Incorporating Sea Level Rise into Capital Planning

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Capital Plan

- Provides road map for ensuring long-term safety, accessibility, & modernization of infrastructure & facilities

- Guidance provides departments with step-by-step approach for considering SLR vulnerability & risk

- Requires all projects over $5 million located in SLR zone to submit completed checklist to City Engineer & City Administrator for project to be eligible for inclusion in Capital Plan or capital budget

Benefits

- Adaptation measures can potentially open-up new funding streams for project proponents
- Federal, state, & private funds available for projects
- For example, FEMA's Building Resilient Infrastructure & Communities funding program
- Bond language requires floodproofing

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London Breed
Mayor

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City Administrator

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CAPITAL PLANNING PROGRAM

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).

https://www.onesanfrancisco.org/node/148

Principles of SLR Adaptation

- Increase project resilience – a resilient facility should be built to withstand, or recovery quickly from, natural hazards

- The SLR Guidance and Checklist help the City:
  - Update and adopt new SLR science as the projections are updated, revised, and the science evolved
  - Increase the resilience and adaptive capacity of City projects
  - Implement a standard vulnerability assessment process to aid in consistency

SLR Guidance and Checklist

- Support selecting appropriate SLR level scenarios for near-term project planning, vulnerability and risk assessments, & implementation

- Promote the need for incorporating adaptation strategies that can be implemented over time – which is critical if SLR exceeds the selected SLR scenario for design

2021 Updates to SLR Checklist

- Better definition of "functional lifespan" or "useful life"
- Visualization Tool for selecting existing Bay water levels, extreme tides, and total water levels (no more long tables!)
- Visualization Tool for selecting the lowest elevation on project sites

Key Steps

* Not addressed in this guidance

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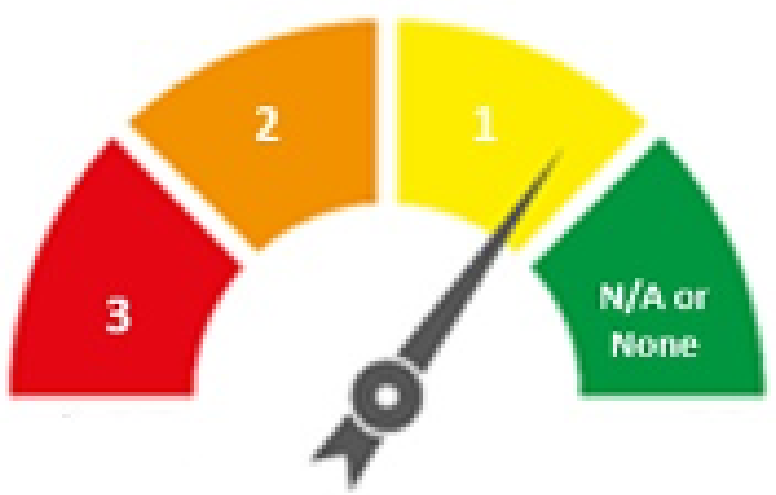
Example Vulnerability Matrix

- N/A or none=not vulnerable
- 1=limited exposure
- 2=moderate exposure, some sensitivity, medium adaptive capacity
- 3=significant exposure, high sensitivity, limited adaptive capacity



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Example **Vulnerability** Matrix

