APPENDIX 1

Sea-Level Rise Hazard Mapping and Coastal Data Memo, ESA

550 Kearny Street
Suite 800
San Francisco, CA 94108
415.896.5900 phone
415.896.0332 fax

esassoc.com

memorandum

date	November 20, 2020
to	Poonam Narkar, WRT
cc	Bay Trail RAAPP Project Team
from	Louis White, PE
subject	Sea-Level Rise Hazard Mapping and Coastal Data, Bay Trail Risk Assessment & Adaptation Prioritization Plan (ESA Ref. #D201900102.00)

Introduction

The WRT team has conducted a site analysis and risk assessment as part of the Bay Trail Risk Assessment & Adaptation Prioritization Plan (RAAPP) for the East Bay Regional Park District (District). The Bay Trail RAAPP is being prepared in order to identify and prioritize adaptation of segments of the Bay Trail that are most vulnerable to sea-level rise in Contra Costa and Alameda Counties. This memo recommends sea-level rise scenarios based on projections issued by the State of California, identifies existing sea-level rise hazard maps to use in the Site Analysis (Task 3.1) and Risk Assessment (Task 3.2) of the RAAPP, and summarizes other available and relevant coastal hazards information, including waves and groundwater, that are used in the Risk Assessment completed by the team. A summary of the analyzed hazard data is attached. The work described in this memo was completed by Tiffany Cheng, PE, Yi Liu, and Louis White, PE.

Sea-level Rise Policy Guidance and Projections

Coastal shorelines will primarily be exposed to climate change impacts via an increase in sea levels, due to thermal expansion of oceanic water and melting of the ice sheets. Estimates of sea-level rise vary by location over regionally. Sea-level rise projections from the State of California Sea-Level Rise Guidance (Ocean Protection Council [OPC], 2018) were used to inform the inundation and flood hazard analysis for the Project site.

The 2018 OPC Guidance provides a science-based methodology for state and local governments to analyze and assess the risks associated with sea-level rise, and to incorporate sea-level rise into their planning, permitting, and investment decisions. The 2018 OPC Guidance draws from a probabilistic approach and provides ranges of likely sea-level rise estimates for future time horizons, compared to the previous OPC (2013) guidance that delineated future scenarios by specific greenhouse gas emission scenarios.

Based on the medium-high risk aversion projections for San Francisco, 3 feet and 6 feet were selected to represent mid- and late-century sea-level rise conditions at the Project site. For the purposes of this analysis, the mid-century time frame is defined as 2050 through 2060 and late-century as 2080 through 2100. These sea-level rise values have a probability of exceedance of 0.005. **Table 1** summarizes sea-level rise projections from the 2018 OPC Guidance. **Figure 1** shows the envelope of sea-level rise estimates for the medium-high and extreme risk aversion scenarios from the 2018 OPC Guidance. The OPC (2018) guidance includes a low risk aversion curve, intended for projects with low consequences and/or high levels of adaptive capacity, that projects approximately 3 feet of sea-level rise by the end of the 21st Century, but is not presented in Table 1 or Figure 1. Under certain circumstances, specific Bay Trail improvements might be justified in applying the low risk aversion projection, but for this planning exercise we recommend using the sea-level rise projections associated with a medium-high risk aversion.

Table 1
State Guidance: Sea – Level Rise projections for San Francisco Bay, CA

Scenario	2030	2050	2070	2100
Low Risk Aversion	0.5 feet	1.1 feet	1.9 feet	3.4 feet
Medium-High Risk Aversion	0.8 feet	1.9 feet	3.5 feet	6.9 feet
Extreme Risk Aversion (H++)	1.0 feet	2.7 feet	5.2 feet	10.2 feet

NOTES:
[a] Sea level rise projections assume high emissions (RCP 8.5).

SOURCE: Ocean Protection Council (2018)

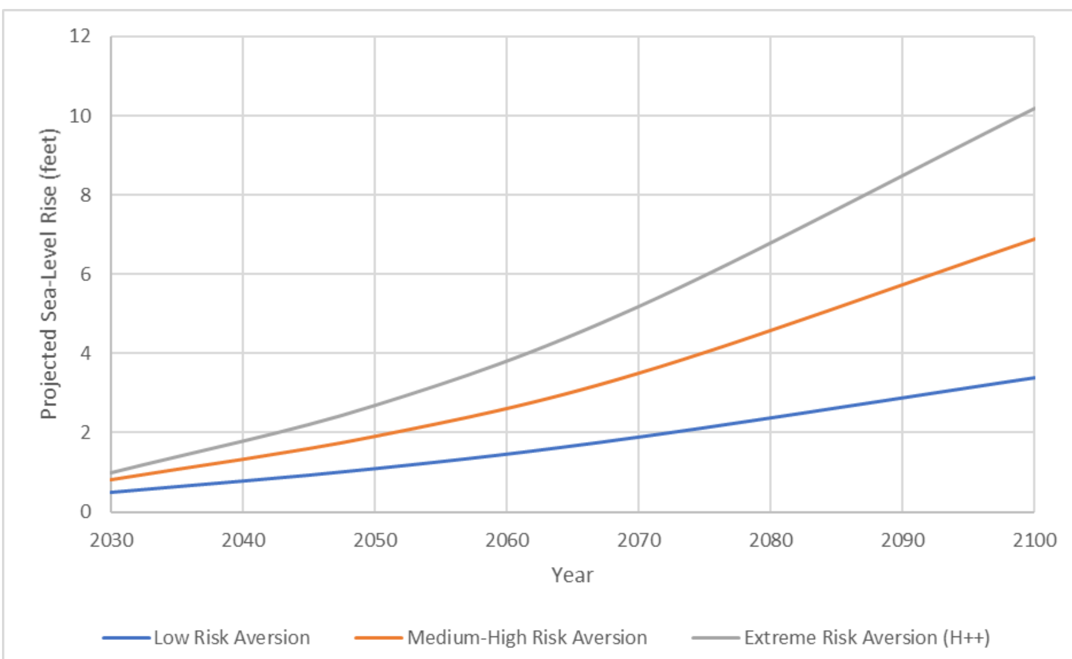


Figure 1. Sea-Level Rise Projections for San Francisco Bay, CA

Inundation and Flood Hazard Data

As part of the inundation and flood hazard analysis, ESA reviewed two datasets covering the Project Area (Contra Costa and Alameda Counties):

1. United States Geological Survey (USGS) Coastal Storm Modeling System[1] (CoSMoS) (Ballard et al. 2016)

2. San Francisco Bay Conservation and Development Commission (BCDC) Adapting to Rising Tides[2] (ART) (BCDC 2012)

Both datasets are available online, for use by coastal resource managers, planners and public to better understand the potential impacts of climate change-induced sea-level rise on Bay Area communities. Brief descriptions of each dataset's background and methodology are provided below.

USGS Coastal Storm Modeling System (CoSMoS)

The USGS Coastal Storm Modeling System (CoSMoS) is a collaborative, user-driven project focused on providing San Francisco Bay Area coastal resource managers and planners locally-relevant, online maps and tools to help them understand, visualize, and anticipate vulnerabilities to sea-level rise, storm surge, and wave hazards (Ballard et al. 2016). The CoSMoS dataset has 50+ combinations of sea-level rise (0 cm, 25 cm, 50 cm, … 200 cm, 500 cm) and storm scenarios (king tide, 0-year, 1-year, 20-year, and 100-year). The modeling approach taken can be described as event-based, including defining discrete storm events based General Circulation Model (GCM) output for each region of the Bay and compositing of results from all contributing storms for final flood maps. The hazard maps do not consider erosion, and they do not explicitly include increased flooding due to wave runup on the shore.

ESA obtained water surface elevation and flood depths data for multiple scenarios:

- Existing Condition: 0-year (tidal) and 100-year (storm) scenarios.

- 1 Meter (3.1 feet) of Sea-level Rise: 0-year (tidal) and 100-year (storm) scenarios.

- 2 Meter (6.2 feet) of Sea-level Rise: 0-year (tidal) and 100-year (storm) scenarios.

