



**San Francisco**  
**Planning**

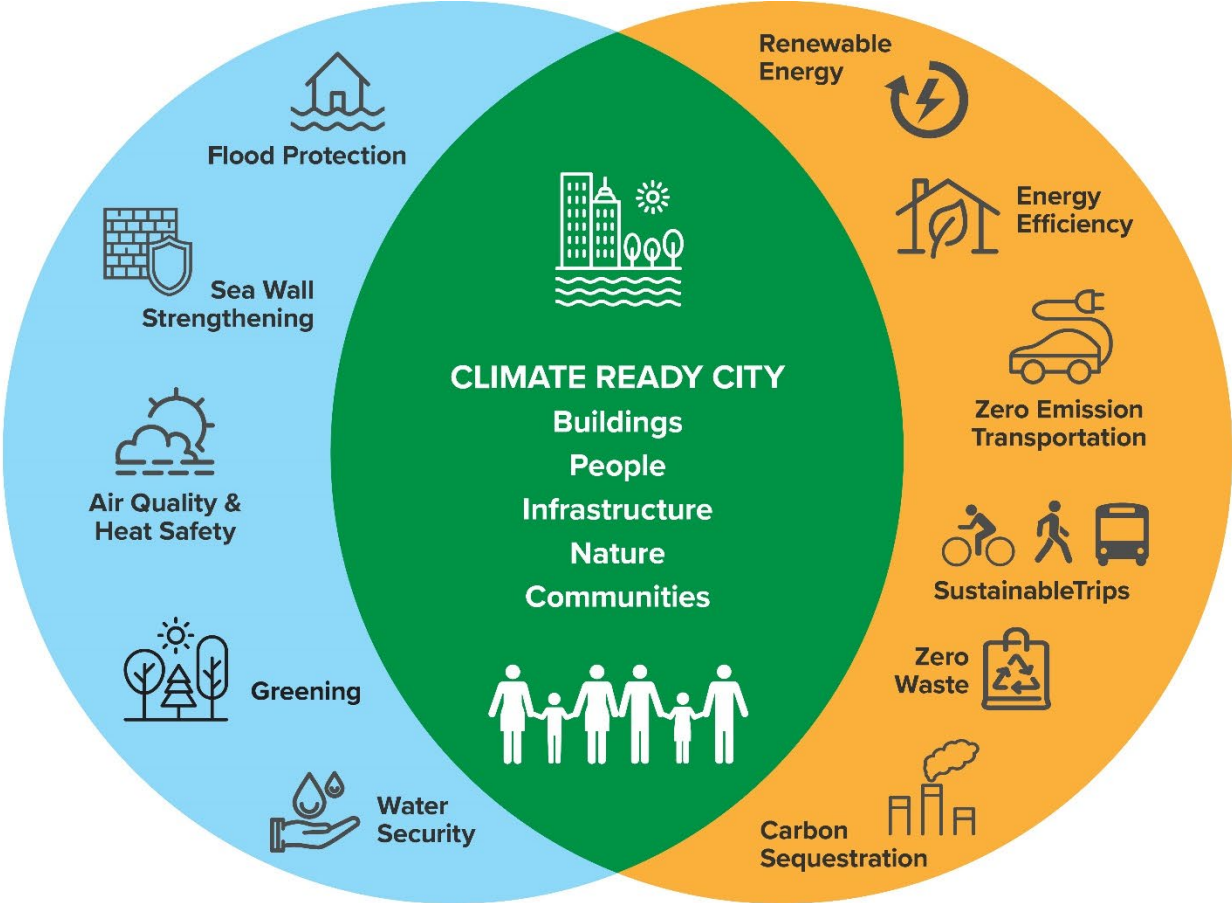
# Sea Level Rise Vulnerability and Consequences Assessment

