



Effective Estuary Restoration Symposium

Using Dredged Sediments For Habitat Restoration

- The San Francisco Bay Region Experience -
May 20, 2026

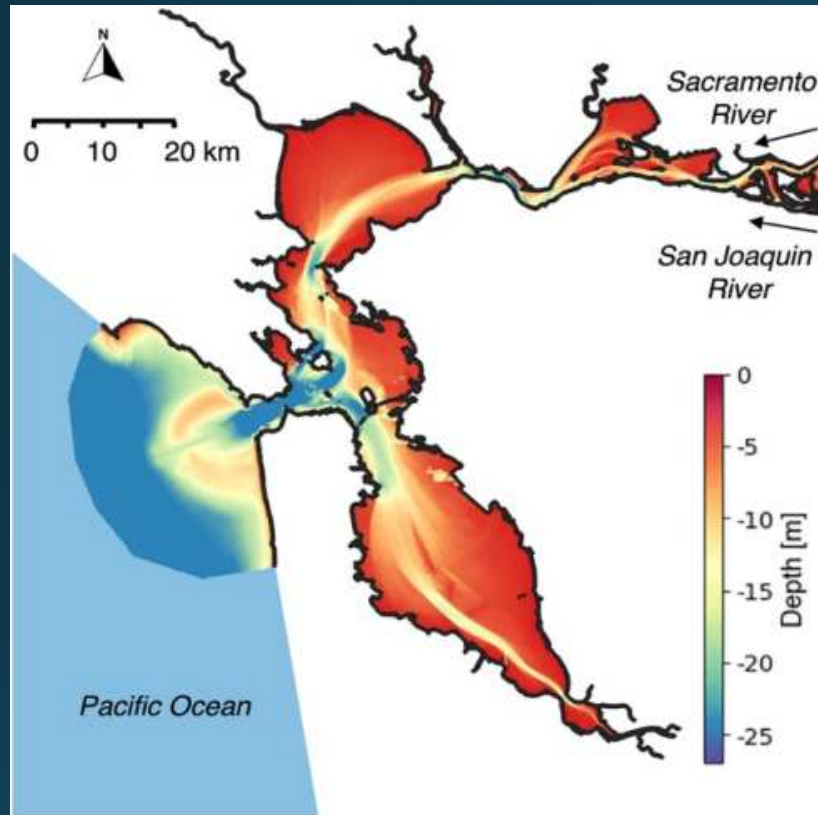
Dilip Trivedi, Dr. Eng., PE
Coastal Engineer, Moffatt & Nichol

KEY POINTS

1. Material dredged from navigation channels is a valuable resource
 - *Not a Spoil*
 - *Beneficial Reuse* – several initiatives underway at National & Regional scales
2. Beneficial reuse needs significant cooperation between otherwise unlikely allies
 - *Partnerships are critical for implementation*
3. Reusing dredged material for ecological restoration is significantly more expensive than disposing it
 - *But can we afford not to?*

SAN FRANCISCO BAY

**Shallow estuary → Ave depth
12 - 15 ft**



**Major ports with navigation
channels maintained via
dredging (30 to 50 ft)**



**Declining suspended
sediment load**



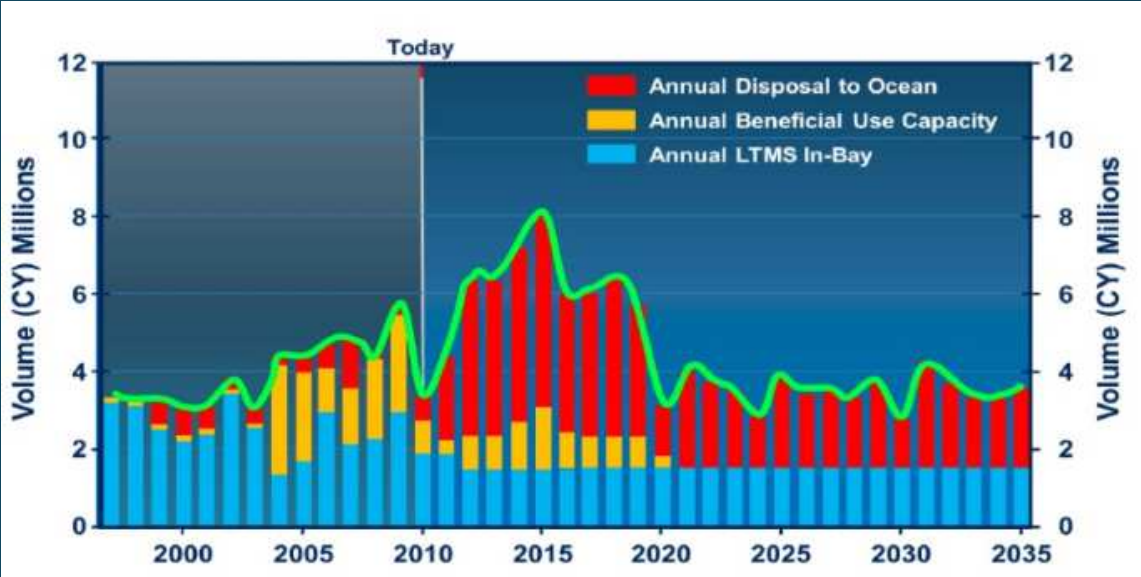
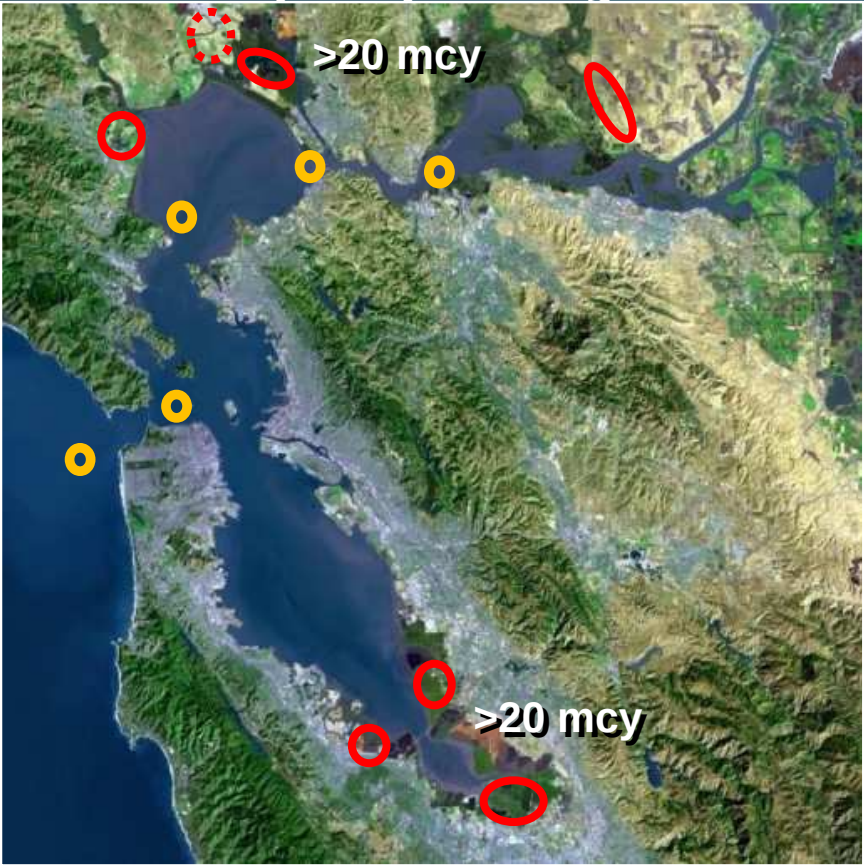
**Annual Sediment Loading → Approx. 1.5 million
cy/yr**

