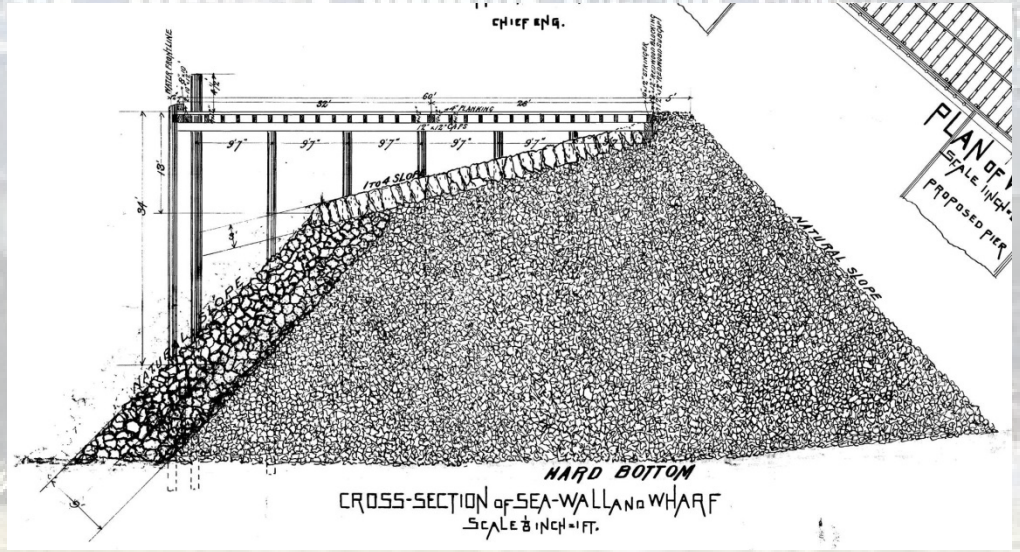
Informational Presentation

Earthquake Vulnerability Study of the Northern Waterfront Seawall

Progress Update



Port Commission Meeting - October 13, 2015

Steven Reel, Project Manager, Engineering Division

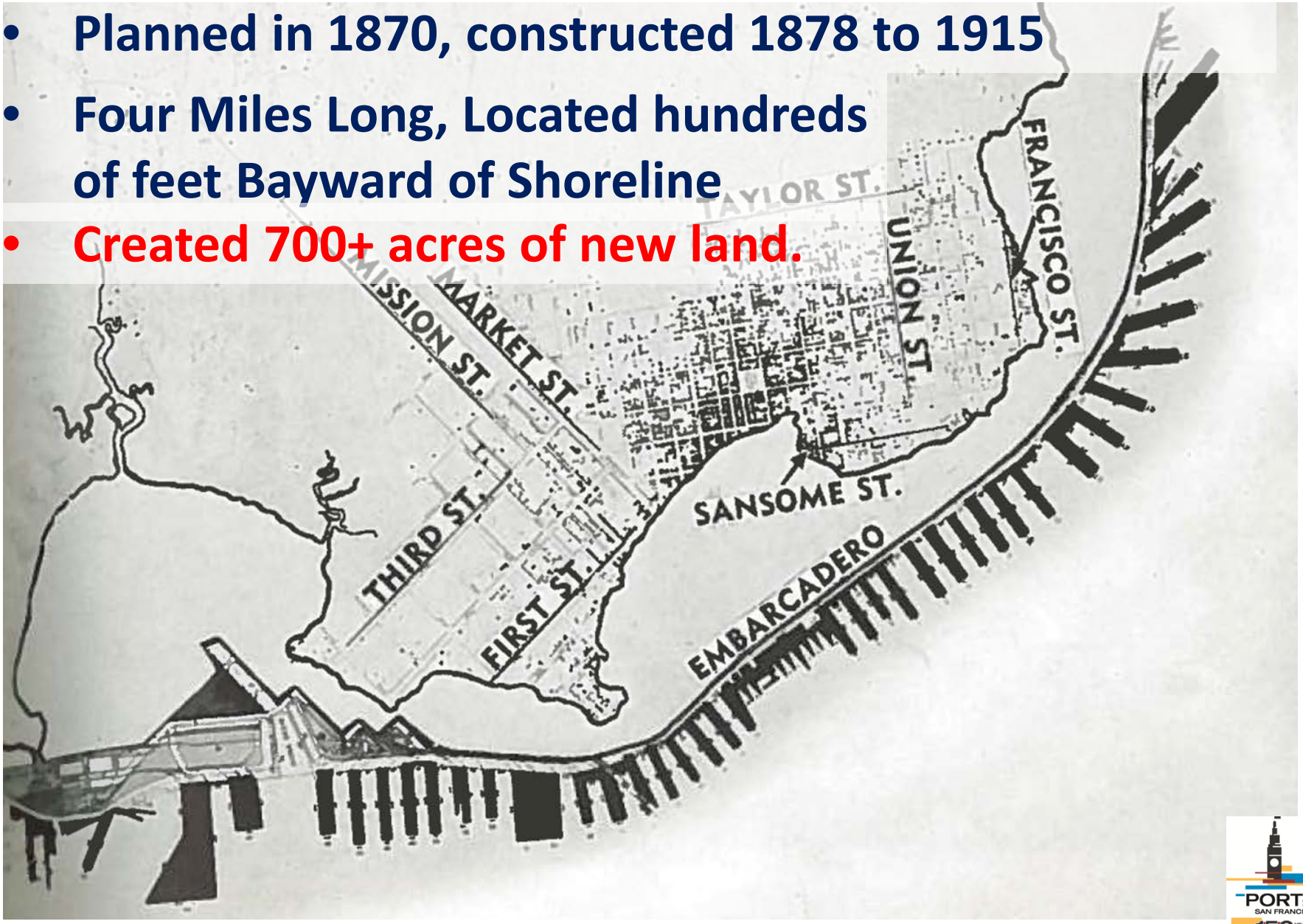
PORT OF SAN FRANCISCO 150 YEARS

1850s San Francisco near downtown

387. Ebb Tide, South Beach, San Francisco.

Great Seawall 1878 - 1915

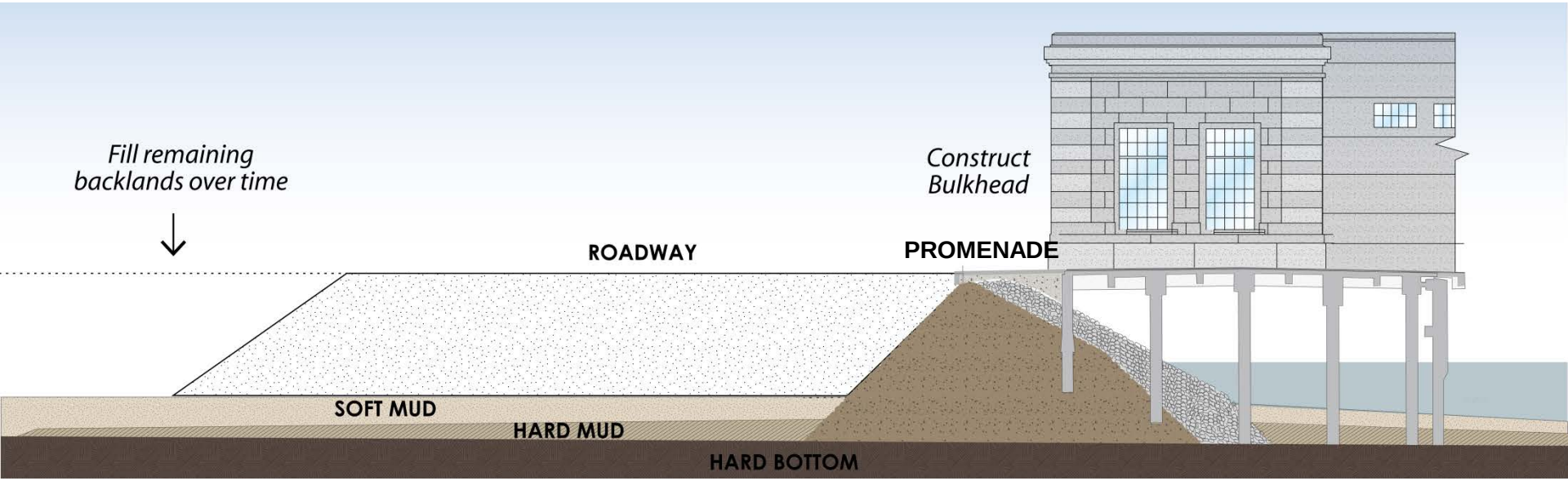
- Planned in 1870, constructed 1878 to 1915
- Four Miles Long, Located hundreds of feet Bayward of Shoreline
- Created 700+ acres of new land.



