6 Awareness and Implications of Sea Level Rise

In August of 2006, the Tampa Bay Regional Planning Council (TBRPC) distributed a document, entitled "*Sea Level Rise in the Tampa Bay Region*", that offers a glimpse into the issues and ramifications regarding rising sea levels in the Tampa Bay area, including Pinellas County. While there is often a general feeling that sea level rise is a problem that will manifest itself decades or even generations into the future, if at all, it is not too soon to begin thinking of and planning for rising sea levels and the related impacts on the coastal environment, coastal land use and overall quality of life. The following discussion is derived from the aforementioned TBRPC study.

RISING TEMPERATURES AND SEA LEVELS

Regardless of the cause, evidence abounds that global temperatures are rising. Average global surface temperatures have risen by approximately one degree Fahrenheit during the past century, and are expected to rise by a few more degrees by the Year 2100 (Titus). One direct result of increasing temperatures is the corresponding rise in sea level. Being largely surrounded by water, the potential consequences for Pinellas County could be profound. Therefore, it is important to remain informed, understand the implications and appropriately plan for the future.

There is a 50% probability that average global sea levels will rise 24 centimeters (cm) by 2050, and a mid-range rise of 50 cm could be possible by 2100 (TBRPC). The average sea level rise in the Tampa Bay region is currently 2.3 millimeters (mm) per year. This should not cause alarm, however, as historical rates indicate a rise of more than 2.5 mm per year along much of the United States coastline (TBRPC). The United States Environmental Protection Agency (EPA) has compiled estimates of future sea level rise in the Tampa Bay area over 25-year increments through the Year 2200 (please see **Table 28**).

TAMPA BAY STUDY ON THE EFFECTS OF SEA LEVEL RISE

As part of an ongoing program evaluating global climate change, the EPA initiated a nationwide project promoting planning for and awareness of sea level rise. In 2000, the EPA issued a grant to the Southwest Florida Regional Planning Council (SWFRPC) to participate in this program and coordinate the study of sea level rise throughout the State. In 2005, the TBRPC entered into a contract with the SWFRPC to conduct a study of the effects of sea level rise within the Tampa Bay Region.

The study was designed to support the EPA's national effort encouraging long-term thinking required to deal with the issues associated with sea level rise. The ultimate goal of the project is to diminish losses to life and property from coastal hazards, such as erosion and inundation, and to ensure the long-term survival of coastal wetlands.

TABLE 28
Estimated Sea Level Rise for the Tampa Bay Region

Sea Level Projections by Year						
Probability	**2025**	**2050**	**2075**	**2100**	**2150**	**2200**
(%)	**cm**	**cm**	**cm**	**cm**	**cm**	**cm**
90	7	13	20	26	40	53
80	9	17	26	35	53	71
70	11	20	30	41	63	85
60	12	22	34	45	72	99
50	13	24	37	50	80	112
40	14	27	41	55	90	126
30	16	29	44	61	102	146
20	17	32	49	69	117	173
10	20	37	57	80	143	222
5	22	41	63	91	171	279
2.5	25	45	70	103	204	344
1	27	49	77	117	247	450
Mean	**13**	**25**	**38**	**52**	**88**	**129**

Source: Tampa Bay Regional Planning Council, "*Sea Level Rise in the Tampa Bay Region"*, 2006.

*The results of this table are based on using Tables 9-1 and 9-2 of the EPA Report "The Probability of Sea Level Rise". Basically, the formula is multiplying the historic sea level rise (2.3 mm/yr) in the Tampa Bay region by the future number of years from 1990 plus the Normalized Sea Level Projections in Table 9.1. In summary, the EPA report has relied on various scientific opinions regarding sea level changes affected by factors such as radiative forcing caused by both greenhouse gases and sulfate aerosols, global warming and thermal expansion, polar temperatures and precipitation, and the contributions to sea level from Greenland, Antarctica and small glaciers.

POTENTIAL RESPONSE SCENARIOS

As sea levels encroach further onto the land, there are three broad response scenarios, as defined by the Coastal Zone Management Subgroup of the Intergovernmental Panel on Climate Change Response Strategies Working Group. Those scenarios are: **retreat**, **accommodation** and **protection**.

Retreat is the policy of abandoning lands and structures in coastal zones and allowing marine ecosystems to move inland. Under this option, development is generally restricted in vulnerable coastal areas, or allowed with conditions for abandonment. **Accommodation** allows occupancy in prone areas to continue with reinforced structures and stronger building codes, but no steps are taken to prevent shoreline advance. This is a shorter term response that may in the end result in a structure being surrounded by wetlands or within the water itself. **Protection** involves using structural, defensive measures to protect the land from inundation. Such protective measures include hard structures such as seawalls, revetments and dikes and soft techniques such as beach nourishment and elevating land surfaces with fill.

Because of the highly developed nature of the Pinellas County shoreline, the most likely scenario in the majority of areas would be a protective response. Seawalls are already in place in many areas and beach nourishment is a proven method of coastal protection. The need to further strengthen the shoreline, however, would almost be a certainty, depending on the level of the rising seas. Such an endeavor would be expensive, although the potential loss of life and property from the effects of rising seas would likely outweigh the preventive expense. It should also be noted that increasing densities in vulnerable areas may exacerbate the problem by putting more lives and property in harms way. Environmental impacts must also be considered. The cost to wetlands, unprotected uplands and offshore fisheries should be assessed before protective measures are built. In the areas of the County where natural shorelines exist, such as certain parks and preserves, the installation of protective measures may not be in the best interest of the environment, nor make monetary sense. Site differences, the potential enormity of the issue and the far-reaching human and environmental effects of sea level rise response are all important reasons why it is necessary to begin planning and considering all options.

