EAST BAY MUNICIPAL UTILITY DISTRICT

Mitigating Risk to Underwater Crossings to Improve Water Supply Reliability: Two Case Studies

10th CTWWA/JWWA/WRF Water System Seismic Conference

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Serge Terentieff, P.E., G.E.

Outline

- Background
- Risk Assessment
- Mitigation Strategy
- Summary

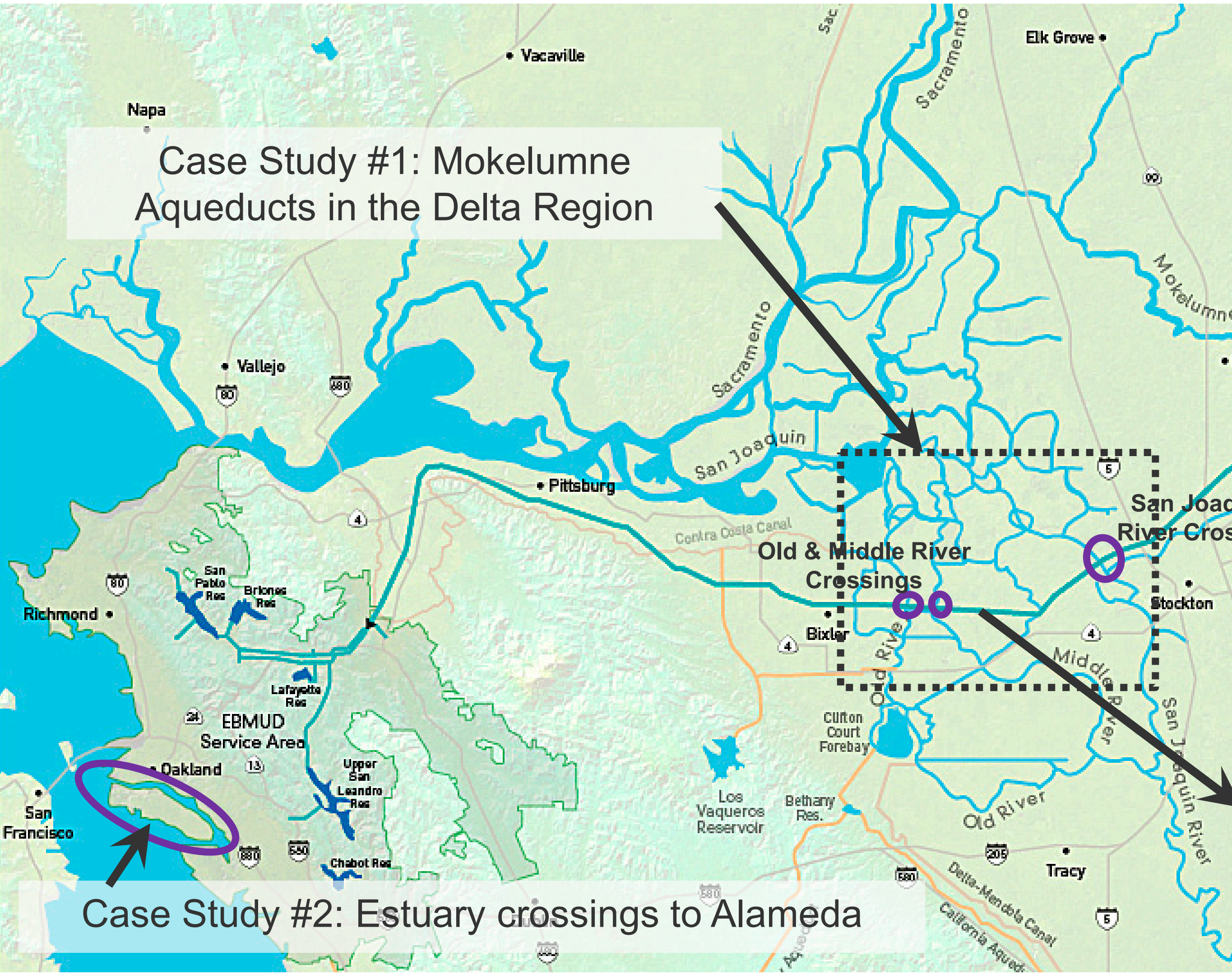
Case Study #1
Raw water supply: Aqueduct Interconnections & River Crossing Repair Concept

Case Study #2
Potable water supply: Alameda estuary crossings

EBMUD Water Supply System

Case Study #1: Mokelumne Aqueducts in the Delta Region

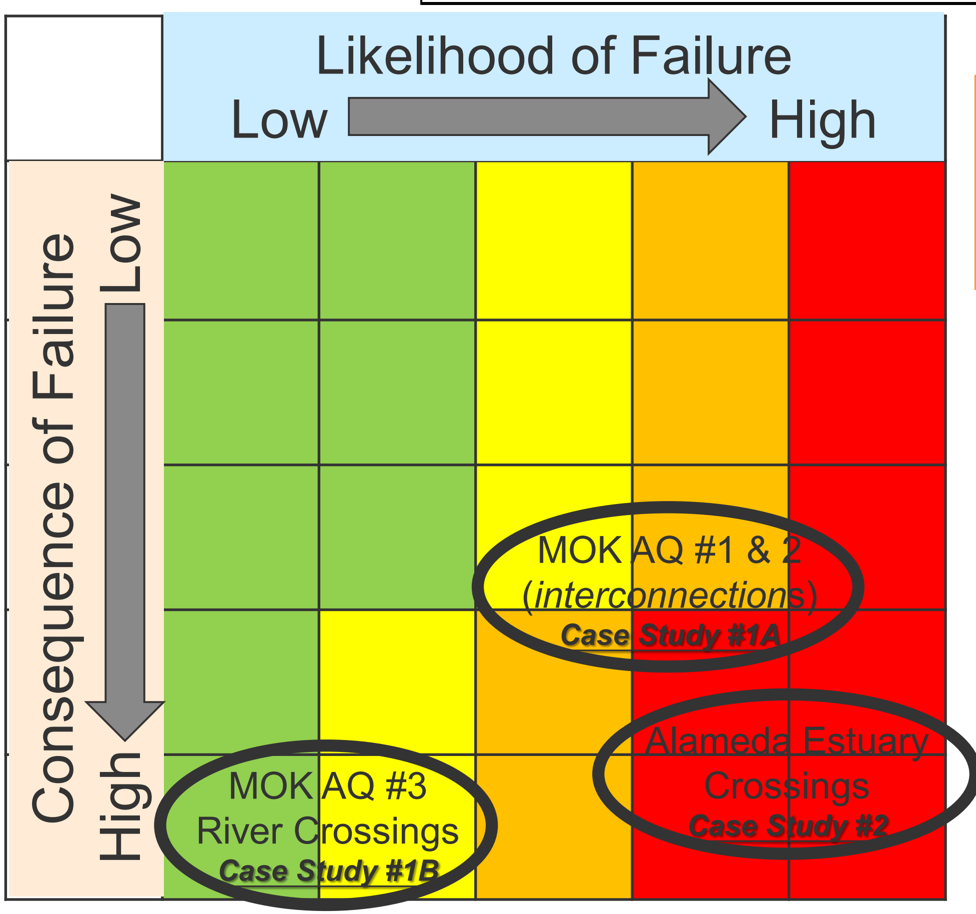
Case Study #2: Estuary crossings to Alameda



