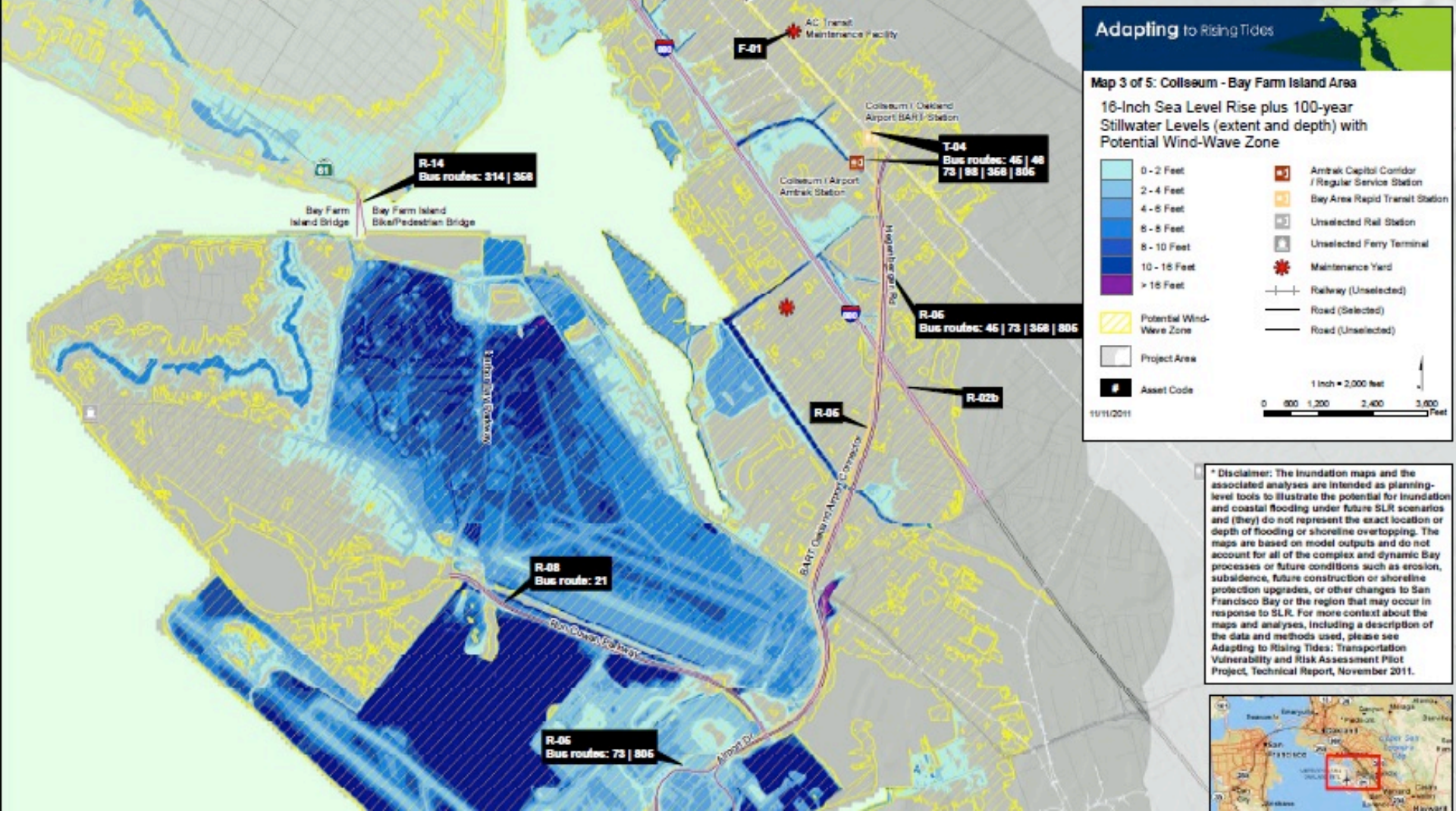


Exposure Analysis

Oakland Working Group

April 8, 2014

AECOM

Sea Level Rise Mapping

- Original ART 1.0 mapping:
  - 16” and 55” of sea level rise
  - MHHW, 100-Year Stillwater Elevation, 100-Year Total Water Elevation (includes waves)
- Refined ART 2.0 mapping
  - Six sea level rise levels (12”, 24”, 36”, 48”, 72”, 96”)
  - Matrix approach to relate to Extreme Tides/ Storm Surge from 1-Year to 100-Year