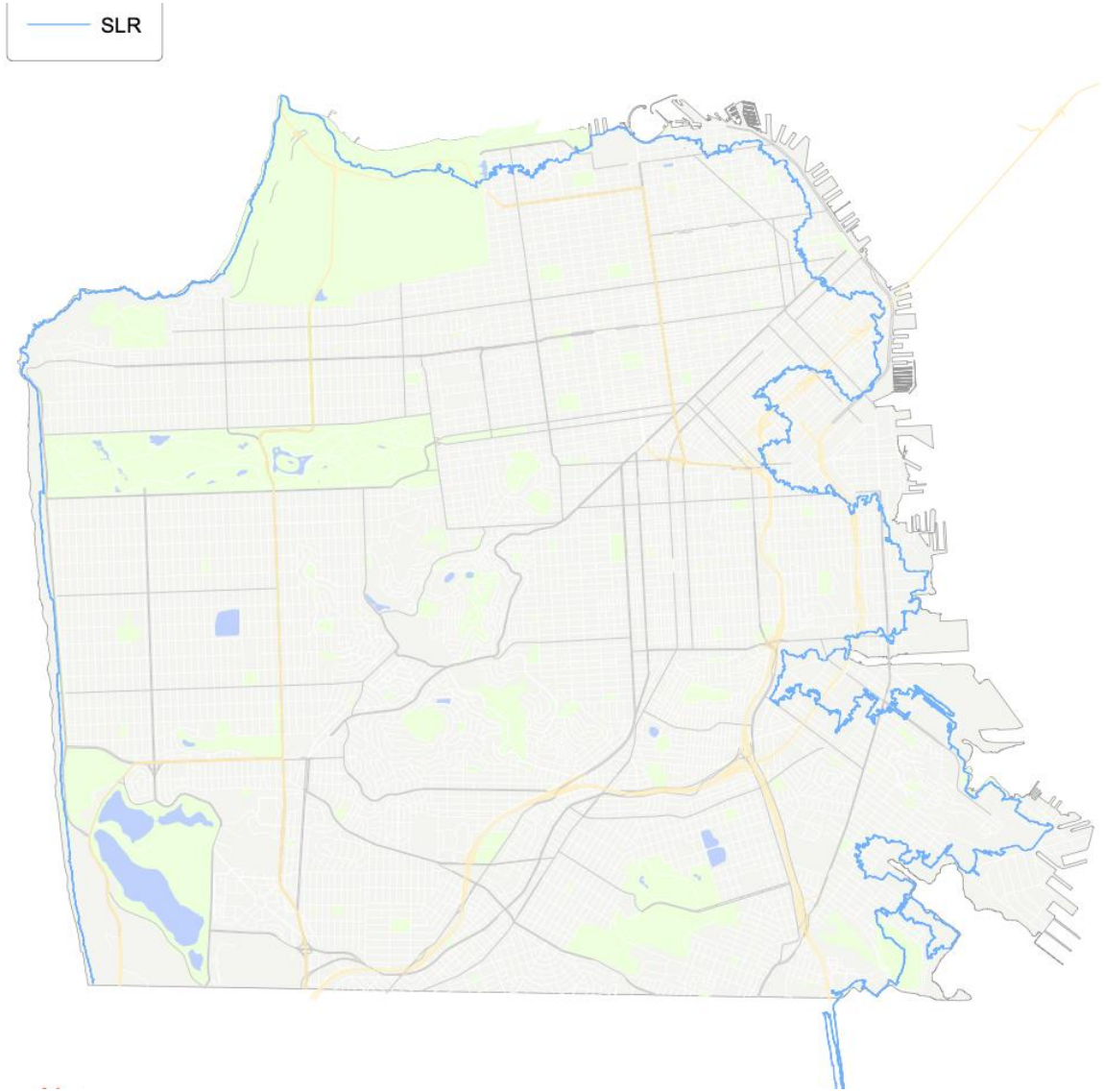
Asset	Exposure to 2050 Sea Level Rise [a]		Sensitivity [b]		Adaptive Capacity [c]		Total Score
	Sea Level Rise	**Storm Surge**	**Sea Level Rise**	**Storm Surge**	**Sea Level Rise**	**Storm Surge**	
Asset #1	None	None	N/A	N/A	N/A	N/A	0
Asset #2	None	Low (1)	N/A	Low (1)	N/A	High (1)	3
Asset #3	Low (1)	Low (1)	Low (1)	Med (2)	Med (2)	Med (2)	9
Asset #4	Med (2)	Med (2)	Med (2)	High (3)	Low (3)	Med (2)	14
Asset #5	High (3)	High (3)	High (3)	Med (2)	Low (3)	Low (3)	17

Example **Consequence** Matrix

Asset	Damage		Cost (Repair/Replace)		Disruption		Total Score
	Sea Level Rise	**Storm Surge**	**Sea Level Rise**	**Storm Surge**	**Sea Level Rise**	**Storm Surge**	
Asset #1	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Asset #2	N/A	Low (1)	N/A	Med (2)	N/A	High (3)	6
Asset #3	Low (1)	Low (1)	Low (1)	Low (1)	Low (1)	Low (1)	6
Asset #4	Med (2)	High (3)	Med (2)	High (3)	Med (2)	High (3)	15
Asset #5	High (3)	High (3)	Low (1)	Med (2)	Low (1)	Low (1)	11

Location – is Project Located in an Inundation Zone During its Lifespan?