Annual Dredging → Approx 2 million cy/yr

Beneficial Use of Dredged Material - SF Bay Experience (PMEP 5.20.26)

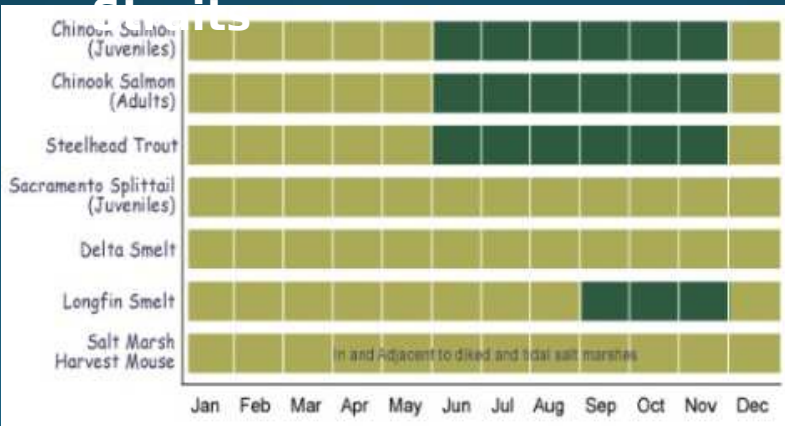
DREDGING & DISPOSAL BY THE NUMBERS

Where is the dredged

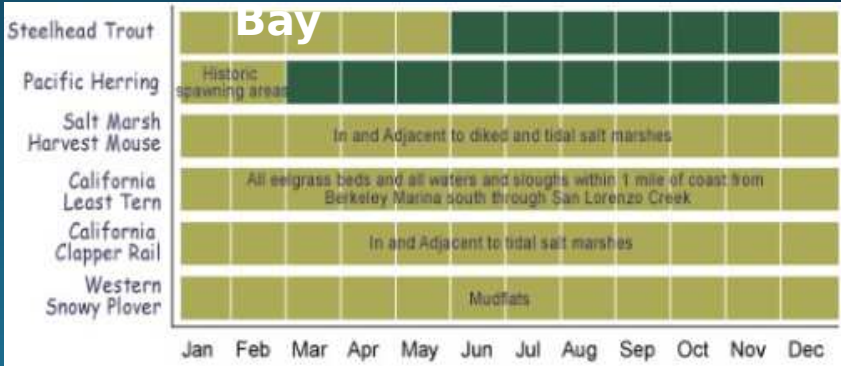


In-water disposal is largest component !