Sea Level Rise Science *

Year	Projections	Ranges
2030	6 ± 2 in	2 to 12 in
2050	11 ± 4 in	5 to 24 in
2100	36 ± 10 in	17 to 66 in

* Sea level rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future (NRC 2012)

Sea Level Rise Scenarios *

- 12” SLR = 2050 “most likely”
- 24” SLR = 2050 upper uncertainty bound
  = 2100 lower 15% confidence interval
- 36” SLR = 2100 “most likely”
- 48” SLR = 2100 upper 85% confidence interval

* Sea level rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future (NRC 2012)

Sea Level Rise and Extreme Tide Matrix

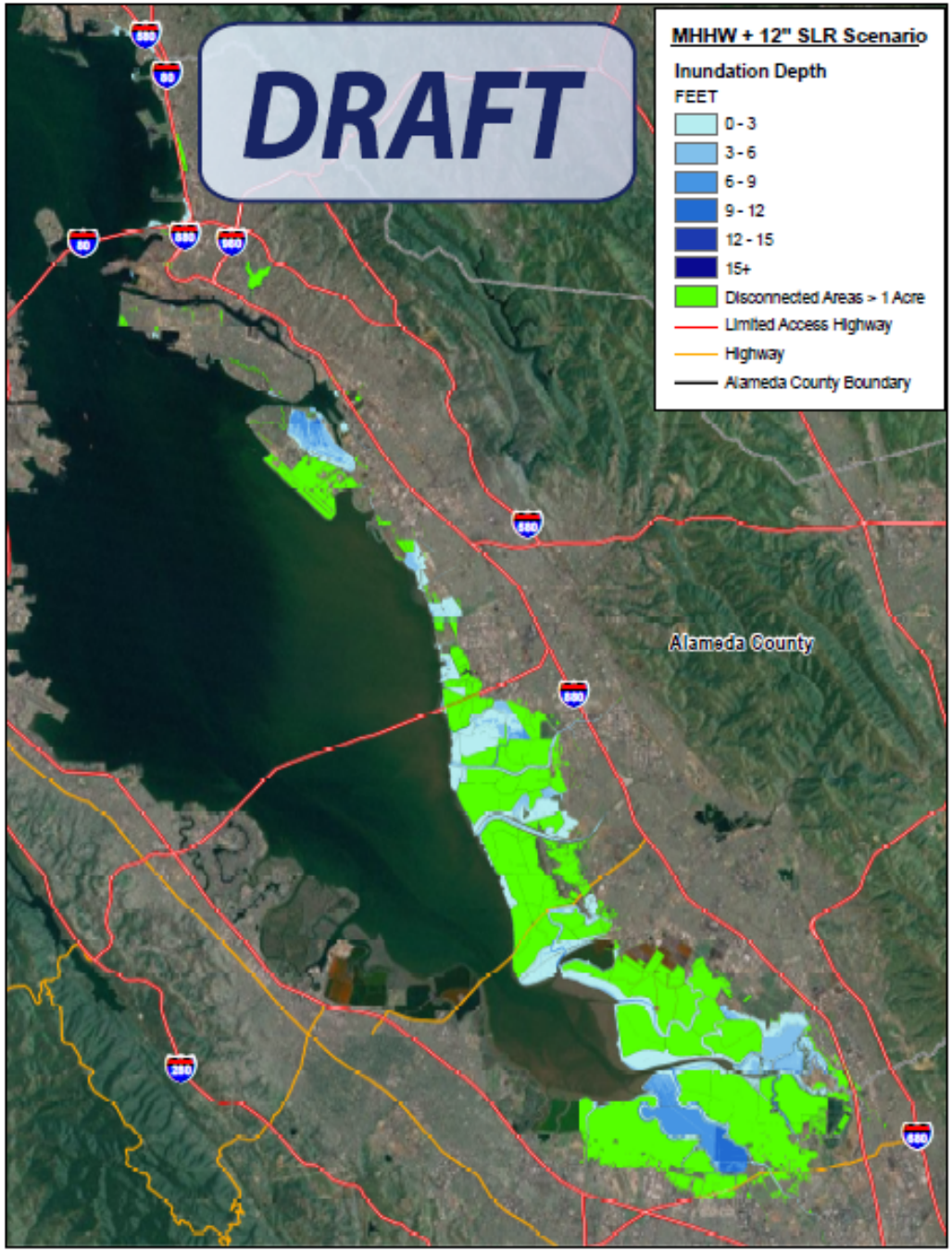
Sea Level Rise	Water Level above MHHW	Extreme Tide (Storm Surge) Levels						
		1-yr	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr
0"	0	12	19	23	27	33	37	42
+6"	6	18	25	29	33	39	43	48
+12"	12	24	31	35	39	45	49	54
+18"	18	30	37	41	45	51	55	60
+24"	24	36	43	47	51	57	61	66
+30"	30	42	49	53	57	63	67	72
+36"	36	48	55	59	63	69	73	78
+42"	42	54	61	65	69	75	79	84
+48"	48	60	67	71	75	81	85	90
+54"	54	66	73	77	81	87	91	96
+60"	60	72	79	83	87	93	97	102

