



## **UNIT IV: IDENTIFYING AND EVALUATING SITE ALTERNATIVES**



## **IDENTIFYING AND EVALUATING SITE ALTERNATIVES**

### **INTRODUCTION**



One of the principal objectives of the *Coastal Construction Manual* is to improve site selection for coastal residential buildings.

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Experience has shown that not all coastal lands are suitable for development—or at least not the type and intensity of development that has occurred on coastal lands in the past. Figures 3-1, 3-2, and 3-3 in the previous unit showed some of the results of inappropriate site selection and development.

Unfortunately, many similar siting and development decisions are made every day based on site conditions at the time of purchase or on an incomplete or inaccurate assessment of future conditions. Too often these decisions leave property owners and local governments to struggle at a later point with a number of **avoidable problems**, such as:

- Damage to or loss of buildings.
- Damage to attendant infrastructure.
- Encroachment of buildings onto public beaches.
- Having to provide emergency or permanent measures to protect vulnerable buildings and infrastructure.
- Having to relocate buildings.
- Emergency evacuation.
- Injuries and loss of life.

Informed decisions regarding siting, design, and construction begin with a complete and detailed understanding of the advantages and disadvantages of potential sites for coastal residential construction—knowledge that should be gained **before** purchasing coastal property and initiating development.

This unit provides information about identifying suitable property for coastal residential structures, compiling information about coastal property, and the process of evaluating hazards and potential vulnerability.

**UNIT OBJECTIVES** After completing this unit, you should be able to:

- 4.1 Identify the factors to be considered when identifying sites for residential coastal development.
- 4.2 Identify the types of information that should be obtained to evaluate coastal property.
- 4.3 Identify sources of information about coastal property.
- 4.4 Describe the major steps in evaluating hazards and potential vulnerability of coastal property.



**THE EVALUATION PROCESS**

A thorough evaluation of coastal property for development purposes involves four steps:



**WARNING**

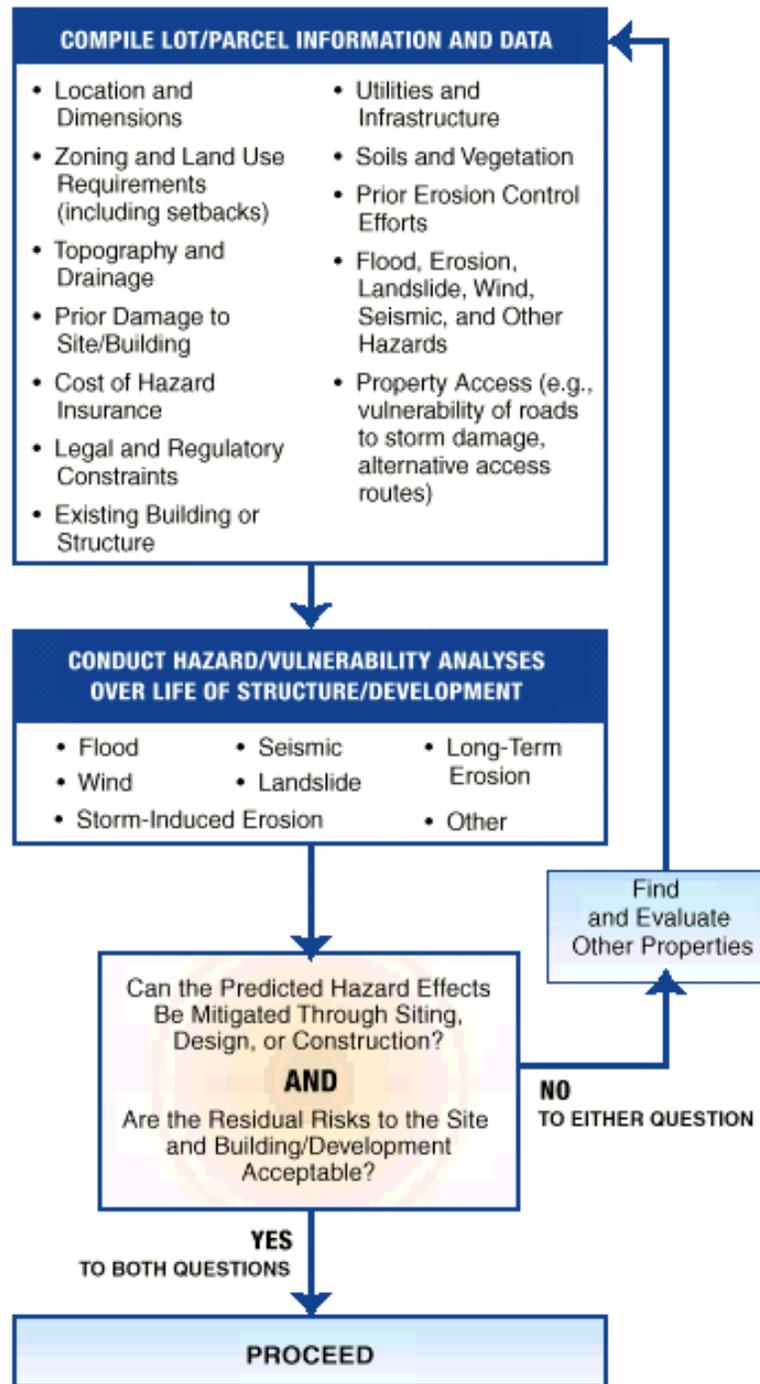
Many coastal property buyers fail to investigate potential hazards to their land and buildings. Designers should work with owners to identify and mitigate those hazards.

<b>1. Compile information.</b>	Identify candidate properties and compile lot/parcel information for each. Then, for each property, follow steps 2 through 4.
<b>2. Evaluate.</b>	Conduct a hazards analysis and risk assessment.
<b>3. Decide.</b>	Determine whether the hazards can be mitigated through siting, design, or construction and whether the residual risks to the site and the building are acceptable.
<b>4. Take action.</b>	Either (a) proceed with the purchase or development of a property, or (b) reject the candidate properties and find and evaluate other properties.