BCDC Adapting to Rising Tides (ART)

The Adapting to Rising Tides (ART) project led by the San Francisco Bay Conservation and Development Commission (BCDC) provides support, guidance, tools, and information to help agencies and organizations understand, communicate, and begin to address complex climate change issues (BCDC 2012). Different from CoSMoS, ART implements the "one map equals many futures" concept, where the flooding depicted is not inherently tied to any time or emission- or risk-based projections. Instead, spatially variable MHHW is used as the current condition baseline. This MHHW data raising by a range of water depths (12'', 24'', 36'', … 96'', 108'') are then mapped to a subset of sea-level rise and storm scenarios.

---

[1] The USGS Coastal Storm Modeling System (CoSMoS) is accessible here: https://www.usgs.gov/centers/pcmsc/science/coastal-storm-modeling-system-cosmos?qt-science_center_objects=0#qt-science_center_objects

[2] The BCDC Adapting to Rising Tides datasets are accessible here: https://www.adaptingtorisingtides.org/

Comparison of the CoSMoS hazard maps to ART hazard maps using the available public databases is challenging because the ART program has made only the inundation depth rasters available to the public. Therefore, ESA obtained water depth data from online platform and received a MHHW raster from AECOM[3]. ESA then developed a set of raster of water surface elevations by "lifting" the MHHW water surface by the corresponding water depth (e.g. 12", 84").

The ART maps do not account for erosion of the shore or wave runup, which would increase the flooding generally.

Flood Hazard Mapping

ESA mapped the selected datasets for tidal and storm conditions over three time horizons: existing conditions, mid-century, late-century (**Table 2**). ESA used the following elevation thresholds to define tidal and storm conditions:

- Tidal conditions are characterized by spring high tide events, which reach approximately 7.0 feet NAVD, or one foot above the Mean Higher-High Water (MHHW) tidal datum.
- Storm conditions are assumed to be 3.2 feet above MHHW (approximately 9.2 feet NAVD), representative of the 100-year still water level (PWA 2007, URS 2012, USACE 1984).

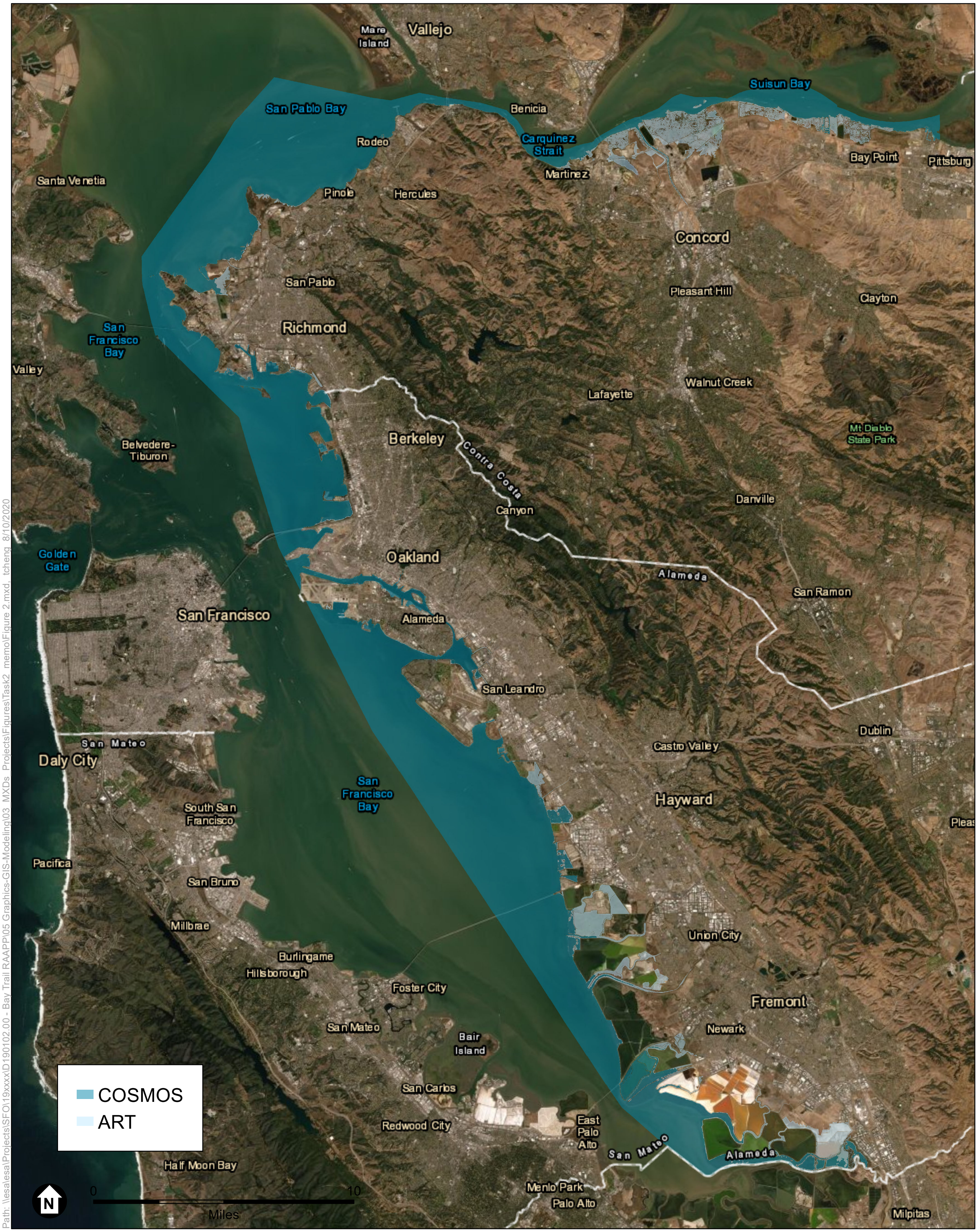
TABLE 2
SELECTED INUNDATION AND FLOOD HAZARD SCENARIOS OF INTEREST

Scenario ID	1	2	3	4	5	6
Time Horizon	Existing Conditions		Mid-Century (2050-2060)		Late-Century (2080-2100)	
Sea-Level Rise (feet)	0	0	3±	3±	6±	6±
Hydrologic Condition	Tidal	Storm	Tidal	Storm	Tidal	Storm
Still Water Level (feet NAVD)[a]	7.0	9.2	10.0	12.2	13.0	15.2
Flood Hazard Scenarios	CoSMoS: 0-year ART: MHHW + 12"	CoSMoS: 100-year ART: MHHW + 36"	CoSMoS: 0-year + 1 meter ART: MHHW + 48"	CoSMoS: 100-year + 1 meter ART: MHHW + 77"	CoSMoS: 0-year + 2 meter ART: MHHW + 84"	CoSMoS: 100-year + 2 meter ART: MHHW + 108"

a Value shown in table is representative of Central San Francisco Bay. Water levels vary spatially throughout the project area by approx. 2 feet.

Figures 2 through 7 present the CoSMoS and ART flood hazard extents for tidal and storm conditions for the three sea-level rise scenarios.

