A Work in Progress:
Engineering with Nature Initiative at the San Francisco District, USACE

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NAS Natural Infrastructure Workshop
University of Georgia

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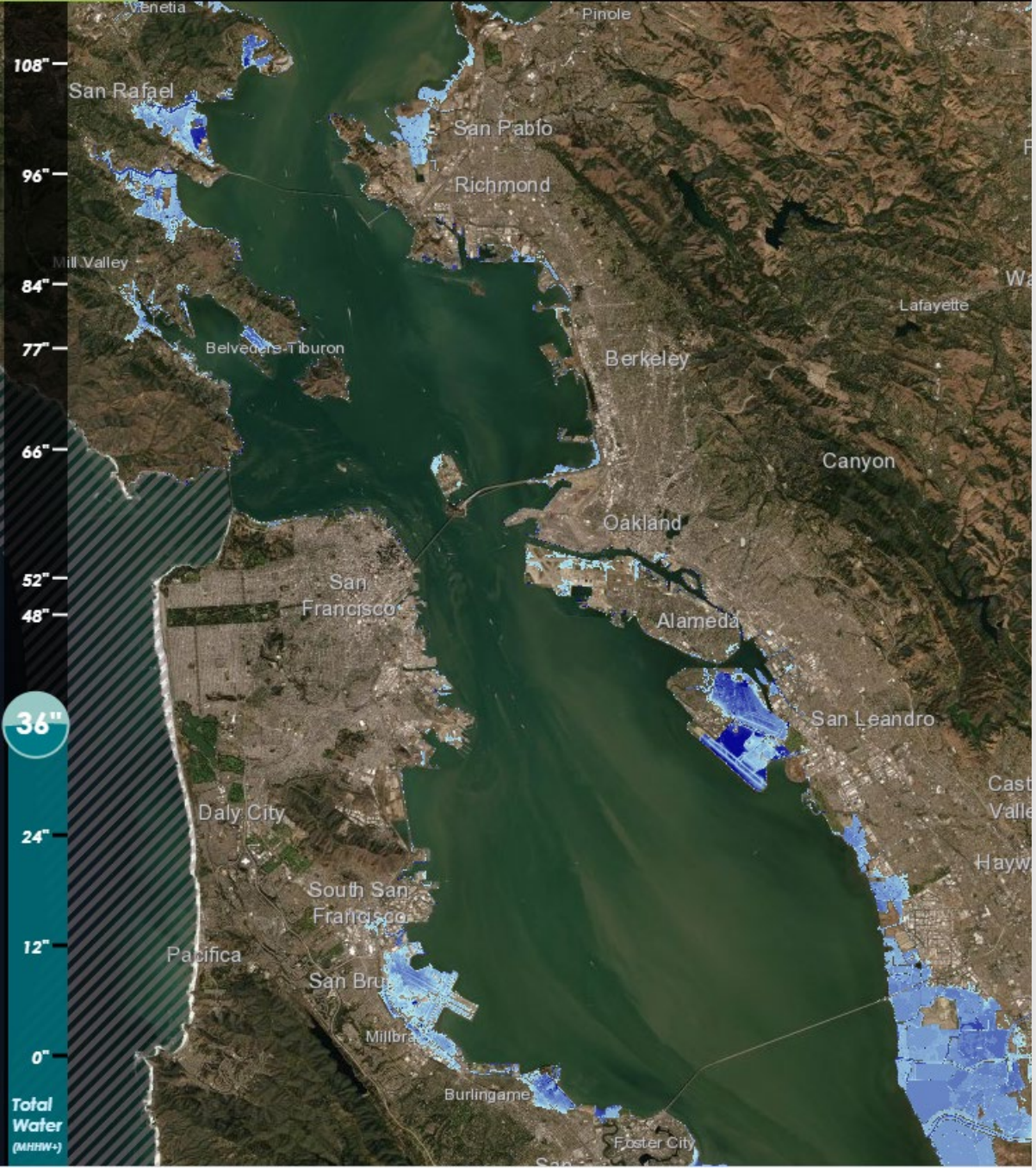
What I hope to convey:

1. Describe the Engineering with Nature (EWN) Initiative at USACE and SF District
2. Describe state of culture change at a large agency
3. EWN “proving ground” progress at SF District to date
4. Ideas for partnerships, collaborations, and new directions

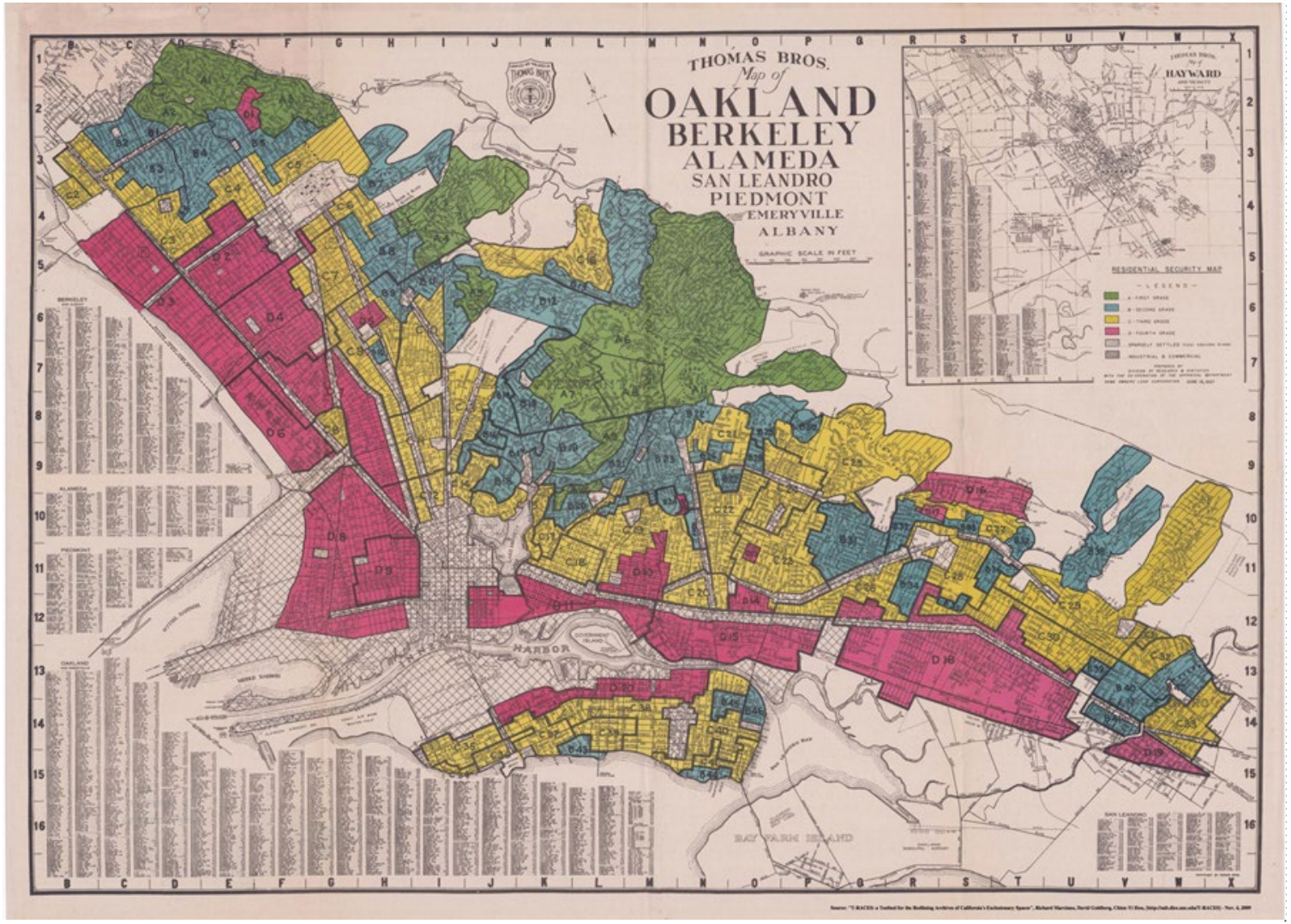

SF Gate
8 Jan 2022



ART Bay Area


King Tides Initiative

ART Bay Area Shoreline Flood Explorer



Redlining in the SF Bay Area forced the **historically marginalized** to live in the lowest lying areas that **flood the most regularly**.

