FLOOD AREA DESIGN GUIDELINES

for CAPE COD

CAPE COD
COMMISSION

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Introduction

Rising flood waters and sea level rise are impacting increasing numbers of properties on Cape Cod. As the pace of change increases and more buildings are impacted, the need for design guidance that is specific to the character of Cape Cod's communities has grown.

Rising flood waters and sea level rise are impacting increasing numbers of properties on Cape Cod. As the pace of change increases and more buildings are impacted, the need for guidance that is specific to the character of Cape Cod's communities has grown.

The Cape Cod Regional Policy Plan includes several goals that led to the development of these guidelines:

> **Coastal Resiliency goal:** to prevent or minimize human suffering and loss of life and property or environmental damage resulting from storms, flooding, erosion, and relative sea level rise, including but not limited to that associated with climate change.
>
> **Community Design goal:** to protect and enhance the unique character of the region's built and natural environment based on the local context.
>
> **Cultural Heritage goal:** to protect and preserve the significant cultural, historic, and archaeological values and resources of Cape Cod.

Addressing all three of these goals, this guide reviews the main strategies available for reducing or eliminating hazards from sea level rise and storm surge to life and the built environment while also protecting the region's distinctive character and historic resources, both in the short term and the long term. In some cases, building retrofit will be appropriate, in others landscape solutions, and in others building elevation, depending upon the specific building involved and its surrounding neighborhood context. The guide also includes Context Case Studies that recommend appropriate designs for specific neighborhood types and specific building types, taking sustainability and possible sea level rise projections into account.

HISTORY OF BUILDING ADAPTATION IN THE REGION

Cape Cod has a history of moving buildings to adapt to its changing coastline, especially those buildings designed to be close to the water's edge. Lighthouses along the Cape's outer beach were moved multiple times from the late 1800s through the 1900s to protect them from the eroding coastal bank, and some lighthouses along Cape Cod Bay were similarly relocated in response to accreting shorelines. Small residential buildings along the shoreline have also been moved. The history of Long Point in Provincetown and Billingsgate in Wellfleet reveal how numerous structures were floated to new and higher ground in the late 1800s, responding to rising sea levels and shrinking land area. Even Cape Cod houses that were not threatened by flooding were sometimes moved to new locations in the late 1800s and early 1900s, as in South Yarmouth's Bass River area where land that had previously been devoted to salt works or other maritime pursuits became available.

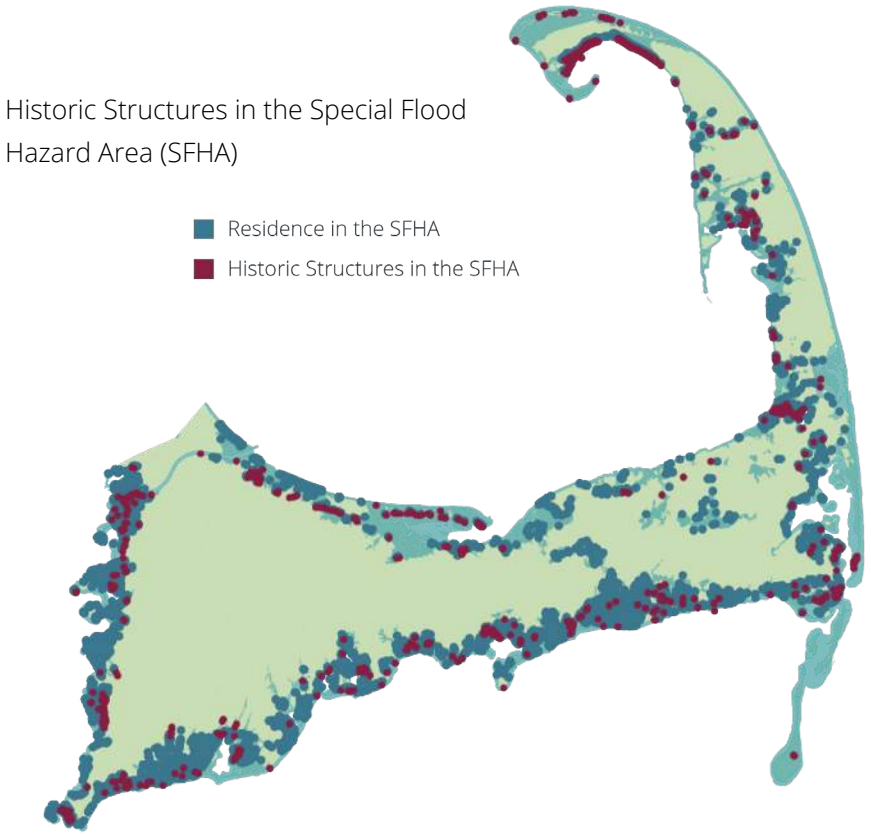
While not in response to rising water levels, some 19th century buildings were constructed on elevated sites with stone retaining walls to give them more prominence -- a feature that also provided protection from flooding. More recently, traditions have shifted to lifting buildings higher off the ground and to landscape solutions such as natural berms and floodwater holding parks. These and other examples provide possible models for adapting the Cape's buildings in flood hazard areas -- relocation, elevation, retrofit, and open lands protection will all be important components in balancing protection from flood risk with protecting the region's distinctive character.

Top: Nauset Light reconstruction after being moved from Chatham in 1923. Bottom: Old Harbor Life Saving Station being moved from Chatham to Provincetown in 1977.

UNDERSTANDING FUTURE PROJECTIONS FOR FLOODING AND SEA LEVEL RISE

Within presently mapped floodplains, 2,092 historic buildings are currently vulnerable to flooding during a storm event. This figure does not include structures that might become inundated during a catastrophic storm with driving winds and rain over a sustained period, such as a hurricane. What we know about future climate conditions based on years of data is that coastal storms will increase in intensity, frequency, and together with higher sea levels and stormwater-based flooding, will result in much greater land areas likely to flood.

We can't predict exactly when and how much seas will rise above current levels, but we know that for the foreseeable future, sea levels will continue to rise. The Boston tide gauge has recorded a .95 ft rise in relative sea level since 1921. Under current conservative estimates for sea level rise (SLR) based on greenhouse gas emissions and trends, the Intergovernmental Panel on Climate Change estimates that North



On Cape Cod, 20% of inventoried historic structures (more than 2,000) are within flood hazard areas. The greatest number of these structures are in Falmouth, Barnstable, Provincetown, and Truro.

Plaques mark buildings relocated from Long Point to downtown Provincetown in the late 1800s; Signage at Wellfleet Bay Wildlife Sanctuary illustrates projected future flood levels along their trails.

America may see as much as 2 ft of sea level rise by mid-century, and a potential 7 ft by 2100. New England may see greater changes due to land subsidence (sinking of the continental shelf). Sea level rise alone may place 184 historic structures in danger of twice daily tidal inundation by 2050. When these increased tide heights – in other words, the shifting of coastal wetland resource areas landward - are combined with the effects of wind-driven storm surge and flooding during storm events, many more valued resources of the region will be vulnerable to flooding (https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8443970).

These guidelines work in cooperation with other projects of the Cape Cod Commission and the Cape Cod Cooperative Extension Coastal Team that respond to sea level rise and flooding. The Resilient Cape Cod project explored a broader range of adaptation strategies than are explored here. These design guidelines primarily expand upon four strategies: Retrofitting Structures, Structure Elevation, Stormwater Management, and, to a lesser extent, Transfer of Development Rights. The entire list of Adaptation Strategies and their associated Educational Fact Sheets can be accessed on the Cape Cod Commission website: www.capecodcommission.org/our-work/resilient-cape-cod. A Model Resiliency Bylaw is also available to guide future development in hazard areas (www.capecodcommission.org/our-work/coastal-resiliency-bylaw).

Education has become an increasingly important component of flood preparedness, helping people to understand where change has already occurred, and the rate of change projected for the future. Signage that illustrates where buildings have been moved and where flood waters are projected is encouraged as a constant reference to the adaptation that is needed to address climate change in the region.

RESPONDING TO NEIGHBORHOOD CHARACTER

Cape Cod relies on its character to attract both residents and visitors, so preserving community character is an important element of protecting the region's history and its economic base. The range of neighborhood character types on Cape Cod is represented in the eight distinct Placetypes identified in the Regional Policy Plan. Those Placetypes that are defined by their scenic elements and the prevalence of cultural resources are particularly sensitive to change and require careful consideration: Rural Development Areas, Historic Areas, Maritime Areas, and Community Activity Centers.

CAPE COD PLACETYPES

The range of neighborhood character types on Cape Cod is represented in the eight distinct Placetypes identified in the Regional Policy Plan.

NATURAL AREAS

Natural Areas are generally the region's least developed and most sensitive areas.

RURAL DEVELOPMENT AREAS

Rural Development Areas are defined by a high percentage of open lands and sparse building development patterns that contribute to the unique rural and scenic character of the region.

SUBURBAN DEVELOPMENT AREAS

Suburban Development Areas include residential neighborhoods built primarily between the 1950s and 1990s as well as automobile-oriented commercial and light industrial development established during the same time period.

HISTORIC AREAS

Historic Areas consist of concentrations of historic structures, including local and/or National Register districts located in a small-scale village setting.

MARITIME AREAS

Maritime Areas are clusters of commercial and mixed-use development that contribute to Cape Cod's working waterfronts and harbors.

COMMUNITY ACTIVITY CENTERS

Community Activity Centers are areas with a concentration of business activity, community activity, and a compact built environment. Buildings are generally smaller in scale and connected by a network of streets, ways or alleys.

INDUSTRIAL ACTIVITY CENTERS

Industrial Activity Centers are lands containing industrial uses that are suitable for future industrial activity as well as emerging industries.

MILITARY AND TRANSPORTATION AREAS

Military and Transportation Areas consist of large land areas developed with and devoted to infrastructure such as airports, transfer stations, waste disposal facilities, and Joint Base Cape Cod.

Rural Development Areas

VISION: To ensure that development is located, sited, and scaled appropriately to avoid impacts on scenic and/or cultural resources, and to help maintain the economic diversity that agriculture can provide for the region including opportunities for the continuation of traditional agricultural occupations, and for the availability of locally-grown food.

Historic Areas

VISION: To protect historic resources and to support infill development that respects the form, scale, and character of existing historic areas.

Maritime Areas

VISION: To support the fin- and shell-fishing industry as well as other commercial, recreational, educational, and research activities associated with the marine environment and to protect water dependent trades.

Community Activity Centers

VISION: To accommodate mixed-use and multifamily residential development in a walkable, vibrant area, preserve historic buildings, and to provide diverse services, shopping, recreation, civic spaces, housing, and job opportunities, with adequate infrastructure and pedestrian amenities to support development.

Placetypes that are defined by their scenic elements and the prevalence of cultural resources are particularly sensitive to change and require careful consideration: Rural Development Areas, Historic Areas, Maritime Areas, and Community Activity Centers. The Regional Policy Plan provides vision statements for all eight Placetypes. See www.capecodcommission.org/rpp.

Most Cape Cod neighborhoods developed over a long period of time and have a variety of structures with different building heights and architectural styles, but many also have consistent characteristics of scale and relationship to the street that should be maintained as they adapt to address flood hazards. In neighborhoods with historic resources, insensitive alterations can threaten their historic integrity, destroying the record of local history and the economic base they provide. To find appropriate adaptation solutions requires first acknowledging the defining physical characteristics of a neighborhood, including the proximity of buildings to each other, the general height and shape of buildings, their setback from the street, the prevalence of pedestrian-oriented features like display windows and porches, and the amount and size of open spaces nearby. It also requires identifying the character-defining features of individual buildings that need adaptation, respecting their orientation and roof form, relationship to the street, entry design, and architectural detailing.