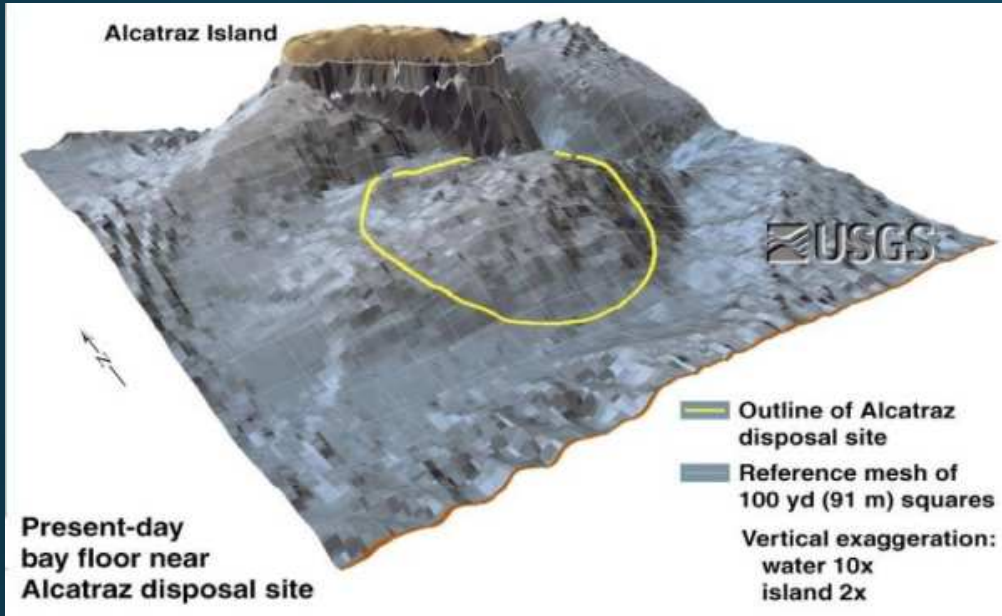
Suisun Bay & Carquinez



South Central



GENESIS OF LTMS

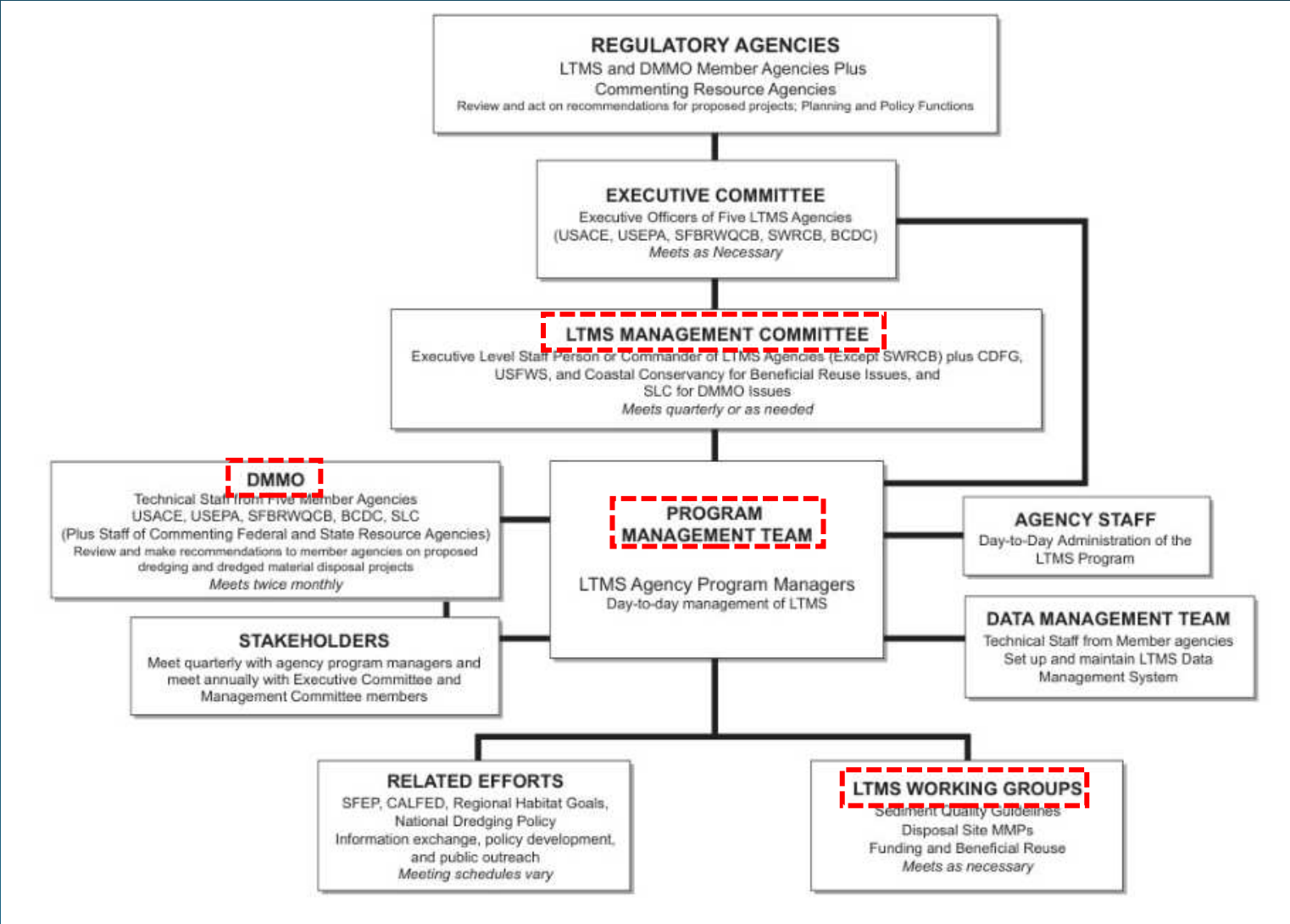


- Severe mounding around disposal site led to Blockade by fishery industry
- Impacts to water quality, fisheries, ecosystem
- → *Long Term Management Strategy* (LTMS) for dredged material

- 9 years of documentation, DMMO formation, governance
- DMMO formed → 1996
- LTMS EIS → 1998