3 Personal communication, ART project contractor



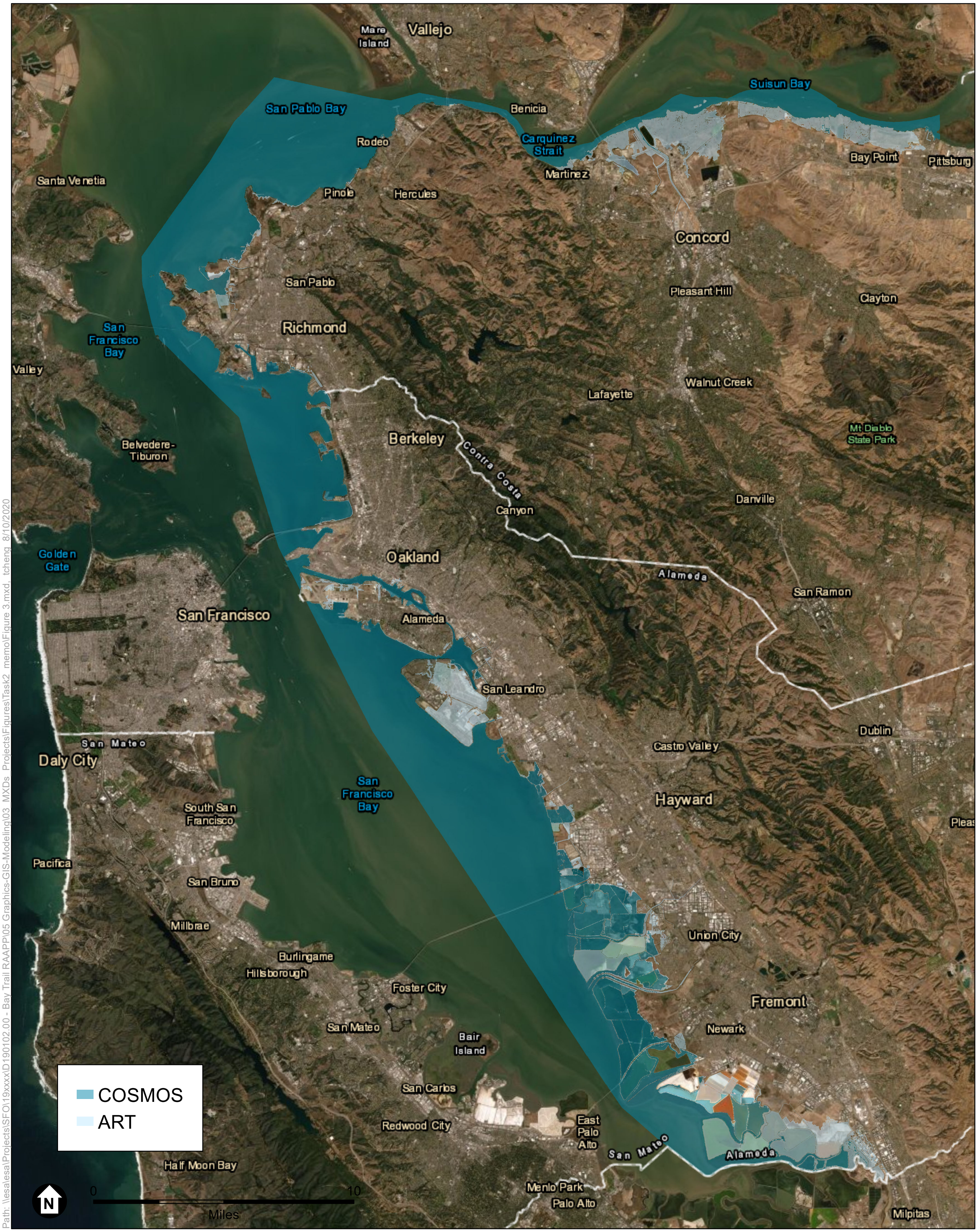
Path: \\esa\esa\Projects\SFO\19xxxx\D190102.00 - Bay Trail RAAPP\05 Graphics-GIS-Modeling\03_MXDs_Projects\Figures\Task2_memo\Figure 2.mxd, tcheng 8/10/2020

SOURCE: USGS, BCDC

Bay Trail RAAPP . D190102.00

Figure 2
Tidal Conditions, Existing Conditions (0 feet SLR)
CoSMos and ART Flood Hazard Extents

ESA



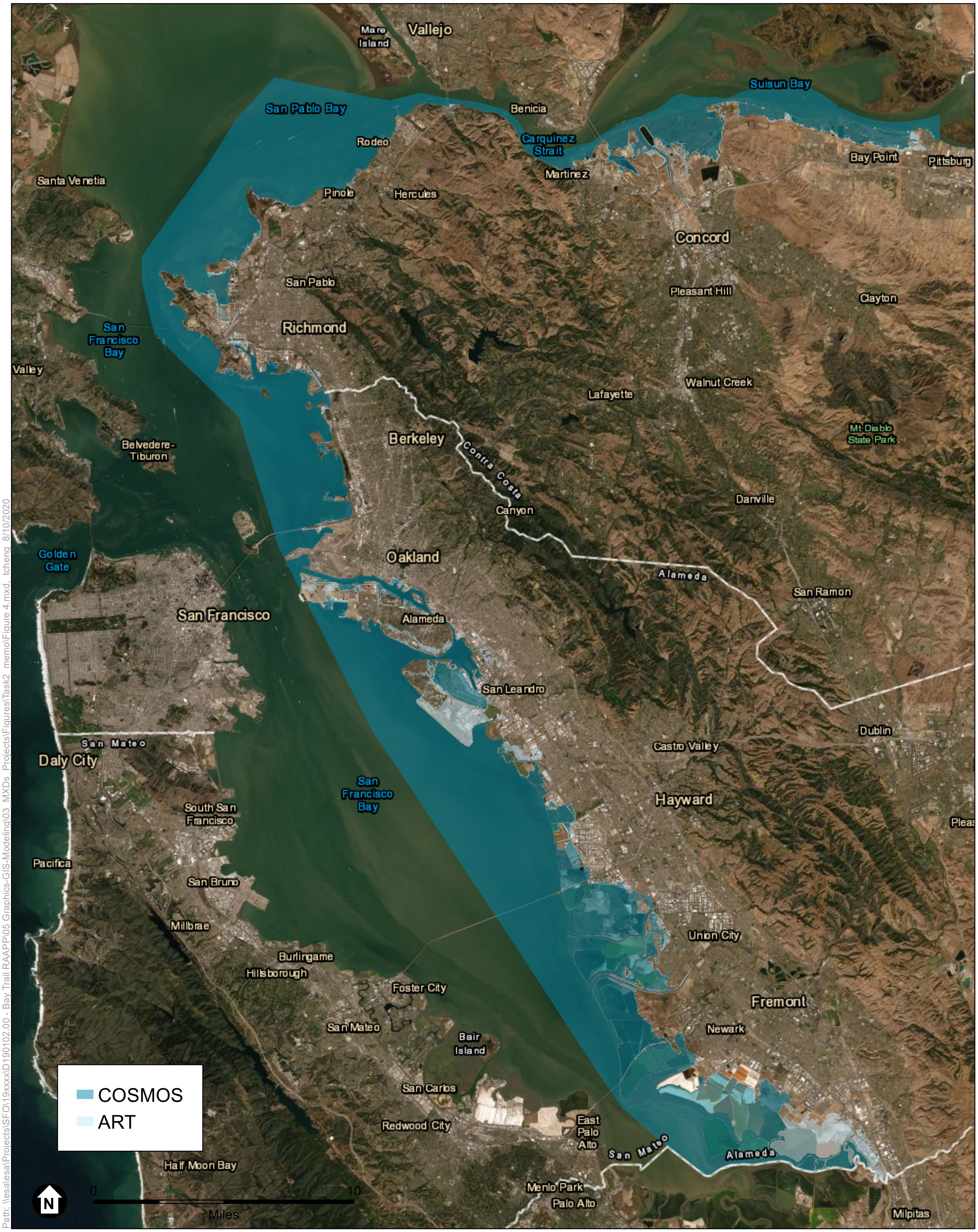
Path: \\esa\esa\Projects\SFO\19xxxx\D190102.00 - Bay Trail RAAPP\05 Graphics-GIS-Modeling\03 MXDs_Projects\Figures\Task2_memo\Figure 3.mxd, tcheng 8/10/2020

SOURCE: USGS, BCDC

Bay Trail RAAPP . D190102.00

Figure 3
Storm Conditions, Existing Conditions (0 feet SLR)
CoSMos and ART Flood Hazard Extents

