# A CLEAR AND FUTURE DANGER

## *Ticking Environmental Time Bombs at Bluff Point Neck*

***Frank W. Fletcher***

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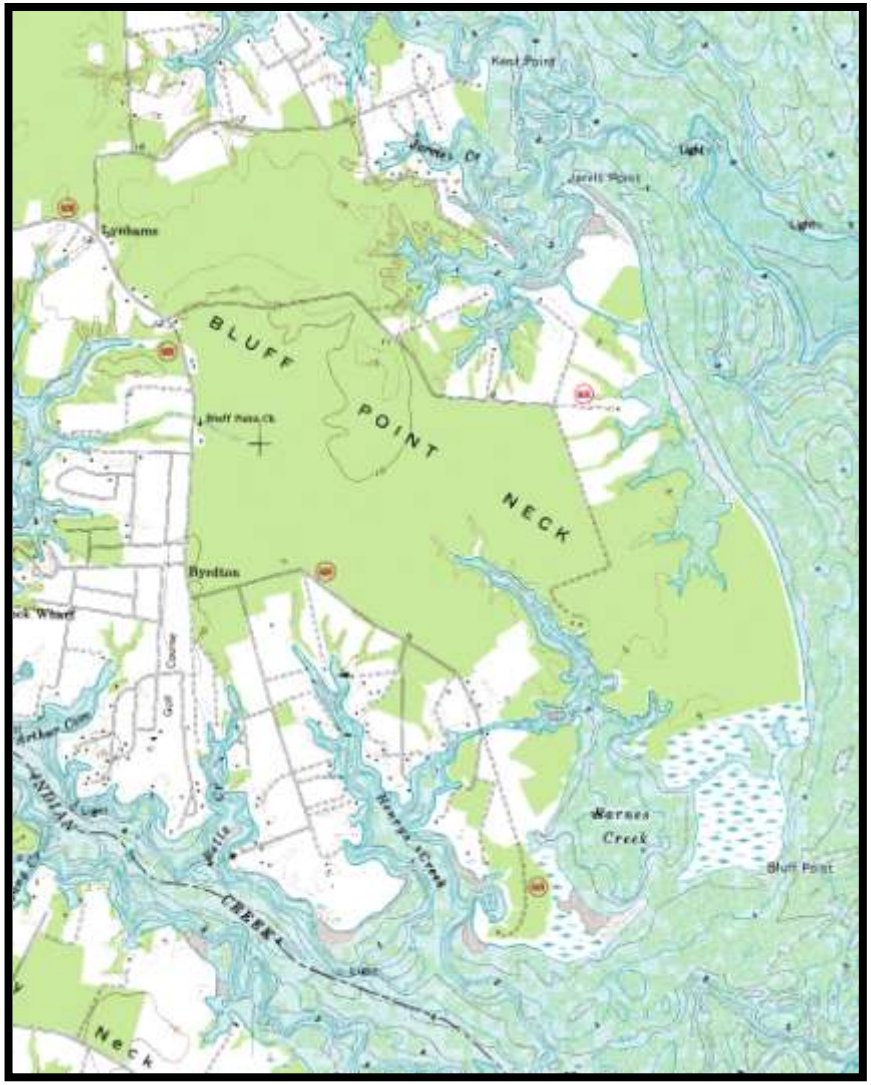
"It is error alone which needs the support of government. Truth can stand by itself."