**LTMS Management Plan →
2001**

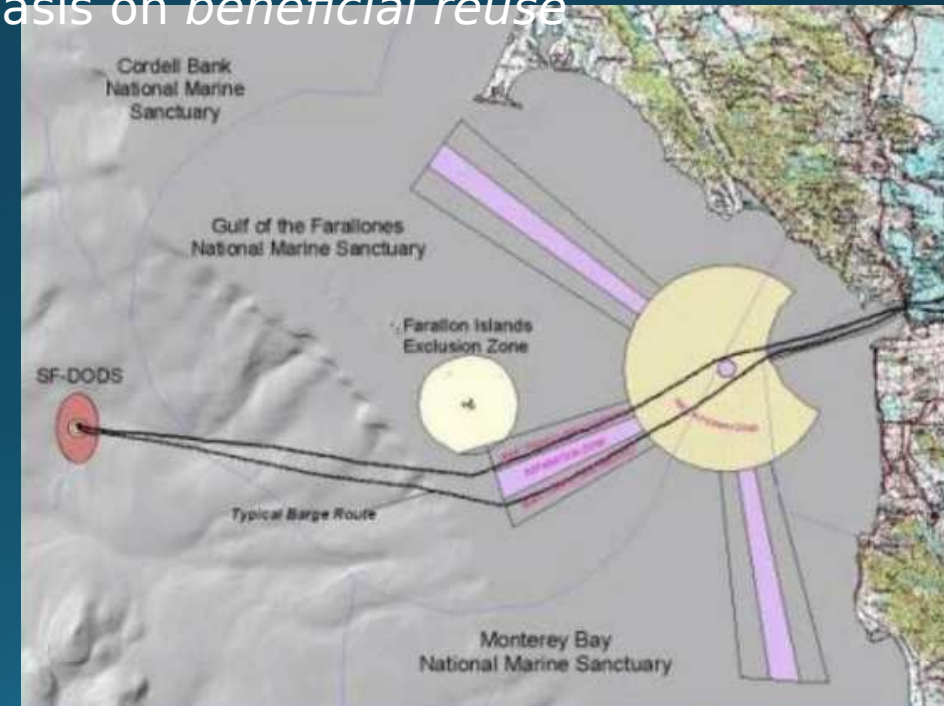
LTMS FRAMEWORK



LTMS FRAMEWORK

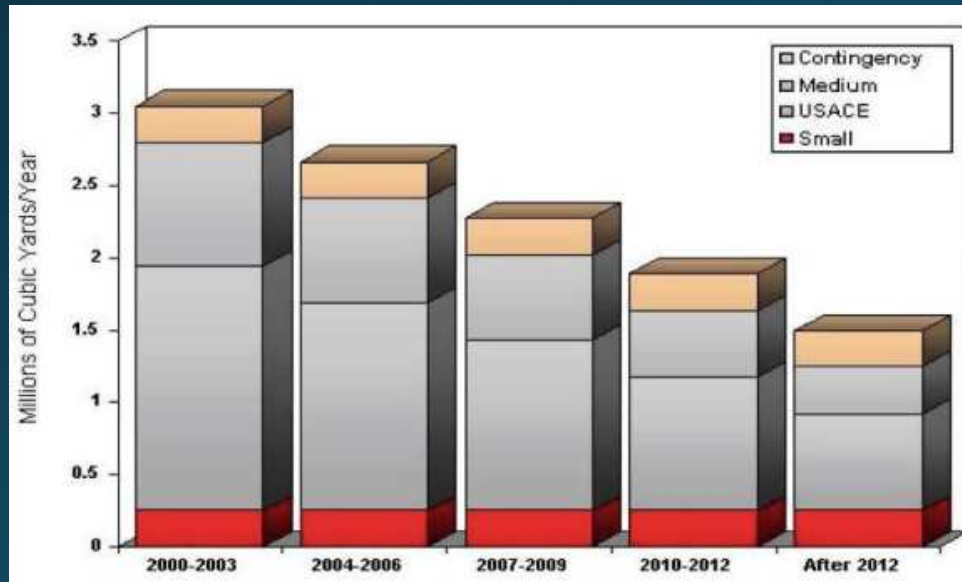


- LTMS EIS/EIR Finalized (1999)
- Established goals
- Transition over 12-year period
- Emphasis on *beneficial reuse*



Creation of “safety valve”
SFDODS

(60 miles offshore in >5000')



GOOD EARLY PROJECT IMPLEMENTATIONS



Sonoma Baylands (300 ac)

2.5 – 3 million CY from Oakland 42' deepening



Bair Island (35 ac)

250,000 CY from Redwood Creek maintenance

GOOD EARLY PROJECT IMPLEMENTATIONS



Montezuma Wetlands (550 acres Phase 1)

Oakland 50' deepening + ongoing maintenance

About 9 million CY placed to date



Hamilton Army Airfield (700 ac)

Oakland 50' deepening + maintenance

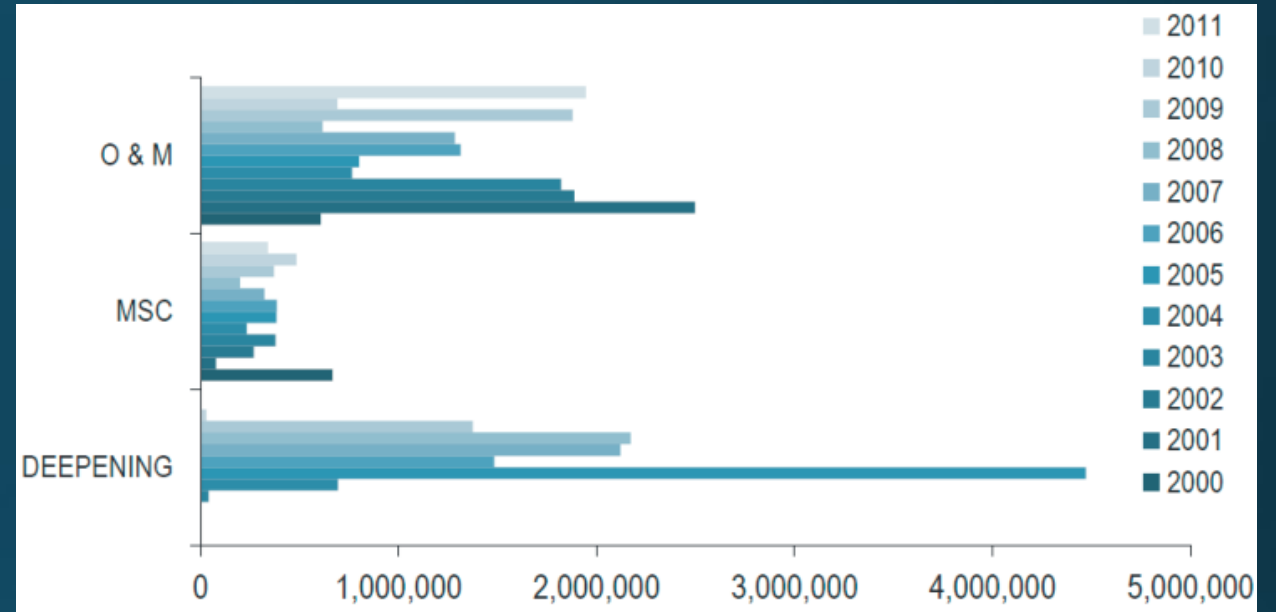
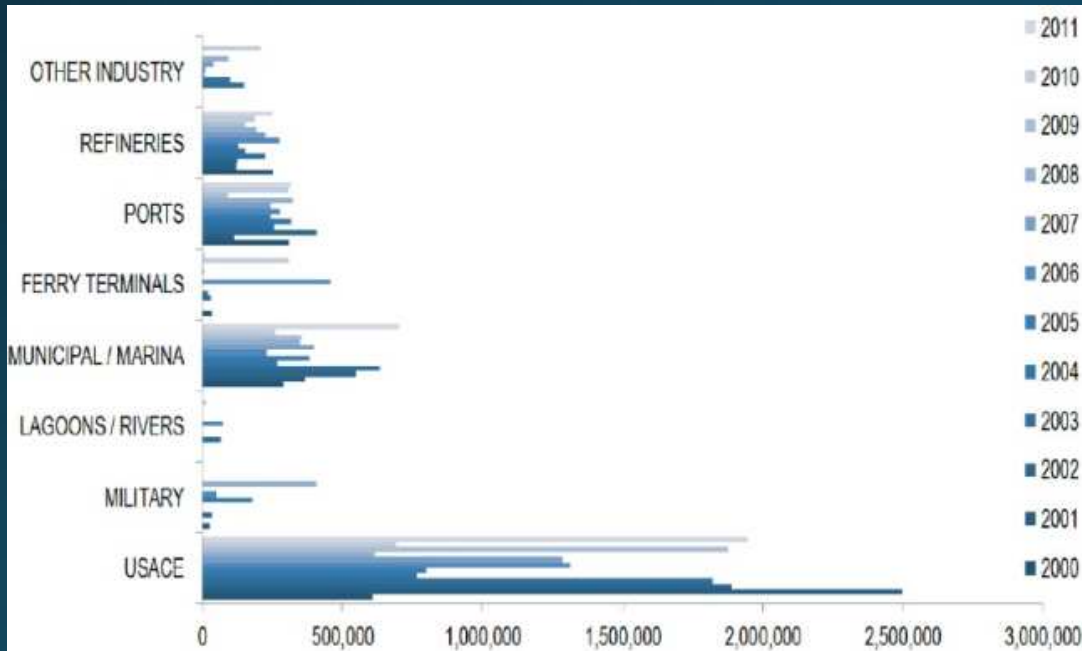
About 5.6 million CY placed

