

Sea Level Rise Vulnerability Assessment for the City of Tampa



**Hillsborough County
City-County
Planning Commission**

In support of compliance with the 2015 Peril of Flood Act (SB 1094)

Fla. Statute 163.3178(2)(f)

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Introduction

The National Oceanic and Atmospheric Administration (NOAA) estimates that sea level rise will impact the Tampa Bay region in the next 25 years. NOAA provides four global mean sea level rise (SLR) scenarios to help gauge potential impacts to an area. The Tampa Bay Climate Science Advisory Panel (CSAP), convened in 2015, studied these scenarios and concluded that the Tampa Bay region might experience sea level rise between 0.5 to 2.5 feet by 2050. Tampa has already experienced an estimated 7 inches of sea level rise over the last 67 years of records, with the highest observed area flood of 4 feet occurring in 1985 (Climate Central 2014)¹. The purpose of this assessment is to identify how sea-level rise will impact the City of Tampa by utilizing the NOAA projections to pinpoint potential areas at risk, as well as population, facilities, and infrastructure that might be affected by sea level rise.



Methodology

Planning Commission staff, with the help of the Tampa Bay Regional Planning Council (TBRPC) staff, utilized the U.S. Army Corps of Engineers' (USACE) Sea Level Change Curve Calculator, which includes NOAA's projections, to generate sea level change projections at the local level through the year 2040. This year was chosen due to the planning horizon of the *Imagine 2040: Tampa Comprehensive Plan*. Per the CSAP's recommendation, staff used the NOAA curves and the St. Petersburg tidal gauge to adjust the NOAA projections to a local context. The calculator results showed the sea level in the Tampa Bay area is projected to rise an additional 0.4 to 1.6 feet, or 5 to 19 inches, above current levels by the year 2040. This projection is based on NOAA's Regional Rate of 0.00860 feet per year. The calculator uses the start date of 1992 as the baseline for sea level rise as it corresponds to the midpoint of the current National Tidal Datum Epoch of 1983-2001. The regionally adjusted NOAA SLR projections through 2040 can be summarized as follows (all values are expressed in feet relative to Local Mean Sea Level (LMSL)):

Year	Low	Intermediate Low	Intermediate High	High
1992	0.00	0.00	0.00	0.00
2015	0.20	0.25	0.35	0.47
2020	0.24	0.31	0.47	0.64
2025	0.28	0.38	0.60	0.84
2030	0.33	0.46	0.74	1.06
2035	0.37	0.53	0.90	1.31
2040	0.41	0.62	1.07	1.59

¹ Coastal Risks for Tampa, FL, Climate Central, 9/14/2016

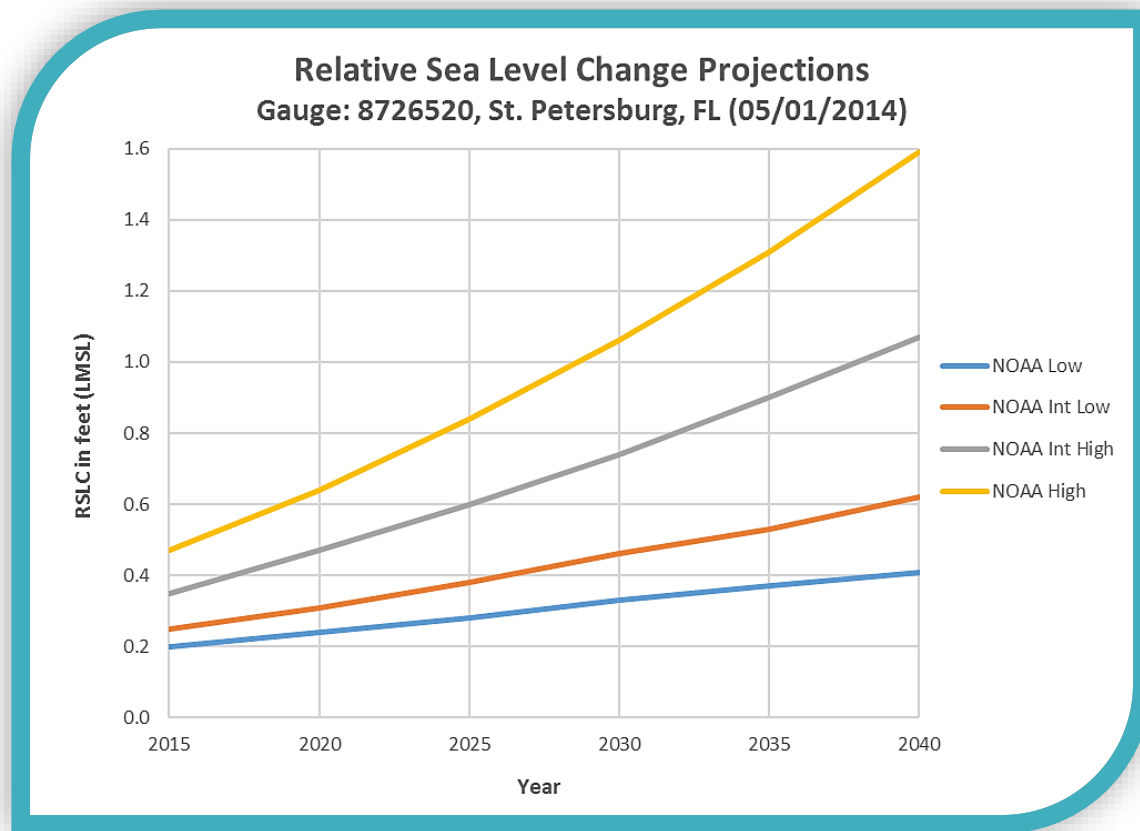


Figure 1 Relative Sea Level Change Projections

Source: USACE Sea Level Change Curve Calculator (Version 2015.46)
<http://www.corpsclimate.us/ccaceslcurves.cfm>

The projections were provided to the TBRPC to use in their scenario modeler to create a model of the sea level rise surface to show inundation.

