4. Selecting a site on an East Florida beach

For the wary and wily coastal dweller, nature holds many clues that can reveal much about the safety of a lot, a cottage, or a condo. Of course, on some Florida islands such as Miami Beach there is not very much natural left except for the sea breeze. Nevertheless, you can do a lot of site evaluation yourself. Although it helps to be an expert in coastal processes, it is not at all necessary. All you need is common sense in most cases, since many of the indicators of site safety are simple to spot (fig. 4.1).

But there are some aspects of site choice that common sense alone will not really solve. For example, if one is examining a homesite on the bay side of an island, one is almost always there on a bright, sunny day. A gentle sea breeze is blowing, the bay is calm, and the waves are small to nonexistent. It is difficult in the extreme for most people to imagine what the same bay looks like with waves pounding the shore during an intense winter storm or summer hurricane.

Another aspect of site choice where common sense often fails is the long-range view of man’s impact on the shoreline. For example, a newly constructed seawall in front of large buildings (say in Wilbur-by-the-Sea where such examples abound) may seem to coexist in perfect harmony with a broad beach, but 10 to 20 years from now the beach in front of that wall almost surely will be gone, and the original wall will be replaced by a much more imposing structure.

The wise landowner knows that more than natural forces are at work. The politics of a community play a major role in determining how the community will interact with nature. Many American coastal communities with seasonal populations in the tens of thousands are controlled politically by a few dozen or a few hundred year-round residents. Therefore, it is important to understand the politics of a beach community.

Nature’s clues to dangers at the beach

Why worry?

Just what are the dangers facing Florida coastal dwellers, especially those living near the beach front or on a barrier island? The fundamental problems of safety fall into three categories: (1) A storm may come and blow you and yours and your building away. (2) You and yours may drown because of high-water levels produced in a storm. (3) The shoreline may erode (with or without a big storm) and your building may fall in.

There are other important problems, less pressing than the loss of your life or property: (1) If poorly sited development results in construction of seawalls, etc., you may be in for a large and continuous tax bill. (2) Your poorly sited development may result in
Fig. 4.1. The ideal way to develop a hypothetical barrier island. Since all barrier islands are different, the ideal plan would differ from island to island.
destruction of the beach that belongs to the rest of us, too. (3) You came for seclusion and quiet, but in a few years the condo developers may turn your village into a metropolis.

What to worry about

The principal factors noted in the danger category of our shoreline classification are (1) elevation, (2) erosion, (3) evacuation, and (4) dunes.

Elevation. Low areas are flooded when water rises during a storm. The back side or lagoon side of East Florida islands are particularly susceptible to this type of flooding (storm surges). It goes without saying: the higher the elevation the better. Much land on the back sides of Florida’s islands has been artificially elevated by trucking or pumping in sand from elsewhere. Often this transfer involved covering up salt marsh or mangrove forests. Artificially elevated land is a better site for construction than lower elevations, but it is a poor substitute for naturally high land.

“High” elevations on the East Florida coast are of the order of 10 to 12 feet and sometimes more. Such sites are inevitably along the crests of sand dune ridges that parallel the present shoreline. You can purchase a U.S. Geological Survey map of an area to find out the natural elevation of your site. More important is the elevation of your site relative to predicted storm-flood levels. Storm-surge levels (fig. 4.2 and table 4.1) vary considerably from beach to beach and island to island because of a number of complex oceanographic factors, so elevation is meaningful only in the context of expected floods. Such information should be available in

Fig. 4.2. The expected storm-surge levels for the 100-year storm at selected locations along Florida’s coast. Courtesy of the National Oceanic and Atmospheric Administration.
Table 4.1. Worst probable storm tide ranges by county

<table>
<thead>
<tr>
<th>Saffir-Simpson Scale</th>
<th>Monroe</th>
<th>Dade</th>
<th>Broward</th>
<th>Palm Beach</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5</td>
<td>5</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>7</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>10</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>4</td>
<td>13</td>
<td>13</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>15+</td>
<td>15+</td>
<td>11+</td>
<td>9+</td>
</tr>
</tbody>
</table>

Data from a Jacksonville District, U.S. Army Corps of Engineers, study in 1983 of hurricane evacuation problems.

virtually all city halls and county administrative buildings in the form of Federal Emergency Management Agency flood maps. In particular, ask to see the 100-year flood maps. They also are available to you by writing the nearest FEMA office.

**Evacuation.** The most prudent thing to do in the face of an approaching major hurricane is to get out. Perhaps the most appalling aspect of the Florida coast’s development patterns is the increasing difficulty of such evacuation. Many older buildings are sited well below flood levels, and it must be assumed that many condos are not well built. Most bridges to Florida’s islands are drawbridges (fig. 4.3). It also must be assumed that the bridges will not be operable because of a power shutdown, or that they will be stuck in the open position, or that yacht traffic may take precedence over car traffic. Furthermore, almost all of East Florida’s bridges have abutments at low elevations on the approaches to both drawbridges and fixed-span bridges. These can be expected to be underwater early in the storm. Add to all of these woes the fact that early in the storm roads lined with Australian pines will almost certainly be blocked by fallen trees.

Successful evacuation not only requires safe escape from a beach-front community, but it is necessary to have a safe place to go. From Palm Beach south the Florida peninsula is so low that rapid escape to a site above the 100-year flood level is
Table 4.2: Evacuation requirements for various coastal areas

<table>
<thead>
<tr>
<th>Location</th>
<th>Saffir-Simpson Scale</th>
<th>Time required for evacuation (hours)</th>
<th>Evacuation Order Time (hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boca Chica</td>
<td>3 to 5</td>
<td>17.5</td>
<td>31.5</td>
</tr>
<tr>
<td>Marathon</td>
<td>3 to 5</td>
<td>12</td>
<td>25</td>
</tr>
<tr>
<td>Key Largo</td>
<td>3 to 5</td>
<td>6.5</td>
<td>18</td>
</tr>
<tr>
<td>Hollywood</td>
<td>4 to 5</td>
<td>6.5</td>
<td>16</td>
</tr>
<tr>
<td>Boynton Beach</td>
<td>4 to 5</td>
<td>6</td>
<td>17.5</td>
</tr>
</tbody>
</table>

Data furnished by the Jacksonville District of the U.S. Army Corps of Engineers.

nearly impossible. North of Palm Beach low ground is frequently a relatively narrow 4- to 5-mile-wide strip paralleling the shoreline.