Map 1

MHHW + 12” SLR
(permanent inundation)

OR

0” SLR + 1-Yr Tide
(King Tide)
(temporary inundation)



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Map 2

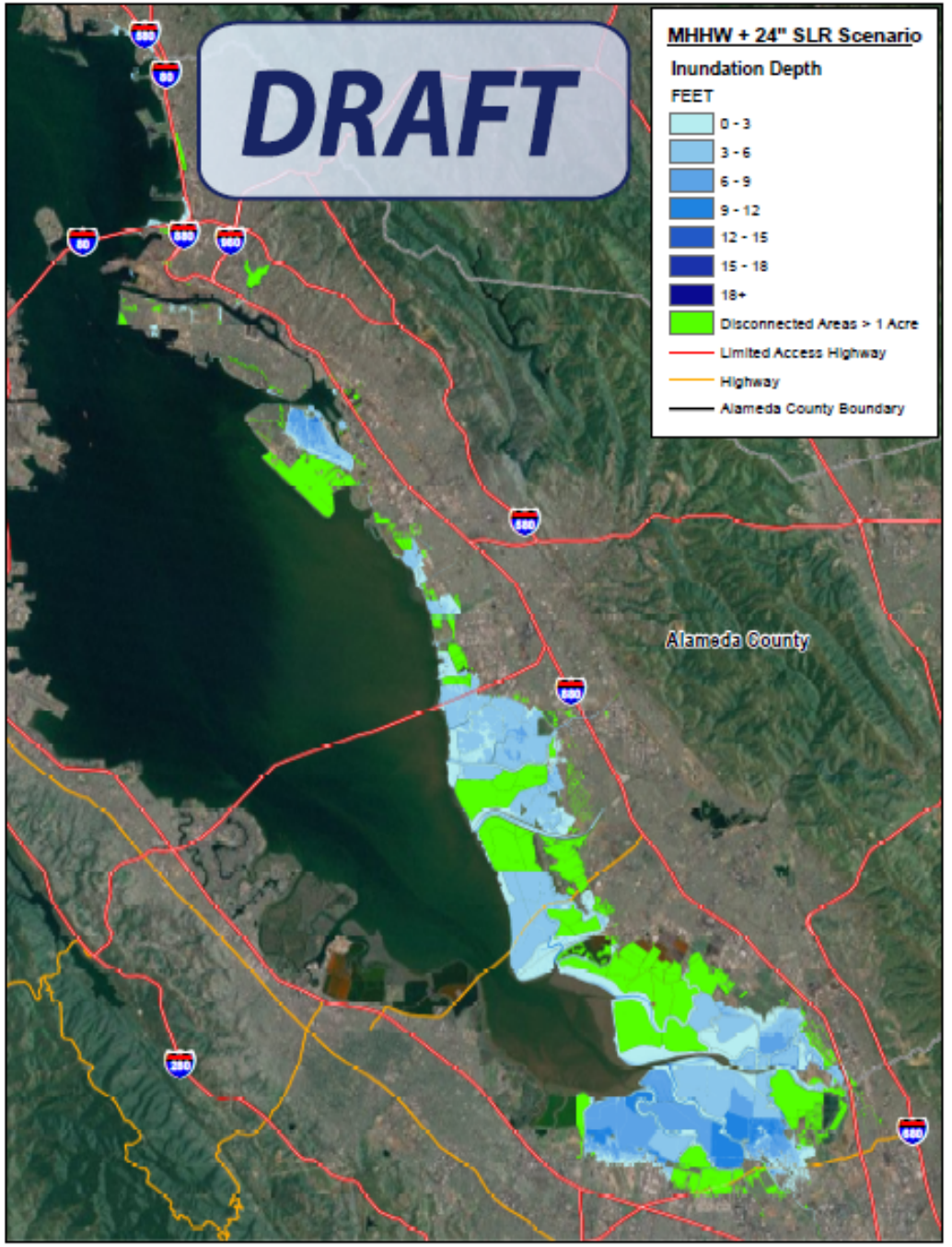
MHHW + 24” SLR
(permanent inundation)