There are benefits to addressing adaptation issues at the neighborhood level, especially in distinctive and densely developed areas where buildings are close to each other and have a consistent design character. If storefronts are floodproofed, they should use consistent barriers along a common streetscape. If buildings are elevated, they should be raised to similar base heights to preserve their relative scale and relationships to each other. Similar treatment of other design features such as moving buildings back from the street edge before elevating, screening the space under elevated buildings, and creating fence walls or landscape features to soften the change in height are also important. While elevated buildings will look very different, if their underlying forms and relationships to each other are preserved, the consistent neighborhood character will remain apparent. Towns can support this by adopting height regulations and design criteria to guide building and site modifications in response to sea level rise. Regulations can be addressed through underlying zoning, overlay districts, and where applicable, historic district regulations.

Elevate buildings in a neighborhood to a consistent base elevation height in order to help protect established character.

HOW TO USE THESE GUIDELINES

STRATEGIES

The Strategy sections below explore a range of possible adaptation alternatives. Any particular strategy may be appropriate in all or only some neighborhood contexts, depending on the existing features that define the neighborhood.

HISTORIC STRUCTURES

Throughout the guidelines, there are specific call-out boxes recognizing issues of special concern for historic structures.

CASE STUDIES

The Case Study sections that follow illustrate those strategies that are most likely to be appropriate to specific neighborhoods and building types. Consistent treatment of buildings in the same neighborhood is important to maintaining a cohesive character. The more similar the neighborhood building forms, the more important consistent treatments will be in protecting that area's distinctive character.

Strategies

The Strategy sections explore a range of possible adaptation alternatives including building, neighborhood and site solutions. Any particular strategy may be appropriate in all or only some neighborhood contexts, depending on the existing features that define it.

Range of Possible Adaptation Strategies

STRATEGIES

Building Solutions

- RETROFIT
- RELOCATION/RETREAT
- ELEVATION

STRATEGIES

Neighborhood and Site Solutions

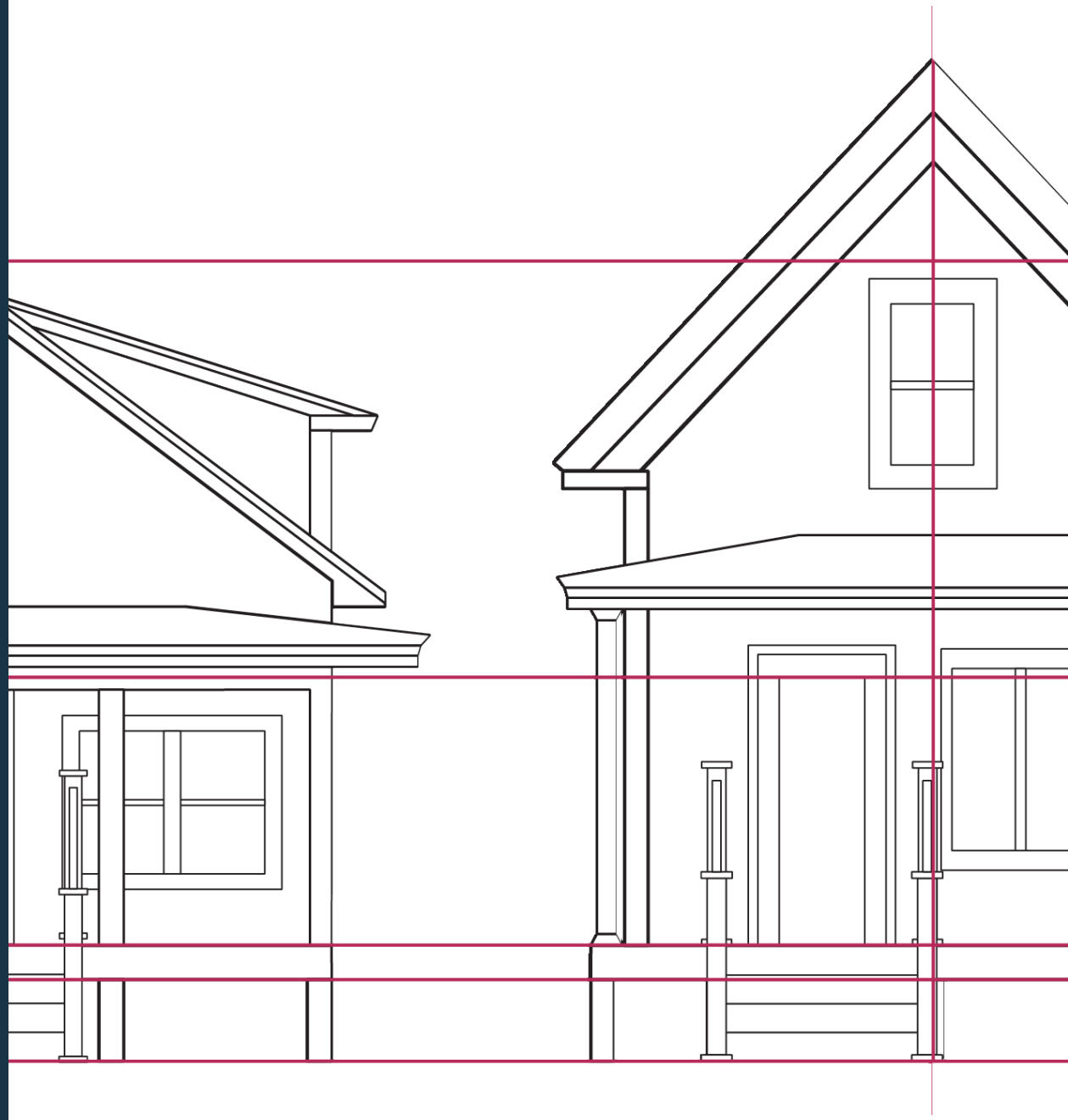
- TEMPORARY SITE BARRIERS
- PERMANENT SITE BARRIERS
- LANDSCAPE SOLUTIONS/GREEN INFRASTRUCTURE

Special Considerations for Historic Structures

STRATEGIES

Building Solutions

This section addresses physical changes to buildings to address flood risks, ranging from very visible changes that raise or relocate buildings out of harm's way to retrofits that may not be visible from the outside.



BUILDING SOLUTIONS
STRATEGY

Retrofit

Strengthening a property to withstand flood waters in its current place can be appropriate for certain buildings, particularly those that do not have residential uses on the ground floor, those that are built of masonry or other materials that can withstand the expected flood impacts, buildings that are difficult to elevate, buildings in areas with low flood levels, and buildings associated with water-dependent uses. Retrofit allows a building to retain much of its existing form and therefore may also be appropriate for some historic structures where elevating the building would destroy key historic features. The majority of the Cape's buildings are constructed of wood, which will be more challenging to floodproof than masonry structures.

Building retrofits include elevating mechanical systems (left), filling basement areas, dry floodproofing (center), wet floodproofing (right), and elevating the interior first floor.

Building retrofit can be implemented in several ways depending on the cause and extent of flooding, including relocating mechanical systems to higher levels, filling basements with sand or gravel, dry floodproofing (which involves keeping water out of the building), wet floodproofing (which allows the building interior to be flooded and then dried out), and elevating the lowest interior floor level. In some cases, building retrofit may provide an acceptable short-term solution but long-term protection may require different strategies like relocation or elevation.

ELEVATE MECHANICAL SYSTEMS

Raise electrical, heating, ventilation, plumbing, and air conditioning equipment to upper interior floors or to exterior platforms above projected flood levels to prevent water from entering or accumulating within the components during flooding conditions. Other systems like water, septic, and sewer will also require design components that prevent floodwater infiltration or contamination. Anchor or elevate fuel tanks and ensure vents and fill line openings are above Base Flood Elevation (BFE) to prevent serious impacts from fuel spills and fire hazards. Work with engineers and certified installers to ensure designs are appropriate.

DESIGN GUIDANCE

1. Locate exterior platforms for mechanical systems on less visible side and rear elevations and design them to be as streamlined as possible. If the platform will be visible, incorporate distinctive architectural details such as picket fencing or wide-open lattice derived from designs in the neighborhood or screen with landscaping.

Raised platform on rear portion of side elevation for elevated mechanical equipment.

2. Relocate interior mechanical systems to a higher floor within the existing building footprint or design a small one-story addition on a less visible facade and preferably one that will not increase the building silhouette when viewed from the street or other public ways.

Small side addition to house mechanical equipment in an elevated interior space.

CONSIDERATIONS FOR HISTORIC BUILDINGS

In historic buildings, relocated mechanical systems should not alter or obscure any distinctive architectural details, and they should be kept away from primary facades whenever possible.

Buildings in Sandwich's Factory Village National Register Historic District have simple yet distinctive facades that should be preserved.

FILL BASEMENT

To minimize flood damage and reduce the potential for structural damage, fill in basement areas with sand or gravel, in combination with elevating mechanical and utility systems to a higher floor level and installing flood vents. This approach is most appropriate in areas where projected flood levels are modest; it is not recommended in areas where wave velocity is a concern and buildings should be elevated on an open foundation.

DESIGN GUIDANCE

1. Permanently seal water access points such as basement doors and windows. When sealing openings below flood risk level that are an integral part of the building design, reference their shape with a change in building material or an inset in the wall to create a distinct shadow line.

The original location and size of a basement window is preserved with inset bricks.

2. Relocate basement space if critical to the use of the property, by developing attic space, a modest addition to building, or constructing a small accessory building. Whenever possible, the building footprint and building silhouette should not be increased.

A small addition to the side can take the place of basement area.

CONSIDERATIONS FOR HISTORIC BUILDINGS

When sealing off basement level features in historic buildings, document existing conditions first with photographs, and design covers in a way that retains or incorporates existing architectural detailing, entries, windows or other features.

This elevated building includes architectural trim at the original base of the siding to illustrate the building's original scale. Different materials below the architectural trim would highlight the change even further. The enclosed basement area includes corner boards and window forms that complement the building's original details.

DRY FLOODPROOF

Dry floodproofing means making a building watertight, substantially impermeable to floodwaters. This form of floodproofing requires the building be properly anchored to resist flotation, collapse, and lateral movement and may also require reinforced walls to withstand flood forces. It is most appropriate for non-residential reinforced masonry structures or foundations that will experience infrequent flooding at a level below 3 feet. Dry floodproofing cannot be used to bring a residential structure up to code except for certain qualifying historic structures. Work with a professional engineer or architect to implement dry floodproofing to ensure the safety of the structure.

DESIGN GUIDANCE

1. Apply masonry materials below flood risk level and cover with brick, clapboard, or shingles consistent with building and neighborhood character. Use membranes/sealants to reduce floodwater seepage through walls and wall openings

The lower portion of this building is a concrete water barrier covered with shingle siding and paneling to maintain the building's character.

2. Use temporary flood shields/ de-mountable flood gates where openings can't be permanently sealed. Modify the design of water access points to repel water through such measures as the installation of exterior bulkheads over open cellar stairwells and basement windows

Tracks for drop-in flood barriers at ground-level doors (shown on left in building photo); water-tight exterior bulkhead over cellar access point.

CONSIDERATIONS FOR HISTORIC BUILDINGS

Dry floodproofing for historic buildings should include means to protect important architectural features below the flood risk level such as detailed entries, windows, and porches on the primary building facade. If temporary flood shields or de-mountable flood gates are used, they should be designed to avoid damaging existing architectural features. If openings must be permanently sealed below the flood risk level, the original design of the opening should be kept visible by slightly recessing the infill material. Waterproof coatings or membranes should be chosen carefully to insure they do not trap moisture in the original materials and cause deterioration.

Historic structure on left with masonry walls below flood level. Entry could be protected with drop-in flood shields without changing entry style or detailing, as with building on right.

