Connecticut Beaches and Dunes: A Hazard Guide for Coastal Property Owners

Adapted by Jennifer O'Donnell[a], and Juliana Barrett[b], from the Maine Sea Grant Website, Maine Property Owner's Guide to Managing Flooding, Erosion & Other Coastal Hazards which was based on an original document by Peter Slovinsky[c], (Slovinsky, 2011).

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[a]Jennifer O'Donnell, Ph.D.
Department of Marine Sciences
University of Connecticut
Groton, CT 06340
jennifer.o'donnell@uconn.edu

[b]Juliana Barrett, Ph.D.
Connecticut Sea Grant
Department of Extension
University of Connecticut
Groton, CT 06340
juliana.barrett@uconn.edu

[c]Peter Slovinsky
Maine Geological Survey
Augusta, ME 04333
peter.a.slovinsky@maine.gov

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Connecticut Beaches and Dunes

Storms and associated hazards such as flooding and erosion can damage coastal property and affect beaches and dunes that provide valuable habitat for uniquely adapted species of plants and animals. This website will help you evaluate these threats and identify what you can do to protect your coastal property and the natural environment.

Connecticut's Long Island Sound shoreline is comprised of beaches, soft and rocky bluffs, and tidal wetlands. Beaches occupy only about 14% or 87 miles of Connecticut's tidal coastline (Vickey, 2002 and Long Island Sound Facts). Connecticut has several types of beaches that include sandy barrier spits, pocket beaches and beaches composed of cobble, gravel, boulders or bedrock.

Connecticut beaches include barrier spits as opposed to the more commonly heard term "barrier islands". The Connecticut coast lacks barrier islands due to: 1) Long Island limiting the distance that wind blows over water and thus restricting the size of waves that can form in Long Island Sound; and 2) the irregular shape of the Connecticut shoreline interrupts longshore transport of sand (Lewis, 2015).

Connecticut has a number of barrier spits such as in the photo of Bluff Point below.

Sandy barrier spits with back-barrier marsh systems (Bluff Point State Park, photo credit: Jennifer O'Donnell)

Most of CT beaches are hybrids of pocket beaches (see aerial photo below). These beaches derive their sediment from wave action that erodes the sand deposits in glacial deltas. They differ from barrier beaches (for example, along the New Jersey and North Carolina coasts) in that they do not derive much sand from longshore transport (due to the irregular coastline of Connecticut) or from offshore sediment sources (Lewis 2015).

Pocket beach bound by rocky headlands (Point of Woods Old Lyme, photo credit: Ralph Lewis)

Connecticut also has beaches composed of gravel or cobble stones, usually quite rounded by wave action, or they may include boulders and bedrock outcrops. State parks such as Rocky Neck and Bluff Point are great places to see bedrock outcrops and boulders along the shoreline.

Cobble beach (Milford, photo credit: Nancy Balcom)

Beaches provide both a natural buffer from storms, and critical habitat for wildlife and plants. Beach-related tourism and recreation contribute significantly to Connecticut's economy. Risks of living near a beach or sand dune system include exposure to flooding, erosion and storm surge from hurricanes and more frequently occurring nor'easters.

With sea level rise, beaches migrate landward as waves erode the deltas (see diagram below). The sand source will last until the glacial deltaic deposits (See Connecticut Surficial Materials Maps on CTECO) are completely eroded or some type of infrastructure (e.g. house, road, railroad tracks) is encountered. In the comparatively low energy environment of Long Island Sound, sand lost offshore is generally not returned to the beach. This lower energy environment results in

Connecticut dunes that are relatively smaller and frequently less well-developed than dunes along the Atlantic coastline (Lewis, 2015).

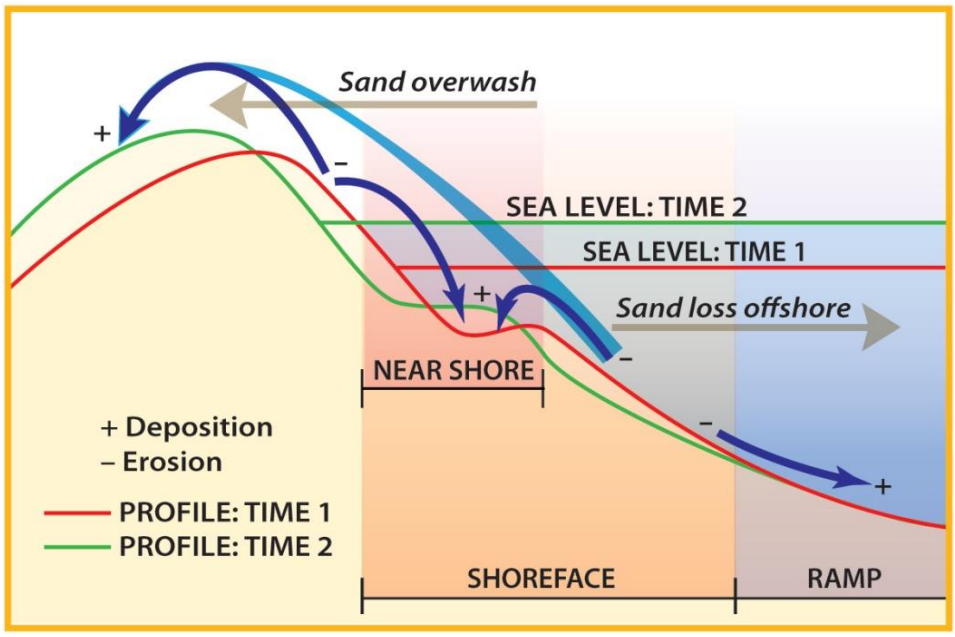
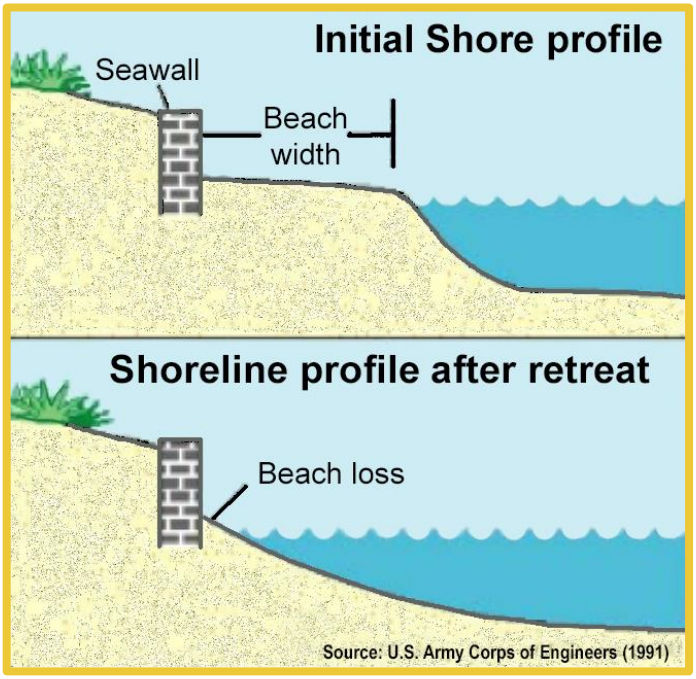


Diagram showing how the beach profile changes with sea level rise. (K. Tenga-Gonzalez/Maine Sea Grant)



Seawalls come between waves and the sediment supply behind them and starve beaches.