This evaluation process is depicted in the graphic on the next page and described in the remainder of this unit.



Figure 4-1.  
Evaluation of coastal  
property.





***TYPES OF DEVELOPMENT***

A building or development site need not be vacant or undeveloped land. Indeed, much of the coastal construction occurring today involves redevelopment or replacement of existing buildings. Therefore, property evaluation as discussed in this unit applies to the following types of development:

- **Infill development**—Development on previously subdivided or platted vacant lots or small parcels, with roads and utilities in place. These lots are surrounded by or adjacent to residential structures.
- **Redevelopment**—Development on previously developed lots or small parcels on which a building currently exists (see Fig. 4-2).
- **Development of raw land**—Development on large, vacant parcels, usually without on-site access roads and utilities.

**Figure 4-2.**  
**Redevelopment of**  
**previously developed**  
**property—post-Hurricane**  
**Fran elevation and**  
**reconstruction project on**  
**Figure Eight Island, North**  
**Carolina.**





**IDENTIFYING CANDIDATE PROPERTIES**

<b>1. Compile information.</b>	Identify candidate properties and compile lot/parcel information for each. Then, for each property, follow steps 2 through 4.
<b>2. Evaluate.</b>	Conduct a hazards analysis and risk assessment.
<b>3. Decide.</b>	Determine whether the hazards can be mitigated through siting, design, or construction and whether the residual risks to the site and the building are acceptable.
<b>4. Take action.</b>	Either (a) proceed with the purchase or development of a property, or (b) reject the candidate properties and find and evaluate other properties.

The first step in the coastal development or construction process involves identifying and purchasing a vacant or previously developed lot or parcel. It is this step that, in many ways, constrains subsequent siting, design, and construction decisions and determines the long-term vulnerability of coastal residential buildings.

Prospective property buyers who fail to fully investigate properties before acquiring them may subsequently be faced with a variety of problems that are difficult, costly, or essentially impossible to solve.

**FACTORS TO CONSIDER**

Although this course will not address the initial identification of candidate properties in detail, property buyers and design professionals who are assisting them in property evaluations should keep the following factors in mind as they narrow their search for a building/development site.

- **Risk.** Before any purchase, each property buyer should, in consultation with experts, determine the acceptable level of residual risk and decide how to manage the actual risks expected over the life of the building or development. Note that risk assessment, risk tolerance, and risk management issues are not simple; *property acquisition and development decisions must often be made with inadequate or imprecise information.*
- **Types of hazards.** The geographic region or area a purchaser is interested in will determine the types of hazards to which the property will be exposed.
- **Historical records.** In the absence of better information, historical records can be used to predict future hazard conditions, impacts, and frequencies. However, natural and manmade changes at a site may render simple extrapolation of historical patterns inaccurate.
- **Intended use.** Any given lot or parcel may or may not be suitable for the purchaser’s intended use of the property.



- **Regulatory requirements.** Requirements related to land use, zoning, setbacks, health, floodplain management, building code, and related issues will, in large part, determine development densities, building size and location limitations, minimum design and construction practices, and allowable responses to erosion hazards. However, *compliance with these requirements does not ensure the future safety of the building or development.*
- **Unreliability of historical development practices.** Development practices that perpetuate or duplicate historical siting, design, or construction practices will not ensure the future safety of a new building or development. Many historical practices are inadequate by today's standards. Further, historical practices that were at one time adequate may be rendered inadequate by changing shoreline conditions.
- **Erosion control.** An existing erosion control structure on a lot or parcel is an indication of prior erosion, but the structure may or may not be adequate to protect a building or development in the future. Moreover, many States and communities limit or prohibit construction or reconstruction of erosion-control devices (see Fig. 4-3).

**Figure 4-3.**  
**Groins and revetments at a Massachusetts community. Narrowing the search for coastal property suitable development or redevelopment requires careful consideration of many factors, including the nature and success of such previous erosion-control efforts. (Note that some communities and States restrict or prohibit such structures.)**





- **Increasing vulnerability.** The vulnerability of a coastal building will probably increase with time, as a result of one or more of the following:
  - Gradual weakening or deterioration of the building itself.
  - Sea-level or lake-level rise.
  - Erosion-induced shoreline recession (which affects the majority of coastal areas).
- **Adjacent and nearby development activities.** Future development activities and patterns on adjacent and nearby properties may affect the vulnerability of buildings or development on any given property.
- **Actual vulnerability and risk.** Property selection, along with subsequent siting, design, construction, and maintenance decisions, will determine the actual vulnerability of and risk to any building or improvements.



***SELF-CHECK REVIEW: IDENTIFYING CANDIDATE PROPERTIES***

**Instructions:** Answer the following questions. Then turn the page to check your answers. If you answered any items incorrectly, you should review the related material before continuing.

1. List the four steps of the process for evaluating coastal property.

1) \_\_\_\_\_

2) \_\_\_\_\_

3) \_\_\_\_\_

4) \_\_\_\_\_

2. Thorough property evaluation needs to be conducted for development of raw land and infill development, but it is not important for redevelopment projects.

True      False

3. In the absence of better information, historical records can be used to predict future hazard conditions, impacts, and frequencies.

True      False

4. To what extent can past development practices at a location be used as a guide for current development?



**The Answer Key for the preceding Self-Check Review is located on the next page.**



*ANSWER KEY*

**NOTE:** Some of your answers may be slightly different, but they should include the same main points.

1. List the four steps of the process for evaluating coastal property.

- 1) **COMPILE INFORMATION:** Identify candidate properties and compile lot/parcel information for each.
- 2) **EVALUATE:** Conduct a hazards analysis and risk assessment.
- 3) **DECIDE:** Determine whether the hazards can be mitigated through siting, design, or construction and whether the residual risks to the site and the building are acceptable.
- 4) **TAKE ACTION:** Either proceed with the purchase or redevelopment of a property, or reject the candidate properties and find and evaluate other properties.

