Destruction Caused by Coastal Flooding

Gloucester, MA

Summary

Sea level rise has been a rapidly growing concern over the past years. Water levels are gradually rising from global temperature increases and the consequent changes to the environment. After taking into account the height of waves during high tide in addition to the estimated sea level rise, values were predicted for the rise in coastal water levels for the year 2100. These values can be found under the conclusions section where sea level rise varies with low, moderate, and high emission rates.

After modeling the different amounts of projected ocean water increase, it allowed us to see exactly where the ocean would potentially overflow into coastal municipalities for each of the three scenarios.

This was done to advise municipalities of the impending damage that the ocean can cause and help them prepare to minimize the destruction to the city or town. In addition, this information should inform individuals about the significance and danger of sea level rise.

Methods

The software ArcMap 10.2 was used for all of the map design purposes and data analysis.

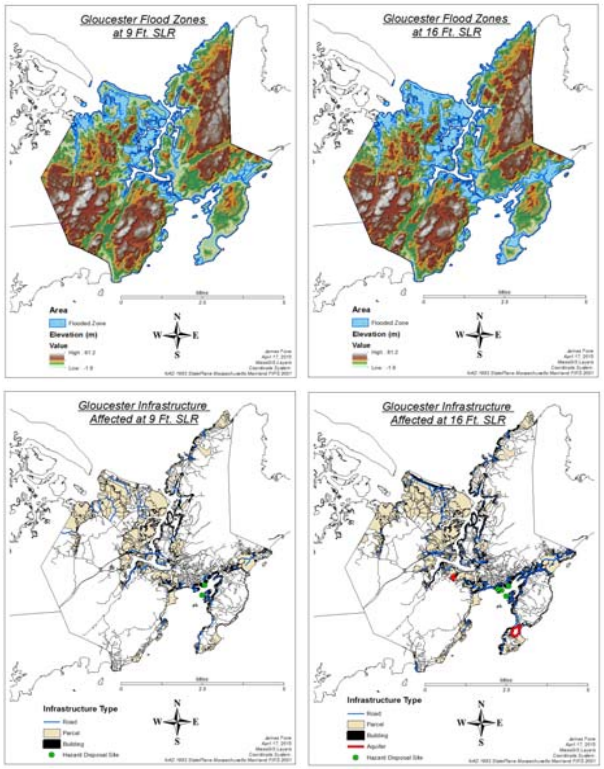
First, the elevation of the municipality was developed in order to see how far above or below each area of the city is compared to mean sea level. This was done by downloading Digital Terrain Model (DTM) files, enabling the creation of an elevation raster.

The flood zones were then calculated by finding all the cells in which land elevation fell below the flood level. This was performed three times, once for each of the scenarios. A polygon was also created for each of them and features that fell within the flood polygons were identified. In the event that an area not along the coastline was selected, that area was manually removed as it is not hydrologically connected and therefore cannot be flooded.

Next, the infrastructure took focus and all of the main functional aspects of the city were identified that would be affected by the flooding in each scenario.

An assessment was also done on the people living in the municipality who would be affected by the flooding. Data was obtained by downloading Block Group files from the Census data folder.

Results



*Note – SLR values include storm surge while at high tide

Looks like a lot of destruction? Here are some of the numbers arranged by each of the worst case flooding scenarios:

Minimal – 6.75 million square meters (10%) of the city is flooded, 13.4 miles of roadways are wiped out, and 2 hazard disposal sites are overflowed. 2,880 residents will be affected.

Moderate – 8.6 million square meters (12.5%) of the city is flooded. 16.4 miles of roadways are wiped out, 3 hazard disposal sites are overflowed, and 1 aquifer was reached. 4,997 residents will be affected.

Severe – 10.5 million square meters (15%) of the city is flooded. 25.6 miles of roadways are wiped out, 4 hazard disposal sites are overflowed, and 2 aquifers were reached. 7,487 residents will be affected.

Conclusions

From the results, it is clear the municipality will no longer be anything it is today in the year 2100. Gloucester has been separated into several islands, areas along and near the shoreline are underwater, billions of dollars in damage has been inflicted upon buildings/facilities, and thousands of people are left without homes.

Aquifers, our sources of drinking water, have been contaminated with toxins carried in the flood water; including pollutants from the submerged hazardous locations and the overflowing of sewerage drains. City officials, along with all of you, can now visually see the potential damage from the coastal water rise. They have 85 years and counting to prepare for this event and should do so diligently.

According to the U.S. National Oceanographic & Atmospheric Administration (NOAA), projected increases of coastal water levels for the year 2100 are as follows:

- *Minimal = 9.04'*
- *Moderate = 12.14'*
- *Severe = 15.94'*

References & Contact information

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References:

MassGIS. 2015. *MassGIS Datalayers.* Massachusetts. http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/layerlist.html (last accessed 10 April 2015).