Table 4.2 gives an estimate of times required for evacuation for several specific communities. The Saffir-Simpson Scale is discussed in chapter 2. *Evacuation order time* refers to the number of hours from the time an evacuation order must be given to the time when the eye of the storm actually passes over the community in question. The problem is that once gale-force winds arrive, evacuation becomes dangerous. For example, in Boca Chica it is assumed that evacuation will be dangerous 14 hours before the arrival of the eye as compared to 11.5 hours for Boynton Beach. The problem is obvious. How do you convince people to evacuate when a storm is still many miles offshore and when its exact track is still uncertain? Ironically, Civil Defense officials not only expect to have difficulty convincing the public to evacuate, but past experience has shown that many people drive to the beach to become eyewitnesses (and sometimes statistics).

**Shoreline erosion.** You should assume that all of Florida’s eastern coast shoreline is eroding (fig. 4.4). This is almost, but not quite, true. The major exceptions to this statement are the shoreline stretches just north of jetties where sand has been halted in its slow trip south—to the detriment of beaches south of the jetties. The most common sign of recent erosion on a natural beach is a vertical or nearly vertical bluff on the seaward edge of the first dune row. Particularly spectacular examples of such bluffs are present on the south end of Amelia Island.

We note on our safety maps those communities that have particularly severe beach erosion. Solution: Do not live near an eroding beach. If you must, set way back and be prepared to move.

**Dunes.** Dunes are pretty and are worth saving for that reason alone. More important, perhaps, dunes furnish a reservoir of sand so the beach can respond properly to a storm. At the same time, dunes absorb the impact of waves that could be hitting buildings.

**Condominiums: friend or foe?**

Increasingly, development along Florida’s eastern shore is going the condo route (fig. 4.5). This is quite understandable since the price of shorefront property has skyrocketed.

There are some important problems stemming from this trend that should be considered by every potential shoreline dweller. High-rise condos instantly contribute to population density, thus increasing the evacuation hazard for all community inhabitants.
Fig. 4.4. Generalized erosion rates along Florida's shores. The "peaks" are almost always just south of jettied inlets. After Todd L. Walton.

Fig. 4.5. The top stories of a 38-story condo at Riviera Beach. Photo by Bill Neal.
A second problem created by high-rises concerns the community response to shoreline erosion. If a community has a rapidly eroding shoreline and its first row of buildings is threatened with collapse, the community can make a more flexible response if the threatened structures are beach cottages. Cottages can be moved or they can be allowed to fall in as their time comes. But few communities will allow a 20-story condo to crumble into the sea. Thus, the condo-lined shoreline is one that will inevitably require stabilization or engineering of some kind; the closer the condos are to the beach, the sooner the seawalls.

Florida and, for that matter, most of the nation could learn a lesson from North Carolina in this regard. North Carolina has a setback line for construction that is 30 times the annual erosion rate. The setback distance for condominiums is twice that for other structures. And unlike Florida, few exceptions to the setback rule are allowed.

North Carolina has gone a step further than this restriction. The state will allow no seawalls to be built for post-1980 construction. State officials even have ordered one individual to remove a nonconforming seawall from in front of his cottage!

There is a plus side to high-rise condominiums, especially on densely populated islands. If they are well-built, they can furnish a means of escape known as vertical evacuation. The idea is that neighbors from low-elevation buildings would prevail upon the neighborliness of nearby condominium dwellers and ride out the storm sitting in apartments on the third or fourth story or higher. The state of Florida toyed with the idea of organizing ver-
tical evacuation on densely populated islands, but there was a hitch. As pointed out by Neil Frank, head of the National Hurricane Center, some condo construction has been substandard, and building inspection can be characterized as uneven. Hurricane Eloise, for example, revealed that an unfinished condominium torn apart by waves had not been properly attached to its pilings. Thus, the problem becomes, how can one designate vertical evacuation sites if the possibility of poor construction exists? For a vivid, worst-case scenario we recommend your reading John D. MacDonald's Condominium, a novel that is readily available in paperback.

In an ideal world, all condos would be on the back side of islands or well removed from the beach. They would all be well-constructed and located near a fixed-span bridge with approach roads at high elevations. Such, however, is seldom the case.

**Finger canals: waterfronts for all**

Finger canals (fig. 4.6) are the waterways or channels dug from the lagoon or bay side of an island into the island proper for the purpose of providing a large number of residents with waterfront lots. Canals can be made by excavation alone or by a combination of excavation and infill of adjacent low-lying salt marshes and mangrove swamps.

Finger canals can be beautiful to live alongside, providing they do not begin to have fish kills and providing a storm does not come by. By its very nature, land along such canals is at low elevation and susceptible to flooding. Problems often associated with finger
Septic effluent pollutes ground water supply as well as finger canal water. Poor circulation, high nutrient input, and associated fish kills result in concentration of pollutants in canal waters.

Salt water infiltrates into ground water, destroying quality of fresh water supply.

Fig. 4.6. The Septic Tank Saga.
canals are (1) lowering of the groundwater table, (2) pollution of groundwater by seepage of salt or brackish canal water into the groundwater table, (3) pollution of canal water by septic seepage, (4) pollution of canal water by stagnation due to lack of tidal flushing or poor circulation or exchange with bay waters, (5) fish kills generated by higher canal water temperatures, and (6) fish kills generated by nutrient overloadings (algal blooms) and de-oxygenation of water.

Bad odors, flotsam of dead fish, and algal scum and contamination of adjacent shellfishing grounds are symptomatic of polluted canal water. Thus, finger canals often become health hazards, and the homesites near them become unpleasant places to live.