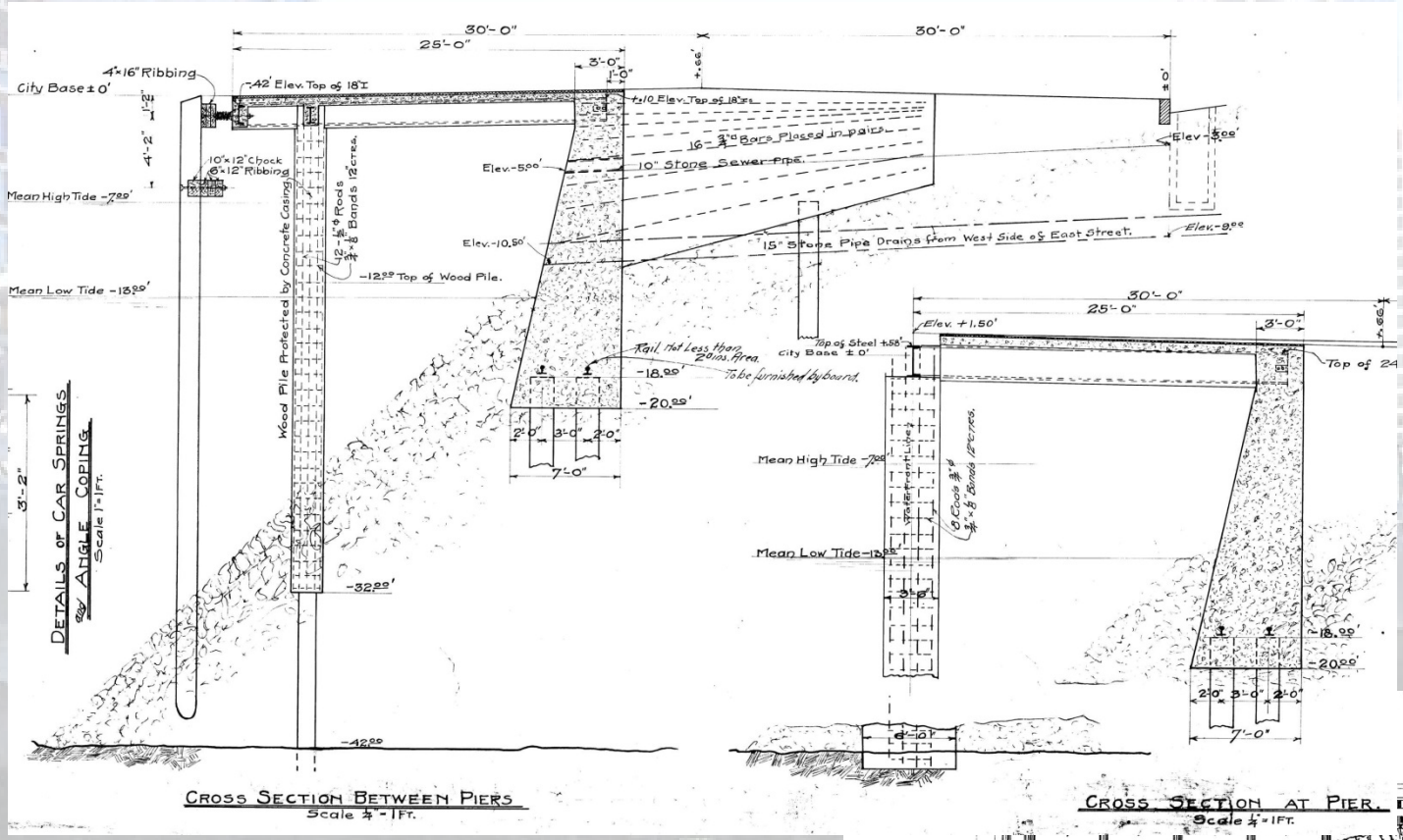
160 Years Later

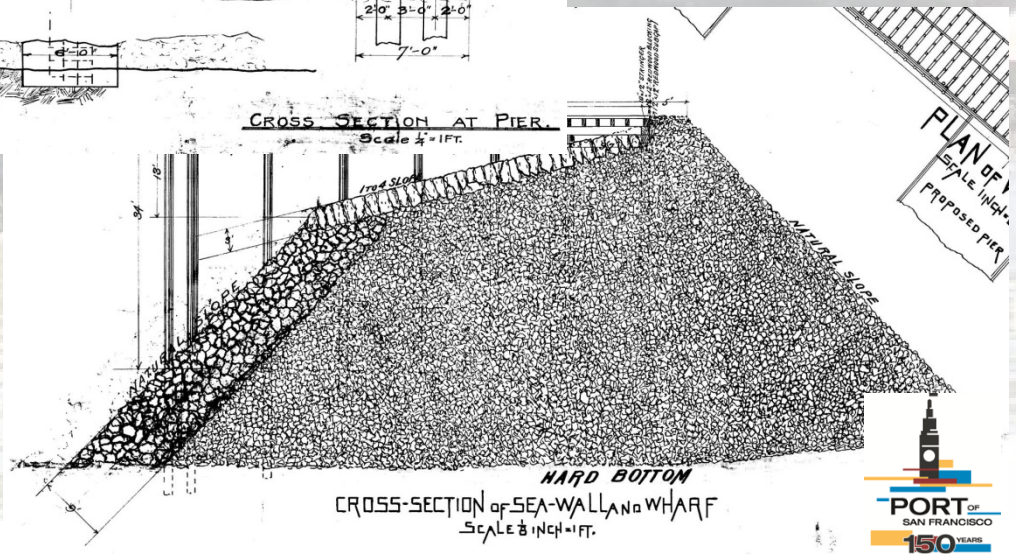
Design & Construction

Choose elevation that has worked well, approximately 8-1/2 feet above Mean Sea Level and 3 feet above the Highest Recorded Tide



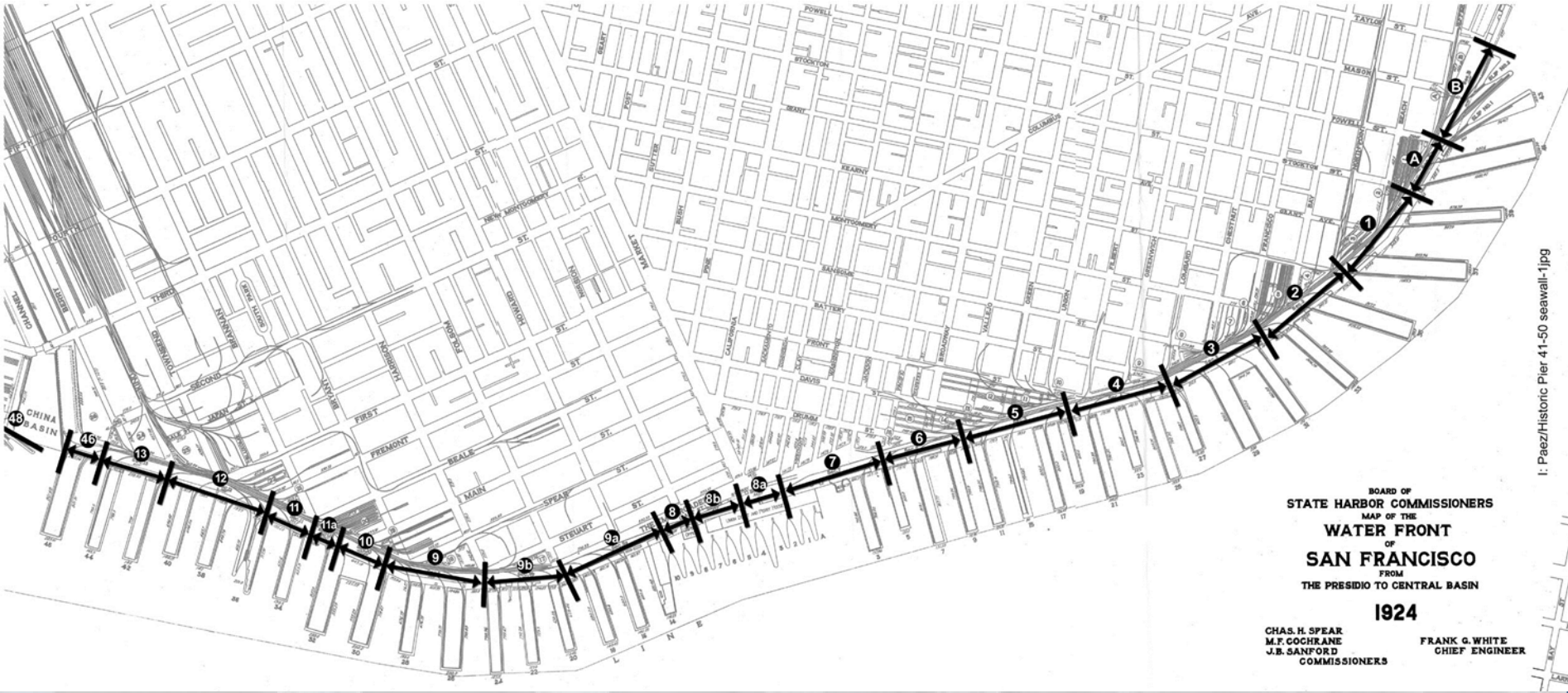
Section 11 Design - October 15, 1909





Section 11 Construction – June 8, 1910

Section 11 - Today



22 Historic Seawall Sections – 1924 Map

B, A, 1, 2, 3, 4, 5, 6, 7, 8a, 8b, 8, 9a, 9b, 9, 10, 11a, 11, 12, 13, 46, 48

55 Combinations of Bulkheads and Wharves

Vulnerability Study Contract Information

Prime Consultant - GHD/GTC Joint Venture

GHD – Multinational Firm, SF Office

GTC – SF LBE Geotechnical Firm

25% LBE Subconsultant Participation Goal

$425,000 Contract

Target Completion early 2016

Vulnerability Study Contract Scope

High Level Screening Approach based on Available Information

Phase 1: Comprehensive Information Review and Evaluation (COMPLETE)

Phase 2: Vulnerability Analysis (UNDERWAY)

Phase 3: Mitigation Alternatives and Recommendations (UNDERWAY)

Peer Review by Separate Contract (PENDING)

Vulnerability Study Contract Scope

- Establish Zone of Influence
- Develop detailed subsurface maps & profiles
- Generate site specific earthquake hazard ground shaking data
- Analyze rock dike for stability and upland areas for lateral spreading and settlement
- Structural analysis of select bulkhead walls and wharves

Vulnerability Study Contract Scope

- Map utilities and assess impacts
- Assess post earthquake flood hazards
- High level economic impact analysis
- Develop conceptual level mitigation measures
- Rank and prioritize areas for mitigation and/or detailed investigation

LEGEND

- Seawall Bulkhead
- Lateral Spread Hazard Boundary (HLA et al., 1992)
- Project Study Area, within 1200 feet of the Seawall Bulkhead and within the Lateral Spread Hazard Zone

0 500 1,000 2,000 Feet

Lateral Spread Boundary Source: Harding Lawson Associates (HLA), Dames & Moore, Kennedy/Jenks/Chilton, EQE Engineering, 1992. Final Report, Liquefaction Study, North Beach, Embarcadero Waterfront, South Beach, and Upper Mission Creeek Area, San Francisco, California.

Zone of Influence – Study Boundary

PORT OF SAN FRANCISCO 150 YEARS

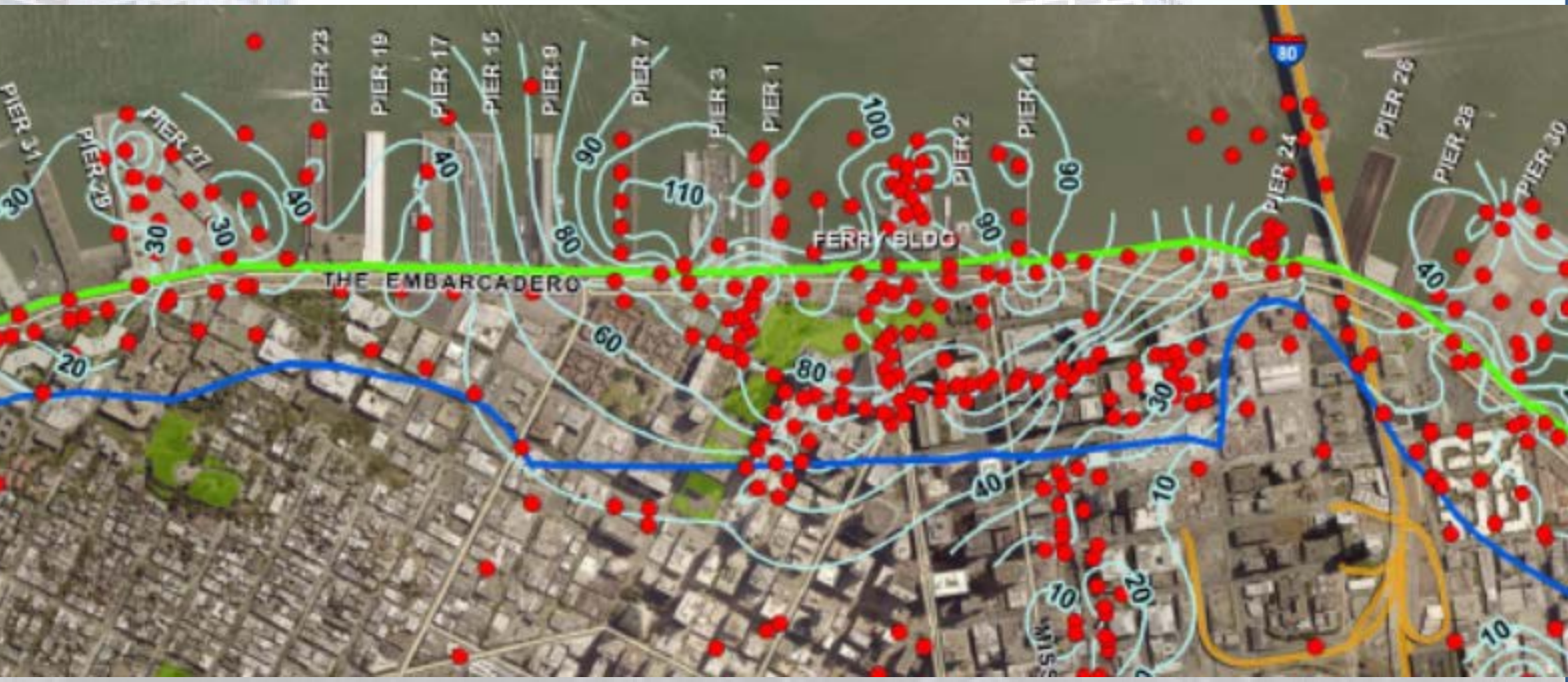
Subsurface Mapping – Artificial Fill Thickness