July 2019

Photo: Dave R

# Climate Resilience

**CLIMATE  
ADAPTATION**



**CLIMATE  
MITIGATION**

# Sea Level Rise Coordinating Committee





CITY AND COUNTY  
OF SAN FRANCISCO

# SAN FRANCISCO SEA LEVEL RISE ACTION PLAN

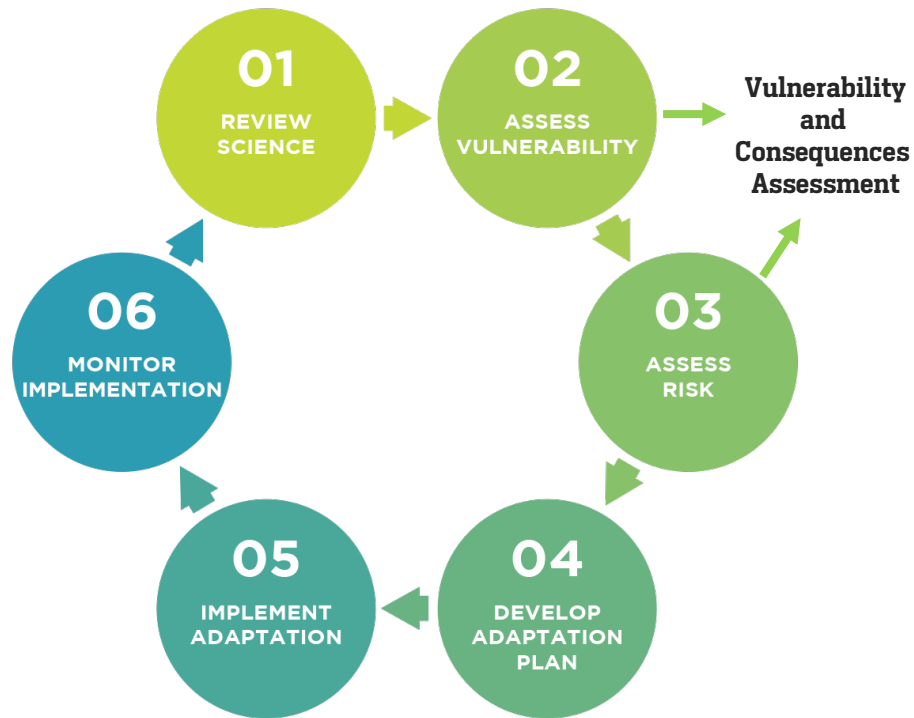
WORKING TOGETHER TO BUILD SAN FRANCISCO'S RESILIENCE TO SEA LEVEL RISE | MAR 2016

## VISION

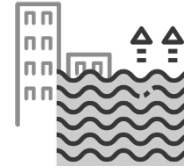
**Make San Francisco a more resilient city in the face of immediate and long-term threats of sea level rise to the Bayshore and Pacific Coast, by taking measures to protect and enhance public and private assets, natural resources, and the quality of life for all.**



# SAN FRANCISCO SEA LEVEL RISE ACTION PLAN



# San Francisco SLR Projections



Year 2030

Year 2050

Year 2100

## Most Likely

Capital Project Approvals \*

6 in

11 in

36 in

## Upper Range

Long-Range Planning \*

12 in

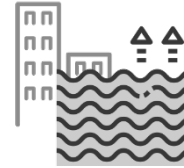
24 in

66 in

\* The City uses the NRC's (National Research Council) most likely SLR projection of 36" for ongoing planning and development purposes related to environmental review and project approvals. The SLR Action Plan considers adaptive strategies to address the NRC's upper end estimate of 66" of SLR by 2100 in the event that future GHG emissions and land ice melting accelerates beyond current predictions.