The TBRPC's model is built using the same methodology employed in the Statewide Regional Evacuation Studies program. The model uses elevation surface from high-resolution laser-based elevation data, and the Sea, Lake and Overland Surges from Hurricanes (SLOSH) basin layer. The SLOSH layer is used to select the area in question, and in case further analysis with storm surge is needed. It uses Mean Higher High Water (MHHW) from NOAA as a base calculation, as well as local tidal gauges for datum calculations. The NOAA MHHW data uses tidal gauges to determine how the level of the sea is distributed throughout an area. At any given point in time, sea level over a large area is entirely different. These differences are incorporated into this model.

It is important to note that the TBRPC model is not a bathtub model. A bathtub model uses near-flat water surfaces in an area to compare exposure. According to the TBRPC, just applying an elevation value to create additive height to the shoreline would not work as actual storms create uneven flooding in specific areas.

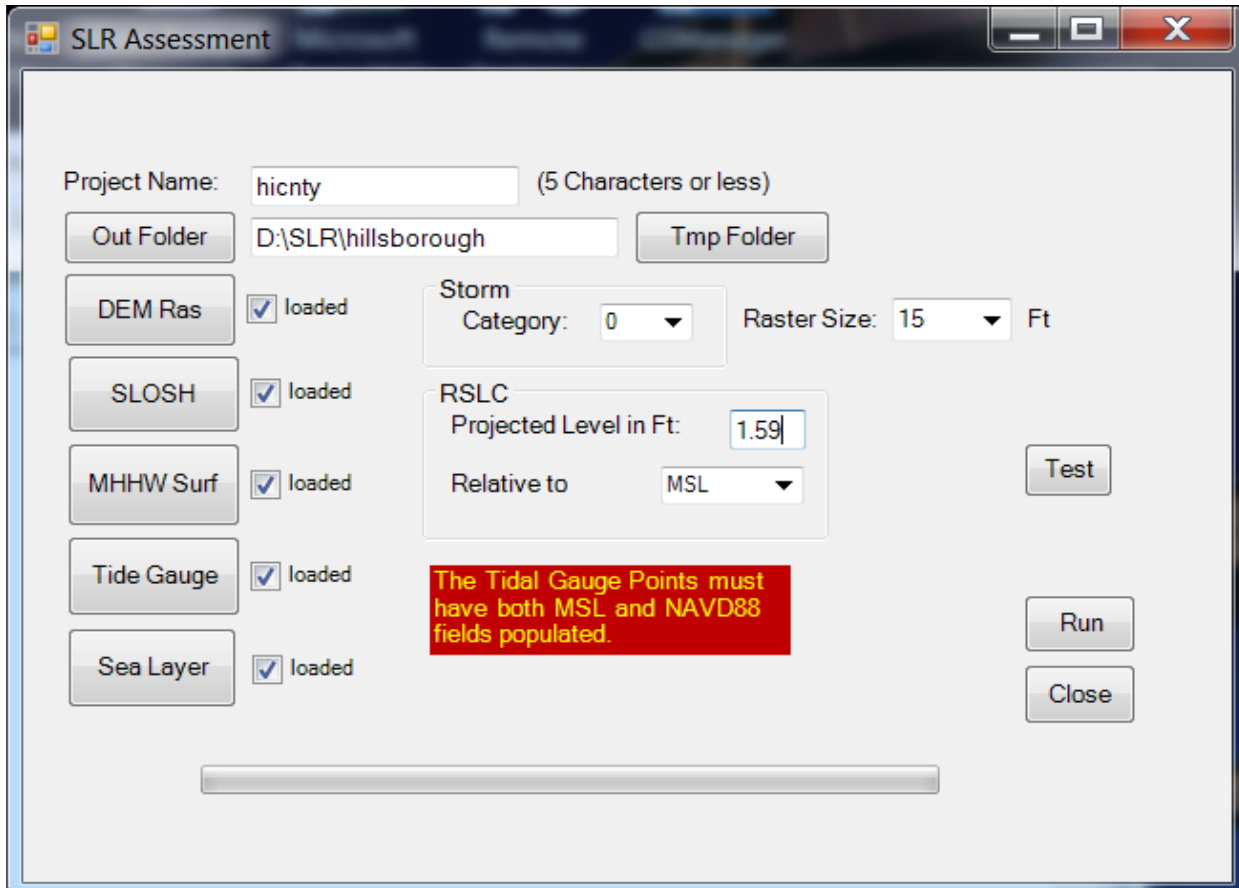


Figure 2 TBRPC SLR Assessment Tool

The NOAA projections created by the TBRPC tool were then used by Planning Commission staff to create a series of maps using Esri's ArcMap GIS software. The four NOAA projections were overlaid on the City of Tampa jurisdiction boundary to analyze potential impacts of sea level rise in different areas of the city.

Once the areas of risk were identified, staff examined the Hillsborough County Property Appraiser's parcel data to identify affected properties and the U.S. Census Bureau's block data to determine the population numbers and demographic groups affected. Finally, the City of Tampa's public facilities, roads, and stormwater infrastructure were evaluated.

All analyses exclude the MacDill Air Force Base jurisdictional area; however, the site appears on all maps for clarity as pictured below in Figure 3.