ESA

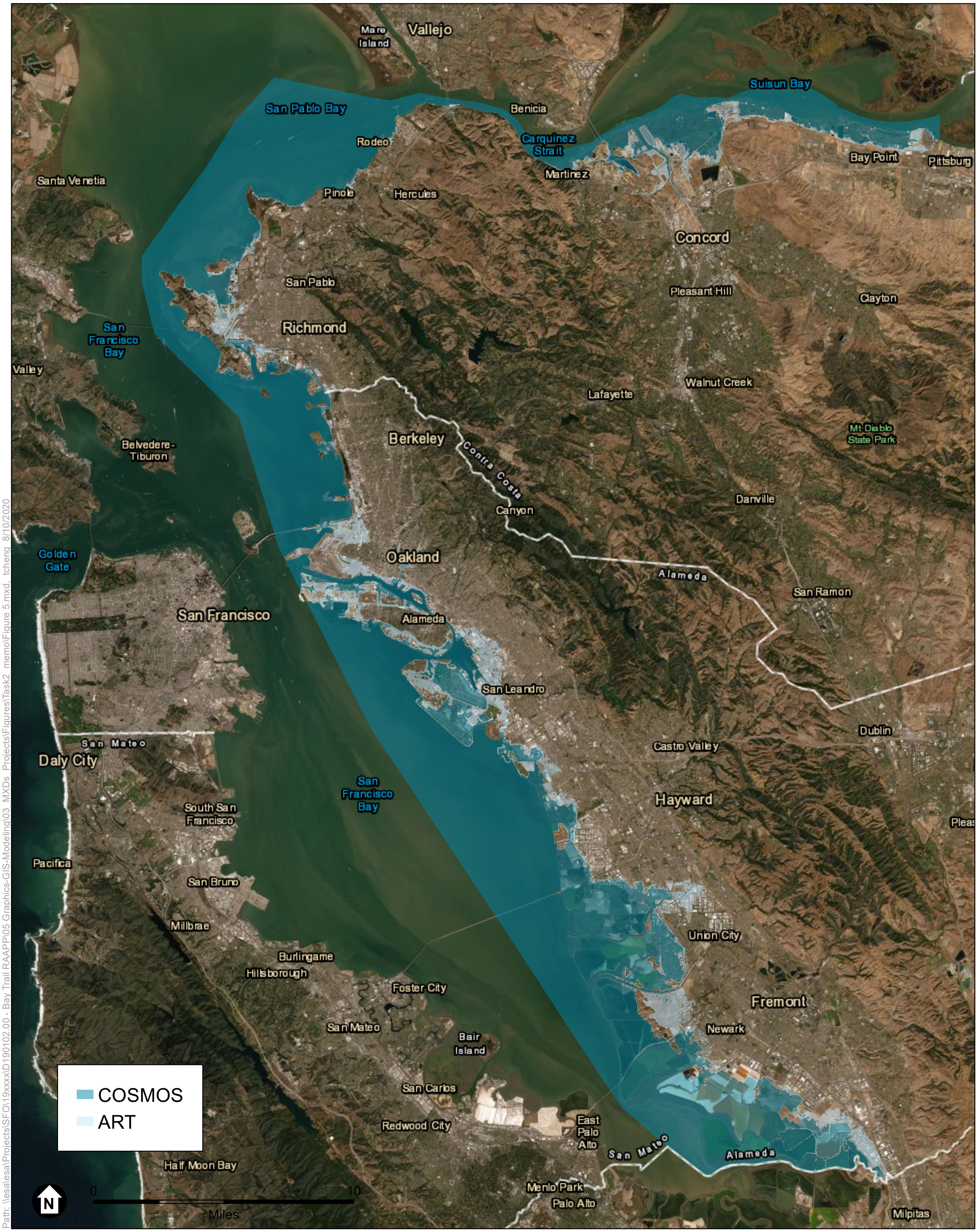


SOURCE: USGS, BCDC

Bay Trail RAAPP . D190102.00

Figure 4
Tidal Conditions, Mid-Century (3 feet ± SLR)
CoSMos and ART Flood Hazard Extents

ESA

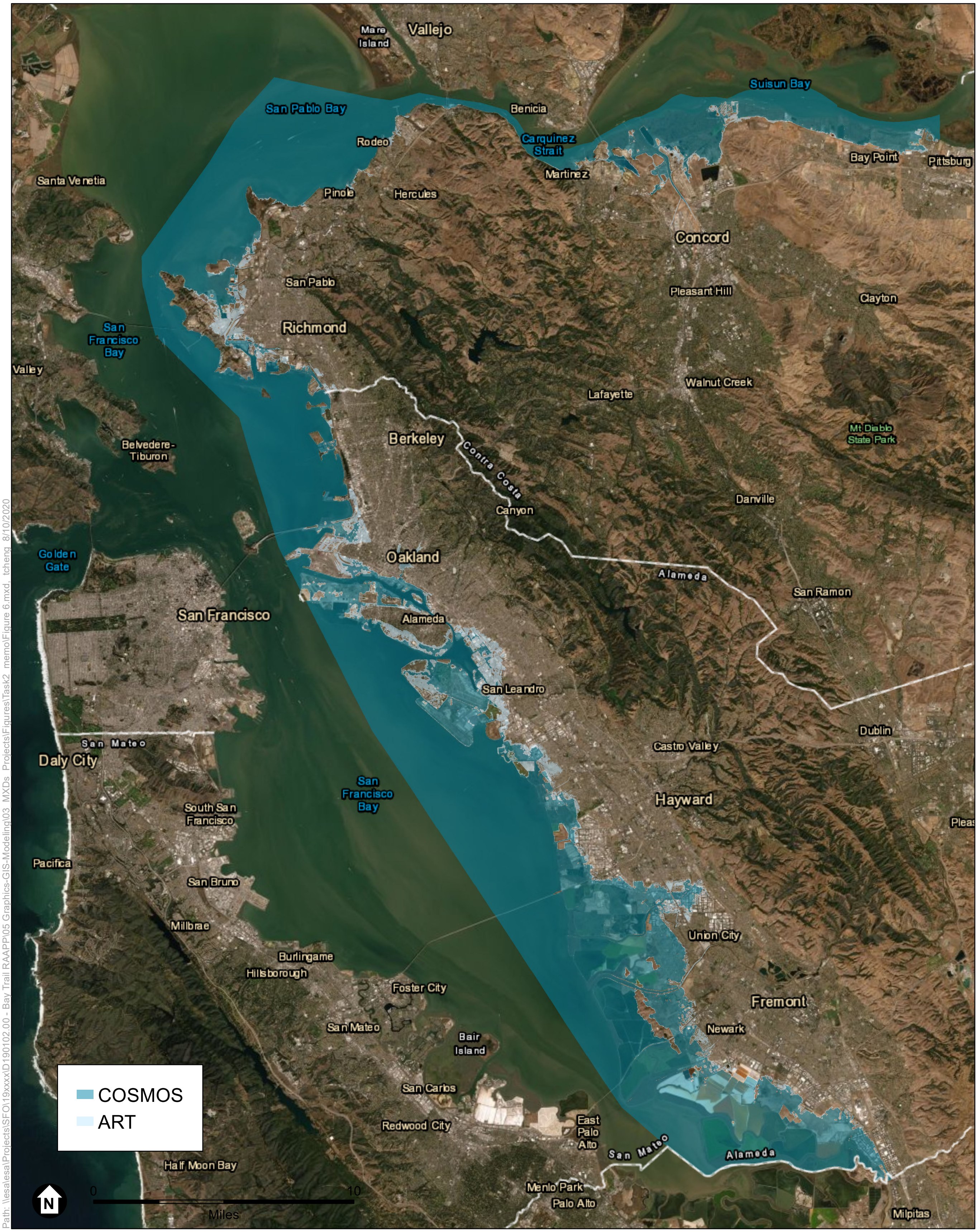


SOURCE: USGS, BCDC

Bay Trail RAAPP . D190102.00

Figure 5
Storm Conditions, Mid-Century (3 feet ± SLR)
CoSMos and ART Flood Hazard Extents