OR

12” SLR + 1-Yr Tide

6” SLR + 2-Yr Tide

0” SLR + 10-Yr Tide
(temporary inundation)



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Map 3

MHHW + 36” SLR
(permanent inundation)

OR

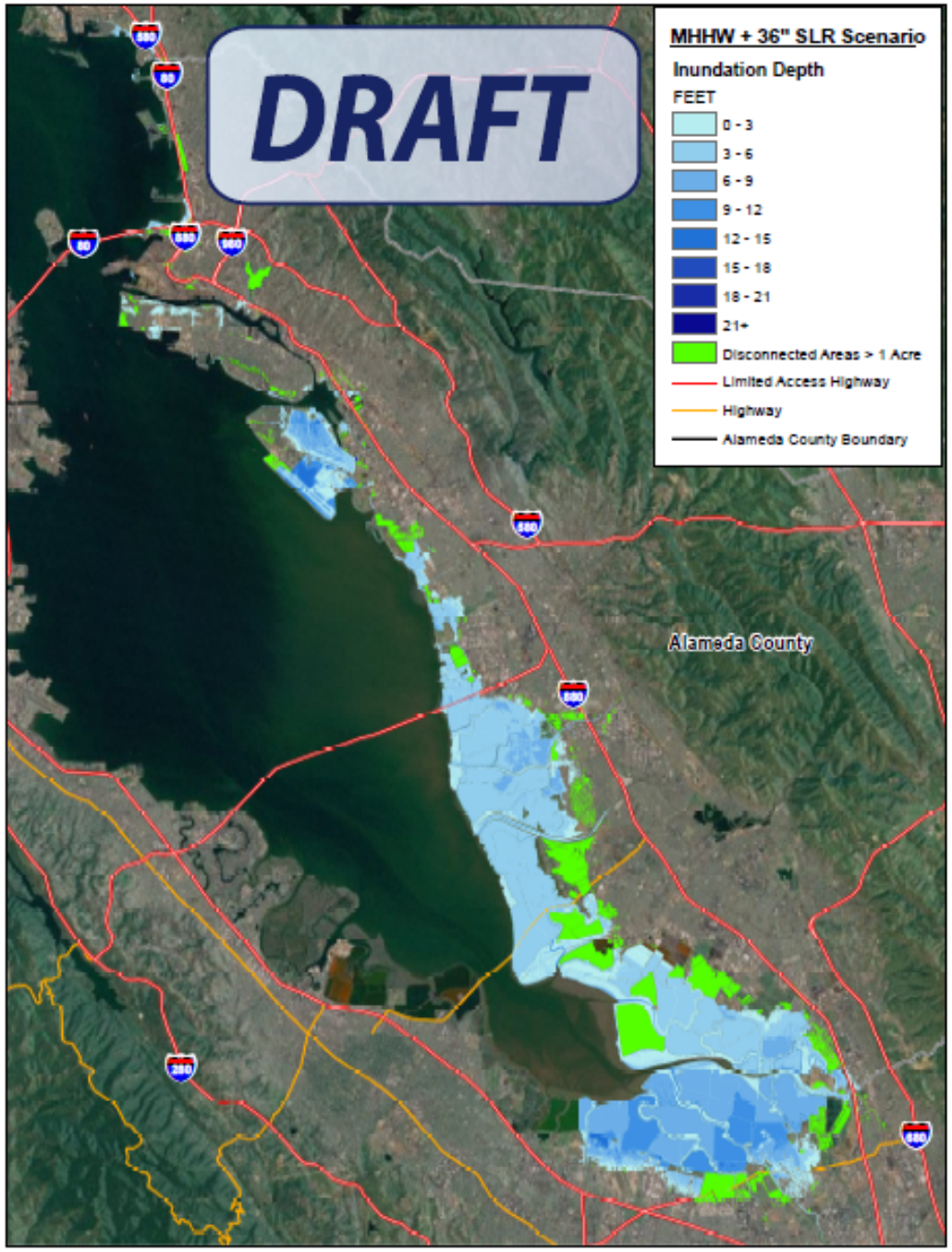
24” SLR + 1-Yr Tide

18” SLR + 2-Yr Tide

12” SLR + 10-Yr Tide

6” + 25-Yr Tide

0” + 50-Yr Tide
(temporary inundation)



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Map 4

MHHW + 48” SLR
(*permanent inundation*)