Erosion of Connecticut's beaches and dunes

Beaches and dunes are dynamic coastal features and are affected by short and long term changes in waves, wind, tides, storm surge, sand availability and sea level rise. These changes may be seasonal, episodic or storm-related, or slow, barely noticeable over many years. Storm impacts occur over a very short period but recovery of the beach may occur with seasonal changes or over a much longer period of time. In the case of severe storms, recovery of the beach may not occur at all.

Sea level rise has been impacting the Connecticut shoreline for centuries. Measurements indicate that rates of sea level rise have been accelerating in recent decades along parts of the eastern United States (Sallenger Jr *et al*. 2012). Sea level rise adversely impacts beaches that are bordered by infrastructure such as roads, homes and rail lines.

Erosion is a natural process and occurs when soil, sand or rocks are transported from one location to another through wind and wave forces. Coastal erosion and associated flooding can damage property and infrastructure. Erosion also compromises the ability of beaches and dunes to protect neighboring property, provide habitat for plants and wildlife, and accommodate recreational uses.

Erosion in Connecticut is generally caused by storms, rising sea levels, changes in sand availability, and is exacerbated by the construction of jetties, groins and seawalls. Sand availability can change when sand is moved offshore during storms and is no longer available for beaches, or when sand transported landward during storms is removed as debris. Erosion may also be caused by stormwater runoff from the adjacent uplands and solutions to this type of erosion will likely be different than those discussed in this document.

Beach in Waterford, photo credit: Jennifer O'Donnell

Beaches may be highly erosional, moderately erosional or slightly erosional. Beaches in Maine are considered highly erosional if they erode at a rate of more than two feet per year (Slovinsky 2011). In Maryland, shorelines that experience at least 4 feet of erosion per year are considered to have moderate to high erosion (MD DNR). According to a 1999 report, 9% of Connecticut's shoreline is considered critically eroding (Bernd-Cohen and Gordon 1999).

Structures may exacerbate erosion issues on beaches. Many highly erosional beaches have seawalls or revetments that protect the land behind them, but can lead to increased erosion of the beach in front of the wall. Seawalls and revetments can also cause erosion on neighboring beaches since the wall interferes with the movement of sand alongshore. Most highly erosional beaches are in need of sand replenishment to replace eroded sand since many highly erosional shorelines have no beach for about half or all of the tidal cycle.

Moderately erosional beaches in Connecticut have erosion rates of one to two feet per year. Natural beaches in this category have chronic dune scarps (steep drop-offs) and frontal dune erosion. Some beaches have exposed gravel berms and reduced recreational opportunities at high tide. As above, structures may increase erosion on these beaches. Along some of these beaches where seawalls are present, the seawalls are regularly overtopped during winter coastal storms, and have been undermined during severe coastal storms. In other areas, local overtopping occurs once or twice a year in winter, but is usually restricted to limited areas of beachfront properties.

Slightly erosional beaches have rates of erosion that are less than one foot per year. Of greatest concern for these beaches may be sea level rise over time.

Types of Erosion:

Seasonal Beach Changes

Typically, beaches and dunes undergo a seasonal transformation from a “summer” beach to a "winter" beach. A summer beach has a wide, well-developed berm often with a vegetated dune where American beach grass grows seaward onto the berm. A winter beach is lower, may not have a berm, and often shows signs of loss of beach grass. These differences are caused by seasonal storms and by differences in waves formed by local winds that vary seasonally. Because the Connecticut shoreline is buffered by Long Island, the seasonal variation in winds is minimized relative to shorelines directly adjacent to the ocean. Winter beaches are generally steeper and narrower, while in the summer beach, smaller, calmer waves dominate, and beaches are generally wider and have a gradual slope.

Short-Term (Storm-Induced) Erosion

One large storm or a series of smaller storms can cause significant beach and dune erosion. Storm erosion follows a similar but more rapid pattern than seasonal erosion. Damaging storms, such as nor’easters, usually occur in the fall, winter, or early spring months when the “seasonal” beach profile is already relatively narrow.

Storm-induced changes lower the beach profile and result in extensive loss of the berm. In addition, storm damage usually causes significant dune erosion, scarping, or complete loss of the dune.

Beach scarping (Waterford, Photo credit: Juliana Barrett)

Storm recovery follows a similar process to that of the seasonal beach, with offshore sandbars providing protection, and slow, gradual increase of the berm in response to smaller waves. This can occur over one season, but may take a year or more. Dune recovery is a much slower process. Dunes rebuild by re-established dune vegetation trapping windblown sand. It can take several seasons or even many years for a dune to recover naturally from a large storm event.

Almost all of Connecticut's beaches are moving landward in response to coastal storms and gradual sea level rise. Over the past century sea level in Long Island Sound has risen approximately 10 inches. The landward migration of the beach and dune system is like the motion of a tank tread; the beach migrates over itself in response to storms and sea level rise, but only in locations where glacial deposits are available to replenish the sand supply and infrastructure does not impede natural movement of the beach. The barrier spit at Bluff Point State Park offers an example of beach migration. (See the Changing Beach at Bluff Point State Park) Because the barrier beach at Bluff Point State Park is not affected by infrastructure, the beach migrates in response to storm events and sea level rise.

Long-term Erosion

Long-term erosion is considered permanent erosion that occurs over decades. Long-term erosion is caused by:

- Shore protection structures such as jetties and groins that prevent sand from being transported to the beach;
- Inadequate sediment supply to replace losses due to alongshore and offshore transport;
- Major storm-related events from which the beach is unable to recover naturally.

How do I know if the beach is eroding?

You may have a moderately to highly eroding beach and frequent or recurring problems if:

- Your beach or dunes are continually losing sediment. Look for signs of continued decreasing dune height with no recovery after storm season, continued reduction of beach elevation in front of seawalls, and evidence of sand loss in front of seawalls.
- You see exposed tree roots or peat deposits on the beach which are signs that the surf zone has moved landward to the backside of the beach. Note that presence of these features may only occur after large storms.
- You experience frequent overwash and flooding (i.e., several times each winter) in response to small storm events.
- You experience chronic damage to ashore protection structure such as a seawall or a bulkhead. Chronic damage may indicate that the beach

Peat Deposits on beach in Old Saybrook. Photo credit: Jennifer O'Donnell

Peat Deposits on beach in Old Saybrook. Photo credit: Jennifer O'Donnell

is attempting to migrate landward.
- You are located in certain FEMA flood zones such as VE zones, where breaking waves and coastal flooding occur across the extent of the beach.
- You have a home adjacent to an inlet that migrates on a regular basis. Proximity to a tidal inlet that migrates can increase the erosion hazard of the beach and dune.