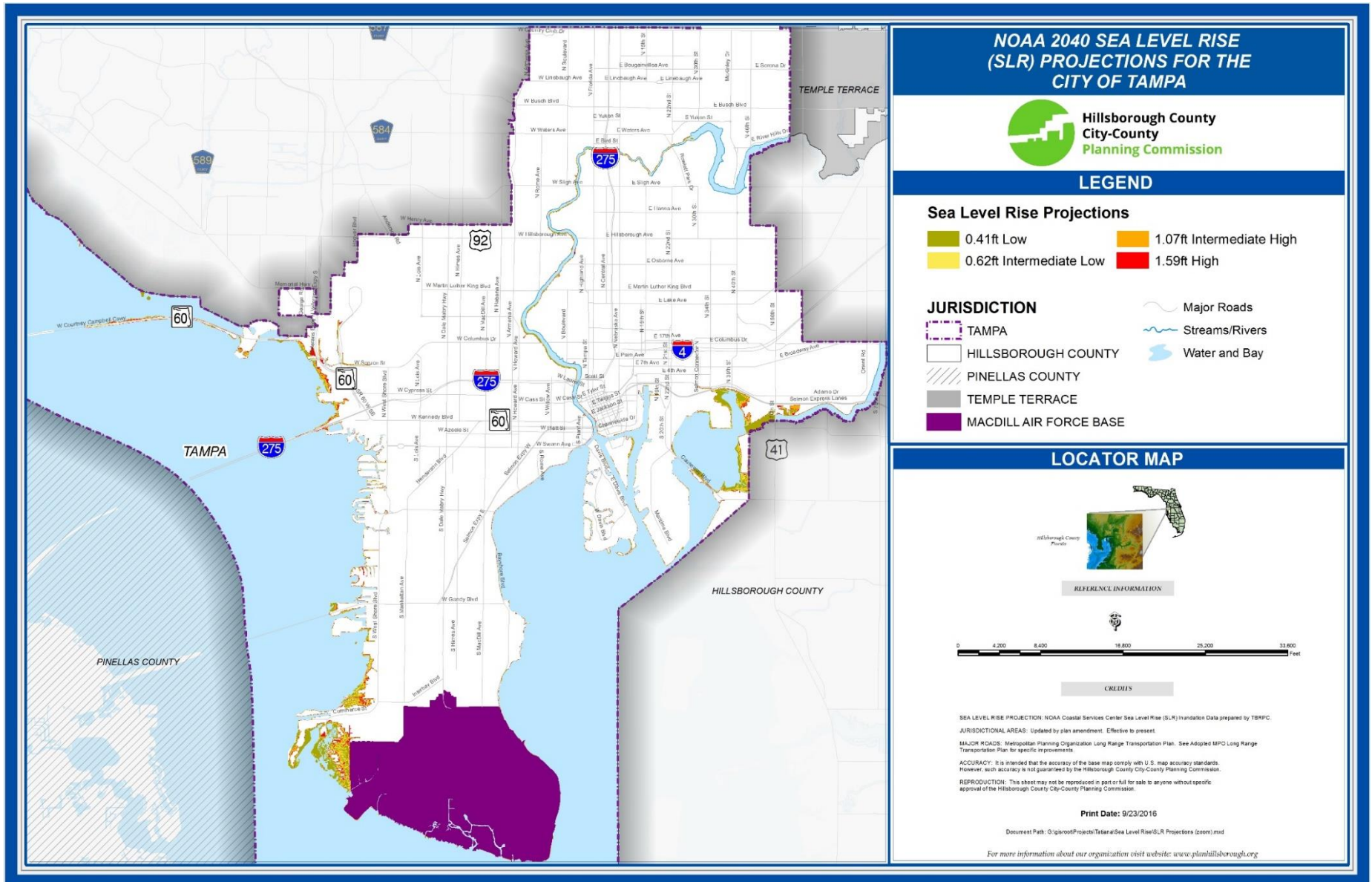


Figure 3 NOAA 2040 Sea Level Rise Projections

Vulnerability Assessment

Areas designated as 100-year flood zones in the city of Tampa were the first areas to be compared to the SLR projections as SLR may exacerbate existing flood risks. In fact, the SLR projections were found to lie within the AE and VE flood zones. Flood zones classified as AE and VE by the Federal Emergency Management Agency (FEMA) are areas with a 1% chance of flooding in any given year, commonly known as the “100-year flood”. VE zones also experience wind and wave action velocity hazards which can intensify damage caused by flooding. In the map below, the AE and VE flood zones are located along coastal and river floodplain areas and are represented by the green and blue hatch marks respectively.

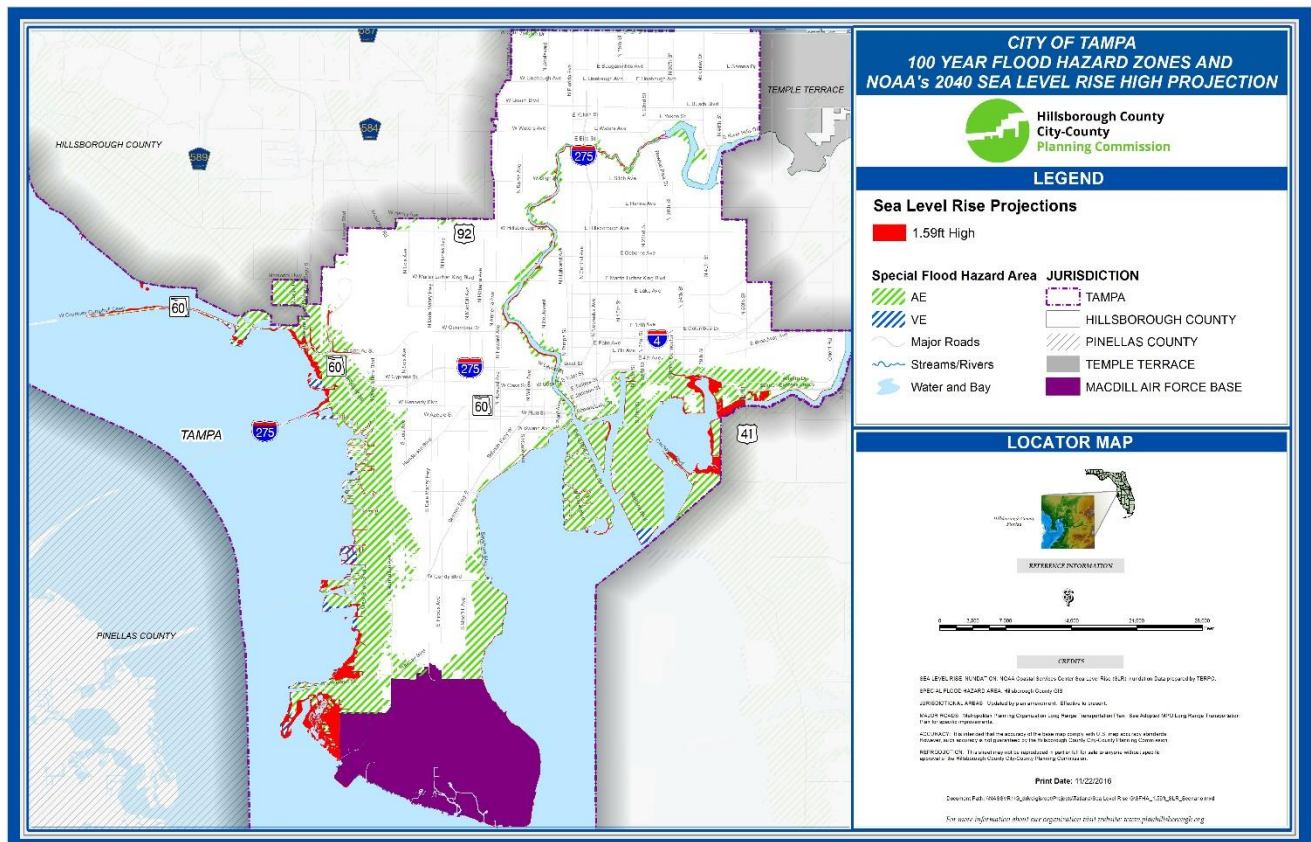


Figure 4 100-Year Flood Hazard Zones (AE & VE) and SLR High Projection Comparison