SUCCESSFUL EXAMPLES OF ECOSYSTEM RESTORATION



OPPORTUNITY - NAVIGATION DREDGING

- Federal deepening → Capital Projects that have long lead time and are infrequent
- O&M → regular cycle, Corps-funded and typically clean



- USACE is largest dredger
 - 51% of CA's O&M \$\$ intended for SF Bay (\$95 million requested by CMANC)
 - Half of it (~\$45 million) for Oakland, Redwood, Richmond, Pinole
- Beneficial Reuse of *Federal O&M Material* is key

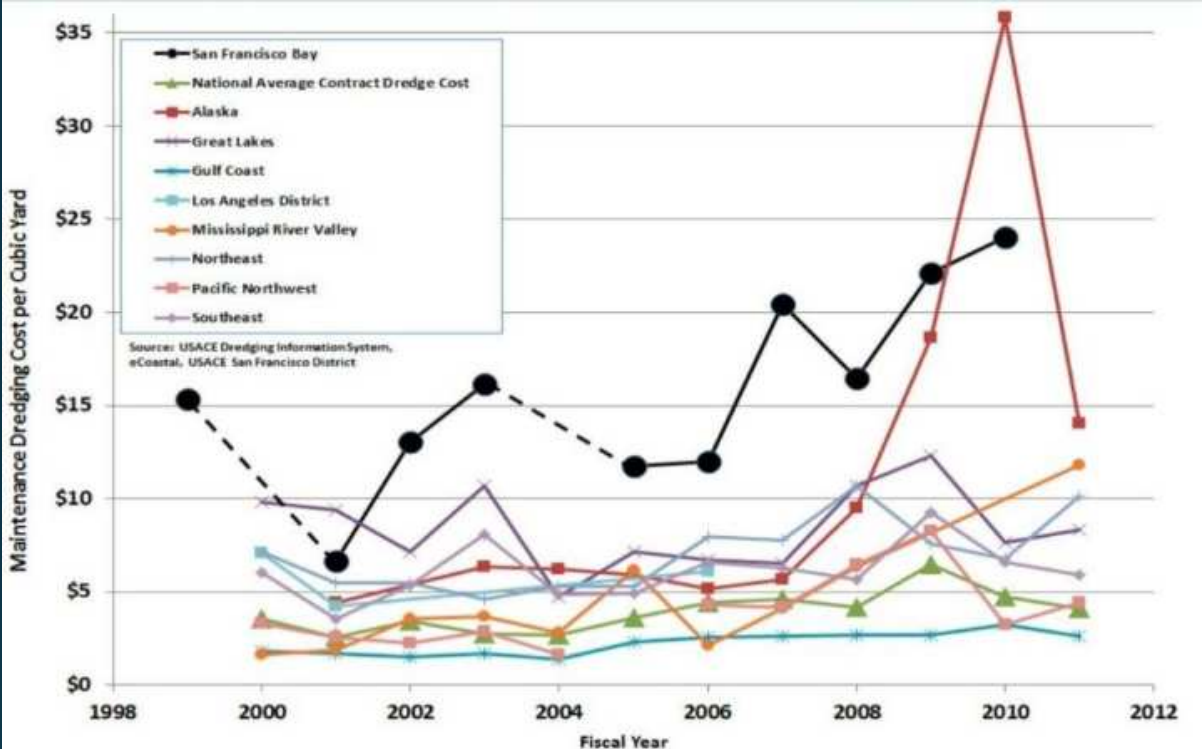
CHALLENGES - TRANSPORT & PLACEMENT

Technical Challenges:

- Urbanization around ports (no sponsor provided site)
- Distance to disposal site (clamshell dredging + scows)
- Mudflats fronting beneficial reuse site (shallow draft scows)
- Federal Standard (beneficial reuse more expensive)
- Annual appropriations (multi-year contracts difficult)