ESA



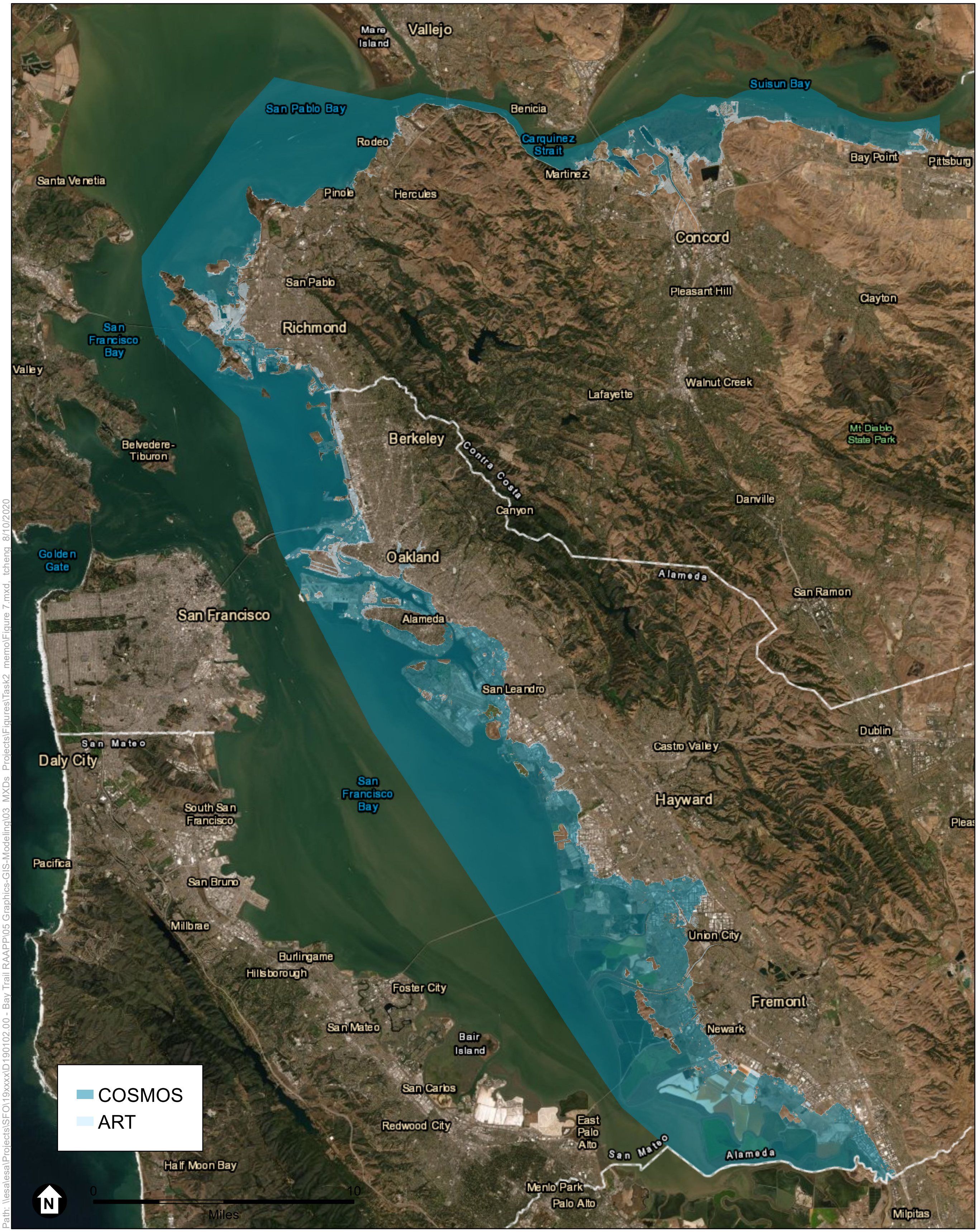
Path: \\esa\esa\Projects\SFO\19xxxx\D190102.00 - Bay Trail RAAPP\05 Graphics-GIS-Modeling\03_MXDs_Projects\Figures\Task2_memo\Figure 6.mxd, tcheng 8/10/2020

SOURCE: USGS, BCDC

Bay Trail RAAPP . D190102.00

Figure 6
Tidal Conditions, Late-Century (6 feet ± SLR)
CoSMos and ART Flood Hazard Extents

ESA



SOURCE: USGS, BCDC

Bay Trail RAAPP . D190102.00

Figure 7
Storm Conditions, Late-Century (6 feet ± SLR)
CoSMos and ART Flood Hazard Extents

ESA

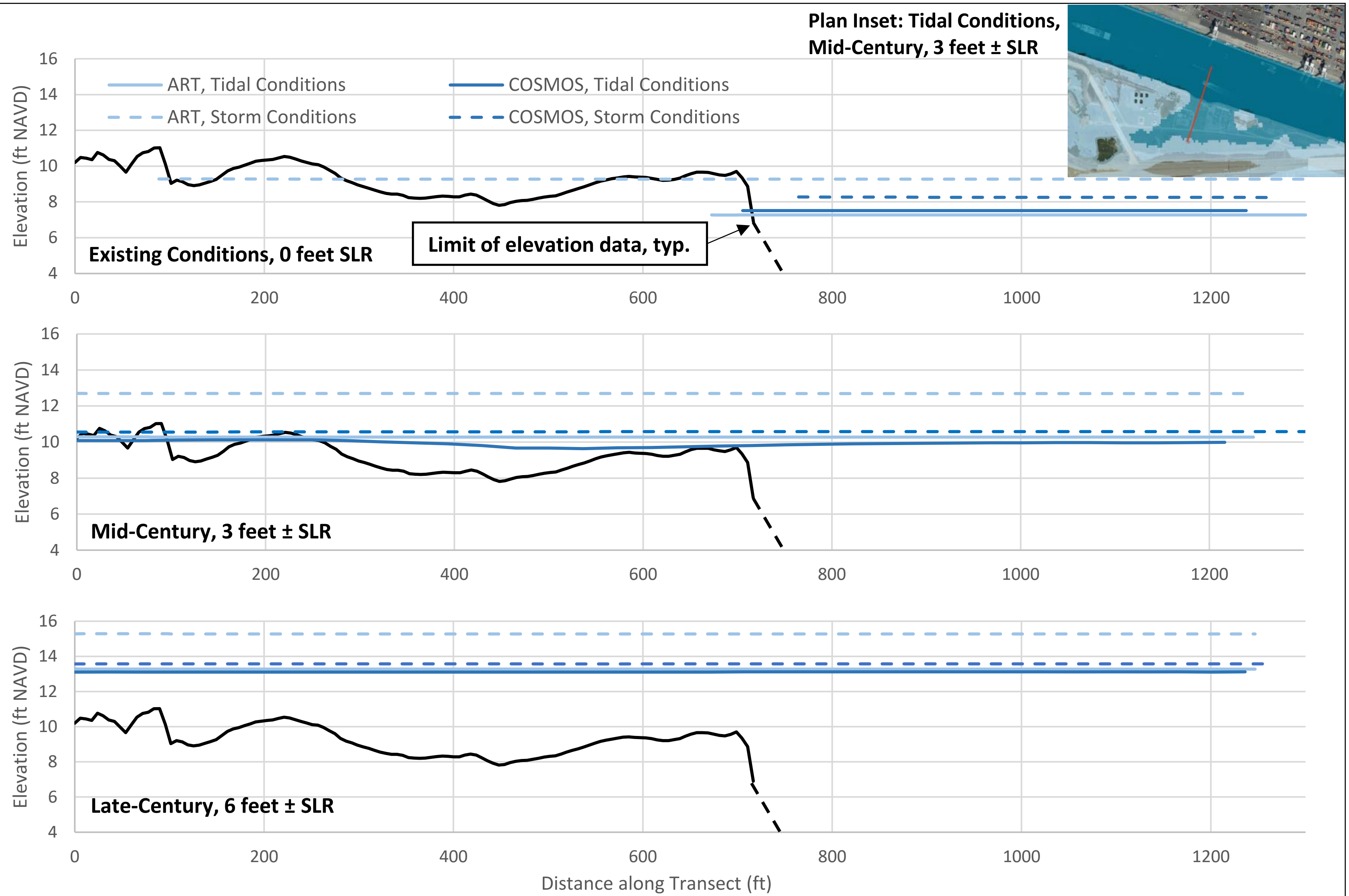
Flood Hazard Analyses

A visual comparison of the CoSMoS and ART datasets in GIS show that ART generally predict larger inundation extents and smaller flood depths along the project area shoreline. A sample transect taken along the north shore of Alameda shows that ART water surface level predictions are higher than those predicted by CoSMoS for both 3 feet and 6 feet sea-level rise and tidal and storm conditions (**Figure 8**).

These differences in water surface elevation predictions result from the distinct methodologies used to develop the flood hazard datasets. The ART dataset was developed using the "bathtub" method for mapping all the MHHW+ scenarios, where the water surface elevation is raised linearly by the amount of sea-level rise and then intersected with adjacent land of the same elevation to calculate the new inundation extent.