PORT OF SAN FRANCISCO 150 YEARS

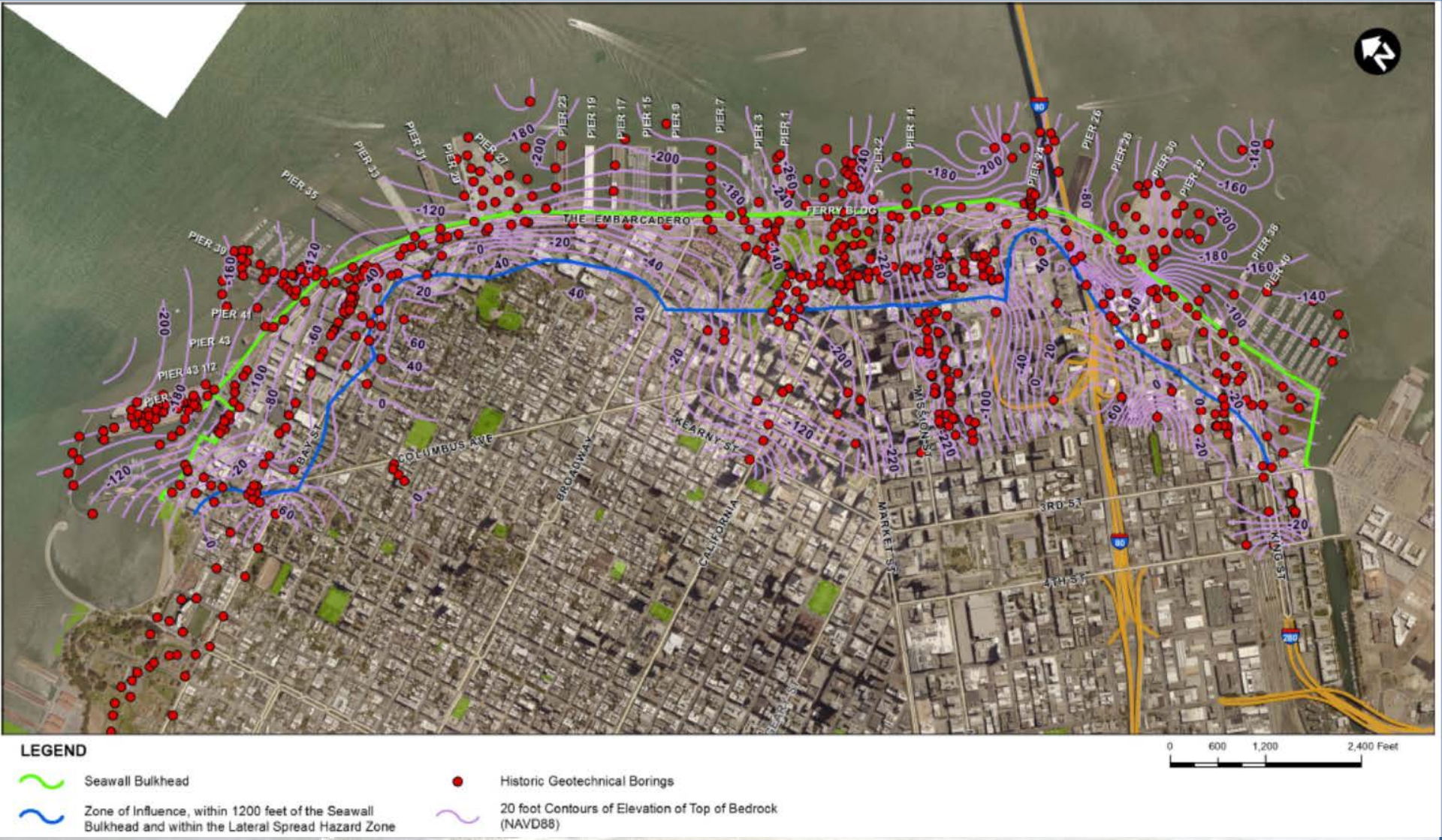
Subsurface Mapping – Artificial Fill Thickness

