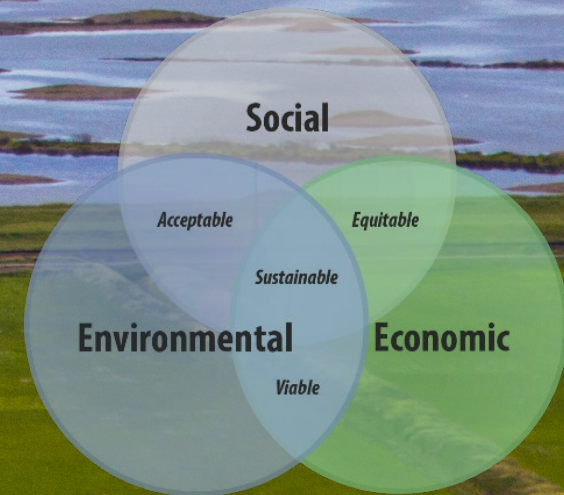


# Engineering with Nature



The intentional alignment of natural and engineering processes to efficiently and sustainably deliver economic, environmental and social benefits through collaboration

## 3 Examples of Strategic Adaptation To Sea Level Impacts in SF Bay



Peter Mull  
USACE San Francisco

# Hamilton-BMK Wetlands Restoration Project

## Aquatic Transfer Facility

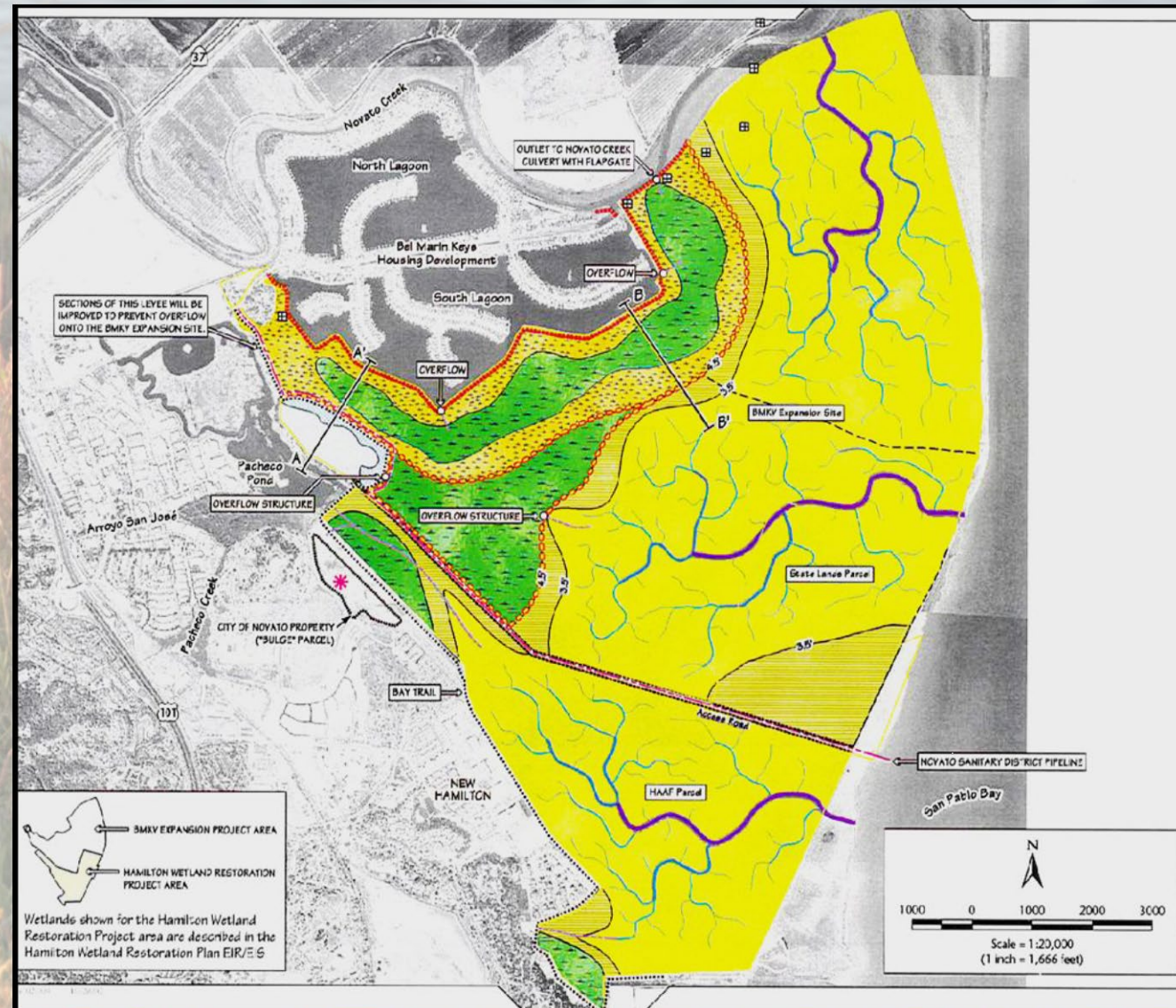


How to deliver 24 MCY of Dredged Material  
for Landscape Scale Restoration ??