WET FLOODPROOF

Wet floodproofing allows a structure's interior to be flooded to equalize hydrostatic pressure on exterior walls, surfaces, and supports during a flood. It requires water to move in, through, and out of a building at a consistent rate and thus should be limited to specific situations where buildings are constructed of masonry or other floodproof materials or where inundation would occur in unfinished, non-living spaces that can dry out easily. Use of wet floodproofing requires careful consideration by structural engineers and installation of sump pumps and floor drains to allow proper drying and cleaning techniques after the floodwaters recede.

DESIGN GUIDANCE

1. Install flood vents in foundations and lower building walls where they can be most effective and where they can either be screened with landscape features or consistent with the design of the building facade.

Flood vents allow water to flow in and out of unfinished and finished living spaces.

2. Use traditional flood resistant materials like stone, brick, or concrete in unfinished spaces like garages and basement storage areas to facilitate drying out after water has entered the area. Maintaining sand floors or drains in these areas is also appropriate.

Stone facing provides a flood resistant material on wall sections that are likely to be exposed to flooding.

CONSIDERATIONS FOR HISTORIC BUILDINGS

Wet floodproofing an historic structure may require removing significant historic materials from floor levels where floodwaters would be allowed to flow or encasing them in floodproof materials. Care should be taken in installing flood vents to avoid destroying significant historic features in building foundations or building walls. If original building materials need to be removed or replaced for this treatment, alternative strategies such as dry floodproofing or site barriers should be explored first. Documentation of original conditions is important prior to making any changes.

ELEVATE INTERIOR FIRST FLOOR

Elevating the interior floor level several feet allows the activity within a building to be lifted above the flood level while keeping the front facade and building structure in their original configuration. This technique is most appropriate for commercial storefronts and similar non-residential uses that have distinctive streetscape architecture, masonry foundations and sufficient ceiling height. Once inside the building, several stairs or a ramp provide access to the raised floor level. Done in concert with dry floodproofing the lower portion of the building, this technique provides increased protection for the uses inside.

DESIGN GUIDANCE

1. Retain materials and detailing on the front facade of the building and provide masonry backing to display windows or other materials that need strengthening.

Woods Hole storefront with ramp and steps to access raised interior floor.

CONSIDERATIONS FOR HISTORIC BUILDINGS

Elevating the first floor on the interior should be considered carefully if there are important historic materials or spaces in the building interior. Interior elevation preserves the building's street entry and original streetscape, but additional techniques such as temporary or permanent flood barriers may be needed to protect exterior architectural detailing and materials from flood damage.

When the Marine Biological Laboratory restored the Candle House in Woods Hole, they moved all office spaces to upper floors of the building.

BUILDING SOLUTIONS
STRATEGY

Relocation/Retreat

Relocating a building outside of flood hazard areas may be the best solution in situations where flood hazards are significant, or where properties are large and varied enough to include land outside designated or projected flood zones. Towns with many properties in flood hazard areas should try to identify those properties that are most important to the community, and which may be best preserved by moving to a new location. They may also identify potential upland areas where buildings of high community value can be relocated together to provide long-term protection and maintain some community relationships. Towns should consider enacting provisions to allow transfer of development rights to facilitate such relocations.

Relocation options include relocating a building on the same site, to a nearby site, or to a new neighborhood.

RELOCATE BUILDING ON THE SAME SITE

This option is for properties that are large enough to have varied topography and land area outside flood hazard areas (and projected future flood areas).

DESIGN GUIDANCE

1. Relocate building to another portion of the same property that has a higher elevation and is outside the flood hazard area.

This historic house in Chatham was relocated on the same lot to preserve it while allowing room for new construction.

2. Remove some portions of the building that are within the flood zone (sometimes only a small ell or rear deck is within a flood zone) and relocate that part of the structure to an area outside the flood risk area.

CONSIDERATIONS FOR HISTORIC BUILDINGS

When relocating an historic building elsewhere on the same site, maintain a similar orientation to the roadway and other prominent features whenever possible. Document the original conditions prior to relocation.

Document the original condition in photographs and plans.

RELOCATE BUILDING TO A NEARBY SITE

This option is appropriate when the building is worth preserving but the site is difficult to protect and where neighboring areas offer very different levels of flood risk and open lands that can accommodate a moved structure.

DESIGN GUIDANCE

1. Relocate building to another site in the same neighborhood or watershed, taking advantage of areas with higher elevations. Maintain a similar relationship to familiar neighborhood features and amenities when possible.

This historic horse barn on Ballston Beach in Truro was relocated by Castle Hill to Edgewood Farm. The structure still remains in the Pamet River valley. Images from Castle Hill.

CONSIDERATIONS FOR HISTORIC BUILDINGS

Relocating an historic building outside of a flood hazard area can provide long term protection for the structure, but it removes the structure from its original setting which may have been part of its significance. When selecting a new location, it is preferable to choose a site within the same neighborhood or in an area with similar characteristics whenever possible. Document the original conditions prior to relocation.

Orleans building lifted in preparation for relocation.

RELOCATE BUILDING TO NEW NEIGHBORHOOD

This option is appropriate when a structure is worth preserving but there is no safe location where it can be moved within its existing neighborhood.

DESIGN GUIDANCE

1. Relocate building to a new neighborhood and maintain a similar orientation to the streetscape or to prominent landscape features if possible.

2. Insert relocated building into an existing neighborhood by placing it on a vacant parcel or orient it as an accessory structure on an already developed parcel. Underutilized areas in large parking lots, golf courses, or other low-density developments may provide possibilities for relocation.

This Falmouth home was relocated from Chappaquoit Island to North Falmouth to save it from demolition

CONSIDERATIONS FOR HISTORIC BUILDINGS

Sometimes the only feasible way to provide long-term protection for an historic structure is to move it far from its original setting. Interpretive markers can help to explain the reason for this change. Document the original conditions prior to relocation.

The 1827 Caleb Nickerson house was saved from demolition and moved to the Nickerson Family Association.

Elevation

Base Flood Elevation and freeboard requirements will determine the amount a building should be elevated to provide protection from flooding, but because elevating buildings will impact community character, especially when buildings are raised more than a few feet, design details will be important to create a new aesthetic that relates to the region's established building forms and patterns. This applies to existing buildings that will be elevated, as well as to any new or replacement construction that is elevated. Significant changes in building height may look out-of-place and block views. Large new enclosed spaces beneath the building can make it appear massive and overwhelm smaller properties nearby. In developed coastal or maritime neighborhoods, moving front doors, windows, and porches from the sidewalk or street level changes the neighborhood character and makes it less pedestrian-friendly. The larger the building and the higher the elevation needed, the more important it is to derive creative solutions from historic precedents and from existing neighborhood design features.

Historic buildings in Sandwich, Hyannis Port, and Woods Hole on sites elevated with low stone walls.

Historic sites on Cape Cod were sometimes elevated with low stone walls around the perimeter of the yard, modeling one possible way to lift a building above flood level while keeping it tied to the ground.

Historic Bourne and Hyannis Port buildings with inset shingle walls below base floor height, extended stairs, and landscaping.

Historic buildings constructed with partially exposed lower floors suggest design solutions for siding, window treatment, and stair access to elevated buildings, highlighting how areas below flood level can be treated differently while adding interest to facades.

Historic buildings in Wellfleet and Provincetown with narrow elevated front decks and streetscape plantings that provide a gradual transition to the higher entry elevation.

Landscape treatments that create layers of plantings and low fences with open decks and broad stairs also model ways to distract from height increases.

Wellfleet oyster shack and Provincetown wharf building with open space below.

For water-dependent uses and outer beach camps, open piers are traditional and suggest where the silhouette should be limited to the elevated building, with views through the space below.

8 KEY PRINCIPLES FOR ELEVATING BUILDINGS ON CAPE COD

1. Limit building silhouette. An elevated building will have an increased silhouette and overall massing which needs to be balanced by efforts to reduce the apparent massing to preserve the region's traditional building scale. Design narrow building additions when working with elevated structures to avoid expanding the silhouette.

2. Limit porch or deck areas. Encircling a building with porches or decks widens the building base substantially and changes the traditional proportions. New porches and decks should follow traditional conventions and proportions, placing them at the front entry and rear elevation or wrapping one corner of the building.

3. Maintain street level of interest. Buildings that are part of a neighborhood or commercial streetscape connect to and interact with pedestrians through porches, display windows, detailed entrances, or landscape elements. Elevated buildings must re-establish that connection to the streetscape through design features.

4. Leave open areas under buildings. Cape traditions show that buildings in proximity to the water were elevated with open pile foundations, allowing views to the water beneath the building. This also helps reduce the overall enclosed massing of the building, making it more consistent with the region's traditional small scale.

5. Use skirting designs that reflect the neighborhood and local traditions. Skirting is most appropriate for buildings elevated a modest height above the ground. Incorporate familiar architectural detailing that references Cape Cod vernacular wood styles. Dark colored skirting, inset several inches to distinguish it from the main building mass, will recede into the background more easily.

6. Use layers of landscape plantings and low fences. Vegetation, arbors, window boxes, and patios can distract from the building's elevation. Place landscape elements both at the building edge and at the street edge to draw the eye to pedestrian-height elements.

7. Elevate buildings in a neighborhood to a consistent base elevation height. Neighborhoods or blocks can best preserve their character if buildings are elevated to a similar height, preserving their relationships to one another. Consistent skirting designs and streetscape treatments will also help protect an area's distinctive character. The same is true if buildings are set back from the street to accommodate access or soften the change in building height.

8. Make parking and garage doors secondary to pedestrian features. Large garage doors and parking areas will become dominant features of a street-facing facade unless they are carefully designed. Any garage or parking should be screened by pedestrian-focused elements like entry stairs and seating areas, especially in areas with high pedestrian activity.

ELEVATING 1-3 FEET

ELEVATING A BUILDING 1-3 FEET

Elevating a building 1-3 feet can usually be accomplished with limited impact to the building or neighborhood character because this amount of change often falls within the range of existing building heights. The general proportions of building wall to top of foundation height are still familiar, and features like doors and windows remain at a height that can be appreciated by pedestrians on the street. The overall height of the building will increase only modestly, but if combined with new additions could impact views from adjacent properties. Changes to the entry structure will be needed to make the transition between ground level and the new entry elevation.

