5 Sea Level Rise Assessment

Global mean sea level (GMSL) rise results from a combination of warming ocean waters and the addition of water mass (i.e., glacial melt) into the ocean, and is a direct effect of warming climate trends. Increases in GMSL elevations are indicative of changing climate conditions, but it is the sea level rise at the local and regional level as measured by tide gauges and satellites that is most important for coastal communities such as the City of Sebastian. It is important to note that sea levels change locally for a variety of reasons and has not been and will not be uniform in time or location.

5.1 State Climate Change Efforts

The State of Florida was an early adopter of climate change and sea level rise legislation, starting with the Renewable Energy Technologies and Energy Efficiency Act in 2006. A major component of the Act was the creation of the new Florida Energy Commission, whose first report was required to include recommended steps and a schedule for the development of a state climate action plan.

Since then, climate change legislative activity has continued, with additional bills directed at utilities emissions, energy standards, automobile efficiency and emissions, green buildings, efficient land use patterns, energy conservation, greenhouse gas emissions in planning, and a bill providing for the Florida Building Commission to make recommendations on energy efficiency.

The State of Florida has focused its resources primarily on the disaster planning and recovery aspects of climate change rather than policy development. Several state agencies have worked on various climate change efforts, including the following:

- The Florida Fish and Wildlife Conservation Commission is doing a significant amount of data collection and monitoring related to habitat and species impacts.
- The Department of Economic Opportunity has been doing extensive work on sea level rise, including pilot planning efforts in several communities. Its approach has been to also provide technical assistance for local governments and to offer review and comment on compliance with legislation passed in 2015 related to addressing “Peril of Flood” issues in comprehensive plans. The Department of Economic Opportunity has also created numerous guides and compilations of resources for local governments that want to start addressing sea level rise in their policy framework.
- The Florida Department of Environmental Protection has primarily been limited to work related to climate change impacts on coral reefs.

In 2011, HB 7207 became law and significantly changed the state’s growth management policy, which is contained in Chapter 163, Florida Statutes (F.S.). The law contained many controversial changes, including a fundamental reorganization of the Florida Department of Community Affairs into a new Florida Department of Economic Opportunity; a shift that retained some planning and growth management functions but clearly focusing more on the state’s economic development policy. In addition, the law reduced state oversight of local planning decisions and actions, concentrating more on resources and issues with statewide significance. Relative to climate change, the law eliminated many of the energy efficiency and greenhouse gas reduction provisions from Chapter 163, F.S.

The 2011 law did not prohibit longer timeframes for planning, but the minimum required planning horizons in Florida’s comprehensive planning law (5 and 10 years) remain too short to effectively include consideration of climate change and sea level rise impacts, even when taking into account infrastructure or development with

usable life spans of many decades. The changes to comprehensive planning law in 2011 do not prevent Florida's local governments from engaging in proactive efforts to increase their resilience to coastal hazards (i.e., erosion, storms, and sea level rise), but they allowed for a more discretionary function than a prescriptive one.

The Florida Legislature in 2020 approved Senate Bill 178, and the rules to implement the bill were finalized in 2021 by the FDEP. Considered one of Florida government's first acknowledgments of rising seas and their complications, the law requires the sea-level impact project (SLIP) study to be done for all government structures built in the coastal building zone using state funds. The statute defines the building zone as most of the beach areas in Florida: the land from the high-water line to an area 1,500 feet landward of the coastal construction control line. Government-built structures in the coastal building zone must now undergo an assessment of the potential damage over the next 50 years from higher seas, flooding, storm surges and wave action.

5.2 Available Reports and SLR Projections

The most recent report available regarding sea level rise projections is from the U.S. Sea Level Rise and Coastal Flood Hazard Scenarios and Tools Interagency Task Force (the "Task Force") titled *Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines* (the "Report"). The Report was published in February 2022 by the National Ocean Service of the National Oceanic and Atmospheric Administration (NOAA) and is an update to the 2017 Task Force report. The Report states that the set of global mean sea level rise scenarios from the 2017 report are updated and downscaled with output directly from the United Nations Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report, through the efforts of the NASA Sea Level Change Team; updates include adjustments to the temporal trajectories and exceedance probabilities of these scenarios based upon end-of-century global temperatures.