# Current Conceptual Site Design

- ~2600 Acres
- 24 mcy
- 18 years



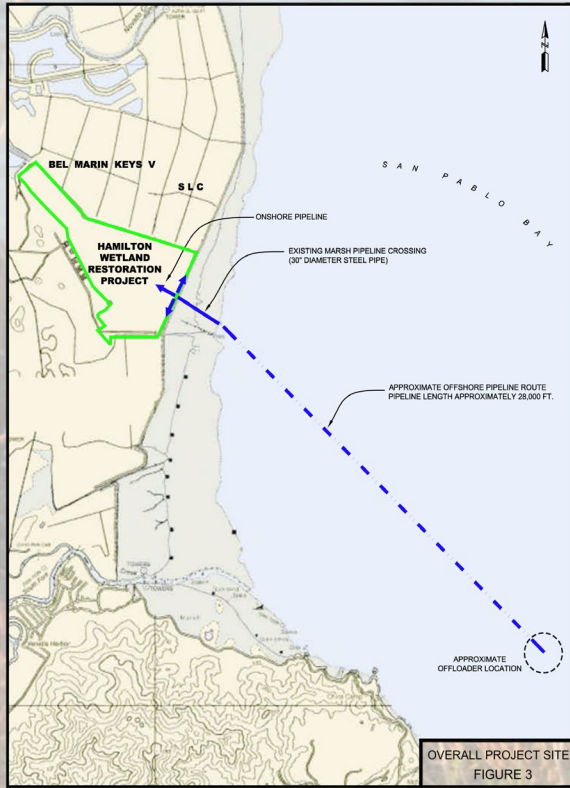
## Benefits to Bay Habitats

- Provides endangered and threatened species habitat
- Provides habitat for wintering shorebirds and waterfowl
- Provides transitional habitat for wildlife
- Improves San Francisco Bay water quality
- Retains Valuable Sediments in Starved SF Bay Estuarine System

## Benefits to Infrastructure

- Buffers against sea level rise
- Improves flood control
- Improves water quality
- Provides public access to the Bay
- Implements the LTMS Goals for beneficial use of dredged sediments
- Ecologically & Sustainably Supports Marine Navigation and Vital Economic Activity