2. Thorough property evaluation needs to be conducted for development of raw land and infill development, but it is not important for redevelopment projects.

**False. Thorough property evaluation should be conducted for any coastal development—whether infill development, redevelopment, or development of raw land.**

3. In the absence of better information, historical records can be used to predict future hazard conditions, impacts, and frequencies.

**True**

4. To what extent can past development practices at a location be used as a guide for current development?

**Past development practices are not a reliable guide for current development and will not ensure the future safety of a new building or development. Many historical practices are inadequate by today's standards. Even historical practices that were at one time adequate may be rendered inadequate by changing shoreline conditions.**



**COMPILING INFORMATION ON COASTAL PROPERTY**

<b>1. Compile information.</b>	Identify candidate properties and compile lot/parcel information for each. Then, for each property, follow steps 2 through 4.
<b>2. Evaluate.</b>	Conduct a hazards analysis and risk assessment.
<b>3. Decide.</b>	Determine whether the hazards can be mitigated through siting, design, or construction and whether the residual risks to the site and the building are acceptable.
<b>4. Take action.</b>	Either (a) proceed with the purchase or development of a property, or (b) reject the candidate properties and find and evaluate other properties.

After candidate properties are identified, a wide range of information should be compiled for each property. This task is no trivial matter and may require considerable time and effort.

Table 4.1 outlines the types of information that should be obtained to evaluate coastal property. Information listed in this table is usually available from local, regional, State, or Federal governments, from universities, or from knowledgeable professionals. However, the availability and quality of the information will vary by State and community.

**Table 4.1. General Information Checklist**

<b>PROPERTY LOCATION</b>	
<ul style="list-style-type: none"> <li>• Municipal, township, county, or other local jurisdiction</li> <li>• Street address</li> <li>• Parcel designation (e.g., tax map ID)</li> </ul>	<ul style="list-style-type: none"> <li>• Subdivision information</li> <li>• Special zoning or land use districts</li> <li>• Other hazard area designation</li> <li>• Natural resource protection area designation</li> </ul>
<b>PROPERTY DIMENSIONS</b>	
<ul style="list-style-type: none"> <li>• Total acreage</li> <li>• Seaward or waterward property boundary—platted or fixed line, moving line (e.g., Mean High Water line, Mean Low Water line, or other datum, elevation, or feature)</li> <li>• Property shape</li> <li>• Property elevations and topography</li> </ul>	<ul style="list-style-type: none"> <li>• Location relative to adjacent properties; configuration of adjacent properties</li> <li>• Shoreline frontage (i.e., dimension parallel to shoreline)</li> <li>• Property depth (i.e., dimension perpendicular to shoreline)</li> <li>• Acreage landward/outside of natural, physical, or regulatory construction or development limits (i.e., usable acreage)</li> </ul>



**Table 4.1. General Information Checklist (Continued)**

<b>LEGAL AND REGULATORY INFORMATION</b>	
<ul style="list-style-type: none"><li>• Land use designation at property and adjacent properties</li><li>• Zoning classification and resulting restrictions on use</li><li>• Building code and local amendments</li><li>• Flood hazard area: elevation and construction requirements</li><li>• Natural resource protection area: siting, construction, or use restrictions</li><li>• Easements and rights-of-way on property (including beach access locations for nearby properties or the general public)</li><li>• Local/State siting and construction regulations</li></ul>	<ul style="list-style-type: none"><li>• Regulatory front, back, and side setbacks</li><li>• Local/State permitting procedures and requirements</li><li>• Local/State regulations regarding use, construction, and repair of erosion-control measures</li><li>• Riparian rights</li><li>• Local/State restrictions on cumulative repairs or improvements</li><li>• Conditions or other requirements attached to building or zoning permits</li><li>• Subdivision covenants and other restrictions imposed by developers and homeowners associations</li><li>• Hazard disclosure requirements for property transfer, including geologic hazard reports</li></ul>
<b>PHYSICAL AND NATURAL CHARACTERISTICS</b>	
<ul style="list-style-type: none"><li>• Soils, geology, and vegetation—site and region</li><li>• Topography of nearshore (including nearshore slope), beach, dune, bluff, uplands</li><li>• Site drainage—surface water and groundwater</li><li>• Littoral sediment supply and sediment budget</li><li>• Storm, erosion, and hazard history of property</li><li>• Erodibility of the nearshore bottom</li></ul>	<ul style="list-style-type: none"><li>• Erosion-control structure on site: type, age, condition, and history</li><li>• Proximity to inlets and navigation structures</li><li>• Previous or planned community/regional beach/dune restoration projects</li><li>• Relative sea-level/water-level changes—land subsidence or uplift</li></ul>
<b>INFRASTRUCTURE AND SUPPORTING DEVELOPMENT</b>	
<ul style="list-style-type: none"><li>• Access road(s)</li><li>• Emergency evacuation route(s)</li><li>• Electric, gas, water, telephone, and other utilities—onsite or offsite lines and hookups</li></ul>	<ul style="list-style-type: none"><li>• Sewer or septic</li><li>• Limitations imposed by utility/infrastructure locations on property use</li></ul>



**Table 4.1. General Information Checklist (Continued)**

<b>FINANCIAL CONSIDERATIONS</b>	
<ul style="list-style-type: none"><li>• Intended use: owner-occupied or rental property</li><li>• Real estate taxes</li><li>• Development impact fees</li><li>• Permit fees</li><li>• Hazard insurance: availability, premiums, deductibles, and exclusions</li><li>• Property management fees</li></ul>	<ul style="list-style-type: none"><li>• Special assessments for community/association projects (e.g., private roads and facilities, dune preservation)</li><li>• Maintenance and repair of private erosion-control structures</li><li>• Increased building maintenance and repairs in areas subject to high winds, wind-driven rain, and/or salt spray</li><li>• Building damage costs (insured and uninsured) from previous storms</li></ul>



**SOURCES OF INFORMATION** Both publications and agencies and/or organizations can be sources of information for evaluating coastal properties.