Subsurface Mapping – Young Bay Mud Thickness

PORT OF SAN FRANCISCO 150 YEARS

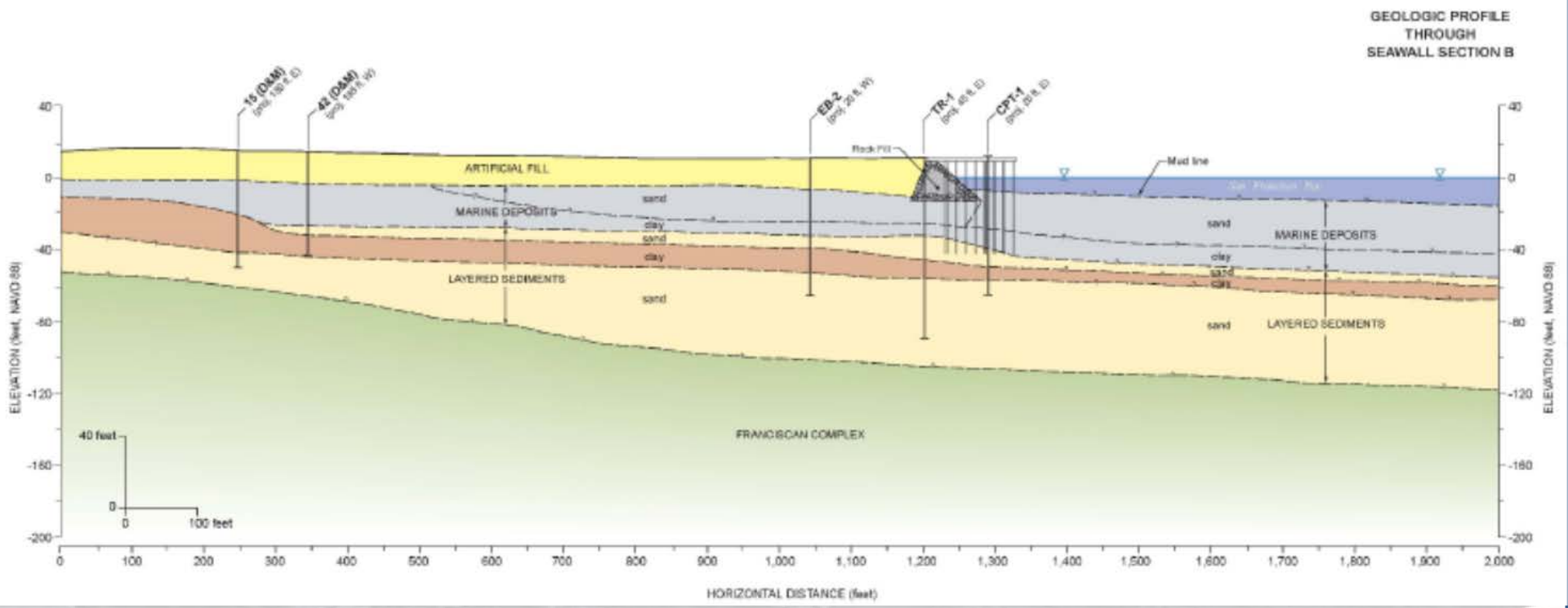


Subsurface Mapping – Young Bay Mud Thickness



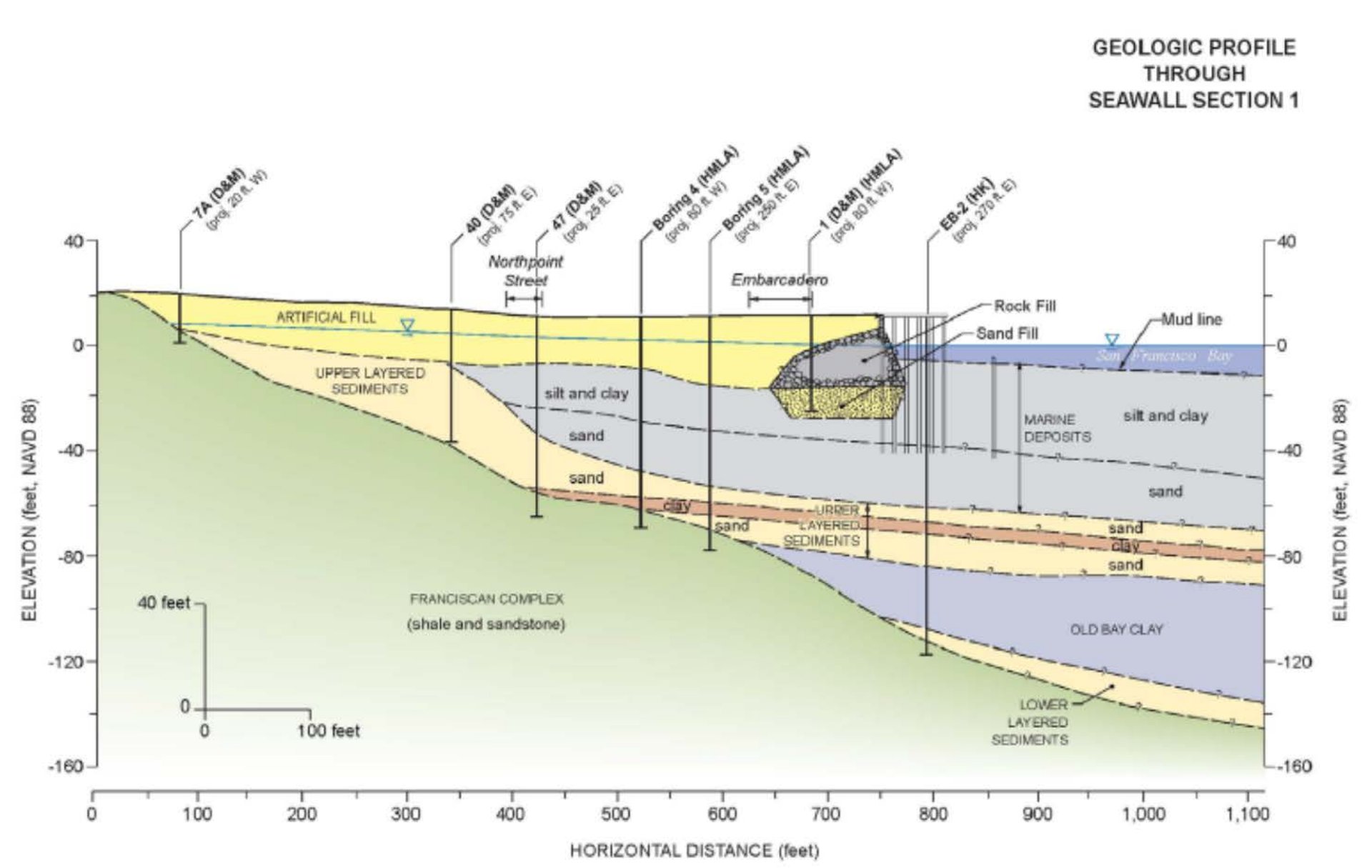
Subsurface Mapping – Bedrock Elevation

Subsurface Mapping – Bedrock Elevation

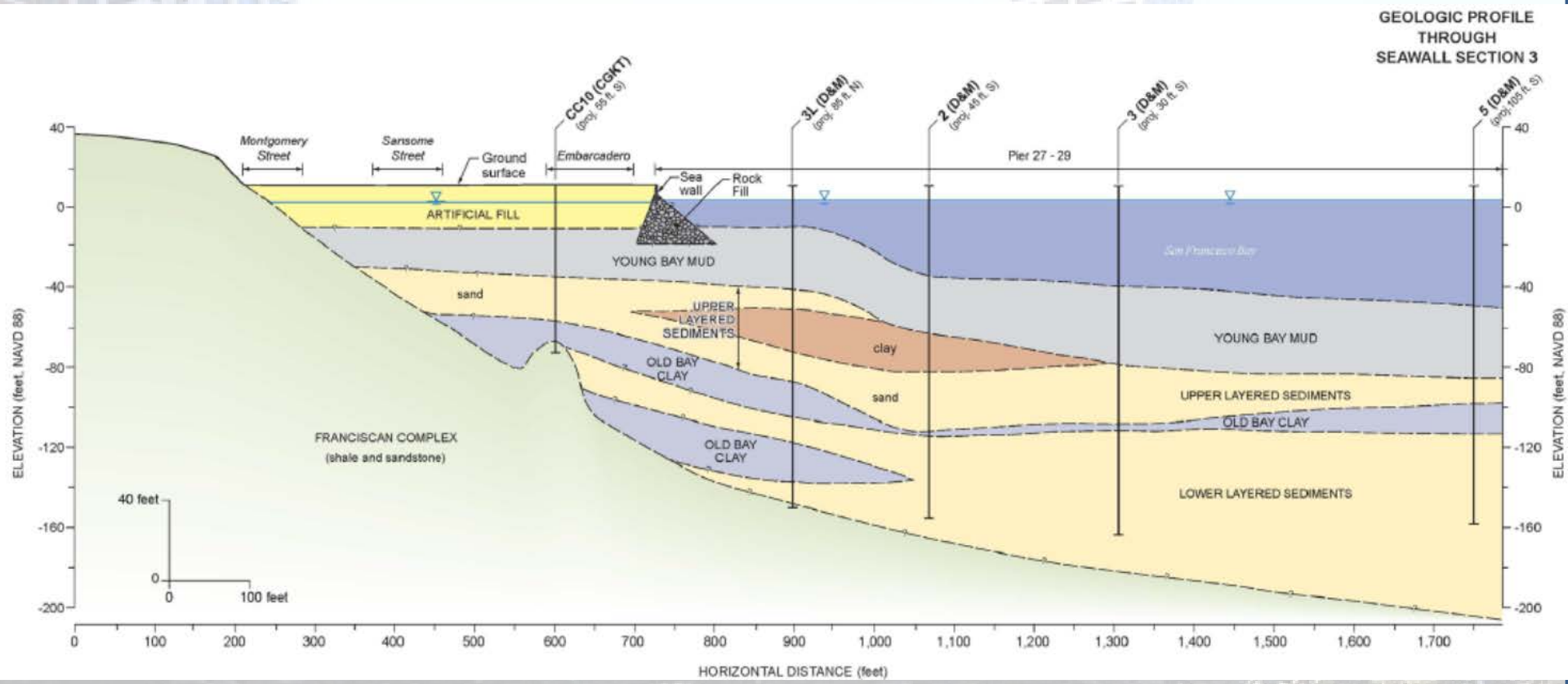


Representative Sections
Section B - Vicinity of Pier 43

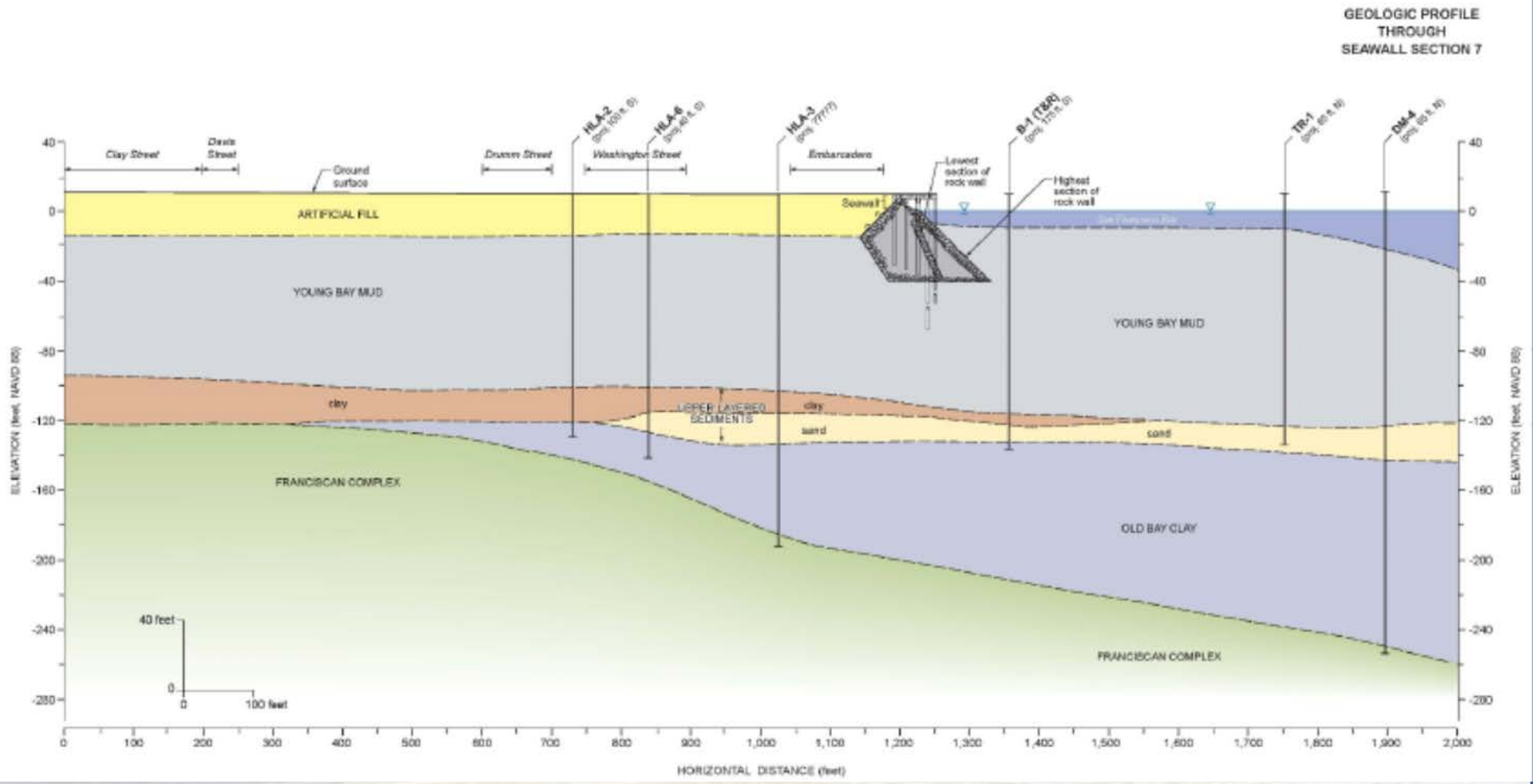
PORT OF SAN FRANCISCO 150 YEARS



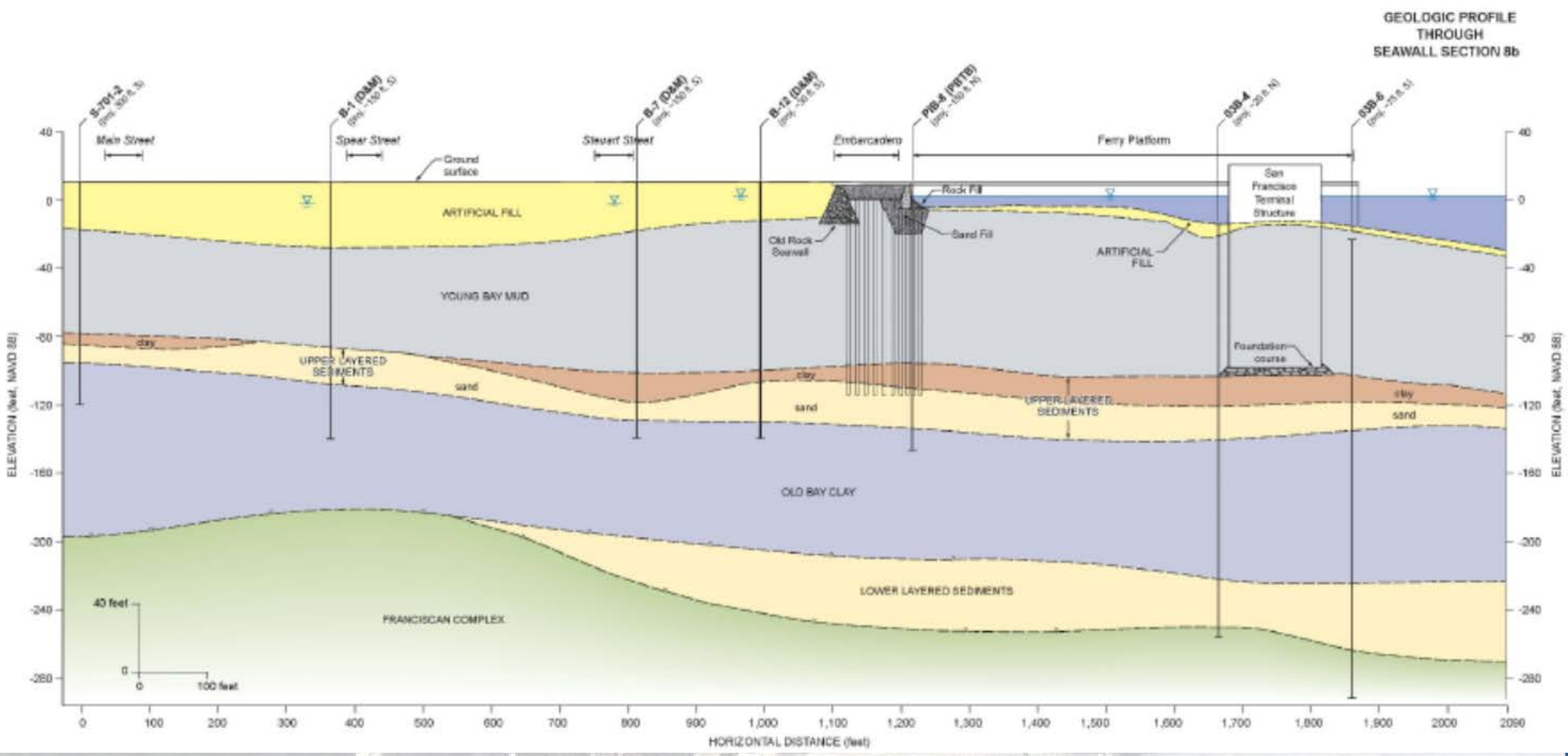
Representative Sections
Section 1 - Vicinity of Pier 39