Sea Level Rise Inundation Mapping



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Site Elevation

- Using the mapping tool provided on the Capital Planning web site, provide the current lowest point of the lot (or of the construction footprint if not on a lot)

- Use the elevation before any construction grading

Planning Horizon Year

- Use the table provided in the checklist to find the correct lifespan estimate for your asset

- Add the lifespan to your estimated year of construction completion to arrive at the “planning horizon” year

Functional Lifespan

Guidance for determining a project's or facility's useful life		
< 20 years	Temporary or rapidly replaced assets	• Interim and deployable flood protection measures • Asphalt pavement, pavers, and other ROW finishing • Green infrastructure • Street furniture • Technology components (e.g., telecommunications equipment, batteries, solar photovoltaics, fuel sells)
20 – 50 years	Facility improvements, and components replaced on regular replacement cycles	• Electrical, HVAC, and mechanical components • Most building retrofits (substantial improvements) • Concrete paving • Infrastructural mechanical components (e.g., compressors, lifts, pumps) • Outdoor recreational facilities • At-site energy equipment (e.g., above ground fuel tables, conduit, emergency generators) • Stormwater detention systems
60 – 80 years	Long-lived buildings and infrastructure	• Most buildings (e.g., public, office, residential) • Piers, wharfs, and bulkheads • Plazas • Retaining walls • Culverts • On-site energy generation / co-generation plants
> 80 years	Assets that cannot be relocated	• Major infrastructure (e.g., tunnels, bridges, wastewater treatment plants) • Monumental buildings • Road reconstruction • Subgrade sewer infrastructure (e.g., sewers, catch basins, force mains, transport / storage boxes outfalls)

Source: NYC Climate Resiliency Design Guidelines, September 2020, Version 4.0

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3 Different Existing Water Levels

- If Mean High-High water (normal high tide) level plus the level of SLR exceed your project's elevation, your project is vulnerable to future inundation
- If the 100-year extreme tide elevation plus SLR is at a higher elevation than your project location is vulnerable to future flooding
- If your project is at the shoreline and 100-year total water elevation plus SLR are above your project elevation, your location is vulnerable to wave inundation