The primary findings of the Report were as follows:

- Multiple lines of evidence provide increased confidence, regardless of the emissions pathway, in a narrower range of projected global, national, and regional sea level rise at 2050 than previously reported.
- Relative sea level along the contiguous U.S. coastline is expected to rise on average as much over the next 30 years (0.25–0.30 m over 2020–2050) as it has over the last 100 years (1920–2020).
- By 2050, the expected relative sea level (RSL) will cause tide and storm surge heights to increase and will lead to a shift in U.S. coastal flood regimes, with major and moderate high tide flood events occurring as frequently as moderate and minor high tide flood events occur today. Without additional risk-reduction measures, U.S. coastal infrastructure, communities, and ecosystems will face significant consequences.
    - Minor/disruptive high tide flooding (HTF; about 0.55 m above mean higher high water [MHHW]4) is projected to increase from a U.S average frequency of about 3 events/year in 2020 to >10 events/ year5 by 2050.
    - Moderate/typically damaging HTF (about 0.85 m above MHHW) is projected to increase from a U.S. average frequency of 0.3 events/year in 2020 to about 4 events/year in 2050.
    - Major/often destructive HTF (about 1.20 m above MHHW) is projected to increase from a U.S. average frequency of 0.04 events/year in 2020 to 0.2 events/year by 2050.
    - Across all severities (minor, moderate, major), HTF along the U.S. East and Gulf Coasts will largely continue to occur at or above the national average frequency.
- Higher global temperatures increase the chances of higher sea level by the end of the century and beyond. The scenario projections of relative sea level along the contiguous U.S. coastline are about 0.6–

2.2 m in 2100 and 0.8–3.9 m in 2150 (relative to sea level in 2000); these ranges are driven by uncertainty in future emissions pathways and the response of the underlying physical processes.

- Monitoring the sources of ongoing sea level rise and the processes driving changes in sea level is critical for assessing scenario divergence and tracking the trajectory of observed sea level rise, particularly during the time period when future emissions pathways lead to increased ranges in projected sea level rise.

The mean sea level elevation continues to rise with similar degree of fluctuation trends as illustrated in data collected from the National Oceanic and Atmospheric Administration (NOAA) Tide Stations. The NOAA Tide Station closest to the City of Sebastian is the Trident Pier Station at Port Canaveral (Station No. 8721604). As shown in Figure 5-1 below, data collected at this station from 1994 to 2022 show the mean sea level elevation increasing at a rate of approximately 0.5 feet (0.15 m) between 2020 and 2050 and the maximum sea level elevations increasing at a rate of approximately 0.6 feet (0.18 m) over the same period. These rates appear to be generally consistent with the lower range of the 0.25 – 0.30 m increase projected in the Report.