-- Thomas Jefferson



## *Environmental Time Bombs*

Bluff Point Neck is a small, ragged bulge in the western shoreline of the Chesapeake Bay, some five miles north of the mouth of the Rappahannock River (Figure 1). It lies on the Mid-Atlantic Outer Coastal Plain, a low, flat strip of land between the Chesapeake Bay and the Suffolk Scarp (Figure 2). [1] Elevation ranges from sea level to about 16 feet. Low relief, clay layers, and shallow water table are responsible for poor


**Figure 1**

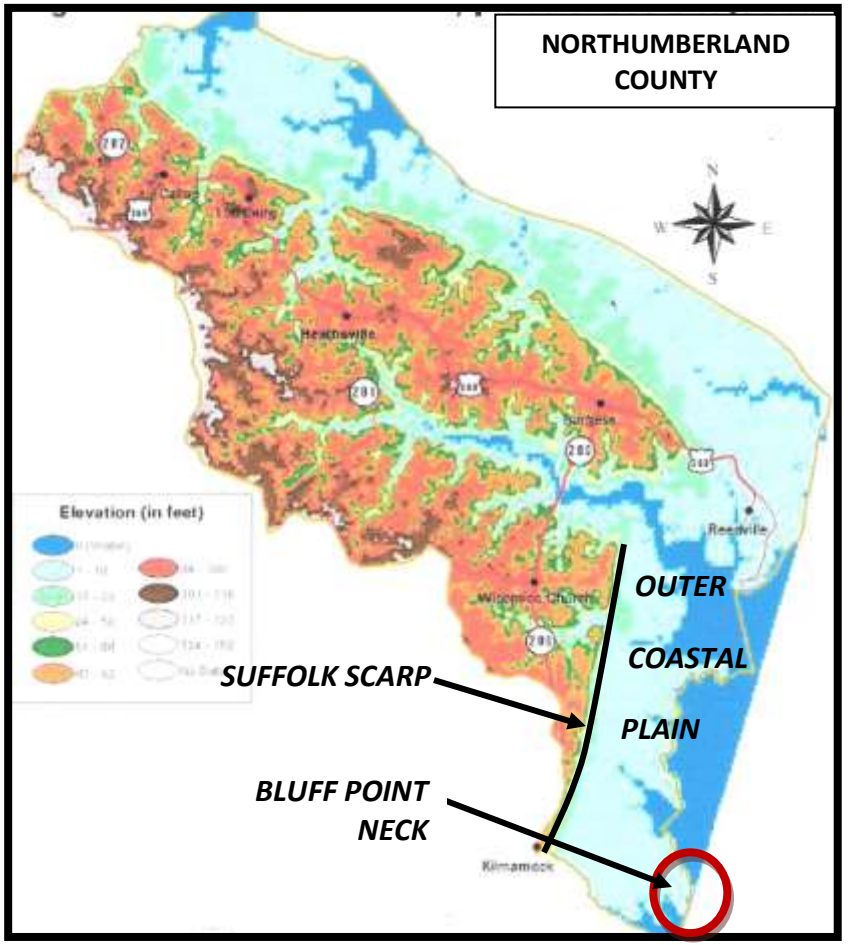



**Figure 2**

[1] The Suffolk Scarp is a former beach feature that was formed during a high stand in sea level approximately two millions years ago. The Outer Coastal Plain corresponds to the Rural Low Shelf of the Northumberland County (Virginia) Comprehensive Plan.

natural drainage and the abundance of both fresh and brackish water wetlands. Where natural shorelines along the Chesapeake Bay and tidal creeks of Bluff Point Neck still exist, they take the form of either sand beach and dune or cord grass marsh.

**Coastal Floods**--The Chesapeake Bay originated about 9,000 years ago when water from melting continental ice sheets submerged the lower Susquehanna River valley. Although the Chesapeake Bay assumed its general shape some 3,000 years ago, its 9,000 miles of shoreline remain geologically active, continuously shaped by waves, currents, tides, and rising sea level. The most powerful forces acting on the Outer Coastal Plain and the greatest threat to life and property are the periodic storm surges that are associated with hurricanes and nor 'easterners. (Storm surge is defined as an abnormal rise of water generated by a storm, over and above the predicted astronomical tides.) During the past 100 years, storm surges as high as eight to ten feet have been measured on the Bay (Source: VIMS). Coupled with the high water level of storm surges, aggressive waves cause erosion of upland banks and structures which would be out of reach of normal tides and waves.[2]