Tampa’s flood vulnerability, with a focus on SLR, can be seen in three specific areas of the city:

1. Tampa Bay,
2. McKay Bay and the Tampa Bypass Canal, and
3. The Hillsborough River.

Properties fronting these three areas may experience impacts of sea level rise. These impacts will likely be limited to the flooding of docks and property boundaries along some waterways through 2040, however some structural flooding may also be a possibility, as strong winds or high waves during storms can affect the intensity of the event.

The maps on the following pages focus on the three specific areas individually.

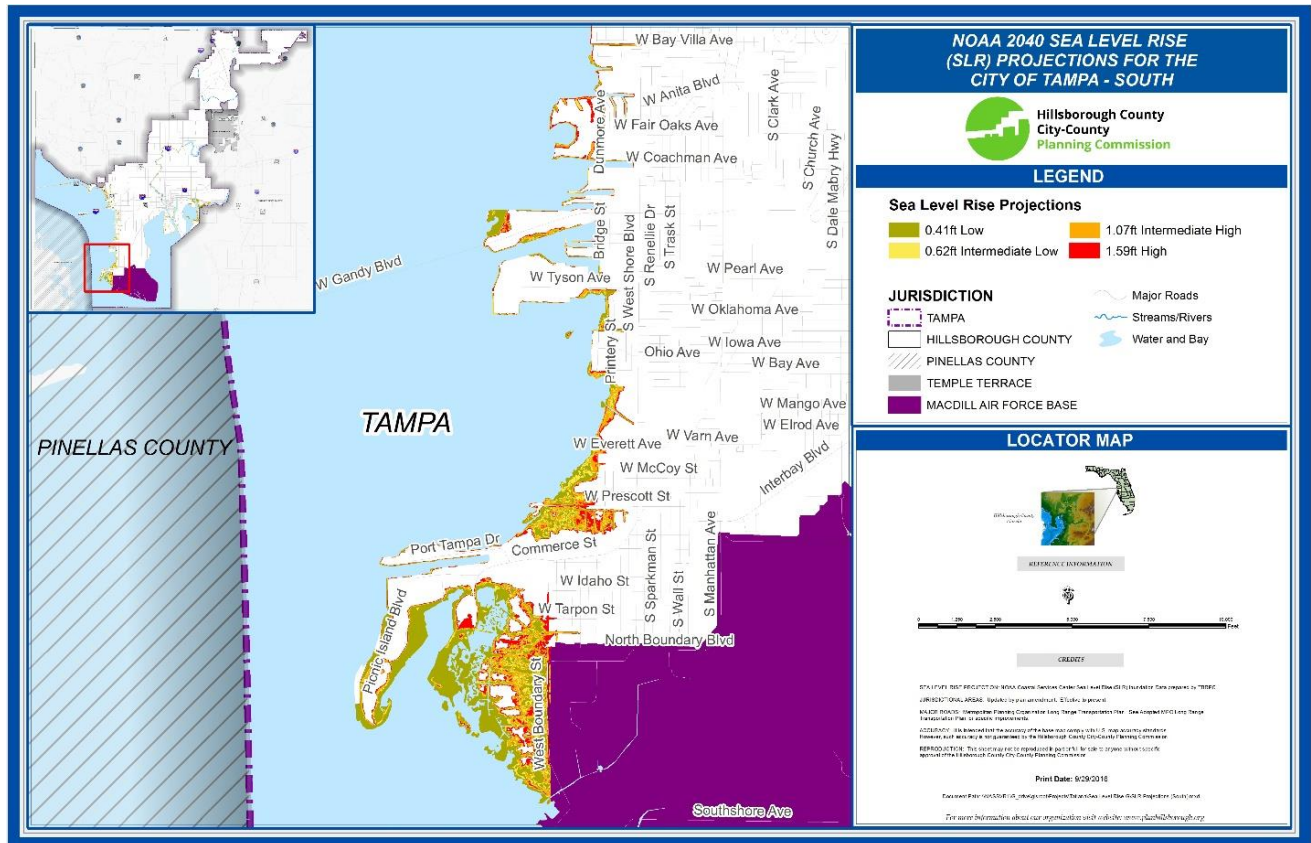


Figure 5 Sea Level Rise Projections - South Tampa

As shown in the map above, the areas in southwest Tampa near MacDill Air Force Base may be impacted.

Areas fronting Old Tampa Bay in West Tampa may also experience impacts, especially properties at the corner of South Westshore Blvd and Commerce Street; and areas to the north and south of Cypress Point Park near SR 60 (see Figure 6). This includes beaches along the Courtney Campbell Causeway.

Areas to the east of McKay Bay Nature Park following the Palm River and areas south along McKay Bay Trail to Business US41 are also at risk as shown in Figure 7 on the following page.

Certain areas along the Hillsborough River may experience impacts on the east and/or west side of the river, beginning at Channelside and continuing past Rowlett Park Drive to the dam (see Figure 8). However, only two structures were identified within the projected vulnerability area citywide. These structures were along the Hillsborough River. The area beyond the dam will not experience any impacts from sea level rise within this assessment's time horizon.