ENGINEERING WITH NATURE (EWN)

An engineering philosophy that uses natural and engineering processes to deliver economic, environmental, and social benefits, including:

- Flood, coastal storm, and erosion risk mitigation
- Ecosystem restoration
- Equitable outcomes for EJ communities
- Recreation
- Climate resilience

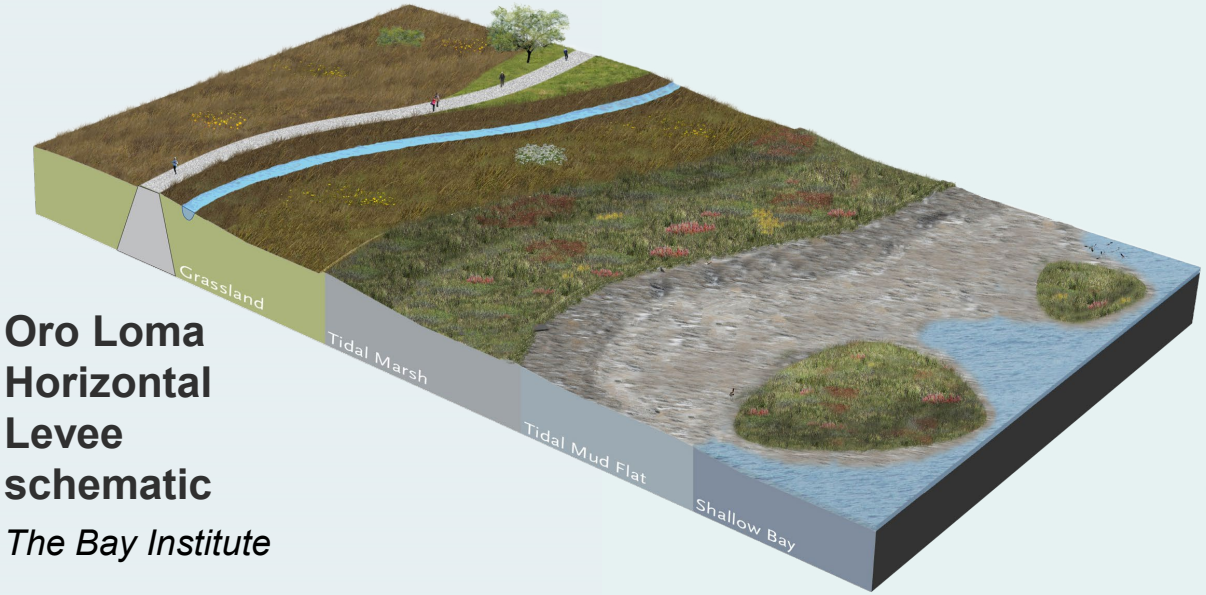
Nature-based solutions referred to as Natural and Nature-based Features (NNBF) in EWN context.

NATURAL AND NATURE-BASED FEATURES

- Use natural physical and biological processes
- Provide multiple benefits
- Can be used in combination with other approaches (green-hybrid-grey, policy)
- Can be cost effective
- Can be more adaptable over time
- Are less well understood by engineers in terms of their performance
- Need to be prioritized to where they match appropriate environmental conditions