Florida has far more finger canal pollution problems than any other state simply because the state has the most and largest canal systems. Florida's experience shows that the problems do not appear until 5 to 10 years after development has occurred. Tributary canals are much more likely to experience pollution than main canals. Short canals are generally less likely to become polluted than long ones.

If you must live by a finger canal, think short.

The safety classification—quantifying the subjective

The maps in this chapter are the most important part of this book. They are intended to provide a basis for anyone who is interested to understand the good and bad aspects of any site on a Florida east coast barrier island. For many reasons, these classifications are subjective. Two of the authors of this book independently classified the entire shoreline of east Florida, we sometimes differed, especially in our judgment as to what should be classified as low risk and what was moderate risk. We rarely differed, however, as to which stretches of the shoreline offer high risk to development. The final decisions regarding classification were made on the scene amid swaying palms, booming surf, and honking car horns.

On each of the site-specific classification maps in this chapter is a list of dangers and cautions. If a problem facing a beach community is severe (for example, high erosion rate, high potential for flooding), it is listed as a danger. If a problem exists but is not severe, the problem falls into the caution category. Three “dangers” result in a high-risk classification. Two “cautions” are considered to be equivalent to a single “danger.” Thus, a listing of two dangers and two cautions also results in a high-risk classification. Two “dangers” lead to a moderate-risk classification. Additional comments, usually of a positive nature, also are listed on the maps. Table 4.3 is a summary of the risk classification categories for various eastern Florida counties.

It can be argued that such a classification into three simple categories does not do complete justice to systems as complex as barrier islands. For example, Fernandina Beach is largely in the high-risk category because of the very severe erosion and flood risk of beach-front property. Yet the old town of Fernandina Beach, well behind the beach, may be the safest community on any Florida barrier island because of its high elevation. Another common
Table 4.3. Risk classification breakdown for beachfronts of Florida East Coast counties

<table>
<thead>
<tr>
<th>County</th>
<th>High risk</th>
<th></th>
<th>Moderate risk</th>
<th></th>
<th>Low risk</th>
<th></th>
<th>Total miles</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Miles</td>
<td>Percentage</td>
<td>Miles</td>
<td>Percentage</td>
<td>Miles</td>
<td>Percentage</td>
<td>Miles</td>
</tr>
<tr>
<td>Nassau</td>
<td>3.6</td>
<td>29.25</td>
<td>5.1</td>
<td>41.5</td>
<td>3.6</td>
<td>29.25</td>
<td>12.3</td>
</tr>
<tr>
<td>Duval</td>
<td>6.9</td>
<td>73.4</td>
<td>2.5</td>
<td>26.6</td>
<td>0</td>
<td>0</td>
<td>9.4</td>
</tr>
<tr>
<td>St. Johns</td>
<td>23.8</td>
<td>59.8</td>
<td>8.6</td>
<td>21.6</td>
<td>7.4</td>
<td>18.5</td>
<td>39.8</td>
</tr>
<tr>
<td>Flagler</td>
<td>8.2</td>
<td>44.8</td>
<td>10.1</td>
<td>55.2</td>
<td>0</td>
<td>0</td>
<td>18.3</td>
</tr>
<tr>
<td>Volusia</td>
<td>28.5</td>
<td>75.7</td>
<td>3.5</td>
<td>9.2</td>
<td>5.7</td>
<td>15.1</td>
<td>37.8</td>
</tr>
<tr>
<td>Brevard</td>
<td>27.4</td>
<td>81.1</td>
<td>6.4</td>
<td>18.9</td>
<td>0</td>
<td>0</td>
<td>33.8</td>
</tr>
<tr>
<td>Indian River</td>
<td>5.8</td>
<td>20.2</td>
<td>22.9</td>
<td>79.8</td>
<td>0</td>
<td>0</td>
<td>28.7</td>
</tr>
<tr>
<td>St. Lucie</td>
<td>18.0</td>
<td>84.5</td>
<td>3.3</td>
<td>15.5</td>
<td>0</td>
<td>0</td>
<td>21.3</td>
</tr>
<tr>
<td>Martin</td>
<td>8.5</td>
<td>5.6</td>
<td>6.8</td>
<td>4.4</td>
<td>0</td>
<td>0</td>
<td>15.3</td>
</tr>
<tr>
<td>Palm Beach</td>
<td>7.9</td>
<td>20.0</td>
<td>25.8</td>
<td>65.5</td>
<td>5.7</td>
<td>14.5</td>
<td>39.4</td>
</tr>
<tr>
<td>Broward</td>
<td>13.3</td>
<td>64.3</td>
<td>7.5</td>
<td>35.7</td>
<td>0</td>
<td>0</td>
<td>21.0</td>
</tr>
<tr>
<td>Dade</td>
<td>4.8</td>
<td>32.7</td>
<td>9.9</td>
<td>67.3</td>
<td>0</td>
<td>0</td>
<td>14.7</td>
</tr>
<tr>
<td>Total</td>
<td>157.0</td>
<td>53.8</td>
<td>112.4</td>
<td>38.5</td>
<td>22.4</td>
<td>7.7</td>
<td>291.8</td>
</tr>
</tbody>
</table>

The problem is exemplified by Vitano Beach. This community is still at a stage of relatively light development, and its moderate classification could change to high risk if beach-front construction of poor quality is allowed.

There are other ways by which the classifications could well change with time. If a 2-lane drawbridge is replaced by a new 4-lane road and a fixed-span bridge, the evacuation risk in case of a storm could be eased. On the other hand, construction of a row of condominiums in any area will increase the congestion and make evacuation more difficult. Politics enter into the classification as well. If a community has a strong emergency plan and will likely enforce early evacuation to a safe place, it will be a better community in which to live. Perhaps even more important for a potential property buyer to consider is how well the setback and hurricane construction regulations have been and will be enforced by local officials.