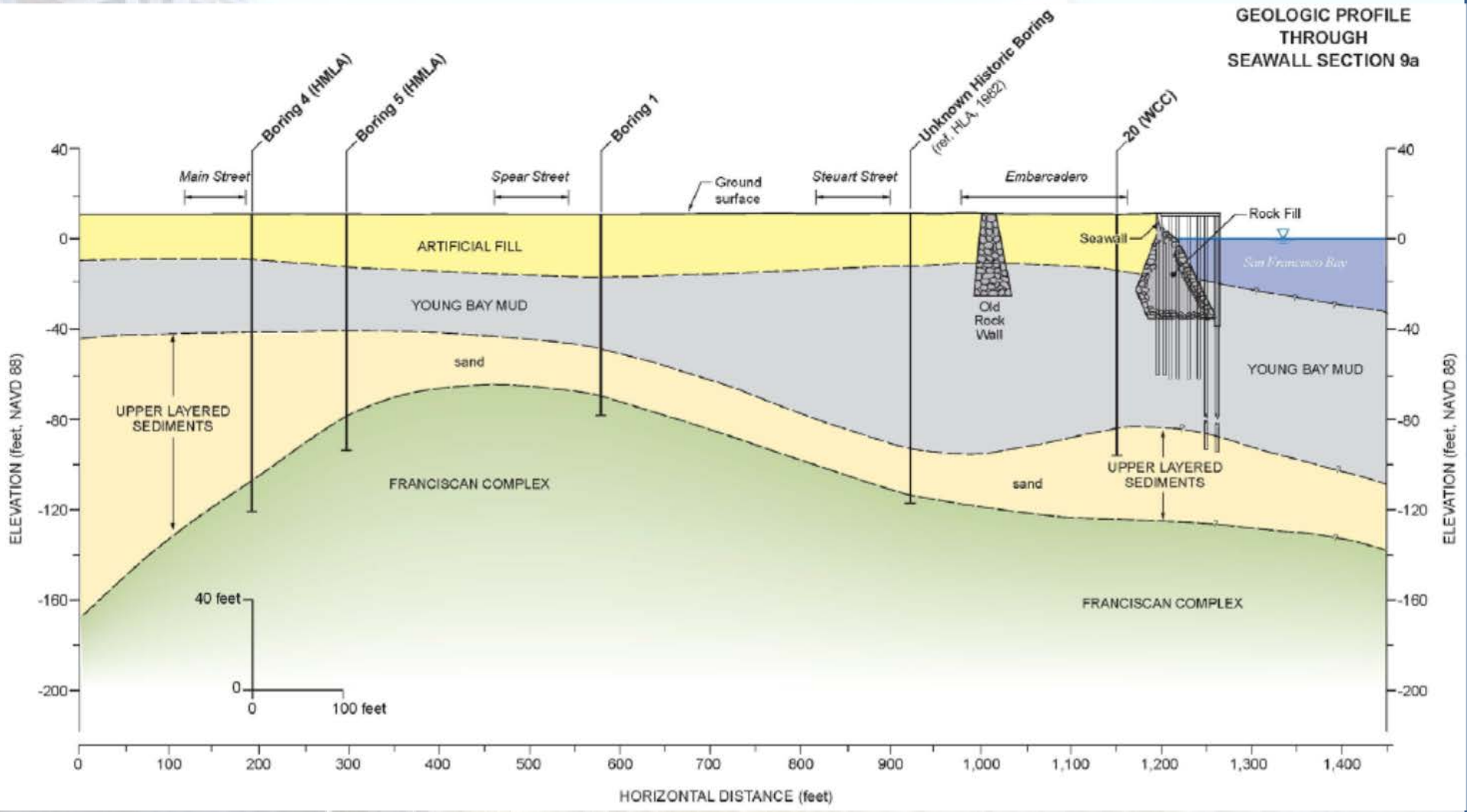
Representative Sections
Section 3 - Vicinity of Pier 29



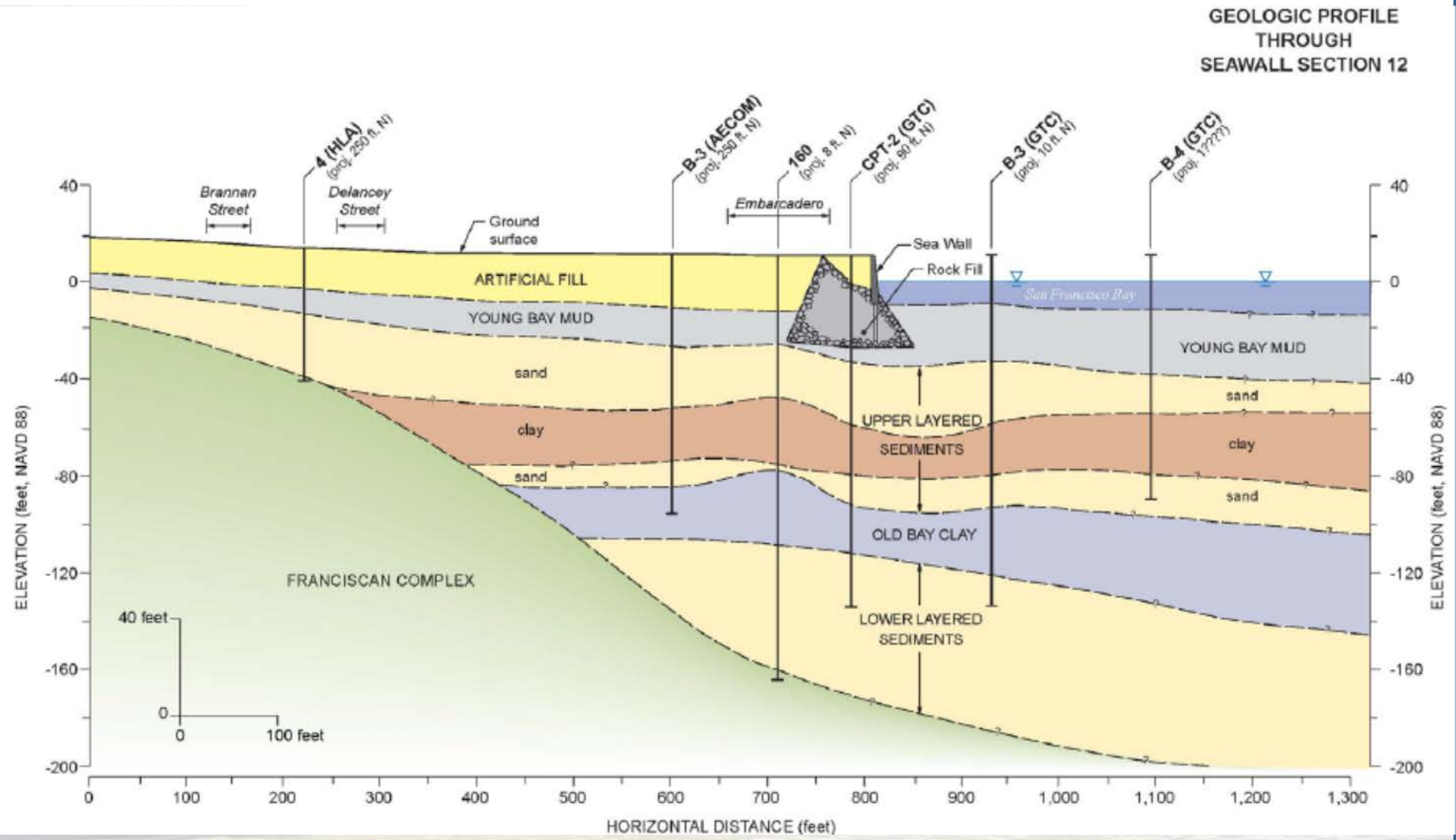
Representative Sections
Section 7 - Vicinity of Pier 3



Representative Sections
Section 8b - Vicinity of Ferry Building

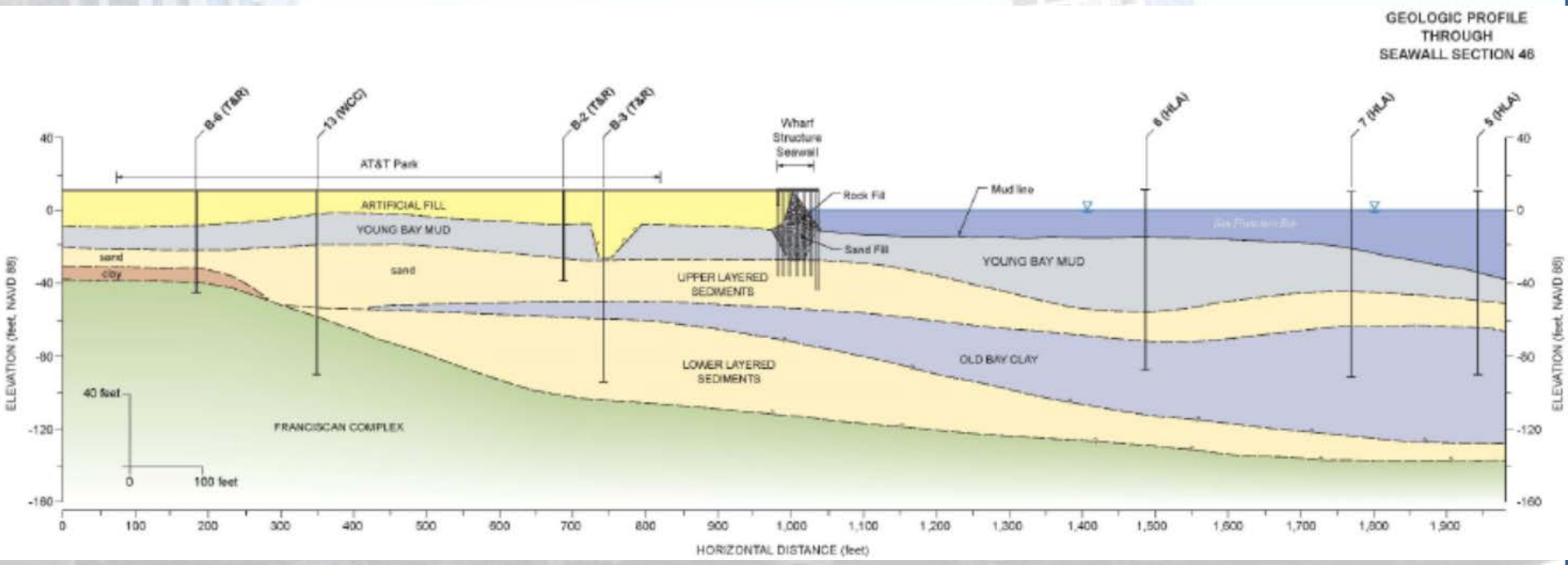


Representative Sections
Section 9a – Vicinity of Howard St.