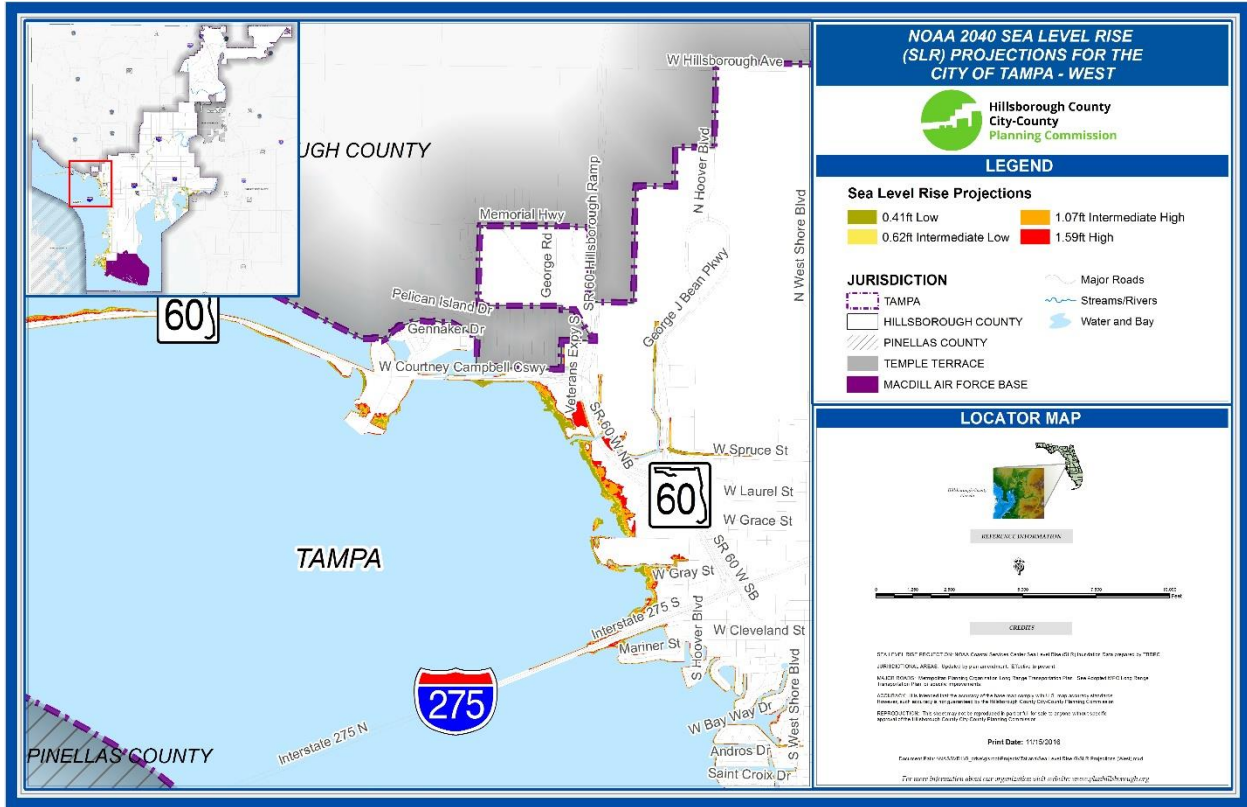


Figure 6 Sea Level Rise Projections - West Tampa

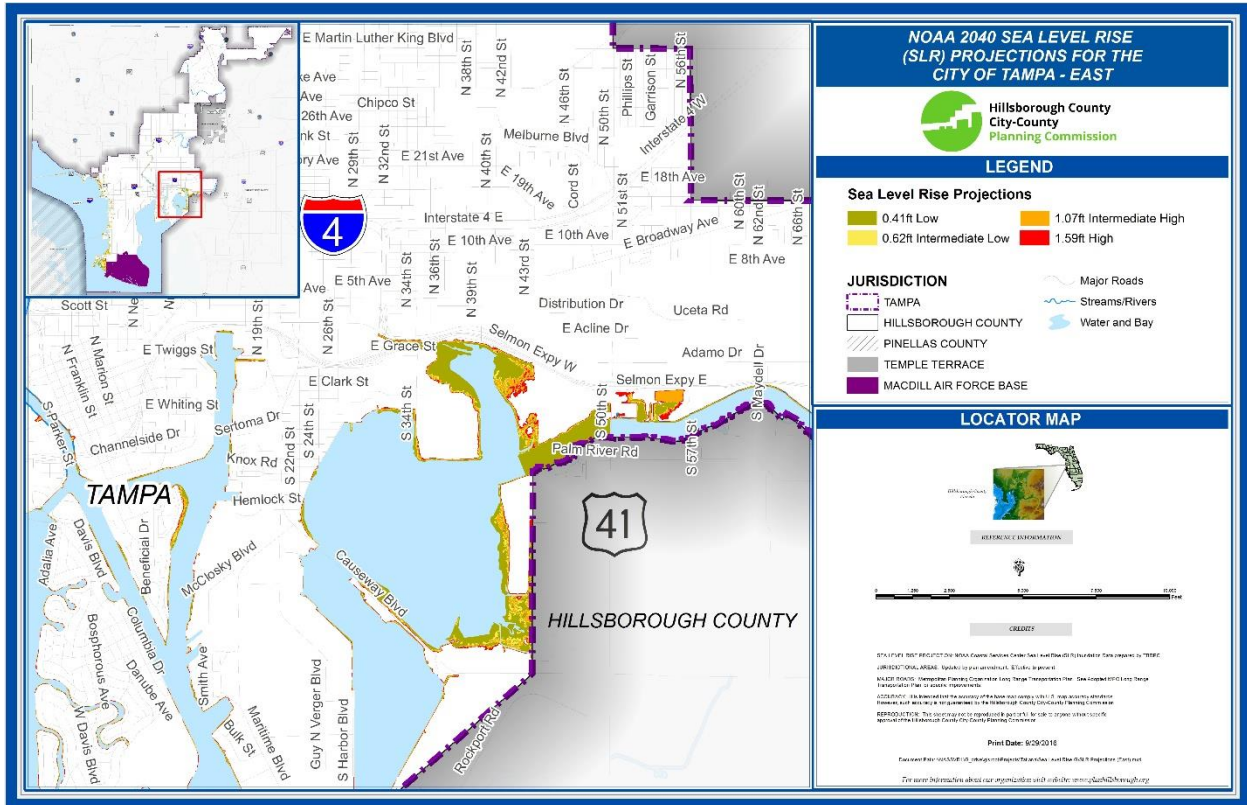


Figure 7 Sea Level Rise Projections - East Tampa

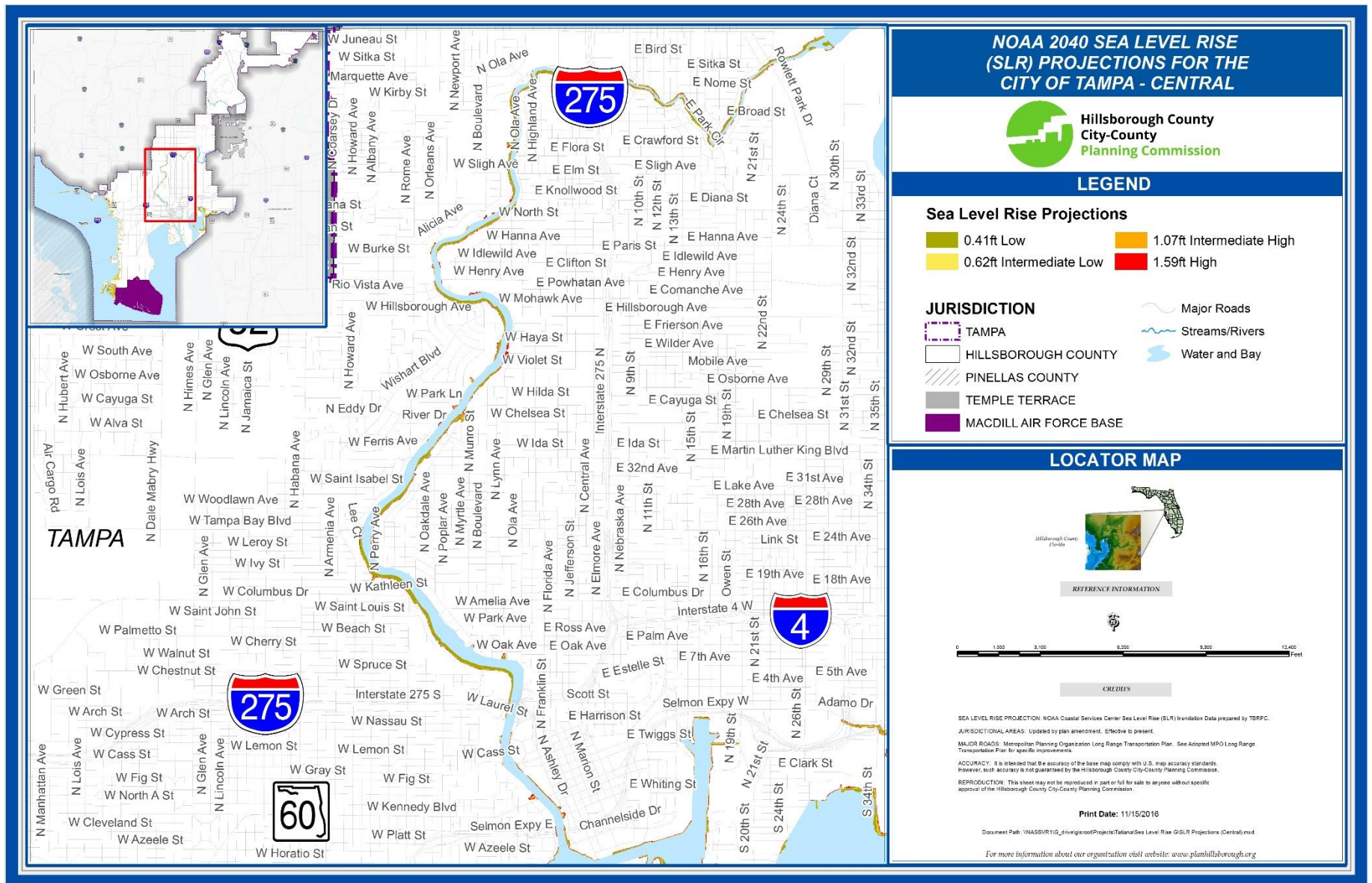


Figure 8 Sea Level Rise Projections – Hillsborough River

Properties

Planning Commission staff conducted a parcel analysis using the Hillsborough County Property Appraiser's Parcel information to identify the number of properties and the types of uses that could be affected by the four sea level rise scenarios. The Property Appraiser's existing land use (ELU) classifications were summarized into eight ELU categories for this study:

- The Residential category includes single family homes, condominiums, townhouses/villas and apartments.
- The Commercial category includes uses such as office, strip centers, restaurants, hotels, mini warehouses, boat slips, and other light and heavy commercial uses.
- The Industrial category includes light and heavy manufacturing uses. These are located primarily along Commerce Street, West Tyson Avenue, and the Port area.
- The Public/Institutional category includes all federal, state, municipal, aviation and port authority properties.
- The Public Utility category includes marinas, utilities, and wetlands/lowlands.
- The Right-of-Way category includes parcels belonging to CSX.
- The Schools category includes public and private schools.
- The Vacant category includes undeveloped residential, commercial, and industrial parcels.