You may have a generally stable or slightly erosional beach with minor flooding problems if:

- Your beach or dune is stable or growing seaward.
- Your beach or dune is eroding slightly.
- You have dry beach at high tide and stable, vegetated dunes.
- Your beach or dune erodes during large storms but is able to recover within a year or two.
- You experience isolated overwash and flooding, only after large storms.
- You are not located in a mapped at-risk flood zone. If you are not located within a flood hazard zone, you likely don't have flood insurance because your overall risk of coastal flooding is low, although isolated flooding problems may still occur.

Flood risk changes over time, and as a result FEMA is updating flood hazard maps across the country. Check the National Flood Insurance Program (NFIP) website for updated information.

This shoreline in Old Saybrook has dry beach above mean high water (MHW) and is backed by an established, vegetated sand dune, indicative of a stable beach (Photo credit: Jennifer O'Donnell).

A **BEACH, DUNE AND COASTAL FLOODING CHECKLIST** is attached to help you conduct a field inventory of your property and identify and rank beach and dune hazards.

My beach is eroding. What can I do?

There are a number of options that property owners can consider to mitigate erosion of their shoreline. The first step is to contact town officials, state agency staff, and coastal experts early and often to explore and understand your options. The Connecticut Department of Energy and Environmental Protection Office of Long Island Sound Programs (CT DEEP – OLISP) website Living on the Shore contains information on coastal property owners' Rights and Opportunities, Coastal Permitting, Residential Dock Guidelines and a fact sheet on the Public Trust.

Actions on beaches and dunes could impact threatened or endangered species such as piping plovers. In these cases, consultation with state and federal wildlife agencies will be needed before action can be taken.

Weigh the risks and the costs with assistance from a coastal engineer, certified geologist, or other coastal expert.

There are a number of options for taking action:

Beach Hazard Response Actions at a Glance				
Action	Pros	Cons	Effort	Cost
Do nothing	Low cost, easy to implement	Unexpected results; uncertain future	Low	$
Move landward	Reduces hazard to structures	Expense, site constraints; may not address erosion	Low – High	$$ - $$$
Elevate structure	Reduces hazard	Expense, site constraints; may not address erosion	Low – Med	$ - $$
Design appropriately	Reduces hazard	Expense, site constraints	Low – High	$$ - $$$
Construct Living Shoreline	Reduces wave energy, increases natural processes and wildlife/fish habitat, protects uplands, improves water quality	Expense, site constraints, regular maintenance	Low-Med	$ - $$
Protect, enhance, construct dunes	Protects uplands, adds sand	Expense, site constraints, regular maintenance	Low – Med	$ - $$
Nourish beach	Reuses or adds sediment, creates habitat	Expense, site constraints	Med – High	$$$
Repair a seawall	Repairs may be covered by general permit	Emergency, temporary, expensive; leads to false sense of security; can cause erosion, scouring, undermining of wall, potentially damaging to adjacent and alongshore property and habitats	Low – Med	$$ - $$$

$ - low, $$ - medium, $$$ - high

Do nothing

The erosion of sand dunes and beaches along the shoreline is, to a large degree, a natural process of shaping and reshaping the coastal environment over time. For this reason, doing nothing to address erosion is an option that should be considered. If the erosion is natural and not causing an immediate hazard to property or infrastructure, doing nothing is almost always the least costly and often the environmentally preferable option.

In evaluating the "do-nothing" alternative, assess the level of risk you are willing to accept in conjunction with the existing and expected uses of the property. The "do nothing" alternative makes the most sense if:

- there aren't any structures or areas of critical habitat on your property, or
- the erosion is minimal and any structures are located far away from the eroding shoreline, and
- a defined erosion rate has been determined (in consultation with local experts).

Appropriate site for Do-Nothing approach. Beach and dune show minimal rates of erosion and structures are located away from shoreline. After major storm events when erosion does occur, system recovers naturally. (Beach in Waterford. photo credit: Juliana Barrett)

Move landward to avoid the hazard

Avoiding existing or potential hazards as much as possible is usually a property owner's most efficient and cost-effective response. This is especially true when siting new development, as structures can be built as far away (landward) from the hazard as possible. Poor lot selection and siting decisions are difficult to overcome, although improved design and construction can mitigate the risks. FEMA has produced a series of Fact Sheets to provide technical guidance and recommendations concerning the construction of coastal residential buildings. The State of Louisiana Department of Natural Resources website may be useful in identifying the FEMA fact sheets of interest.

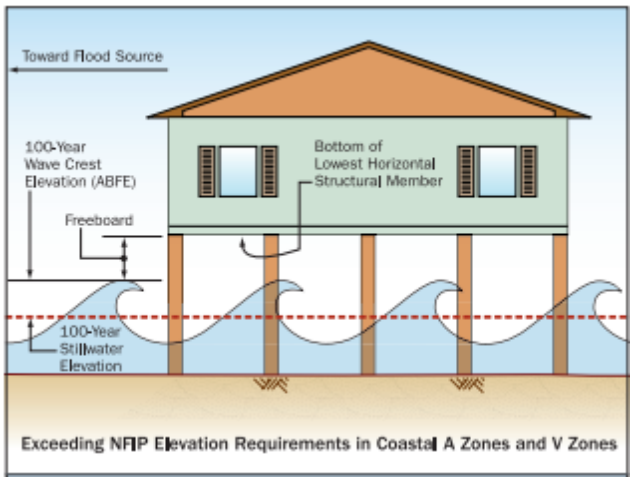
To ensure safety of an existing structure that is being threatened by erosion or flooding, a property owner can elevate a structure or move landward. One of the most effective ways to ensure safety of an existing structure that is threatened by erosion or landslides (bluff erosion) is to relocate the structure out of the hazardous area, typically in a landward direction. Although moving landward can be very effective in minimizing the hazard, it can also be expensive. Costs vary from several thousand dollars to tens or hundreds of thousands of dollars, and are based on the existing foundation of the structure, size of the structure, topography and geology, and distance the structure may need to be moved. Relocation of a structure can also be constrained by the size of a property and any applicable setbacks, such as from other existing structures or roadways.

As much as is practical, consider moving back to avoid some hazards and relocate structures outside a mapped flood zone. Building standards are extremely restrictive in the "V-Zone" which are areas along the coast subject to inundation by the 1-percent-annual-chance flood event (100-year flood event) with additional hazards associated with storm-induced waves. Building standards will be less restrictive if a structure is moved back to the "A-Zone" which is an area subject to inundation by the 1-percent-annual-chance flood event without the additional risk of storm wave action. More information on FEMA coastal flooding building codes can be found on their website.