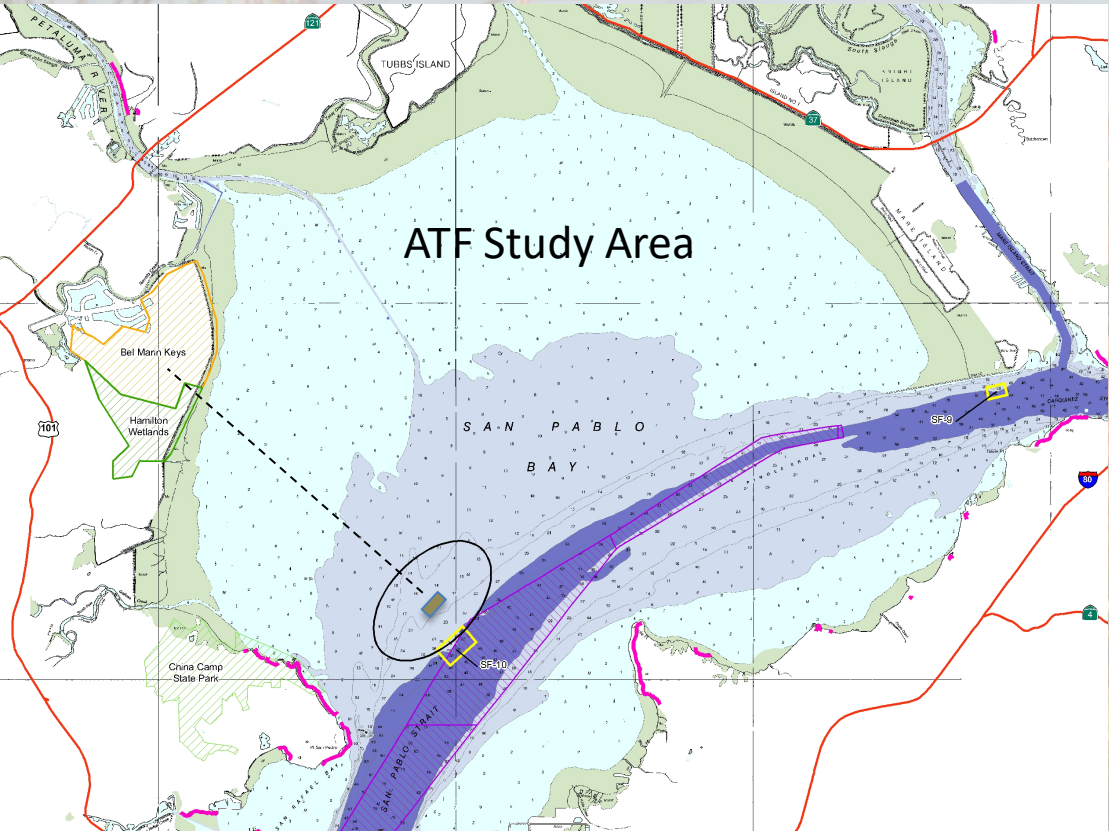
# The Traditional Way In Bay Off-loader



- Small footprint (~2.3 acres of floating fill)
- Offloads only 1 barge at a time (3-5kcy in 3 - 6 hrs. – high stand by times)
- Can accept large and medium scows (not small scows or hoppers)
- Estimated Max 1.2 Mcy/year transfer capacity

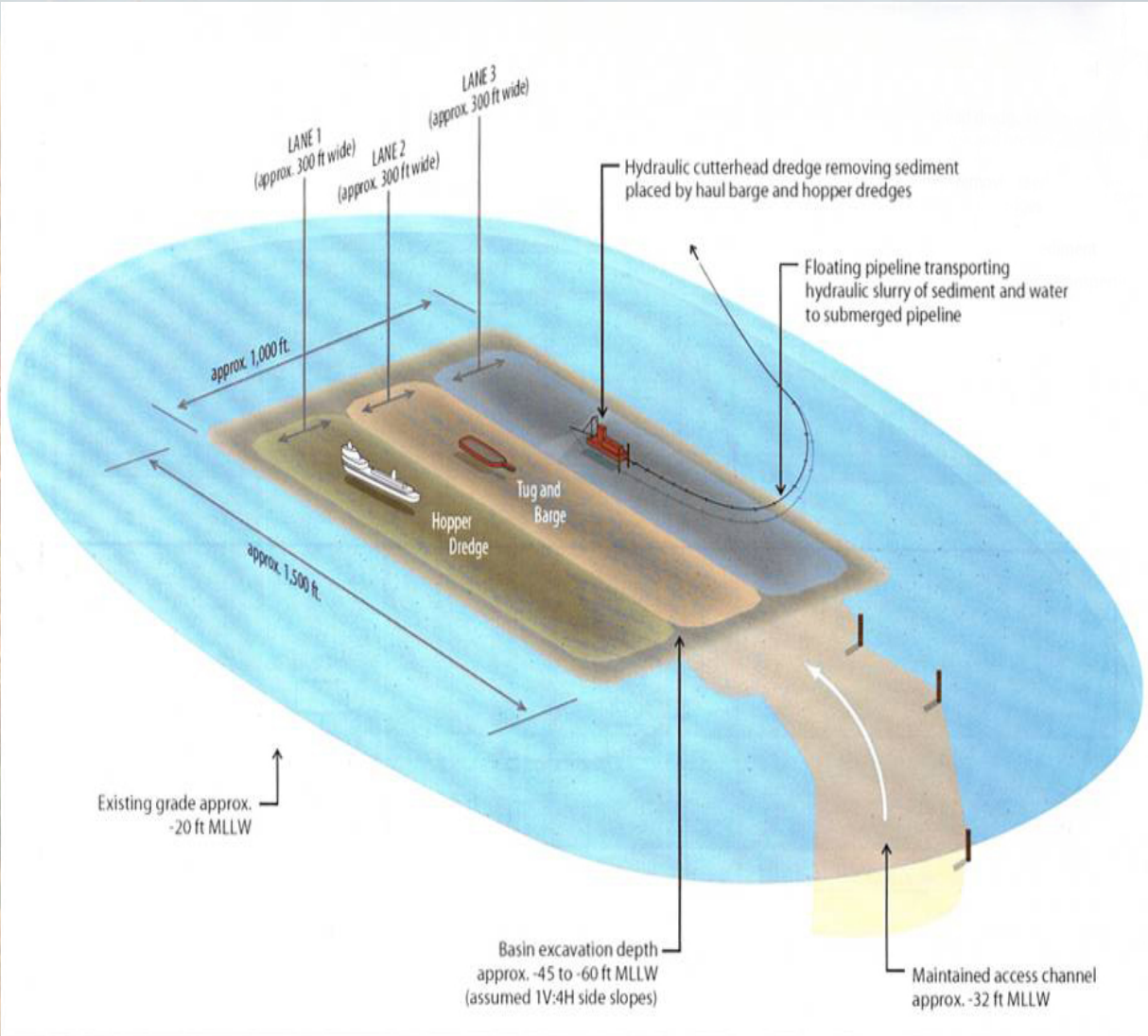
# A Good Idea Whose Time Has Come...