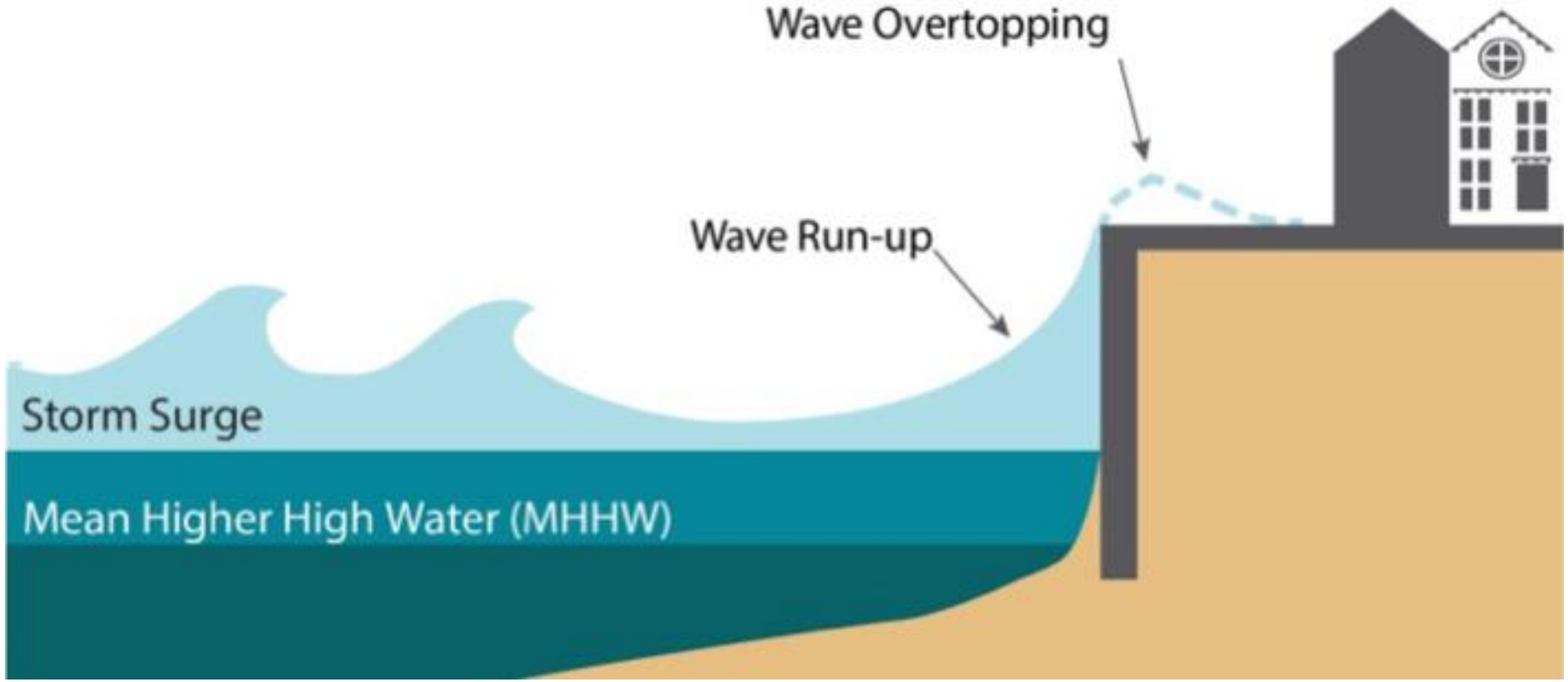
Inundation vs. Flooding

- **Inundation = Permanent**
  - Inundated every day by tides
  - Area inundated will increase with SLR
  - King Tides are extreme high tides that occur twice per year
- **Flooding = Temporary**
  - Floodwaters recede once storm surge or wave event passes
  - Events related to a recurrence interval (1-year, 5-year, 100-year)
  - Area that is flooded will increase with SLR

Recommended Sea Level Rise Projections

	NRC 2012 Prior Guidance Levels		RCP 4.5 *Rising Seas 2017* New Low Range		RCP 8.5 *Rising Seas 2017* New High Range	
Year	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

Storm Surge and Waves



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Identify Sea-Level Data

- Water levels to be used vary by location around the City's shoreline
- Using interactive map on the Capital Planning web site, select current Mean Higher High Water elevation and 100-year extreme tide elevation that are closest to your project's location
- If your project is within 100 feet of the shoreline, use the interactive map to determine your 100-year total water level elevation

Choose Data & Check Results

- Choose data set that corresponds to your project, depending on whether or not the project represents a critical City asset & whether it is within 500’ of shore

- Checklist will auto-calculate & present the results

Complete Sensitivity & Adaptive Capacity Assessments

- **Sensitivity**: Degree to which an asset is affected
- **Exposure**: Nature & degree to which SLR impacts asset
- **Adaptive Capacity**: Asset's inherent ability to adjust to SLR impacts
- See guidance document for more details

Complete the Risk Assessment

- **Damage:**
  - What is the level of damage to the asset?
  - Can asset be repaired, or would it require replacement?
- **Disruption:**
  - Is there disruption in service?
  - If yes, what is the length of that disruption? Does disruption threaten public health & safety?
- **Cost:**
  - What is the cost to repair or replace asset?
  - What are the economic (or health & safety) costs associated with the service disruption?
  - Are there secondary impacts that need to be considered?