ELEVATING 1-3 FEET

KEY ELEVATION PRINCIPLE

Limit Building Silhouette

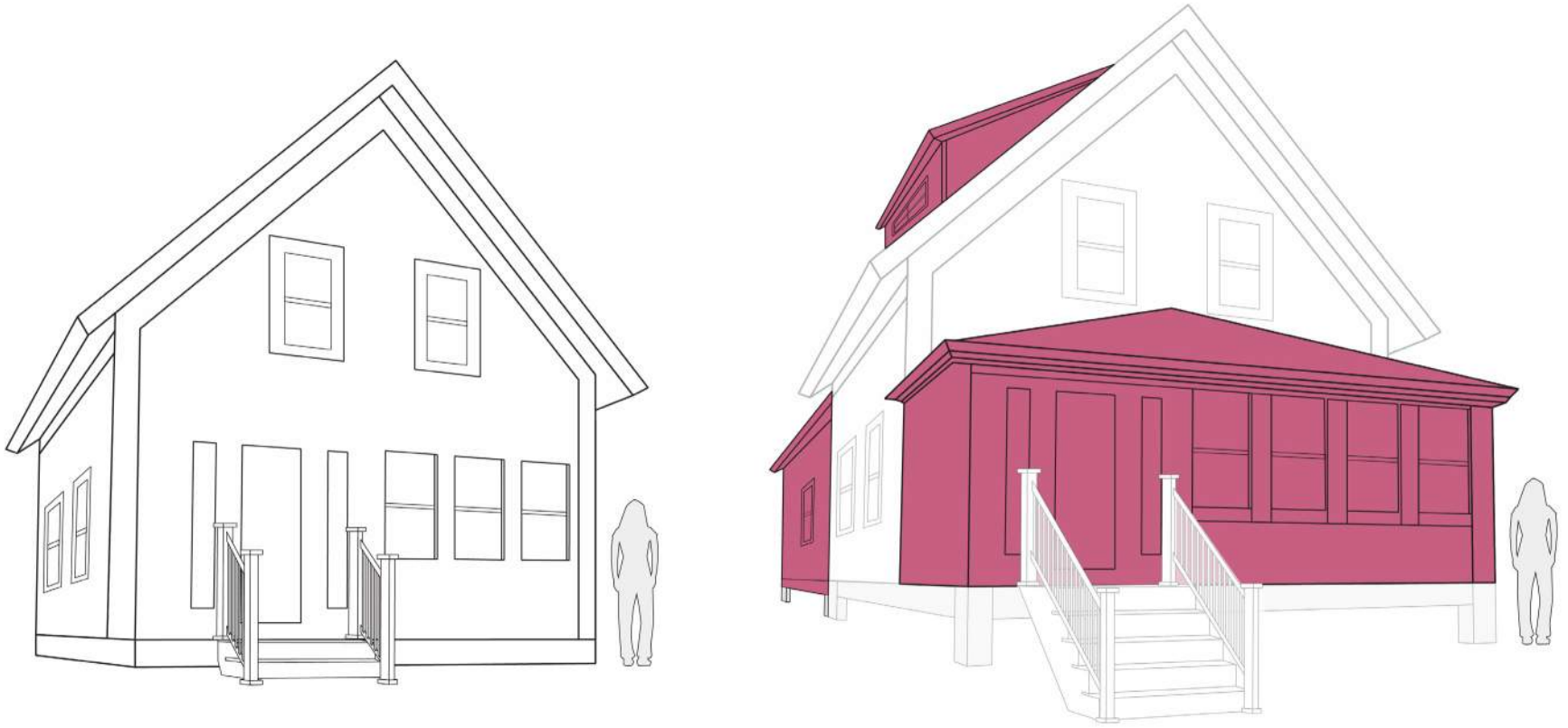
Preserve existing building scale and relation to neighboring buildings with small building masses and additions that hug the main building mass.

1. Design a modest main mass and narrow building additions to avoid expanding the silhouette beyond that created by the increased elevation. Keep any additions close to the main mass and compact, especially if they could block views through the site to the water.

2. Accommodate any utilities relocated from the basement in interior closets or on exterior building walls, either on a raised platform or in a small addition with a streamlined silhouette.

Keeping the side addition at one story and designing the entry deck to cover only a portion of the front facade preserves the modest scale of this building.

ELEVATING 1-3 FEET



Limit building silhouette. An elevated building will have an increased silhouette and overall massing which needs to be balanced by efforts to reduce the apparent massing to preserve the region's traditional building scale. Design narrow building additions when working with elevated structures to avoid expanding the silhouette.

ELEVATING 1-3 FEET

KEY ELEVATION PRINCIPLE

Maintain Street Level of Interest

Elevated buildings must re-establish the connection to the street and the neighborhood through design features such as a prominent main entry.

1. Design extended entry stairs facing the street wherever possible or turn stairs 90 degrees to run parallel to the front facade if space is limited.

Left: Falmouth home with extended stairs that face the street and keep the entry prominent. Right: Provincetown home with stairs turned 90 degrees due to narrow setback from street.

2. For buildings without a front porch, a narrow open deck or stair landing with seating can animate the elevated building front with pedestrian features. This may be appropriate especially in densely developed areas.

Left: Example of narrow front deck that invites pedestrian activity in Chatham. Right: Another way to provide pedestrian access is with a central deck structure that provides elevated access to several buildings arranged around a courtyard as in this Chatham example.

ELEVATING 1-3 FEET

Maintain street level of interest. Buildings that are part of a neighborhood or commercial streetscape connect to and interact with pedestrians through porches, display windows, detailed entrances, or landscape elements. Elevated buildings must re-establish that connection to the streetscape through design features.

ELEVATING 1-3 FEET

KEY ELEVATION PRINCIPLE

Use skirting designs that reflect the neighborhood and local traditions

Incorporate familiar architectural detailing that references Cape Cod vernacular wood styles.

1. Screen elevated foundation materials with architectural detailing that differentiates between the main body of the building and the extended foundation wall to add interest while preserving proportions.

2. Use skirting styles that follow neighborhood traditions of wooden horizontal louvers, vertical slats, and lattice patterns, or that echo traditional brick or stone foundation materials or a combination of wood and masonry. White skirting provides contrast to weathered shingle buildings above, while natural wood tones and dark colors are a good alternative for buildings that are a lighter color.

3. Inset skirting several inches from the building mass to further distinguish it from the mass of the elevated building.

Extended foundations with traditional masonry, wood lattice screening, and vertical boards provide contrast with the primary exterior siding material while expressing neighborhood traditions.

ELEVATING 1-3 FEET

Use skirting designs that reflect the neighborhood and local traditions. Skirting is most appropriate for buildings elevated a modest height above the ground. Incorporate familiar architectural detailing that references Cape Cod vernacular wood styles. Dark colored skirting, inset several inches to distinguish it from the main building mass, will recede into the background more easily.

ELEVATING 1-3 FEET

KEY ELEVATION PRINCIPLE

Use layers of landscape plantings and low fences

Landscape plantings of varying heights, combined with traditional picket or split rail fences, distract from elevated foundations.

1. Screen elevated foundation materials with plantings, or with landscape materials (this option will need to consider storm water impacts on the site and immediately off-site and may not be acceptable in all cases).

Natural and formal plantings along the building edge, and low fencing, help screen the additional height of these buildings in Sandwich and Falmouth.

ELEVATING 1-3 FEET

Use layers of landscape plantings and low fences. Vegetation, arbors, window boxes, and patios can distract from the building's elevation. Place landscape elements both at the building edge and at the street edge to draw the eye to pedestrian-height elements.

CONSIDERATIONS FOR HISTORIC BUILDINGS WHEN ELEVATING 1-3 FEET

DIFFERENTIATE BETWEEN ORIGINAL AND NEW

On historic buildings, maintain the existing line between siding and foundation materials to preserve the original configuration and scale of historic features; include a slight inset or materials change to differentiate between original and new parts of the foundation; extend entry stairs in similar style but with slight differentiation between original and new elements.

The historic structure is clearly differentiated from the elevated and extended foundation in this Falmouth example.

PRESERVE EXISTING ARCHITECTURAL DETAILS

Architectural details, especially around the entry and along the front facade, often define the architectural style of the building and should be preserved; relocate utilities in areas away from distinctive architectural details.

An elevated historic building in Provincetown preserved the original entry details and, when there was no room at the street edge, designed stairs on a side elevation.

ELEVATING 4-6 FEET

ELEVATING A BUILDING 4-6 FEET

Elevating a building 4-6 feet has a greater impact on the building and neighborhood character, though may be necessary to protect the structure from flooding and comply with code requirements in areas with higher BFEs. Creative design elements are important to compensate for the overall increase in building height, to reduce the visibility of the large area underneath the elevated building, and to reconnect the building entrance to the street. Elevating a building 4-6 feet will alter the relationship between display windows, porches, or other pedestrian-oriented features that play an important role in main street commercial areas and other tight neighborhoods. In less densely developed areas, increased building heights may block views from adjacent properties and require efforts to create new view corridors.

ELEVATING 4-6 FEET

KEY ELEVATION PRINCIPLE

Limit Building Silhouette

Preserve existing building scale and relation to neighboring buildings with small building masses and additions that hug the main building mass. Balance the overall massing's increased silhouette with efforts to reduce the apparent massing.

1. Design any new additions to be narrow and compact, hugging the main part of the structure to limit the building's profile. Consider removing non-historic side ells or building features to reduce the footprint of the elevated building and to open view corridors through a site.

2. Maintain steep roof pitches on upper floors to preserve distinctive gable silhouettes and step back dormers several feet from the eaves to reduce massing at the highest parts of the structure.

3. Orient the narrow end of the building facing the street, or facing the beach if a coastal property, to present a smaller massing when elevated and allow views through the site along the sides of the building.

4. Design garage and storage areas as hidden spaces or as separate, rather than attached, structures to limit the overall building mass.

A small addition can accommodate utilities moved from basement level.

A steep gable roof silhouette on elevated buildings helps to balance their increased height and anchor them to the ground. Roof dormers stepped well back from the roof edge keep the gable form prominent.

An open area beneath the elevated building (left) provides room for parking without increasing the overall scale of the original structure. An outbuilding can provide additional space without adding bulk to the main building.

ELEVATING 4-6 FEET

Limit building silhouette. An elevated building will have an increased silhouette and overall massing which needs to be balanced by efforts to reduce the apparent massing to preserve the region's traditional building scale. Design narrow building additions when working with elevated structures to avoid expanding the silhouette.

ELEVATING 4-6 FEET

KEY ELEVATION PRINCIPLE

Limit Porch or Deck Areas

Avoid wrapping decks or porches around all sides of the building because it adds substantial width and creates an overly large base when buildings are elevated more than several feet. Traditionally, most porches are located on the front facade, along a side ell, or at a corner of the building. New porches and decks should follow traditional conventions and proportions.

1. Limit porches and decks primarily to front and rear facades of a structure or to corners of the building to reduce the elevated massing. If the facade is wide, limit decks or porches to half of the front facade width.

2. Design a front porch that covers only a portion of the facade to help break down the larger massing of an elevated structure.

3. Use streamlined or thin railings on long decks and porches to limit their bulk.



A traditional one-story porch (left) helps reduce the apparent size of the building behind it. Inset porches (center and right) create a space that breaks up a larger building mass.


A narrow wood railing with metal rods or cabling has a very small visual profile that can help to reduce the bulk of railings.

ELEVATING 4-6 FEET

Limit porch or deck areas. Encircling a building with porches or decks widens the building base substantially and changes the traditional proportions. New porches and decks should follow traditional conventions and proportions, placing them at the front entry and rear elevation or wrapping one corner of the building.

ELEVATING 4-6 FEET

KEY ELEVATION PRINCIPLE

Maintain Street Level of Interest

Buildings that are part of a neighborhood or commercial streetscape should interact with pedestrians through porches, display windows, detailed entrances, or landscape elements. Elevated buildings must re-establish that connection to the streetscape through design features.

1. Extend entry stairs toward the street if there is enough front yard area, incorporating platforms and right angle turns, if necessary, but keeping the lowest part of the stairs facing the street whenever possible.

2. Construct a narrow open deck or stair landing with seating or other pedestrian features to animate the entire building front or a portion of the facade.

3. Incorporate new features like porches, arbors, seating, or unique paneling at the street level to preserve a strong relationship to streetscapes with a pedestrian focus. For commercial properties, consider incorporating movable display windows oriented to pedestrians on the sidewalk, raising them out of harm's way in advance of flooding events.

Extended stairs and architectural details below basement windows provide interest at the street edge (left), while new porches and decorative entry designs create the transition on a lot with more yard area (right).

Stepped back from the street edge, and with landscaping in between, an open deck along a portion of the front facade provides a pedestrian-focused space without adding a lot of bulk to the building mass.

A series of porches facing the street provides places for pedestrians to gather in Dennis; open porch and landscaping invite pedestrians to a commercial property in Provincetown.

ELEVATING 4-6 FEET

4. Consider shifting the building elsewhere on the lot to see if that will change the flood zone requirements. It may be preferable to move a building farther from the street edge if it avoids a more severe flood zone and reduces the elevation requirements. Shifting the building farther from the street edge also allows more space to provide landscaping and other treatments that can soften the change in height. To maintain a similar feeling of scale, density and light along the streetscape, consider increasing the building setback at least 1 foot for every foot of increased elevation.