## Aquatic Transfer Facility



ATF Study Area

ATF Dimensions  
1000' Wide x 1500' Long; 45-60 feet deep



# Aquatic Transfer Facility

- A basin is dredged in San Pablo Bay near the San Pablo Bay disposal site SF-10
- Dredged sediment is temporarily stockpiled
- A hydraulic dredge pumps continuous quantity for efficient wetlands construction
- The Basin remains available to all dredgers during lulls in wetlands construction
- Basin is 1,500' x 1,000' x 40' deep
- Basin can store up to 2.2 MCY and deliver ~ 4 MCY annually
- Material types can be segregated for better construction of wetland design features
- Basin can accept all dredge equipment, including small scows and Hopper Dredges

	Offloader	Aquatic Transfer Facility
Acreage	2.3	58 to 77
Capacity per year	1.2 mcy	4 mcy
Hold Sediment	No	Yes
Timing	18 years	10 years
Beneficial Reuse	Limited	Maximized
Bay Water Used	Maximum	Minimum
Air Emissions	Highest	Lowest
Cost	\$302 - \$447 M	\$119 M



## Bolstering Bay Margins and Mudflats with Strategic Open Water Placement

### Problems

- A change in sediment regime, sea level rise, and localized erosion will lead to a long-term loss of mudflats and marshes in the San Francisco Bay.
- Dredged sediment is critical for adaptation/restoration of marshes and mudflats that protect us from rising seas and storms.

### Opportunities

- Strategic shallow water placement may offer one of many possible solutions to the problem of losing mudflats and marshes.
- Potential to lower the cost of beneficial reuse of dredge material by using natural processes to bring the material onshore.

SCIENCE

### Got Mud? For Coastal Cities, Humble Dirt Has Become A Hot Commodity

May 1, 2021 · 7:28 AM ET  
Heard on [Weekend Edition Saturday](#)

LAUREN SOMMER 

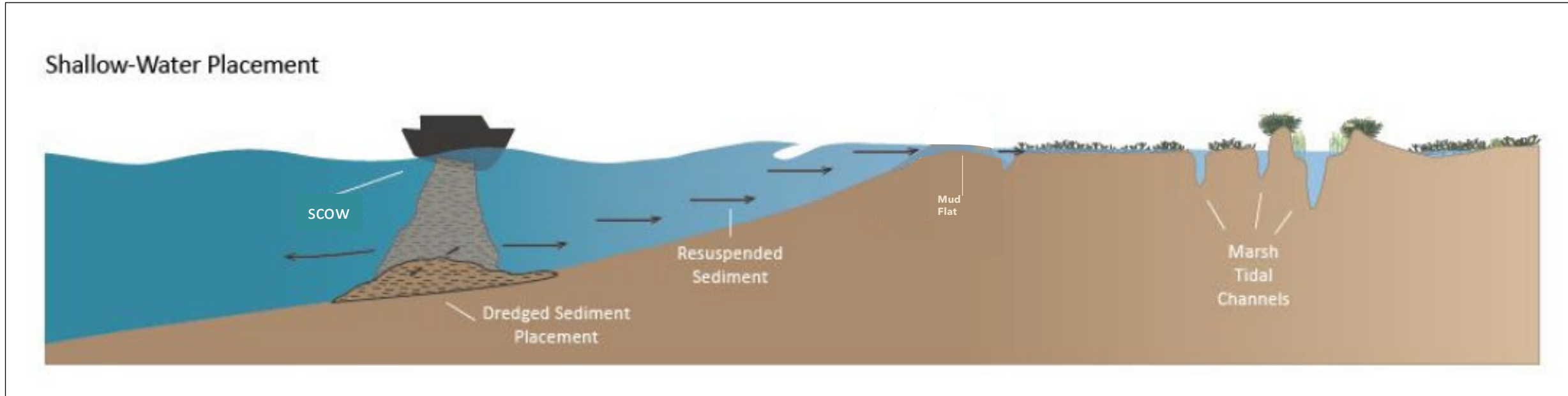
LOCAL // ENVIRONMENT

The simple local solution to sea level rise? Mud from the bottom of San Francisco Bay