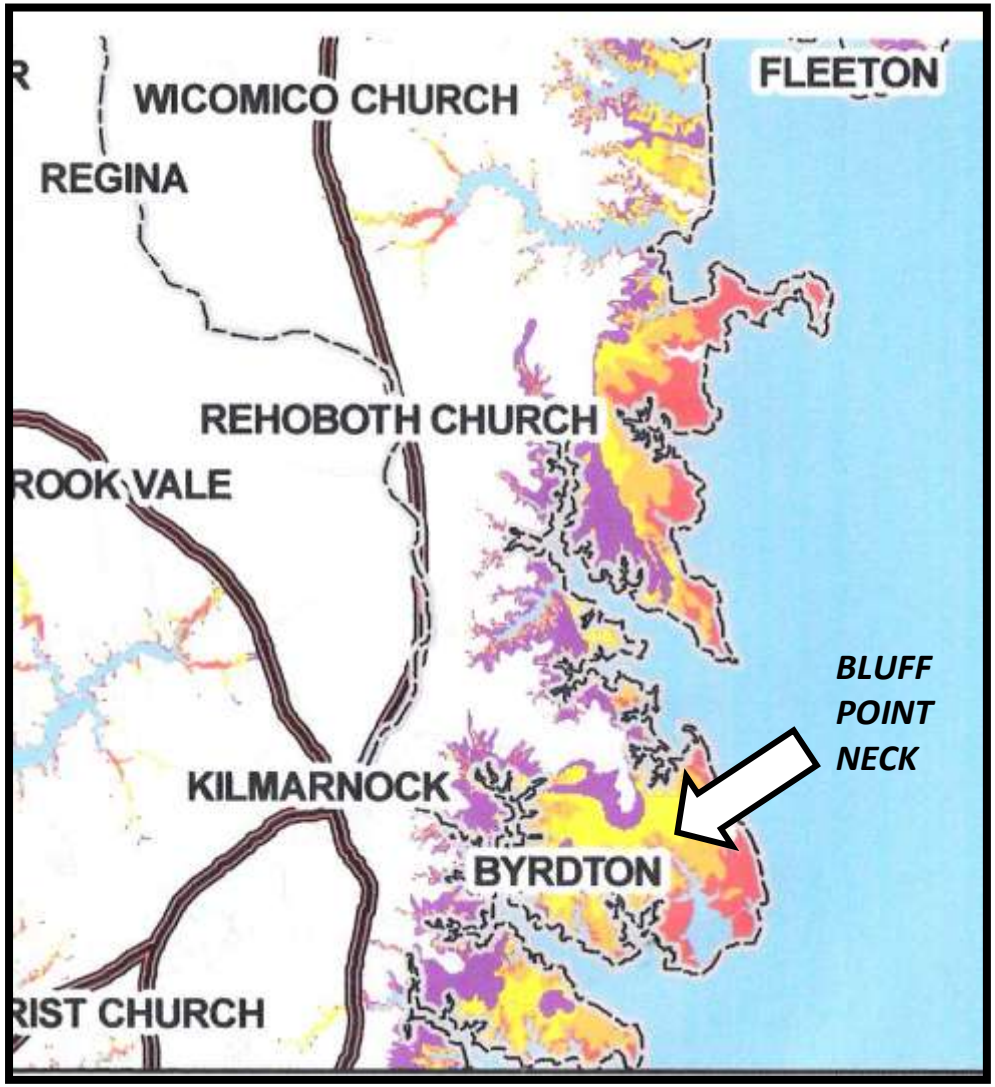



**Figure 3**

The Outer Coastal Plain is particularly vulnerable to the destructive power of storms impacting the Chesapeake Bay. Figure 3 illustrates a storm surge inundation map for a portion of the Outer Coastal Plain in lower Northumberland County. The map source is the Virginia Department of Emergency Management. The colors designate the areas at risk from hurricanes of a given category (or higher): red - Category 1; orange -Category 2; yellow - Category 3; purple - Category 4. Hurricanes Floyd (1999), Isabel (2007), and Irene (2011) are only the most recent destructive storms to cause severe damage to Chesapeake Bay region. A scientific consensus warns that the impacts of coastal flooding will be made worse in the future by rising sea level. This is not good news for the low-lying communities of the Outer Coastal Plain.

