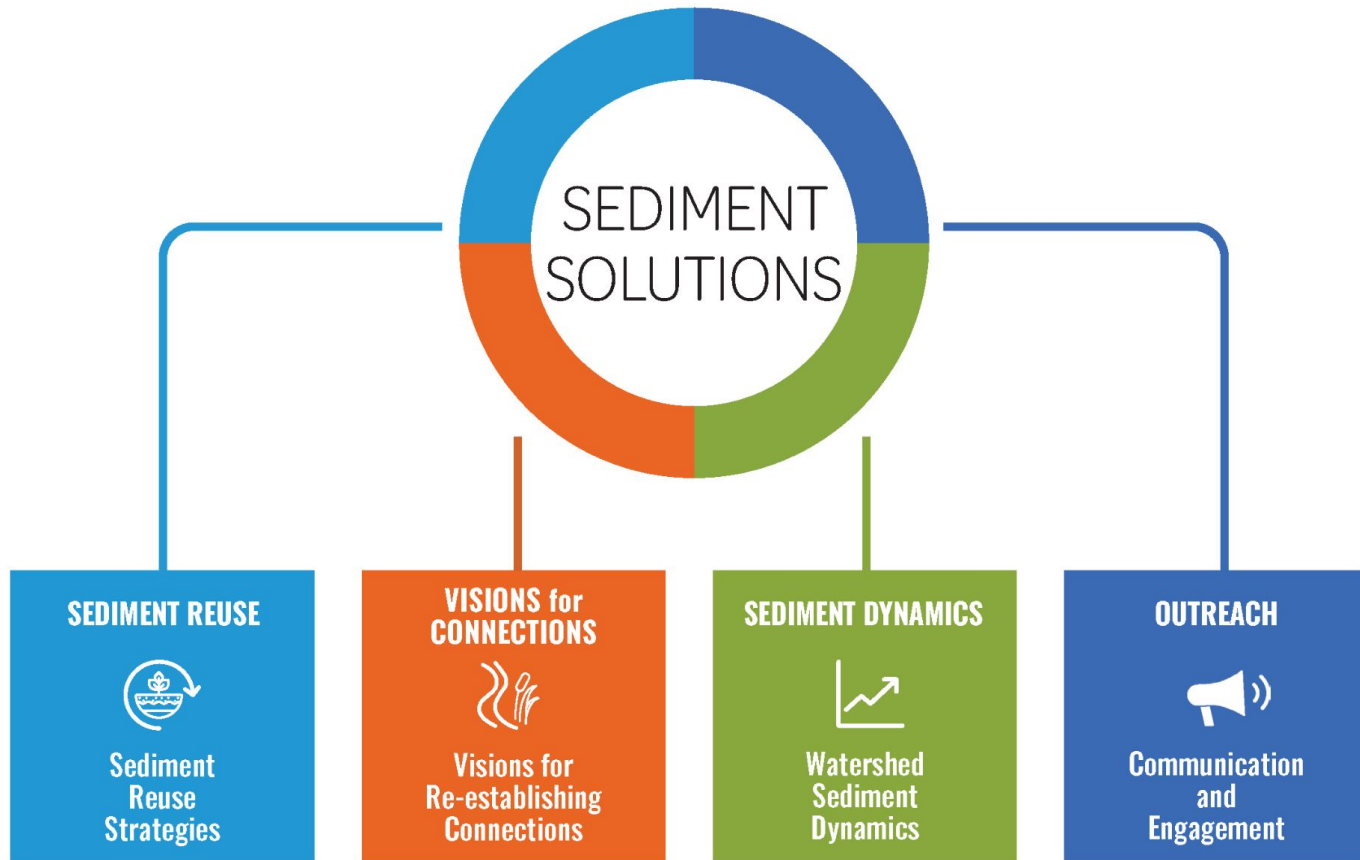
ESTUARY PARTNERSHIP

Flood Control & Water Conservation District





Funded by the San Francisco Bay Regional Water Quality Improvement Fund, EPA Region IX



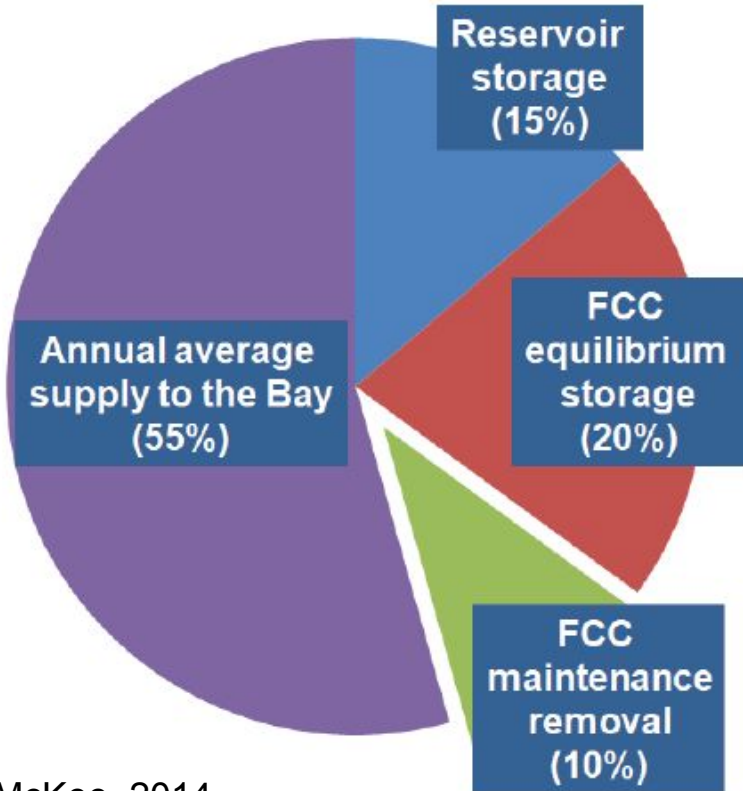
Funded by the San Francisco Bay Regional Water Quality Improvement Fund, EPA Region IX

What is a Sediment Reuse Strategy?

What is a Sediment Reuse Strategy?

A plan that considers existing barriers, challenges, and potential opportunities to beneficial sediment reuse to develop specific and coordinated actions that increase the amount of sediment available to meet local/regional watershed and bayland goals.

Why is a strategy needed?



- Baylands need more sediment.
- Dredged sediment is one of the management actions to help us reach healthy and resilient watersheds and baylands.
- The natural supply of sediment has been disrupted.
- What actions can we take to unlock this sediment?

Why is a strategy needed?



From 2000-2013, 1.7 Million Cubic Yards of sediment was removed from Bay Area flood control channels.

However, >60% of that sediment was disposed of as “waste” (SFEI-ASC, 2017).

One of the key recommendations of the Science Update to the Baylands Goals (Goals Project, 2015), was to recognize that the severe sediment deficit for the Bay means that all sediment should be considered a resource for the public good rather than a waste product.

1. Watershed Sediment Reuse Strategies & Pilot Projects



Sonoma Water
Service Area

Project Partners

City of Petaluma
Sonoma Water
SFEP
Valley Water

Valley Water
Service Area

Main Elements

Identifying new approaches for increasing beneficial reuse of flood control channel sediment

- Bayland restoration/shoreline adaptation
- Watershed channel restoration

Workshops to discuss beneficial reuse challenges and opportunities

1. Watershed Sediment Reuse Strategies & Pilot Projects

Towards a Coarse Sediment Strategy for the Bay Area

MARCH 2021



PREPARED BY
San Francisco Estuary Institute



IN PARTNERSHIP WITH
Alameda County Flood Control and
Water Conservation District, Zone 7

SFEI
SAN FRANCISCO
ESTUARY INSTITUTE



FUNDED BY
San Francisco Bay Water Quality
Improvement Fund, EPA Region IX

A PRODUCT OF PREPARING FOR THE STORM

Strategies will build upon previous efforts

EPA-funded “Towards a Coarse Sediment Strategy for the Bay Area” report

- Focus upon increasing the beneficial reuse of watershed sediment for restoration efforts
- Highlighted regional barriers and challenges
- Offered regional incentives and solutions