Risk-Based Approach to Assess LOF & COF and Guide Mitigation Strategy

LOF **COF**

RISK = (Likelihood of Failure) x (Consequence of Failure)



The probability an underwater crossing will fail

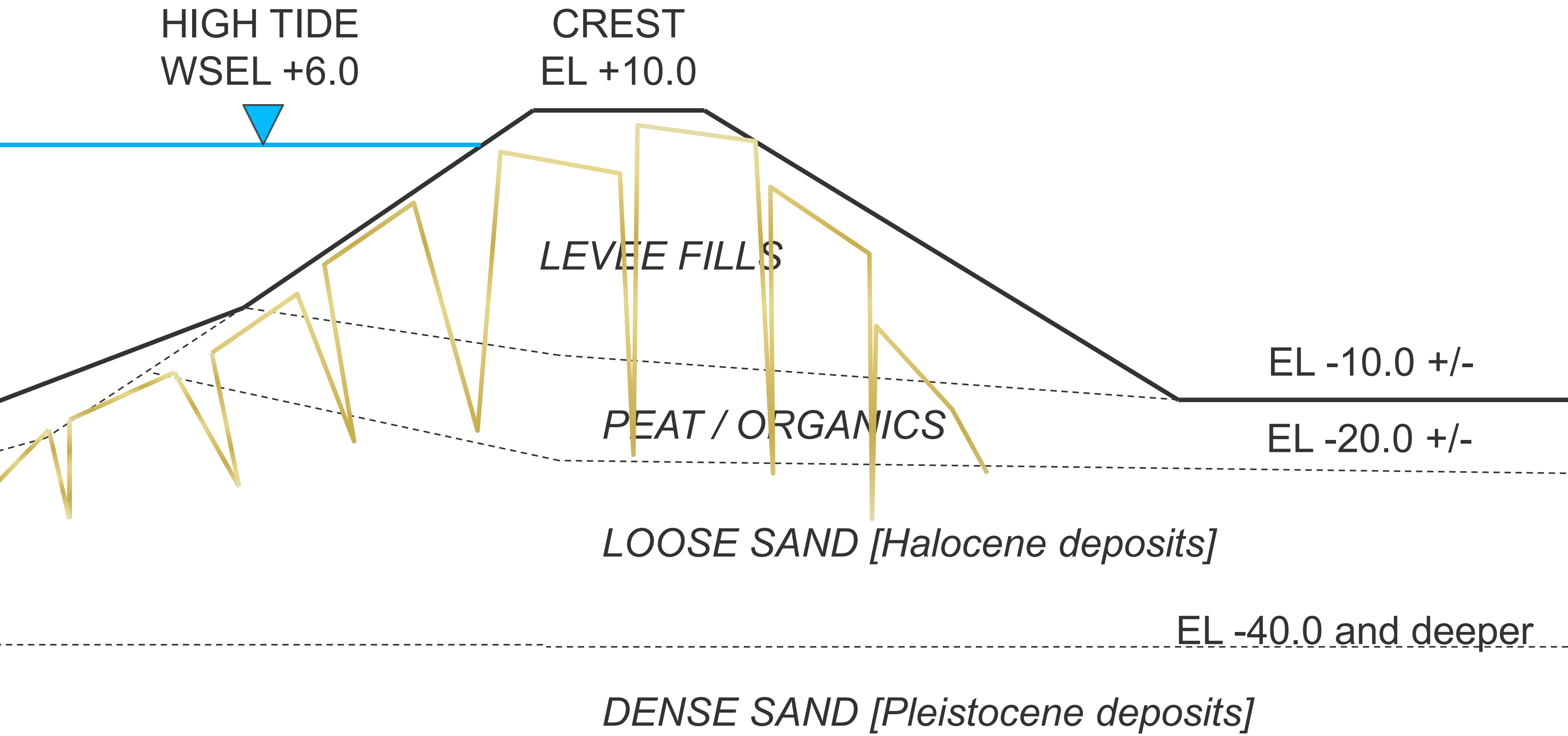
The resulting magnitude of consequence if the underwater pipe breaks