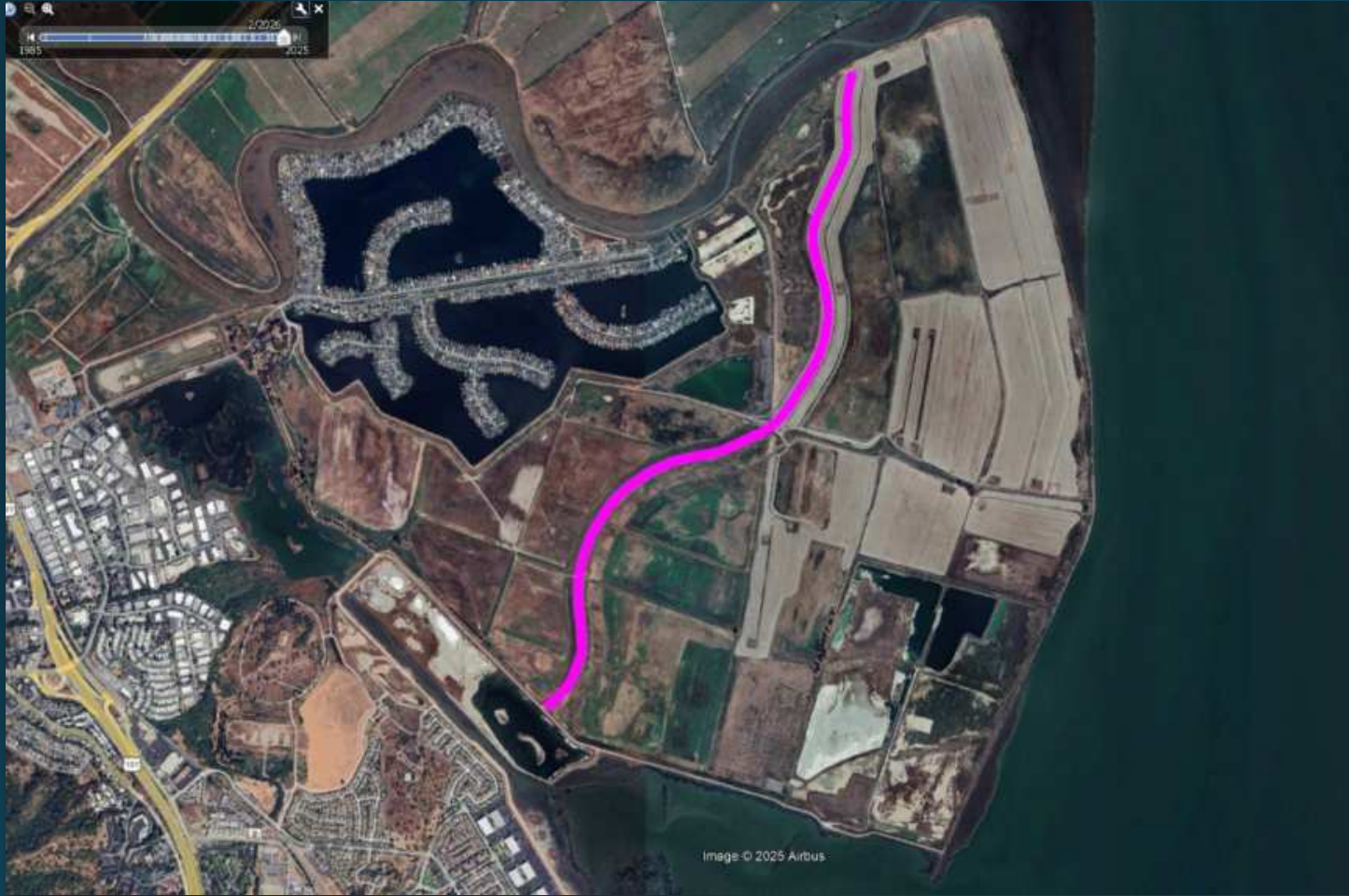
COSTS WERE LARGEST CONSTRAINT



Beneficial Reuse Costs Unsustainable....

Component	Cost	Cost/CY
Site Construction		
Design and PED	\$34.9 m	\$6.20
Construction Management	\$3.3 m	\$0.59
LERRDs and Relocation	\$2.6 m	\$0.46
Site Shaping, Culverts, and Nursery	\$26.7 m	\$4.74
Planting, Surveys, and Monitoring	\$2.0 m	\$0.36
Other	\$1.3 m	\$0.23
Off-loading/Placement Increment (HWRP Share)	\$24.9 m	\$4.42
Dredging/Off-loading (Paid by 50-Foot Project and USACE O&M Projects)		
50-Ft Project (3.46 mcy)	\$99.3 m	\$28.70
Oakland Harbor O&M (1.02 mcy)	\$23.2 m	\$22.75
Richmond Harbor O&M (0.75 mcy)	\$12.4 m	\$16.53
Pinole + RWC O&M (0.40 mcy)	\$7.6 m	\$19.00
Total Cost to Construct HWRP	\$238.2 m	\$42.31

BEL MARIN KEYS PHASED RESTORATION STRATEGY



- 1600-ac Site
- Subsided (>5' lift required for marsh elevations)
- Phase 1 (Levee) - \$18 million



FEASIBILITY STUDY - REGIONAL STRATEGY (COASTAL CONSERVANCY)