***Publications***

Many States and communities have produced brochures or publications that will help property owners and prospective buyers evaluate coastal property. The publications listed below are examples of the types of information available.

***EXAMPLES OF AVAILABLE PUBLICATIONS***

- *Purchasing Paradise: Things to know and questions to ask when buying coastal property in Florida* (Florida Coastal Management Program, 1997).

This brochure briefly summarizes coastal ecosystems, coastal processes, the impacts humans have on coastal environments, and important considerations regarding the purchase of coastal property.

- *Coastal Processes Manual: How to Estimate the Conditions of Risk to Coastal Property from Extreme Lake Levels, Storms, and Erosion in the Great Lakes Basin*, 2<sup>nd</sup> edition (Keillor, 1998).

Although this manual contains information specific to the Great Lakes shorelines of Wisconsin, it also provides a technical framework for evaluating coastal processes and erosion-control measures in other areas. A videotape was produced in conjunction with the first edition (1987) of the manual. The following web site complements, supplements, and updates the current manual:

[http://www.seagrant.wisc.edu/advisory/coastal\\_engr/index.html](http://www.seagrant.wisc.edu/advisory/coastal_engr/index.html)

- *A Manual for Researching Historical Coastal Erosion* (Fulton, 1981).

This manual describes in detail how one might use historical weather data, local government records, and historical maps and photos to understand and quantify shoreline, sea bluff, and cliff retreat. Two communities in San Diego County, California, are used as case studies to illustrate the research methods presented.

- *Questions and Answers on Purchasing Coastal Real Estate in North Carolina* (North Carolina Real Estate Commission, 1996).

This brochure provides prospective property owners with basic information on a variety of topics: shoreline erosion, erosion control, siting, storm-resistant construction techniques, flood and wind insurance, and building repair regulations.



**EXAMPLES OF AVAILABLE PUBLICATIONS (CONTINUED)**

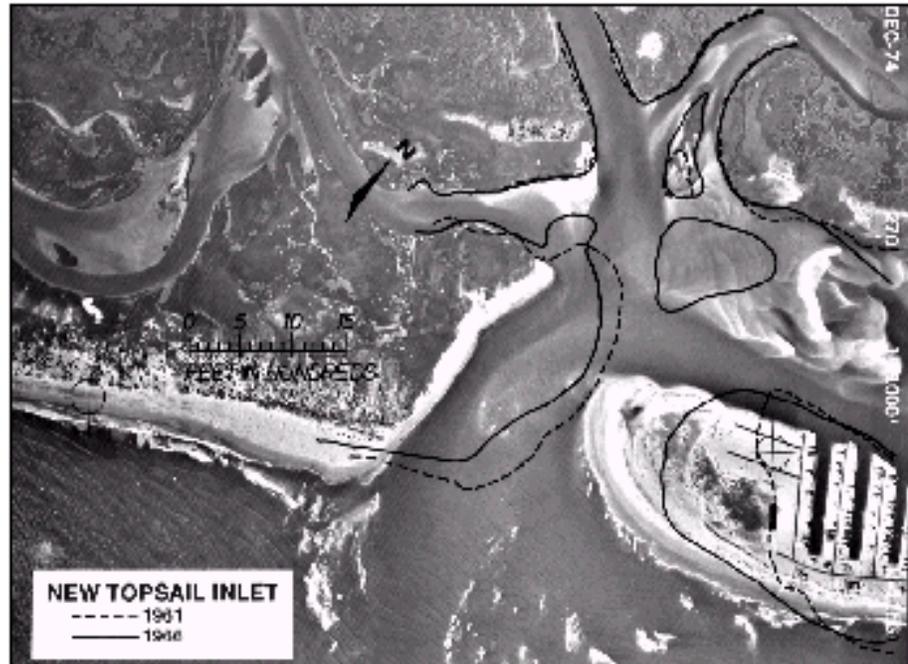
- *The Citizen's Guide to North Carolina's Shifting Inlets* (Baker, 1977).

This publication illustrates the dynamic nature of tidal inlets by superimposing historical shorelines onto more recent aerial photographs (see Fig. 4-4). This excellent method of presentation could serve as a model for other States to follow.

- *A Pictorial Atlas of North Carolina Inlets* (Cleary and Marden, 1999).

This is North Carolina Sea Grant's replacement for *The Citizen's Guide to North Carolina's Shifting Inlets* (see above).

**Figure 4-4.**  
1974 photograph with  
earlier shorelines  
superimposed—evidence  
that development near  
tidal inlets requires special  
attention.





***Agencies and Organizations***

Prospective property buyers and designers can contact agencies and organizations listed in Table 4.2. These sources may be able to provide information that will support an evaluation of the suitability of coastal property for residential construction or development. The *Coastal Construction Manual* lists additional sources of information.