**NOTE: Storm Surge + King Tides add ~40" to SLR (108" in 2100)**

# 2018 State Guidance Update

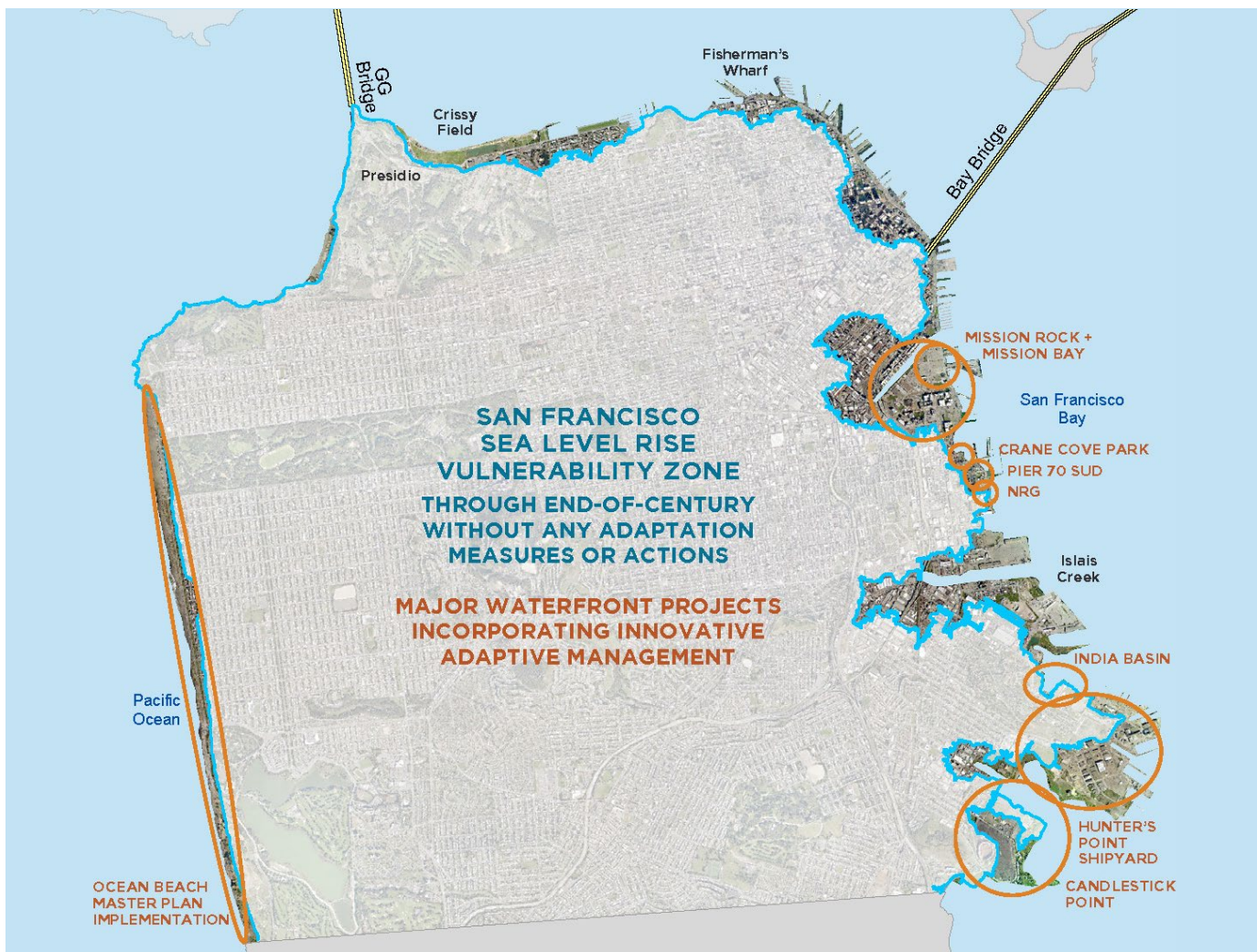


	Year 2030	Year 2050	Year 2100
<b>Most Likely</b> Capital Project Approvals *	<b>6 in</b>	<b>11 in</b>	<b>36 in 30 in</b>
<b>Upper Range</b> Long-Range Planning *	<b>12 in</b>	<b>24 in</b>	<b>66 in 83 in</b>

\* The City uses the NRC's (National Research Council) most likely SLR projection of 36" for ongoing planning and development purposes related to environmental review and project approvals. The SLR Action Plan considers adaptive strategies to address the NRC's upper end estimate of 66" of SLR by 2100 in the event that future GHG emissions and land ice melting accelerates beyond current predictions.