1. Watershed Sediment Reuse Strategies & Pilot Projects



Sonoma Water
Service Area

Valley Water
Service Area

Project Partners
City of Petaluma
Sonoma Water
SFEP
Valley Water

Main Outputs

Watershed Sediment Reuse Strategies

Beneficial Reuse Pilot Project Support

Timeline

Sonoma Water area: Summer 2023 - Winter 2025

Valley Water area: Winter 2025 - Spring 2026

1. Watershed Sediment Reuse Strategies & Pilot Projects



Coordinated Effort



1. Watershed Sediment Reuse Strategies & Pilot Projects



Sonoma Water
Service Area

Project Partners
City of Petaluma
Sonoma Water
SFEP
Valley Water

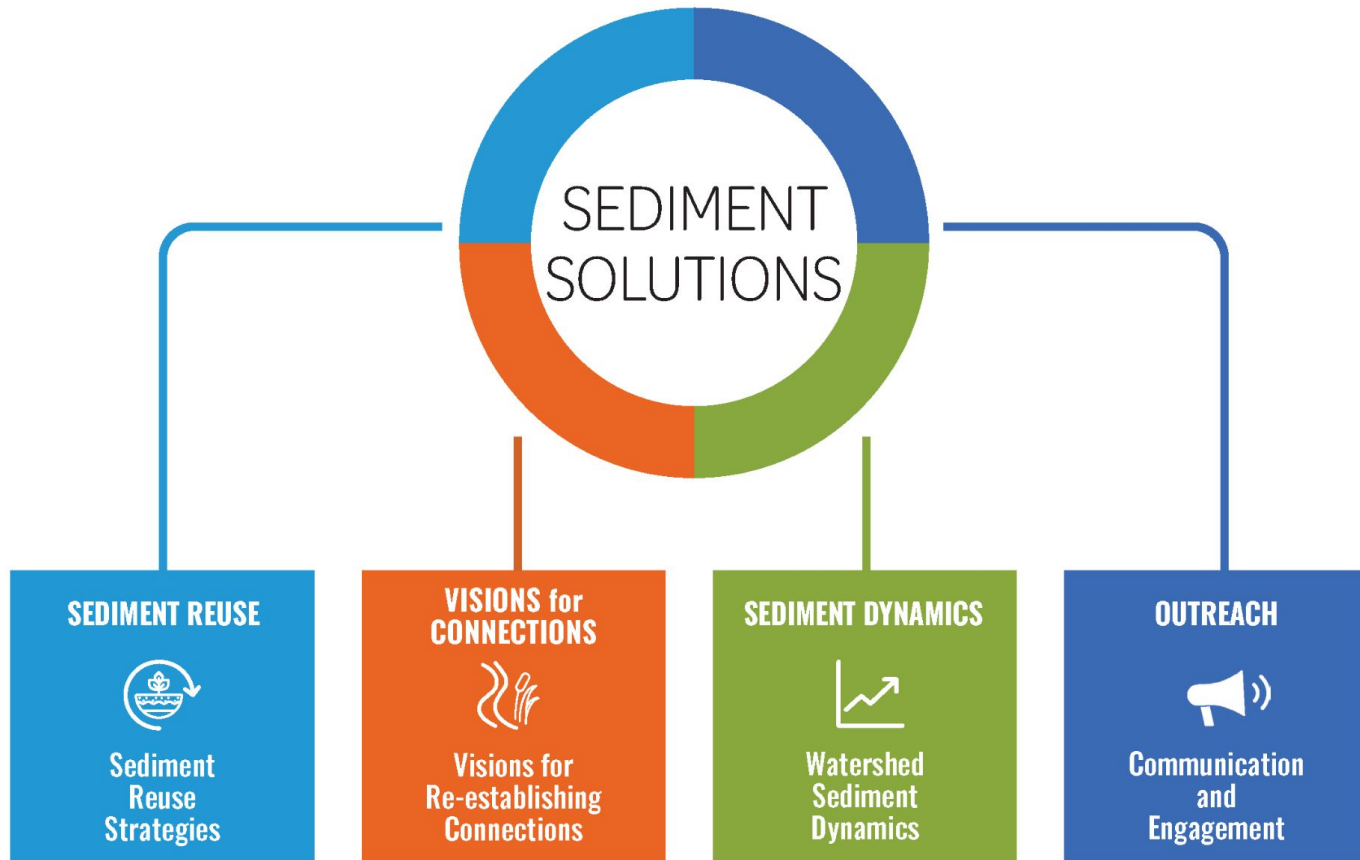
Valley Water
Service Area

Focus in 2024

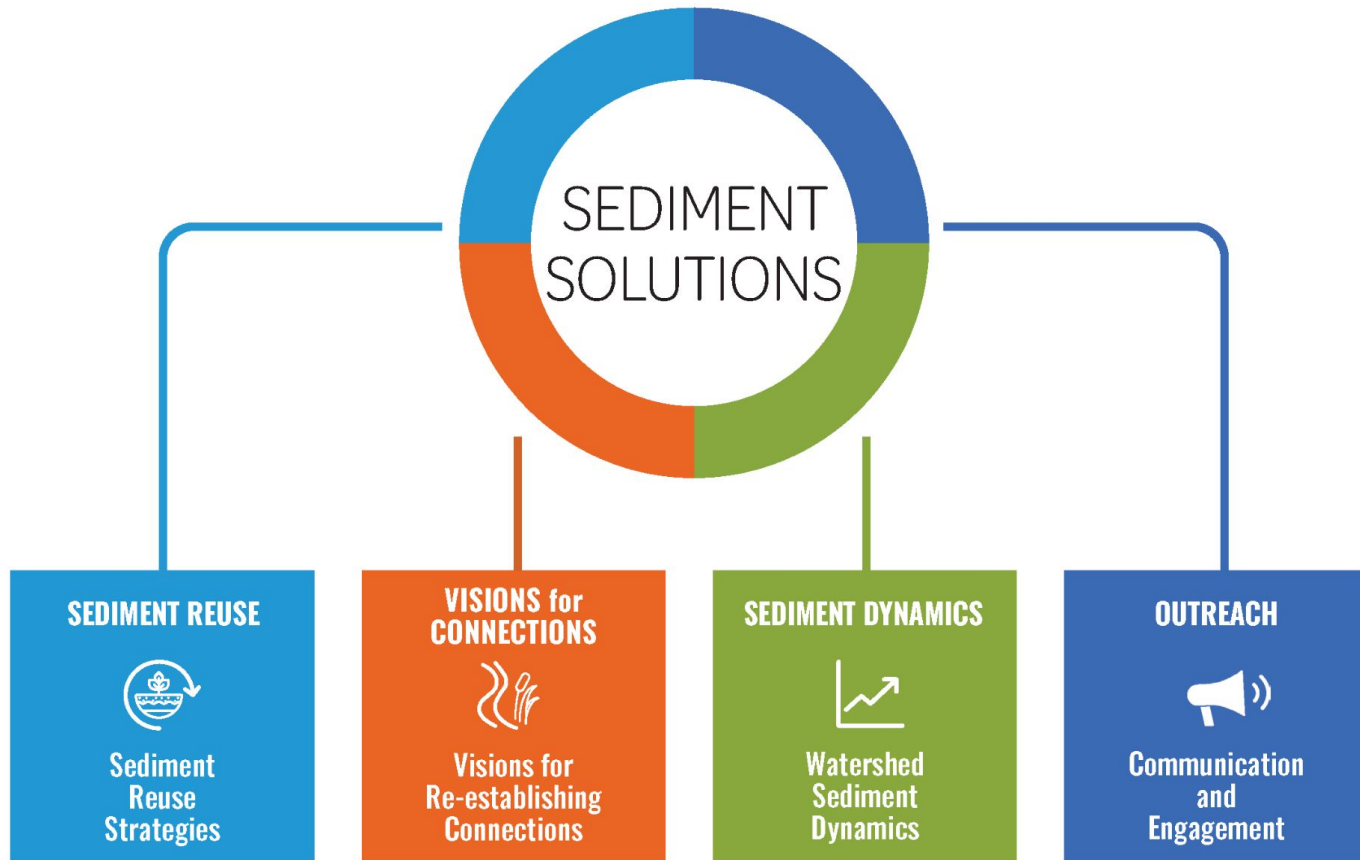
Working with partners to identify reuse opportunities and constraints in Sonoma Water service area

- First workshop in late April (SFEP)
- Goal: Define place-based constraints and explore specific potential opportunities
- Structure: In-person, collaborative, brainstorming, thought exercises

Developing draft Sonoma Water Watershed Reuse Strategy



Funded by the San Francisco Bay Regional Water Quality Improvement Fund, EPA Region IX



Funded by the San Francisco Bay Regional Water Quality Improvement Fund, EPA Region IX

What is a Resilient Landscape Vision?

What is a Resilient Landscape Vision?

A multibenefit design solution that reintegrates natural processes between creeks and baylands while prioritizing ecosystem services that benefit nearby communities and support plants and wildlife

2. Visions for Re-establishing Creek-Marsh Connections

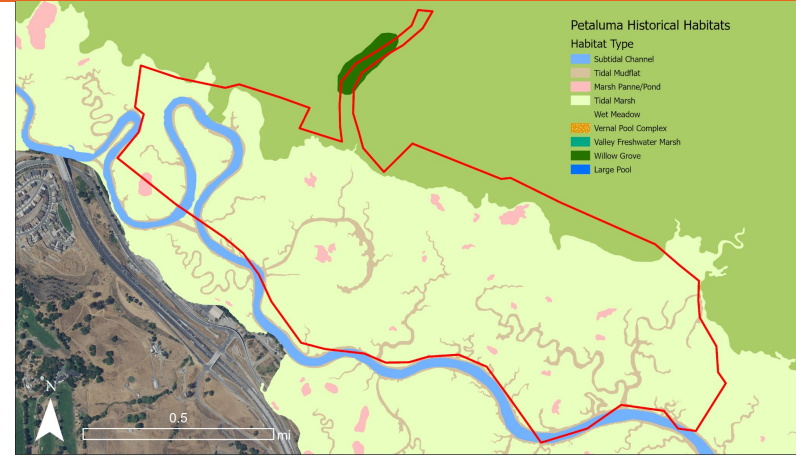


Lower Adobe Creek Petaluma River Watershed



Lower Adobe Creek, Petaluma River Watershed

- Land conversion and channel modification → Losses in riparian habitat, reductions in water quality, sedimentation issues/increased flooding



Lower Adobe Creek, Petaluma River Watershed

- Land conversion and channel modification → Losses in riparian habitat, reductions in water quality, sedimentation issues/increased flooding
- Steelhead stream → important North Bay wildlife corridor



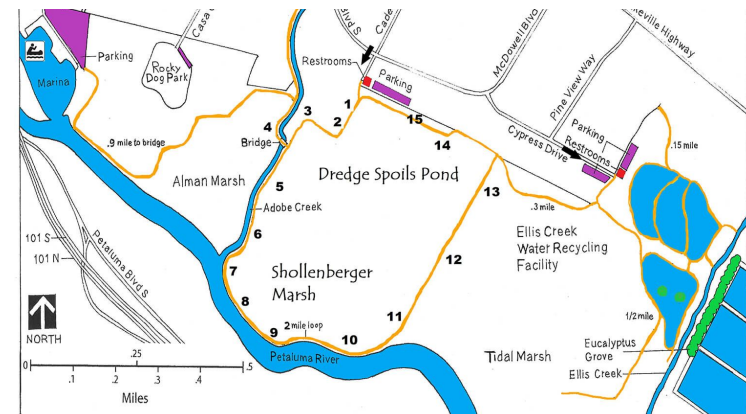
Lower Adobe Creek, Petaluma River Watershed

- Land conversion and channel modification → Losses in riparian habitat, reductions in water quality, sedimentation issues/increased flooding
- Steelhead stream → important North Bay wildlife corridor
- Flows past diked baylands before draining into the Petaluma River