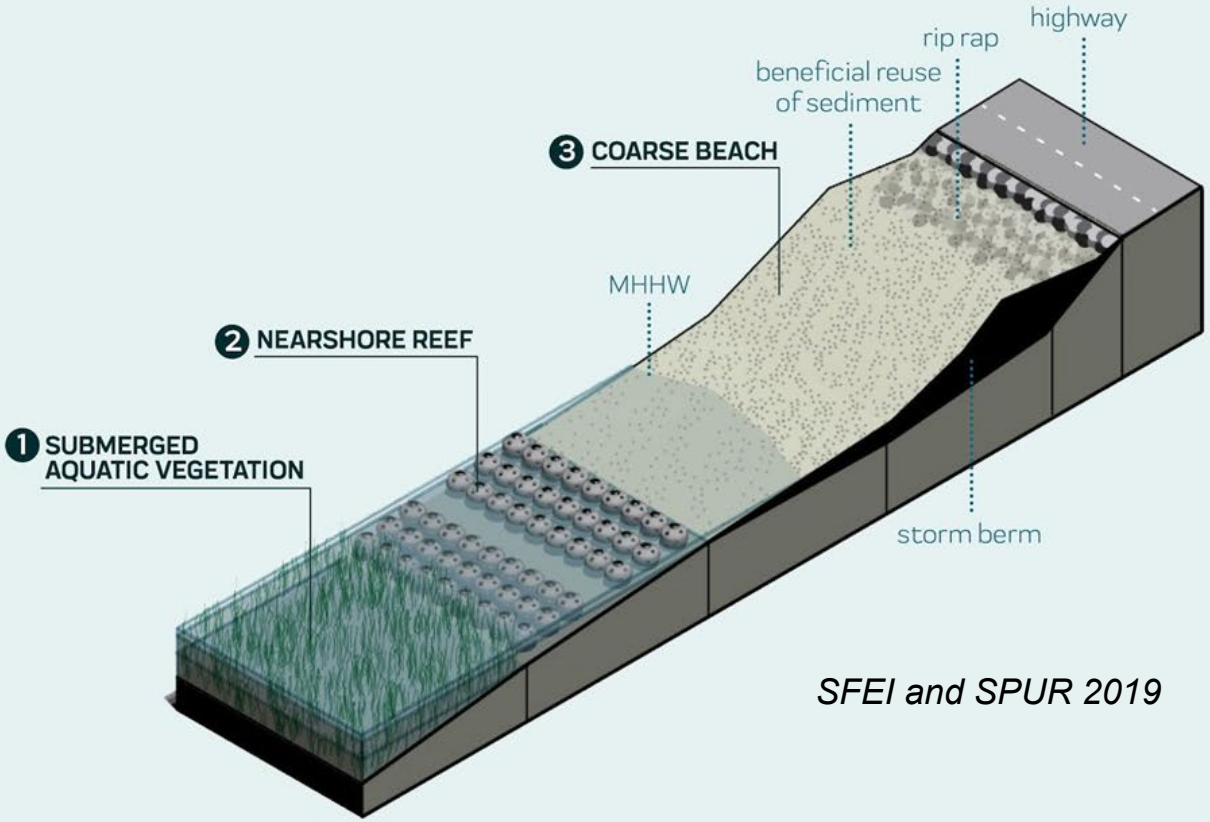
Photo by
Shira Bezalel

Examples appropriate to SF Estuary



Oro Loma Horizontal Levee schematic

The Bay Institute

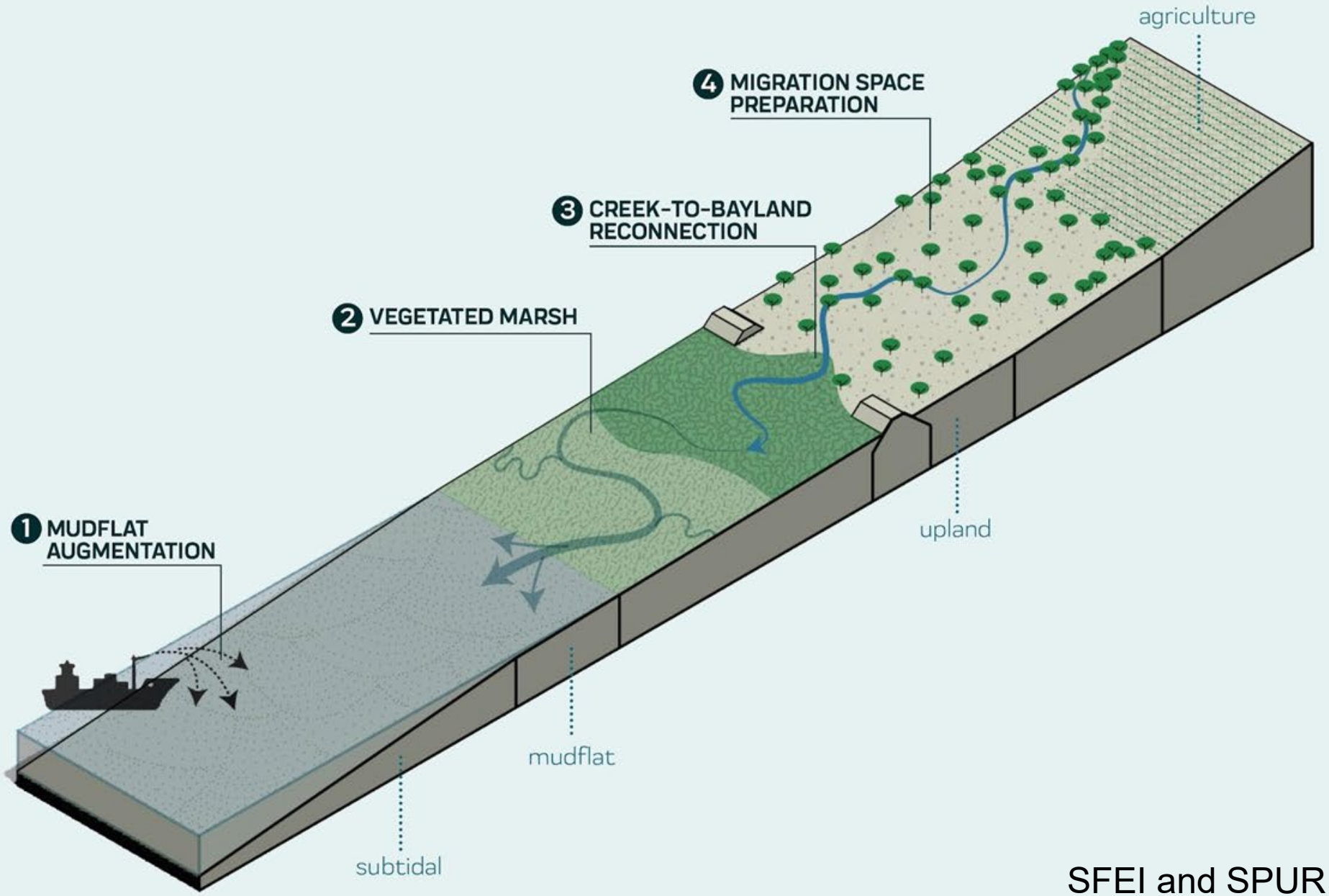


SFEI and SPUR 2019

Arambaru beach enhancement project

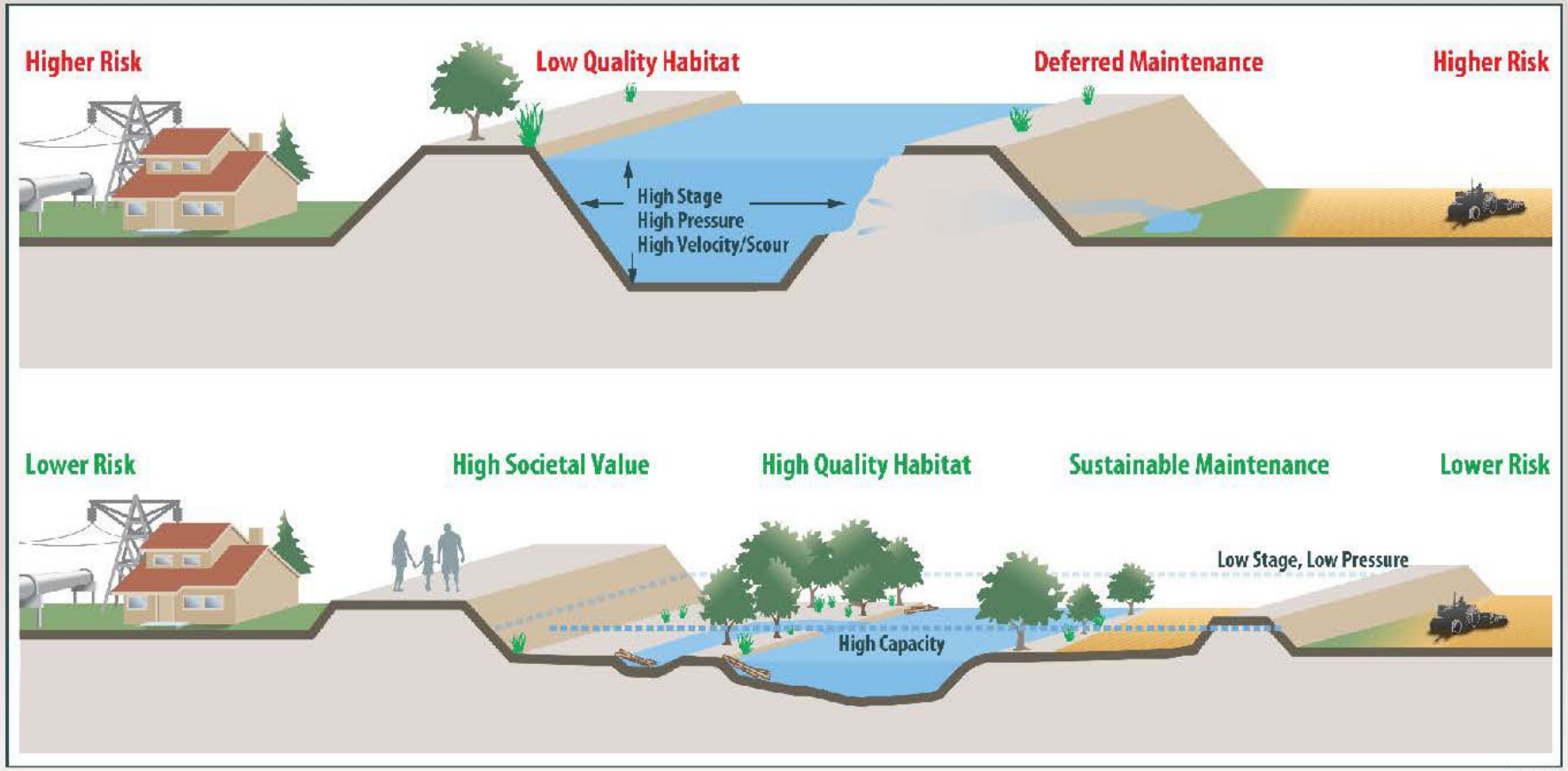
Marin County DPW

Combine measures at the basin scale

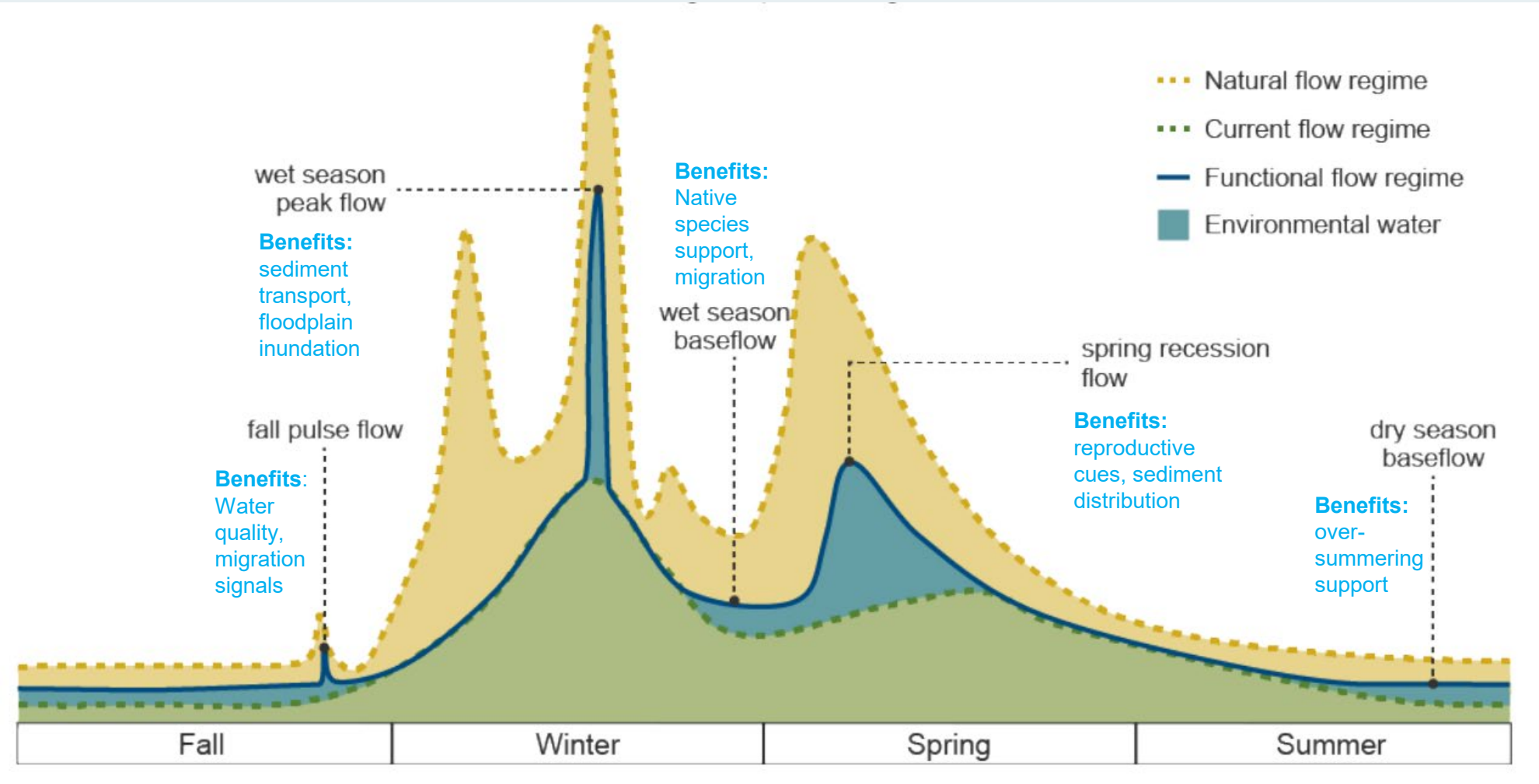


SFEI and SPUR 2019

EWN in fluvial systems



EWN in reservoir operations



Grantham et al. 2020

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EWN ACROSS THE WATERSHED

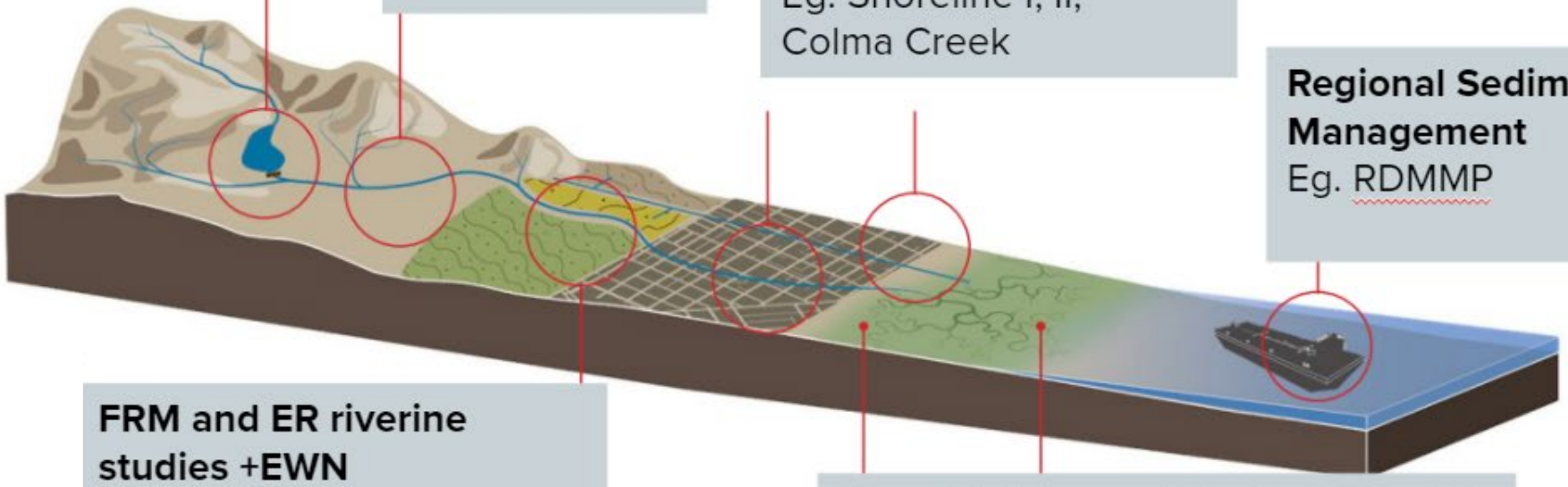
Sustainable Rivers Program

Eg. Dry creek

SLR adaptation and flood protection

Eg. Shoreline I, II, Colma Creek

Regional Sediment Management
Eg. RDMMP



FRM and ER riverine studies +EWN
Eg. Upper Guadalupe

Beneficial reuse of dredge materials
Eg. Hamilton-Direct placement
1122- Shallow water strategic placement
Coarse beaches

Yolo Bypass (Sacramento River Flood Control Project) 1917

Hamilton Wetlands (beneficial reuse of dredge materials for wetland restoration)

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HISTORY OF CHALLENGES AT USACE

- **Limits of the Federal Standard** (for O&M dredging and Beneficial Use)
- **Lack of multi-benefit approaches**, budgeting, planning, policies, and business lines
- Knowledge **gaps** and inability to **measure benefits equitably**
- **Top-down** and **internally driven approaches** (as opposed to community and partnership-focused)
- “We’ve **always** done it this way”