[2] Water weighs approximately 1,700 pounds per cubic yard; extended pounding by storm waves can easily demolish most ordinary structures.

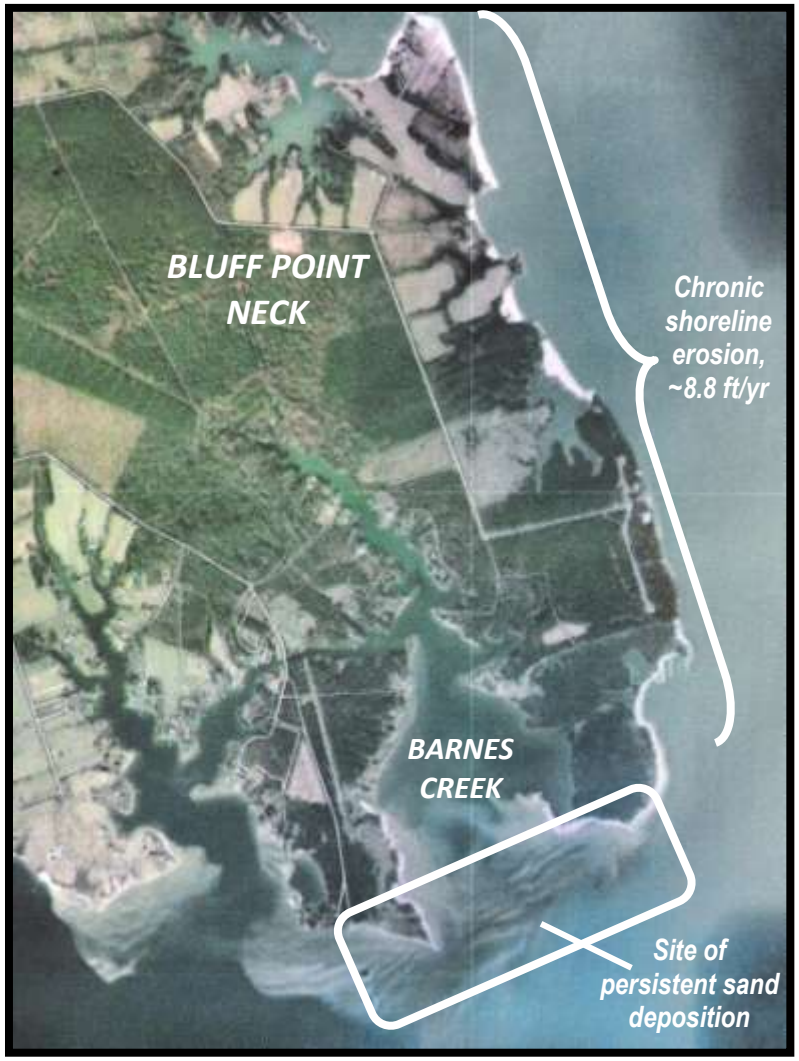



**Figure 4**

The threat of coastal flooding at Bluff Point Neck cannot be mitigated by affecting it's source; that is to say, humans can't prevent hurricanes. They remain an ever-present hazard on the Virginia Coastal Plain. Long experience with hurricanes in the United States has demonstrated that heroic engineering measures can provide only limited protection to vulnerable regions--and they are enormously expensive. Moreover, the true cost of developing in flood zones must take into account the dollars spent on insurance[3], emergency services, clean-up, reconstruction, and plain old human suffering. It's worth keeping in mind that none of these post-development costs are borne by the developers of flood zone property but by the property owners and by the general public.