Lower Adobe Creek, Petaluma River Watershed

- Land conversion and channel modification → Losses in riparian habitat, reductions in water quality, sedimentation issues/increased flooding
- Steelhead stream → important North Bay wildlife corridor
- Flows past diked baylands before draining into the Petaluma River
- Sediment staging at Shollenberger Park from dredging on Petaluma River
 - Sediment surplus → reuse strategy

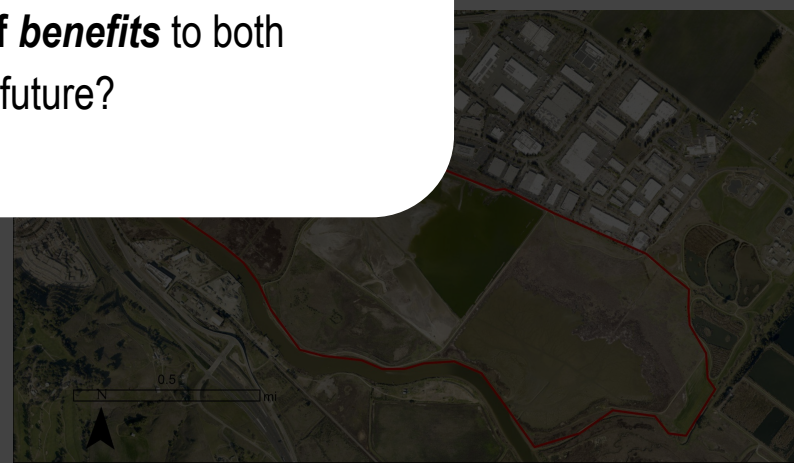
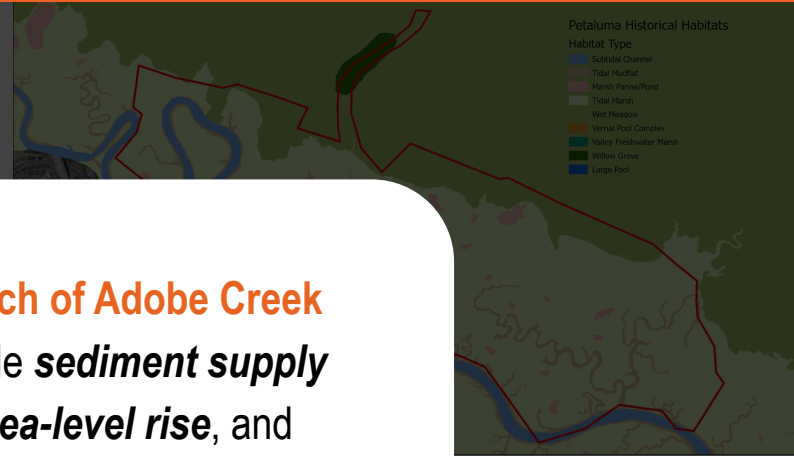


Source: Petaluma Wetlands Alliance

Lower Adobe Creek, Petaluma River Watershed

- Land conversion and channel modification → Losses in riparian habitat, reductions in water quality, sediment
- Steelhead corridor
- Flows p
Petalum
- Sedime
dredging
 - Sediment surplus → reuse strategy

Can we **redesign the downstream reach of Adobe Creek** to flow directly onto tidal marsh to provide **sediment supply** the marsh needs to **keep pace with sea-level rise**, and **continue to provide a wide range of benefits** to both people and wildlife into the future?



Project partners



Lower Adobe Creek Petaluma River Watershed



Main Elements



Main Elements

Assessment of landscape functioning

- Past → Present → Future w/ climate change

Vision process



Main Elements

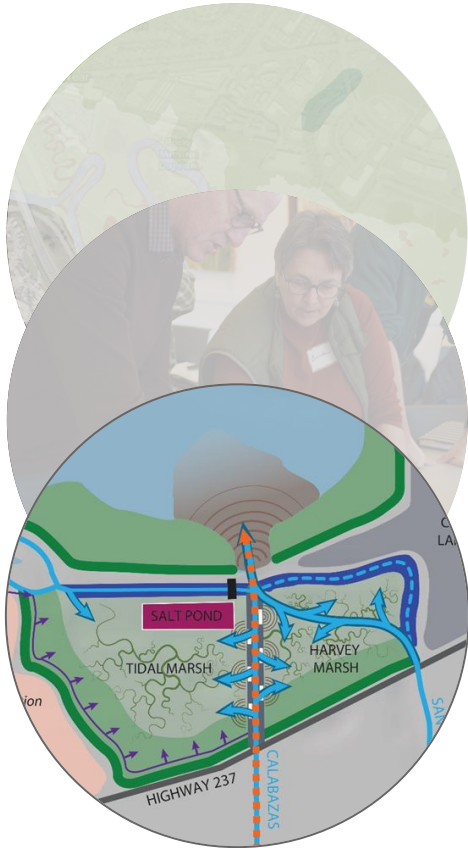
Assessment of landscape functioning

- Past → Present → Future w/ climate change

Technical workshops & community meetings

- Identify opps, constraints, and restoration concepts
- Get input from community and tribal reps

Vision process



Main Elements

Assessment of landscape functioning

- Past → Present → Future w/ climate change

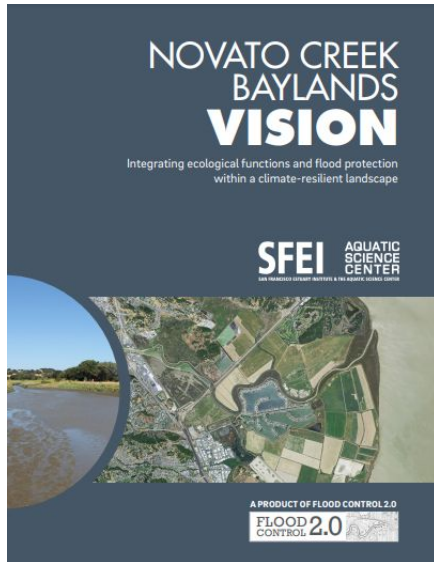
Technical workshops & community meetings

- Identify opps, constraints, and restoration concepts
- Get input from community and tribal reps

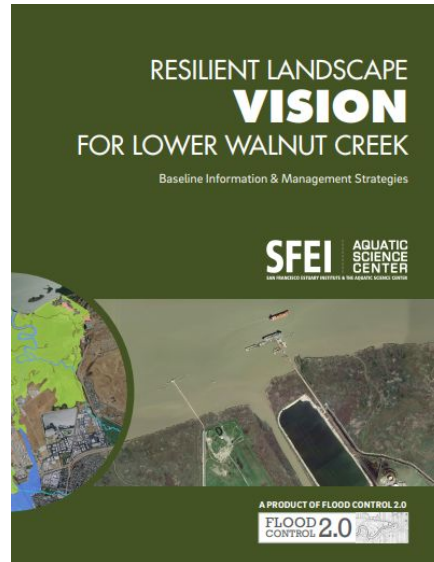
Develop restoration vision and assess benefits

SFEI's Resilient Landscape Vision portfolio

Novato Creek
(2015)



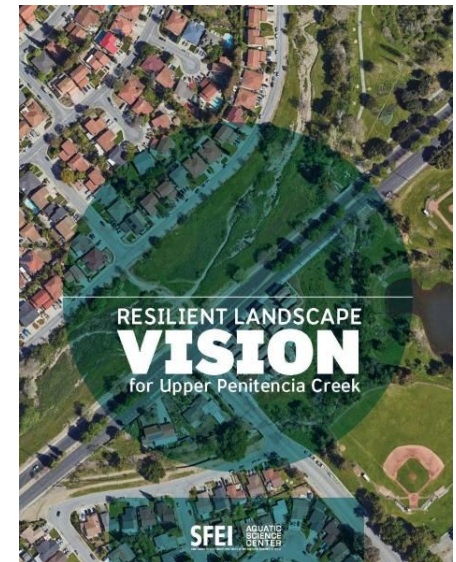
Walnut Creek
(2016)



Calabazas & San
Tomas Aquino
creeks (2018)



Upper
Penitencia
Creek (2018)



Outputs & timeline



Project Partners

City of Petaluma
Friends of the Petaluma River
Sonoma Water
SFBRWQCB
SFEP
Sonoma RCD
WRMP

Main Outputs

- Cultural Resource Assessment
- Restoration Vision Report

Outputs & timeline



Lower Adobe Creek

Project Partners

City of Petaluma
Friends of the Petaluma River
Sonoma Water
SFBRWQCB
SFEP
Sonoma RCD
WRMP

Main Outputs

- Cultural Resource Assessment
- Restoration Vision Report

Timeline for developing restoration concepts for Lower Adobe Creek

Overall timeline: *Fall 2023 - Winter 2025*

- **Community meeting #1** - Feb 28, 2024
- **Vision workshop** - May/June 2024
- **Community meeting #2** - August/Sept 2024