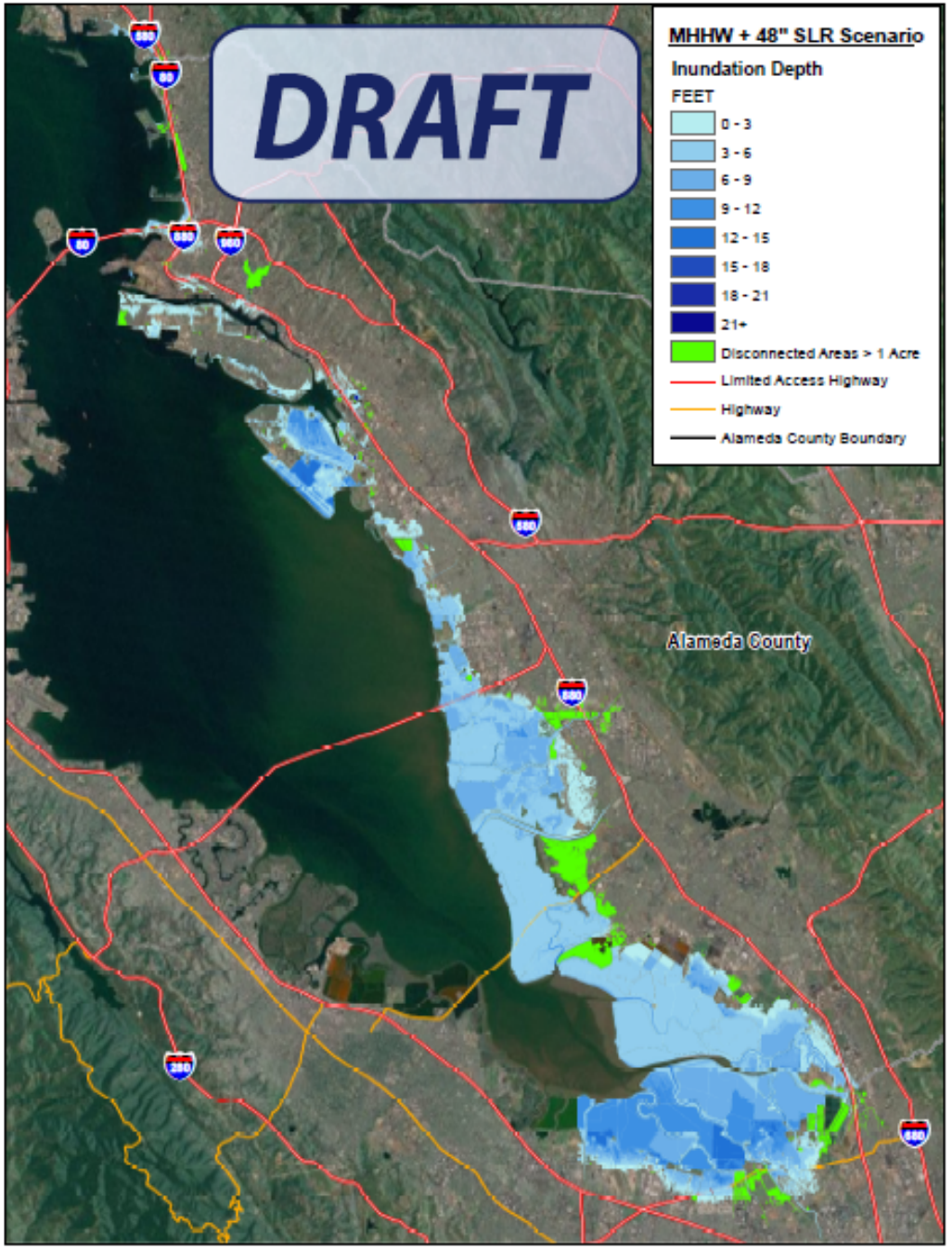
OR

36” SLR + 1-Yr Tide

24” SLR + 10-Yr Tide

18” SLR + 25-Yr Tide

12” SLR + 50-Yr Tide
(*temporary inundation*)



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MHHW + 12” SLR
King Tide (1-year extreme tide) + 0” SLR