**Shifting Shorelines**--Few things are as misleading as a map or aerial photograph of the shorelines of Chesapeake Bay. Maps and photos are only snapshots of a shoreline, not videos. They illustrate none of the activity and energy of a shoreline. They demonstrate none of the relentless changes in shape and position. One should not confuse a static image of a strand line with the existential commotion found in nature.

The shoreline of the Outer Coastal Plain of Chesapeake Bay is a dynamic place; it is characterized by high and variable rates of erosion and deposition. Indeed, the Chesapeake Bay has one of the highest rates of tidewater erosion in the United States. According to one study, more than 270 million cubic meters of sediment were eroded and lost to the Bay system in the last century.[4] Years can pass with little impact to a shoreline, but a major storm or modification of land-use can quickly bring about a substantial change. Some of the most dramatic examples of shoreline erosion are found along the main stem of the Bay where fetch and wave energy are greatest. A VIMS study concluded that the shoreline between Jarvis Point and Bluff Point is eroding at an average rate of 8.8 feet a year (Figure 4). ATM engineering consultants estimated that the Bluff Point shoreline bordering the

[3] Provided, of course, that flood insurance will even be available. Many of the nation's insurance carriers are no longer writing new policies in chronic flood-prone zones, and the FEMA National Flood Insurance Program is nearly bankrupt.

[4] Byrne, R.J. and Anderson, G.L., 1973. Shoreline erosion in Virginia's tidal rivers and Chesapeake Bay (abs). Va. J. Sci., 24(3): p.158.

Chesapeake Bay is eroding at an average rate of 6.9 feet per year. Moreover, ATM reported that the net southerly transport is the primary source of sand that forms the expansive shoal features at the mouths of Barnes and Indian Creeks. This sand is transported to the site of deposition by seasonal and longer-term storms, which bring increased wave action and long shore currents.[5]

Like protection from coastal flooding, heroic engineering measures can be used to mitigate shoreline recession and sand accumulation. And like protection from coastal flooding, these measures are limited and expensive. Moreover, they are notoriously destructive to natural habitats. Hardened shoreline structures, such as bulkheads, groins, and breakwaters, may provide local solutions to shoreline problems, but they also cause disruptions in natural hydraulic processes and sand movement that can lead to new problems in adjacent areas. Additionally, these structures seldom escape damage or destruction during storms that exceed their design specifications. They are especially vulnerable to overtopping by storm surge and breaking waves. Similarly, the dredging of waterways is a continuing and long-term burden. One should never believe in the permanence of hardened shorelines or dredged waterways. There's no such thing as "set it and forget it."

**Unsteady Ground**--Although not as flashy as hurricanes and disappearing shorelines, the particular soil and geologic conditions of Bluff Point Neck also represent environmental hazards. These hazardous conditions are typical of the Outer Coastal Plain of Virginia and are the result of the geologic processes that have operated on the Chesapeake Bay and its environs in the past and continue to operate today.

It doesn't take long to grasp the important topographic, pedologic, and geologic features of Bluff Point Neck. The first thing that strikes the eye is how low and flat the land is, a product of near-shore erosion during a high stand of sea level. The low topographic gradient guarantees that any rain the falls will not run off quickly but will pond in shallow depressions and road side ditches. Slow runoff, low soil permeability (clays), and high water table, facilitate the formation of wetlands but is not favorable to the creation of a firm and stable building foundation. Throw in shrink/swell soils and you have a recipe for trouble.[6] Cracked foundations, floors, and basement walls are typical types of damage done by expandable soils. What's more, these same