**Table 4.2. Potential Sources of Supporting Information for Evaluating Coastal Property**

<b>LOCAL, REGIONAL, AND STATE AGENCIES RESPONSIBLE FOR:</b>		
<b>LOCAL</b>	<ul style="list-style-type: none"> <li>• Environmental</li> <li>• Planning</li> <li>• Zoning</li> <li>• Floodplain Management</li> <li>• Land Use</li> <li>• Health</li> <li>• Building Permits</li> </ul>	<ul style="list-style-type: none"> <li>• Soils and Geology</li> <li>• Municipal Engineering</li> <li>• Utilities</li> <li>• Deeds and Property Records</li> <li>• Assessments and Taxes</li> <li>• Emergency Management</li> </ul>
<b>REGIONAL</b>	<ul style="list-style-type: none"> <li>• Health</li> <li>• Planning</li> <li>• Utilities</li> <li>• Water/Waste Management</li> <li>• Soils and Geology</li> <li>• Beach or Shore Management/ Erosion Control</li> </ul>	<ul style="list-style-type: none"> <li>• Navigation and Ports</li> <li>• Natural Resource Conservation and Management</li> <li>• Geographic Information Systems</li> <li>• Photogrammetry and Remote Sensing</li> </ul>
<b>STATE</b>	<ul style="list-style-type: none"> <li>• Coastal Zone Management</li> <li>• Planning</li> <li>• Building Codes and Standards</li> <li>• Soils and Geology</li> <li>• Floodplain Management</li> <li>• Natural Resource Management</li> <li>• Beach or Shore Management/ Erosion Control</li> </ul>	<ul style="list-style-type: none"> <li>• Department of Insurance</li> <li>• Navigation and Ports</li> <li>• Emergency Management</li> <li>• Transportation</li> <li>• Natural Resource Conservation and Management</li> <li>• Geographic Information Systems</li> <li>• Photogrammetry and Remote Sensing</li> </ul>



**Table 4.2. Potential Sources of Supporting Information (Continued)**

<b>FEDERAL AGENCIES, INCLUDING:</b>
<ul style="list-style-type: none"> <li>• Federal Emergency Management Agency (FEMA)</li> <li>• U.S. Army Corps of Engineers (USACE)</li> <li>• U.S. Geological Survey (USGS)</li> <li>• National Ocean Service, Office of Ocean and Coastal Resource Management (OCRM)</li> <li>• U.S. Natural Resources Conservation Service (NRCS)</li> <li>• National Weather Service (NWS)</li> <li>• International Joint Commission (Great Lakes)</li> </ul>
<b>UNIVERSITY DEPARTMENTS, INCLUDING:</b>
<ul style="list-style-type: none"> <li>• Coastal or Ocean Engineering</li> <li>• Geology, Civil Engineering, or Soils</li> <li>• Architecture and Building Construction</li> <li>• Planning</li> <li>• Atmospheric Sciences</li> <li>• Botany, Biology, or Marine Biology</li> <li>• Coastal or Ocean Law</li> <li>• Sea Grant Programs (Research and Advisory Components)</li> </ul>
<b>PROFESSIONAL ORGANIZATIONS, INCLUDING:</b>
<ul style="list-style-type: none"> <li>• American Society of Civil Engineers (ASCE)</li> <li>• National Society of Professional Engineers (NSPE)</li> <li>• American Institute of Architects (AIA)</li> <li>• American Planning Association (APA)</li> <li>• Model Building Code Organizations             <ul style="list-style-type: none"> <li>▪ Building Officials &amp; Code Administrators International, Inc. (BOCA)</li> <li>▪ International Conference of Building Officials (ICBO)</li> <li>▪ Southern Building Code Congress International, Inc. (SBCCI)</li> </ul> </li> <li>• American Society of Landscape Architects (ASLA)</li> <li>• Geological Society of America (GSA)</li> <li>• Association of State Flood Plain Managers (ASFPM)</li> <li>• National Association of Home Builders (NAHB)</li> </ul>



**PROPERTY DISCLOSURE REQUIREMENTS**

A number of States require that residential real estate transactions be accompanied by a disclosure of information pertaining to flood hazards and/or other hazards (if the seller or agent knows of such hazards).

However, the requirements concerning the form and timing of disclosures differ from State to State, so the type and amount of information that must be disclosed varies widely.



**WARNING**

Even in States that require hazard disclosures in residential real estate transactions, property buyers should conduct their own investigations of prospective sites rather than rely solely on information provided by sellers and real estate agents.

Table 4.3 summarizes disclosure requirements for selected States. This list is based on information presented in *Coastal Hazard Mitigation 309 State Enhancement Grants, Assessment & Strategy Summary*, by the National Ocean Survey, Office of Ocean and Coastal Resource Management (OCRM 1998), as well as a review of selected State statutes and regulations.

Taken collectively, the disclosure requirements (in force and as proposed) provide a good indication of the types of information that prospective property buyers and designers should seek—whether or not their State requires such a disclosure.

**Table 4.3.  
Selected State Disclosure Requirements and Ongoing Efforts to Require Hazard Disclosure**

STATE	COMMENTS
<b>CALIFORNIA</b>	Section 8589.3 of the California Codes requires disclosure if a property is within a Special Flood Hazard Area (A zone or V zone). Section 1102.6c requires sellers or agents to complete a natural hazard Disclosure Statement, disclosing whether property lies within any of the following: an SFHA; an area of potential flooding in the event of a dam failure; a very high fire hazard severity zone; a wildland area that may contain substantial forest fire risks and hazards; an earthquake fault zone; a seismic hazard zone.
<b>FLORIDA</b>	Chapter 161, “Beach and Shore Preservation,” and Chapter 498, “Land Sales Practices,” of the Florida Statute address property disclosure statements. Section 161.57, “Coastal Properties Disclosure Statements,” sets forth specific requirements. Section 498.037 requires that any public offering statement for subdivided lands disclose fully and accurately the physical characteristics of the lands and make known to prospective buyers all unusual and material circumstances of features that affect those lands.
<b>HAWAII</b>	Hawaii has adopted procedures, as part of its NFIP ordinances, requiring disclosure of flood zone information.
<b>ILLINOIS</b>	Illinois requires that sellers sign a form that states whether they know if the property has ever been flooded.