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# Sea Level Rise Vulnerability Zone



## Legend

Sea Level Rise Vulnerability Zone





# Vulnerability and Consequences Assessment



		2030 SCENARIO	2050 SCENARIO	2100 SCENARIO
Residents		5,044	15,471	31,121
Jobs		10,243	49,287	168,058
Streets		20 miles	50 miles	91 miles
Open Space		232 acres	550 acres	684 acres
Public Land		442 acres	887 acres	1,490 acres
Schools		2	9	19

# Vulnerability and Consequences Assessment

## Exposure



## Vulnerability: Sensitivity + Adaptive Capacity



## Consequences for People, Economy and Environment



# Vulnerability and Consequences Assessment

## SECTORS



**Water**



**Wastewater**



**Public Power**



**Public Safety**



**Mobility**



**Recreation &  
Open Space**



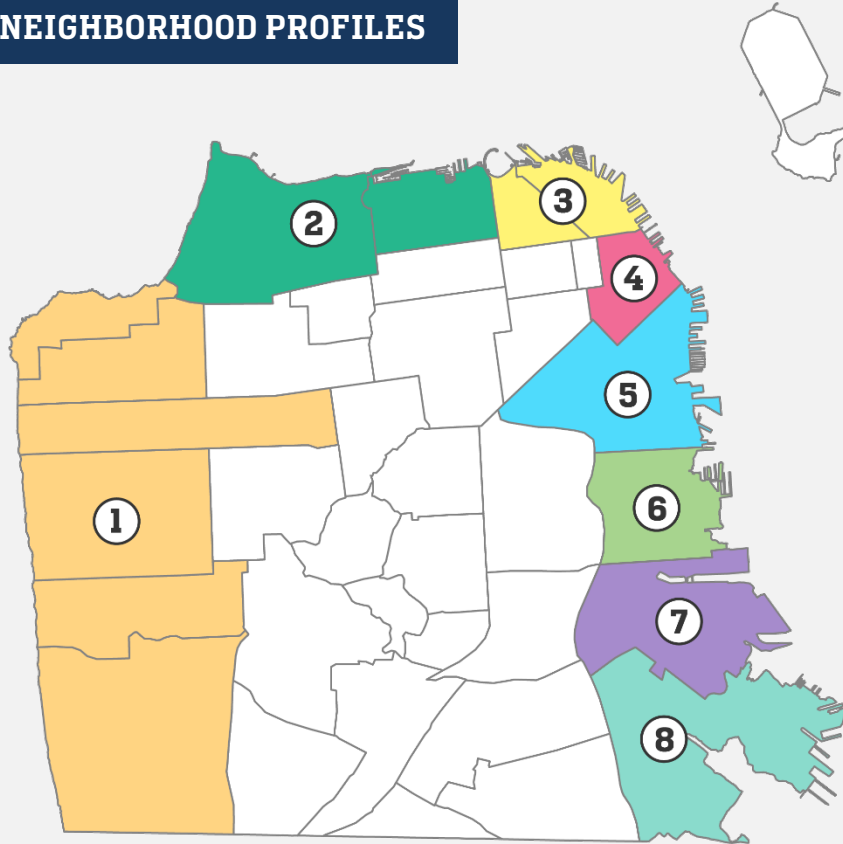
**Waterfront  
Development**



**Port  
Facilities**

# Vulnerability and Consequences Assessment

## NEIGHBORHOOD PROFILES



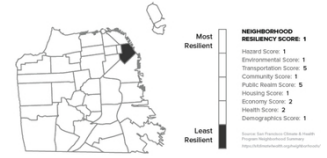
1. Westside/Ocean Beach
2. Marina/Presidio
3. Fisherman's Wharf/North Beach
4. Financial District
5. South of Market/Mission Creek
6. Dogpatch/Central Waterfront
7. Bayview North/Islais Creek
8. Bayview South/Hunters Point