Staff also calculated the taxable valuation of these parcels, the total amount of affected acreage and the percentage of the acreage affected. Below are the summary tables of the parcel analysis undertaken for properties located within each sea level rise scenario for the 2040 planning horizon.

0.41ft Low – Impact of 4 to 5-inch rise in sea level

Existing Land Use	Number of Parcels	Taxable Valuation	Parcels Acreage	Affected Acreage	Percent Affected
Residential	864	\$ 928,174,865.00	688.79	20.07	4.64%
Commercial	49	\$ 284,242,697.00	253.32	13.27	3.07%
Industrial	27	\$ 106,310,291.00	442.56	4.09	0.95%
Public Institutional	166	\$ 54,404,030.00	10,470.57	351.27	81.24%
Public Utilities	16	\$ 12,042,990.00	230.20	8.90	2.06%
Right-of-Way	6	\$ -	127.00	0.97	0.22%
Schools	4	\$ -	133.76	1.71	0.40%
Vacant	118	\$ 78,057,531.00	476.60	32.12	7.43%
TOTAL	1,250	\$ 1,463,232,404.00	12,822.80	432.40	100.00%

Although the vast majority of parcels affected by the Low scenario are in the residential category, the actual acreage affected shows properties in the Public Institutional category experiencing 81% of the impact from a sea level rise scenario of 0.41 feet, or an estimated 5 inches, when compared to the other categories. Following that category is the Vacant category with 7.43% of the acreage affected, and Residential properties comprise only 4.64% of affected properties. Properties in the Schools and Right-of-Way categories, such as Stewart Middle School and CSX properties respectively, show minimal impacts. The Public Utility Category includes 5.38 acres of impacted wetlands. Although wetlands were present on other parcels, that level of analysis was not examined as part of this study.