Pinellas County's highly-developed coastline is vulnerable to sea level rise

IDENTIFYING AND MAPPING ANTICIPATED RESPONSE TO SEA LEVEL RISE

The TBRPC study created maps of the Tampa Bay Region that identified the coastal areas likely to be protected from erosion, inundation, and flooding separate from those areas where natural shoreline retreat is likely to take place. The study followed the general approach of other sea level rise planning studies sponsored by the EPA. Decision rules defined by a statewide approach were used for identifying the likelihood of land use protection to characterize all uplands from 0 to 10 feet in elevation and within 1,000 feet of the shoreline into the following four general categories:

- protection almost certain;
- protection reasonably likely;
- protection unlikely; and
- no protection

Colors were assigned to each category to distinguish the protection scenarios on the sea level rise maps prepared for each county in the region. Please see **Figure 23** for a map of Pinellas County's anticipated response to sea level rise.

The mapped protection scenarios were derived through the incorporation of state policies and regulations, local concerns, land use data, and general planning judgment. "It is understood that every effort will be made to protect highly developed land from saltwater intrusion. This is due to the economic value of these lands and the high population density in these areas" (TBRPC). Three land use patterns were typically designated as 'protection almost certain'.

They are as follows: 1) existing developed land with extensively develop areas and/or designated growth areas; 2) future development within extensively developed areas and/or designated growth areas; and 3) parks extensively used for purposes other than conservation and which have current protection or are surrounded by protected lands. As readily distinguishable on **Figure 23**, the vast majority of Pinellas County, 96.5% of the study area, falls within the 'protection almost certain' category (see **Table 29**).

The 'protection reasonably likely' category includes lands that will probably be protected, but with plausible reasons not to. The land uses within this scenario include less densely developed areas, future development outside of growth areas, private beaches, agricultural areas, and military lands. Because these areas are not extensively developed yet, they have not reached the point where it would be inconceivable for policymakers and landowners to allow them to retreat. In Pinellas County, only 1.6% (see **Table 29**) of the study area falls within the 'protection reasonably likely' category, the majority of that being Fort DeSoto Park, Sand Key Park and Honeymoon Island.

The 'protection unlikely' category includes areas of undeveloped privately-owned lands, un-bridged barrier islands or lightly-developed coastal high hazard areas, minimally-used parks, undeveloped areas where most of the land will be part of a wildlife refuge, but where development is also planned and conservation easements preclude shore protection. Generally, these are areas where land values are low compared with the costs of shore protection. Only 1.3% (see **Table 29**) of Pinellas County's study area falls within the 'protection unlikely' category, underscoring the dense development pattern and high values of the land.

Lastly, the 'no protection' scenario includes conservation lands where shore protection is absolutely prohibited. Private lands owned by conservation groups, conservation easements the preclude shore protection, wildlife refuges and parks with a policy preference for natural occurring processes and public lands/parks with little or no prospect for public use fall within this category. In Pinellas County, a mere 0.6% (see **Table 29**) of the study area is projected to have a 'no protection' scenario, including Shell Key Preserve, Three Rooker Bar, Anclote Key and a number of other small, uninhabited islands.

Mangrove islands such as this one fall into the 'no protection' category

FIGURE 23
PINELLAS COUNTY ANTICIPATED RESPONSE TO SEA LEVEL RISE

TABLE 29
Pinellas County Acreage by Likelihood of Shoreline Protection

Pinellas County Acreage Per Protection Scenario		
Protection Scenario	**Acreage**	**Percentage of Dry Land**
Protection Almost Certain	78,770	96.5%
Protection Reasonably Likely	1,272	1.6%
Protection Unlikely	1,034	1.3%
No Protection	474	0.6%
Wetlands	18,402	-
Water	9,171	-
TOTAL	**109,123**	**100.0%**

Source: Tampa Bay Regional Planning Council, "*Sea Level Rise in the Tampa Bay Region*", 2006

SUMMARY

The final TBRPC report and associated map has given Pinellas County a starting point to engage in a meaningful dialog concerning sea level rise. It is important to remember that the sea level rise planning map provided by the TBRPC is intended for general planning purposes only. The map does not represent a comprehensive program to address sea level rise, but rather constitutes a planning baseline that decision makers can use when evaluating land use, density, infrastructure, wetland permits, and other decisions whose outcomes may be sensitive to future sea level rise, flooding, and shoreline erosion. The map is not intended to be based on a benefit-cost analysis, but rather based on the best planning judgments of the local and regional authorities responsible for land use planning. In the future, it may be decided to retreat from lands currently deemed to be protected lands, due to coastal and environmental considerations, or vice versa. Given the broad planning context for the study, an analysis of specific parcels was beyond the intended scope. However, the maps should be detailed enough to identify areas where factoring sea level rise into near-term decision making is most important.

The final report in its entirety and its associated maps are available for download off the TBRPC's website at www.tbrpc.org/gis/sealevelrise.htm.