Maintain street level of interest. Buildings that are part of a neighborhood or commercial streetscape connect to and interact with pedestrians through porches, display windows, detailed entrances, or landscape elements. Elevated buildings must re-establish that connection to the streetscape through design features.

ELEVATING 4-6 FEET

KEY ELEVATION PRINCIPLE

Leave Open Areas Under Buildings

Cape buildings close to the water were traditionally elevated on open pile foundations, allowing views beneath the building. When solid foundations were used, they were typically limited to the main body of the house, while porches and other additions remained open underneath or lightly screened with landscaping or lattice.

1. Limit solid foundation walls to areas beneath the core of a structure and leave open areas beneath porches, decks, and additions. For buildings elevated more than several feet, open areas under all or part of the building will reduce the overall enclosed area and make the building appear more consistent with the traditionally small-scale buildings of the region.

2. Define areas under porches, decks, and additions with overhangs and detailed posts or columns to add interest without adding mass.

3. In larger structures, leave some areas beneath the core of the structure open to reduce the overall massing. Use lattice or similar open screening materials to define small areas such as the core of the street-facing building facade or to enclose small storage or central stair areas. Leave areas underneath ells and other features open to light.

Open spaces under porches, ells, or the entire structure help to reduce the overall scale of an elevated building.

Architectural detailing with lots of space between elements can define the area under a deck without blocking views through the space.

ELEVATING 4-6 FEET

Leave open areas under buildings. Cape traditions show that buildings in proximity to the water were elevated with open pile foundations, allowing views to the water beneath the building. This also helps reduce the overall enclosed massing of the building, making it more consistent with the region's traditional small scale.

ELEVATING 4-6 FEET

KEY ELEVATION PRINCIPLE

Use Skirting Designs That Reflect the Neighborhood and Local Traditions

Incorporate familiar architectural detailing that references Cape Cod vernacular wood treatments and borrows details from the surrounding neighborhood. Vertical slats, woven lattice patterns, horizontal louvers, and widely spaced trellis forms all relate to common designs in the region.

1. Differentiate the enclosed understory with a different color or material or use two different treatments along horizontal bands to balance the proportions of the original building. For buildings elevated more than several feet, skirting that is darker than the main building walls will recede into the background more easily. Natural weathered wood tones and dark colors that clearly differentiate from light colored trim are desirable underneath large buildings.

2. Inset the skirting or screening materials several inches from the main building wall and support piers to differentiate the elevated area and to make the raised structure more prominent than the skirting.

3. Use lattice or skirting materials with a lot of space between components to provide screening under the elevated building without giving the appearance of a solid mass.

Skirting materials contrast with the main building wall materials above, preserving the original scale of the elevated building.

Skirting and screening materials inset from the shingled building walls above.

These skirting designs allow light through the space below buildings and reduce the perceived increase in building mass.

ELEVATING 4-6 FEET

4. Relate the design of skirting to the character of the neighborhood and to regional traditions. A consistent form of screening can help to define a district or a neighborhood block. Lattice patterns or vertical boards may be most appropriate in areas along the street frontage of village centers and densely developed neighborhoods, while more open treatments are preferred along beachfronts and large landscaped lots.

Lattice panels are borrowed from existing building designs in the neighborhood at top, and vertical boards are copied from historic designs above.

Use skirting designs that reflect the neighborhood and local traditions. Skirting is most appropriate for buildings elevated a modest height above the ground. Incorporate familiar architectural detailing that references Cape Cod vernacular wood styles. Dark colored skirting, inset several inches to distinguish it from the main building mass, will recede into the background more easily.

ELEVATING 4-6 FEET

KEY ELEVATION PRINCIPLE

Use layers of landscape plantings and low fences

Incorporate decorative fencing and arbors, window boxes, and layers of plantings of different heights to distract from the building's elevation.

1. Define the street edge with gardens, fences, hedges, arbors, pergolas, and seating areas to provide effective screening and reinforce neighborhood streetscape characteristics.

Screening with a fence at the street edge and bench seating at the building edge (left), and two layers of landscape plantings (right).

2. On lots with sufficient space and natural elevation, use landscape features like terraces, berms, and low walls to create tiers of varying height for a more gradual transition from the street to the elevated building height.

Landscaping, raised planters, hedges, and terracing can provide a gradual transition in elevation.

ELEVATING 4-6 FEET

Use layers of landscape plantings and low fences. Vegetation, arbors, window boxes, and patios can distract from the building's elevation. Place landscape elements both at the building edge and at the street edge to draw the eye to pedestrian-height elements.

ELEVATING 4-6 FEET

KEY ELEVATION PRINCIPLE

Elevate buildings in a neighborhood to a consistent height

Preserve the character of distinctive neighborhoods with consistent building elevation heights and similar streetscape treatments. This is particularly important in densely developed areas and historic neighborhoods where the relationships between buildings are the product of hundred-year-old traditions.

1. Follow consistent elevation heights for logical subsections of a neighborhood, such as along street or block frontages, or adjacent to key landscape features such as parks or coastlines, to help protect an area's distinctive character. When considering the appropriate height to elevate, recognize that BFEs and freeboard requirements will likely increase in the future.

2. If specific site characteristics would require a small number of buildings to be elevated higher than most other structures in a neighborhood, consider ways to address the presumed increased elevation needed through other means, such as shifting or removing a portion of the building in a more hazardous flood zone or using temporary flood barriers to protect some portions of the property, if permitted.

3. Use a similar palette of design features on elevated buildings including designs for extended entry stairs, open porch forms, containment walls, fencing, and other landscape elements.

Neighborhood with consistent elevation height.

Fencing, plantings, porch details, and trim should reflect the established neighborhood character.

ELEVATING 4-6 FEET

Elevate buildings in a neighborhood to a consistent base elevation height. Neighborhoods or blocks can best preserve their character if buildings are elevated to a similar height, preserving their relationships to one another. Consistent skirting designs and streetscape treatments will also help protect an area's distinctive character. The same is true if buildings are set back from the street to accommodate access or soften the change in building height.

ELEVATING 4-6 FEET

CONSIDERATIONS FOR HISTORIC BUILDINGS WHEN ELEVATING 4-6 FEET

KEEP NEW FEATURES SIMPLE

Design simple extended entry features that do not distract from original architectural details and use simple screening materials to reduce their visibility and keep the focus on the historic structure. Document original conditions before making a change so there is a record of the original configuration.

The front deck on this historic building in Provincetown creates an active pedestrian face without changing any of the building's historic facade details.

USE EXISTING NEIGHBORHOOD DESIGN DETAILS

Establish a neighborhood approach using a palette of design techniques that relate to details already in the historic district, such as porch or deck widths, railing designs, lattice screening materials, etc.

Front porches, dormers, materials, and building setbacks are consistent in this Provincetown neighborhood.

ELEVATING 7+ FEET

ELEVATING A BUILDING 7+ FEET

Elevating a building 7 feet or more will dramatically impact neighborhood character, lifting features that were designed to be at street level to well above a pedestrian's head. First, consider whether other strategies could be appropriate for the specific situation. In cases where elevations of this height are necessary to protect the structure from flood hazards, creative designs will be needed to bridge the gap. Use designs that highlight original building forms and reinforce connections to the streetscape in densely developed areas with pedestrian activity. In other areas, focus on preserving natural areas and reducing the footprint of development. As with the previous section, increased heights will significantly change views from adjacent properties, so make efforts to create new view corridors underneath and to the sides of buildings.

Consider Alternatives to Elevation in Significant Natural and Cultural Resource Areas

In some natural landscapes and historic districts, building retrofit, lower elevation heights, and other strategies may be more desirable due to lesser resource impacts and long-term access considerations. Consider these alternatives before elevating buildings more than 6 feet:

- Dry or wet floodproofing for commercial or mixed-use buildings with masonry bases (or where masonry can be added to the base)
- Temporary or permanent property or neighborhood barriers
- Remove a portion of the building that sits within a higher flood risk area to reduce the overall flood risk designation
- Retreat to a higher elevation on the subject property
- Relocate to upland outside of flood risk areas

The original part of this historic house in Sandwich was wet floodproofed while additions were elevated to address flood risk (top); dry floodproofed office building in Harwich (bottom).

KEY ELEVATION PRINCIPLE

Limit Building Silhouette

A building elevated more than 6 feet will have a significantly increased silhouette and overall massing which needs to be balanced by efforts to reduce the apparent building scale.

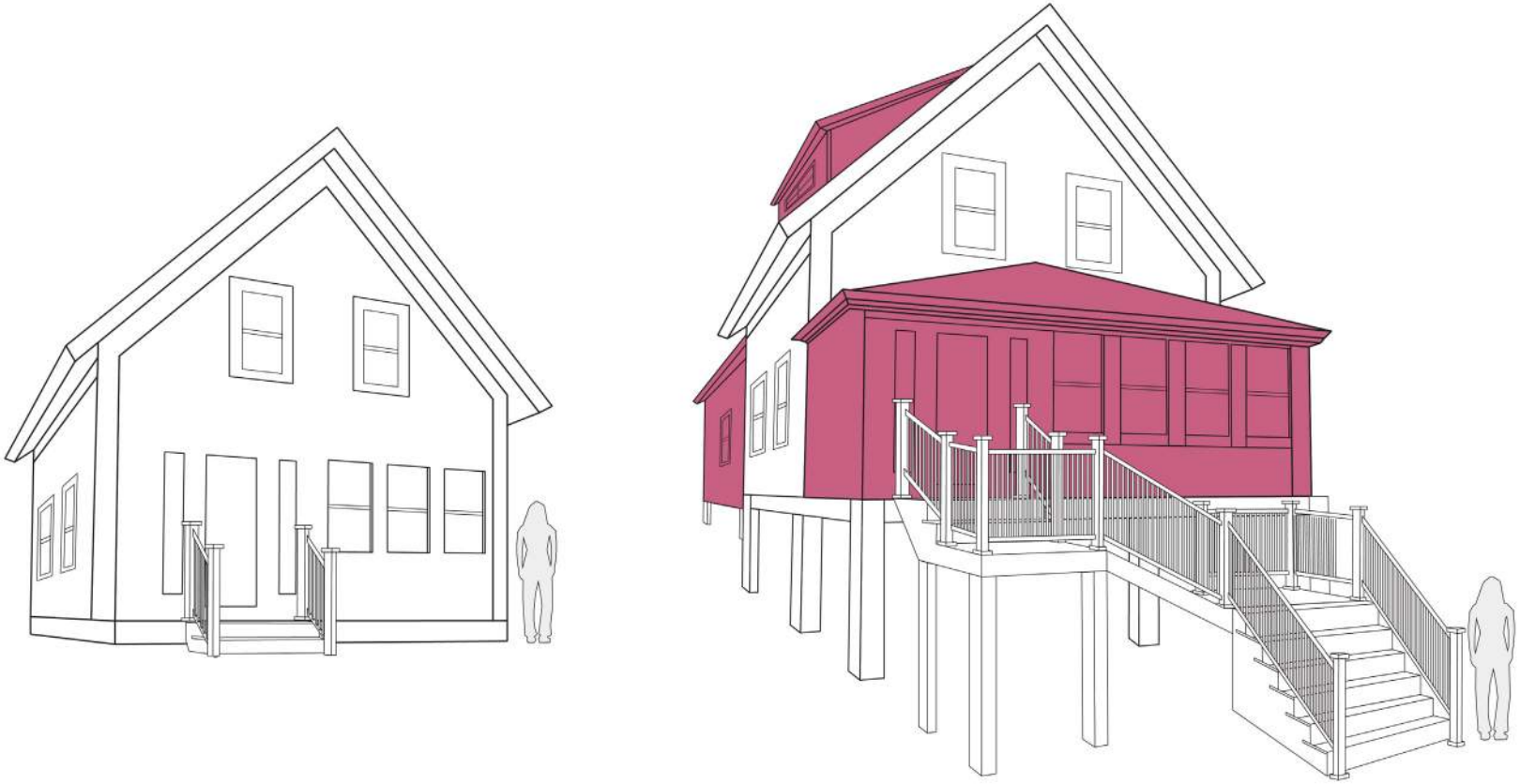
1. Consider moving the building back from the street to maintain the ratio of building setback to building height in neighborhoods where building walls are very close to the street edge.