Case Study 1: Natural Hazards & Risks to Mok AQs in the Delta

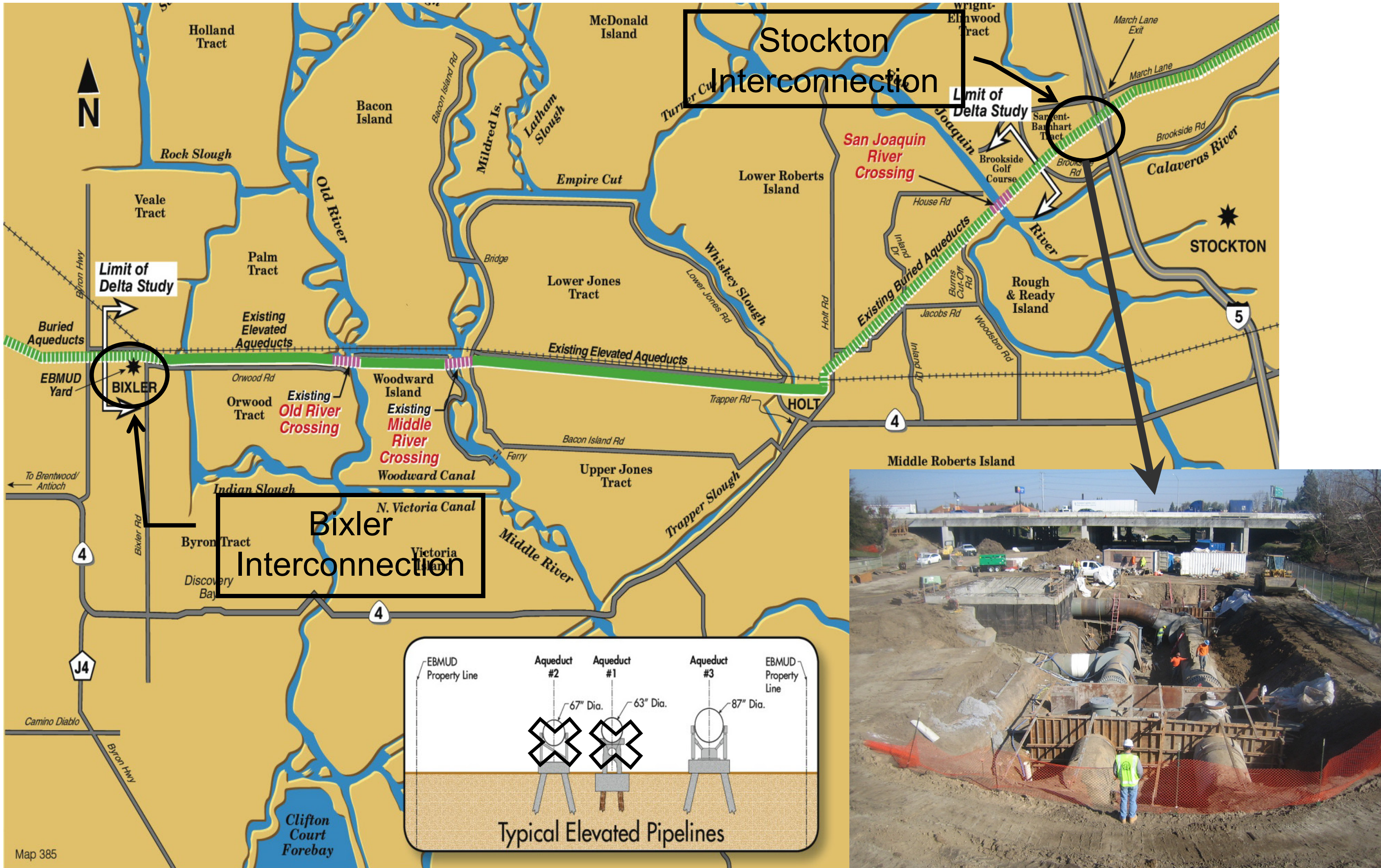
EBMUD

- Natural hazards:
  - Flooding
  - Seismic Events
  - Subsidence
- Risk to AQs:
  - Structural failure of AQ #1 & 2
  - Damage from levee failure & flooding
  - Damage to AQ #3 at a river crossing

Typical Levee Cross-Section



Case Study 1A: Risk to MOK AQs #1 & 2: High Likelihood/Consequence

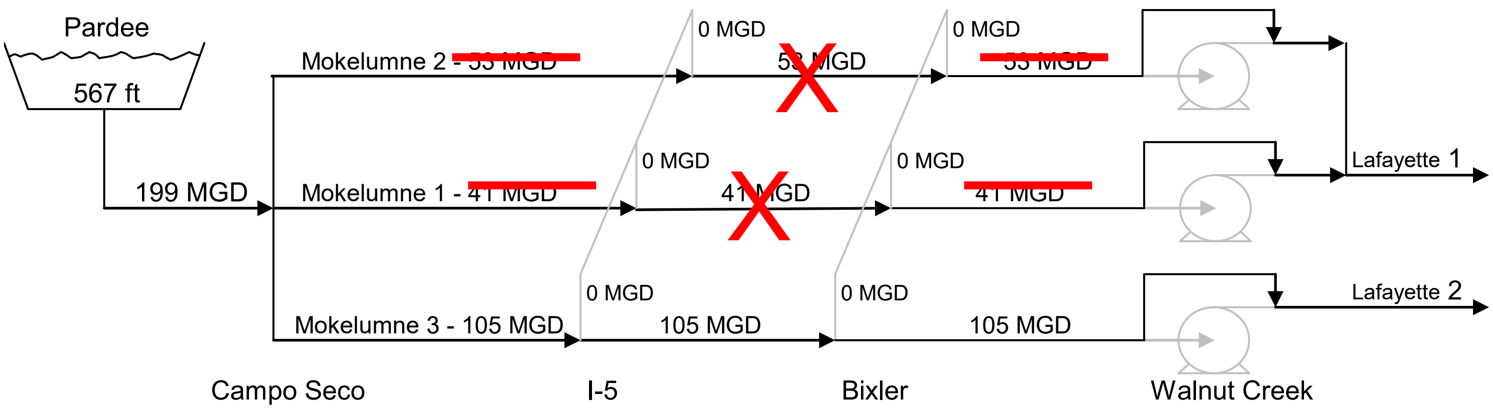


Delta Interconnections to Mitigate Risk to MOK AQs #1/2

EBMUD

To increase Mokelumne Aqueduct conveyance following Delta emergency events

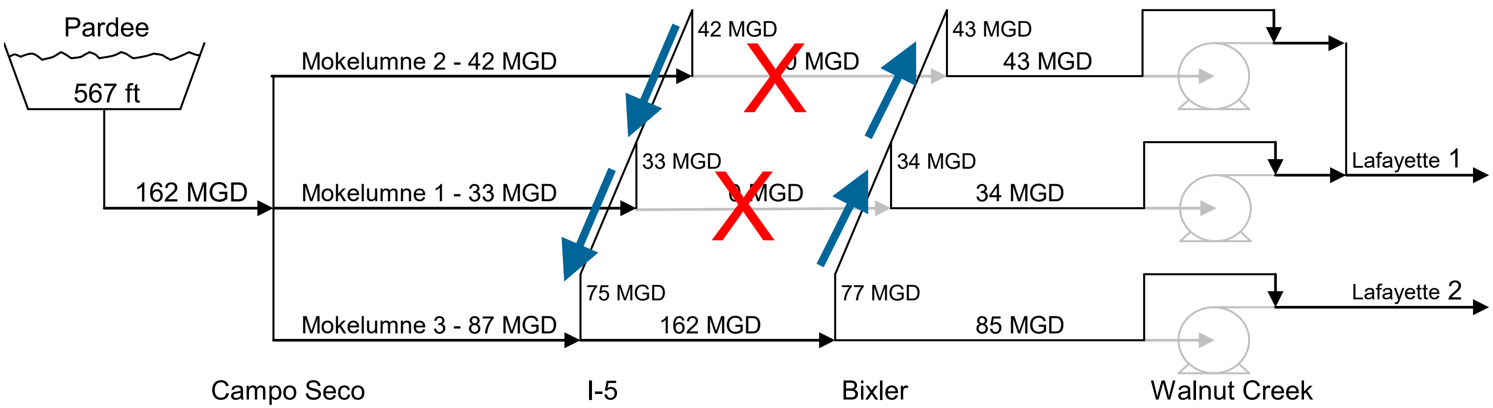
Aqueducts without Delta Interconnections