Even your age will play a role in using this classification as a basis for property purchase. If you are young and energetic, your chances of successful evacuation are better than if you are in the "golden years."
To sum up, we have produced a classification of Florida’s east coast shoreline based on a geologic view of the natural hazards of beaches and islands. You will have to insert your own priorities into the classification to make it work for you. In chapter 1 we noted that if we were looking for a homesite for our parents, we would apply extremely stringent standards, and only a couple of sites on the Florida coast would meet our approval. We urge you to see for yourself if we are correct in our assessment of hazards in your particular community; and, most of all, we again urge you to take a long trip on Highway A1A before you settle down.

Nassau County

Amelia Island is the northernmost island on the east coast of Florida (fig. 4.7). St. Marys Entrance at the north end of the island marks the Florida-Georgia border. Unfortunately, the entrance is protected by a very long pair of U.S. Navy-built jetties that are bound to cause erosion problems for the island in the long run. The southern tip of Amelia Island ends at St. George Inlet in Nassau Sound, down the center of which runs the boundary with Duval County. The island is more than 13 miles long and covers 16,500 acres.

Of the shoreline capable of being developed on Amelia Island, we classify 3.6 miles as low risk, 5.1 miles as moderate risk, and 3.6 miles as high risk.

Amelia Island is an island of paradoxes. In some regards it may be Florida’s safest island for development. Much of the old town of Fernandina Beach on the back side of the island against the Amelia River is above 20 feet in elevation. None but the most disastrous of storms could possibly flood the high areas of town. As a consequence, the storm evacuation problem for this island is almost nonexistent; at least prudent homeowners should be able to easily escape to high ground.

On the other hand, serious beach erosion occurred during the winter of 1983 on both the northern third and southern third of the island. Amelia Island Plantation to the south often has been cited as an environmentally sound development because many of its condos are nestled in maritime forests at relatively high elevations. But if the beach continues to erode at the same high rates of the past few years (fig. 4.8), some of the most shoreward buildings will soon be threatened. On northern Fernandina Beach, shorefront houses sit almost astride the surf zone. South of state Highway 108, however, two rows of dunes are usually present between the houses and the surf, and homesites are much safer as a result.

American Beach is the last of a vanishing kind of community in the American South (fig. 4.9). This small community is owned almost exclusively by blacks, most of whom come from nearby Jacksonville. The town is suffering some beach erosion, but most buildings sit well back from the beach at high elevations.

Between 1837 and 1945, more than 60 storms of hurricane intensity affected Amelia Island’s beaches. The most notable hurricanes occurred in September 1896, October 1898, October 1944, October 1950, August 1964 (Cleo) and September 1964 (Dora). Northeasters that inflicted major damage include those of November 1932, September-October 1947, March 1962 (Ash Wednesday
storm), February 1973, as well as winter storms in 1981 and 1983. These hurricanes and northeasters have caused extensive damage to local property by flood and erosion due to high tides, storm surge, wave action, and strong winds. More than 200 feet of beach width and more than 5 to 10 feet of beach/dune elevations have been eroded in a single storm. The 100-year storm-surge levels are 12 to 15 feet above mean sea level. The highest dune on Amelia Island is 47 feet above mean sea level.

The northern portion of the island at the mouth of St. Marys Entrance has been changing rapidly since the first jetty was built in 1881–1890. The area south of the jetty built seaward along the northern 3,500 feet between 1843 to 1943. However, since 1950 there has been a gradual erosion along this section (fig. 4.10) as well as the section south of Atlantic Boulevard. The average erosion rate is about 2 feet per year.

The central section of the island is generally stable and high, but 4 identifiable storm washovers can be seen on recent aerial photographs. The southern section of the island has experienced severe erosion, and as much as 15 feet of beach per year disappears at the mouth of St. George Inlet. Three major washover sites are identifiable in this zone.

After Hurricane Dora in 1964, the state of Florida’s Office of Emergency Preparedness provided funds for 3.6 miles of revetment for Fernandina Beach. In 1979 a beach nourishment project followed, using the dredged material from St. Marys Inlet maintenance. Most of this sand has long since disappeared.

In summary, if you really want a safe building site, look to the portion of Fernandina Beach on the lagoon side where high elevations prevail. Otherwise, the safest sites are atop high dune ridges paralleling the shoreline. Probably it would be most prudent to stay away from sections of the shoreline where revetments have been placed. Adjacent property owners may have large tax assessments in the future for wall construction and repair.

Amelia Island offers an abundance of relatively safe (and beautiful) home sites for the discerning property owner. Watch out, however, for the eroding shoreline on the northern and southern sections of the island.

**Duval County**

Here in Duval County is the northernmost extension of a type of development that characterizes much of South Florida: high-density, high-rise condominiums (fig. 4.11). Duval County also is the northernmost example of one of Florida’s most serious hazards affecting beach-front development: the problem of storm evacuation. Evacuation will be necessary along much of the Duval shoreline because a major storm will cause widespread flooding. Because the Duval shoreline is served by narrow drawbridges with approach roads at low elevations, we consider evacuation to be a real danger here.

We classify 6.9 miles of Duval County’s developable shoreline as high risk and 2.5 miles as moderate risk for development (fig. 4.12). We find no shorefront areas in the low-risk category.

Duval County’s 16 miles of Atlantic beach front is entirely a barrier island shoreline. The county is bounded to the north by
DANGER: Flood risk
DANGER: Severe erosion
DANGER: Engineered shoreline
CAUTION: Unvegetated dunes
CAUTION: Jetty to the north
Safe sites in town

Fig. 4.7. Site analysis: Amelia Island.
Nassau Sound and is interrupted by Fort George Inlet at the mouth of the St. Johns River. North of the St. Johns River jetty is Little Talbot Island, which is entirely in state hands and will not be developed for private use. South of the St. Johns River jetty, development is intense. The barrier island (Guano Island) ranges in width from 3,000 to 13,000 feet and in elevation from 10 to 15 feet above the low water mark; the island continues, uninterrupted, for 10 miles in Duval County and another 23 miles in St. Johns County to St. Augustine Inlet.