# Key Findings

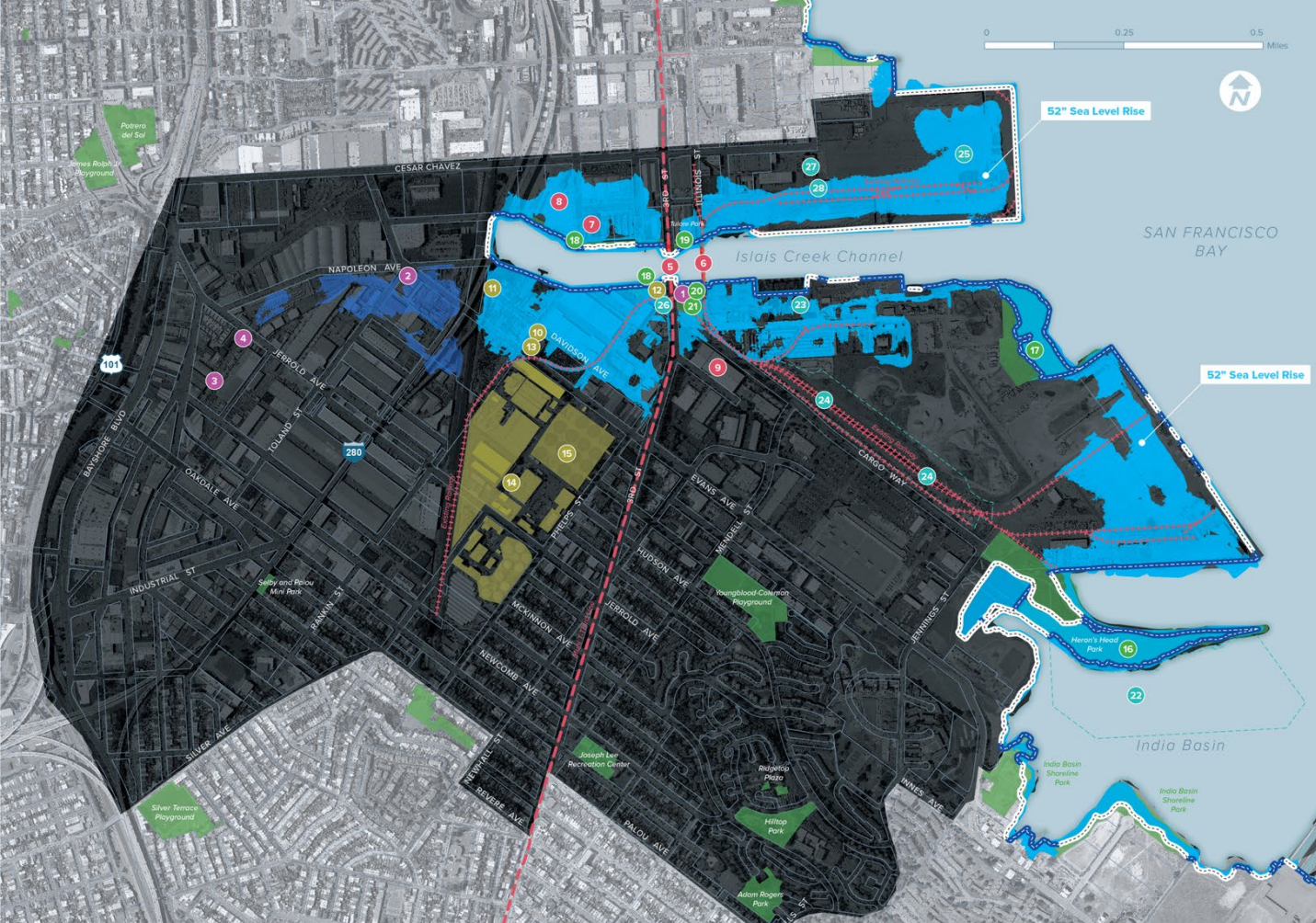
	North Beach	Financial District	Mission Creek	Islais Creek	Hunters Point
Transportation Impacts	✓	✓	✓	✓	
Loss of Open Space	✓	✓		✓	
New Development			✓		✓
Joint Coastal and Precipitation Flood Risk			✓	✓	
Contamination and Liquefaction		✓	✓	✓	✓