Post-Disaster Gravity Flow Capacity

= 105 MGD

Aqueducts with Delta Interconnections



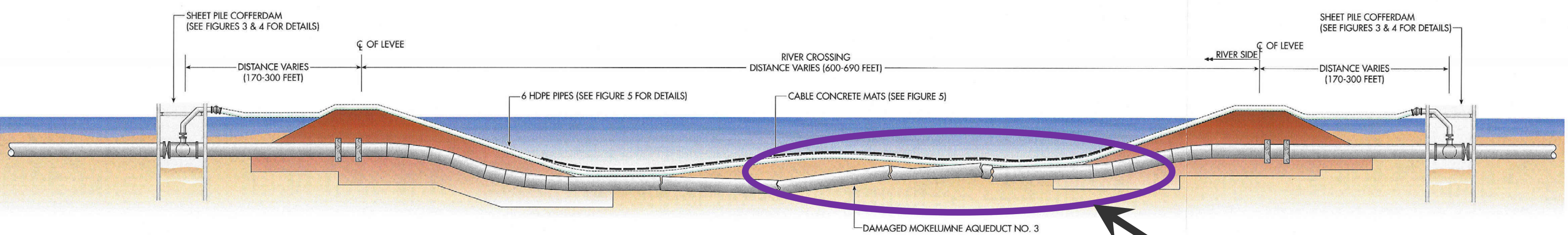
Post-Disaster Gravity Flow Capacity

= 162 MGD

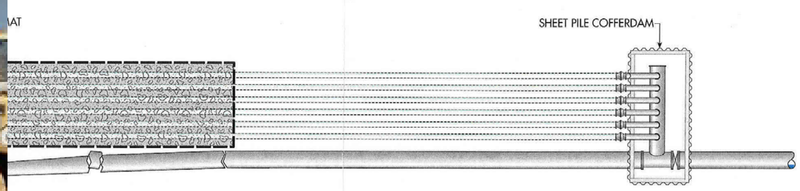
Case Study 1B: Risk to MOK AQ#3 @ River Crossings

Low Likelihood/High Consequence Event:

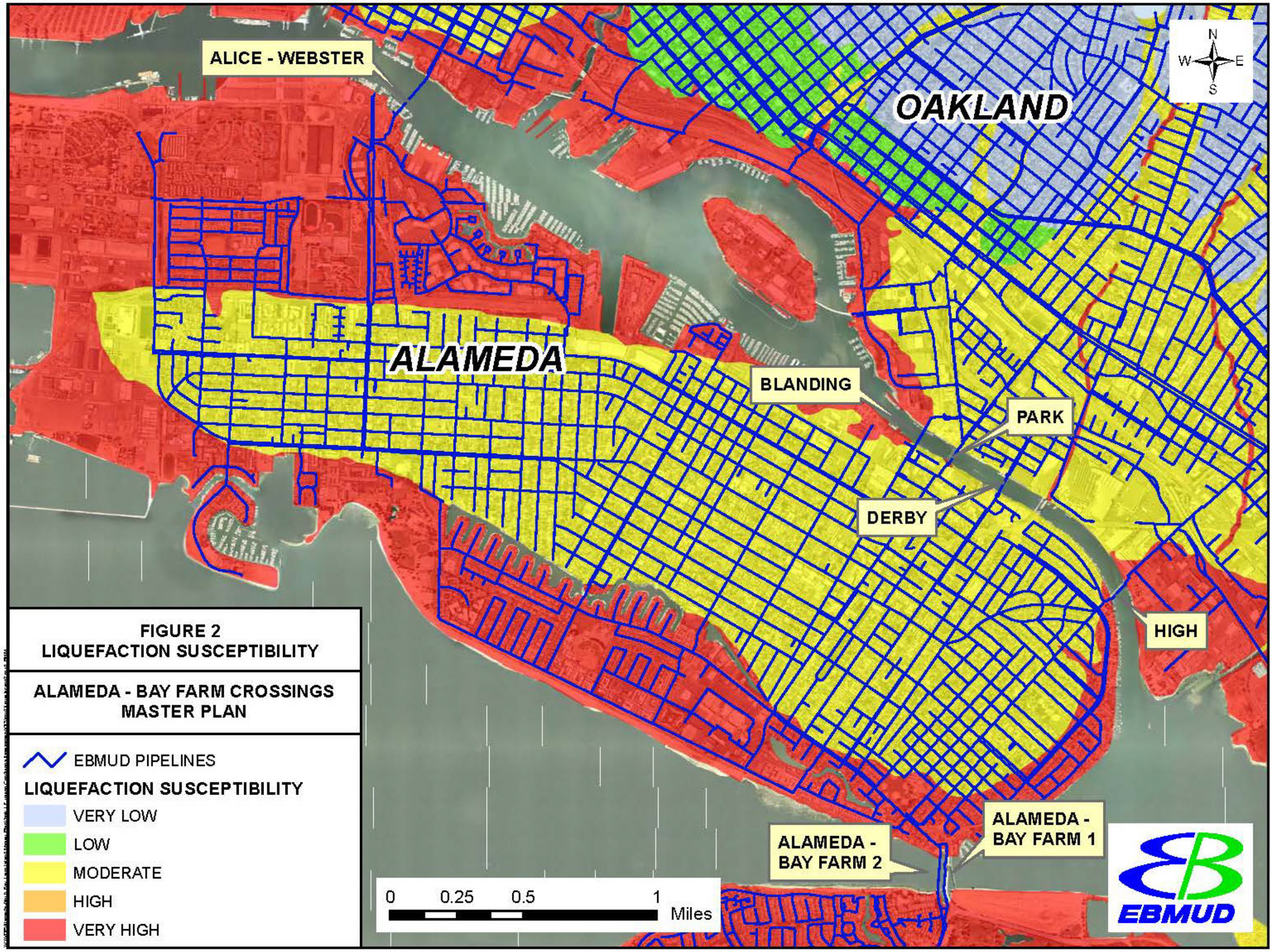
AQ No. 3 River Crossing Repair Concept at San Joaquin River