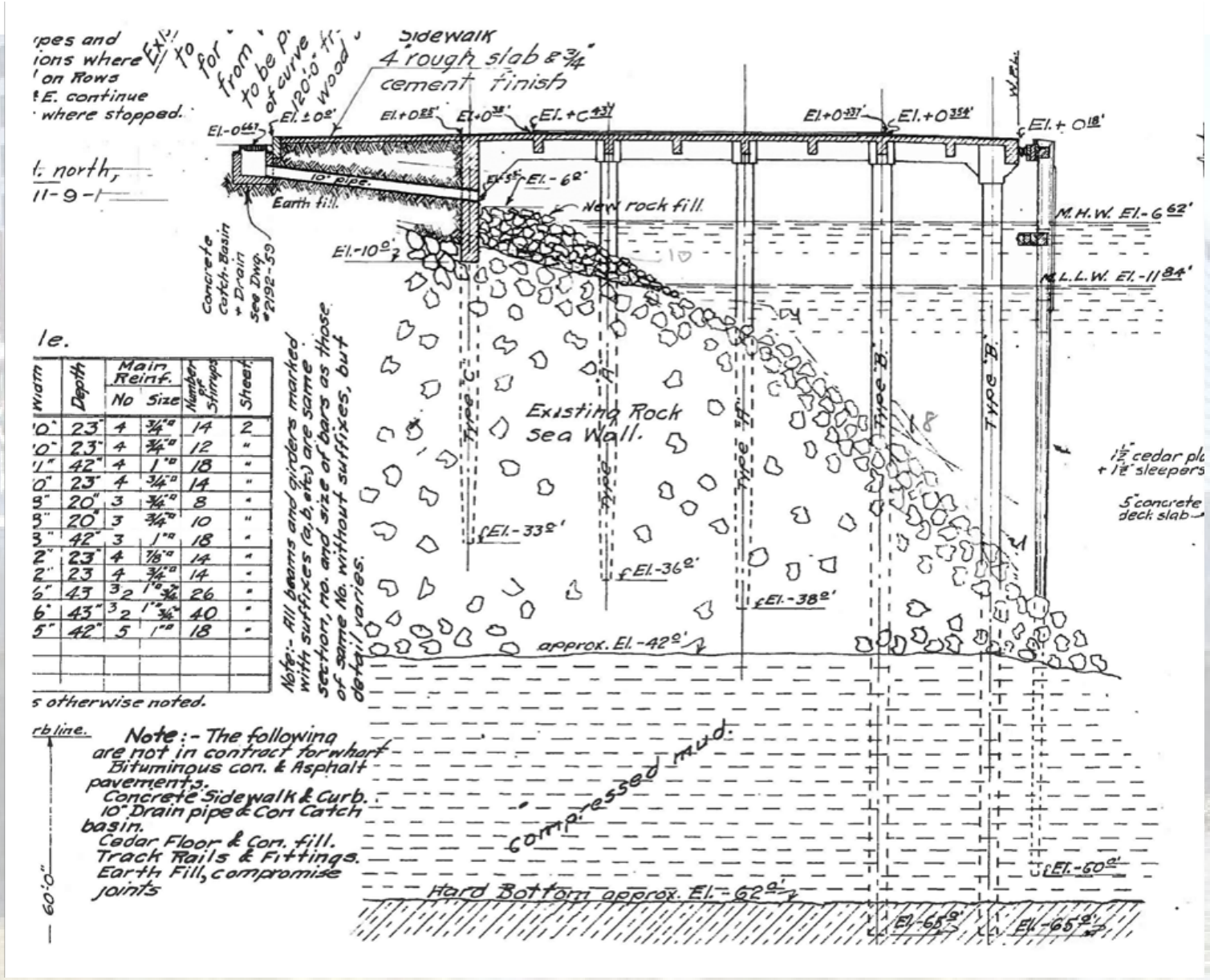


Representative Sections
Section 12 – Vicinity of Pier 38

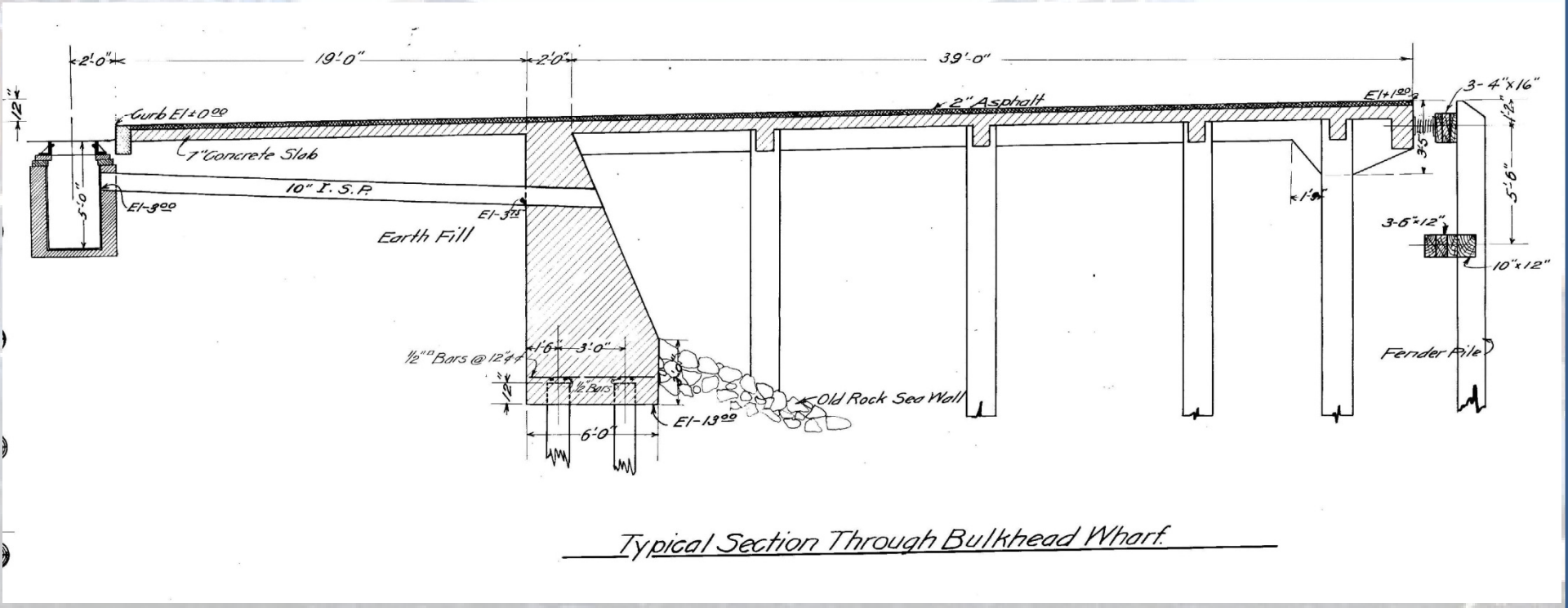
PORT OF SAN FRANCISCO 150 YEARS



Representative Sections
Section 46 – Vicinity of AT&T Park



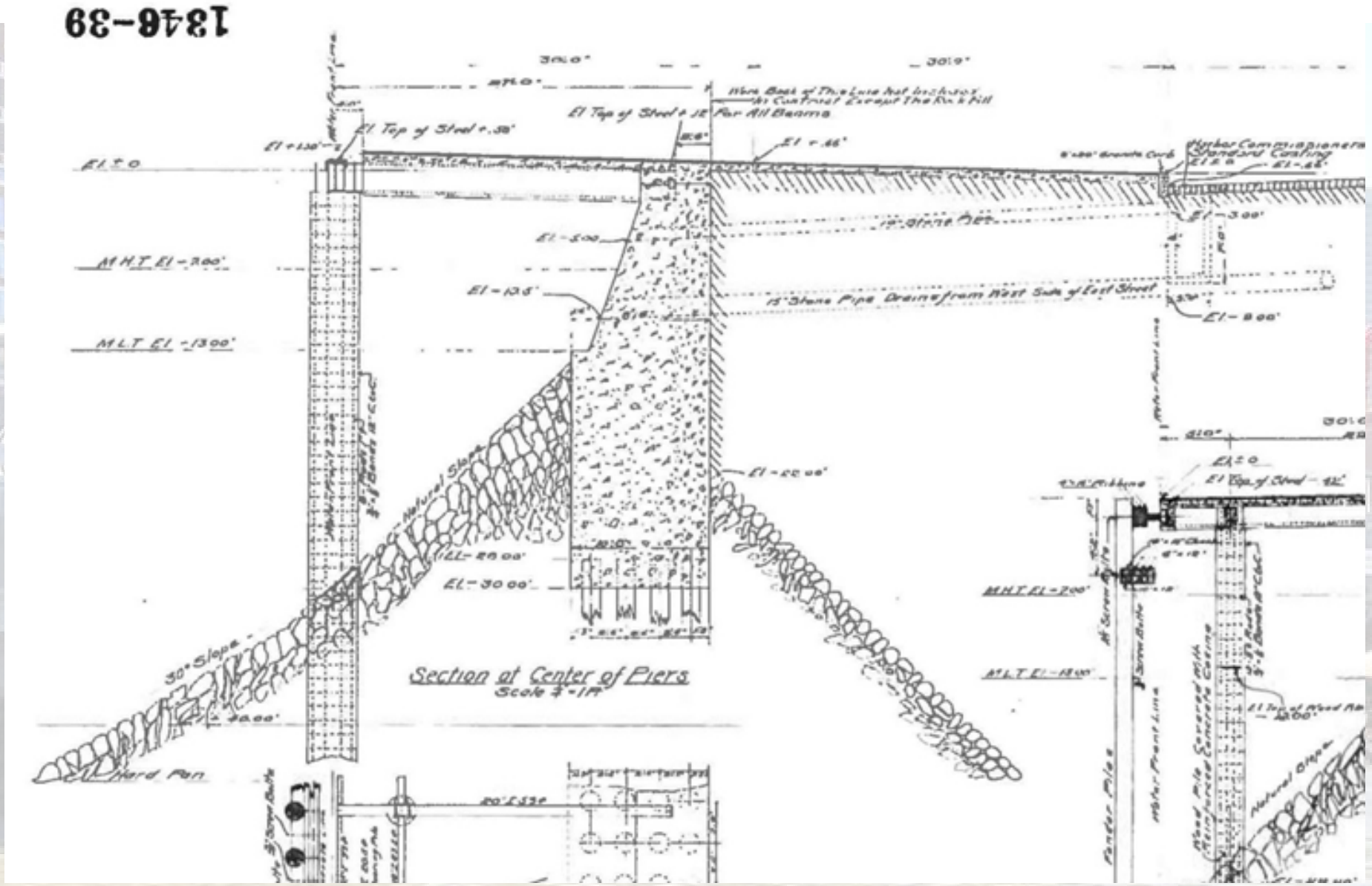
Structural Sections
Bulkhead Wall & Wharf – Pier 9 Area