2. Design any new additions to be narrow and to hug the main part of the structure to limit increases in the building's profile.

3. Maintain steep roof pitches on upper floors to preserve distinctive gable silhouettes; new roof dormers should be small scale and stepped back from eaves and ridgelines to reduce massing at the highest parts of the structure.

These elevated buildings maintain steeply pitched roof forms and narrow profiles

ELEVATING 7+ FEET



Limit building silhouette. An elevated building will have an increased silhouette and overall massing which needs to be balanced by efforts to reduce the apparent massing to preserve the region's traditional building scale. Design narrow building additions when working with elevated structures to avoid expanding the silhouette.

KEY ELEVATION PRINCIPLE

Limit Porch or Deck Areas

Avoid wrapping decks or porches around all sides of the building because it substantially widens the building footprint and creates overly large base proportions on buildings elevated 7+ feet. New porches and decks should follow traditional conventions and proportions.

1. Limit decks or porches primarily to the front and rear of the structure, or to an L-shape along two adjacent facades.

2. On long facades, limit porches to only a portion of the entire facade length, or to small insets within the facade.

3. Use streamlined railings to limit their bulk.

Traditional porches span the front of a modest building facade, or small portions of a long building facade. Streamlined railing materials reduce their visibility.

ELEVATING 7+ FEET

Limit porch or deck areas. Encircling a building with porches or decks widens the building base substantially and changes the traditional proportions. New porches and decks should follow traditional conventions and proportions, placing them at the front entry and rear elevation or wrapping one corner of the building.

KEY ELEVATION PRINCIPLE

Maintain Street Level of Interest

Buildings that are part of a neighborhood or commercial streetscape connect to pedestrians through porches, display windows, detailed entrances, and landscape elements to promote interaction. Elevated buildings must re-establish that connection to the streetscape through design features without adding to the bulk of the structure.

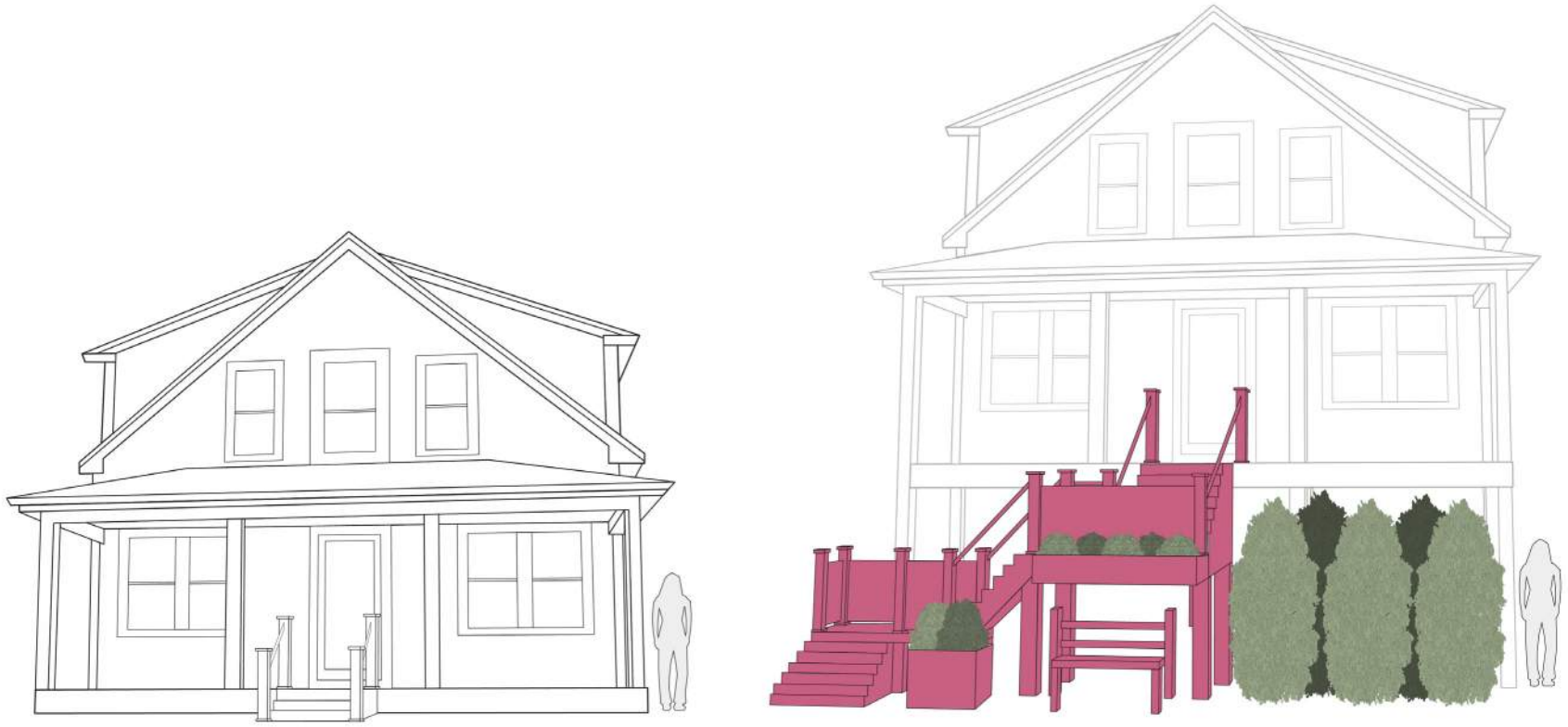
1. Design extended entry stairs facing the street wherever possible or turn stairs 90 degrees to run parallel to front facade. Design new stairs with a narrow silhouette to reach the new entry height, covering less than half of the front facade (unless the building is very small) or running along the side elevation and facing to the street at the bottom section.

2. Incorporate small decks or seating areas into the stair design in commercial areas where pedestrian activity is high and a greater connection to the street is desired, possibly integrating platforms at the height of the original entry or porch

3. Design support piers to correspond with design features of the building, such as porch columns, corner boards, and window bays. Incorporate details that reflect neighborhood characteristics such as framed landscape views in natural areas, or architectural trim and window boxes along pedestrian streetscapes and dense neighborhoods.

Entry stairs oriented to the street help link the building to the neighborhood even when it is elevated; wide stairs and landings can accommodate seating below the building height.

ELEVATING 7+ FEET



Maintain street level of interest. Buildings that are part of a neighborhood or commercial streetscape connect to and interact with pedestrians through porches, display windows, detailed entrances, or landscape elements. Elevated buildings must re-establish that connection to the streetscape through design features.

KEY ELEVATION PRINCIPLE

Leave Open Areas Under Buildings

Cape buildings close to the water were traditionally elevated on open pile foundations, allowing views beneath the building. When buildings are elevated 7 feet or more it is especially important to keep open areas below the structure to limit the massing of the building.

1. Leave the area beneath the building open to reduce the enclosed massing and to create a view corridor under the structure. Enclose only small access or storage areas, grouping them together to limit their silhouette.

2. Avoid the use of skirting when elevating buildings more than 6 feet. If areas must be enclosed for storage, use architectural detailing that references Cape Cod vernacular wood lattice or panel treatments with wide spacing, so it does not appear as a solid wall.

Traditional piers or piers treated with architectural details define an otherwise open area beneath these buildings.

ELEVATING 7+ FEET

Leave open areas under buildings. Cape traditions show buildings in proximity to the water were elevated with open pile foundations, allowing views to the water beneath the building. This also helps reduce the overall enclosed massing of the building, making it more consistent with the region's traditional small scale.

KEY ELEVATION PRINCIPLE

Use layers of landscape plantings and low fences

Traditional picket fences placed close to the street and paired with landscape plantings of different heights add pedestrian elements that help distract from dramatic increases in building elevation.

1. Low fences and arbors, window boxes and layers of plantings of different heights can help to distract from the building's elevation.

2. Animate the street edge with gardens, low fences, hedges, arbors, pergolas, and seating areas to reinforce neighborhood streetscape characteristics. Elements at the street edge are most important where pedestrian activity is high.

These elevated buildings maintain open patios beneath and incorporate landscaping at the building edge and the streetscape edge to provide some pedestrian scale.

ELEVATING 7+ FEET

Use layers of landscape plantings and low fences. Vegetation, arbors, window boxes, and patios can distract from the building's elevation. Place landscape elements both at the building edge and at the street edge to draw the eye to pedestrian-height elements.

KEY ELEVATION PRINCIPLE

Elevate buildings in a neighborhood to a consistent height

Use consistent design treatments to reinforce neighborhood patterns, especially in distinctive neighborhoods.

1. Establish consistent elevation heights for neighborhoods or for subsections of a neighborhood, maintaining consistency along street or block frontages, or adjacent to parks or other key landscape features. When considering the appropriate height to elevate, recognize that BFEs and freeboard requirements will likely increase in the future.

2. If specific site characteristics would require a few properties to be elevated higher than most other properties in a neighborhood, consider ways to maintain a more consistent elevation height with strategies such as shifting or removing a portion of the building in a higher risk flood zone, flood-proofing lower portions of the building, or using temporary flood barriers to protect some portions of the property.

3. Create neighborhood policies regarding whether buildings elevated over 6 feet should be set farther back from the street edge. Aim to maintain a similar line of sight/angle of sight from the center of the street to the top of the roof form facing the street. Use any increased setback areas for pedestrian-scale features such as stairs, open decks, and landscaping. Only small portions of the road frontage should be allowed for parking or driveway access, and they should be suitably screened with landscape features.

This historic structure was elevated four feet, less than would be required for a non-historic structure, in an effort to preserve the historic streetscape.

This building was originally set at the street edge but was pulled back about 10 feet to soften the impact of elevating it approximately 11 feet above its original height. The change still has a dramatic effect on the district's character.

ELEVATING 7+ FEET

4. Adopt a palette of appropriate design features for elevated buildings in key neighborhoods, addressing extended entry stairs, open porch and deck forms, containment walls, fencing, and other landscape elements.

Elevate buildings in a neighborhood to a consistent base elevation height. Neighborhoods or blocks can best preserve their character if buildings are elevated to a similar height, preserving their relationships to one another. Consistent skirting designs and streetscape treatments will also help protect an area's distinctive character. The same is true if buildings are set back from the street to accommodate access or soften the change in building height.

KEY ELEVATION PRINCIPLE

Make parking and garage doors secondary to pedestrian features

Garage doors and parking areas will become dominant features of a street-facing facade unless they are carefully designed.

1. Limit garage doors, driveways and parking access to side elevations, especially where buildings are an important element of the streetscape.

2. Allow parking or garaging on the front elevation only when no alternatives exist and when it spans less than 40% of the building facade to prevent parking from dominating the streetscape. Recess the garage access and extend pedestrian-focused features such as entry stairs or porches closer to the street so they are more prominent.

Garage access should be limited to the side of a building or to a small portion of the front so pedestrian-focused features remain prominent.

ELEVATING 7+ FEET

Make parking and garage doors secondary to pedestrian features. Large garage doors and parking areas will become dominant features of a street-facing facade unless they are carefully designed. Any garage or parking should be screened by pedestrian-focused elements like entry stairs and seating areas, especially in areas with high pedestrian activity.