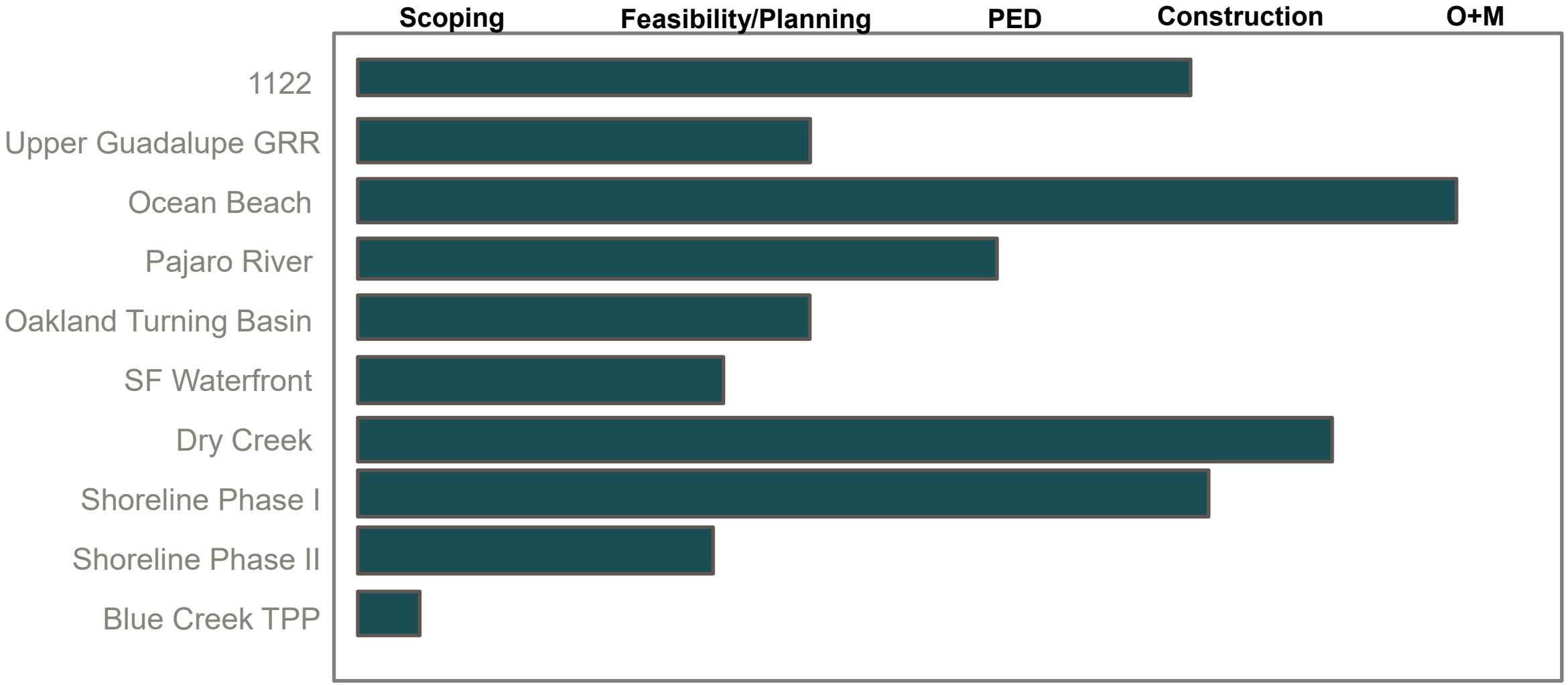
INSTITUTIONALIZING EWN

Invest in **PEOPLE**
Build **PORTFOLIO**
Develop **PROCESS**
Develop and test **POLICY**
Grow **PARTNERSHIPS**

IT STARTS WITH PEOPLE

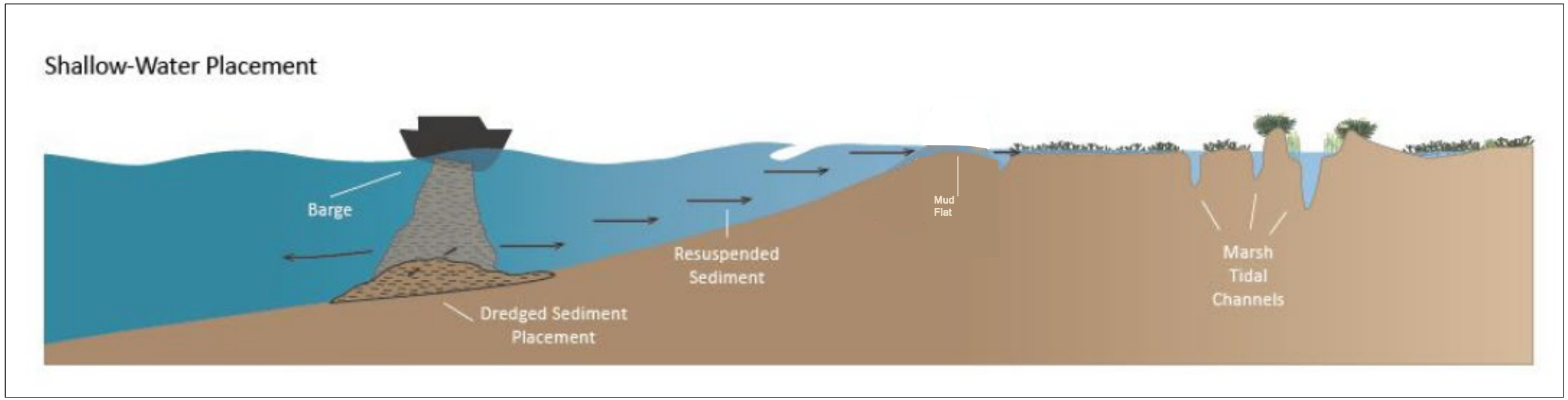
- Technical training and tools integrated across disciplines
- Recruit, hire and retain technical experts
- Facilitate EWN and EJ training and capacity building (ERDC university, other trainings)
- Knowledge comes in many forms (community expertise, Traditional Ecological Knowledge, Subject matter experts)

BUILD A PORTFOLIO



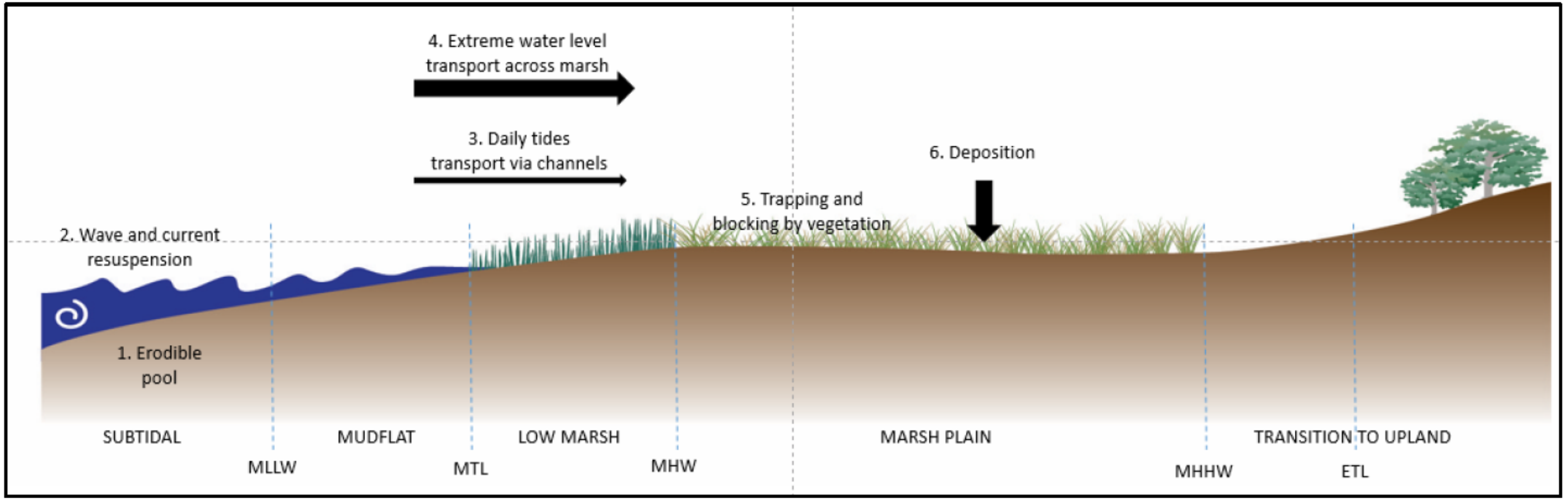
SECTION 1122 SHALLOW WATER PLACEMENT

- Using natural transport processes to move material onshore
- Creates resilience for mudflats and marshes
- Innovative, cost-effective, moves towards regional goals
- Monitoring impacts and effectiveness



