4.9 Coastal Hazard Mitigation and Sea Level Planning

Climate change and sea level rise are important issues to the Town of Guilford. The Town sponsored a "Municipal Workshop on Climate Change and its Impact on Shoreline Communities," held on November 19, 2004. As interest in these topics has continued to increase, the Board of Selectmen passed a resolution on February 5, 2007 that the government of the Town of Guilford formally recognize climate change as a phenomenon requiring long term governmental monitoring and management. Accordingly, the Board directed Town Departments and recommended that Town Boards and Commissions formally consider impacts of this phenomenon on planning, management, procurement and budgetary decisions, and regulations relating to the objective of reducing greenhouse gas emissions, and mitigating negative effects that are projected to evolve from climate change. Thus, this updated Municipal Coastal program addresses sea level rise and their implications on coastal land use.

The IPCC concludes that there has been a global mean rise in sea level between 10 and 25 cm (approximately 4 to 10 inches) over the last 100 years. Relative sea level rise at Boston and Woods Hole gauges over the same time period is estimated at 26 cm (10 inches), according to USGS. As discussed in Section 4.2, the IPCC estimated that global sea level will rise 9 to 88 centimeters during the 21st century. According to the much-publicized February 2007 report by IPCC, these predictions have been somewhat refined using six models to predict a more narrow range of sea level rise of 28 to 43 cm (11 to 16.9 inches) in the 21st century.

Separate from sea level rise but increasingly related, coastal hazards will continue to impact Guilford. Unlike inland flooding that can occur rapidly during intense thunderstorms, coastal flooding is often due to hurricanes and nor'easters. Aside from flooding caused by hurricanes and nor'easters, smaller magnitude flood events occur on a more frequent basis. For example, coastal areas and low-lying areas proximal to waters under tidal influence may simply be susceptible to frequent flooding as a result of persistent strong winds. In general, coastal flooding can occur as a result of astronomical high tides acting alone or concurrent with storms. Maps 4-4 and 4-5 illustrate the coastal flood zones and hurricane surge inundation areas, respectively.

Although erosion and shoreline change have long been recognized as coastal hazards, it is only recently that the chronic problem of sea level rise has been closely connected to the acute threats of erosion and shoreline change. Indeed, sea level rise may accelerate from current trends and therefore increase the incidence, severity, and adverse effects of erosion and shoreline change.

Rising sea levels will inundate low areas, increase erosion of beaches and bluffs, and increase the incidence of flooding from storm surges. As sea level rises,
storm surges from hurricanes and nor'easters will reach further inland as they are starting from a higher base level.

FEMA coastal base flood elevations, which are currently at 8 to 9 feet (NGVD) depending on the location, will progressively rise. This means that the 100-year and 500-year flood levels will affect lands that are currently at unaffected elevations. This will exacerbate the problem of coastal and near-coastal inland flooding.
Map 4-4
Map 4-5
As sea level rises, drainage systems become less effective. Rainstorms will have the potential to cause greater flooding. Guilford already experiences problems with inadequate storm drainage in areas south of downtown. As sea level rises, these areas will likely experience increased flooding. In particular, storm drainage systems along Whitfield Street and near Guilford Center may need to be improved to function with a rising sea level (and thus, a rising base level at drainage system outlets). This will require periodic upgrades and may require that portions of the systems be retired in favor of less traditional stormwater management solutions.

As coastal population densities increase, greater numbers of people and assets are at risk. For example, increased storm surges due to rising sea levels has the potential to flood important low-lying arterial roadways that currently flood only infrequently.

Erosion and shoreline change are two consequences of sea level rise and coastal hazards working separately or together. Loss of land, including important tidal marshes, is due partly to active erosion of the shoreline and partly to passive submergence caused by the natural component of relative sea level rise. The erosion and passive submergence together cause a net loss of land resulting in shoreline change.

Shoreline change can result in significant economic and emotional loss in the current land use system of fixed property lines and ownership. However, attempting to halt the natural process of erosion with seawalls and other hard structures can sometimes shift the problem, subjecting other property owners to similar losses. The challenge is to site coastal development in a manner that allows natural physical coastal processes such as erosion to continue.

Land use planning in coastal areas must take into account coastal hazard mitigation and sea level rise. Three fundamental long-term responses to sea level rise are typically reported in the literature. These are *retreat*, *accommodation*, and *protection*. Variations of these include *elevation of infrastructure*, adopting *freeboard standards*, and *beach nourishment*:

- **Retreat** refers to the eventual abandonment of the coastal zone, reducing vulnerability to coastal hazards and allowing sea level rise to take its course.
- **Accommodation** allows for the continued use of land at risk, but does not prevent the land from...
flooding.

- **Protection** is the construction of structures meant to protect land from inundation and flooding.
- **Elevation of infrastructure** is the raising of roadways and drainage systems so they continue to function.
- **Freeboard standards** are legally defensible and require the elevation of structures higher than the minimal standards set forth by FEMA.
- **Beach nourishment** is the process of replacing sand on and along eroded beaches.

As a coastal community with a long shoreline, Guilford is susceptible to the full array of coastal hazards. The areas of Guilford that are most vulnerable to coastal hazards are similar to those vulnerable to sea level rise, including areas at low elevations. However, the areas that are vulnerable to coastal hazards also tend to include rocky shorefronts as well as other higher-elevation areas that are not vulnerable to sea level rise, because wave action and strong winds can damage properties and structures that are not simply subject to inundation.

The developed areas of Guilford that are most vulnerable to sea level rise include those at low elevations and those characterized by a lack of near-surface competent bedrock. Thus, a home situated ten feet above sea level on bedrock is not necessarily vulnerable, but the road leading to the home could be vulnerable.

With regard to undeveloped areas, all of the tidal marshes are vulnerable to sea level rise. They will continue to erode as more saline water migrates inland, as marshes spend more time inundated, and as other contributors to marsh die-off continue. The marshes will continue to be "squeezed" where they can not migrate inland.

Viable evacuation routes can increase a community's disaster resistance. The Guilford evacuation route map is attached to this report. Note that the primary routes to the Community Center Shelter (blue lines) are concentrated in coastal flood and storm surge zones. For example, Route 146 and Whitfield Street are important evacuation routes, but portions of these routes are subject to flooding.
roads may be completely impassable during a coastal hazard event such as a hurricane or nor'easter. The concept of an evacuation route being vulnerable to flooding is contradictory to the objectives of hazard mitigation (reducing property damage and the loss of life). Therefore, coastal residents must evacuate as soon as possible after receiving a warning, or risk either isolation or evacuation during a storm.