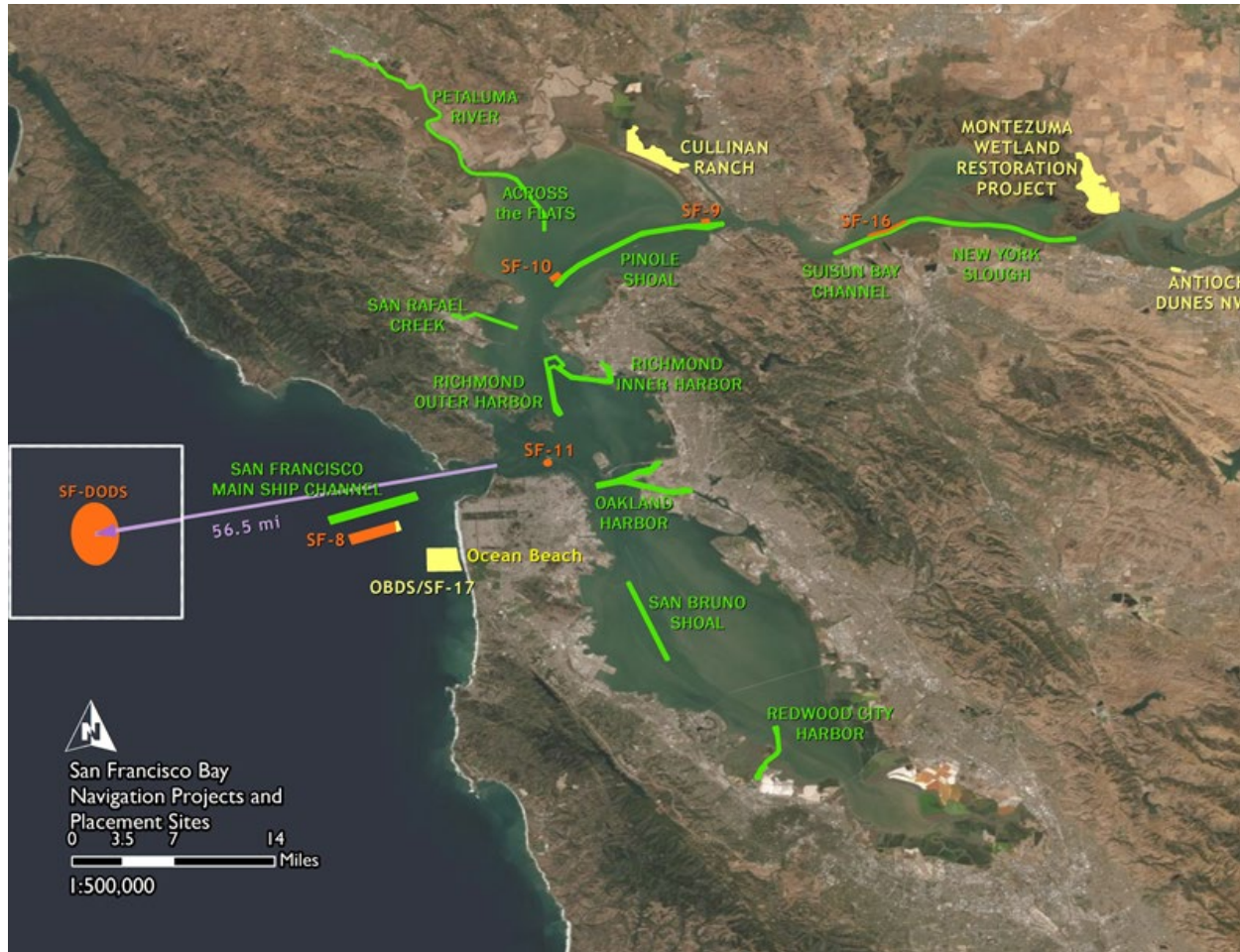
  
Tara Duggan  
April 13, 2021 | Updated: April 19, 2021 2:11 p.m.