SFEI framework, draft, 2017

INORGANIC SEDIMENT SUPPLY TO MARSHES (CONCEPTUAL FRAMEWORK)



SFEI framework, 2017 draft

DRAFT VISUALIZATION OF SHALLOW WATER PLACEMENT MODEL RUNS

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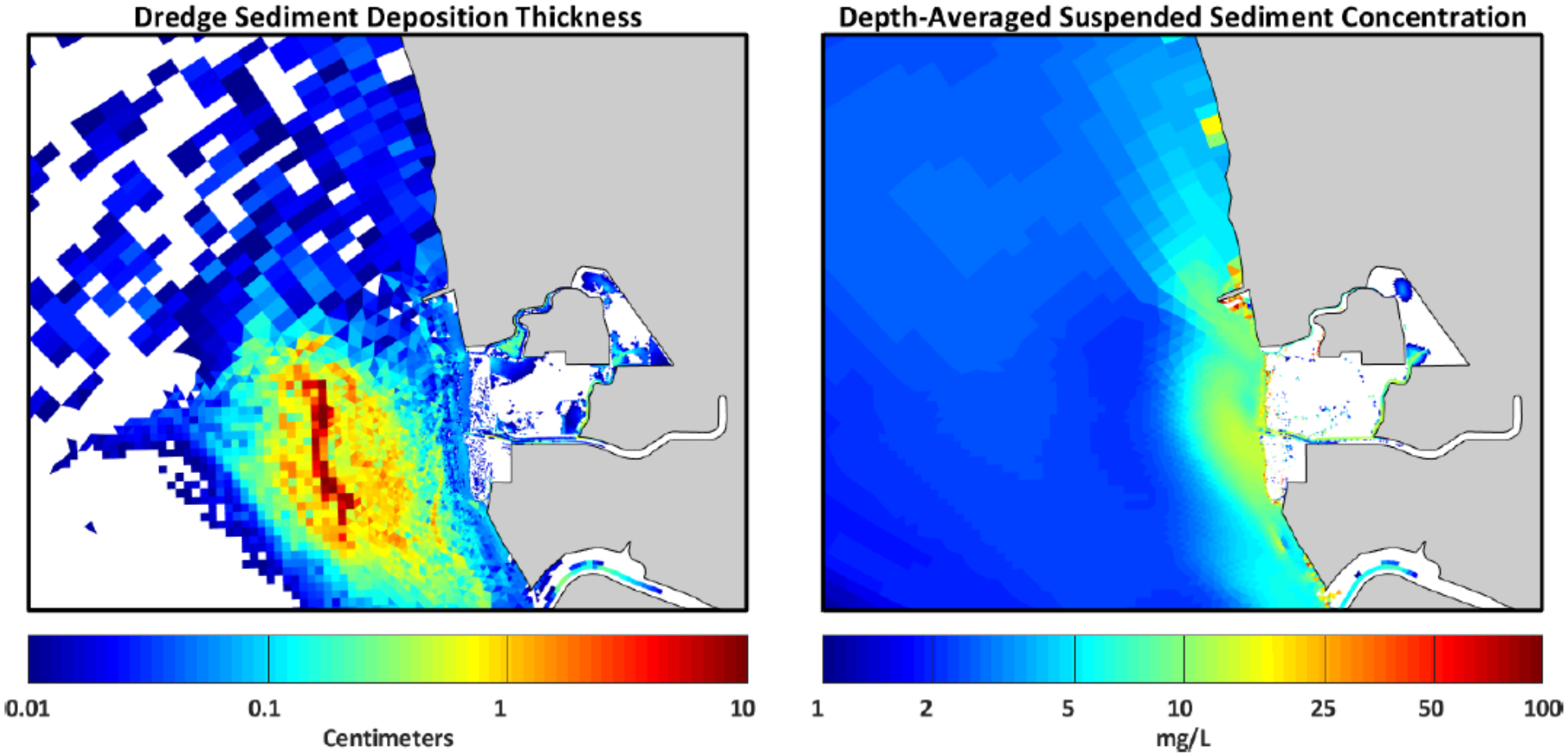


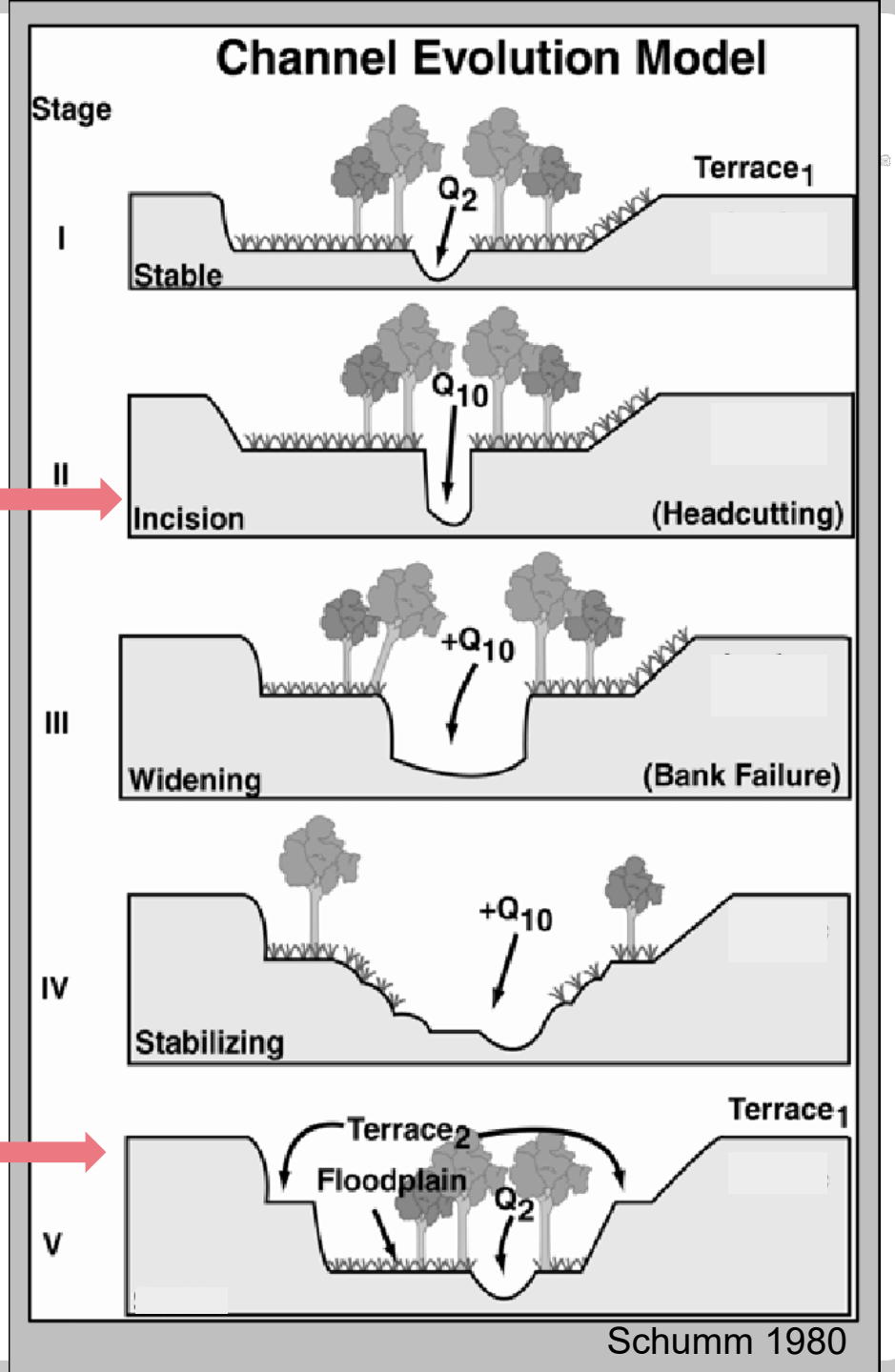
Draft

UPPER GUADALUPE RIVER

- FRM project
- Critical Steelhead habitat
- Incised, constrained river with high velocities and bank erosion/failures
- EWN approach provide efficiencies in lowering erosive force of high velocity flow, self-sustaining channel
- Provides habitat for salmonids, and lower maintenance cost

