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## PROACTIVELY ADDRESSING SEA LEVEL RISE FOR THE TREASURE ISLAND REDEVELOPMENT PROJECT



### **Project Background**

- Today Treasure Island is an existing neighborhood within the City and County of San Francisco that is home to 2,500 residents, commercial tenants, various non-profit organizations and the US Department of Labor, Job Corps
- Internationally heralded as a sustainable community model, development plans for Treasure Island and Yerba Buena Island will provide 300 acres of parks and open space, 6,000 to 8,000 new homes, up to 100,000 square feet office, a town center with retail, restaurants, hotels and entertainment venues, a 400-slip marina, and an intermodal transit hub supported by all-new infrastructure systems designed to maximize resource conservation and efficiency

### **Sea Level Rise Estimates and Guidance**

- Sea level rise (SLR) estimates in published literature and policy papers vary widely
- Over the last century, 8-inches of SLR has been observed<sup>i</sup>
- The IPCC<sup>ii</sup> has projected SLR of between 7 and 30 inches over next century
- High-resolution global altimetry data through the end of 2009 suggest that in the last two decades global mean sea level has increased

at a rate close to the upper end of the IPCC projections, corresponding to an increase of 10 inches by 2050 and 30 inches by 2100

- Semi-empirical studies by Rahmstorf<sup>iii</sup> and others have stated that SLR could be as much as 55-inches by 2100
- A 55-inch estimate of SLR was adopted by the CALFED Independent Science Board as a plausible/high value
- State Executive Order S-13-08 directs the California Resources Agency to request that the National Academy of Sciences convene an independent panel to complete the first California Sea Level Rise Assessment report. This report, expected in December 2010, would advise how California communities should plan for sea level rise
- The BCDC in a recently released study<sup>iv</sup> recommended that Bayfront developments address 16-inch SLR by 2050 (mid-term) and 55-inch SLR by 2100 (long-term). The California State Coastal Conservancy (SCC) has issued a similar guidance policy<sup>v</sup>, based on work by the California Climate Change Center<sup>vi</sup>

### **Treasure Island Sea Level Rise Strategy**

1. **Determine the site-specific conditions** at Treasure Island related to tides, wind-wave and storm-wave

- a. A SLR study was prepared by Moffatt & Nichol<sup>vii</sup> based on an exhaustive review of the literature and guidance from regional agencies, and extensive modeling of tidal and wave processes for the Central Bay
2. **Immediate Improvements** constructed as part of the redevelopment project to address flood protection for the mid-to-long term (2075 to 2125):
- Elevate new building pads, streets and vital infrastructure to accommodate 36 inches of SLR, plus an additional 6 inches for finish-floor of buildings. Depending on the estimate, this would mitigate SLR for 75 to 150 years or more
  - Enhance the island's perimeter to protect from wave over-topping for SLR up to 16 inches, balancing flood protection, public access and view preservation
  - Set development back 200 – 350 feet from the shoreline to provide land for future SLR mitigation while permitting a natural and accessible perimeter around entire island
3. **Future Improvements** will be enabled by a funded Adaptive Management Strategy for the long to very-long term (2100 and beyond) to protect against SLR of 55 inches or greater
- SLR up to 16 inches: no adaptations required
  - SLR 16 to 36 inches: the shoreline edge could be modified to mitigate more frequent wave overtopping and storm drain pumps installed
  - SLR above 36 inches: the shoreline protection system would be modified to act as a flood barrier for the entire island
  - The proposed development setbacks will enable adaptations to mitigate at least 55 inches of SLR, and even more if necessary
  - The redevelopment project includes a mechanism to create a steady stream of project-generated funding dedicated to future adaptive management improvements

the redevelopment project will provide the time and space to respond with innovative adaptation strategies that are sensitive to open space programming, public access and different wave run-up characteristics around the island. Soft and hard shoreline modifications can be utilized in combination:

- Raising the shoreline edge embankment in place to function as a storm surge and flood barrier or levee
- Constructing a series of embankments of increasing heights inland from the shoreline. Land between sets of embankments can hold periodic wave overtopping that would drain out between high tides while also creating habitat
- Constructing sea walls – particularly at the ferry quay and along Clipper Cove where they would also function as a public amenity
- Laying back the shoreline to create cobblestone or natural beaches, tidal wetlands, and other ecosystems to limit wave run-up and overtopping, creating accessible public amenities

## References

<sup>i</sup> Moffatt & Nichol, *Treasure Island Development Project, Planning For Sea Level Rise, Part I – Background and Projections*, prepared for Treasure Island Community Development, July 2008

<sup>ii</sup> Intergovernmental Panel on Climate Change, 2007. *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Solomon S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor, and H.L. Miller (eds.). Cambridge University Press

<sup>iii</sup> Rahmstorf, S., 2007: *A Semi-Empirical Approach to Projecting Future Sea-Level Rise*. Science Magazine 315, pp. 368-370

<sup>iv</sup> San Francisco Bay Conservation and Development Commission, *Living With A Rising Bay, Vulnerability and Adaptation in San Francisco Bay and on its Shoreline* April 2009

<sup>v</sup> California State Coastal Conservancy. *Policy Statement on Climate Change*. Adopted at the June 4, 2009 Board Meeting

<sup>vi</sup> Cayan, D., M. Tyree, M. Dettinger, H. Hidalgo, T. Das, E. Maurer, P. Bromirski, N. Graham, and R. Flick. 2009. *Sea Level Rise Estimates for the California 2009 Climate Change Scenarios Assessment*. California Climate Change Center Report No. CEC-500-2009-014-F, August 2009

<sup>vii</sup> Moffatt & Nichol, *Treasure Island Development Project, Coastal Flooding Study*, prepared for Treasure Island Community Development, April 2009

### **A Variety of Shoreline Modifications**

The generous development setbacks and SLR mitigation improvements built as part of