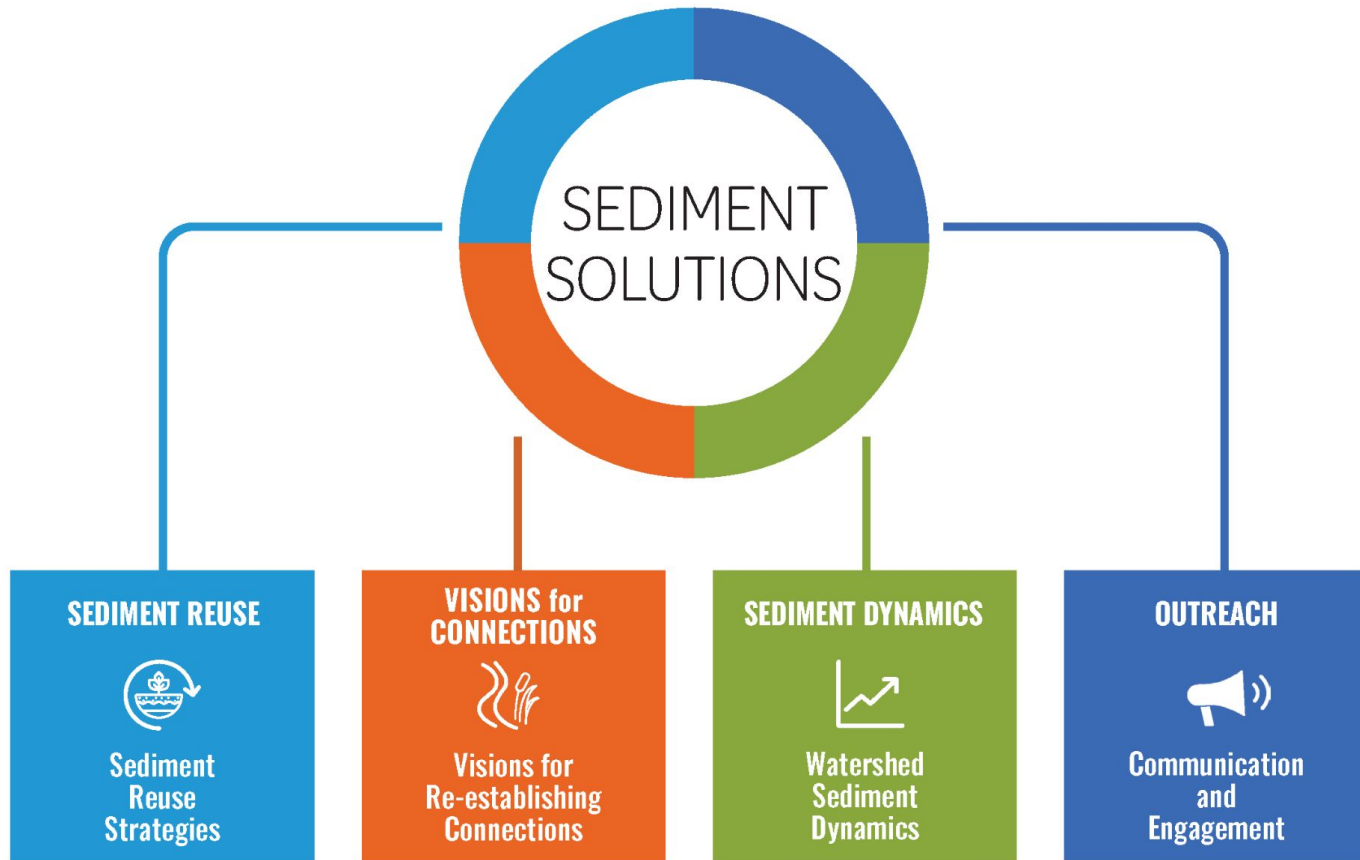
Upcoming community meeting

- Led by Friends of the Petaluma River, in collaboration with SFEI
- Open meeting (project partners, community members, local organizations and any other interested parties can participate)
- Chance to hear community priorities: **what do you want to see prioritized in the Resilient Landscape Vision for Lower Adobe Creek?** (e.g., recreational, cultural, economic, environmental priorities)
- Tentative meeting structure:
 - Brief presentations introducing the project/goals
 - Mingling with partners (e.g. tabling) and enjoying food
 - Vision exercise (e.g. storytelling, drawing, post-it notes)

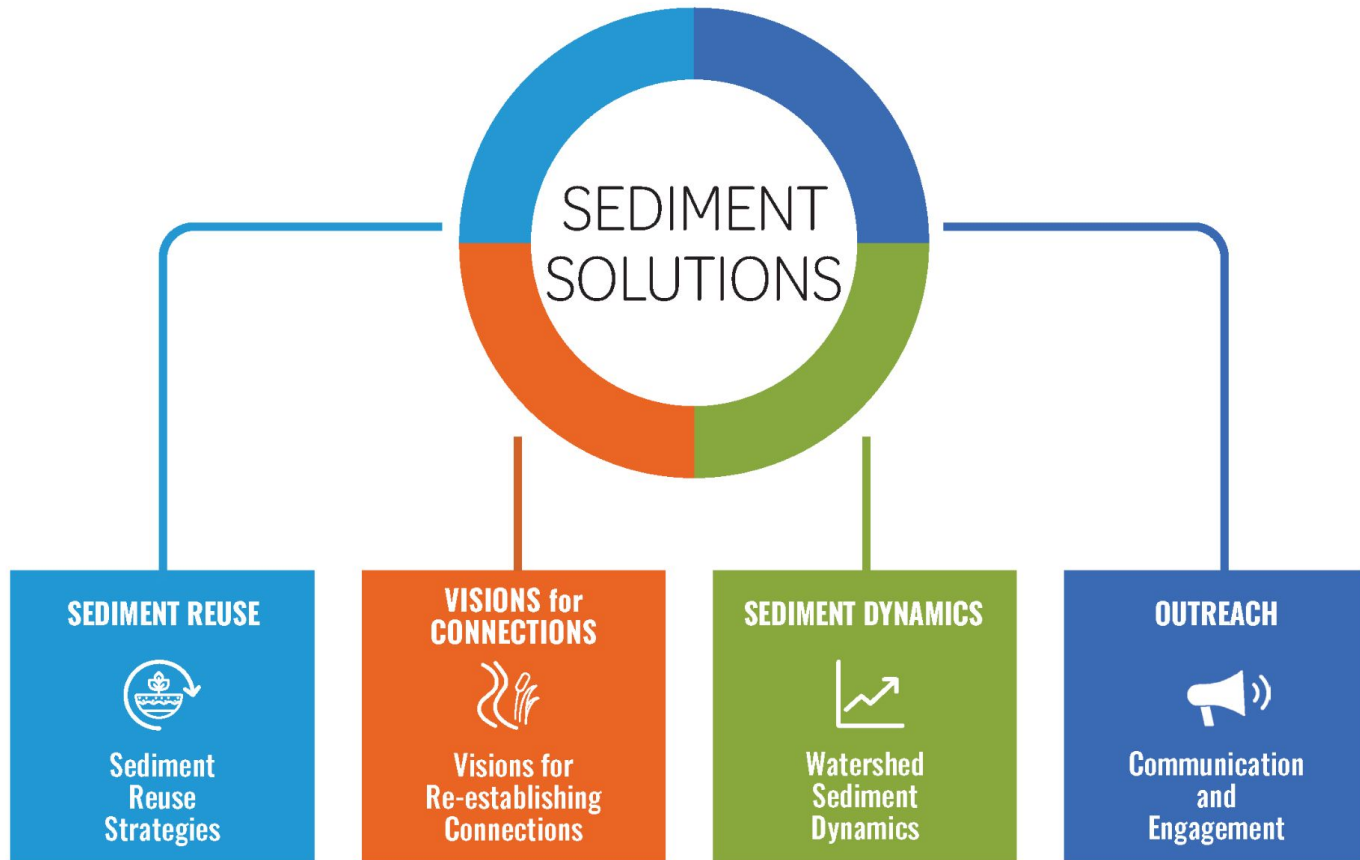
Save the Date:
Feb 28th
*(5:30pm-7:30pm,
details TBD)*



Synthesize and
present ideas at
Vision Workshop



Funded by the San Francisco Bay Regional Water Quality Improvement Fund, EPA Region IX



Funded by the San Francisco Bay Regional Water Quality Improvement Fund, EPA Region IX

3. Current & Future Riparian Conditions & Sediment Dynamics



Project Partners

Bay RMP
City of Petaluma
SFBRWQCB
SFEP
Sonoma RCD
Sonoma Water
Valley Water

Research/Management Questions

- How much watershed sediment currently reaches the Bay and where are the erosion “hotspots”?
- What are the current channel and riparian conditions, functions, and their drivers?
- How will climate change impact watershed erosion, sediment delivery, and riparian conditions?
- What watershed management actions could support bayland sediment supply AND watershed ecosystem health?

3. Current & Future Riparian Conditions & Sediment Dynamics



Project Partners

Bay RMP
City of Petaluma
SFBRWQCB
SFEP
Sonoma RCD
Sonoma Water
Valley Water

Watershed Sediment Dynamics Assessment

Field-based sediment source assessments

Modeling climate change impacts to flow, erosion, and sediment transport

Modeling of management/restoration scenarios to assess impacts to flow, erosion, and sediment transport

Developing management recommendations for supporting flow/sediment transport that benefits watershed AND baylands ecosystems

3. Current & Future Riparian Conditions & Sediment Dynamics



Project Partners

Bay RMP
City of Petaluma
SFBRWQCB
SFEP
Sonoma RCD
Sonoma Water
Valley Water

Petaluma Watershed Riparian Assessment

- Current riparian characteristics, functions, and drivers
- Climate change impacts
- Management recommendations for promoting riparian ecosystem resilience

Existing conditions assessment recently completed!

3. Current & Future Riparian Conditions & Sediment Dynamics



Project Partners

Bay RMP
City of Petaluma
SFBRWQCB
SFEP
Sonoma RCD
Sonoma Water
Valley Water

Main Outputs

- Current and future sediment supply maps
- Riparian memos
- Sediment and riparian synthesis report

Timeline

Petaluma River: Summer 2023 - Fall 2025

3. Current & Future Riparian Conditions & Sediment Dynamics



Project Partners

Bay RMP
City of Petaluma
SFBRWQCB
SFEP
Sonoma RCD
Sonoma Water
Valley Water

Focus in 2024

Receiving Petaluma River watershed Stakeholder input

- Seeking your input today!