Estimates of MHHW vary along the shoreline since tides are spatially variable along San Francisco Bay. As tides propagate from the mouth of the Bay southwards, they are modified by the bathymetry, bottom friction, and reflected waves. The effect of tidal amplification increases further south from the mouth of the Bay. Thus, South San Francisco Bay has a larger tide range than the Pacific Ocean and other parts of the Bay. The tidal range increases from 5.84 feet at the San Francisco tide gage to 8.85 feet at the NOAA Coyote Creek (Station # 9414575) tide gage. Additionally, setup from wind-generated waves can elevate water levels in the South Bay, with increased fetch (distance over which wind can blow) and wind speed. Local water levels can also reflect freshwater inputs and storm surge from extreme events. Therefore, spatial variability in the tidal signal is reflected in the MHHW dataset that was processed in order to develop the future water surface elevation maps for tidal and storm conditions.

ESA recommends using the CoSMoS inundation and flood hazard dataset for input into the risk analysis for the project, and suggests considering the range of CoSMoS and ART hazards. ESA received a map of the Bay Trail segments from WRT and conducted GIS mapping analysis to quantify inundation and flood hazards for each of the forty-eight trail segments. Specifically, ESA intersected the CoSMoS data with the Bay Trail segments to calculate the percentage of trails flooded under the range of sea-level rise and storm conditions. The same technique was applied for groundwater hazard quantification. All results are summarized in the attached Bay Trail Segment Selection Criteria Table that was collaboratively developed by the WRT team, including WRT, Arup, ESA, SFEI and OnClimate.



SOURCE: USGS, BCDC

Figure 8

Comparison of ART and COSMOS Water Surface Elevation Profiles at Alameda Point for Tidal and Flood Conditions at Existing, Mid-Century, and Late-Century

Wave Data

As part of the FEMA Region IX Coastal Flood Study, DHI Water and Environment Inc. conducted wave modeling and extreme value analysis of the simulated wave heights for North and Central San Francisco Bay (Kerper et al. 2012). This dataset was leveraged for our wave hazard analysis. Specifically, ESA selected maximum 100-year wave height for each trail segment north of the San Mateo-Hayward Bridge within the DHI study limit, and assumed a 100-year wave height of 4 feet for areas south of the San Mateo-Hayward Bridge (**Figure 9**Error! Reference source not found.).

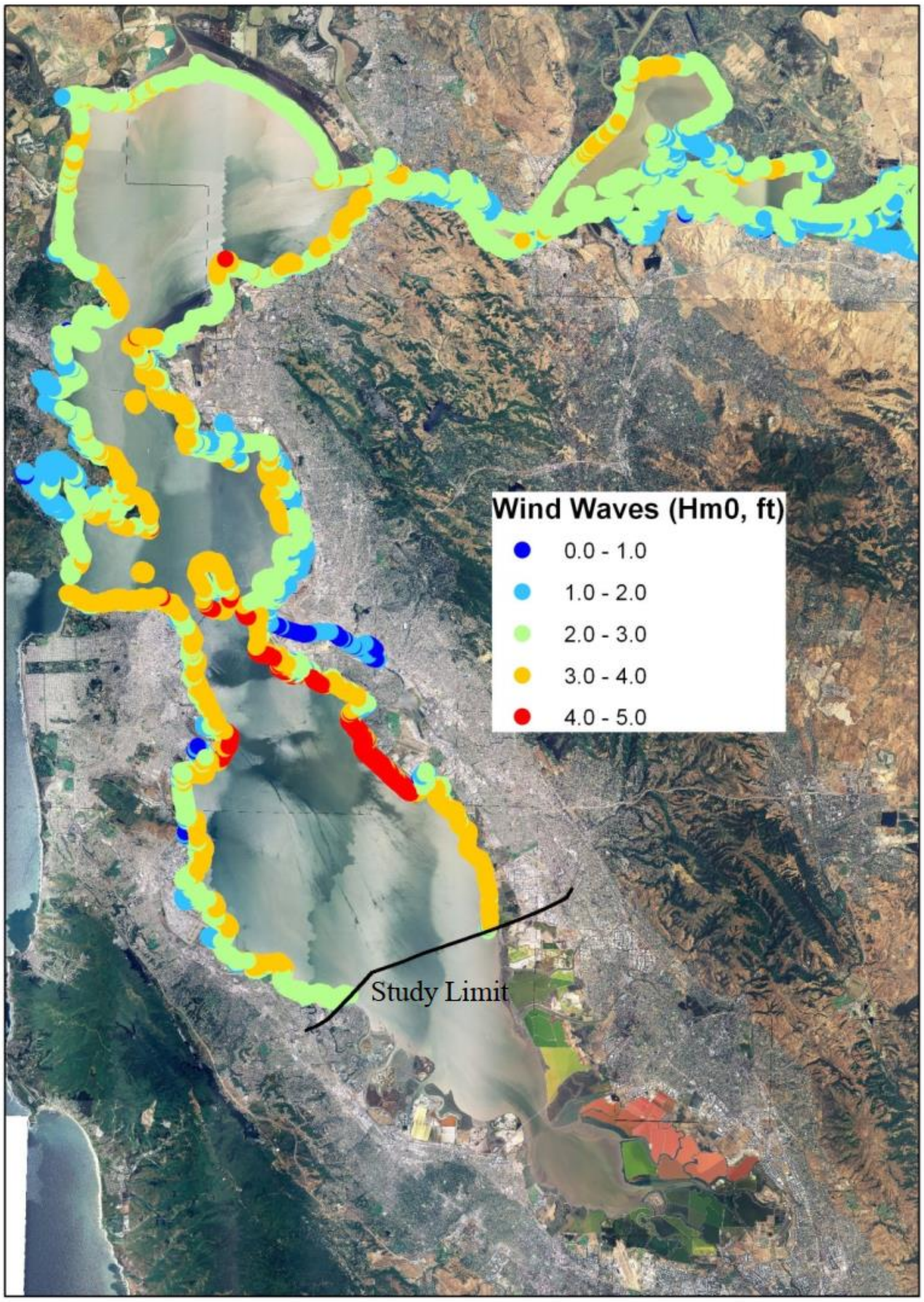


Figure 9. Distribution of 100-year Wind Wave in San Francisco Bay (DHI 2011)

Groundwater

Plane et al. (2019) estimated values for minimum depth to groundwater in the coastal Bay Area. Their estimation is based on an interpolation that uses ground elevation data and minimum depth to water values measured at monitoring wells in the nine Bay Area counties over the past 20 years. ESA acquired the minimum depth to groundwater dataset for an initial groundwater hazard analysis.

To simplify the analysis for the first-tier screening, we assume that areas within 5 feet to groundwater table are located within the groundwater hazard zone. We further assume that groundwater table will rise linearly with sea-level rise. For example, for a mid-century time frame with 3 feet sea-level rise, the future groundwater hazard zone will include areas that are now within 8 feet depth to groundwater. Similarly, areas that are now within 11 feet to groundwater will located in the groundwater hazard zone in late-century with 6 feet sea-level rise. Note that a fair amount of the trail segments is within the “No Data” zone (**Figure 10**).

ESA understands that this method of quantifying groundwater hazard is approximate; however, for a high-level screening analysis, this approach is suitable for developing an appropriate understanding of the risk posed by future changes to groundwater hydrology. New data is available from a recently released USGS study on groundwater response to sea-level rise, and we understand this uses the data that was used in the Bay Trail RAAPP analyses (Befus et al. 2020). ESA reviewed the new USGS data and determined that there would be no major changes to findings presented. However, we suggest using and leveraging the new data for future assessment and analysis.