The St. Johns River navigation channel is maintained at a depth
of 40 feet. The jetties are of “rubble mound” construction. The north jetty is 14,200 feet long, and the southern jetty is 11,192 feet in length. These jetties have a profound effect on “downdrift” beaches, that is, beaches to the south. They increase the natural erosion or recession rate by trapping sand.

Hurricanes and tropical storms, as well as northeasters, cause beach erosion and property damage along the barrier islands. Between 1870 and 1972 more than 20 hurricanes passed within a 50-mile radius of Duval County; that is an average of 1 hurricane every 5 years. With the exception of Hurricane Dora in 1964 and
Fig. 4.12. Site analysis: St. Johns River to Ponte Vedra Beach.
4. Selecting a site

DANGER: Flood risk
DANGER: No dune protection
CAUTION: Engineered shoreline
CAUTION: Evacuation difficult
+ Safest sites on ridges

DANGER: Flood risk
DANGER: Evacuation difficult
DANGER: No foredune
CAUTION: Engineered shoreline
CAUTION: Narrow island

JACKSONVILLE BEACH

Ponte Vedra Beach

1 mile
1 kilometer
Hurricane David in 1979, northeasters have been more damaging to Duval County barrier beaches than hurricanes. Particularly severe northeast storms occurred in 1925, 1932, 1947, 1962, and 1981. Memorable and damaging hurricanes occurred in 1926, 1944, 1964 (Dora), 1968 (Gladys), and 1979 (David). The federal government estimates 100-year flood tides to be 11.0 feet above mean sea level in Duval County. The storm surge could add another 5 to 7 feet to this flood level along some embayments behind the island. In 1898 a hurricane produced water levels 8 to 10 feet above normal in Mayport. The 1944 hurricane produced 11- and 12-foot floods, respectively, in Atlantic Beach and Jacksonville Beach. Twenty years later Hurricane Dora left behind 6-foot waters in the same communities. Waves of 20 to 30 feet were reported striking the beaches during the 1944 and 1964 hurricanes. The mean tidal range of the Atlantic here is just over 5 feet. This tidal range is sufficiently large that storms which strike at high tide may do much more damage than those which hit at low tide.

Beach erosion was noted as early as 1834 in Duval County. When Manhattan Beach and Neptune Beach were first laid out, there was another tier of lots seaward of the present concrete bulkheads. These oceanfront lots were 150 to 175 feet deep, but all became property of King Neptune by the mid-1930s due to natural recession of the shoreline. The present-day concrete bulkhead and the public right-of-way in these communities are located on the back side of the earlier “oceanfront” lots. Since the 1920s, construction of seawalls, bulkheads, and riprap revetments has been carried out to protect property and “control” erosion. Timber bulkheads were built in the 1920s and were destroyed in the 1925 storm. They were rebuilt to be destroyed again in the 1932 storm. After the 1932 storm Neptune Beach, Atlantic Beach, and Jacksonville Beach constructed a concrete seawall with federal aid. These seawalls were seriously damaged in 1947, 1956, 1962, 1964, and 1968 storms (fig. 4:13). After the 1962 storm, granite revetments were placed in the damaged seawalls, and about 320,000 cubic yards of sand also was placed on the beaches. After Hurricane Dora in 1964 more than 25,750 linear feet of granite revetment reinforcement were placed on Jacksonville Beach, Neptune Beach, and Atlantic Beach, and protective beach nourishment was provided at Mayport Naval Station.

Contour maps of the seafloor off beaches here show that the nearshore zone is steepening. For example, the 18-foot contour in front of Manhattan Beach receded 1,000 feet between 1874 and 1963. This effect is probably due to the various walls and revetments that have been placed there. The same effect has been observed on beaches in New Jersey where stabilization structures such as seawalls have been in place for many years.

Largely as a result of the damage caused by the Ash Wednesday storm (1962), planning began in 1964 for a beach nourishment project along 10 or 11 miles of Duval County, south of the St. Johns River jetty. It was planned to place 3.75 million cubic yards of sand from offshore borrow sites at an estimated cost of $4.145 million initially, plus $565,000 annually, to provide a beach 60 feet wide and 11 feet above mean low water. The project was finally initiated in 1977 and completed in 1980. The total cost for
2,250,000 cubic yards of beach nourishment on 10 miles of beach exceeded $18.0 million. (That is, when the project was completed, it had cost 4 times the original dollar estimate to emplace 60 percent of the sand originally estimated to be needed. Such escalations in cost are almost sure to continue.)

The new beach provides much-improved recreational opportunities and protects structures behind the planted dunes from some storms. However, the new beach has given developers and potential residents a false sense of security, and many small beach-front cottages and motels are being replaced with very expensive high-density/high-rise residential and commercial buildings on the beach. It has increased the potential for greater loss of property during a major hurricane, and it has created hurricane evacuation problems due to the narrow bridges linking the barrier island to the mainland. The new beach is eroding; even now the beach is very narrow to absent at high tide in some areas south of the jetty.

A continuous sand ridge, more than 10 feet in elevation, runs about 100 feet back of the midtide shoreline south of the jetty to the county line, with the exceptions of automobile access points where the elevations have been lowered. There were several areas where 20-foot dunes were present before development activities leveled them, making the island more vulnerable to flood and erosion damage. Automobile access points and street endings will provide access for the sea during the next storm.

**St. Johns County**

St. Johns County still has miles of beautiful, unspoiled beaches
and barrier islands. But the future is arriving fast; development is increasing in intensity almost on a daily basis. How well the county controls the development will determine how safe shoreline habitation will be for future homeowners. As things stand at present, the St. Johns shoreline has examples of very dangerous homesites south of Summer Haven (fig. 4.14), and examples of low-risk development in areas such as Butler Beach. In fact, the stretch of Anastasia Island south of St. Augustine Beach has some of the best-sited shorefront buildings to be seen in any heavily developed area along the east coast of Florida. Many buildings along Butler Beach and Crescent Beach, including condominiums, stand behind two rows of dunes! A notable exception to this excellent development trend is a cluster of condos just south of St. Augustine Beach that are built out virtually on the beach. Probably a “rich” political story stands behind these condos.