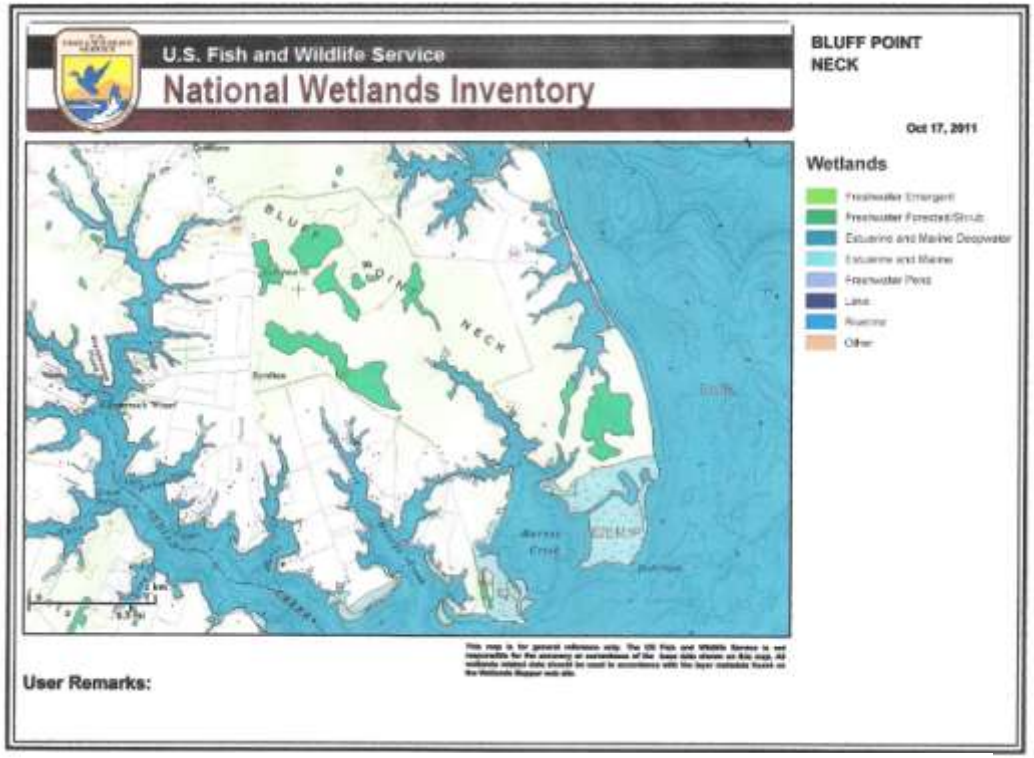



**Figure 5**

[5] According to one engineering feasibility study, it will be necessary to dredge Barnes Creek every 3 or 4 years in order to maintain a 10-foot channel.

[6] Swelling and shrinkage are the result of a build-up and release of water within the soil pore spaces.

substrate conditions cause the native oak and loblolly pine of the Outer Coastal Plain to develop shallow root systems, making them prone to toppling by the high winds of tropical storms. Falling trees are a significant cause of home damage and power outages in Virginia during hurricanes.

No soil or rock foundation is ever perfect for the emplacement of a house, hotel, highway, or high-rise. Poor soils are engineered to render them suitable for construction. This usually calls for compacting or dewatering them in situ or, after excavating the offensive soils, replacing them with more suitable soils. The cost of this site work can be high--and land disturbance extensive. Heavy equipment, such bulldozers, dump trucks, and earth rollers, is required to prepare the site for construction. Ensuring effective erosion and sedimentation protection is always difficult, particularly at sites where natural habitats must be protected. Improper site preparation can lead to long-term, post-construction costs.

## *Conclusion*

It is self-explanatory that some land is more suitable for development than other. Avoiding construction on active landslide slopes or earthquake faults or over limestone sinkholes seems obvious. If experience is any guide, then developing a sizeable community in a coastal zone, in a dynamic region of powerful natural forces and continuous change, should also raise suspicion. Coastal flooding is not a problem unless humans settle in flood zones. Shoreline erosion is not a problem unless humans encroach on littoral land. Sediment deposition in waterways is not a problem unless humans demand a channel for navigation. Poorly drained or expandable soils are not problems unless humans build on them. In other words, these natural processes are not inherently hazardous or offensive. Only when and where these processes impact on humans, their structures, and their activities do they become a menace, something to combat and overcome. These hazards at Bluff Point Neck are ticking environmental time bombs. It is not a question of *if* they will go off--only *when*. And who will be left with the bill?