**Table 4.3. Selected State Disclosure Requirements (Continued)**

STATE	COMMENTS
<b>MAINE</b>	The Maine Coastal Management Program is working with real estate agents to develop a mechanism for disclosing the risks of coastal hazards.
<b>MASSACHUSETTS</b>	Massachusetts Coastal Zone Management has generated shoreline change maps depicting long-term average annual shoreline change rates at 50-meter intervals along the shore. A Coastal Hazards Notification bill (disclosing erosion rate and flood zone information) has been submitted to the legislature.
<b>NEW JERSEY</b>	Amendments to the Coastal Area Facility Review Act (CAFRA) include a provision that permits issued for properties in the coastal zone, and conditions that must be met to receive the permit, must be recorded with the deed to the property.
<b>NEW YORK</b>	A Coastal Erosion Task Force report recommended notification if a property lies within a designated State Coastal Erosion Hazard Area. Draft disclosure legislation was developed by the Department of State but has not been enacted by the legislature.
<b>NORTH CAROLINA</b>	The Division of Coastal Management is working to develop disclosure mechanisms, in response to recommendations from the Governor’s Task Force on Hurricane Mitigation.
<b>OHIO</b>	Section 1506.06(F) of the Ohio Administrative Code requires disclosure if a property is included in a Lake Erie Coastal Erosion Area. Section 5302.30(D) of the Ohio Revised Code requires completion of a disclosure form developed by the Director of Commerce.
<b>OREGON</b>	A Coastal Natural Hazards Policy working group (Oregon Sea Grant 1994) concluded that Oregon law requires only minimal disclosure of natural hazards information. The Working Group recommended creation of a new category of information (Geotechnical) to be included in the disclosure form required under Oregon Revised Statute 696. The legislature has not yet acted on the recommendation.
<b>SOUTH CAROLINA</b>	Section 48-39-330 of the Code of Laws of South Carolina requires a disclosure statement for the transfer of property extending seaward of the 40-year setback line. The statement must include language that states the property is or may be affected by setback requirements, must include the local erosion rate, and must include the State plan coordinates of the seaward corners of habitable structures.



**Table 4.3. Selected State Disclosure Requirements (Continued)**

<b>STATE</b>	<b>COMMENTS</b>
<b>TEXAS</b>	Section 61.025 of the Texas Statutes, Natural Resources Code, requires disclosure of the following to purchasers of property in close proximity to Gulf of Mexico beaches: that the public has acquired a right-of-use or easement over the area seaward of the vegetation line; that State law prohibits any obstruction of, barrier to, restraint of, or interference with use of the public easement; and that structures erected seaward of the vegetation line, or that become seaward of the vegetation line as a result of natural processes, are subject to a lawsuit by the State seeking removal.
<b>WASHINGTON</b>	Section 64.06.020 of the Revised Code of Washington requires, among other things, that sellers complete a disclosure form that lists the following information (if known by the seller): if the property is in a designated floodplain; if the property or structure is damaged as a result of fire, wind, flood, beach movements, earthquake, expansive soils, or landslides; if rights-of-way, easements, and access limitations affect the property; or if settling, slippage, or sliding of the house or improvements has occurred.





***ANSWER KEY***

**NOTE:** Your answers may be slightly different, but they should include the same main points.

1. Where can a prospective home buyer obtain information about a coastal property's location in relation to the floodplain?

**In some States, the seller is required to disclose information pertaining to flood hazards. The buyer can also contact local and State agencies responsible for floodplain management, as well as FEMA. In addition, the State or community may have publications available that provide useful information.**

2. Where could the developer obtain relevant information about floodplain management and about soils and geology?
  - **Local, regional, and State agencies responsible for floodplain management and for soils and geology.**
  - **Federal agencies (e.g., FEMA, U.S. Geological Survey).**
  - **University departments (e.g., coastal or ocean engineering, geology, civil engineering, soils).**
  - **Professional organizations (e.g., Geological Society of America, Association of State Flood Plain Managers).**



**EVALUATING HAZARDS AND POTENTIAL VULNERABILITY**

1. <b>Compile information.</b>	Identify candidate properties and compile lot/parcel information for each. Then, for each property, follow steps 2 through 4.
➔ 2. <b>Evaluate.</b>	Conduct a hazards analysis and risk assessment.
3. <b>Decide.</b>	Determine whether the hazards can be mitigated through siting, design, or construction and whether the residual risks to the site and the building are acceptable.
4. <b>Take action.</b>	Either (a) proceed with the purchase or development of a property, or (b) reject the candidate properties and find and evaluate other properties.

This step is perhaps the most crucial in evaluating the suitability of coastal lands for development or redevelopment.

Basing hazard and vulnerability analyses solely on building code requirements, the demarcation of hazard zones or construction setback lines, and the location and design of nearby buildings is clearly an inadequate approach.

A recommended procedure for evaluating hazards and potential vulnerability is outlined below.

**DEFINE COASTAL HAZARDS AFFECTING THE PROPERTY**

1. **Characterize hazards.** Use all available information to characterize the type, severity, and frequency of hazards (e.g., flood, storm-induced and long-term erosion, accretion or burial, wind, seismic, tsunami, landslide, wildfire, and other natural hazards) that have affected or could affect the property.
2. **Identify trends.** Examine the record for long-term trends (> 50–100 years), short-term trends (< 10–20 years), and periodic or cyclic variations (both spatial and temporal) in hazard events. Determine whether particularly severe storms are included in the short-term or long-term records and what effects those storms had on the overall trends. If cyclic variations are observed, determine the periods and magnitudes of the variations.
3. **Consider extrapolation.** Determine whether or not extrapolation of historical trends is reasonable. Examine the record for significant changes to the coastal system or upland areas that will reduce, intensify, or modify the type, severity, and frequency of hazard occurrence at the property.



This process is intended primarily for design professionals, coastal specialists, and others with the expertise to evaluate coastal hazards and the vulnerability of sites and buildings to those hazards. If you are not familiar with hazard and vulnerability evaluations, you should seek the services of qualified professionals.

Examples of events or processes that will preclude simple extrapolation of historical trends are given on the next page.