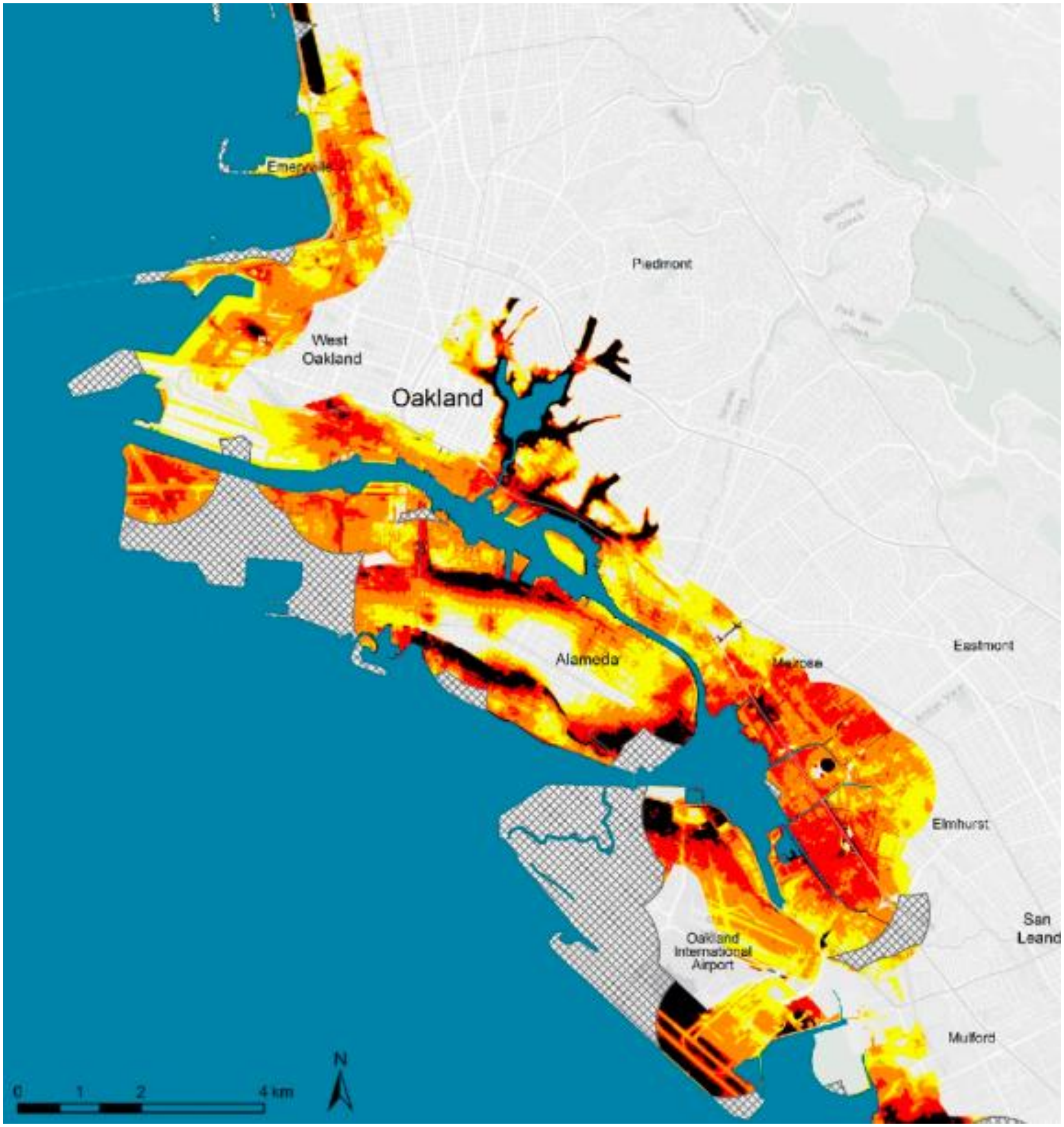


Figure 10. Map showing 5' Groundwater Polygon with No Data Zone

References

Ballard, G., Barnard, P., Erikson, L., Fitzgibbon, M., Moody, D., Higgason, K., Psaros, M., Veloz, S., and Wood, J. 2016. Our Coast Our Future (OCOF). [data downloaded from web application]. Petaluma, California. Available at: http://www.ourcoastourfuture.org (Last Accessed: March 2019).

Befus, K.M., Barnard, P.L., Hoover, D.J., Hart, J.F. and Voss, C.I. 2020. Increasing threat of coastal groundwater hazards from sea-level rise in California. Nature Climate Change, 10(10), pp.946-952.

Kerper D., Zyserman J. A., Shen T., and Appendini C.M. (2012). Regional Coast Hazard Modeling Study for North and Central San Francisco Bay – Final Draft Report. Prepared for FEMA Region IX.

Ocean Protection Council (OPC), 2018, State of California Sea-Level Rise Guidance 2018 Update, Prepared by the California Natural Resources Agency and the California Ocean Protection Council, March 2018.

Philip Williams & Associates, Ltd. (PWA), 2007, Flood Analyses Report, Appendix to EDAW et al. 2007, Final Environmental Impact Statement/Report, South Bay Salt Pond Restoration Project, Prepared for U.S. Fish and Wildlife Service and California Department of Fish and Game, December 2007.

Plane, Ellen; Hill, Kristina; May, Kris (2019), Minimum Depth to Groundwater for the Coastal San Francisco Bay Area, v12, UC Berkeley, Dataset, https://doi.org/10.6078/D1W01Q

San Francisco Bay Conservation Development Commission (BCDC). 2012. Adapting to Rising Tides Project. Available from: http://www.adaptingtorisingtides.org

URS, and AGS, 2012, Sea Level Rise and Adaptation Study: Project Report Compilation, Report Prepared for the Port of San Francisco, June 29, 2012.

U.S Army Corps of Engineers (USACE), 1984, San Francisco Bay Tidal Stage vs. Frequency Study, San Francisco District U.S. Army Corps of Engineers, October 1984.

Attachments

Attachment A - Bay Trail Segment Selection Criteria Table

Attachment A - Bay Trail Segment Selection Criteria Table (WRT and others)