The well-sited development of southern Anastasia Island stands in stark contrast to the very dangerous construction patterns south of Daytona Beach, an area at a similar stage of development. There is a fly in the ointment on Anastasia Island, however. At the south boundary of Anastasia State Park a short stretch of shoreline has been seawalled, and the beach has disappeared. The long-range prognosis is that the lack of a beach front in front of this short stretch of seawall will stop beach sand transport to the south, allowing increased erosion rates to ensue.

The St. Johns County shoreline consists of more than 41 miles of barrier beach with tidal marshes and lagoons behind it. For the northern 6 miles the barrier island is about 3 miles wide with 15-25-foot dunes. For the next 12 miles the barrier island has 2 major dune ridges separated by 2 low marshes. The shorefront sand dune ridge is about 500 to 1,500 feet wide, with 15-foot to 40-foot elevations along its length. The back side of the island is bordered by a salt marsh, 3,000 to 9,000 feet wide, along the

Fig. 4.14. Beach to the left may soon merge with marsh to the right. This narrow stretch of land just north of Marineland is a very unsafe location to build. Photo by Barb Gruver.
Tolomato River and the Intracoastal Waterway. The Tolomato River and Guano River meet 18 miles south of the Duval County—St. Johns County line. For the next 7 miles to Vilano Beach and St. Augustine Inlet the barrier beach is about 1,000 to 2,000 feet wide with dunes of around 15 feet in height. Some of the description of island widths can be misleading. From the county line south to St. Augustine Inlet the area presently being developed is a single narrow sand ridge, and many buildings are being sited too close to the beach.

South of St. Augustine Inlet is Conch Island, which was formed by the coalescing of several small islands after inlet stabilization with rocks in 1940. Conch Island is now about 3 miles long and 500 to 4,000 feet wide. The old, natural St. Augustine Inlet was temporarily reopened across Conch Island by a northeaster in 1962 (the Ash Wednesday storm). The opening has now closed again. Anastasia Island exists south of Salt Run for a distance of about 11 miles to Matanzas Inlet. The width of the island varies from about 2 miles at the northern end to less than 1,000 feet at the southern end, and the elevations range from 10 to 30 feet above midtide. The beach ridge south of Matanzas Inlet to the Flagler County line, a distance of 3 miles, is very narrow and only 5 to 10 feet in elevation.

The various communities along the barrier islands from north to south are Ponte Vedra Beach, South Ponte Vedra Beach, Usina Beach, Vilano Beach (St. Augustine Inlet), Anastasia State Park, St. Augustine Beach, Coquina Gables, Butler Beach, Crescent Beach (Matanzas Inlet), and Summer Haven.

The barrier islands of St. Johns County are composed of unconsolidated sand and shell material. Underlying this sand and shell in some places is a type of coquina or shelly rock in various stages of consolidation, known as the Anastasia Formation, formed during the ice ages. These coquina outcappings are found sporadically from St. Augustine to Palm Beach; the most prominent outcrops in this county are at Anastasia Island and at Matanzas Inlet. Rocks generally occur in thin layers and are easily eroded by wave action, thereby contributing large quantities of shell fragments to the beaches.

St. Johns County barrier islands are subject to frequent northeasters during winters and tropical storms and hurricanes during summers. The northeaster storms have been, with a few exceptions, the more damaging of the two for this county. This is because hurricane-generated winds and waves are usually of short duration and affect localized areas, whereas a northeaster may cause high winds and waves over a larger area for a longer duration, slowly nibbling away the beaches. The granddaddy of all northeasters to affect St. Johns County was the 1962 Ash Wednesday storm. An idea of the size of this storm can be gained from the fact that the Ash Wednesday storm did most of its damage along the New Jersey shore.

Between 1830 and 1982, 20 hurricanes passed within 50 miles of the St. Johns County shoreline, an average hurricane frequency of 1 every 7.5 years. During the same period 48 hurricanes passed within 150 miles of the shoreline, an average of 1 hurricane every 3 years.
The most damaging hurricanes and northeasters to strike the county were the following ones. The October 1944 hurricane caused 50 to 150 feet of beach erosion and a 3 to 4 feet vertical drop in beach profile at Summer Haven. The October 1956 northeaster caused tides 4 feet above normal, damaged Highway A1A, and dropped the beach profile 3 feet in some places with severe erosion. Hurricane Greta (October 1956) followed on the heels of the previous storm and caused more flooding and erosion. The Ash Wednesday storm of March 1962 was followed by another storm in November 1962, causing extensive damage from high tides and the reopening of old St. Augustine Inlet, known as Salt Run. Hurricane Dora in September 1964 caused 125 mph winds, tides 12 feet above normal along Anastasia Island, and waves 20 to 30 feet high along the island’s beaches! The shoreline at St. Augustine Beach receded more than 100 feet, and 15-foot dune scarps (a sure sign of severe erosion) appeared at Crescent Beach. Damage to structures was estimated at $1.8 million in St. Johns County and $200 to $300 million in all of Florida. A northeaster in February 1973 caused 60 to 70 feet of beach recession at St. Augustine Beach and a 3-foot drop in the beach profile at Crescent Beach. According to the federal government, 100-year flood tide levels along St. Johns County are 8.5 feet above midtide along the northern half and about 8.0 feet above midtide along the southern half of this stretch. However, these estimates do not include the wave height on top of the still-water elevations.

The St. Johns County shoreline is characterized by recession of the shoreline and dunes, lowering of beach profiles, and in a few places accretion or building out due to long-term natural processes. The problems of erosion were noted as early as 1887. Beach erosion has become a much more critical problem where man-made structures like buildings, parking lots, seawalls, bulkheads, revetments, groins, or jetties have been placed on the shifting and unstable beaches and dunes.

