

HRPDC Sea Level Rise Planning Policy and Approach

Summary of Recommendations

- Localities should plan for sea level rise using 1.5 feet of relative sea level rise above current mean higher high water (MHHW) for near-term planning, 3 feet of relative sea level rise above current MHHW for medium-term planning, and 4.5 feet of relative sea level rise above current MHHW for long-term planning.
- For engineering and design, localities should calculate project-appropriate sea level rise scenarios by using a tool such as the U.S. Army Corps of Engineers Sea Level Change Calculator and conduct a benefit-cost analysis of various adaptation strategies to determine an appropriate amount of sea level rise for a specific project.
- These scenarios should be reevaluated as appropriate based upon new information developed by the National Oceanic and Atmospheric Administration, U.S. Army Corps of Engineers, or Virginia Institute of Marine Science.

Rationale

- Sea level rise is projected to be significant for Hampton Roads. Factoring it into planning and design decisions will reduce risk and damage from flooding and storm surge.
- Significant advances in climate modeling and analysis of observed trends support development of new sea level rise projections at the local level that are improvements above previously recommended projections.
- A regional consensus on values and approaches for sea level rise planning would provide support for local efforts, assist with regional coordination, and encourage state and federal agencies to adopt similar standards.

Information Sources

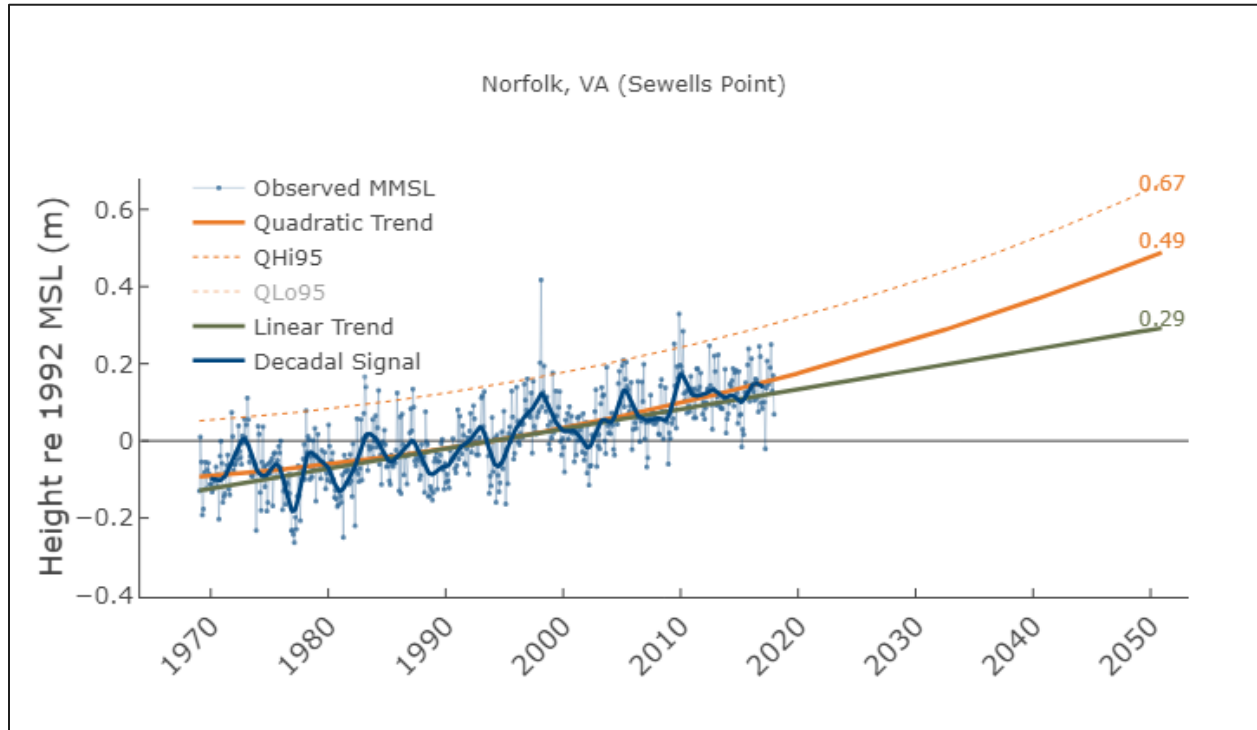
This proposal relies on two sources of information on relative sea level rise in Hampton Roads: regression-based projections from the Virginia Institute of Marine Science (VIMS) based on observational data and regional sea level rise scenarios from NOAA's Center for Operational Oceanographic Products and Services (CO-OPS).