***EXAMPLES: EVENTS OR PROCESSES THAT PRECLUDE  
SIMPLE EXTRAPOLATION OF HISTORICAL TRENDS***

- **Dune or bluff loss.** Loss of a historically present protective dune or bluff feature may lead to increased incidence and severity of flood or erosion damage.
- **Sea-, bay-, or lake-level rise.** Significant increases in sea, bay, or lake levels will probably increase vulnerability to flooding and coastal storm events.
- **Effects of erosion.** Erosion or storms may create weak points along the shoreline that will be predisposed to future breaching, inlet formation, and accelerated erosion, or may expose geologic formations that are more resistant to future erosion.
- **Inlet modifications.** Recent or historical modifications to an inlet (e.g., construction or modification of jetties, creation or deepening of a dredged channel) may alter the supply of littoral sediments and modify historic shoreline change trends.
- **Inlet formation/closure.** Formation or closure of an inlet during a storm will alter local tide, wave, current, and sediment transport patterns and may expose previously sheltered areas to damaging waves (see Figures 4-5 and 4-6).
- **Construction of erosion-control devices.** Widespread construction of erosion-control devices may reduce the input of sediments to the littoral system and cause or increase local erosion.
- **Seismic events.** Recent seismic events may have caused uplift, settlement, submergence, or fracturing of a region, altering its hazard vulnerability to flood and other hazards.
- **Groundwater changes and loss of vegetative cover.** Changes in surface water flows, drainage patterns, or groundwater movements, and reduction in vegetative cover may increase an area's susceptibility to landslides.
- **Sea cliff or bluff changes.** Topographic changes resulting from the retreat of a sea cliff or coastal bluff may increase wind speeds at a site.



**Figure 4-5.**  
A breach cut across Nauset Spit on Cape Cod, MA, by a January 1987 northeaster. The breach grew from an initial width of approximately 20 feet to over a mile within 2 years, exposing the previously sheltered shoreline of Chatham to ocean waves and erosion.



**Figure 4-6.**  
Ocean City Inlet, MD, opened by a hurricane in 1933 and stabilized by jetties in 1934–35. Note extreme shoreline offset and downdrift erosion resulting from inlet stabilization (1992 photo).





4. **Forecast.** Forecast the type, severity, and frequency of future hazard events likely to affect the property over a suitably long period of time—over at least 50–70 years.

This forecast should be based on either: (1) extrapolation of observed historical trends, modified to take into account those factors that will cause deviations from historical trends, or (2) detailed statistical and modeling studies calibrated to reflect basic physical and meteorological processes, and local conditions.

The first procedure should be attainable for almost any coastal site and project. The second procedure will be beyond the scope and capabilities of all but a few coastal development projects.

***EVALUATE HAZARD  
EFFECTS ON THE  
PROPERTY***

After the type, severity, and frequency of future hazard events have been forecast, designers should use past events as an indication of the nature and severity of effects likely to occur during those forecast events.

Information about past events at the site of interest and at similar sites should be considered. This historical information should be combined with knowledge about the site and local conditions to estimate future hazard effects on the site and any improvements.

Designers should consider the effects of low-frequency, **rare events** (e.g., major storms, extreme water levels, tsunamis, earthquakes) and **multiple, closely spaced lesser events** (see Figure 4-7). For example, many of the post-storm damage assessments you read about in Unit I show that the cumulative erosion and damage caused by a series of minor coastal storms can be as severe as the effects of a single, major storm.



**Figure 4-7.** Siting and design should include consideration of multiple storms or hazards within a short period, whose cumulative effects can exceed those of a design-level event.





***SELF-CHECK REVIEW: EVALUATING HAZARDS AND VULNERABILITY***

**Instructions:** Answer the following questions. Then turn the page to check your answers. If you answered any items incorrectly, you should review the related material before continuing.

1. Give an example of **trend information** that would be useful in evaluating hazards and potential vulnerability of a coastal property.

2. Give two examples of coastal events or processes that might make simple extrapolation of historical trends unreasonable.

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3. Designers should consider the effects of low-frequency, rare events when determining potential vulnerability to hazards.

True      False

4. Designers should consider the effects of multiple, closely spaced lesser events when determining potential vulnerability to hazards.

True      False



**The Answer Key for the preceding Self-Check Review is located on the next page.**



**ANSWER KEY**

**NOTE:** Some of your answers may be slightly different, but they should include the same main points.

1. Give an example of **trend information** that would be useful in evaluating hazards and potential vulnerability of a coastal property.

**Any of the following:**

- **Long-term trends (> 50–100 years) in hazard events.**
- **Short-term trends (< 10–20 years) in hazard events.**
- **Whether particularly severe storms are included in the short- or long-term records and what effects those storms had on the overall trends.**
- **Periods and magnitudes of any cyclic variations.**

2. Give two examples of coastal events or processes that might make simple extrapolation of historical trends unreasonable.

**Any two of the following:**

- **Dune or bluff loss.**
- **Sea-, bay-, or lake-level rise.**
- **Effects of erosion.**
- **Inlet modifications.**
- **Inlet formation/closure.**
- **Construction of erosion-control devices.**
- **Seismic events.**
- **Changes in surface water, drainage patterns, or groundwater movements.**
- **Loss of vegetative cover.**
- **Sea cliff or bluff changes.**

3. Designers should consider the effects of low-frequency, rare events when determining potential vulnerability to hazards.

**True**

4. Designers should consider the effects of multiple, closely spaced lesser events when determining potential vulnerability to hazards.

**True**



**DECISION TIME**

1. <b>Compile information.</b>	Identify candidate properties and compile lot/parcel information for each. Then, for each property, follow steps 2 through 4.
2. <b>Evaluate.</b>	Conduct a hazards analysis and risk assessment.
3. <b>Decide.</b>	Determine whether the hazards can be mitigated through siting, design, or construction and whether the residual risks to the site and the building are acceptable.
4. <b>Take action.</b>	Either (a) proceed with the purchase or development of a property, or (b) reject the candidate properties and find and evaluate other properties.