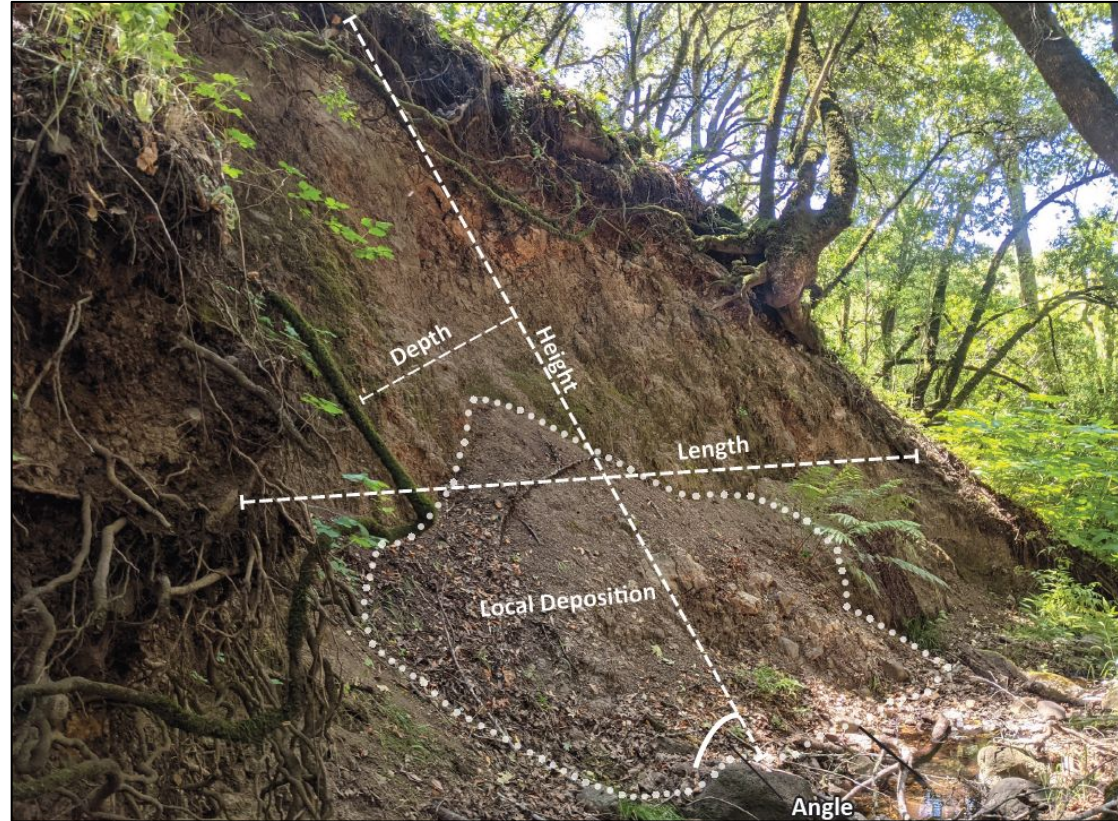
Completing Petaluma River sediment source assessment

Assessing climate change impacts to flow, erosion, sediment dynamics, and riparian conditions

3. Current & Future Riparian Conditions & Sediment Dynamics

Petaluma Watershed Sediment Source Assessment

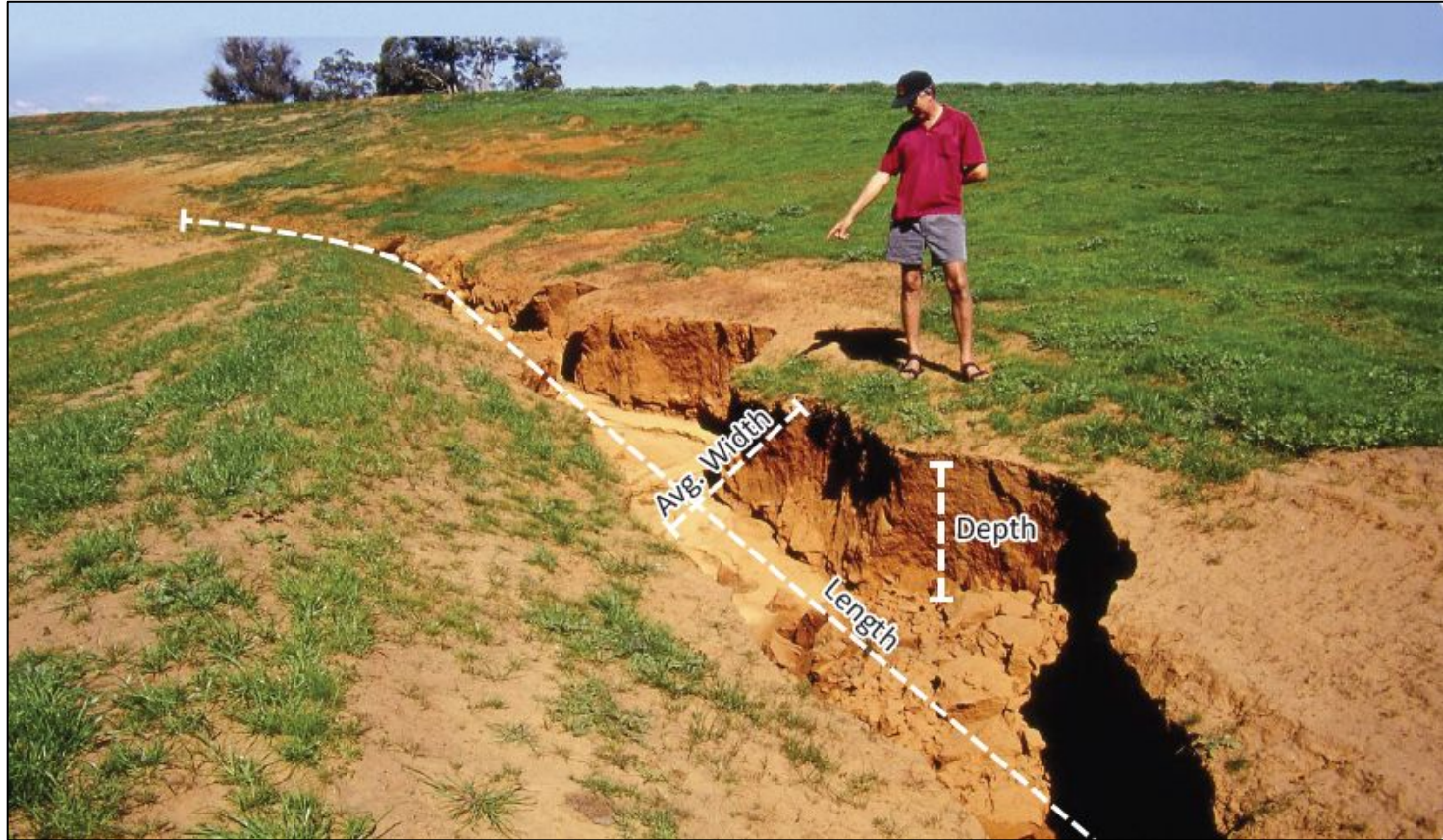
- Our sediment source assessment is field-based.
- We measured every erosion feature along channels with access
- Sonoma RCD assisted with land access and discussions with landowners



3. Current & Future Riparian Conditions & Sediment Dynamics



3. Current & Future Riparian Conditions & Sediment Dynamics



3. Current & Future Riparian Conditions & Sediment Dynamics



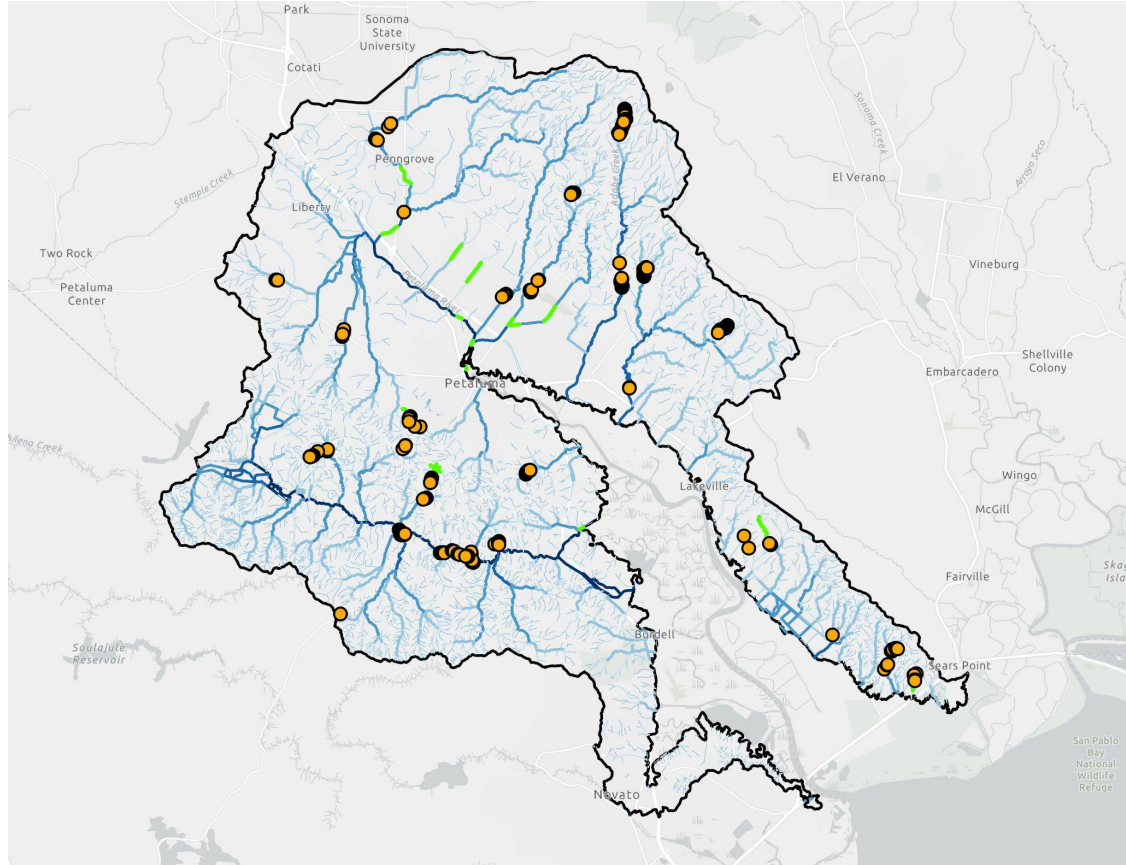
3. Current & Future Riparian Conditions & Sediment Dynamics