# STRATEGIC SHALLOW WATER PLACEMENT PILOT

- 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



# LOGISTICAL OPPORTUNITIES AND CHALLENGES



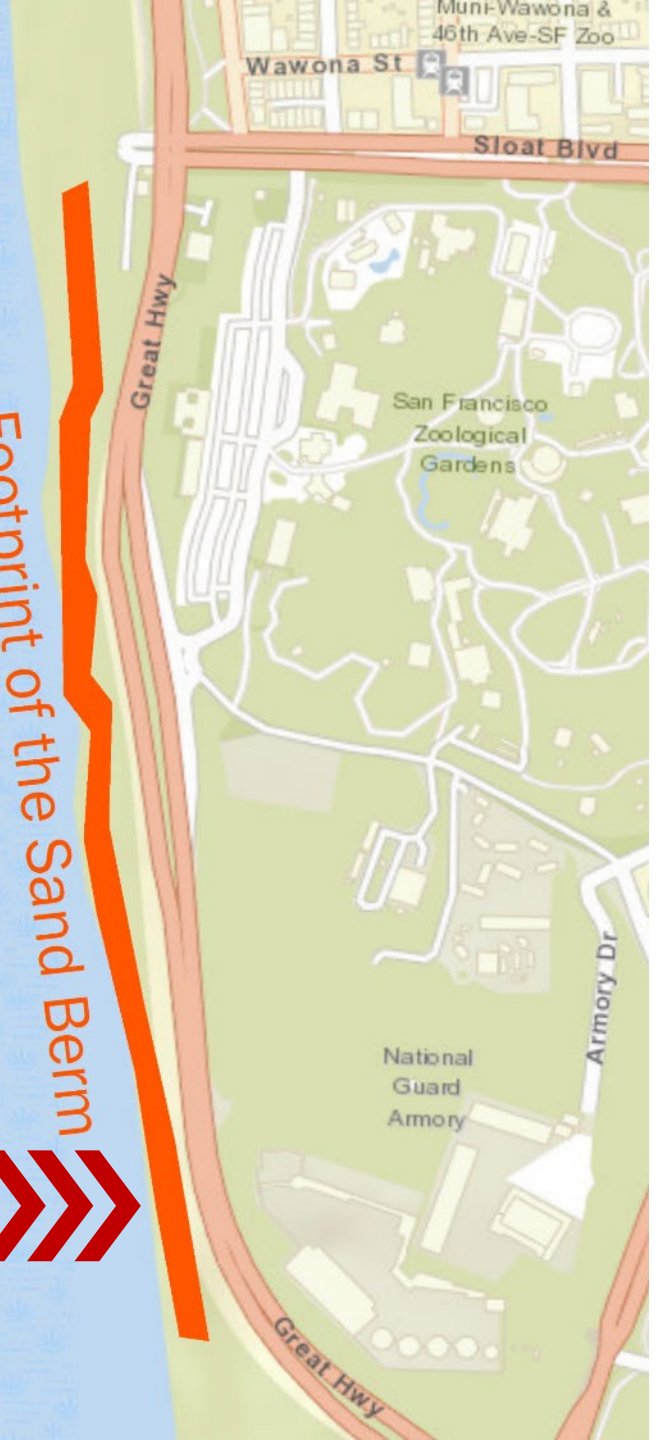
- **Near a dredging location**
  - Current USACE dredging operations occur annually, or biennially, in Redwood City, the Port of Oakland, and Richmond. Other dredging locations include San Rafael and Petaluma.
- **Year-round access** from both the Bay, for dredging equipment, and from the land, along levees, for monitoring.
- **A shallow bay:** Scow draft depth for shallow water placement