Various structures have been placed to stabilize St. Johns County’s inlets and beaches, but they have had limited success and incurred great costs. The Corps of Engineers placed three groins on Anastasia Island and Vilano Beach in 1889 (private interests built four additional groins at Vilano Beach) to stabilize the inlet for navigation. Since 1892 various types of seawalls and bulkheads were placed along the developed coast of Anastasia Island and St. Augustine Beach. After the Ash Wednesday storm the Federal Office of Emergency Planning authorized 50,000 cubic yards of sand fill and 450 linear feet of granite revetment for St. Augustine Beach at a cost of $95,000 as well as 1,800 feet of granite revetment and 1,130 linear feet of road pavement at Summer Haven. After Hurricane Dora in 1964 federal emergency funds were provided for more stabilization of both St. Augustine Beach and Summer Haven. Now at St. Augustine Beach (fig. 4.15) there is a concrete seawall 800 feet in length and 13.5 feet in elevation with an 18-foot-wide boardwalk. North of this seawall is a 580-foot timber seawall. At Ponte Vedra Beach a 2-mile-long concrete seawall with a height of 13.5 feet was built in 1934.

The most severe erosion problems in St. Johns County during storms occur in the St. Augustine Beach and Summer Haven areas.
crete revetments contribute to greater wave scouring, lowering of the beach profiles, higher velocities of the littoral currents, and higher erosion rates.

Automobiles on the beaches create a major problem along the county shoreline. The automobile access points create weak spots where overwash and erosion are magnified during storms. The use of automobiles on the beaches (in the opinion of some) interferes with tranquility, peace, and recreational enjoyment; disrupts the nesting of sea turtles and shore birds; and most significantly interferes with the stabilization by beach grasses that help to build new dunes by trapping sand.

Evacuation difficulty is a major hazard for residents along the St. Johns County shoreline. There are 5 roads leading off county islands to higher ground. The situation is complicated by the fact that most of the escape routes are over drawbridges that may be inoperable because of power failure in times of need. State Highway 312 is a safer fixed-span bridge. People evacuating Ponte Vedra Beach will have to drive through the congestion of Jacksonville Beach or alternatively drive down long stretches of flood-prone Highway 210. Evacuees from Vilano Beach, St. Augustine Beach, Crescent Beach, and Summer Haven will have to evacuate into the congestion and chaos of St. Augustine. Plan your escape route (and your destination) ahead of time.

For long stretches of St. Johns County the highway runs along the crest of the most seaward dune, giving developers the choice of siting buildings between the road and the sea or behind the road. Do not live in the narrow areas between sea and road, for
example, near South Ponte Vedra. It makes sense to keep the road between you and the sea.

According to our classification scheme, shorefront development is high risk along 23.8 miles of St. Johns County shoreline; 8.6 miles is of moderate risk; and 7.4 miles is classified as low risk (figs. 4.16, 4.17, and 4.18).

Flagler County

Flagler County has only 18 miles of open ocean shoreline. From Matanzas Inlet to just north of the county line and then to Ponce de Leon Inlet to the south, the barrier island extends uninterrupted for a length of 50 miles, making it the longest barrier island in Florida. In Flagler County the barrier island varies considerably in width. The island is about a mile wide in the northern 9 miles of the county and between 800- and 2,000-feet wide in the southern 9 miles. A continuous dune ridge with 10- to 15-foot elevations runs along the entire county shoreline. Along the southern half of the Flagler County shore some secondary dune ridges are found. The barrier island is separated from the mainland by the Matanzas River to the north, Smith Creek to the south, and the Intracoastal Waterway in the middle section of Flagler County. Marineland, Painters Hill, Beverley Beach, Silver Lake, and Flagler Beach are the developed communities, while the rest of the coast remains undeveloped at this time.

Beaches along the northern 3 miles of Flagler County are quite narrow, 30 to 50 feet wide at low tide, as well as steep and soft because of high shell content. Much of the shell is derived from a large offshore coquina outcrop, known as “The Rocks,” about 1 mile south of the northern county line. This coquina outcrop contributes shells for the beaches all the way to Flagler Beach and Ormond Beach in Volusia County. Although beaches along Flagler County are 100 to 150 feet wide above low tide, there are several locations where erosion scarps at the toes of dunes are pronounced (indicating severe erosion).

Information on other characteristics of the Flagler shoreline, such as storm history, are given in the next section on Volusia County.

We consider 8.2 miles of the Flagler shoreline to be high risk for development and 10.1 miles to be moderate risk (fig. 4.19). Over most of Flagler County a single ridge line next to the beach is the only developable land of reasonable safety. The best sites are those with the highway (A1A) between them and the beach. In many areas building sites have been carved out of an overly narrow strip, with sites crowded against the beach by the highway. There is very little beach stabilization in Flagler County, which is a definite plus for the future. A notable exception is Marineland where shoreline recession is threatening the buildings. Evacuation difficulty is a serious problem and will become more so as development proceeds and population increases.

Flagler County citizens will decide the safety of shoreline development by their future action. Lots of future options remain open for sound shoreline management.

Volusia County

Volusia County has about 49 miles of shoreline along the Atlantic Ocean. North of Ponce de Leon Inlet the Volusia shoreline is
part of the 50-mile barrier island extending through Flagler County and into St. Johns County. The barrier islands in Volusia County generally should have been relatively safe for development, but poor development practices have negated the natural advantages of the islands.

The prevailing winds here are from the northeast during the winter months and from the east during spring, summer, and fall. Wave heights average 4 to 9 feet. The mean tide range at Daytona Beach pier is 4.1 feet, with a spring tide range of 4.9 feet. The ocean swells approach the coast predominantly from the northeast and contribute to the net southerly littoral drift of beach sand, except during June, July, and August when the prevailing winds and swells are from the southeast and south and the littoral drift of sand is temporarily to the north.