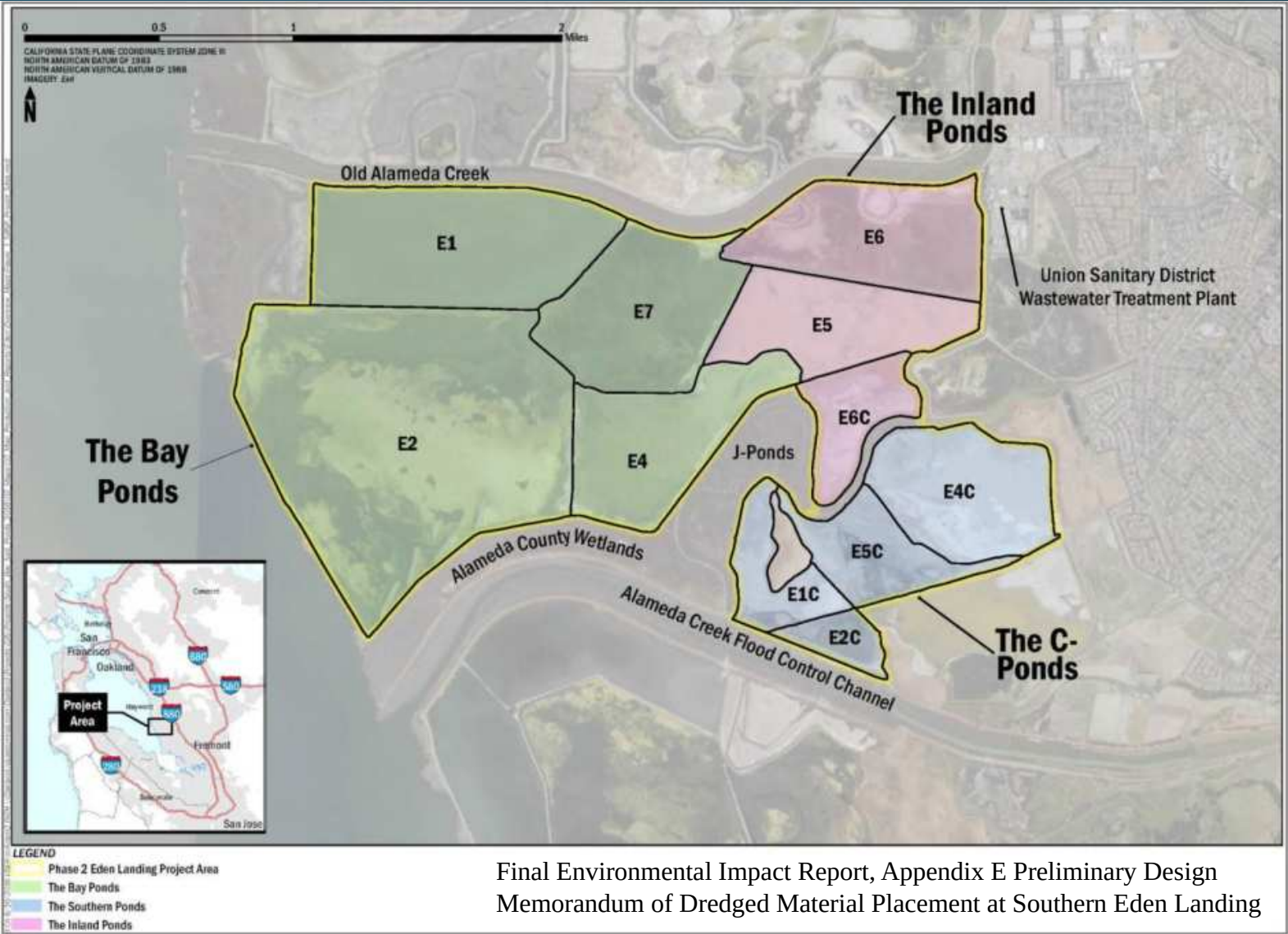
1. Evaluate beneficial use of dredged material - focus on Eden Landing Ecological Reserve
2. Develop construction costs
3. Develop contracting options for a procurement strategy
4. Include Redwood City Harbor as first project
5. Compare costs for Beneficial Reuse to Current Practices
6. Assess constraints for beneficial reuse in Bay Area

PLACEMENT LOCATION

Pond	Area (Acres)	Placement Volume (CY)
E1	297	1,052,000
E2	692	2,449,000
E4	202	501,000
E7	217	723,000
Total	1408	4,725,000

Assumptions:

- Raise pond bottoms to average elevation of +6 ft NAVD88
- Repair internal levees
- Discharge weir to Bay or Old Alameda Creek



Final Environmental Impact Report, Appendix E Preliminary Design
Memorandum of Dredged Material Placement at Southern Eden Landing

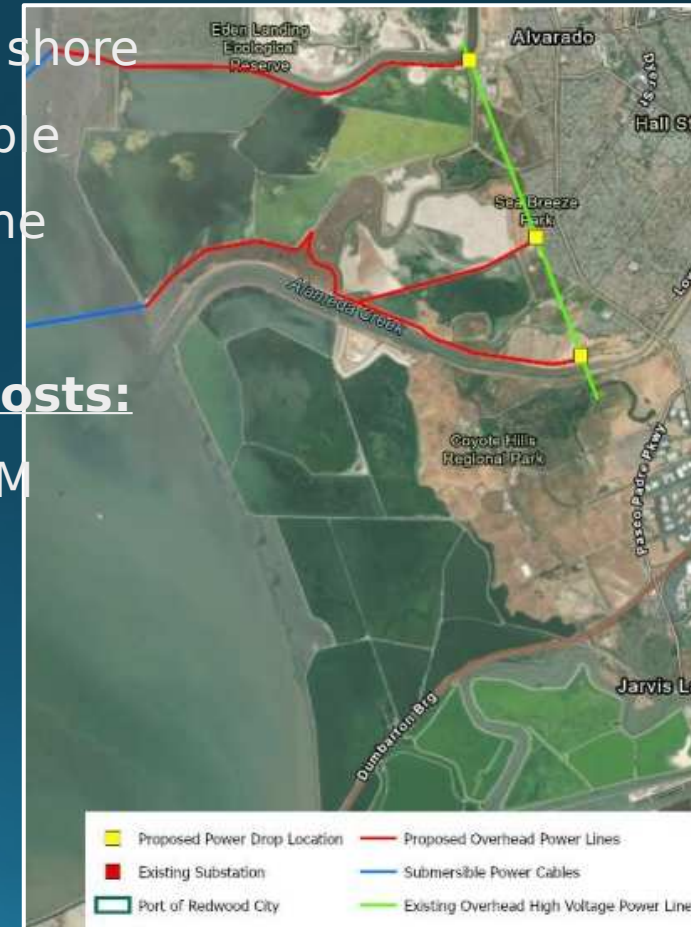
ONSITE IMPROVEMENTS



- Improve Internal Levees
- Power drop from OH transmission line
- Temporary pole line to shore
- Submersible power cable
- Shore discharge pipeline

Onsite Improvement Costs:

- Electric Option - \$14.9M
- Diesel Option - \$6.8M

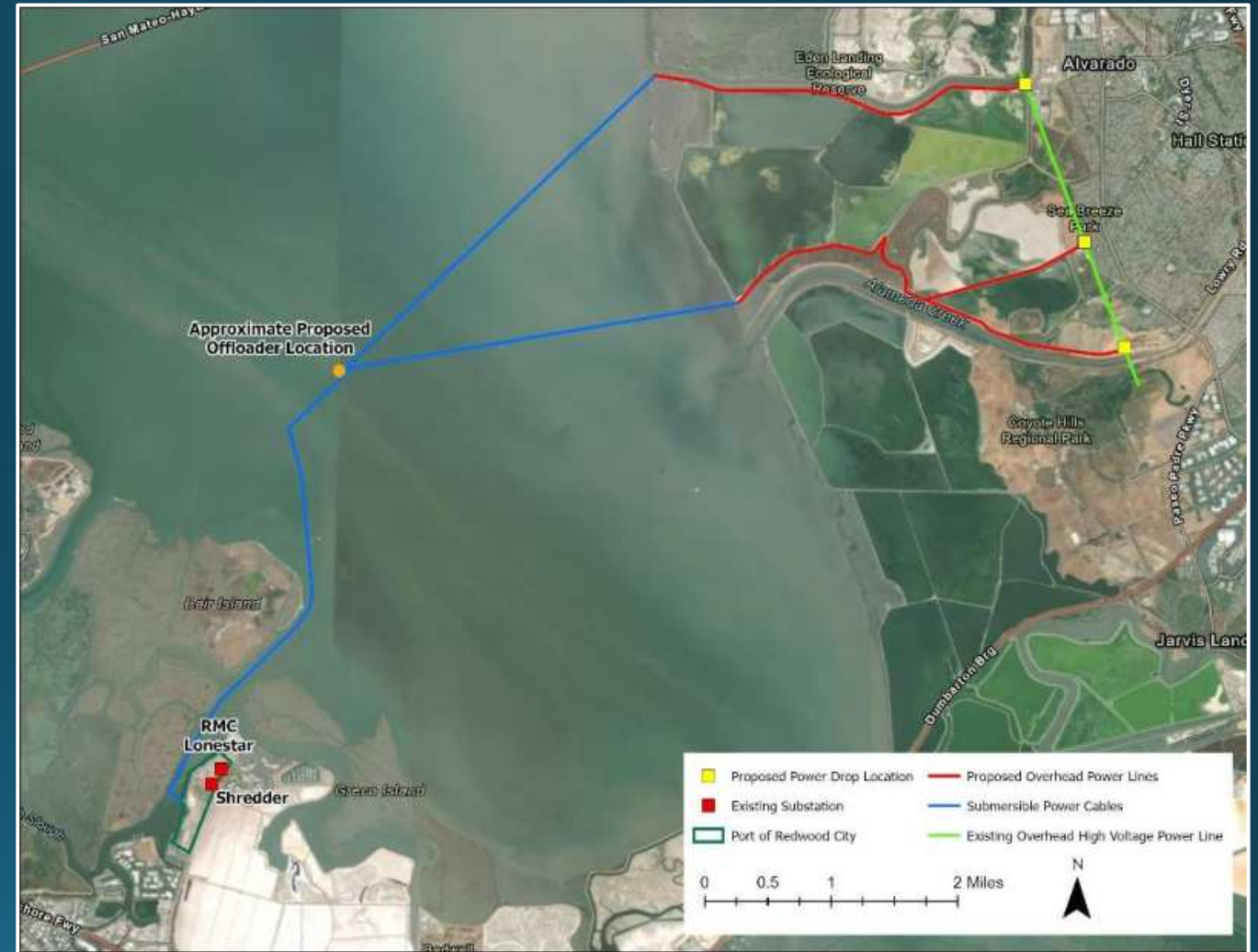


OFFSITE IMPROVEMENTS

- Offloader located near ship channel over 3 miles from Eden Landing shoreline
- Water depth of 20-25 feet to allow for fully loaded scows
- Mooring system – approx. 30 steel pilings
- Pipeline – 16,500 lf submerged pipeline
- Booster pump (s)
- Submersible power cable

Power Costs:

- Electric Option - \$6.4M
- Diesel Option - \$2.1M



COMPARISON OF COSTS

ESTIMATE DESCRIPTION	Total Project Cost (\$M)							
	Site Improvements	Mob/Demob	Dredging & Transport	Offloading	Remaining Dredging	Site Management	Total*	Difference
Current Disposal Practice Oakland/Redwood City (over 7-Years)	N/A	\$16.5	\$195.4	N/A	N/A	N/A	\$212.0	-
Concession Model* Oakland/Redwood City (compressed schedule)	\$9.0	\$14.9	\$75.9	\$41.2	\$88.4	\$4.2	\$233.5	+\$21.5
USACE Model Oakland/Redwood City (Bundled)	\$5.1	\$46.0	\$75.9	\$42.5	\$88.4	\$5.9	\$263.7	+\$51.7

*The SBSP project would have to upfront about \$60 million and recoup a significant portion of this cost via a tipping fee

SUMMARY

1. Costs for Beneficial Reuse at Eden Landing → \$22 to \$52 million over 7 yrs
2. A Tipping Fee based model works out to an additional cost of about \$3 million/yr to the region BUT Significant Upfront Costs
3. Competition with other Reuse sites will remain (Montezuma, Cullinan, Others)
4. Long-Term Changes needed for shift from Aquatic to Beneficial Reuse
 - Partnering with and Supporting USACE
 - Non-O&M Program Funding Source(s) at time of bids
 - Bundling/Streamlining Multiple Projects Essential
 - Explore Multi-year Dredging Contracts
 - Re-evaluate Hydraulic Dredging option
 - Include In-Bay Beneficial Reuse within mix

[credits – prior SCC work, dredgers, others]

HOW TO INCREASE BENEFICIAL REUSE?

1. If you build it, will they come?
 - Montezuma, Bair, Cullinan worked....
 - Corps commitment needed to include BR as alternative (already doing that.....but costs are significantly higher)
2. How to address Federal Standard for baseline costs?
 - Cover incremental costs for beneficial reuse (regional partnerships)
 - Leverage EVERY New Work project for building site infrastructure to accommodate future O&M material
 - Restoration community's acceptance that restoration \$\$ are better leveraged by building infrastructure (site & offloading infrastructure)
 - Offloader via private enterprise with public \$\$ (tipping fee) (Bair Island, Montezuma, landfills are models)

Questions