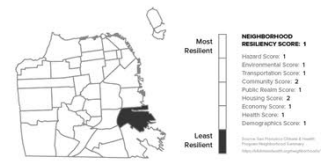
# Financial District



- PUBLIC SAFETY**
  - 1 Fire Station #13
  - 1 Contaminated Lands
- MOBILITY**
  - 1 The Embarcadero
  - 1 Streetcar (E-Line)
  - 1 Embarcadero BART
  - 1 Ferry Terminal
  - 1 Cable Car
  - 1 Regional bus routes (Temporary Transbay Terminal)
- OPEN SPACE**
  - 1 Embarcadero Plaza
  - 1 Ferry Park/Plaza
  - 1 Harry Bridge's Plaza
  - 1 Maritime Plaza
- PORT**
  - 1 Pier 7: Public pier and fishing
  - 1 Pier 3: Restaurants, offices, water taxi, Hornblower, parking (H)
  - 1 Pier 1: Office (H)
  - 1 Ferry Building: Offices, public serving, restaurants, retail, incinerator (H)
  - 1 Pier 14: Public pier and fishing
  - 1 Embarcadero Promenade (Bay Trail)
  - 1 WETA, Golden Gate Ferries



# Bayview North Islais Creek



- PUBLIC SAFETY**
- 1 Fire Station #25
  - 1 Forensic Service Police Department
  - 1 Emergency Firefighting Water System (EFWS) Yard
  - 1 Fire Station #9

- MOBILITY**
- 1 3rd Street Bridge
  - 1 Illinois Street Bridge
  - 1 Marin Yard
  - 1 Islais Creek Division
  - 1 Burke Warehouse

- WASTE WATER**
- 1 Rankin Minor Pump Station
  - 1 Davidson Minor Pump Station
  - 1 Booster Major Pump Station
  - 1 Bruce Flynn Pump Station
  - 1 Southeast Major Pump Station
  - 1 Southeast Treatment Plant

- OPEN SPACE**
- 1 Herons Head
  - 1 Pier 92 Wetlands
  - 1 Islais Plaza/Islais Creek Park
  - 1 Tulare Park
  - 1 Fireman's Plaza Park
  - 1 Gateway Park

- PORT**
- 1 India Basin Marina
  - 1 Pier 92: industrial, cargo ship loading
  - 1 Intermodal Container Transfer
  - 1 Pier 80: working pier and railroad connection
  - 1 3rd Street/Cargo Way Triangle
  - 1 Pier 80 Administration Building
  - 1 Pier 80 Quonset Building

# Westside



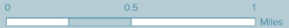
**WASTE WATER**

- 1 Lake Merced Transport/Storage Box
- 2 Vincente Transport/Storage Box
- 3 Lincoln Transport/Storage Box
- 4 Combined Sewer Discharge (CSD)



**OPEN SPACE**

- 5 Coastal Trail



PACIFIC OCEAN

■ Inundation at 66" Sea Level Rise    
 — Coastal Trail



# Project Adaptation



**Mission Rock**



**Pier 70**



**Crane Cove Park**

# District-Scale Adaptation



## Ocean Beach Long-Term Improvements Project

- Implements portions of Ocean Beach Master Plan
- Addresses erosion at Great Highway, and protects critical infrastructure
- Adds recreational amenities



## Islais Creek/Southeast Mobility Adaptation Strategy

- Caltrans grant award of \$390,000; 2019 to 2021
- Long-range vision for Islais Creek basin, with a focus on securing transportation assets
- Youth engagement in Bayview