3. Current & Future Riparian Conditions & Sediment Dynamics

Petaluma Watershed Sediment Source Assessment

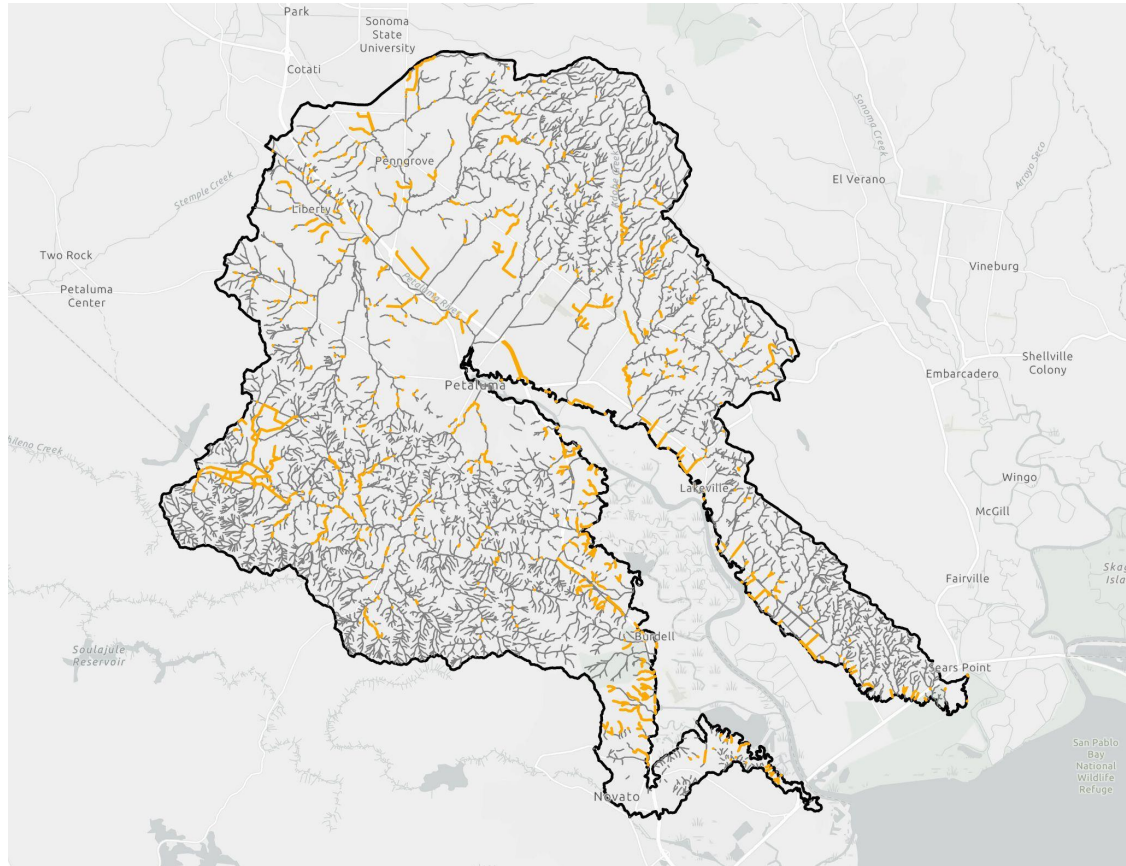
- 11 days of surveys
- Walked 11 of 826 total stream miles (1.3%)
- 356 erosion points



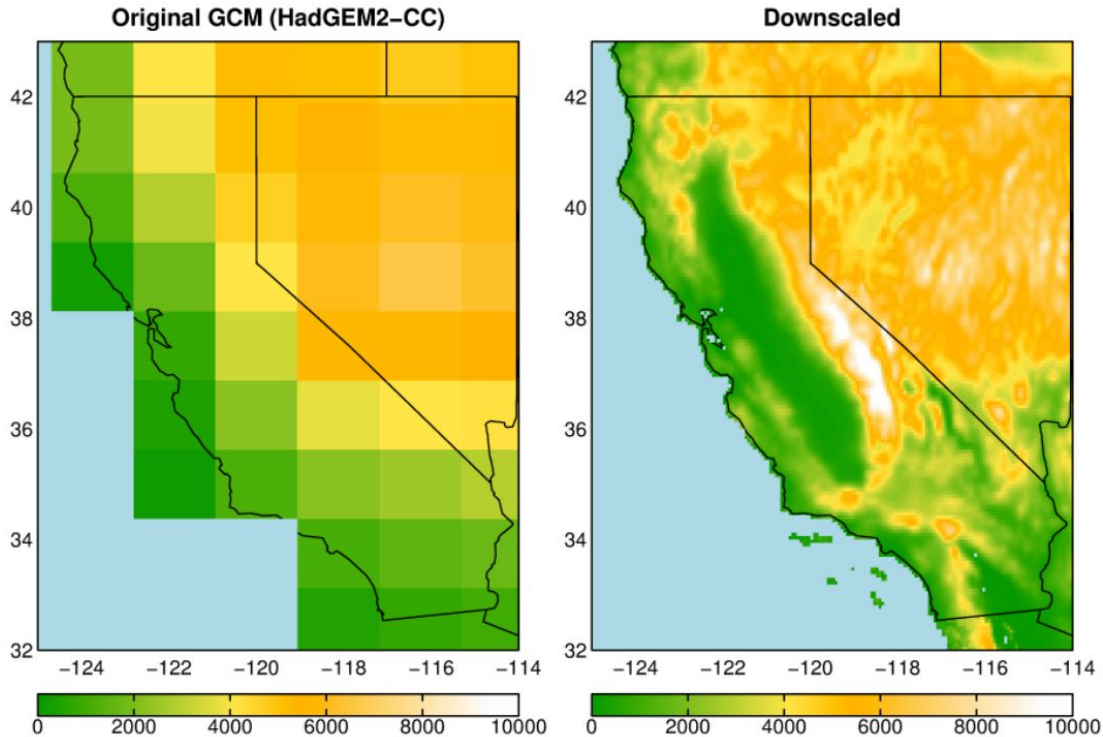
3. Current & Future Riparian Conditions & Sediment Dynamics

What's Next: Sediment Source Assessment

- Extrapolation of erosion rates
- Geomorphic Landscape Unit (GLU) Approach
 - Strahler stream order
 - 1, 2, 3, 4, 5+
 - Geology
 - Metamorphic
 - Sedimentary
 - Volcanic
 - Unconsolidated
 - Land Cover
 - Cultivated
 - Developed
 - Forest & Chaparral
 - Grassland



3. Current & Future Riparian Conditions & Sediment Dynamics



Future work: sediment dynamics with climate change

- Retrieve downscaled climate models
- Implement flow and sediment model for watershed
- Evaluate how flow and sediment may change over time

3. Current & Future Riparian Conditions & Sediment Dynamics



Petaluma Watershed Riparian Condition Assessment

- Description of watershed geomorphic setting and landscape characteristics
- Description of key drivers of channel and riparian characteristics and functions
- Description of channel and riparian hydrogeomorphic and ecological characteristics
- Synthesis and overall conceptual understanding of dominant controls on current channel and riparian conditions

3. Current & Future Riparian Conditions & Sediment Dynamics



Petaluma Watershed Riparian Condition Assessment

Technical Advisory Committee

Andy Collison - [ESA](#)

Laurel Collins - [Watershed Sciences](#)

Bronwen Stanford - [TNC](#)

Additional Guidance / Funder

Setenay Bozkurt Frucht - [SFBRWQCB](#)

Lisa Hunt - [SFBRWQCB](#)

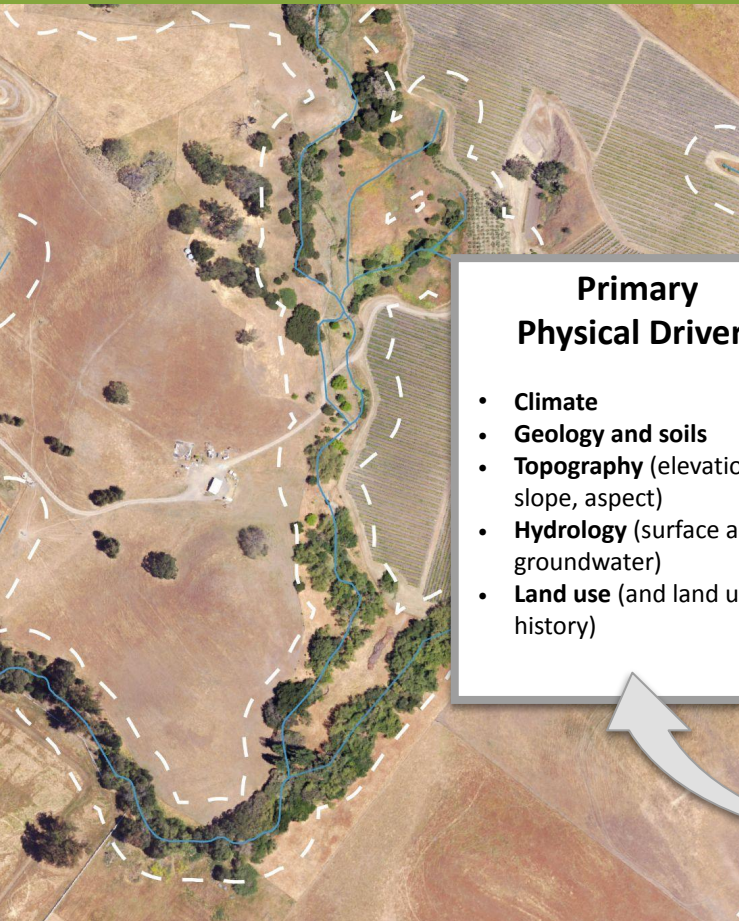
3. Current & Future Riparian Conditions & Sediment Dynamics



Petaluma Watershed Riparian Condition Assessment

- Riparian Zone: 100 feet on either side of streamlines
 - Adapted from NRC
 - Collins et al. 2006
- Simple & captures multiple functions
- Guided by vegetation