- Conventional Repair ~ 8+ Months
- Terminal Storage ~ 6 Months
- “Float & Sink” Repair ~ 6 Months

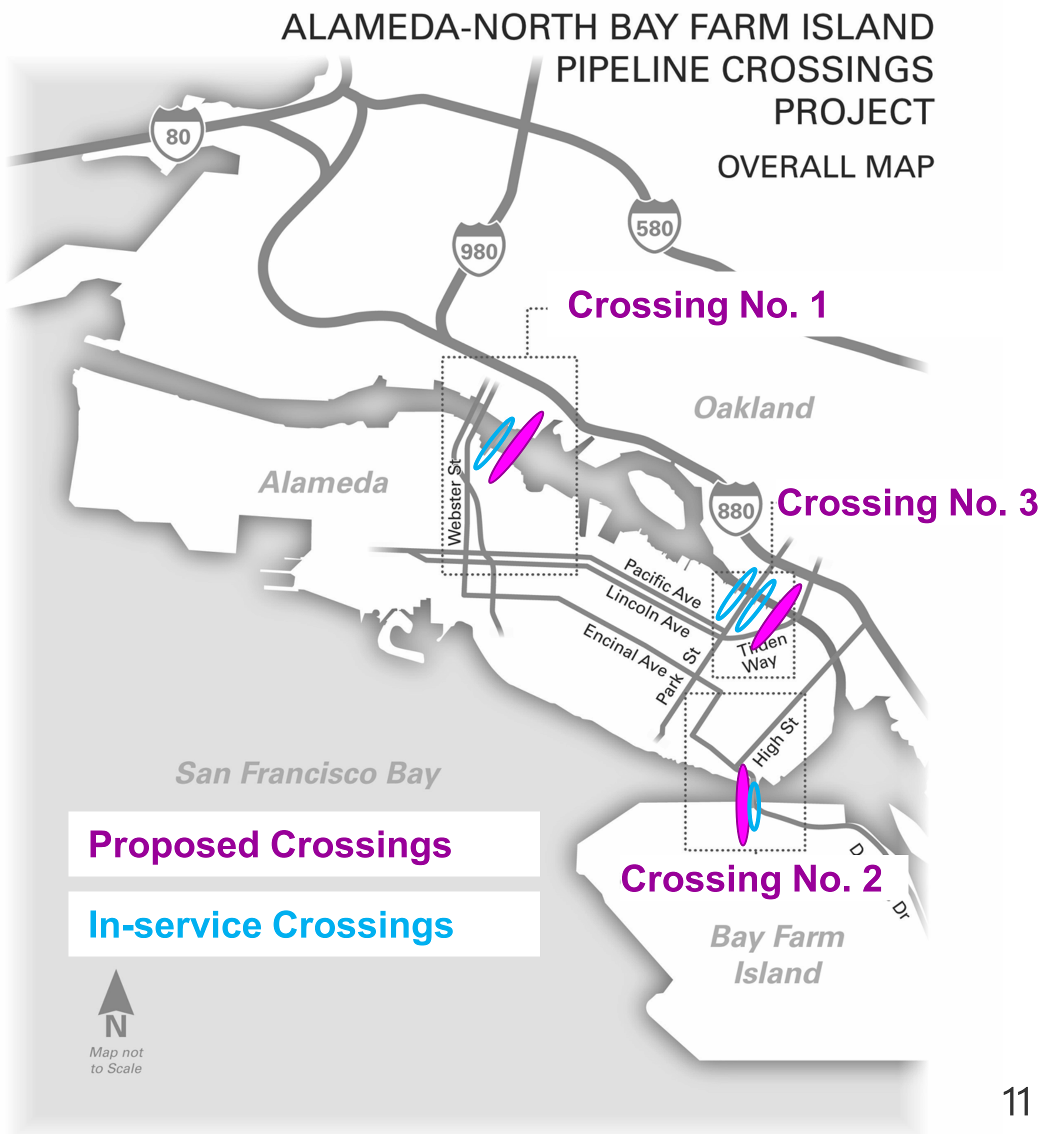


Case Study 2: Natural Hazards & Risks to Estuary Crossings



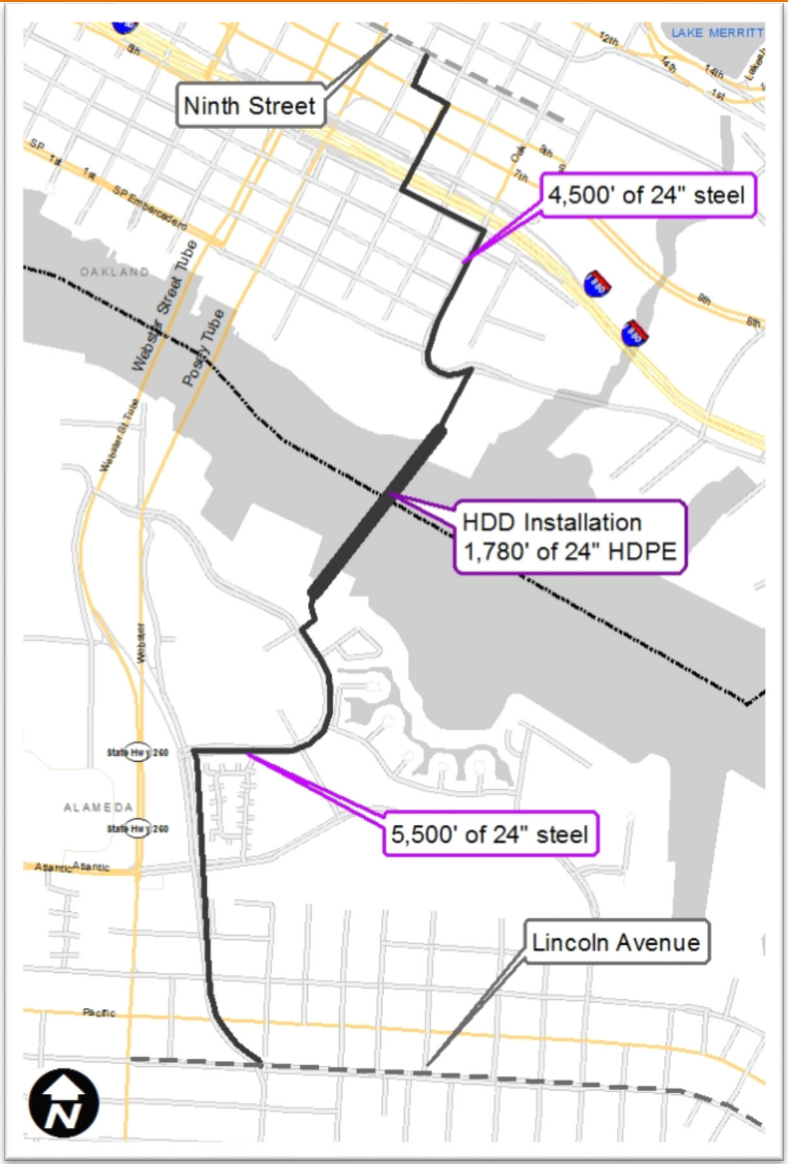
Case Study 2: Alameda Estuary Crossings: Overview & Purpose