Typical Section Through Bulkhead Wharf

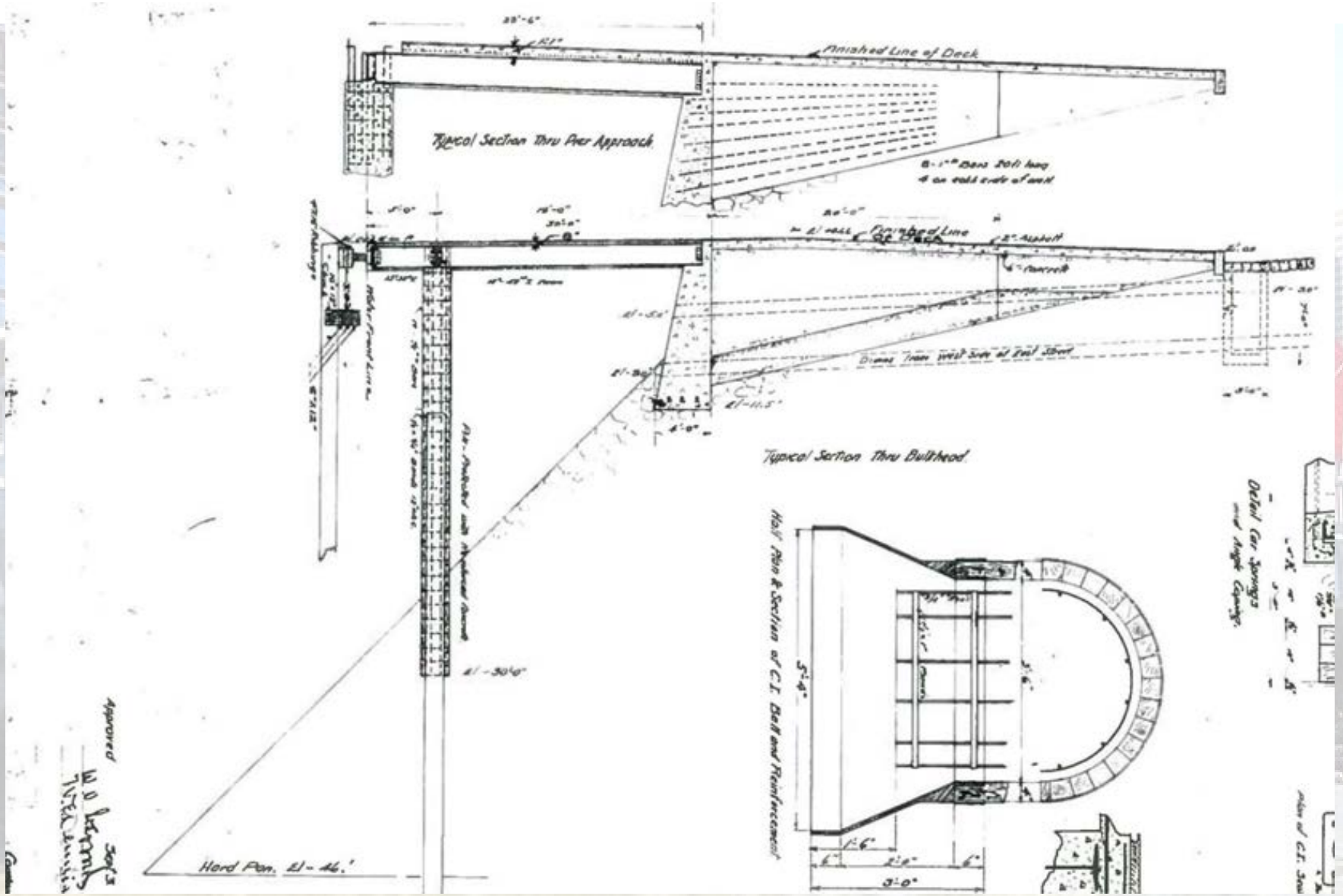
Structural Sections
Bulkhead Wall & Wharf – Pier 17 Area

PORT OF SAN FRANCISCO 150 YEARS

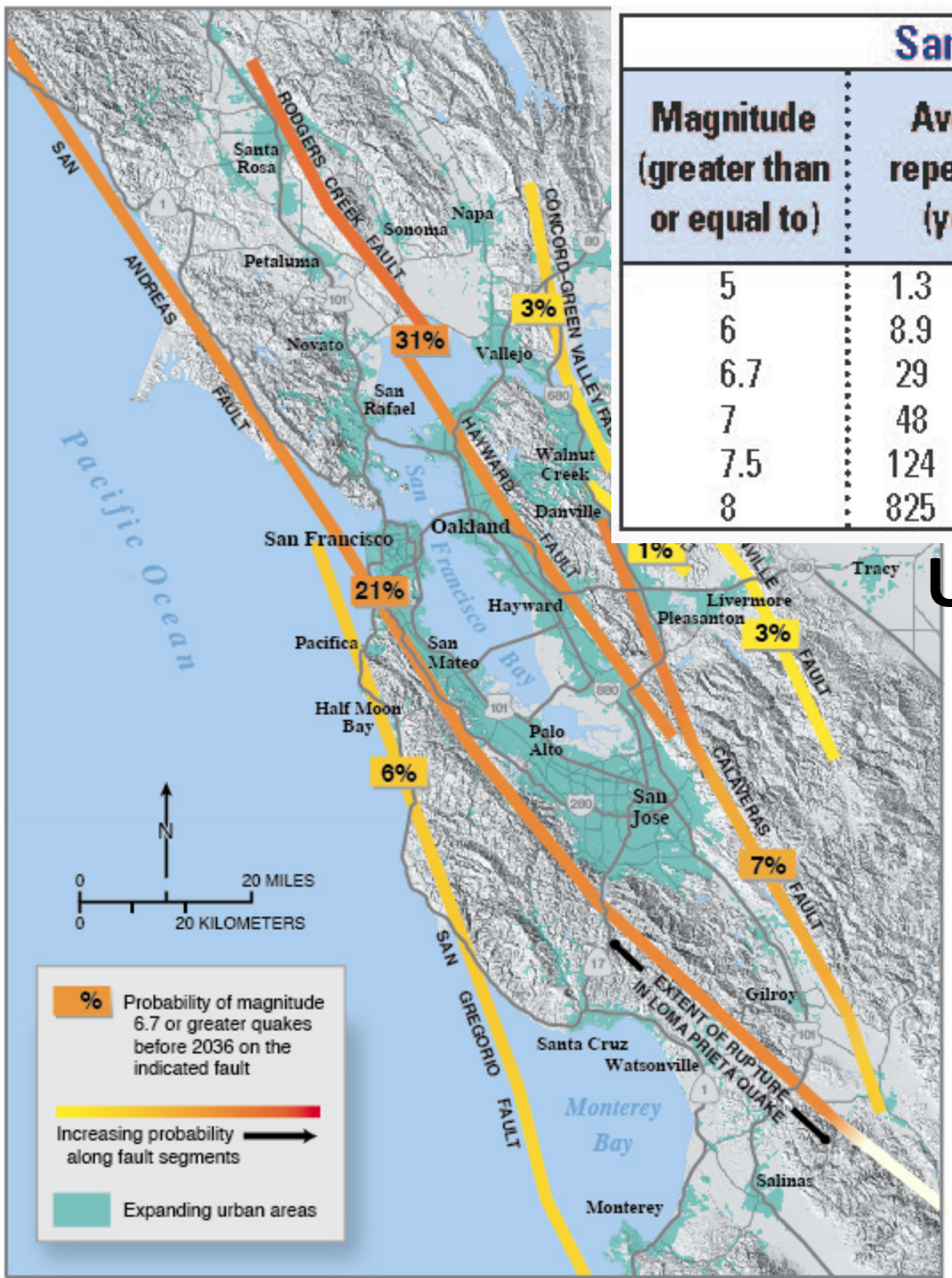


Structural Sections

Bulkhead Wall & Wharf – Pier 26 – 28 Area



Structural Sections
Bulkhead Wall & Wharf – Pier 38 Area

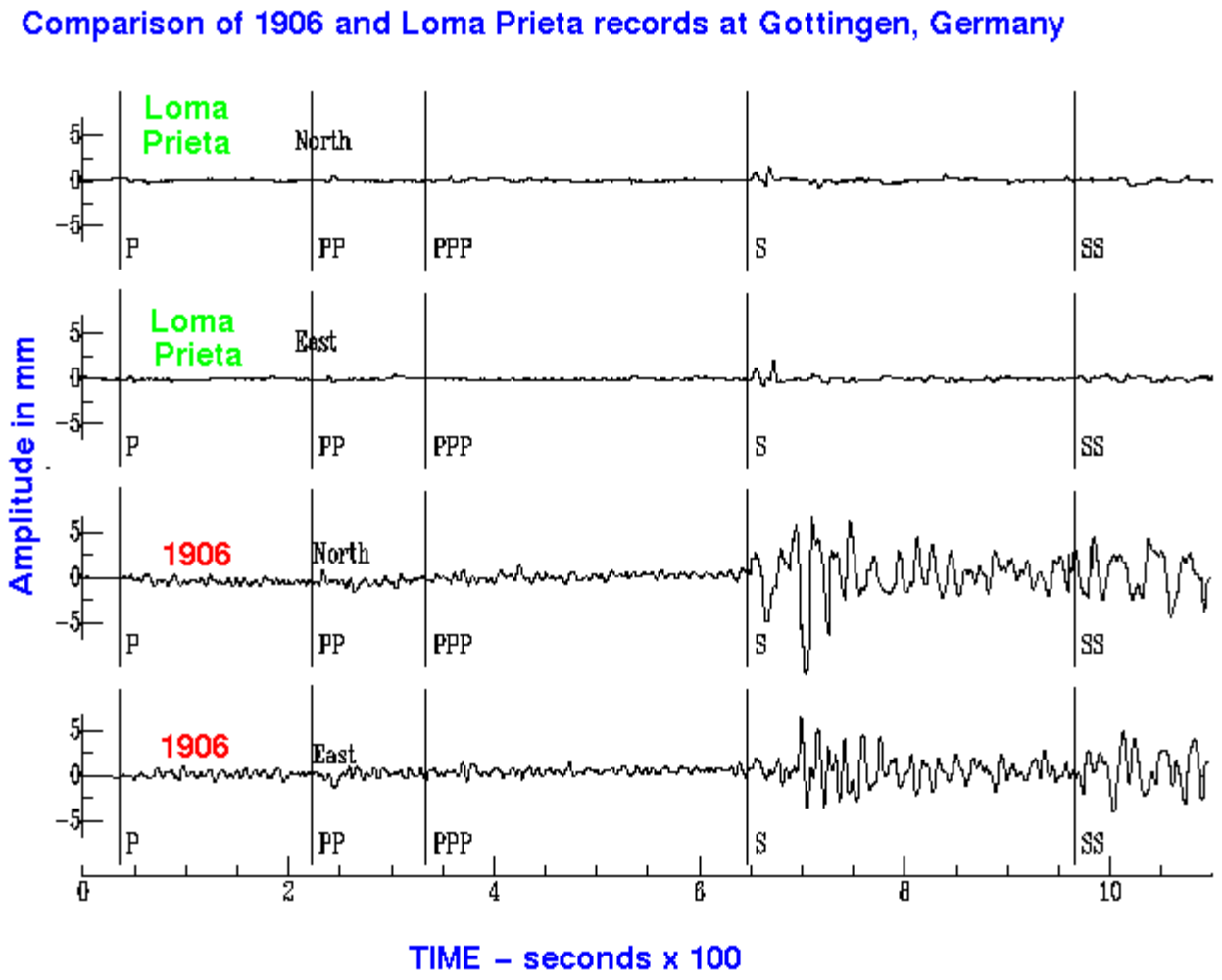


San Francisco region					
Magnitude (greater than or equal to)	Average repeat time (years)		30-year likelihood of one or more events		Readiness
5	1.3	(0.7)	100%	(1.0)	1.0
6	8.9	(1.0)	98%	(1.0)	1.0
6.7	29	(1.1)	72%	(1.1)	1.1
7	48	(0.9)	51%	(1.3)	1.1
7.5	124	(0.7)	20%	(1.6)	0.9
8	825	(0.7)	4%	(1.9)	1.0