CONSIDERATIONS FOR HISTORIC BUILDINGS WHEN ELEVATING 7+ FEET

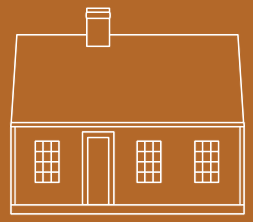
CONSIDER ALTERNATIVE MEANS OF PROTECTING HISTORIC BUILDINGS

Elevating buildings this much will dramatically change their setting and the neighborhood character, so consider alternative protection techniques such as relocation and wet or dry floodproofing. Relocating buildings may be most appropriate in areas of high erosion and where there is available open space. Floodproofing in protected and tightly developed activity centers may be more appropriate. When elevation is deemed necessary, the design should aim to preserve all exterior architectural features. Document the building prior to making any changes.

DEFINE A CONSISTENT ELEVATION HEIGHT AND APPROPRIATE DESIGN FEATURES FOR HISTORIC AREAS

Neighborhood approaches are critical when elevating buildings more than 6 feet. Identifying a consistent elevation height, consistent guidance for moving highly elevated buildings back from the street edge, and other consistent design features is particularly important for historic neighborhoods and can be key to preserving the character of a specific block or crossroads.

This Truro building and another next door were relocated farther inland to move them away from the eroding coastal bank and flood hazard areas.



Special Considerations for Historic Structures

Many of Cape Cod's historic structures are threatened by flooding. Villages reliant on maritime industries in the 1700s and 1800s built close to the water for convenient access to materials, storage, and shipping. More recently, communities developed close to the shore to provide easy access to recreational spaces, ocean breezes and open views. Many buildings that have stood for hundreds of years are now threatened by rising sea levels and increased storm events, and along with them the materials, construction techniques, and architectural styles that reveal the history of their users and the surrounding community. The challenge is to find the best ways to protect these structures without destroying the unique architectural features that make them significant.

The following guidance applies to all projects that involve historic structures.

DOCUMENT BUILDINGS AND SITES PRIOR TO CHANGES

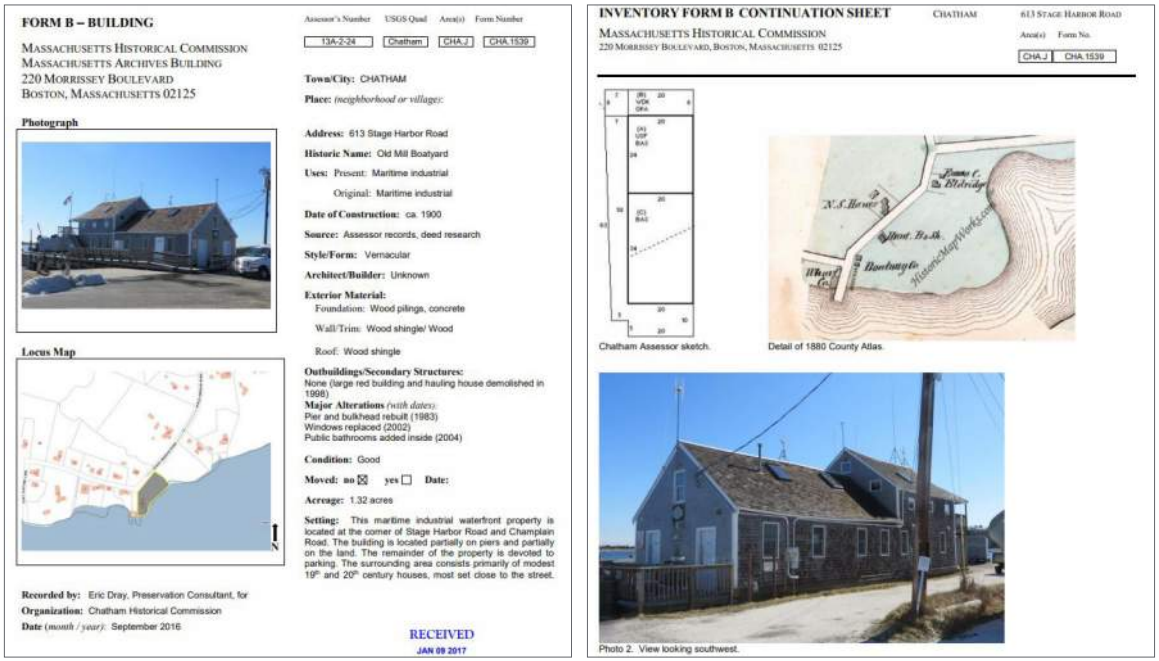
Threatened individual structures and neighborhoods should be documented to preserve information about their original historic materials, architectural details, and construction technology prior to being impacted by hazards. Documenting an historic building in its original setting is also important before moving it to a new location. Documentation should include scaled as-built drawings as well as photographs of the entire site, of all building facades and features, and any distinctive architectural detailing. Historic American Building Survey (HABS) recordation may be appropriate for high community value buildings.

GUIDANCE

Use Massachusetts Historical Commission's historic inventory forms (typically Form B for buildings) to document existing structures with photographs, sketches, and narrative descriptions.

Photograph all sides of the historic building to create a record of its existing condition. Also photograph any particularly distinctive or unusual architectural features, and photograph the building in relation to its larger setting.

For buildings that have unique construction details visible on the building interior, include photographs of structural framing techniques and materials.



FORM B – BUILDING

MASSACHUSETTS HISTORICAL COMMISSION
MASSACHUSETTS ARCHIVES BUILDING
220 MORRISSEY BOULEVARD
BOSTON, MASSACHUSETTS 02125

Assessor's Number: 13A-2-24 | USGS Quad: Chatham | Area(s): CHA.J | Form Number: CHA.1539

Photograph

Locus Map

Town/City: CHATHAM
Place: (neighborhood or village):
Address: 613 Stage Harbor Road
Historic Name: Old Mill Boatyard
Uses: Present: Maritime industrial
Original: Maritime industrial
Date of Construction: ca. 1900
Source: Assessor records, deed research
Style/Form: Vernacular
Architect/Builder: Unknown
Exterior Material:
Foundation: Wood pilings, concrete
Wall/Trim: Wood shingle/ Wood
Roof: Wood shingle
Outbuildings/Secondary Structures:
None (large red building and hauling house demolished in 1998)
Major Alterations (with dates):
Pier and bulkhead rebuilt (1983)
Windows replaced (2002)
Public bathrooms added inside (2004)
Condition: Good
Moved: no ☒ yes ☐ Date:
Acreage: 1.32 acres
Setting: This maritime industrial waterfront property is located at the corner of Stage Harbor Road and Champlain Road. The building is located partially on piers and partially on the land. The remainder of the property is devoted to parking. The surrounding area consists primarily of modest 19th and 20th century houses, most set close to the street.

Recorded by: Eric Dray, Preservation Consultant, for
Organization: Chatham Historical Commission
Date (month / year): September 2016

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INVENTORY FORM B CONTINUATION SHEET
CHATHAM
613 STAGE HARBOR ROAD

MASSACHUSETTS HISTORICAL COMMISSION
220 MORRISSEY BOULEVARD, BOSTON, MASSACHUSETTS 02125

Area(s): CHA.J | Form No.: CHA.1539

Chatham Assessor sketch.

Detail of 1880 County Atlas

Photo 2. View looking southwest.

Sample Historic Inventory Form with photographs, narrative description, assessor's record, and historic map reference.

CONSIDER ALTERNATIVE MEANS OF PROTECTION

Relocation, barriers, floodproofing, and building elevation should all be considered before deciding on a course of action. Dramatic changes to buildings and settings can destroy the integrity of an historic building and threaten its significance, so it is important to find the strategy that best balances preservation and protection.

GUIDANCE

Consider the timeframe for protection, acknowledging solutions that provide protection for only a short period of time may be appropriate if long-term plans for building relocation are also considered.

Look to historic precedents for ideas:

Some historic buildings were designed on raised lots intentionally to give them greater prominence. Regional examples with historic retaining walls may offer a solution in certain settings.

Raising the ground level through natural-looking contours may provide another option, especially on larger lots where floodwaters can collect elsewhere on the lot. (Note: Fill should not be brought into densely developed sites and is not permitted in the floodplain in all towns.)

In waterfront locations, historic piers and pilings may provide a design reference.

Pedestrian interest at the street level can be preserved through new entrance features, raised seating areas, and open decks that create a transition from the street level to the new building height.

Acknowledge FEMA flexibility for National Register structures:

Individual structures on the National Register of Historic Places and contributing buildings in a National Register district can get relief from certain floodplain requirements. The provision is applied at the discretion of state or local governments and might not be available to all historic property owners, but the National Flood Insurance Program and state building code allow for alternative compliance when prescriptive flood code requirements would threaten the character-defining features of the building. This allows property owners to propose alternative ways to minimize flood risk that will also protect the key historic elements of a property. (Foodplain Regulations and Historic Structures)

PROTECT KEY CHARACTER-DEFINING FEATURES

Before selecting a method of protection, identify the key character-defining features of the property and consider how different adaptation strategies will require changes to those features. Consult preservation professionals (and local historic boards) and select the option that protects the building with alteration of the fewest character-defining features. Cape Cod Commission staff can help evaluate proposed plans and identify key historic features that should be preserved.

GUIDANCE

Retain key features such as the building's proximity to the street, the original roof form and slope, the arrangement of windows and doors on the primary or front facade, architectural trim details at the eaves and around the front entry, and the original distinction between siding and foundation materials.

Consult National Park Service's Guidelines on Flood Adaptation for Rehabilitating Historic Buildings -- The best recognized standards and guidelines for work on historic properties are the Secretary of the Interior's Standards for Treatment of Historic Properties and their associated Guidelines, which define appropriate ways to adapt historic structures without losing their significance, and the National Park Service's Guidelines on Flood Adaptation for Rehabilitating Historic Buildings. These guidelines, released initially in November 2019 and in illustrated form in 2021, discuss technical limitations and offer guidance with "Recommended" and "Not Recommended" actions when using different flood treatment options on historic structures (Guidelines on Flood Adaptation for Rehabilitating Historic Buildings (U.S. National Park Service).

This historic building in Harwich was elevated several feet while preserving all its historic architectural features and trim details. Landscape materials were used to disguise the increased foundation height.

USE CONSISTENT TREATMENTS WITHIN A NEIGHBORHOOD

In historic districts, buildings have significance as a group and work together to reveal how that neighborhood has developed over time. Consequently, solutions are appropriately considered at a neighborhood scale. Consistent treatment is important to preserve the original relationships between buildings, and to maintain the cohesiveness that characterizes most historic districts.

GUIDANCE

Use consistent dry or wet floodproofing methods along a common streetscape

Employ similar site barriers and green infrastructure solutions within a neighborhood

Elevate buildings to a consistent height along a common streetscape or block

Follow consistent techniques to shield elevation changes, whether through landscape treatments, increased building setbacks, or a combination of methods

Adopt a palette of designs for reconnecting entries and porches to the street that are consistent with historic neighborhood characteristics

Require new buildings in historic areas and districts to follow established building setback patterns, prevalent building forms and scale, and orientation to the street. In some areas where there is more variety in building setbacks or building forms, it may be appropriate to site new buildings farther from the street edge to give more prominence to the historic structures.

This historic building in Sandwich National Register Historic District uses traditional low picket fence to screen the elevated foundation.

IDENTIFY CULTURAL RESOURCES OF HIGH COMMUNITY VALUE

Communities should begin planning for how to protect their resources of highest community value in the short and the long term. In some cases, methods to protect buildings will require complicated planning and construction processes. Community surveys and research efforts should be combined to ensure that the history of previously under-represented groups is acknowledged in deciding which resources are most cherished.

GUIDANCE

Conduct research and public surveys to identify historic resources of greatest significance to the community and at regional, state, and national levels

Identify upland areas and vacant lots outside of flood hazard areas which could provide future locations for a community's cherished buildings

Begin discussions about how to document and memorialize historic sites that may eventually be lost, using methods such as photo and video documentation, movable monuments, and internet sites

Town Hall is one of the most recognized historic buildings in Provincetown.