- Severn underwater pipelines crossings built (1917 – 1987)
- Four crossings remain in-service today
- Three new 24" crossings & open-trench pipelines needed
- Ensure long-term reliability and redundancy
- Meet existing and future demands
- Repair and replace aging infrastructure

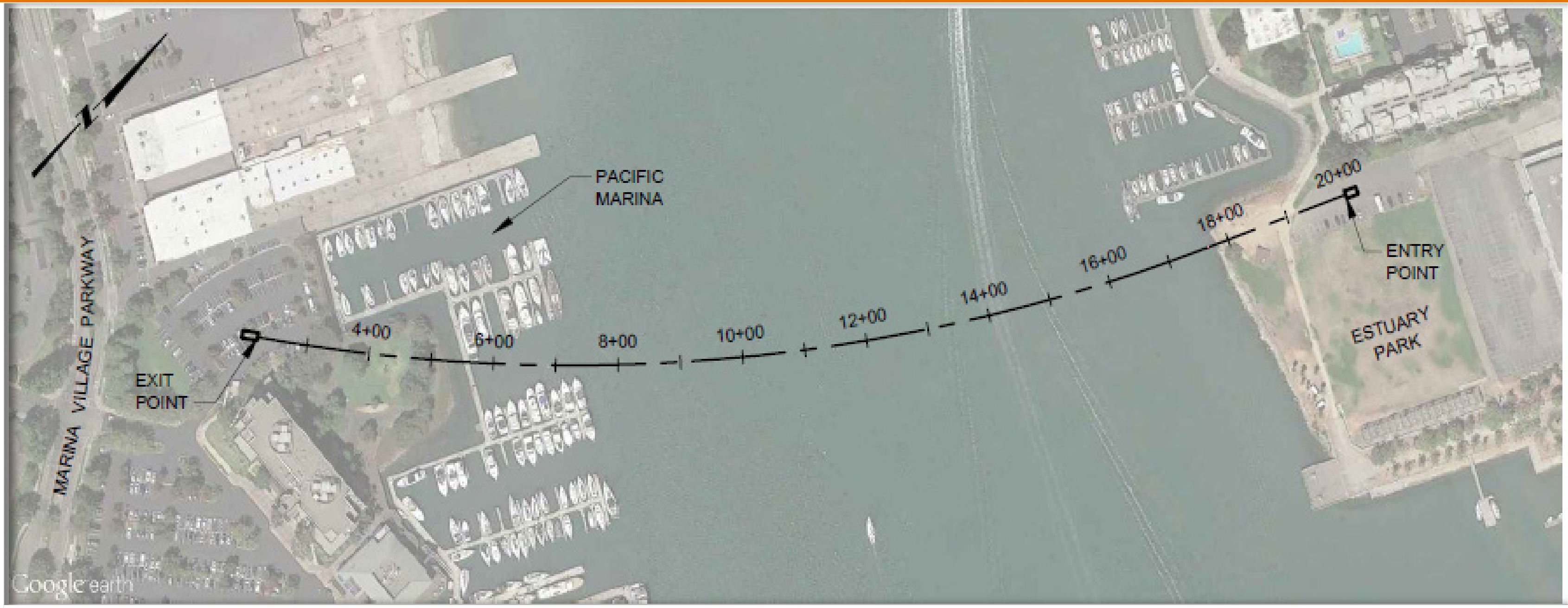


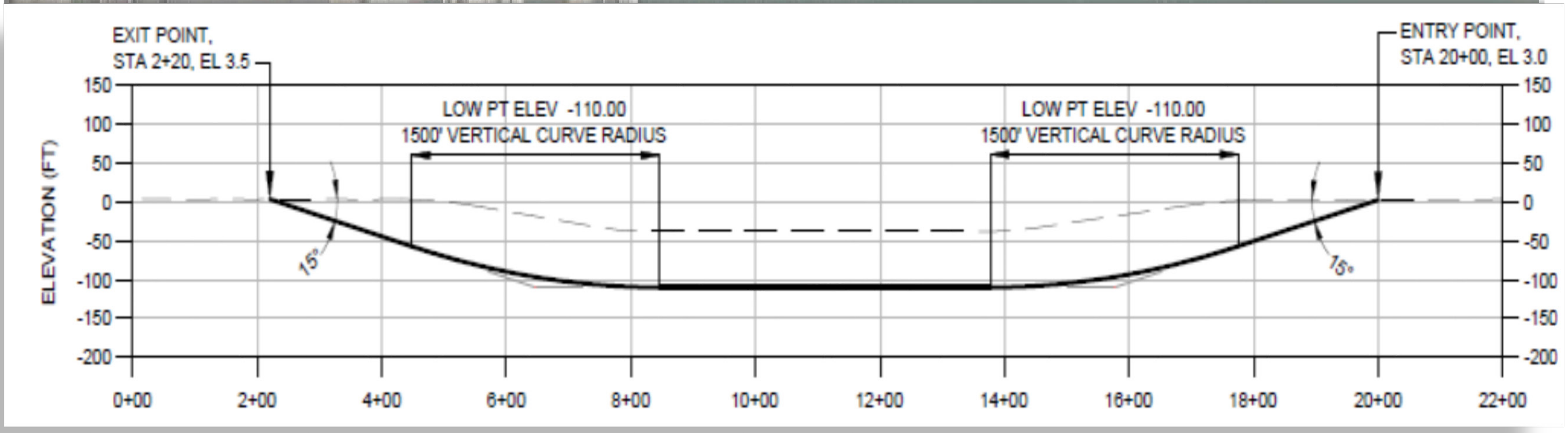
Selected Project: Crossing No. 1

- Install 1,780 feet of 24-inch HDD pipeline in new alignment
- Install ~5,000 feet of connecting pipeline on each side
- Estimated project cost = $14M