Propose Adaptation Measures

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Potential Adaptation Measures

- Install permanent barriers at a site (e.g., flood wall)
- Maintain deployable flood barriers on site
- Protect or elevate electrical, mechanical, or other critical or costly-to-replace equipment
- Install backflow preventers, backwater valves, and sump pumps for all buildings (including those behind flood protection barriers)

Dry vs. Wet Floodproofing

- For dry floodproofing, design a facility to ***prevent*** water from entering

- For wet floodproofing, design a facility to ***permit*** floodwaters to flow in & out of the structure without causing significant damage (e.g., protect or elevate critical equipment, use water-resistant materials, include flood vents and pumps)

New Police Station Example

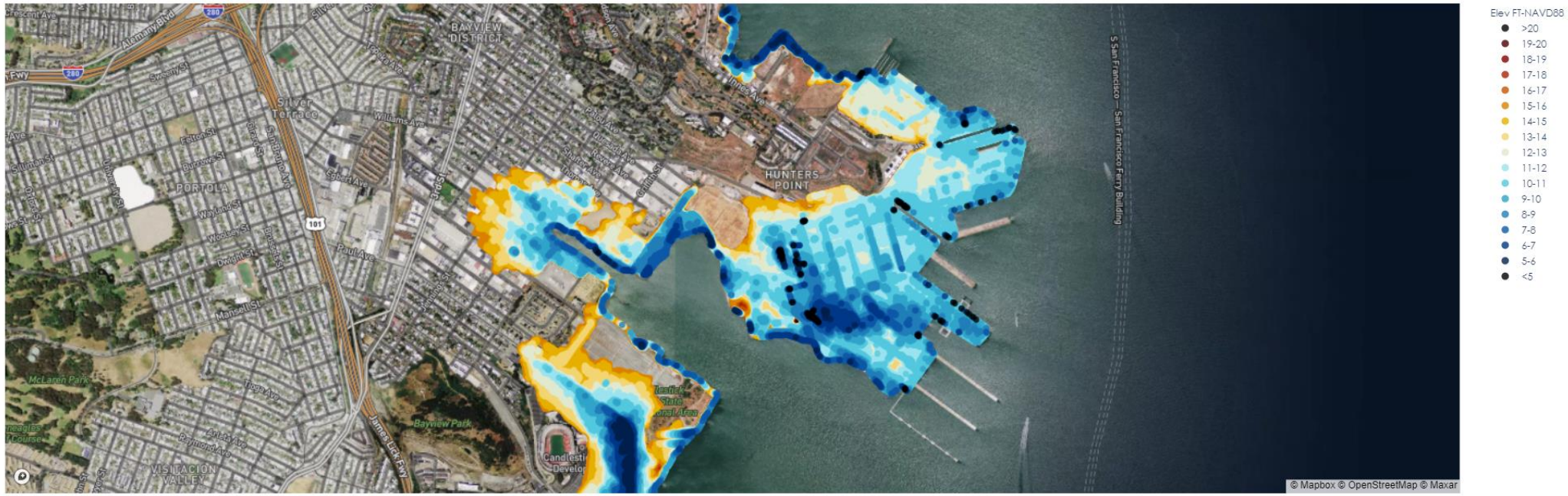
- **SLR Scenario Selection:**
  - Project is in SLR Inundation Zone
  - Functional lifespan is 50 years
  - SLR Scenario = 2065 (34.6” in Appendix 3)
- **Vulnerability Assessment:**
  - Inundated by 100-yr flood event
  - Asset is given a medium exposure rating and is considered highly sensitive due to its function
- **Risk Assessment:**
  - Overall consequence of siting the station is high
- **Adaptation Planning:**
  - Police station should be sited in an alternate location at a higher grade

Next Steps

- **March 1**: Deadline for departs. to submit checklists
- **May 1**: SF PW reviews departmental checklists
- City Administrator and Engineer sign checklists

Checklist and tools demonstration

City and County of Francisco
Bayview South / Hunters Point
Ground Elevations in Feet-NAVD88



REV: 11.2020

Sources:
Bay Area Toll Authority and Metropolitan Transportation Commission (BATA and MTC). 2017. Adapting to Rising Tides Bay Area Sea Level Rise Analysis and Mapping Project.

Notes:
Ground elevations obtained from DEM derived using LiDAR data collected in 2010/2011, with additional updates to account for recent shoreline construction (e.g., Downtown Ferry Terminal and Brannan Street Wharf).