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Shoreline Delineations

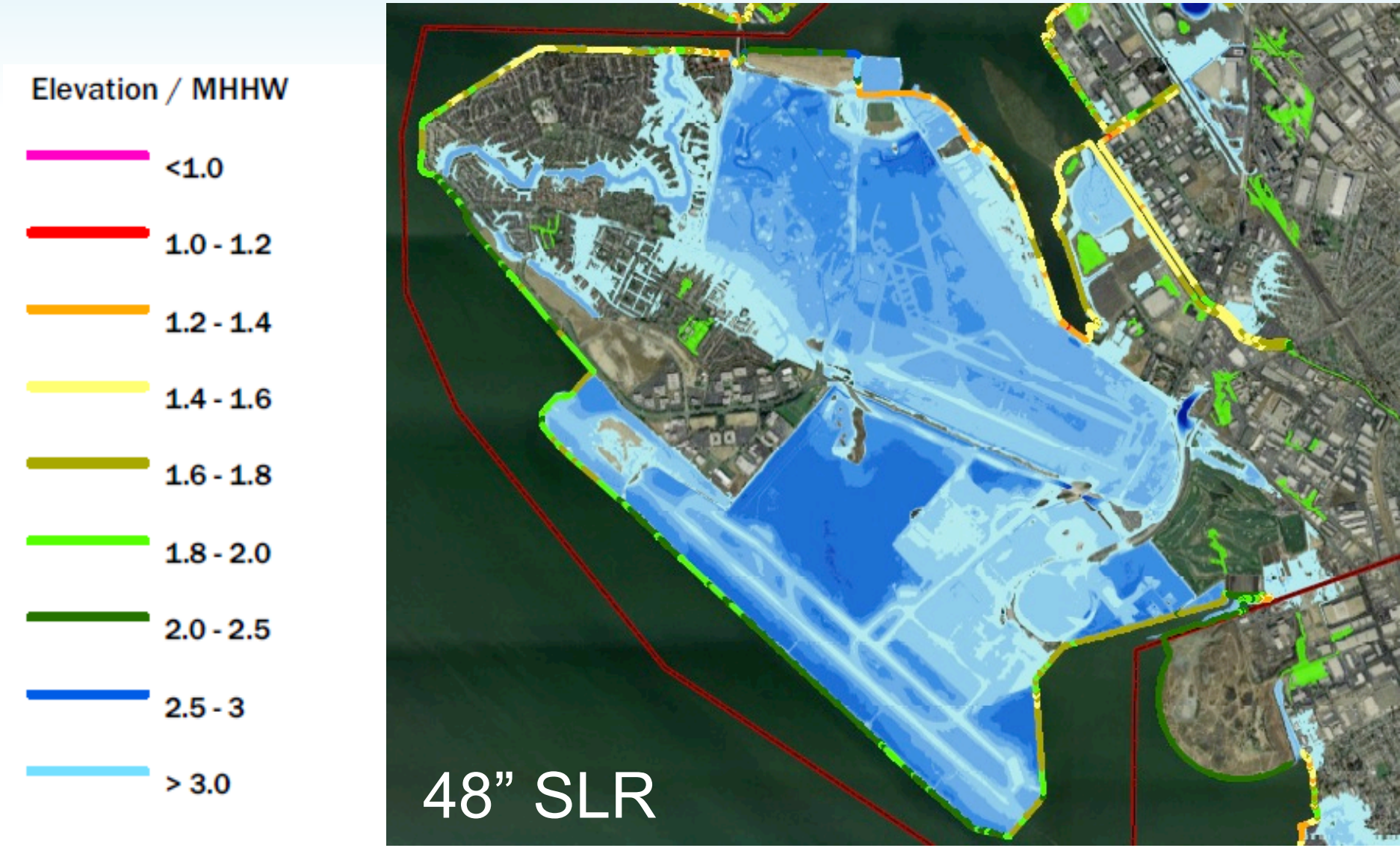
Overtopping Depth
Depth of water at feature

Normalized Elevation
Shoreline elevation / MHHW

Shoreline Delineations

- Overtopping Depth
  - Known: shoreline elevation and future sea level rise water surface elevations at shoreline feature
  - Measures depth of water over shoreline feature
  - Scenario dependent
- Normalized shoreline elevation
  - Known: shoreline elevation and existing MHHW elevation at shoreline feature (*no SLR maps!)*
  - Measures height of shoreline relative to existing tides
  - Scenario independent