3. Current & Future Riparian Conditions & Sediment Dynamics



Petaluma Watershed Riparian Condition Assessment

Primary Physical Drivers

- **Climate**
- **Geology and soils**
- **Topography** (elevation, slope, aspect)
- **Hydrology** (surface and groundwater)
- **Land use** (and land use history)

Channel and Riparian Condition

- **Channel and floodplain morphology**
- **Streamflow patterns** (wet and dry season regime)
- **Sediment transport and deposition**
- **Riparian vegetation** (type, composition, structure, width)

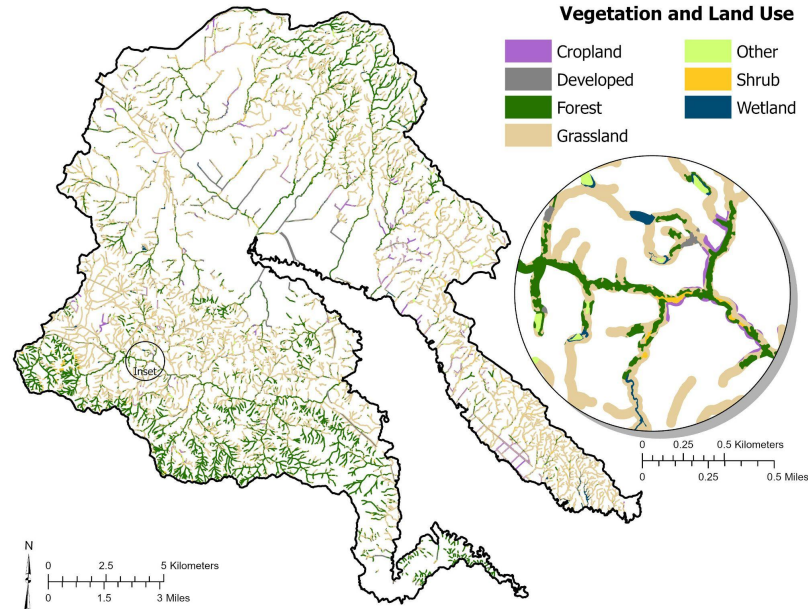
Key Riparian Vegetation Functions

- **Bank stability**
- **Channel shading and thermal refuge**
- **Allochthonous inputs**
- **Runoff filtration**
- **Habitat**

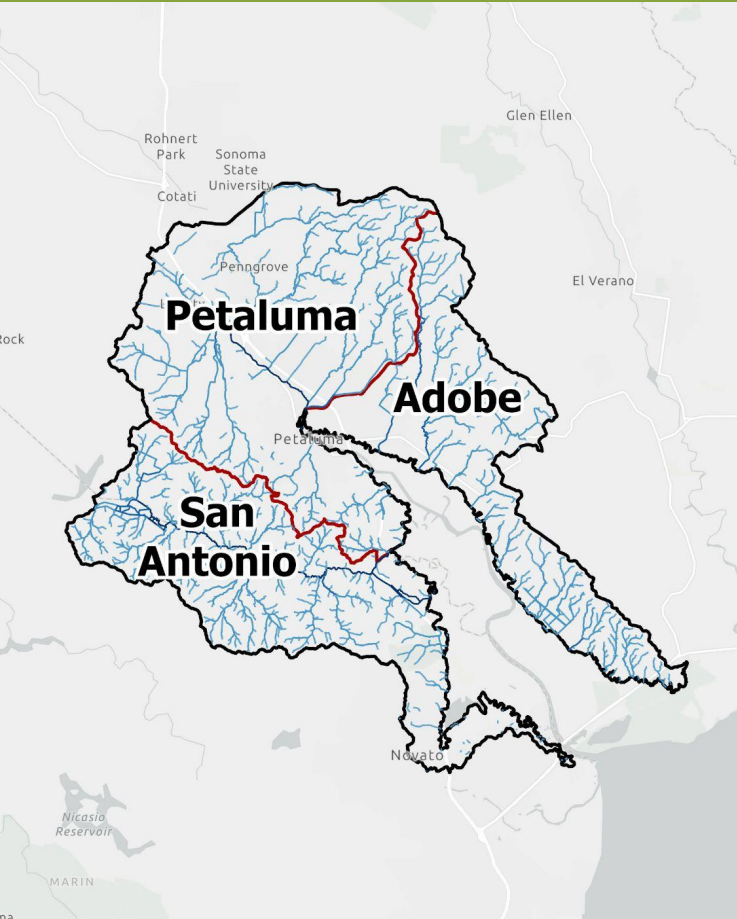
3. Current & Future Riparian Conditions & Sediment Dynamics

Petaluma Watershed Riparian Condition Assessment

- Watershed scale assessment
- Publicly available data
- Scientific literature
- Local studies and reports



3. Current & Future Riparian Conditions & Sediment Dynamics

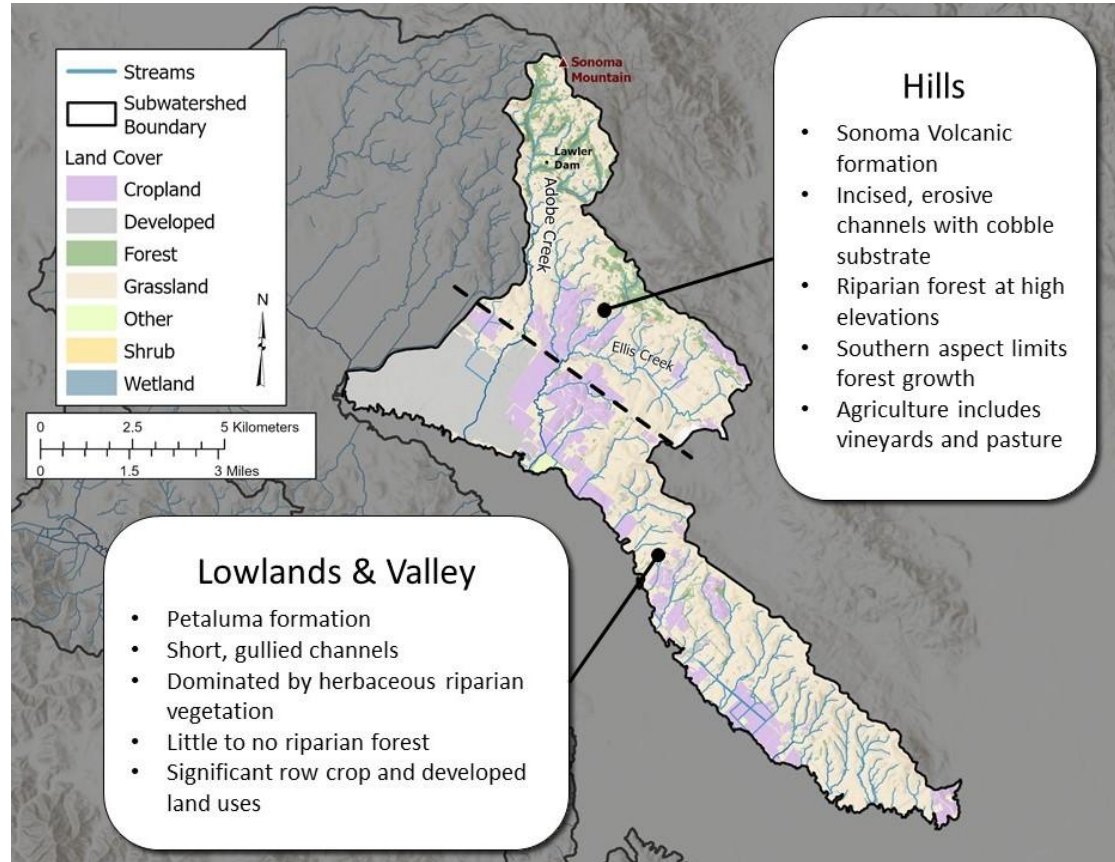


Petaluma Watershed Riparian Condition Assessment

- Subwatershed-scale assessment
- Highlight key drivers
- Discuss condition
- Highlight likely key riparian functions

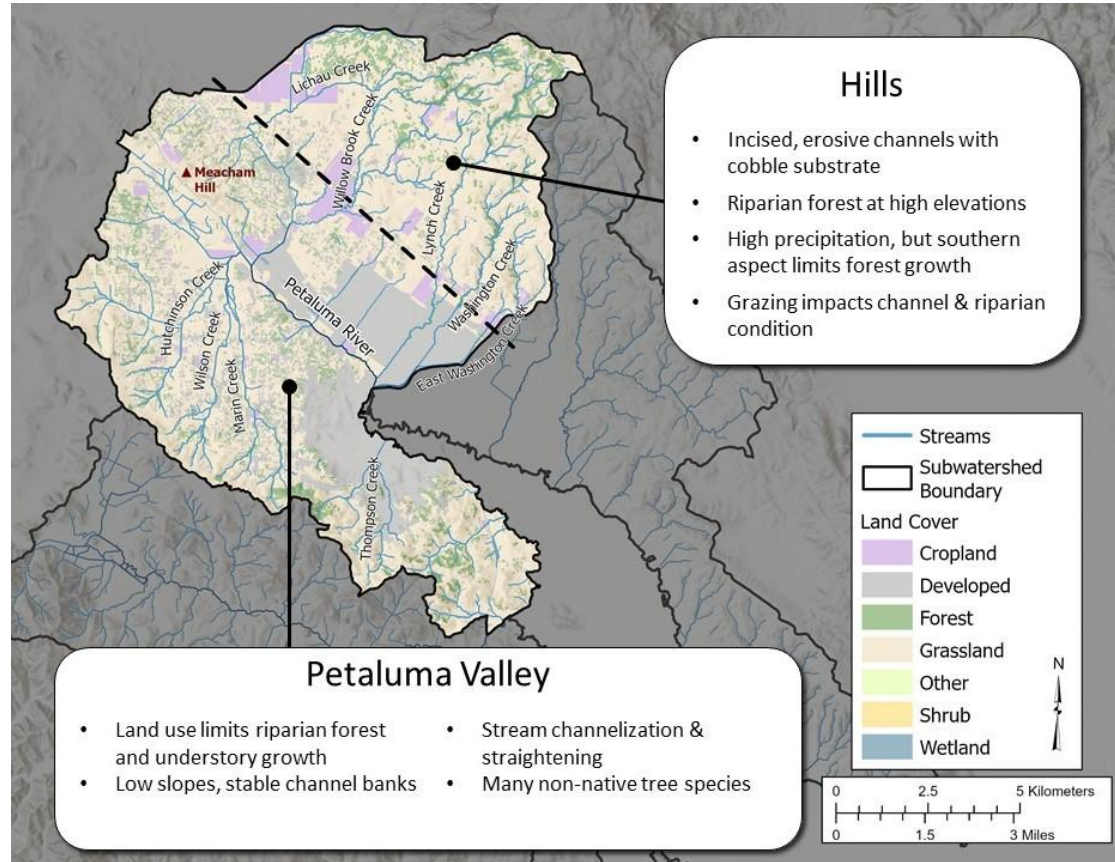
3. Current & Future Riparian Conditions & Sediment Dynamics