We are here

We want to be here



Schumm 1980

PAJARO RIVER

- Existing levees provide 8-year level of flood protection
- Community of Pajaro average median income is 22k /yr
- Project sets back levees to give river room to activate floodplain, and alleviate flooding

Flood of 1995, Courtesy of Pajaro Regional Flood Management Agency

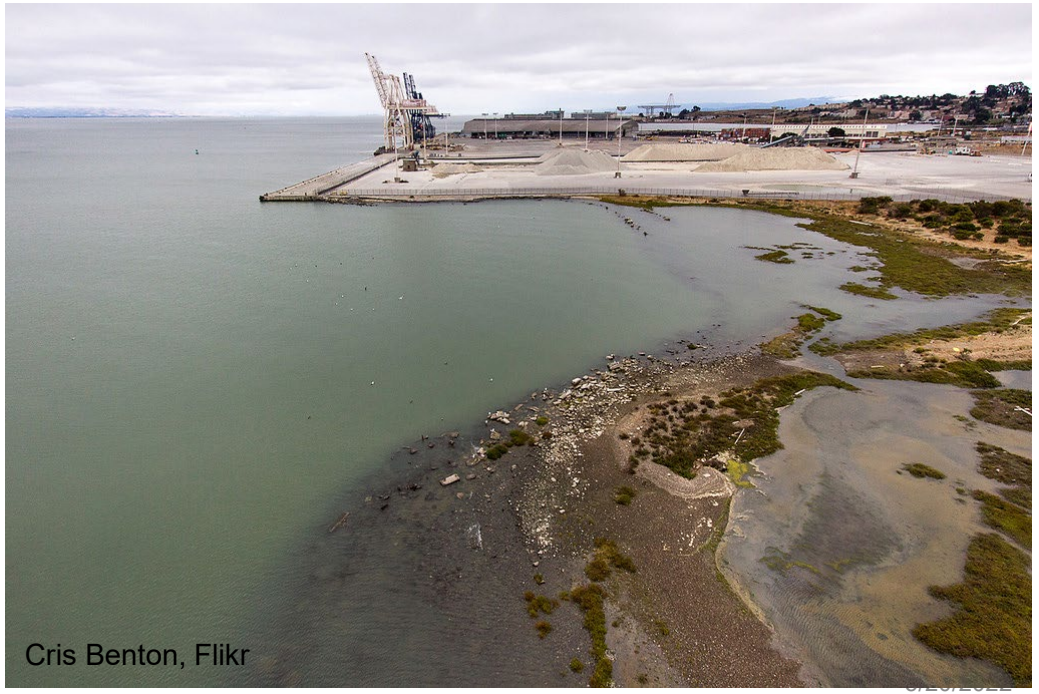
BLUE CREEK ECOSYSTEM RESTORATION

- Tribal Partnership Program **driven by the Yurok Tribe**
- Existing **undersized bridge** installed in 1990s
- Contributes to channel incision, loss of spawning gravel, and **lack of floodplain connectivity**
- Backwater from Klamath River
- Removing (and rebuilding) bridge to achieve **ecosystem functions**

SF WATERFRONT STUDY

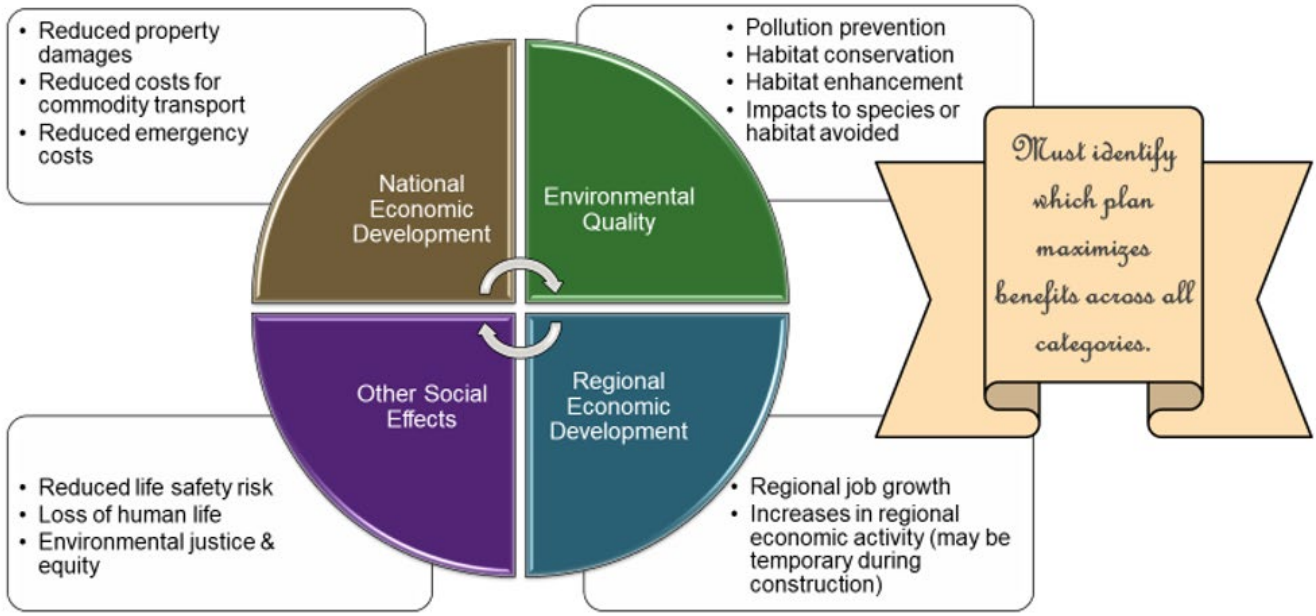
- SF Port-led **EWN working group** to integrate nature-based features equitably across the project area
- Interviews with **local fishing community**
- **Drawing on experience** in Australia, Seattle, New York, and other steep urban shorelines
- **Interdisciplinary team:** scientists, community members, landscape architects, engineers, architects