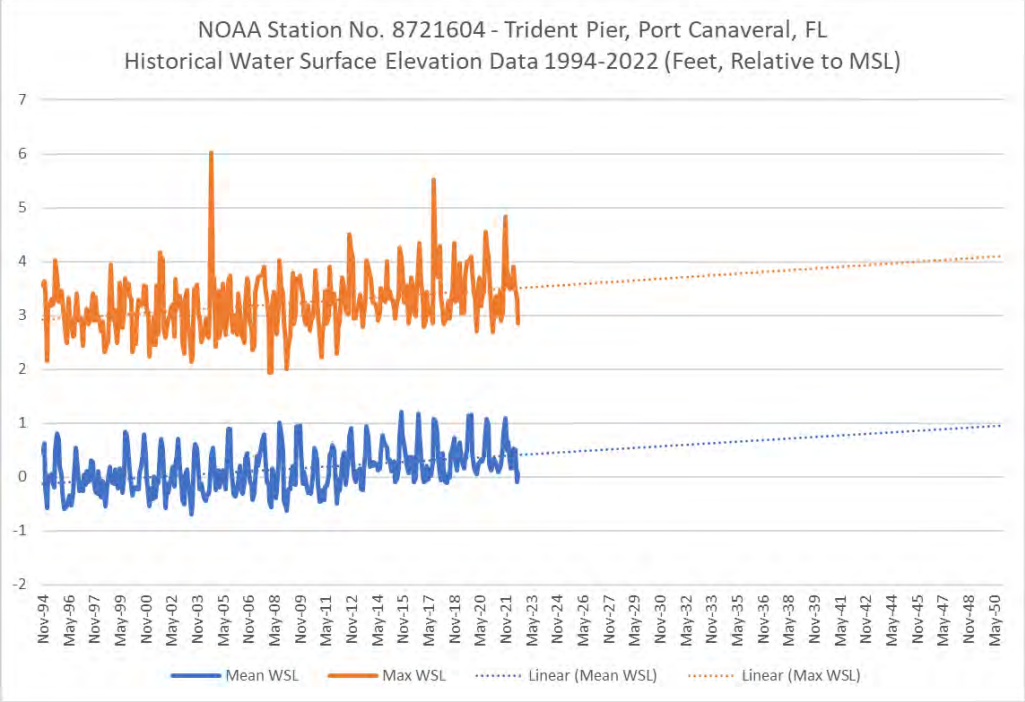

Figure 5-1. NOAA Tide Station No. 8721604 Historical Data

An increase in the sea level rise will not result in noticeable changes to the normal standing water elevations adjacent to existing roads and buildings. However, the changes in the performance of the City's SWMS during large and peak storm frequency events will be more noticeable. Stormwater conveyance systems rely on gravity to move the stormwater through open channels and drainage pipes. As the sea level increases at the outlet end of a drainage system, stormwater flow rates through that drainage system will be reduced, which will result in elevated flooding over longer durations.

The FEMA Flood Insurance Study (FIS) water surface elevations along the South Prong of the St. Sebastian River resulting from the 10-year, 25-year, and 100-year storm events were used as a boundary condition in the 10-year, 25-year, and 100-year stormwater models respectively and act as the controlling tailwater condition for the City drainage areas studied in this stormwater master plan update. The 10-year stormwater surface elevation

is higher than the projected 2050 sea level rise elevation and results in a conservative analysis of existing and proposed drainage system improvements. The City can continue to use this 10-year storm event tailwater elevation in replacing existing structures and in designing new storm systems.

The King Tide elevation was extracted from the Maximum Sea Level data recorded at the Trident Pier Station at Port Canaveral (Station No. 8721604) from 1994 to 2022. King Tides were assumed to be the two highest maximum sea level elevations recorded each year, generally occurring during the fourth quarter. Based on that assumption, the average King Tide elevation was calculated at 3.90 feet and the maximum elevation was 6.02 feet relative to Mean WSL. Therefore, the worst case tailwater condition for the City's SWMS through 2050 would be an increase in Mean WSL of 0.5 feet (approximately -0.46 feet NAVD88), with an additional 6.02 feet to account for a maximum King Tide event, or approximately elevation 5.56 feet NAVD88.

5.3 Expected Effects

Based on the data available, the estimated increase in mean sea levels alone through 2050 are not expected to have a significant effect on the performance of the City's SWMS. Figures 5-2, 5-3, and 5-4 below were taken from the NOAA Sea Level Rise Viewer and show the current conditions and the areas affected by one foot and two feet of seal level rise, respectively. However, in the unlikely event that a storm event were to occur during the peak of a maximum estimated king tide similar to Hurricane Nicole in November 2022, the resulting tailwater elevation may temporarily reduce or stop flow from some City outfalls (i.e., Stonecrop weir, etc.), resulting in localized flooding conditions upstream. City outfalls along the Indian River Lagoon may experience some surcharging prior to tide valve actuation and discharge flows would decrease due to the increase in tailwater elevations.

Other effects of sea level rise to the City may include the following:

- Increased shoreline erosion
- Habitat damage/destruction
- Habitat loss/migration
- Changes to plant and animal communities

There are many publications available discussing the sea level rise issue with suggested options for mitigation. The City should partner with Indian River County, SJRWMD, FDEP, and other agencies to craft joint policies that will address the economic needs of the City while mitigating the anticipated effects of rising sea levels. The following general mitigation policies should be considered:

- **Shoreline Protection.** Develop and enhance policies to protect and strengthen exposed shorelines along the Indian River Lagoon. These policies should focus on minimizing erosion and proper maintenance of infrastructure in the coastal and urban waterfront environments. These measures should also consider coastal setback zones.
- **Outfall Modifications.** The Stonecrop weir and other outfalls may need to be modified to maintain maximum allowable discharge flows with increased tailwater elevations. This effort must be balanced with the overall goals of reducing the quantity of discharged stormwater and improving its quality.

At this moment, there are no federal or state rules addressing sea level rise. This provides an opportunity for the City to develop policies and ordinances that make sense for their citizens. There are many publications available that can provide meaningful information to the City and its residents to aid in the difficult process of adapting to sea level rise. These include the following:

- City of Sebastian 2022 Stormwater Master Plan Update
- City of Sebastian 2040 Comprehensive Plan
- City of Sebastian Coastal Resiliency Plan
- Others

It is recommended that the City begins planning and having open discussions with residents and businesses on the issue of sea level rise so that policies and ordinances can be thoroughly considered by all stakeholders. Fortunately, sea level rise is generally not expected to have significant effects on the City's stormwater infrastructure, and SWMS components in affected areas can be modified to mitigate sea level rise. However, such modifications may require substantial costs, which may be a limiting factor for the City.