SF Bay Trail RAAPP
Selection Criteria Table
12/12/2019

		Restoration Potential			EBRPD			Serving Disadvantaged Communities			Coastal Hazards													
											Tidal Inundation			Storm Flooding			Extreme Wave Conditions in Vicinity of Segment	Groundwater Emergence							
ID	Bay Trail Segments	Adjacent to Existing Marsh (yes or no)	Adjacent to potential marsh?	Suitable for beaches?	Partially Operated by EBRPD (yes or no)	Interest by EBRPD	Interest by EBRPD_weight	Overlapping Disadvantaged Communities (75-100%) yes or no	Within 1/4 mile Disadvantaged Communities (75-100%) yes or no	Segment Length (feet, measurement of GIS object)	% of segment inundated in SLR 0 ft Scenario	% of segment inundated in SLR 3 ft Scenario	% of segment inundated in SLR 6 ft Scenario	% of segment inundated in SLR 0 ft Scenario	% of segment inundated in SLR 3 ft Scenario	% of segment inundated in SLR 6 ft Scenario	100-year Wind Wave (ft, based on DHI 2011)	% of segment 5 ft to water table in SLR 0 ft Scenario	% of segment 8 ft to water table in SLR 3 ft Scenario	% of segment 11 ft to water table in SLR 6 ft Scenario	% of segment in no data zone	total	rank	8 Sites_ID	8 Sites_Name
340	Arrowhead Marsh Trail	1	1	1	1	1	1	1	1	16,567	1%	14%	71%	1%	51%	98%	≤ 3	76%	93%	96%	0%	12.01	1	1	MLK Shoreline
330	Damon-Garretson Trail	1	1	1	1	1	1	1	1	15,237	0%	15%	56%	0%	34%	97%	≤ 3	83%	92%	92%	6%	11.69	2	1	MLK Shoreline
320	Dolittle Pond Trail	1	1	1	1	1	1	1	1	9,460	1%	35%	63%	5%	59%	68%	≤ 3	58%	67%	86%	6%	11.42	3	1	MLK Shoreline
300	MLK Trail Alameda	1	1	1	0	1	1	1	1	11,332	0%	1%	32%	0%	28%	79%	≤ 4	52%	53%	53%	38%	8.98	6	1	MLK Shoreline
100	North Richmond Wetlands Loop	1	1	1	1	1	1	1	1	16,535	0%	30%	37%	0%	32%	48%	≤ 4	23%	62%	75%	0%	10.07	4	2	North Richmond
110	Wildcat Creek Trail South	1	1	0	1	1	1	1	1	9,307	0%	12%	41%	0%	38%	53%	≤ 4	13%	64%	95%	5%	9.16	5	2	North Richmond
90	Wildcat Creek Trail North	1	1	1	1	0	0	1	1	15,723	0%	5%	32%	0%	7%	59%	≤ 3	21%	22%	22%	73%	6.68	18	2	North Richmond
260	Alameda Point Trail	0	1	1	1	1	1	0	1	34,511	0%	44%	83%	2%	60%	85%	≤ 5	31%	37%	37%	62%	8.79	8	3	Alameda Point
400	Hayward Shoreline Trail South	1	1	1	1	0	0	1	1	9,662	0%	58%	74%	37%	74%	74%	≤ 4	20%	21%	21%	53%	8.79	7	4	Coyote Hills/Hayw
420	Coyote Hills Trail North	1	1	0	1	0	0	1	1	18,113	0%	65%	97%	0%	94%	100%	≤ 4	23%	41%	41%	59%	8.61	9	4	Coyote Hills/Hayw
380	Hayward Shoreline Trail North	1	1	1	1	0	0	1	1	9,835	1%	21%	75%	3%	56%	76%	≤ 4	40%	41%	41%	55%	8.54	10	4	Coyote Hills/Hayw
430	Eden Landing Loop	1	1	0	0	0	0	1	1	19,391	0%	89%	100%	0%	100%	100%	≤ 4	18%	20%	20%	67%	7.47	12	4	Coyote Hills/Hayw
450	Alameda Creek Trail	1	1	0	0	0	0	1	1	10,131	0%	56%	98%	0%	91%	100%	≤ 4	18%	24%	24%	76%	7.11	14	4	Coyote Hills/Hayw
440	Coyote Hills Trail South	1	1	0	0	0	0	1	1	24,573	0%	58%	80%	0%	77%	89%	≤ 4	17%	31%	41%	41%	6.93	16	4	Coyote Hills/Hayw
290	Crown Beach Trail	1	1	1	1	0	0	0	0	13,980	0%	4%	32%	0%	49%	97%	≤ 4	52%	72%	76%	24%	7.82	11	5	Crown Beach
170	Eastshore Trail North	1	1	1	1	0	0	1	1	25,379	0%	5%	15%	0%	7%	56%	≤ 4	24%	58%	75%	18%	7.4	13	6	Eastshore State F
190	Eastshore Trail South	1	1	1	1	0	0	1	1	61,820	0%	4%	0%	1%	20%	57%	≤ 4	24%	49%	54%	41%	7.09	15	6	Eastshore State F
180	Gilman to Buchanan Trail	0	0	1	0	1	1	1	1	5,061	0%	15%	60%	0%	37%	64%	≤ 4	14%	47%	54%	20%	6.91	17	6	Eastshore State F
490	Spine Trail	1	1	0	0	0	0	1	1	78,137	0%	4%	59%	0%	21%	77%	≤ 4	48%	69%	72%	24%	6.5	20	7	Spine Trail
140	Ferry Point Trail	0	1	1	1	1	1	0	0	15,990	0%	0%	15%	0%	1%	52%	≤ 4	0%	0%	0%	94%	5.68	26	8	Miller Knox
250	MLK Trail Oakland	0	1	1	0	0	0	1	1	25,722	0%	18%	63%	0%	20%	93%	≤ 2	63%	0%	95%	0%	6.52	19		
160	Pt. Isabel Trail	1	1	1	0	0	0	1	1	41,328	1%	3%	29%	0%	19%	59%	≤ 3	24%	36%	73%	7%	6.44	21		
240	Embarcadero	0	1	0	0	0	0	1	1	11,412	0%	6%	63%	0%	8%	86%	≤ 2	72%	98%	99%	0%	6.32	22		
350	Oyster Bay Trail South	0	1	0	0	1	1	1	1	8,727	0%	0%	59%	0%	1%	91%	≤ 5	2%	17%	62%	0%	6.32	23		
70	Pt. Pinole Shoreline Trail	1	1	1	1	0	0	1	1	56,179	0%	0%	4%	0%	1%	11%	≤ 4	31%	35%	39%	37%	6.21	24		
370	Marina Park Trail	1	1	1	0	0	0	1	1	22,381	0%	6%	40%	0%	39%	92%	≤ 4	0%	0%	0%	80%	5.77	25		
20	Martinez Shoreline Trail	1	1	0	1	0	0	1	1	26,575	0%	7%	16%	0%	6%	16%	≤ 3	39%	41%	42%	37%	5.67	27		
360	Oyster Bay Trail North	0	1	1	1	0	0	1	1	14,845	0%	0%	10%	0%	13%	30%	≤ 4	14%	17%	29%	9%	5.13	28		
310	Bay Farm Island Loop	1	1	1	0	0	0	0	1	27,560	0%	20%	29%	1%	34%	90%	≤ 5	8%	12%	12%	71%	5.06	29		
80	Pt. Pinole Regional Trail	1	1	1	1	0	0	1	1	22,823	0%	0%	0%	0%	0%	3%	≤ 5	0%	0%	0%	100%	5.03	30		
390	San Lorenzo Creek Trail	1	1	0	1	0	0	1	1	7,768	0%	20%	28%	0%	25%	29%	≤ 4	0%	0%	0%	93%	5.02	31		
210	Judge John Sutter Trail	0	0	0	0	0	0	1	1	6,197	0%	0%	45%	0%	0%	99%	≤ 4	47%	100%	100%	0%	4.91	32		
130	Miller Knox Trail West	0	1	0	0	0	0	1	1	16,516	0%	0%	11%	0%	7%	24%	≤ 4	60%	80%	94%	0%	4.76	33		
200	San Francisco Bay Bridge	1	1	0	0	0	0	1	1	25,429	0%	1%	24%	1%	6%	48%	≤ 4	10%	34%	45%	13%	4.69	34		
280	Oakland Estuary Trail	0	1	0	0	0	0	0	1	26,044	0%	5%	37%	0%	18%	60%	≤ 2	56%	92%	96%	4%	4.64	35		
410	San Mateo Bridge	1	1	0	0	0	0	1	1	16,539	0%	24%	28%	0%	27%	30%	≤ 4	5%	12%	12%	26%	4.38	36		
220	7th Street Trail	0	1	1	0	0	0	1	1	5,821	0%	0%	2%	0%	0%	10%	≤ 4	7%	33%	66%	0%	4.18	37		
120	Miller Knox Trail East	0	1	1	1	0	0	0	0	30,734	0%	1%	1%	0%	1%	2%	≤ 4	21%	31%	42%	32%	3.99	38		
480	Marshlands Road Trail	1	1	0	1	0	0	0	0	5,574	0%	2%	28%	0%	14%	31%	≤ 4	0%	2%	2%	98%	3.79	39		
470	Paseo Padre Trail	1	1	0	0	0	0	0	0	14,003	0%	0%	70%	0%	13%	84%	≤ 4	0%	0%	0%	87%	3.67	40		
150	Shipyard Trail	0	1	1	0	0	0	0	0	24,848	0%	0%	4%	0%	1%	16%	≤ 4	17%	32%	47%	17%	3.17	41		
270	Crown Beach Connection Trail	0	0	0	0	0	0	0	0	11,274	0%	13%	55%	0%	19%	81%	≤ 3	34%	54%	54%	46%	3.1	42		
60	Carquinez Bridge	0	1	0	0	0	0	1	1	3,867	0%	0%	12%	0%	0%	11%	≤ 3	0%	0%	0%	50%	2.23	43		
10	Benicia Bridge	0	1	0	0	0	0	1	1	4,218	0%	0%	0%	0%	0%	0%	≤ 3	5%	6%	7%	0%	2.18	44		
230	Middle Harbor Road Trail	0	0	0	0	0	0	0	1	11,205	0%	0%	26%	0%	0%	40%	≤ 1	29%	37%	74%	0%	2.06	45		
460	Alvarado Trail	1	1	0	0	0	0	0	1	15,833	0%	0%	0%	0%	0%	0%	≤ 4	0%	0%	0%	100%	2	46		
30	George Miller Regional Trail	0	0	0	1	0	0	0	0	9,183	0%	0%	0%	0%	0%	0%	≤ 3	0%	0%	0%	100%	1	47		
40	Bull Valley Trail	0	0	0	1	0	0	0	0	12,953	0%	0%	0%	0%	0%	0%	≤ 3	0%	0%	0%	100%	1	47		
50	Carquinez Trail	0	0	0	1	0	0	0	0	23,630	0%	0%	0%	0%	0%	0%	≤ 3	0%	0%	0%	97%	1	47		