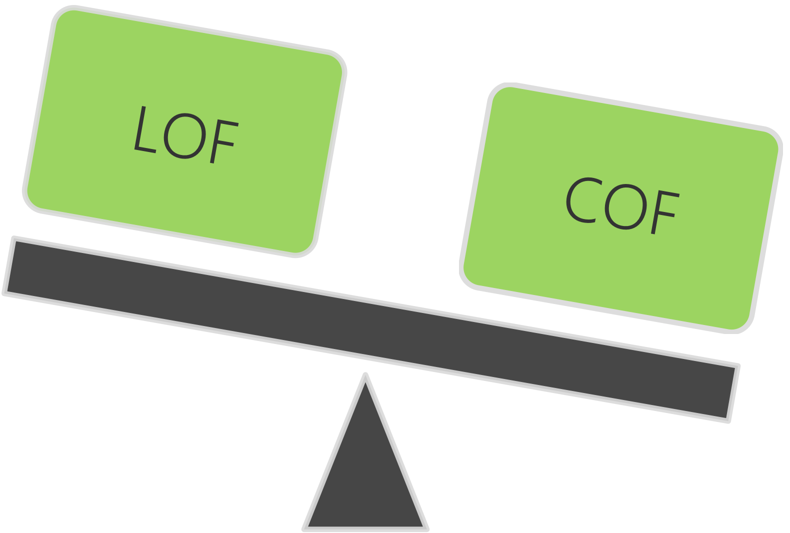
HDD Option: Selected Project





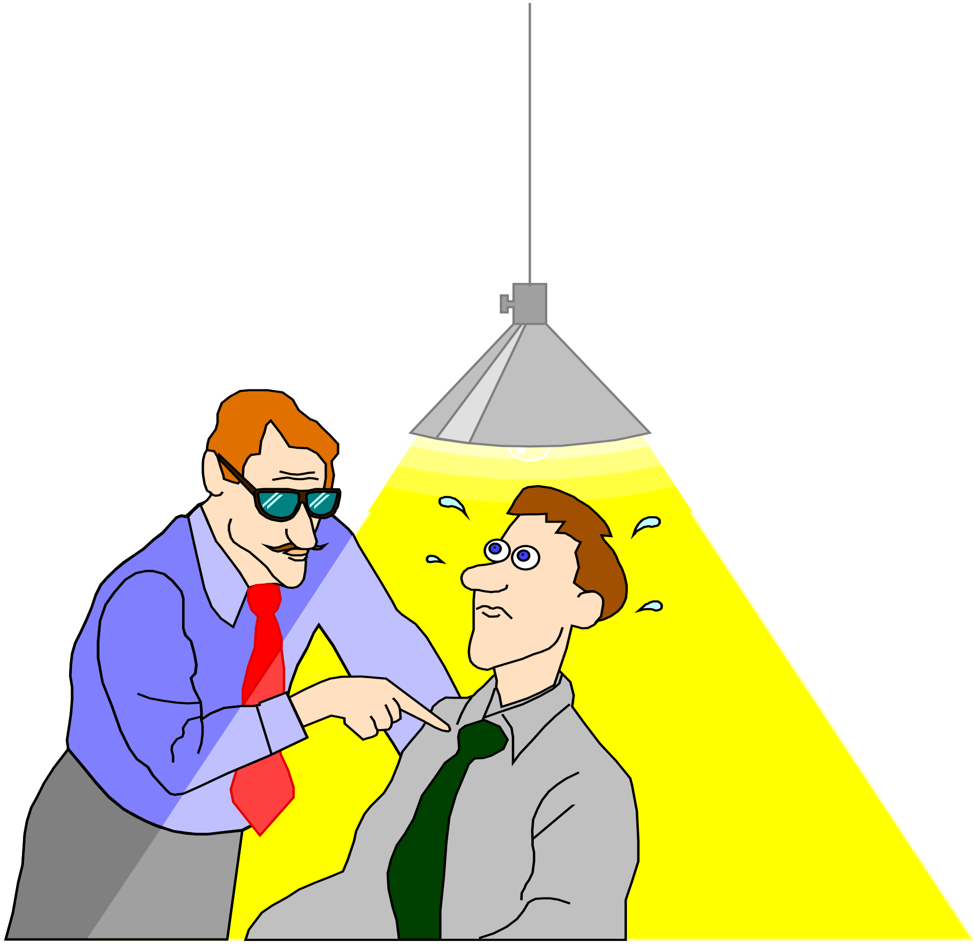
Summary

- Assess risk, considering LOF and COF
- Adopt a mitigation strategy based on risk/consequence:
  - Case Study #1A: Pre-disaster mitigation (High LOF & High COF)
  - Case Study #1B: Post-disaster response (Low LOF & High COF)
  - Case Study #2: Pre-disaster mitigation (High LOF & High COF)