## US Army Corps/Port Flood Study

- Approximately 3 to 5 year study of shoreline flood risk
- Assesses flood risk and identifies a preferred alternative
- Preferred project becomes eligible for Federal funding

# Citywide Adaptation



## Sea Level Rise Capital Planning Guidance

- 2019 update based on revised State guidance
- Applies to large capital projects in SLR exposure zone



## Hazards and Climate Resilience Plan

- Assessment and Strategies for climate and other hazards
- Updates Local Hazard Mitigation Plan; incorporated into GP Safety Element
- Expected completion 2019, submitted to Cal OES and FEMA for review



## Citywide Climate Resilience (Scope of Work TBD)

- Comprehensive capital planning for climate resilience
- Multi-hazard climate resilient codes and guidelines
- Funding, legislative, and governance strategies

## Next Steps

- Hire Climate Resilience Lead (ORCP) and build up multi-agency Climate Resilience coordination
- Develop shared materials and funding strategies for resilience needs
- Continue work on on-going projects to address key near-term impacts:
  - Hazard and Climate Resilience Plan
  - Ocean Beach long-term improvements project
  - Port/U.S. Army Corps Flood Study
  - Embarcadero Seawall Program


# Sea Level Rise Checklist Update




July 22, 2019

# Sea Level Rise Checklist


Sea Level Rise Checklist has been updated to accommodate the updated sea level rise projections





**ONESF**  
Building Our Future

CAPITAL PLANNING PROGRAM



**London Breed**  
Mayor

**NAOMI M. KELLY**  
City Administrator

**BRIAN STRONG**  
Director, Office of Resilience and Capital Planning

**Guidance for Incorporating Sea Level Rise into Capital Planning in San Francisco**  
**Sea Level Rise Checklist (Version 2.0)**

*This checklist should be used in conjunction with the SLR Guidance document ("Guidance") for use by City departments to guide the evaluation of capital planning projects in light of sea level rise.*

**Pre-Checklist check:**

*The checklist is only required if the following 3 conditions are ALL met. If the answer is "No" to ANY of these questions, do not complete the SLR checklist at this time. The pre-checklist should be retained for your records.*

1. **Project has a location identified** (some projects are so early in planning that they do not yet have a specific location within CCSF) Yes  No
2. **Project is within the SLR Vulnerability Zone** Yes  No   
*(see the Supplementary Document "SLR Vulnerability Zone Map" at: <http://onesanfrancisco.org/staff-resources/sea-level-rise-guidance/>; contact Hemiar Alburati (hemiar.alburati@sfgov.org) to request a Geodatabase (GIS file) of the SLR Vulnerability Zone Map (overlaid on San Francisco base layers).*
3. **Anticipated total project costs<sup>1</sup> equal or exceed 5 million dollars** Yes  No

*Only projects answering "Yes" for questions 1, 2 AND 3 must complete the following checklist.*  
**As noted above, if the answer to questions 1, 2 OR 3 is "No", the SLR checklist does not need to be submitted.** However, it is recommended that the project manager retain this document in their project records.

**Preparer and Project Information** Revised Form

Department Name:	
Project Name:	
Project ID:	
Name of Project Mgr:	
Name of Preparer:	
Dept. Director:	
Date prepared:	

<sup>1</sup> Project costs include planning, design, and construction costs.

Department Name: \_\_\_\_\_  
Project ID (if available): \_\_\_\_\_ Date prepared: \_\_\_\_\_

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Guidance for Incorporating Sea Level Rise into Capital Planning in San Francisco

Sea Level Rise Checklist

**SLR checklist – only for projects meeting all 3 pre-checklist conditions above:**

**Project Information**

1. What is the project location? (Please provide the street address or GIS coordinates):  

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2. What type of asset or project is being proposed? (e.g., new construction, rehabilitation or modification of existing structure, building(s), roadway structure, utility structure, park, etc.):  