USGS WORKING GROUP ON CALIFORNIA EARTHQUAKE PROBABILITIES 2014 UPDATE

72% PROBABILITY OF MAJOR EARTHQUAKE BY 2044

1906 vs 1989 Loma Prieta Earthquake Ground shaking recorded in Germany



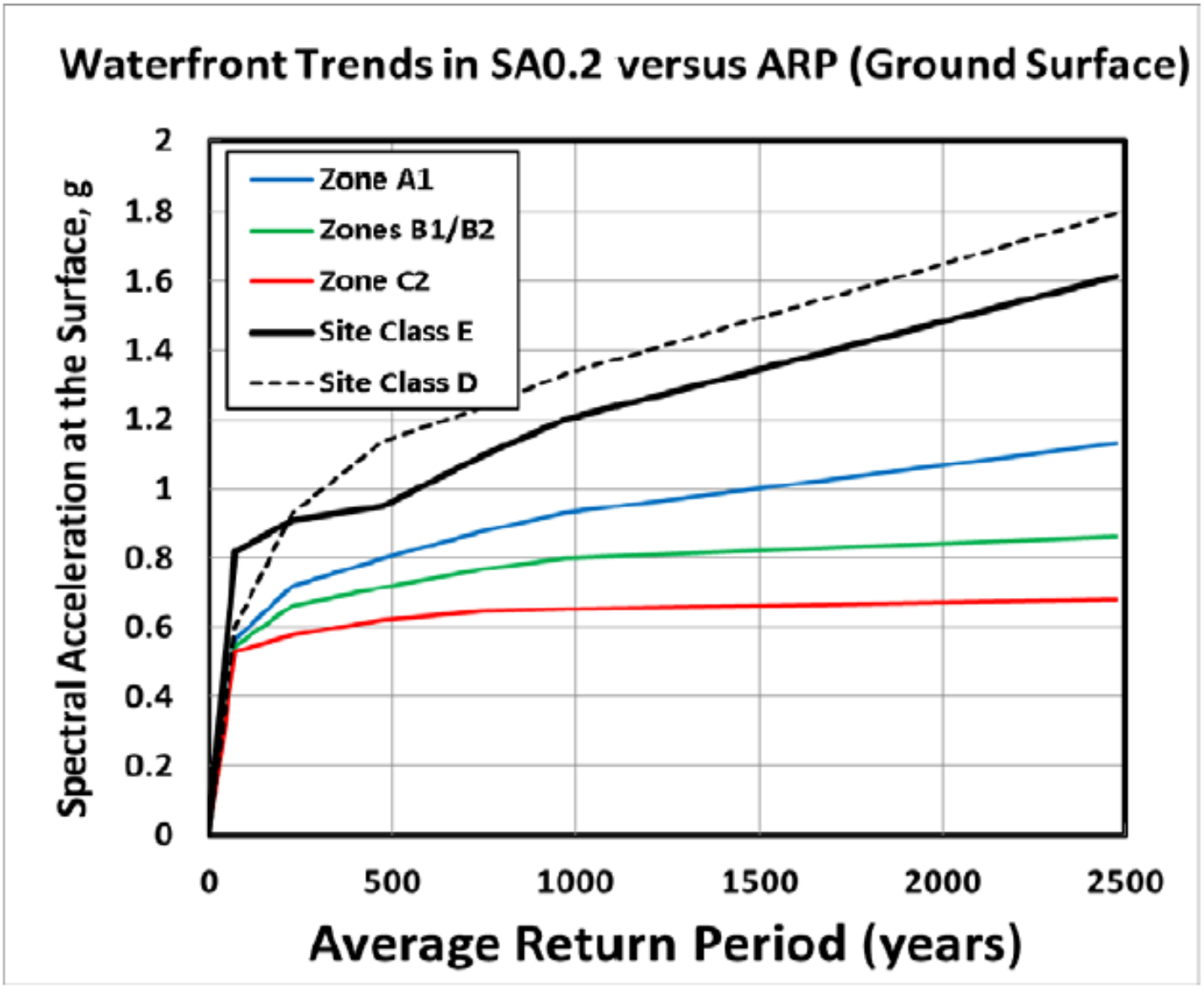
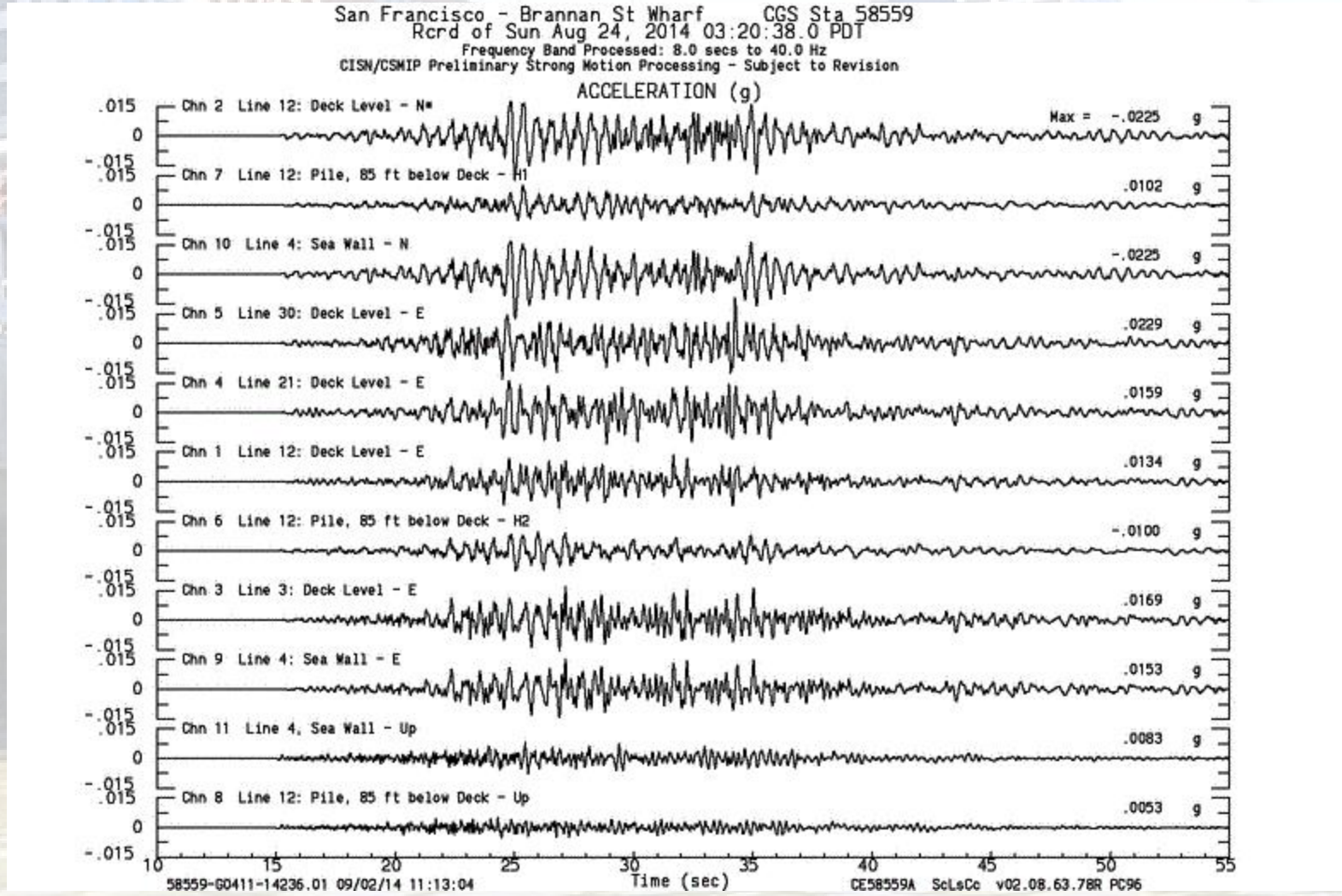


Figure 3-20: Trend of Ground Surface Spectral Acceleration at 0.2-second Period with Average Return Period.

Next Steps

- Complete Initial Draft of Vulnerability Results, end of 2015
- Peer Review, end of 2015
- Final Draft of Results & Recommendations early 2016
- Inform efforts to improve resiliency, Waterfront Land Use Plan Update, and Climate Change Planning

QUESTIONS


San Francisco - Brannan St Wharf CGS Sta 58559
Rcrd of Sun Aug 24, 2014 03:20:38.0 PDT
Frequency Band Processed: 8.0 secs to 40.0 Hz
CISN/CSMIP Preliminary Strong Motion Processing - Subject to Revision
ACCELERATION (g)
Chn 2 Line 12: Deck Level - N*
Max = -.0225 g
Chn 7 Line 12: Pile, 85 ft below Deck - H1
.0102 g
Chn 10 Line 4: Sea Wall - N
-.0225 g
Chn 5 Line 30: Deck Level - E
.0229 g
Chn 4 Line 21: Deck Level - E
.0159 g
Chn 1 Line 12: Deck Level - E
.0134 g
Chn 6 Line 12: Pile, 85 ft below Deck - H2
-.0100 g
Chn 3 Line 3: Deck Level - E
.0169 g
Chn 9 Line 4: Sea Wall - E
.0153 g
Chn 11 Line 4, Sea Wall - Up
.0083 g
Chn 8 Line 12: Pile, 85 ft below Deck - Up
.0053 g
.015
0
-.015
10
15
20
25
30
35
40
45
50
55
Time (sec)
58559-G0411-14236.01 09/02/14 11:13:04
CE58559A ScLsCc v02.08.63.78R PC96