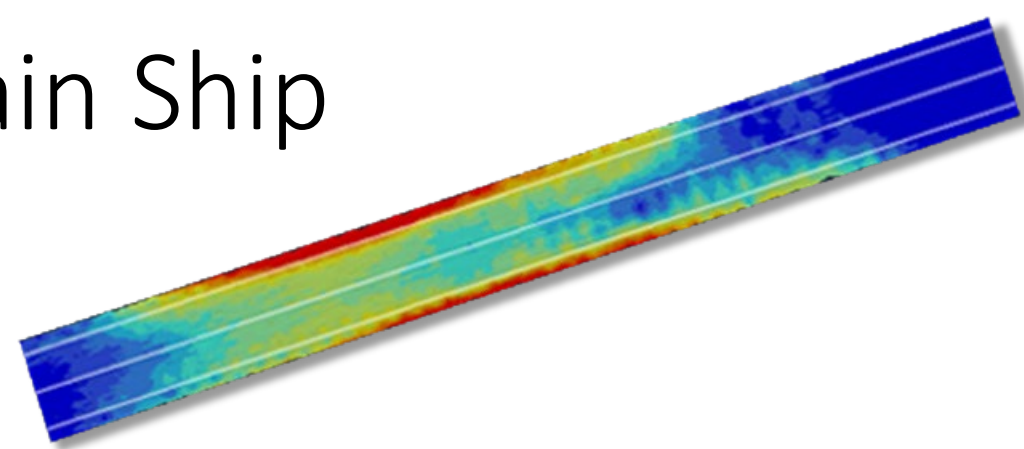
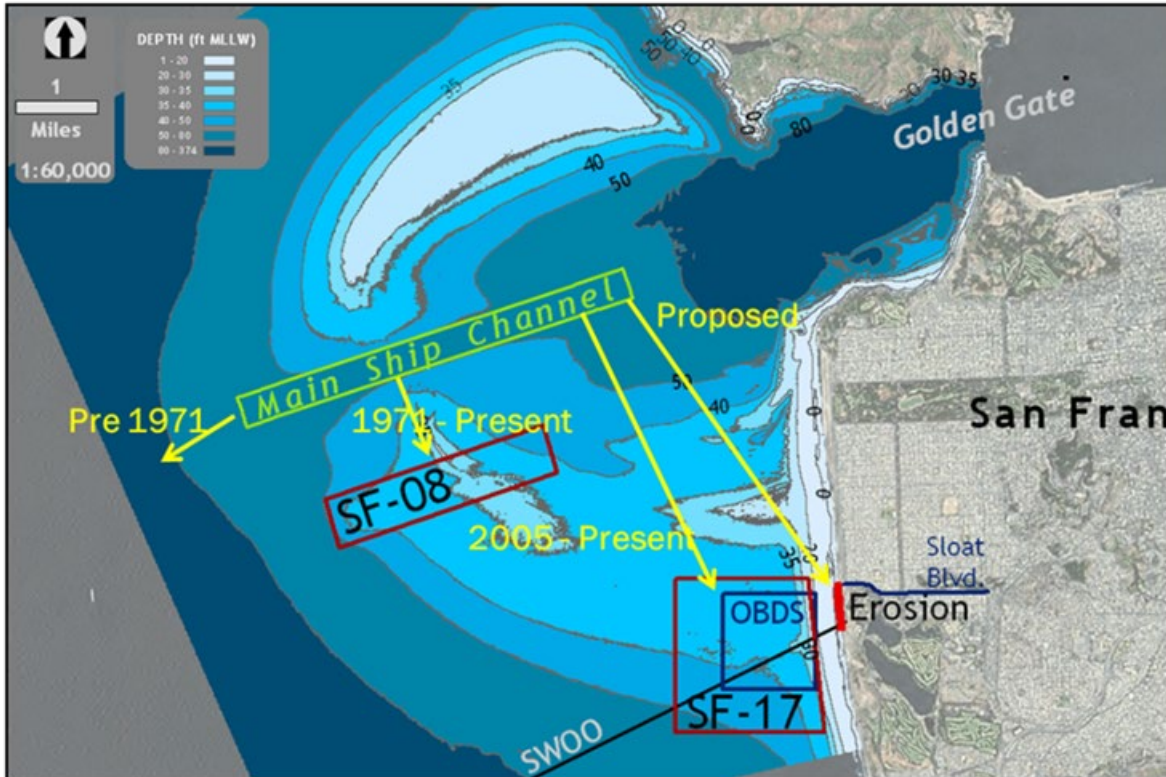
# Ocean Beach Infrastructure