Consideration should also be given to significant habitat resources or environmentally sensitive areas, which are usually identified by municipal or state regulations.

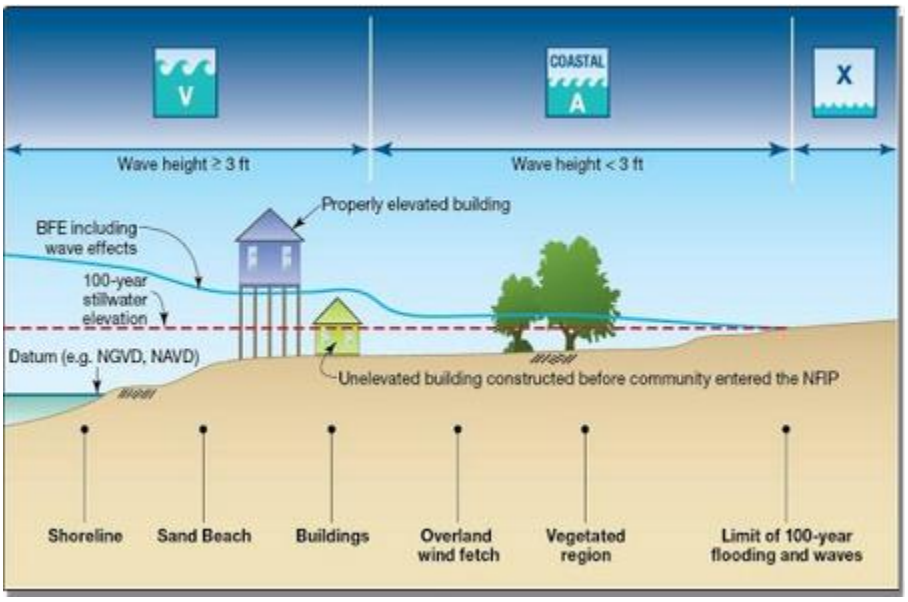
Elevate structures

Existing structures that are threatened with coastal flooding or erosion often can be moved up or elevated. You can check the FEMA Flood Map Service Center to see if your property is in a flood zone.



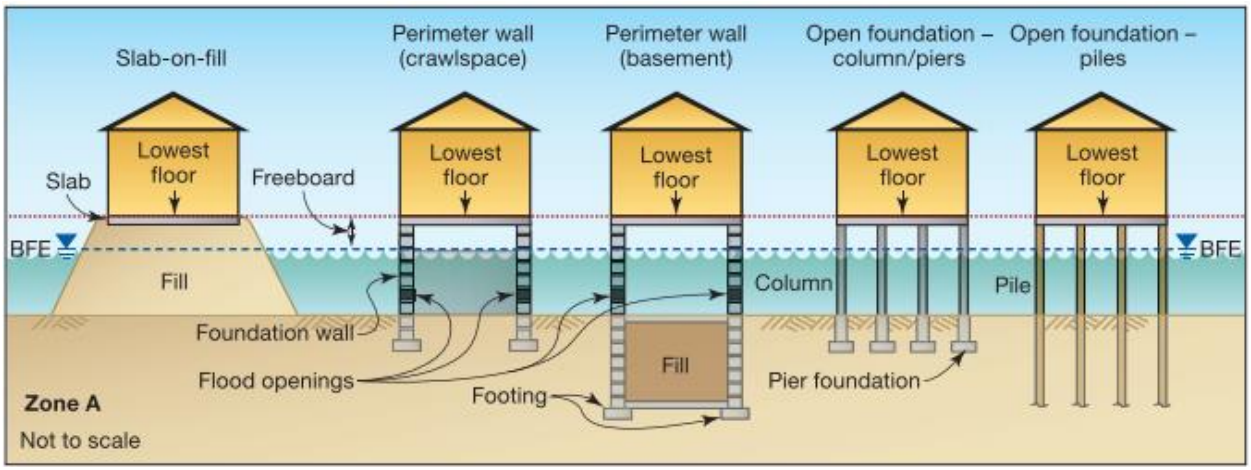
If you are located in a flood zone, your town may require that the lowest structural part of your house be a minimum of one foot above the Base Flood Elevation (BFE). This is typically the minimum standard, but check with your local zoning enforcement officer for local ordinances. (Source: FEMA Designing for Flood Levels Above the BFE, Home Builders Guide to Coastal Construction, Technical Fact Sheet 1.6)

If your structure has been flooded and does not meet current standards, or you are planning updates on your home, consider elevating your structure with a flow-through or pile foundation. If you are planning 'substantial improvements,' meaning that improvements meet or exceed 50% of the value of the structure, Floodplain Management regulations will require that your building be brought up to code, which may include elevating the building and its utilities.



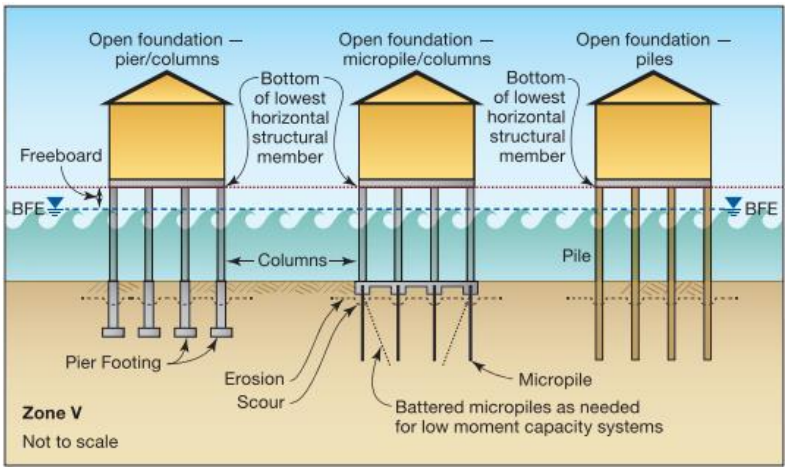
Schematic of FEMA flood zone designations for coastal V, A and X zones (source: FEMA Region II Coastal Analysis and Mapping, Coastal Mapping Basics)

The schematic below shows types of foundations that are National Flood Insurance Program (NFIP) compliant in A-zones where the elevation of the top of the lowest enclosed floor is above the BFE. For more specific information about the NFIP criteria, consult [Hurricane Sandy Recovery Advisory No. 5, Designing for Flood Levels Above the Base Flood Elevation](#) (2013).



(source: [FEMA Foundation Requirements and Recommendations for Elevated Homes Hurricane Sandy Recovery Fact Sheet No. 2 May 2013](#))

Homes in coastal high hazard areas (V-zones) are required to have open foundations, that is, piers, columns, or piles. Open foundations reduce the surface area impacted by flooding and breaking wave loads on the structure and the risk of scour and erosion around the foundation. NFIP requires a licensed engineer or architect to design and certify foundations for buildings in V-zones.