Adobe Subwatershed



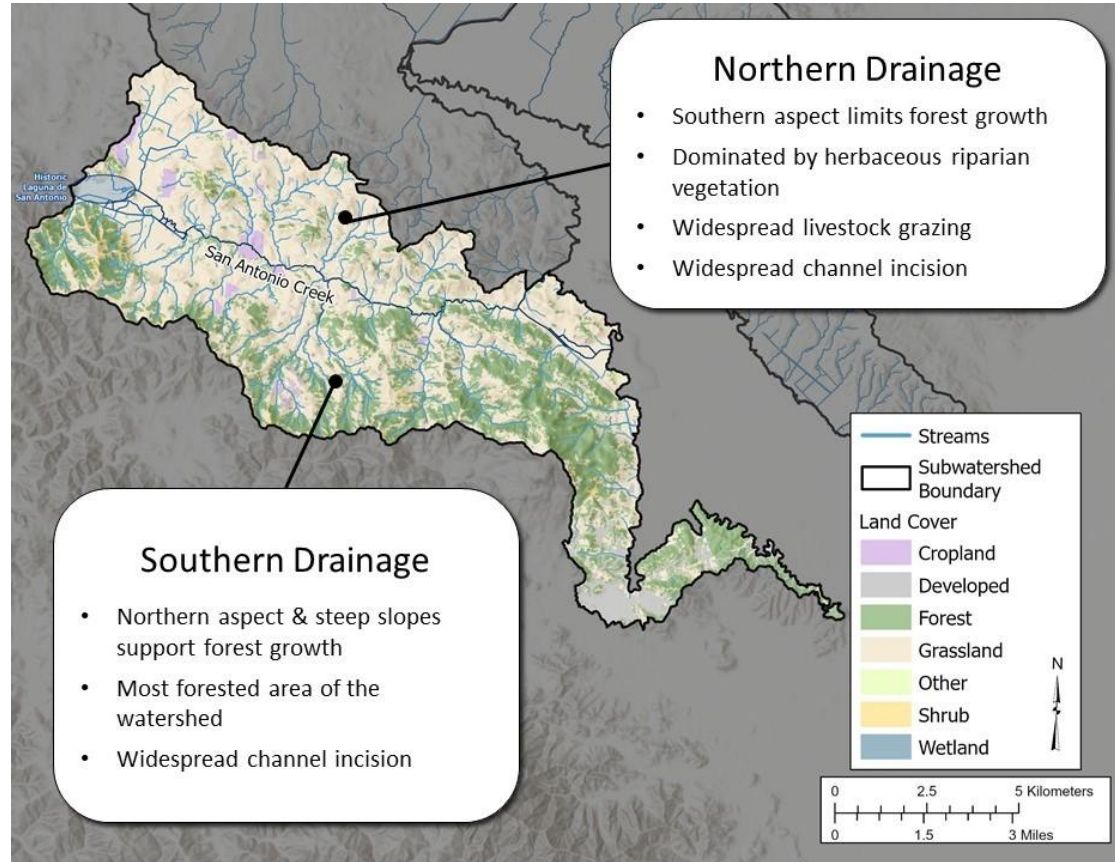
3. Current & Future Riparian Conditions & Sediment Dynamics

Petaluma Subwatershed



3. Current & Future Riparian Conditions & Sediment Dynamics

San Antonio Subwatershed



3. Current & Future Riparian Conditions & Sediment Dynamics

PETALUMA RIVER WATERSHED CONTEMPORARY RIPARIAN CONDITION ASSESSMENT

January 2024

SFEI San Francisco
Estuary Institute

AUTHORS

David Peterson
Sean Baumgarten
Kyle Stark
Lydia Vaughn
Scott Dusterhoff

PREPARED BY
San Francisco Estuary Institute

IN COOPERATION WITH and FUNDED BY
SF Bay Regional Water Quality Control Board

IN PARTNERSHIP WITH
Sonoma Water

SAN FRANCISCO ESTUARY INSTITUTE PUBLICATION #1160

Next Steps - Riparian Condition

- Contemporary condition assessment complete!
- Future climate impacts assessment
 - Focus on expected climate-related stressors to riparian zone
 - Discuss potential management approaches

3. Current & Future Riparian Conditions & Sediment Dynamics



Project Partners

- Bay RMP
- City of Petaluma
- SFBRWQCB
- SFEP
- Sonoma RCD
- Sonoma Water
- Valley Water

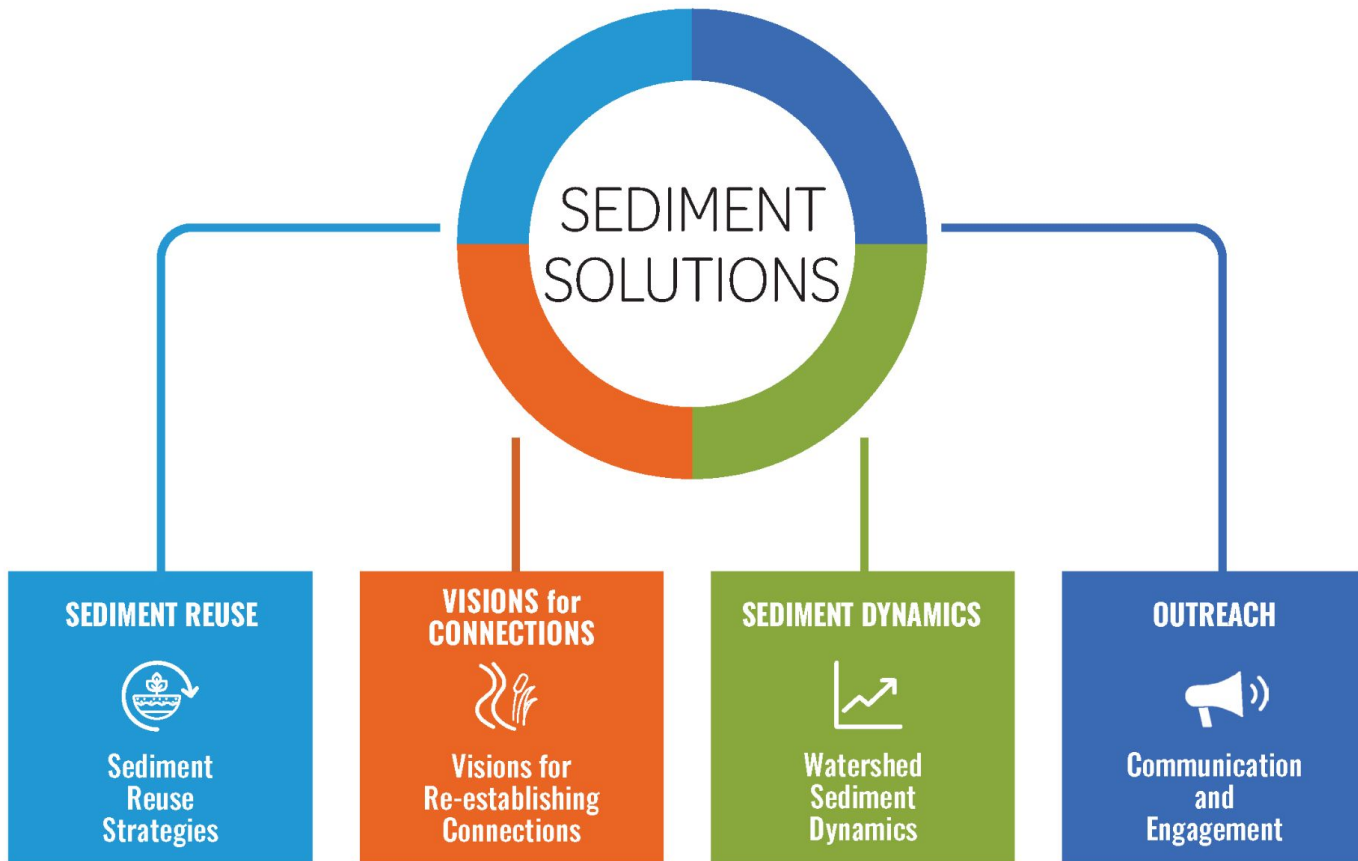
Questions?

3. Current & Future Riparian Conditions & Sediment Dynamics



Polling Questions

1. Are there specific datasets that you know about that we should bring into this project?
2. What are some things that we should consider including in the future riparian analysis?
3. Do you have other ideas about what should be considered for the future sediment analysis and management scenarios?
4. How do you envision using the outcomes of this project?



Funded by the San Francisco Bay Regional Water Quality Improvement Fund, EPA Region IX

Next Steps



Photo by Shira Bezalel

Stakeholder Comment Document - **please add your thoughts!**

Project meetings in 2024

- **Feb** - Lower Adobe Cr Vision Community Mtg 1
- **April** - Sonoma Water Sed Reuse Worksop 1
- **May** - Lower Adobe Cr Vision Workshop
- **Aug** - Lower Adobe Cr Vision Community Mtg 2

Project website: sfei.org/sedimentsolutions

Thank You!

sfei.org/sedimentsolutions

scottd@sfei.org