Footprint of the Sand Berm



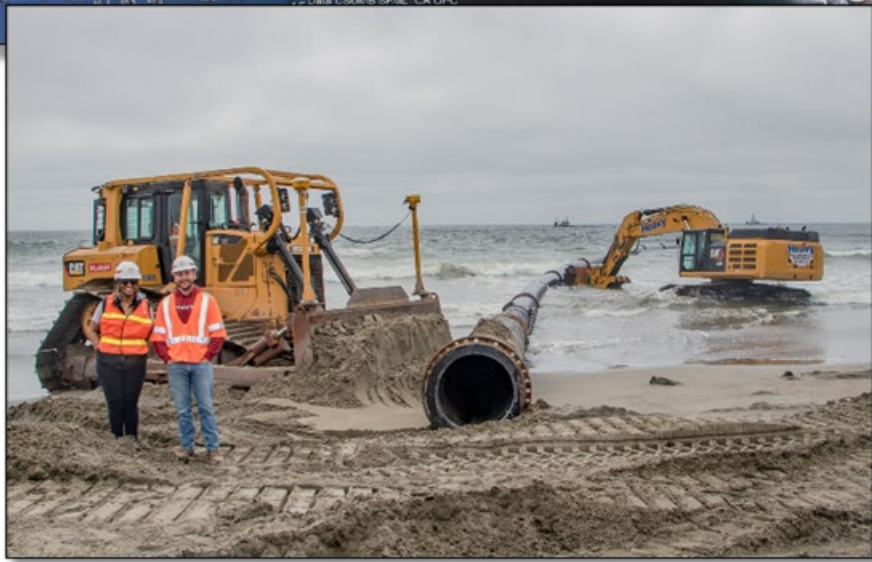
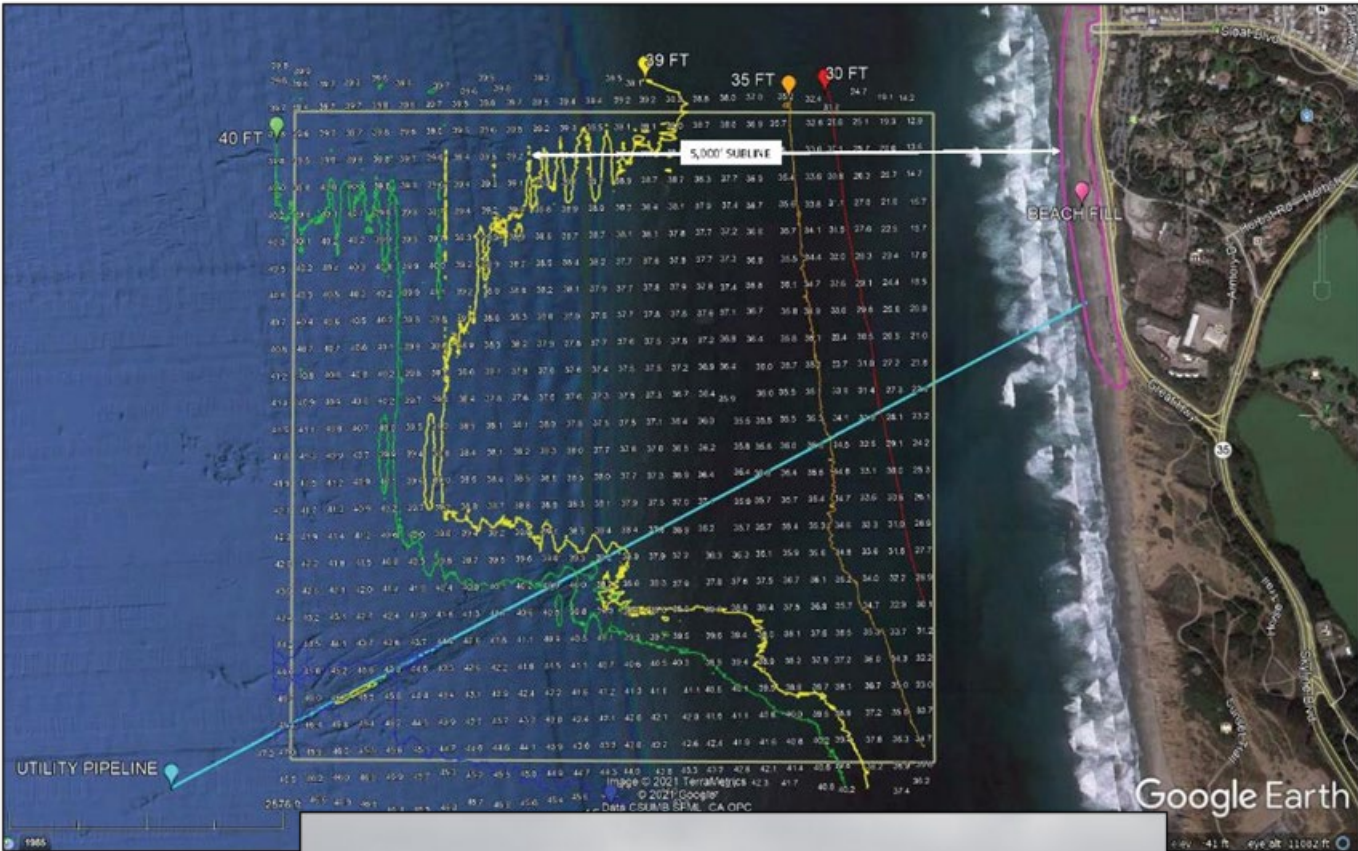
# San Francisco Main Ship Channel



- Channel length: ~26,000 ft; Channel width: ~2000 ft
- Maintained depth: 55 ft MLLW (annually dredged by USACE)
- Nearshore placement  $\approx 320,000$  yd<sup>3</sup> (2000–2018 average)



# Pump Ashore



# Building a Protective Dune To Protect Vital Infrastructure



# Voila! A New Beach!

Finis