The barrier islands of this coast are subject to attack by frequent northeasters during winter and hurricanes and tropical storms during summer. The records indicate that a hurricane will pass within 50 miles of Matanzas Inlet once every 7 years, and within 50 miles of Ponce de Leon Inlet once every 8 years. Northeasters, which are typically caused by a low-pressure system located off the coast, may occur several times during each winter, causing more chronic beach erosion problems. Some of the more damaging northeasters and hurricanes occurred in 1848, 1932, 1947, 1956, 1962, 1964, 1973, and 1979. The September 1848 hurricane came ashore near the Flagler County–Volusia County line and caused 11 shipwrecks along the Florida coast, including 3 in Volusia County. In July 1926 a hurricane came ashore near Ponce de Leon Inlet and wrecked the Inlet Terrace, a million-dollar hotel under construction in Ponce Park. The foundations of this wrecked hotel can still be seen from the beach. In the October 1944 hurricane the tides were 8.4 feet above mean sea level at Daytona Beach, and property damage along the beaches was in the millions of dollars; total damage in Florida was $60 million. An October 1947 northeaster caused 100 feet of beach retreat and 10-foot dune scarps between Ormond Beach and New Smyrna Beach. More than a dozen houses disappeared into the ocean, and roads and seawalls were destroyed along the developed barrier island. Hurricane “King” in October 1950 caused tides 8 feet above normal along the coast from Daytona Beach to St. Augustine and in the Halifax River, flooding many homes. The winter storm of 1962 (the famous Ash Wednesday storm) caused extensive beach erosion in Volusia, Flagler, and St. Johns counties, which were declared federal disaster areas. Seawalls were destroyed along Daytona Beach, and Highway A1A was overwashed and required revetment reinforcement. Hurricane Dora in September 1964 caused extensive flooding along the beach and up the Halifax River; beach erosion near the Coast Guard Lighthouse at Ponce Inlet exceeded 100 feet. A northeast storm in February 1973 washed away a seawall at the Ponce Inlet Club South condominium, dislodged a rubble mound portion of the north jetty at Ponce de Leon Inlet, and breached a channel on the north side of the inlet. Tropical Storm “Gilda” in October 1973 caused substantial dune erosion north of Ponce Inlet.

The Federal Emergency Management Agency and NOAA estimate 100-year flood levels along this coast at about 8.0 feet above
Fig. 4.16. Site analysis: Micklers Landing and vicinity.
DANGER: Flood risk
DANGER: Evacuation difficult
DANGER: No foredune
CAUTION: Engineered shoreline
CAUTION: Narrow island
mean sea level at the north Flagler County line and 8.0 feet above msl in Volusia County along the open coast. However, these estimates do not include wave height, that is, the height of the storm waves which are on top of the water flooding the beach areas.

Detailed information on shoreline and offshore depth contour changes over historic periods is not available for the entire Flagler County and Volusia County shoreline. However, information from the U. S. Army Corps of Engineers' studies and the University of Florida Coastal and Oceanographic Laboratories' studies at Matanzas Inlet, Ponce de Leon Inlet, and Daytona Beach reveal that in the last century most of the shoreline has retreated and offshore depth contours have steepened.

It is fair to say that some of the communities in Volusia County have not done a good job of promoting safe shoreline development. An indication of this can be gained by comparing the locations of old buildings with those of more recently developed towns such as Daytona Beach Shores, Halifax Estates, and Wilbur-by-the-Sea (fig. 4.20). Buildings of about 20 years ago are usually set back a prudent distance from the beach. It is apparent that some of the development in Volusia County is unsafe, unsound, environmentally damaging, and in violation of at least the spirit of the state's present setback regulations. The next big storm someday will demonstrate the lack of wisdom in ignoring the power of the sea.

Ironically, most of the barrier island area in Volusia County is relatively wide and high, with multiple ridges of sand dunes that make good building sites (figs. 4.21 and 4.22). Citizens living one

Fig. 4.17. Site analysis: South Ponte Vedra Beach to St. Augustine Inlet.
DANGER: Flood risk
DANGER: Evacuation difficult
CAUTION: Narrow island in places
Safe sites on ridges
Fig. 4.18. Site analysis: St. Augustine Inlet to Matanzas Inlet.
DANGER: Flood risk
DANGER: Buildings too close to beach
CAUTION: Beach erosion
CAUTION: No dune

DANGER: Flood risk
CAUTION: Evacuation difficult
CAUTION: Individual sites differ in safety
CAUTION: Low elevations by the river
+ High, vegetated foredune
+ Best sites on ridge top
or more blocks from the beach should remember that someday they may be asked to pay to halt the beach erosion caused by imprudent beach-front development.

The use of automobiles on beaches of Volusia County is an old and important tradition—an American tradition. Daytona Beach (fig. 4.23) has the unique characteristics of a wide, flat, compact beach with little or no shell material. These attributes created conditions suitable for automobile races, the first of which was the Daytona 500 in 1906. The name of Daytona Beach has become synonymous with car speed—which exceeded 200 miles per hour by 1930. However, because of natural storm events and possibly excessive use of the beach, shell pockets began to appear in early 1932. These pockets created hazards for drivers, and the races were moved to new quarters inland.

Storm evacuation problems are severe for Volusia County. Evacuation routes on the island north of Ponce de Leon Inlet will be relatively safe because most routes are above 11 feet in elevation. The problem stems from the low elevation (4 feet) of bridge approaches on both the island and mainland sides of the Halifax River. Most of the bridges are drawbridges, which adds to the evacuation problem, but Fairview Main Street Bridge and the Florida Highway 20 bridge are fixed spans. New Smyrna Beach evacuation should not pose an insurmountable problem because two bridges (both drawbridges) serve a relatively small population.

In all, 28.6 miles of the Volusia County shoreline are considered high risk for coastal development. Moderate-risk and low-
DANGER: Flood risk
DANGER: Evacuation difficult
CAUTION: Very narrow developable ridge
CAUTION: Beach erosion
+ Vegetated foredune
+ Non-engineered broad beach
Fig. 4.20. Site analysis: Flagler Beach.
DANGER: Flood risk
CAUTION: Evacuation difficult
CAUTION: Beach erosion
CAUTION: Low elevation on the riverside of island
+ Road between beach and development
+ Best sites on ridges
Fig. 4.21. The primary dune was removed to site this house in Wilbur-by-the-Sea. Photo by Barb Gruver.

Fig. 4.22. Homes in Ormond-by-the-Sea set back a relatively safe distance. Photo by Bill Neal.