Having performed the hazard analysis and risk assessment, it is time to decide.

To complete this step in evaluating a lot or parcel for potential development or redevelopment, two questions must be answered:

- **Can the predicted hazard effects be mitigated through siting, design, or construction?**
- **Are the residual risks to the site and building/development acceptable?**



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Remember, buildings near the shoreline are at a far greater risk of being damaged by natural causes than buildings farther inland.

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**TAKING ACTION**

<b>1. Compile information.</b>	Identify candidate properties and compile lot/parcel information for each. Then, for each property, follow steps 2 through 4.
<b>2. Evaluate.</b>	Conduct a hazards analysis and risk assessment.
<b>3. Decide.</b>	Determine whether the hazards can be mitigated through siting, design, or construction and whether the residual risks to the site and the building are acceptable.
<b>4. Take action.</b>	Either (a) proceed with the purchase or development of a property, or (b) reject the candidate properties and find and evaluate other properties.



The last step is to take action based on the decision you have made. Unless both questions can be answered affirmatively, the property should be rejected (at least for its intended use) and other properties should be identified and evaluated.

Alternatively, the intended use of the property might be modified so that it is consistent with predicted hazard effects and other constraints.

Ultimately, however, reducing the long-term risks to coastal residential buildings requires an approach to site evaluation such as the process described in this unit.



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**UNIT IV EXERCISE**

**Instructions:** Use this Unit Exercise to test how well you learned the material presented in Unit IV. When you complete the exercise, check your answers against those in the Answer Key that follows. If you answered any questions incorrectly, be sure to review the corresponding section of the unit before proceeding to Unit V.

1. A thorough property evaluation is needed before developing **or** redeveloping coastal property.  
True      False
2. After identifying candidate properties, the next task is to:
  - a. Conduct a risk assessment.
  - b. Compile information about the properties.
  - c. Determine whether hazards can be mitigated through siting, design, or construction.
  - d. Either proceed with development or reject the candidate properties.
3. The \_\_\_\_\_ will determine the types of hazards to which a particular property will be exposed.
  - a. Building design.
  - b. Building code.
  - c. Intended use.
  - d. Geographic region or area.
4. \_\_\_\_\_ may render simple extrapolation of historical patterns inaccurate.
  - a. Natural and manmade changes to the coastal system.
  - b. Intended use of the property.
  - c. Future development activities.
  - d. Trends.
5. Compliance with regulatory requirements ensures the future safety of a building or development.  
True      False
6. Information compiled about a candidate property should include property location and dimensions, physical and natural characteristics, infrastructure and supporting development, financial considerations, and \_\_\_\_\_.



7. Potential sources of information about coastal property include local, regional, State, and Federal agencies; university departments; and \_\_\_\_\_.
8. Requirements concerning disclosure of hazards affecting residential real estate are standard and uniform in the coastal States of the United States.
- True      False
9. In evaluating hazards affecting coastal property, simple extrapolation of historical trends:
- a. May be reasonable if significant changes to the coastal system have not occurred.
  - b. Is the best approach if significant changes to the coastal system have occurred.
  - c. Is reasonable for short-term trends but not long-term trends.
  - d. Is reasonable for long-term trends but not short-term trends.
10. Designers should forecast the type, severity, and frequency of future hazard events likely to affect the property over a period of:
- a. Up to 20 years.
  - b. At least 30 years.
  - c. At least 50–70 years.
  - d. 200 years.
11. In determining potential vulnerability to hazards, designers should consider: (mark all that apply)
- a. Past events at the site.
  - b. Past events at similar sites.
  - c. Knowledge about the site and local conditions.
  - d. Low-frequency, rare events.
  - e. Multiple, closely spaced lesser events.
12. In deciding whether to proceed with development, designers must determine (1) whether the predicted hazard effects can be mitigated through siting, design, or construction and (2) \_\_\_\_\_.



**The Answer Key for the preceding Unit Exercise is located on the next page.**



**UNIT IV EXERCISE—ANSWER KEY**

**NOTE:** Some of your answers may be slightly different, but they should include the same main points.

1. A thorough property evaluation is needed before developing **or** redeveloping coastal property.

**True**

2. After identifying candidate properties, the next task is to:

**b. Compile information about the properties.**

3. The \_\_\_\_\_ will determine the types of hazards to which a particular property will be exposed.

**d. Geographic region or area.**

4. \_\_\_\_\_ may render simple extrapolation of historical patterns inaccurate.

**a. Natural and manmade changes to the coastal system.**

5. Compliance with regulatory requirements ensures the future safety of a building or development.

**False**

6. Information compiled about a candidate property should include property location and dimensions, physical and natural characteristics, infrastructure and supporting development, financial considerations, and **legal and regulatory information**.

7. Potential sources of information about coastal property include local, regional, State, and Federal agencies; university departments; and **professional organizations**.

8. Requirements concerning disclosure of hazards affecting residential real estate are standard and uniform in the coastal States of the United States.

**False. Not all States have such requirements, and in those that do, the requirements vary.**



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9. In evaluating hazards affecting coastal property, simple extrapolation of historical trends:
- a. May be reasonable if significant changes to the coastal system have not occurred.**
10. Designers should forecast the type, severity, and frequency of future hazard events likely to affect the property over a period of:
- c. At least 50–70 years**
11. In determining potential vulnerability to hazards, designers should consider: (mark all that apply)
- a. Past events at the site.  
 b. Past events at similar sites.  
 c. Knowledge about the site and local conditions.  
 d. Low-frequency, rare events.  
 e. Multiple, closely spaced lesser events.
12. In deciding whether to proceed with development, designers must determine (1) whether the predicted hazard effects can be mitigated through siting, design, or construction and (2)
- Whether the residual risks to the site and building/development are acceptable.**