Thank you for your kind attention

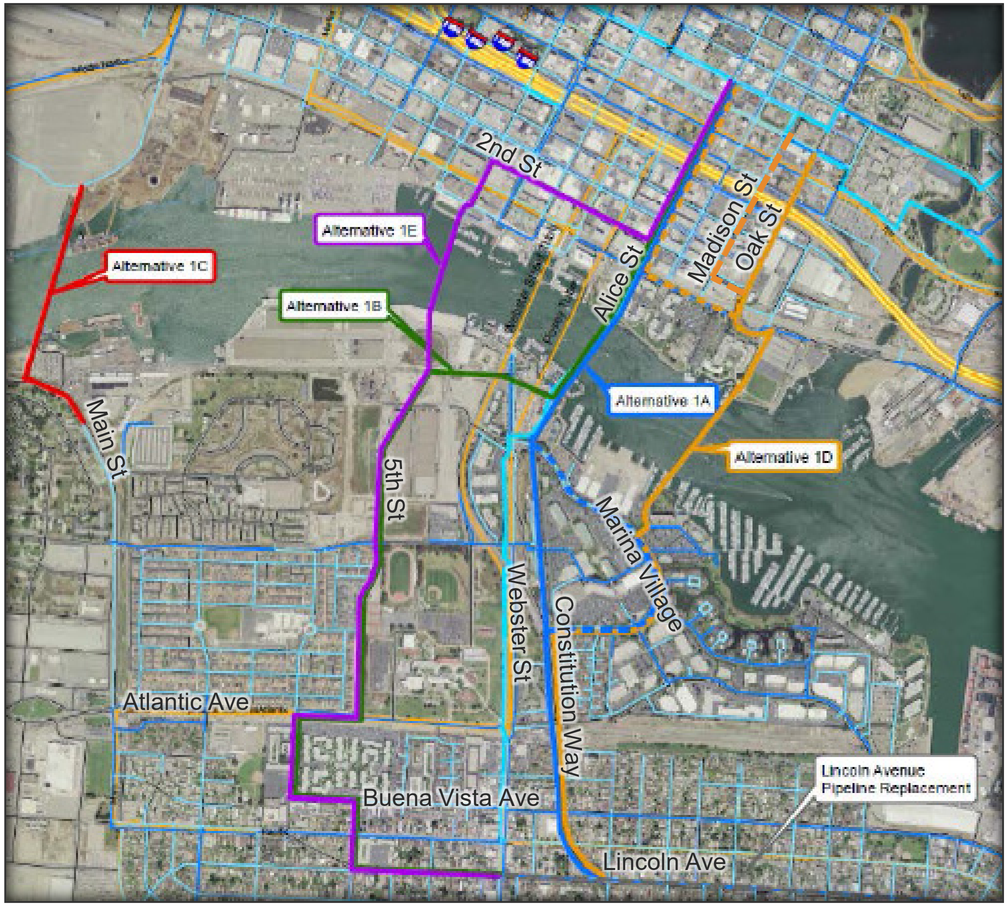
Questions?



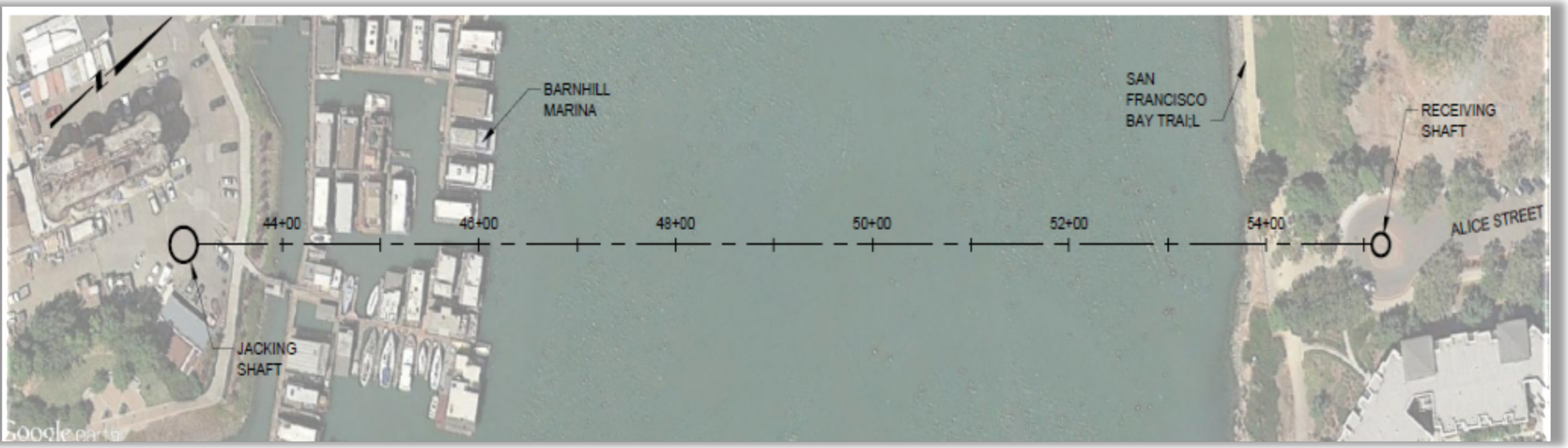
Serge Terentieff
serge.terentieff@ebmud.com

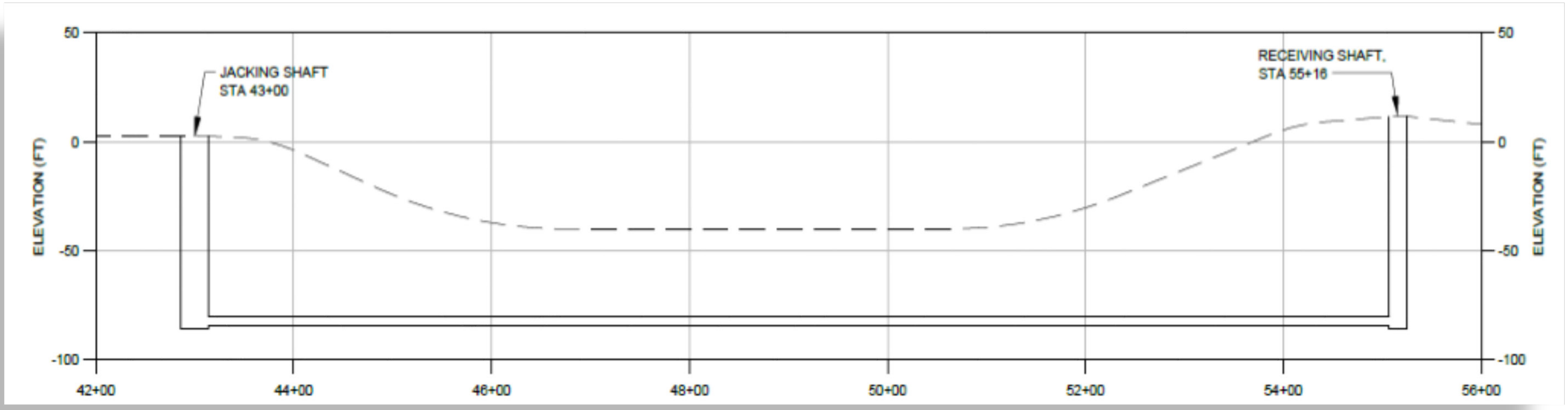
Alternative Alignments for Crossing No. 1

- Alice-Webster vicinity
  – 5 alternatives
- Northeast corridor – 4 alternatives
- Connection to Bay Farm Island
  – 2 alternatives



Microtunneling Option





Jet Grouting to Reduce Potential for Differential Settlement