Figure 5-2. Current Conditions – NOAA Sea Level Rise Viewer

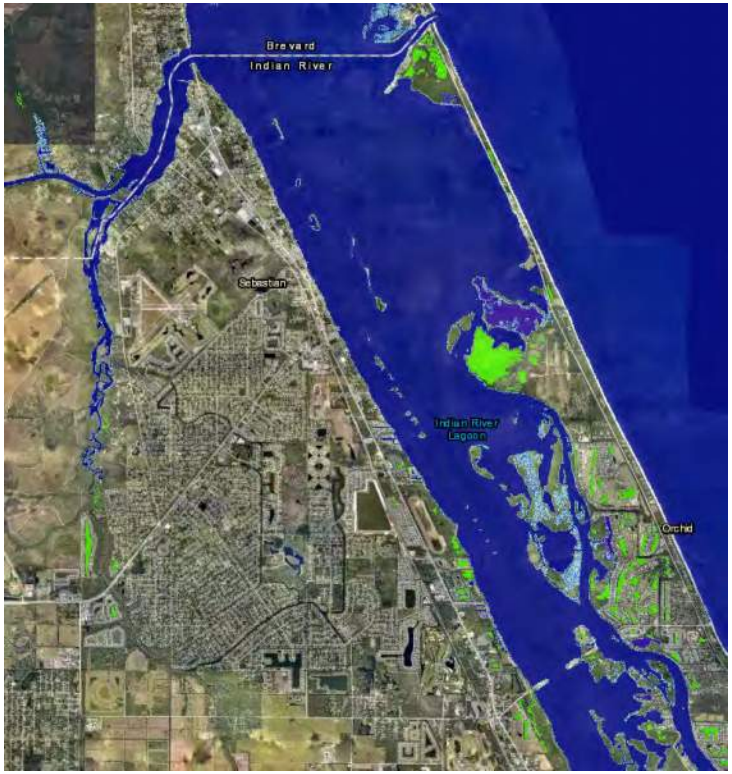

Figure 5-3. One Foot Sea Level Rise – NOAA Sea Level Rise Viewer

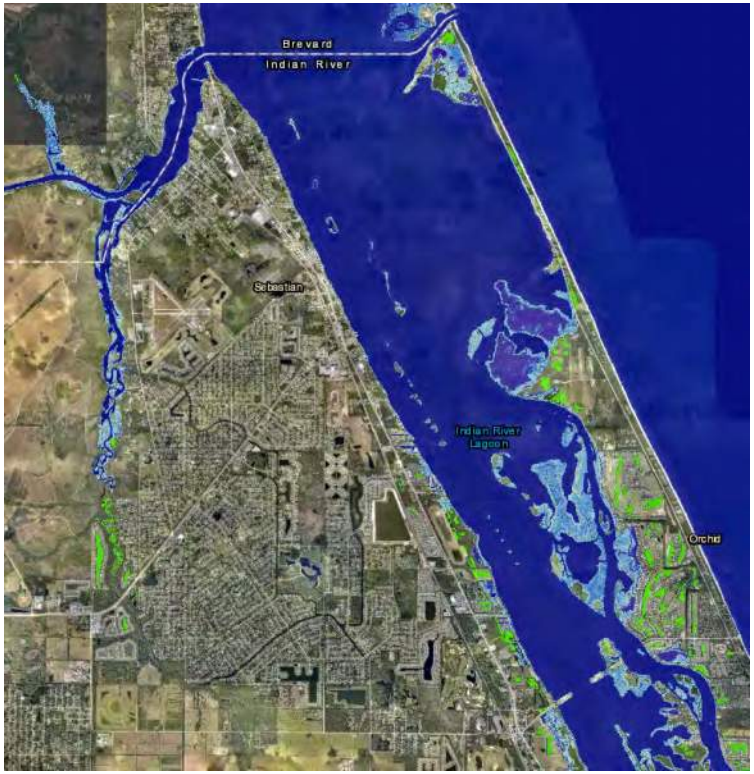

Figure 5-4. Two Foot Sea Level Rise – NOAA Sea Level Rise Viewer