(source: [FEMA Foundation Requirements and Recommendations for Elevated Homes Hurricane Sandy Recovery Fact Sheet No. 2 May 2013](#))

The concept behind these foundation types is that water, sediment, and debris travel through the open foundation, instead of applying pressure and lateral force to the foundation, which can cause structural failure. Both foundation types can significantly reduce potential flood damage to a structure.

In some A zones, fill can be added below a foundation to increase the elevation of the structure to meet floodplain standards. Care must be taken to ensure that this does not increase flood hazard impacts to adjacent properties.

Check with local zoning enforcement for specific standards (such as height restrictions) applicable to your lot when considering any potential elevation options.

Base Flood Elevations (BFEs) are shown on Flood Insurance Rate Maps (FIRMs) and on the flood profiles. Your town may have additional requirements that meet or exceed minimum FEMA standards. Contact your local Zoning Enforcement Officer for more information about building standards and requirements for each flood zone.

You may also want to review the FEMA Coastal Construction Manual and the FEMA Home Builder's Guide to Coastal Construction Technical Fact Sheets. The Coastal Construction Manual is also available as a CD or in print copy by calling FEMA Publications Distribution Facility at 1-800-480-2520. Another source for building safe structures is FLASH (Federal Alliance for Safe Homes).

FEMA recommends consideration of elevating your structure over and above the elevation required by your floodplain ordinance to account for expected rates of sea-level rise and higher future floodplain elevations. This higher "freeboard" (or measure of safety above the base flood elevation) may also reduce flood insurance premiums. Information on financial grants for elevating homes in Connecticut can be found at ShoreUP Connecticut.

If you are considering elevating your home, think about elevating utilities, and designing improvements to ensure your home is more storm and flood resilient.

Design and build new structures appropriately

Construction techniques that are appropriate to coastal areas involve not only siting of the structure and support structures, including septic, utilities, etc., but also design and building techniques that can withstand hazards and potential land, wind, and water forces associated with the dynamic coastal zone.

Things to consider:

- The construction footprint, given applicable setbacks for sensitive areas;
- The extent of grading needed to achieve a stable building footprint;
- The level of engineering required to address erosion or flooding;
- Potential physical forces such as water and wind; and
- Be neighborly. Think about potential impacts on your neighbor's property that may result from an activity on your property, such as adding fill or elevating your structure. At the same time, it may make sense to work with adjacent property owners if a common goal is found or regional approach is being adopted to address particular hazards.

Elevated home. Photo credit: Jennifer O'Donnell

Some of the best and most comprehensive resources available regarding proper coastal construction techniques are the FEMA Coastal Construction Manual and the FEMA Home Builder's Guide to Coastal Construction Technical Fact Sheets. The Coastal Construction Manual is available as a CD or in print copy by calling FEMA Publications Distribution Facility at 1-800-480-2520, and may also be available for review at your local land use office or public library.

Construct a Living Shoreline

Over the last few decades the increasing awareness of the potential negative impacts of hardened coastal protection such as seawalls, bulkheads, and groins, has increased interest in the development of approaches that minimize the destructive effects of traditional shoreline protection approaches on natural habitats. Connecticut has passed legislation to encourage the consideration of "feasible, less environmentally damaging alternatives" of shoreline erosion control.

Living Shoreline example: Marsh protected by low, rock sill. photo credit: Jennifer O'Donnell

Nonstructural approaches (such as beach nourishment, restored or enhanced seagrass, vegetated, graded bluffs and creation or restoration of fringing salt marshes) are frequently referred to as "living shorelines." A living shoreline provides ecosystem services such as marsh habitat that a hard structure such as a seawall does not. In the Chesapeake Bay area, living shorelines have long been used to control erosion from boat wakes along embayments and water courses and may be as simple as coir logs along an embankment or a hybrid structure which combines a hard structure like a rock sill (to slow the wave energy and current) with marsh habitat. (Coir logs are tube shaped erosion control features made from natural, biodegradable materials.) To learn more about living shorelines and see before and after photographs, see NOAA Living Shorelines.

Although Connecticut has not formally adopted a definition for Living Shorelines, the Connecticut DEEP Office of Long Island Sound Programs is using the following working definition:

> *A shoreline erosion control management practice which also restores, enhances, maintains or creates natural coastal or riparian habitat, functions and processes. Coastal and riparian habitats include but are not limited to intertidal flats, tidal marsh, beach/dune systems, and bluffs. Living shorelines may include structural features that are combined with natural components to attenuate wave energy and currents.*

Consistent with this working definition, recent statutory amendments that refer to the concept of living shorelines highlight a necessary resource-oriented component: living shorelines techniques "maintain or restore coastal resources or habitat" [CGS §22a-92(e)] and are projects "for which the primary purpose or effect is the restoration or enhancement of tidal wetlands, beaches, dunes or intertidal flats."[CGS §22a-109(c)].

Not all coastal or riverine sites are appropriate for a living shoreline approach. Living shorelines will be most successful where

- conditions support marsh grass or sand deposition;
- the shoreline is protected from large waves and boat wakes;
- upland vegetation does not shade the shoreline;
- the nearshore region slopes gradually;
- the shoreline is stable or slightly erosional; and
- upland homes and infrastructure are not vulnerable to erosion and coastal/riverine flooding.

The U.S. Army Corps of Engineers has adopted the term "Natural and Nature-Based Features" as a way of improving coastal resilience, and have developed several publications which include the use of vegetated features to attenuate wave energy. See USACOE's Coastal Risk Reduction and Resilience for more information.

Living shorelines are relatively new approaches to shoreline protection in Connecticut. CT Sea Grant, the Connecticut Institute for Resilience and Climate Adaptation (CIRCA) and CT DEEP OLISP are working together to develop guidelines for siting and building living shorelines along the Connecticut coast.

A Story Map modeling site suitability for Living Shorelines in Connecticut is now available.

It is important to work with both a coastal engineer and DEEP OLISP technical and permitting staff to understand the causes of erosion along a particular stretch of shoreline before designing any type of erosion control structure, including living shorelines.

Protect, enhance, or construct dunes

Sand dunes provide natural coastal protection against storm surge and high waves, preventing or reducing coastal flooding and structural damage, as well as providing important ecological habitat. They also act as sand storage areas, supplying sand to eroded beaches. Preserving or enhancing dune systems can help protect coastal property, especially in areas with low or moderate erosion. However, dunes do not provide protection from seasonal beach fluctuations, long-term erosion or inlet migration – no matter how large the dune. Sand dunes are dynamic features so the movement of the landform must be considered for all dune preservation, enhancement, and reconstruction activities.