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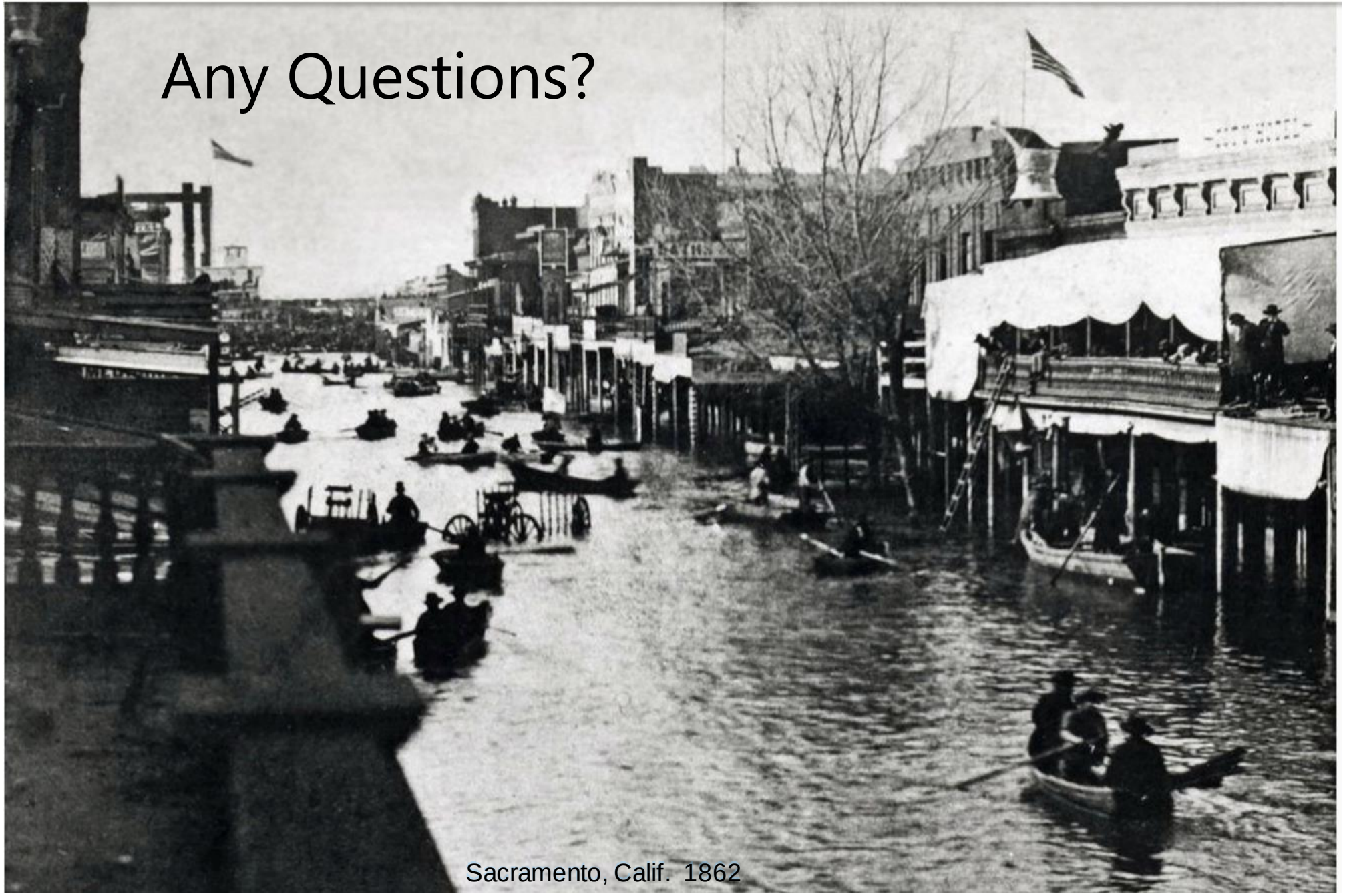
Any Questions?



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Contact Information

- For capital planning questions:
  - Brian Strong, Capital Planning
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- For mapping and data questions:
  - Hemiar Alburati, Capital Planning
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- For assistance with the checklist:
  - Oliver Iberien, San Francisco Public Works
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