0.62ft Intermediate Low – Impact of 7-inch rise in sea level

Existing Land Use	Number of Parcels	Taxable Valuation	Parcels Acreage	Affected Acreage	Percent Affected
Residential	900	\$ 953,775,734.00	681.12	24.05	4.68%
Commercial	53	\$ 319,977,207.00	275.29	15.39	3.00%
Industrial	27	\$ 106,310,291.00	442.56	5.18	1.01%
Public Institutional	163	\$ 57,559,189.00	10,452.65	417.13	81.22%
Public Utilities	15	\$ 12,039,239.00	230.15	10.55	2.05%
Right-of-Way	6	\$ -	127.00	1.13	0.22%
Schools	4	\$ -	133.76	1.71	0.33%
Vacant	128	\$ 86,246,637.00	480.97	38.41	7.48%
TOTAL	1,296	\$ 1,535,908,297.00	12,823.50	513.55	100.00%

In the second scenario, the trend continues with the Public Institutional category experiencing the majority of the impacts from a 7-inch rise in sea level, once again followed by the Vacant and the Residential category. The Public Utility Category includes 6.41 acres of impacted wetlands.

1.07ft Intermediate High – Impact of 12 to 13-inch rise in sea level

Existing Land Use	Number of Parcels	Taxable Valuation	Parcels Acreage	Affected Acreage	Percent Affected
Residential	968	\$ 1,040,301,927.00	737.33	35.74	5.40%
Commercial	56	\$ 372,439,225.00	291.16	19.83	3.00%
Industrial	27	\$ 106,310,291.00	442.56	7.14	1.08%
Public Institutional	173	\$ 57,559,189.00	10,478.13	531.81	80.42%
Public Utilities	15	\$ 12,039,239.00	230.15	14.55	2.20%
Right-of-Way	6	\$ -	127.00	1.33	0.20%
Schools	4	\$ -	133.76	1.90	0.29%
Vacant	137	\$ 87,633,722.00	495.59	48.99	7.41%
TOTAL	1,386	\$ 1,676,283,593.00	12,935.68	661.29	100.00%

In the third scenario, the Residential category's affected acreage increases faster than the Public Institutional and Vacant categories. However, the primarily impacted land continues to be properties within the Public Institutional and Vacant categories. The Public Utility Category includes 9.14 acres of impacted wetlands.

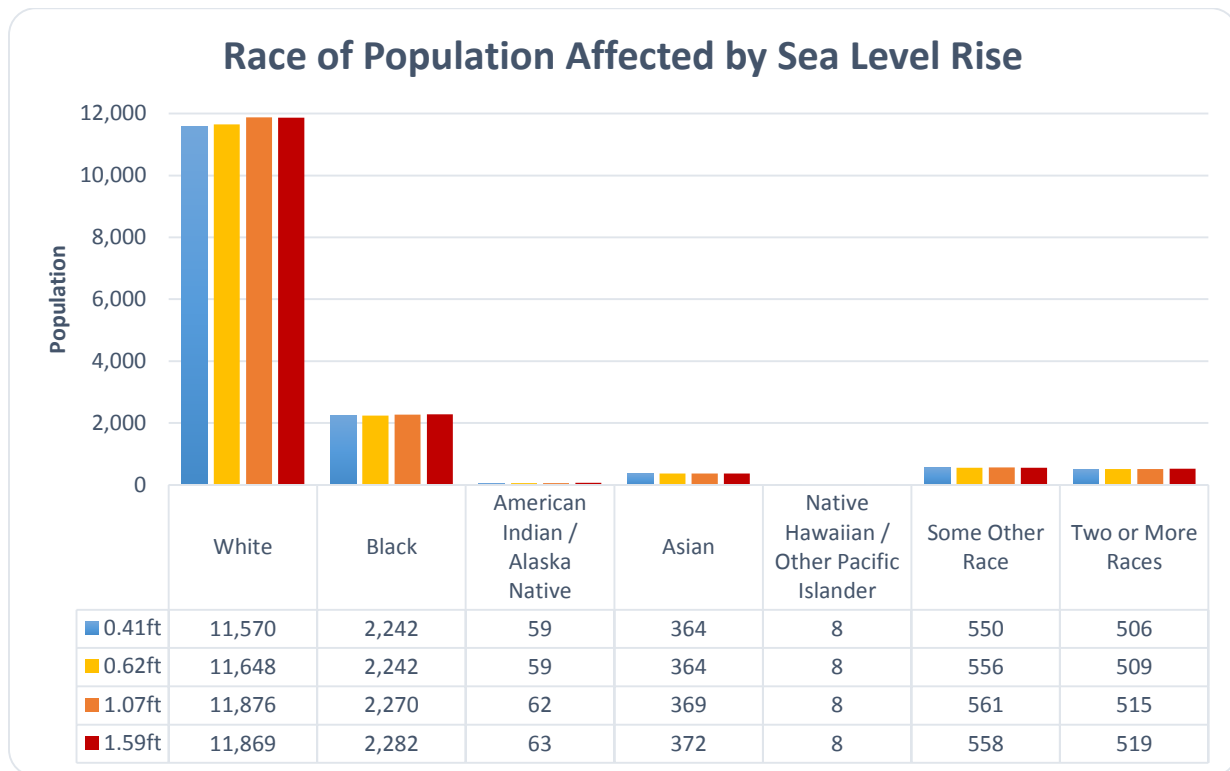
1.59ft High – Impact of 19-inch rise in sea level