Protecting Dunes*:* For areas with existing dunes and low erosion rates, simply preserving dunes might be all that is needed to help maintain protection from storms. Other options include planting beach grass, erecting fencing, building dune paths and walkovers to prevent trampling of the dunes in multiple areas. See CT Beaches and Dunes for more information and resources.

Dune grass protected by fencing. photo credit: Jennifer O'Donnell

Sand Fencing: Dunes can be protected in two ways with fencing. Fencing can serve to keep people off fragile dunes and beach grass by designating paths to cross the dunes. Fencing can also serve to help sand accrete in the dunes. MA CZM has a fact sheet on sand fencing. There are numerous considerations when using fencing:

- Fencing, while a low cost option, can be easily destroyed in a storm event.
- Fencing may restrict bird or turtle habitat.
- Fencing should be installed landward of the high tide line.
- There are different patterns of installation to consider depending on beach orientation and wind patterns.

Contact state and local officials before installation of any fence type on the dunes.

Constructing Dunes: Property owners can work together to increase or create dunes as a protective measure. Teaming with your neighbors can help defray construction costs, and create a more storm-resistant dune. Dune construction may

require an individual permit or a Certificate of Permission from the Connecticut DEEP. You should consult with staff from Office of Long Island Sound Programs (OLISP) to determine the appropriate permit process. Dune activities are limited by specific timing windows, mostly related to seasonality of plants and threatened or endangered species such as least terns or piping plovers. If these species are present, you will need to submit a Request for Natural Diversity Data Base (NDDB) State Listed Species Review Form (DEP-APP-007), and all required attachments, including maps, to the NDDB for further review. The process is designed to assist in complying with the State Endangered Species Act program. Maps have been developed to serve as a pre-screening tool to help applicants determine if there is a potential impact to state listed species. You can find these pre-screening maps at CT DEEP NDDB.

Dune construction is not appropriate for all coastal sites as dunes are not simply piles of sand (e.g. a berm) or rocks covered with sand or soil. Natural sand dunes usually start as windblown sand that accumulates in a sheltered area behind some type of obstacle such as piles of seaweed. The obstacle slows down or blocks the wind, causing sand to accumulate behind it. In Connecticut, dunes are often colonized by American beach grass. As the plants grow, they trap additional windblown sand with their stems and their extensive root systems hold sand in place.

Extensive root system on American beach grass (Photo credit: Juliana Barrett)

Because vegetation and sand fencing take a long time to build a new dune, bulldozing has become a common form of artificial dune construction. However,

bulldozed piles of sand are not the same as natural dunes. Natural dunes require a source of sand transported to the beach by waves and currents. Over time, windborne sand causes the dune to grow and move with the local conditions. Lack of a natural source of sand means the constructed "dune" may be just a very expensive and temporary pile of sand.

Other dune creation techniques involve using long geotextile tubes that are filled with sand and then placed so as to create a dune system. The tubes are then covered with sand and planted with American beach grass. This technique has been used successfully in several coastal Connecticut locations but siting of the dune location is critical and requires input from coastal engineers and other experts, as well as possible permitting from state and local officials.

Historical aerial photos and maps can help property owners determine if dunes once existed naturally at their site. Alternatively, a section of dune fencing can be set up to see if it successfully traps sand. The Connecticut Natural Diversity Data Base (NDDB) should be checked to ensure fencing is allowed at the site since fences can disturb nesting birds. In addition to a source of sand, constructed dunes must be placed far enough landward on the beach to withstand the average storm wave run-up. Many beaches are too narrow to support the construction of a stable, artificial dune. For more information on sand dunes and their formation, see Sand Dunes.

In addition to providing protection from storm waves and coastal flooding, restored dunes can provide critical habitat for a variety of plants and animals. Further guidance on dune construction, fencing, and management for restoring dune habitats is provided by the by the Long Island Sound Study in a technical guide on dune management and construction. Massachusetts has a series of fact sheets that also provide information useful to coastal property owners.

Plant vegetation on the dune: Native dune vegetation traps and stabilizes sand on the dune, increasing the dune height and width, thereby providing enhanced protection against storms and related erosion.

Most native dune plants have extensive root systems which, when mature, stabilize the dune system against the forces of erosion. Native dune plants are extremely salt-tolerant and can withstand periodic flooding by tidal water during storms and extreme high tide events.

See the Connecticut Coastal Planting Guide and the Coastal Landscaping Tool for more information on native coastal plantings.

Consider site conditions when using Christmas trees (i.e. Evergreens): Discarded Christmas trees are sometimes used to trap sand. You will find arguments for and against using discarded Christmas trees as erosion control in dunes.

Waterford Beach with Christmas trees to trap sand, photo credit: Jennifer O'Donnell

Old Black Point Beach with Christmas trees, Photo credit: David Kozak

The main argument against using them is that a storm can easily wash them away, even trees that are secured with stakes, causing a cleanup challenge. Location is a key concern when considering this approach for dune restoration. Favorable locations will have**:**

- sufficient available sand for trapping;
- open space between the vegetated dune edge and the highest tides;
- sufficient space between the Christmas trees so the dune is not "carpeted" prohibiting growth of American beach grass;
- dune scarps where the beach grass would have trouble growing until sand builds up to fill in the scarp.

Beach in Waterford with Christmas trees used to trap sand, photo credit: Jennifer O'Donnell

Christmas trees should be fastened together, staked down, or otherwise secured. Like dune fencing, major storms can easily move these trees, scrubbing away sand and dune plants.

Planting Considerations:

Avoid non-native vegetation: The establishment of non-native dune vegetation, such as lawn grass and typical landscape trees and shrubs, should be minimized within the dune because these plants do not have the root systems and salt tolerance necessary to create a healthy dune environment to withstand the sometimes harsh conditions of the coastal environment.

Manage for endangered species: In some cases on beaches and dunes, actions you might take could impact threatened or endangered species such as piping plovers. Always check with CT DEEP Natural Diversity Database to determine if you have rare species present on your property. If present, consultation with state and federal wildlife agencies will be needed before action can be taken.

Plant native dune species: Dune planting typically uses species of plants that are native to the coastal sand dune system. In Connecticut, this includes American beach grass (*Ammophila breviligulata*), which is the dominant dune species. Other common species include: Seaside goldenrod(*Solidago sempervirens*) and Beach pea (*Lathyrus japonicus*).

Seaside goldenrod in tidal wetland. photo credit: Juliana Barrett

Avoid Planting Invasive Species:

Rugosa rose (*Rosa rugosa*), also known as beach or Japanese rose, is native to Asia and was introduced to the United States as a garden and landscape ornamental around 1845. It soon escaped from cultivation and naturalized to the New England coast, where it is now a characteristic feature of seaside Connecticut. Its ability to spread rapidly and shade out native plants has earned this species an invasive designation in some states, and it is not recommended as a plant to introduce to a dune system. In Connecticut, rugosa rose is considered potentially invasive, but is not banned from sale. Where it is already established, removing or pulling out plants is not recommended as it can disturb the sand, and the root system does provide good erosion control. If invasive plant control measures are taken on dunes, aboveground biomass can be removed leaving the root system for temporary erosion control, and native species planted.