USACE


Cris Benton, Flikr

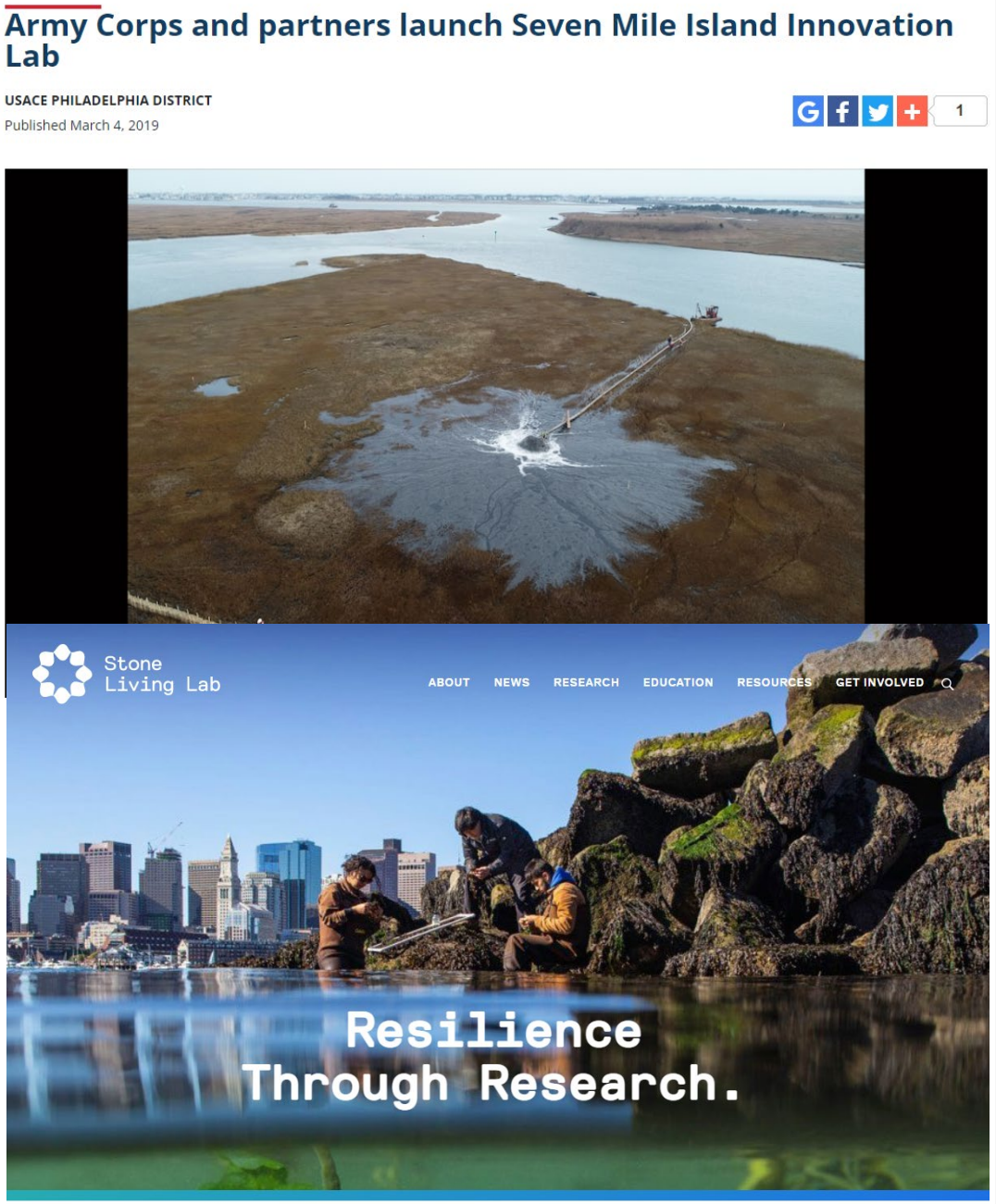
DEVELOP AND TEST POLICIES

- Continue to test the **Comprehensive Benefits Memo** process
- Develop **Engineering and Planning guidance and specs** for NNBF implementation
- BCA is reconsidered to provide **equitable outcomes** (not equal outcomes)
- How to pay incremental cost of Beneficial Use or how to-reinterpret the Federal Standard for **more beneficial outcomes**



GROW PARTNERSHIPS

- Working **collaboratively with partners** is essential to nature-based adaptation to climate change
- Collaboration with junior colleges, internships to **develop new staff, new ideas**
- Multi-stakeholder **partnerships**:
  - EWN has an MOU with California DWR
  - Living shorelines laboratory
- Opportunities for **research**, partnering with ERDC, USGS, others.



CHANGE AT ALL LEVELS

National scale:

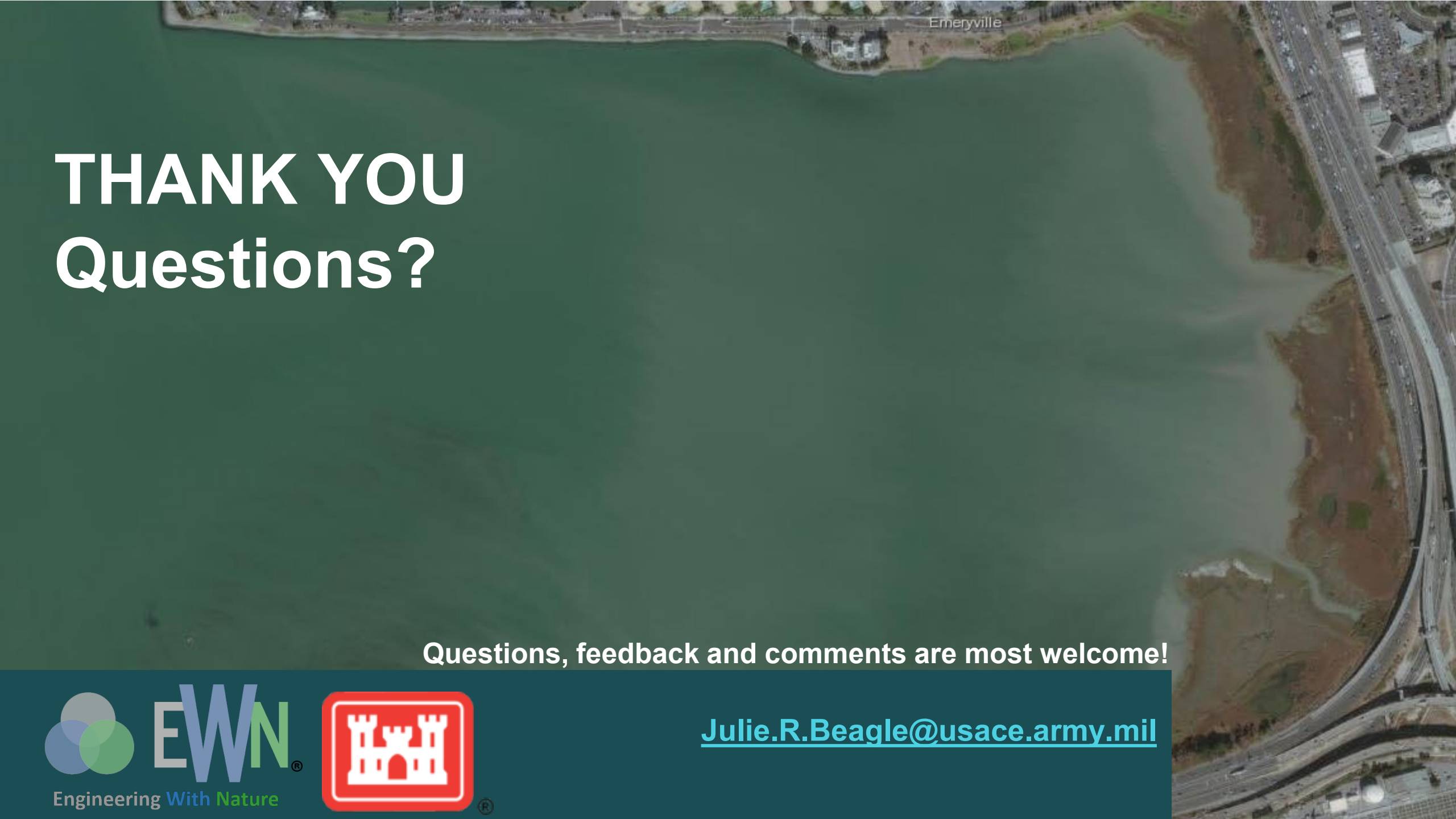
- WRDA 2020 requires that we consider and implement nature-based solutions
- USACE wide flip of BU from 30% → 70%
- Center climate change and communities in infrastructure planning

Vertical alignment:

- Create an EWN and EJ center of expertise and vertical team reviewers at all levels of USACE process
- Develop tools for quantifying benefits of natural infrastructure
- Remove waiver mandate for “Comprehensive Benefits” planning

District scale

- Hire diversified workforce with lived experiences more representative of communities we serve
- Educate and empower all disciplines in EWN options, opportunities.



THANK YOU
Questions?

Questions, feedback and comments are most welcome!

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