Existing Land Use	Number of Parcels	Taxable Valuation	Parcels Acreage	Affected Acreage	Percent Affected
Residential	1057	\$ 1,159,291,000.00	790.76	44.67	5.75%
Commercial	60	\$ 375,356,663.00	296.68	25.91	3.33%
Industrial	28	\$ 106,677,278.00	444.45	12.47	1.60%
Public Institutional	180	\$ 54,661,901.00	10,507.59	613.06	78.85%
Public Utilities	16	\$ 12,042,990.00	230.20	17.48	2.25%
Right-of-Way	6	\$ -	127.00	1.51	0.19%
Schools	4	\$ -	133.76	2.14	0.28%
Vacant	135	\$ 89,258,308.00	486.70	60.28	7.75%
TOTAL	1,486	\$ 1,797,288,140.00	13,017.14	777.52	100.00%

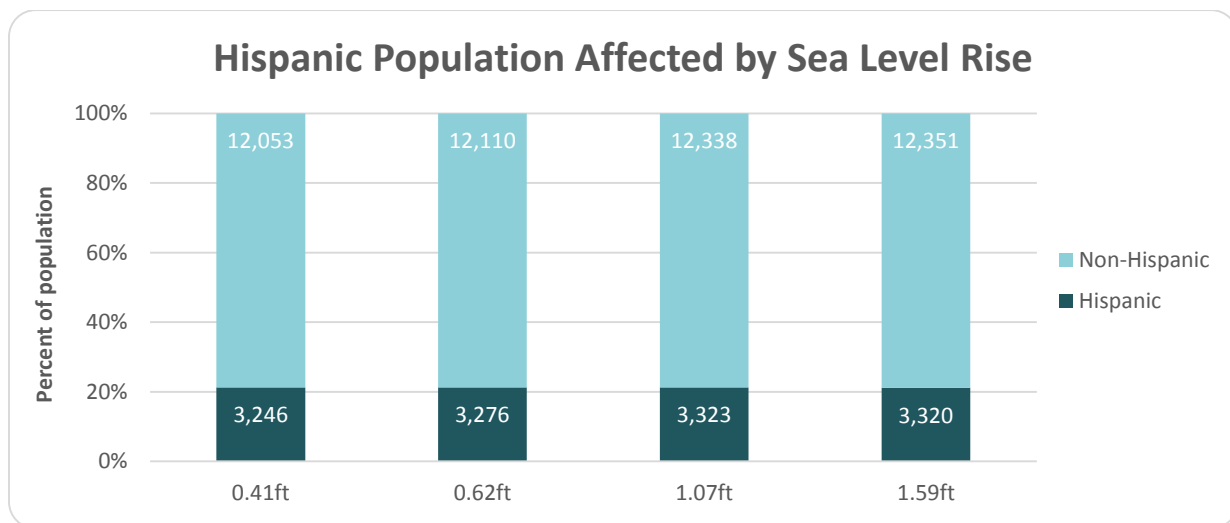
In the last scenario, a 19-inch rise in sea level continues to affect properties primarily in the Public Institutional and Vacant categories. The Public Utility Category includes 10.86 acres of impacted wetlands.

Population

Based on Tampa’s 2010 census blocks population count, an estimated 15,300-15,700 people live in one of the 118 census blocks that may be potentially affected by one, if not all, the sea level rise scenarios. This population range accounted for 4.68% of the total city of Tampa population of 335,709 as of the last decennial census in 2010. A demographic breakdown of the census blocks reveals that over 75% of the at-risk population is white, and over 14% is black. Additionally, 21% of the affected population within the at-risk census blocks is of Hispanic descent.



Source: U.S. Census Bureau; Census 2010, Summary File 1



Source: U.S. Census Bureau; Census 2010, Summary File 1

- Al Palonis Park
- Alan Wright Park
- Ballast Point Park
- Cotanchobee Fort Brooke Park
- Curtis Hixon Waterfront Park
- Cypress Point Park
- Davis Islands Park
- Desoto Park
- Epps Park
- Gandy Park South
- Ignacio Haya Linear Park
- Julian B Lane Riverfront Park
- Lowry Park
- MacDill Park on the Riverwalk
- McKay Bay Nature Park
- Bayshore Boulevard Linear Park
- Blackwater Hammock Park
- Columbus Statue Park
- Patterson Street Park
- Picnic Island Park
- Plant Park
- River Cove Park
- River Tower Park
- Rivercrest Park
- Riverside Garden Park
- Southwest Port Tampa Park
- Sulphur Springs Park
- Tappan Tract Park
- Tony Jannus Park
- USF Park



Figure 10 Curtis Hixon Waterfront Park

Infrastructure

There are also impacts to particular types of infrastructure, such as roads and utilities.

Roads

Portions of 83 different roadways (segments) may potentially be impacted by a high sea level rise of 1.59ft. Of those roads, 31 are classified as local roads:

- Airport Access
- Bayport Drive
- Bowen Daniel Drive
- Campbell Causeway Access Rd N
- Campbell Causeway Access Rd S
- Culbreath Key Way

Open Drains

80 drains are located within the SLR scenarios. The drainage ditch on the corner of Adamo Drive and N 34th Street, Bayport Drive may experience minimal impact but is worth monitoring.

Redline Properties

According to a list of parcels flagged for drainage issues by the City of Tampa Stormwater Department, four redline properties that are prone to flooding lie within the SLR scenarios near MacDill Air Force Base.

Conclusion

The analysis identified and focused on three areas that may be impacted by the NOAA 2040 sea level rise projections: Old Tampa Bay near Tampa International Airport, the Tampa Bay area west of MacDill Air Force Base, and McKay Bay and the Tampa Bypass Canal. Properties along the Hillsborough River may also see a distributed rise in water level. Some of the most notable findings in the analysis are:

- Projected property impacts through 2040 are primarily limited to open spaces and docks with only two structures identified on the Hillsborough river as being in the vulnerability area.
- At least 80% of affected properties are publicly owned;
- Tampa General Hospital and a number of parks are at risk;
- Critical facilities are not located within at-risk areas; however, the area surrounding the McKay Bay Refuse-To-Energy Facility should be monitored;
- Segments of 31 local roads are at-risk;
- Several stormwater basins and some stormwater facilities are within the at-risk areas.