Phragmites australis, also known as common reed, is a widespread and invasive plant in Connecticut. It should not be planted anywhere or allowed to spread.

American Beach Grass Planting Techniques: American beach grass is normally planted between November 1 and April 1 while the plants are still dormant, with the optimal planting time considered to be early to mid March. The grass can be planted using the broom stick method: insert a broomstick 8 inches deep into the sand, and place 2 sprigs of grass in each hole. American beach grass is typically planted in staggered rows at 12-18 inch spacings, depending on the application. Fertilization should follow planting. There are numerous fact sheets with details on how to plant and fertilize American beach grass.

Planting dune grass in Fenwick. photo credit: Nancy Balcom

American beach grass can be ordered from a number of New England nurseries but care should be taken to acquire either local genotypes of the species or the Cape variety, which is considered the best for planting along the Connecticut coastline.

Check out a MA CZM fact sheet for more information on planting American beach grass.

A good resource regarding plants is the USDA Natural Resources Conservation Service Cape May Plant Materials Center.

Nourish the beach:

Beach nourishment is defined as the artificial addition of sand, gravel or other similar natural material to a beach or subtidal area adjacent to a beach. This activity may require a permit from regulated DEEP OLISP pursuant to the Structures, Dredging and Fill Act (Conn. Gen. Statutes (CGS) Sec. 22a-359 - 22a-363f, inclusive). It is important to work with both a coastal engineer and DEEP OLISP permitting staff before developing a beach nourishment plan.

Beach nourishment can be an effective, temporary response to coastal erosion, though it tends to be costly, and its effectiveness is generally short-lived (5 years or less), especially in areas with high erosion rates. Generally, there are two sources of material in Connecticut that have been used for beach nourishment:

- "beneficial reuse" of dredged material, usually in conjunction with a federal (US Army Corps of Engineers) dredging project of navigable waterways; and
- upland sourcing of material, typically from a gravel pit, where trucks are used to transport material from an upland source to the beach.

Sand transported landward during Superstorm Sandy used to re-nourish beach. photo credit: Jennifer O'Donnell

Generally, if the U.S. Army Corps of Engineers dredges a project and the material is considered to be clean, beach-compatible sand, the beneficial reuse of dredged materials as beach nourishment is encouraged. If beach nourishment is considered to be a least cost alternative for disposal of the dredged material, the costs of dredging and material placement are borne by the federal government. If not, some cost-matching by a local sponsor (typically the receiving community) is required for the Corps to proceed with a project.

Repair an existing seawall

"Hard" engineering structures like seawalls limit the natural ability of beach and dune systems to adjust to changes in sediment supply and short-term (seasonal and storm-related) and long-term (sea level rise) changes in coastal water levels through sediment exchange. Seawalls can also cause increased erosion of the beach and on neighboring properties. In accordance with the Structures, Dredging and Fill Act, in Connecticut seawalls may only be permitted when necessary and unavoidable for the protection of infrastructural facilities, water-dependent uses, or inhabited structures constructed as of January 1, 1995, cemetery or burial grounds, and where there is no feasible, less environmentally damaging alternative and where all reasonable mitigation measures and techniques have been provided to minimize adverse environmental impacts. Construction of a shoreline flood and erosion control structure above the CJL may require permit approval from CT DEEP and local land use commissions.

Crumbling seawall. Photo credit: Jennifer O'Donnell

Coastal management standards do permit repair of existing seawalls and construction of erosion control measures necessary to protect homes; however, a property owner is not entitled to build a new seawall simply to expand or preserve a lot boundary. In addition to the adverse environmental impacts of such structures, the protection they afford is not an inherent property right. Connecticut law has long recognized that natural coastal processes such as erosion or accretion change coastal property boundaries.

In an emergency, a property owner can make temporary fixes to an existing seawall to protect private infrastructure from storm damage. The specific activities are outlined in the Section 22a-363d of the Connecticut General Statues (CGS) which authorizes CT DEEP to issue emergency authorizations for activities subject to the Structures, Dredging and Fill Regulatory Program. Emergency authorizations are limited to situations that pose an imminent, unforeseen and unacceptable threat to life, health or welfare or significant loss of property if corrective action, otherwise requiring a permit or a certificate of permission, is not undertaken. These authorizations can be issued quickly and contain conditions appropriate for the activity. Temporary authorizations are only available for activities for which CT

DEEP has been authorized to issue general permits and are relatively short in duration (i.e., less than 90 days). Temporary authorization may only be issued once for a maximum of 90 (whether consecutive or not). If you have questions about an emergency, temporary fix to protect your property, contact local, state and/or federal regulatory officials for advice on applicable regulations before proceeding.

Minor maintenance of existing, authorized or legally installed seawalls is covered by a general permit. Minor repair work includes patching concrete, repointing mortar between stone, resetting fallen stones and applying a skim coat to the face of the seawall. No registration is required to be submitted for the activity to be authorized by the general permit. Any modifications to the design of an existing seawall that will alter the size and location of the structure will require an individual permit. Again, contact local, state and/or federal regulatory officials for advice on applicable regulations before proceeding with seawall maintenance or repair.

Damaged seawall Photo credit: Jennifer O'Donnell

If an authorized seawall protecting property is damaged, a coastal property owner may sometimes replace or repair the seawall in-kind and in-place (i.e., same materials, same dimensions as the previously existing structure) with a General Permit issued by CT DEEP. Seawall repair or reconstruction requires a survey plan prepared by a licensed engineer.

If a property owner proposes to change their seawall, an individual permit would be required.

Ready to get started?

After you have considered your options, follow the steps below to gain the environmental and regulatory information needed for decision making. The steps are listed in general order although some steps may be conducted concurrently.

1) Contact local, state and/or federal regulatory officials. Begin by working with your local zoning enforcement office and/or on a FEMA firmette to determine if your property is in a mapped flood zone and if so, what building requirements apply.

2) Consult with and/or hire a professional such as a coastal engineer or environmental consultant familiar with CT DEEP's permitting process who can assist you in the preparation of the application and plans. In most cases local, state, and/or federal regulators can help direct you to the best professional discipline to assist with your specific project. Sometimes it is helpful to have the consultant completing the environmental assessment and the construction contractor present at regulatory consultation meetings.

3) Evaluate your risk. Check your insurance coverage to make sure you have adequate liability coverage related to loss due to shoreline erosion, as well as flood insurance through the National Flood Insurance Program or a private insurance company.

4) Create a Coastal Site Plan. Construction activities landward of the Coastal Jurisdiction Line may have adverse impacts on coastal resources and may be subject to municipal Coastal Site Plan Review. The Coastal Site Plan does not need to be prepared by a professional in all cases; however, a good, clear plan can improve the efficiency and timeliness of any permitting that may be required. Good plans also will be beneficial to the construction contractor and can help avoid costly mistakes during the construction process.