---
3. What is the remaining or potential future functional lifespan of the project? (The functional lifespan is the period for which a structure can still meet the purposes for which it was constructed. It refers to the time the asset may realistically be in use at this location, including routine repair and maintenance cycles. (See Guidance for more information).  
Construction completion year (past or planned): \_\_\_\_\_  
Remaining or potential functional lifespan in years: \_\_\_\_\_  
Please provide a brief explanation of how this number was derived:  

---
4. What is the planning horizon? (The construction completion year + functional life span = planning horizon year; e.g., 2017 construction completion year + 60 year functional life span = 2077.)  
Planning horizon year: \_\_\_\_\_

**Site Information**

**Past/Current**

5. Has the site historically been flooded due to high tides/and or storms?  
(If yes, please describe conditions: e.g., king tide, storm surge, rainstorm event)  
 Yes  No \_\_\_\_\_
6. What is the lowest ground elevation at your project location (in feet)?  
(Please select the elevation baseline used for all calculations (NAVD88 or City Datum).  
This assessment is based on:  
 a) existing grade  
 b) proposed grade (e.g., with fill)  
 c) other? (\*If "other", please add explanation under Question 22.)  
\_\_\_\_\_ ft  NAVD88  City Datum
7. What map/ modeling is used for this assessment?  
 SFPUC 2014 Maps and the Supplementary Document "Sea Level Rise Scenario Selection and Design Calculation" found at <http://onesanfrancisco.org/staff-resources/sea-level-rise-guidance/>  
 Site Specific Modeling (please provide date and source of information): \_\_\_\_\_
8. What is the Mean Higher High Water (MHHW) elevation closest to your project location?  
(Use the data source in question 7; e.g., from Figure 1 in Supplementary Document cited in question 7) or site-specific modeling.  
MHHW Elevation (year 2000): \_\_\_\_\_ ft  NAVD88  City Datum

Department Name: \_\_\_\_\_  
Project ID (if available): \_\_\_\_\_ Date prepared: \_\_\_\_\_

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# Updated Sea Level Rise Projections

## Previous SLR guidance based on NRC 2012 scenarios

- Likely scenario for design
- Upper range scenario for adaptation

## Updated guidance, in 2100:

- **Likely scenario remains in same range**, no change needed for design decisions
- **Upper range scenario increases**, some change may be needed in adaptation planning

Year	NRC 2012		RCP 4.5 Rising Seas 2017		RCP 8.5 Rising Seas 2017	
	Likely	Upper Range	Likely	1 in 200 Chance	Likely	1 in 200 Chance
2030	6	12	6	10	6	10
2050	11	24	13	23	13	23
2070	20	38	20	39	24	45
2100	36	66	33	71	41	83
2150	--	--	55	140	70	156

*Numbers in inches*

# Updates to checklist

➤ **Q.12** Updated Sea Level Rise projections included in auto-calculation

## Future Sea Level Rise Calculations

**12. Calculate projected sea level rise at the end of the planning horizon year 2100 (from Question 4.)**  
*(If your project is within 500 feet of the shoreline, or if it provides a critical service for the City, please select RCP 8.5 for all following calculations. If RCP 4.5 is selected, please provide justification for this selection below.)*

RCP 4.5    a) 33 in inches and 2.7 in feet -- likely value  
                   b) 71 in inches and 5.9 in feet -- 1-in-200 chance value

RCP 8.5    c) 41 in inches and 3.4 in feet -- likely value  
                   d) 83 in inches and 6.9 in feet -- 1-in-200 chance value

- Use RCP 8.5 for projects within 500 ft of shoreline, or that provide a critical service
- Use RCP 4.5 for projects that are inland, have a limited service life, or that can accommodate temporary flooding

➤ **Q.13, 14, 15** will auto-calculate the vulnerability of the project to permanent inundation, temporary flooding associated with a 100-year extreme high tide, and wave hazards associated with a 100-year total water level respectively

- It is recommended that the answers to these questions be evaluated under both RCP 4.5 and RCP 8.5 when completing the checklist.





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