VIMS

Earlier this year, VIMS released Sea Level Rise Report Cards for a number of coastal communities in the United States, including Norfolk. These report cards are based on the statistical analysis of observed sea level trends based on established tide gauges. In the case of Norfolk, this analysis has found that there is significant evidence of sea level rise accelerating over the last fifty years. Based on this analysis, VIMS is predicting that sea level will rise at Norfolk by 0.49 meters (1.61 feet) between 1992 and 2050, with a

95% chance that mean sea level in 2050 will be between 0.29 and 0.67 meters (0.95 to 2.20 feet) above 1992 mean sea level. This confidence interval accounts for interannual and decadal variations in mean sea level.

Figure 1: VIMS Sea Level Rise 2050 Projection for Norfolk¹



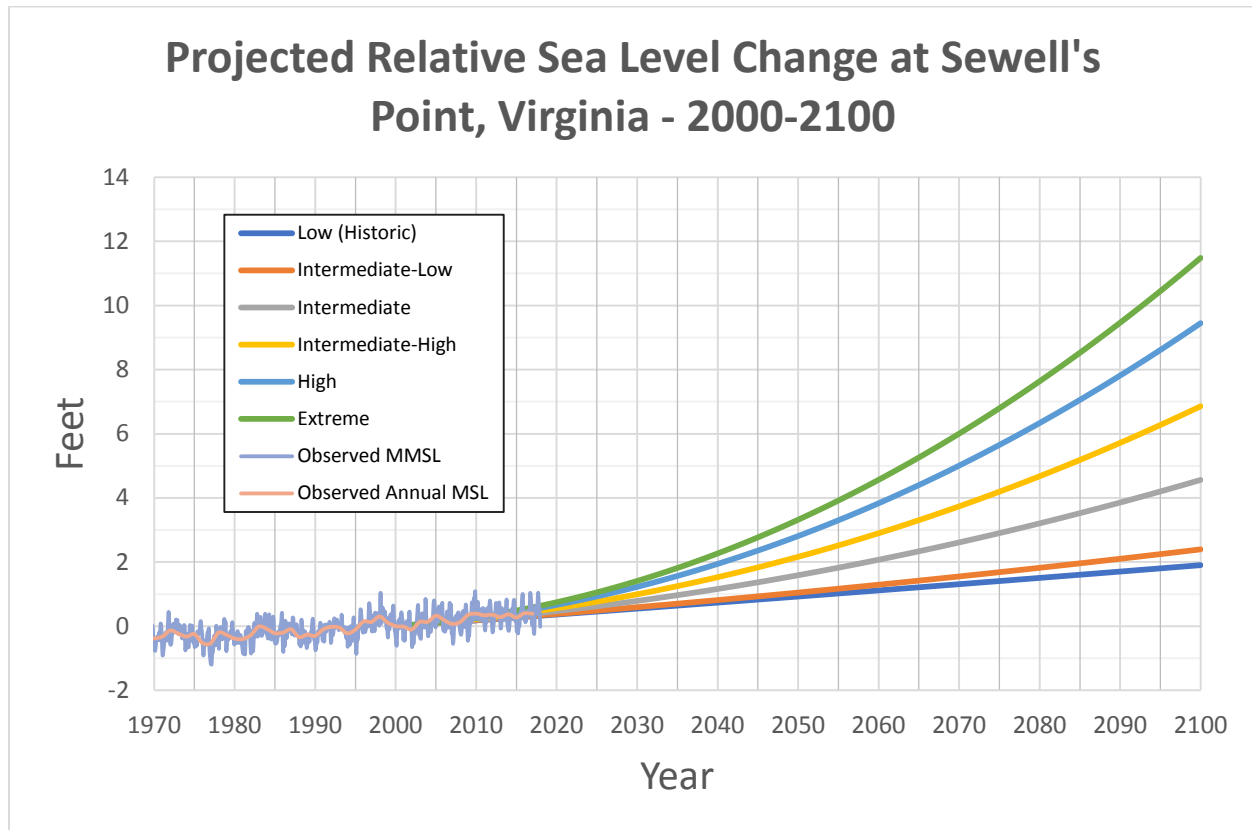
NOAA

In January 2017, NOAA, in partnership with the U.S. Geological Survey, the U.S. Environmental Protection Agency, and Rutgers University, published a report updating global and regional sea level rise scenarios for the United States.² This report takes advantage of additional observations of sea level change and ongoing research into global and regional drivers of sea level rise, including rapid ice melt, ice sheet instability, shifts in ocean circulation patterns, changes in the Earth's gravitational field, and vertical land movement. The overall result is that the upper bound of plausible global sea level rise is higher than considered in the previous 2012 NOAA report. In addition, regional drivers such as vertical land movement, ocean circulation, and shifts in the gravitational field account for a significant amount of projected sea level rise in Hampton Roads. Overall, the report projects between 1.9 feet of sea level rise in Hampton Roads between 2000 and 2100 at the low end and 11.5 feet of sea level rise under the most extreme case. According to the report's probabilistic assessment, the most likely scenario is approximately 4.5 feet of sea level rise by 2100.

¹ <http://www.vims.edu/research/products/slrc/localities/norfolkva/index.php>

² https://tidesandcurrents.noaa.gov/publications/techrpt83_Global_and_Regional_SLR_Scenarios_for_the_US_final.pdf

Figure 2: Updated NOAA Sea Level Rise Scenarios for Norfolk, VA



Planning Recommendations

Planning for sea level rise, in the form of land use and other policy decision-making, should use estimates of sea level rise that are based on observational data and a range of scenarios for future conditions. Such values can be used to help implement zoning overlay districts or new building requirements. Another potential use for these scenarios is as a set of screening values, which can be used to identify vulnerable areas and facilities for further study. Based on the observational data and predictions from VIMS and the scenarios from the most recent NOAA technical report, the HRPDC recommends using the following scenarios for planning for sea level rise at the local and regional level:

- For near-term decisions (2018-2050): 1.5 feet of sea level rise above current MHHW
- For medium-term decisions (2050-2080): 3 feet of sea level rise above current MHHW
- For long-term decisions (2080-2100 and longer): 4.5 feet of sea level rise above current MHHW

Engineering and Design Recommendations

Selecting a value for sea level rise to include in the design of a structure or project requires more precision than planning. In addition, while a single value may work for planning decisions, engineering

involves a more in-depth assessment of the costs and benefits of various measures to mitigate the impacts of sea level rise. Many factors must be accounted for to determine how much sea level rise should be accounted for in a design, including:

- 1) When will construction start?
- 2) What is the projected lifespan of the project?
- 3) How sensitive is the project to impacts from flooding or sea level rise?
- 4) How critical is the project to public health, safety, and welfare (or other significant concerns)?

Answering the first two questions helps a designer to calculate the amount of sea level rise that is projected to occur between the present and the start of construction and between construction and possible replacement. Answering the last two questions helps to determine how to address the inherent uncertainty present in any sea level rise projection. For projects of low importance, addressing a higher amount of sea level rise may be cost prohibitive. However, for projects of high importance, reducing the chance of failure by accounting for higher levels of sea level rise may be more prudent. The desired level of protection can be determined through a benefit-cost analysis of different adaptation measures.

For engineering purposes, the HRPDC recommends

- Using the U.S. Army Corps of Engineers Sea Level Change Curve Calculator with the 2017 NOAA sea level rise scenarios³
- Performing a benefit-cost analysis of adaptation strategies under various sea level rise scenarios to determine the appropriate level of sea level rise to design for given the accepted level of risk of the project

Future Policy Recommendations

Sea level trends are continuously being monitored and updated by both federal (NOAA, USGS) and state (VIMS) entities. In addition, research and analysis into the dynamics of sea level and how it responds to changing climatic conditions are also ongoing. The HRPDC recommends that the HRPDC staff and localities reevaluate and consider updating these scenarios as appropriate based upon new information developed by the National Oceanic and Atmospheric Administration, U.S. Army Corps of Engineers, or Virginia Institute of Marine Science.

³ <http://www.corpsclimate.us/ccaceslcurves.cfm>