5) Be Neighborly. If the planned project involves work at or near a property boundary, or may affect an abutter's "viewshed," consider sharing the plan with the abutter(s) to make sure they fully understand the work to be performed and the potential impact to their property. This consultation is a courtesy at this stage, and not a regulatory mandate; however, obtaining "buy in" from abutter(s) can potentially avoid neighbor disputes that may lead to costly permitting and/or construction delays.

6) Need a local permit? Share plans with local zoning enforcement to determine what, if any, town ordinances may need to be followed. Local zoning requirements will determine the acceptable activities and location(s) for coastal construction. A

coastal site plan must be filed with the local municipal zoning commission for any proposed building, use, structure or shoreline flood and erosion control structure fully or partially within the coastal boundary. In addition to undertaking stormwater management practices, precautions must be taken to prevent direct construction-related impacts to adjacent resources. The Connecticut Coastal Management Manual contains a Municipal Coastal Management Review Process Flowchart.

7) Need a state permit? Connecticut's permit authority through DEEP's Office of Long Island Sound Programs (OLISP) regulates all activities conducted in tidal wetlands and in tidal, coastal or navigable waters in Connecticut waterward of the Coastal Jurisdiction Line (CJL) under the Structures, Dredging and Fill Act (Conn. Gen. Statutes (CGS) Sec. 22a-359 - 22a-363f, inclusive) and the Tidal Wetlands Act. Three types of permits are issued for activities conducted along the coast, depending on the nature of the work proposed: individual permits, Certificates of Permission (COP) and General Permits. Each involves a different review process, as explained in the overview of Connecticut's coastal permit program. Before submitting a permit application, you should consult with staff from OLISP to determine the appropriate permit process. A pre-application meeting is strongly recommended prior to the submittal of an application. DEEP recommends that you consult with a professional such as a land surveyor, engineer or environmental/marine consultant familiar with the Department's permitting process who can assist you in the preparation of the application and plans. Call 860-424-3034 to request an application package and to schedule a pre-application meeting with the appropriate Permitting and Enforcement analyst who is assigned to the town in which you are proposing the project.

8) Need a federal permit? If the plan involves work below the highest annual tide (HAT) and/or in a freshwater wetland or habitat for endangered or threatened species, a federal permit(s) under the Federal Clean Water Act and Rivers and Harbors Act may be required. Share the plan with all applicable federal authorities to determine what permits may be necessary. Any applicant for a federal Army Corps of Engineers permit for work that would result in the discharge of dredged or fill material into the waters of the United States, including wetlands, may also be required to obtain a state Water Quality Certificate from DEEP pursuant to Section 401 of the federal Clean Water Act. Such work or discharge must be consistent with the provisions of the federal Act and with the Connecticut Water Quality Standards. Generally, certification is made in conjunction with issuance of a state permit under the structures, dredging and fill statutes. In cases where an Army Corps permit is being sought, the applicant may qualify for authorization under a Programmatic General Permit (PGP), which is a more expedited process.

9) Hire qualified contractors who are experienced with the best practices associated with construction in or adjacent to the shoreline.

A **BEACH, DUNE AND COASTAL FLOODING CHECKLIST** is attached to help you conduct a field inventory of your property and identify and rank beach and dune hazards. A checklist can be found at the end of this fact sheet to help you identify and rank beach and dune hazards in this guide and by conducting a field inventory of your property.

COASTAL PROPERTY OWNER: BEACH, DUNE AND COASTAL FLOODING CHECKLIST

This checklist is provided to enable you, the coastal property owner (working independently and with the local Zoning enforcement Officer) to collect basic information on the status of your property. The completed checklist can then be used as a reference for work with professionals (geologists, surveyors, general contractors, architects, etc) contracted for services on the property. Accurately answering as many of these questions as possible will reduce the need to hire professionals to gather these data, thereby saving money. Note: If you have less than five years of familiarity with the property, plan to work through the entire checklist with the help of your local Zoning enforcement Officer.

COASTAL PROPERTY OWNER QUESTIONS

Is there a vegetated sand dune at the seaward edge of the property?

Yes No

Is a dry beach present (sand above normal high tide)?

Yes No

Is there a seawall at the seaward edge of the property?

Yes No

Is there evidence that your dune or seawall is *regularly* overtopped and overwashed by waves, and/or that flooding occurs landward of the dune or seawall crest?

Yes No

Does your seawall have a history of being damaged on a regular basis?

Yes No

Does your dune and beach naturally gain sand after each winter season?

Yes No

How would you qualify the erosion of your dune or beach over the past decade?

_____Highly Erosional (2 feet or more per year)

ZONING ENFORCEMENT OFFICER QUESTIONS

Is the property within the Connecticut Coastal Boundary? (This link takes you to an online map viewer. On the left hand side scroll down and click on Coastal Resource Management and find a box for Connecticut Coastal Boundary. You will need to zoom in on the map to see the boundary line.)

Yes No

Are any of the resources below on the site?

General Coastal Resources

Beaches & Dunes

Bluffs & Escarpments

Coastal Hazard Area

Coastal Waters, Estuarine Embayments, Nearshore Waters

Offshore Waters

Developed Shorefront

Freshwater Wetlands and Watercourses

Intertidal Flats

Islands

Rocky Shorefront

Shellfish Concentration

_____Moderately Erosional (1-2 feet per year)

_____Slightly Erosional (less than 1 foot per year)

_____Stable (no change)

_____Accretional (growing seaward)

Are you located adjacent to a tidal inlet that moves over time?

Yes No Don't Know

Is there an existing structure on the property?

Yes No

How do you use or plan to use your property?

_____No use planned

_____Conservation Property/easement

_____Beach/dune restoration or enhancement

_____Access to the beach only (trail/road/stairs/other)

_____Primary Residence

_____Secondary Residence

_____Expand existing structure size or retrofitting greater than 50% of structure's value?

Yes No

_____Build Additions or Porches greater than 50% of structure's value?

Yes No

Shorelands

Tidal Wetlands

Is the property within one or more FEMA Flood Hazard Zones?

Yes No

If yes, list which zones:

Is the property within the town's coastal zone?

_____ Yes, within town coastal zone

_____ Required setback distance

_____ Outside town coastal zone

What is the distance of the structure from the Coastal Jurisdiction Line? (see Supplementary Materials at link)

_____ feet

If there is an existing structure on the property:

Is the structure currently elevated above the 100-year Base Flood Elevation based on the effective FEMA Flood Insurance Rate Map?

Yes No Don't Know

Does the structure meet your municipality's existing floodplain management ordinance?

Yes No Don't Know

Has the structure been constructed, or retrofitted, to meet existing coastal construction standards?

Yes No Don't Know

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