Normalized shoreline elevations



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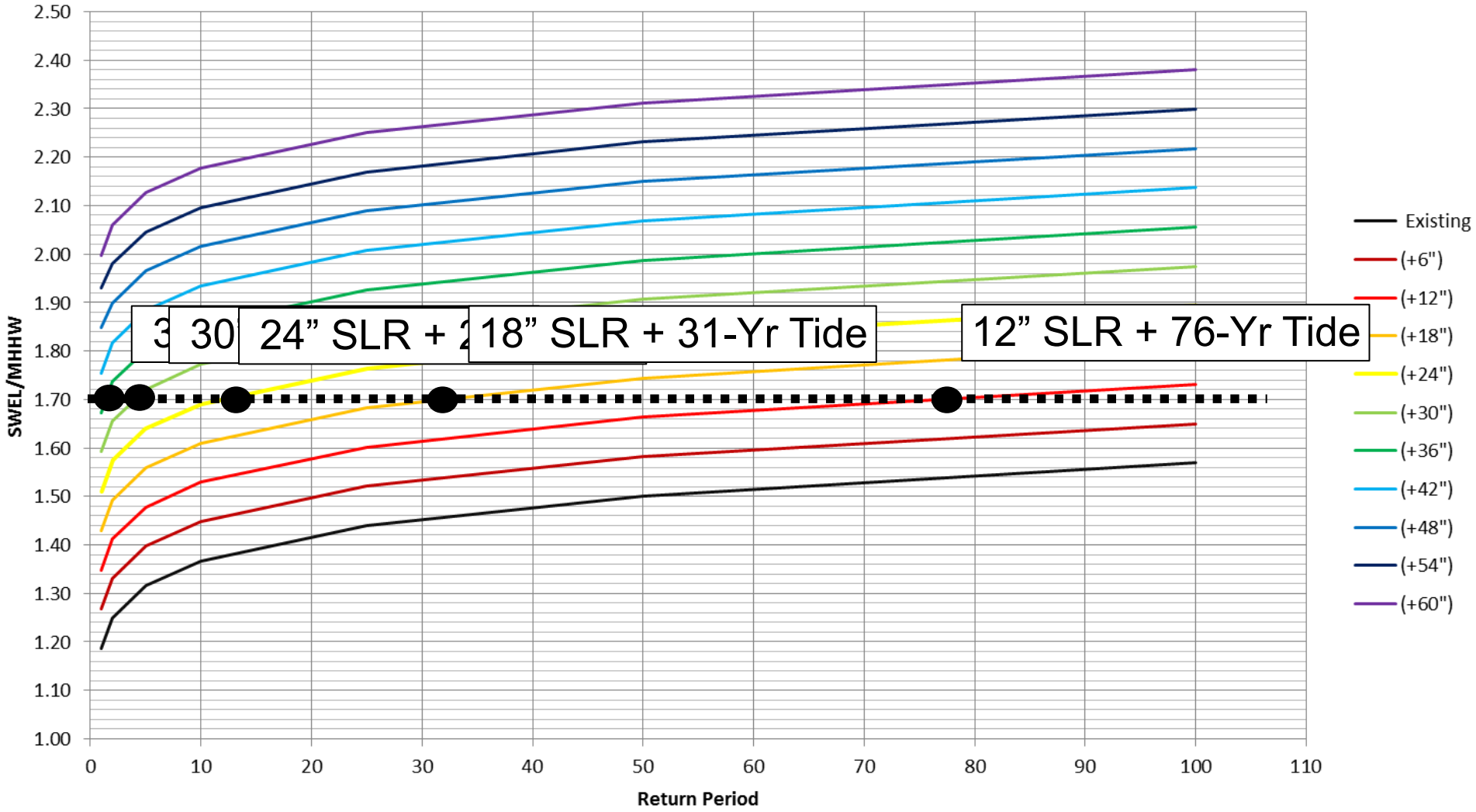
Elev. vs Storm Surge Frequency



MHHW + 12” SLR
King Tide (1-year extreme tide) + 0” SLR

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Verify Vulnerabilities

- SLR mapping highlights potential exposure
- Normalized shoreline analysis identifies potential vulnerabilities along shoreline
- Overtopping potential line can also identify potential vulnerabilities along shoreline
- Field visits needed to verify vulnerabilities – are they real?


Doolittle Road

Bay Farm Bridge


Bay Farm
Lagoon
Tide Gate

Reality Check

- Make corrections to DEM (if needed)
- Re-run the mapping process
- Highlight and verify new vulnerabilities

MHHW + 12” SLR
King Tide (1-year extreme tide) + 0” SLR

MHHW + 24” SLR
10-Year Storm Surge + 0” SLR

MHHW + 36” SLR
50-Year Storm Surge + 0” SLR

Bay Farm Island / Doolittle

MHHW + 36"

- 0 - 3
- 4 - 6
- 7 - 9
- 10 - 12
- 13 - 15
- > 15

Overtopping Potential

- 0.1 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- > 5

Lowlying Area > 1 acre