PRESERVE ARCHAEOLOGICAL RESOURCES

Numerous ancient and historic archaeological sites will be exposed to erosion along Cape Cod's coastlines as flood risks increase. Archaeological sites are the primary way we learn about historic period and ancient cultures, and they hold great significance to our region's Native American populations. Communities will benefit from having emergency procedures in place to address these important sites as they become exposed.

GUIDANCE

Consult with tribal representatives prior to any work contemplated on sites significant to the Mashpee Wampanoag Tribe and Herring Pond Wampanoag Tribe.

Consider ways to stabilize and protect archaeological sites from coastal erosion so they can be studied in their original configuration, where their clues to the past can be best understood.

For archaeological sites that cannot be stabilized and protected from coastal erosion, materials may be recovered and documented by trained archaeologists under a permit from the Massachusetts Historical Commission. Consider identifying areas threatened by erosion and hiring an archaeologist or partnering with a university to recover and document threatened sites.

STRATEGIES

Neighborhood and Site Solutions

This section addresses adaptation strategies for the land around buildings, whether individual sites or entire neighborhoods. Temporary and permanent landscape changes play an important role in addressing flood risk and in some cases may alleviate or eliminate the need to make significant changes to buildings.

NEIGHBORHOOD AND SITE SOLUTIONS STRATEGY

Temporary Site Barriers

Temporary barrier systems for flood events can take the form of hydraulic-actuated concrete barriers, inflatable barrier systems, flip-up or placed-in flood barriers, or water-filled or air-filled temporary barriers, sandbags, and gravel-filled containers. They have the advantage of being movable and thus can be deployed to different locations based on the impending storm situation, plus they can provide protection for buildings that cannot be easily adapted through other means. For a temporary barrier system to work, an emergency plan is needed with materials stockpiled ahead of time and pumps in place to address water that gets inside the barriers. The amount of flood warning time available for the site is critical, as time is needed to deploy barriers successfully and prevent water infiltration.

CONSIDER TEMPORARY SITE BARRIERS IN THESE SITUATIONS

Short-term Solutions – to address impacts from flooding in the near term while evaluating and assessing more permanent solutions to protect structures and neighborhoods

Water Dependent Uses – to protect water-dependent uses where relocation is not an option

Strong Masonry Structures – Use temporary barriers with masonry structures that are able to withstand the projected forces of flood waters

Storm Tide Pathways - Employ temporary barriers to block identified/ mapped storm tide pathways into neighborhoods where streets and other open areas would otherwise act as a conduit for flood waters. Barriers must be carefully designed so they will not increase flooding on neighboring properties

Temporary barrier deployed at Chatham Outermost Harbor Marine.

A temporary dune barrier blocks a storm tide pathway and protects the area around Gosnold Street in Provincetown.

NEIGHBORHOOD AND SITE SOLUTIONS STRATEGY

Permanent Site Barriers

Permanent barriers or floodwalls can take the form of earthen berms, site levees, or water-resistant retaining walls that prevent water from entering individual structures or defined neighborhoods. Much smaller scale floodwalls of brick, concrete block, or poured concrete can be designed to protect low elevation window or door openings on a single building. Barriers should be securely tied into a footing to prevent being undercut by scouring, and pumps must be deployed to address water that gets inside the barriers. While permanent barriers may protect entire neighborhoods or historic districts from floodwaters, they can also significantly alter viewscapes, natural floodplain functions, and accessibility to beaches and waterfront areas so need to be carefully designed to address these issues. Offshore barriers such as artificial reefs, marshlands, living dunes and shorelines, wave attenuators, or some combination of these, in some cases may be better choices.

CONSIDER PERMANENT SITE BARRIERS IN THESE SITUATIONS

Infrastructure – to protect important infrastructure that serves the entire community and cannot be easily relocated.

Dense Development – to provide protection for densely developed areas or large numbers of properties where individual treatments would be cost prohibitive.

Cultural Resources - to protect key historic structures of high community value or to prevent erosion of extremely significant cultural (archaeological) resources that cannot be replaced or relocated.

Provincetown Town Hall with lower entry stairs, doors, windows.

DESIGN GUIDANCE

Follow local traditions. Consider barriers that mimic existing neighborhood features such as low stone or masonry walls, pier or dock designs, and common landscape elements like hedges or fences to screen barriers behind them.

Design entrances or access points that can be easily sealed with temporary or drop-in barriers.

Historically elevated lot in Factory Village Historic District, Sandwich; landscape hedge and decorative gate in a neighborhood in Provincetown's Historic District.

NEIGHBORHOOD AND SITE SOLUTIONS STRATEGY

Landscape Solutions/ Green Infrastructure

Landscape design features and vegetated buffers partner with building adaptation techniques to help move and hold water away from buildings and other important resources. Also called "Green Infrastructure," these techniques are intended to slow, retain, treat, and infiltrate stormwater on location or nearby. Integrating this type of design on individual properties, across neighborhoods, and throughout activity centers can provide important places to hold water safely while it infiltrates. Neighborhoods that experience flooding should discuss how they can "make space for water," considering and identifying appropriate locations and designs for Green Infrastructure. Projects range from small-scale elements that fit on individual properties, to designs that can provide larger amounts of containment, sometimes known as floodwater parks, or networks of connected containment areas, sometimes called "blue corridors."

It is important to use native vegetation that can tolerate pollutants and extended exposure to water in stormwater treatment systems. It will also be important to use salt tolerant plants for coastal sites. The Massachusetts Stormwater Handbook is a good reference for these ideas.

LIMIT IMPERVIOUS SURFACES

Reducing impervious surfaces allows water to drain through the surface and infiltrate into the soil where it falls, thereby reducing the volume of stormwater runoff. Pervious pavement contains small voids that allow water to drain through to an aggregate reservoir and then infiltrate into the soil. Green or planted roofs are another means of reducing impervious area and facilitating water absorption.

DESIGN GUIDANCE

Use porous treatments such as gravel, dirt, or clam shell for pathways, driveways, and parking areas wherever possible

Use pervious pavement such as pervious concrete, porous asphalt, grass-pave, or permeable interlocking pavers where more stable surfaces are required. Note that these materials and treatments will require maintenance to function as intended.

Incorporate green roofs wherever possible to limit impervious roof area and facilitate water absorption.

Seashell drive/pathway in Dennis neighborhood allows easy drainage (top); permeable pavement on Commercial Street in Provincetown (bottom left) and a public plaza.

LOW IMPACT DESIGN

Low impact design (LID) is an approach to land development or redevelopment that works with nature to manage stormwater as close to its source as possible. These are systems and practices that use or mimic natural processes to contain and clean stormwater onsite. They preserve, restore, or create green space using soils, vegetation, and rainwater harvest techniques with the bonus benefit of being aesthetically pleasing. Use LID to help move water away from buildings and sensitive resources.

DESIGN GUIDANCE

Incorporate LID by creating new landscape features instead of lawn area, perhaps parallel to buildings to guide stormwater away from the structure.

Design bioswales or long, narrow stormwater holding areas in combination with street-front landscaping to provide stormwater holding areas while also creating a feature that defines the property edge similar to a low fence, wall or hedge.

Design LID elements along the side of driveways or parking areas to more quickly capture stormwater runoff.

Low impact design incorporated into entrance landscaping on this Cape property.

BIORETENTION/RAIN GARDEN

Bioretention or rain garden is a technique that uses soils, plants, and microbes designed to receive and treat runoff before it infiltrates. Vegetation can include trees, shrubs, grasses, vegetated ground cover or mulch that can withstand urban environments and periodic inundation as well as dry periods. Stormwater is collected into the treatment area, and through a variety of physical, biological, and chemical processes the contaminants and sediments are removed from the runoff. Bioretention basins are best suited for areas that would typically be dedicated to landscaping and can be designed to capture impervious surface runoff.

DESIGN GUIDANCE

Add a rain garden to the landscape design on a low area of the property.

Add a rain garden as a feature in the center of a circular or curved driveway.

Add a rain garden as a feature adjacent to road edge.

Bioretention and interpretive panel at Sandwich Public Library (top); Bioretention area at Heritage Museums and Gardens in Sandwich (right).

INFILTRATION BASIN/FLOODWATER PARK

An infiltration basin is a constructed low-lying area designed to provide temporary storage of stormwater for subsequent infiltration into the underlying soil. These structures consist of an impoundment area where water can collect, constructed over permeable and typically vegetated soils. They are commonly used as water quality controls with additional benefits such as storage and groundwater recharge. Large scale infiltration basins, such as floodwater parks, require large open areas and can be configured to provide multi-use benefits between rain events, such as parks. In areas that are prone to flooding during rain events, vegetated infiltration basins can serve dual purposes: to collect and treat stormwater during flood events and as a park or green space between rain events when floodwaters are not present.

DESIGN GUIDANCE

Consider creating larger landscaped areas that can double as stormwater holding areas in neighborhood parks, parking lots, or underutilized areas.

One case study can be found in Peabody, Massachusetts. Veteran's Memorial Park was developed into an integrated park incorporating stormwater management and flood storage design. The project transformed an EPA brownfield site into a community asset. The reclaimed site not only serves as a park, but also benefits the city by furthering its flood mitigation efforts.

Infiltration basin

Interpretive panel and view of Teaticket Park in Falmouth, where wetland and grassland areas act as a floodwater storage park.

DRAINAGE CHANNEL/VEGETATED SWALE

Drainage channels or vegetated swales are long linear open channels that provide retention and treatment of stormwater as it is moved from one location to another. They slow, filter and move stormwater. A vegetated swale can be a grassed channel, dry swale, wet swale or biofilter with a trapezoidal or parabolic cross-section with relatively flat side slopes. Swales to slow down water in channels, retention ponds to hold water, and native plant species that thrive in wetter, even brackish, conditions, can aid in soil retention within channels, banks, and ponds.

DESIGN GUIDANCE

Provide swales along road edges and within parking lots where their long narrow shape is well suited.

Encourage individual property owners or groups of property owners to create water-absorbing or water-diverting landscape features in their neighborhood to support building adaptation efforts.

Vegetated swale along Cole Road in Eastham (left); Vegetated swale in parking lot (below)

CONSTRUCTED STORMWATER WETLAND

A constructed stormwater wetland is a basin designed to remove pollutants from stormwater runoff through wetland vegetation uptake, retention, and settling. Wetland plants help to slow incoming runoff, allowing sediment and other particles to settle in the wetland. Constructed wetlands consist of deep pools, shallow waters and areas of temporary inundation. The variable depths allow for diverse vegetation as well as bacteria that remove nitrogen, phosphorus, and break down hydrocarbons. These are most effective in conditions where infiltration is not feasible.

DESIGN GUIDANCE

Construct treatment wetlands on uplands and outside floodplains in order to avoid damage to natural wetlands and other aquatic resources.

Consider the role of treatment wetlands within the watershed (e.g., potential water quality impacts, surrounding land uses and relation to local wildlife corridors).

Closely examine site-specific factors, such as soil suitability, hydrology, vegetation when determining an appropriate location for the project.

Use soft structures, diverse and sinuous edges in design configuration, and bio-engineering practices that incorporate the existing natural landscape and native vegetation.

Design the margins as natural transition zones, including woody vegetated buffer areas.

Minimize mosquito problems by minimizing the potential formation of stagnant water, facilitating vegetation management, and by using natural biological control mechanisms

Oyster Pond stormwater wetland.

Case Studies

The Case Study sections illustrate strategies that are most likely to be appropriate to specific neighborhoods and building types. Consistent treatment of buildings in the same neighborhood is important to maintaining a cohesive character. The more similar the neighborhood building forms, the more important consistent treatments will be in protecting that area's distinctive character.

Case Studies

CASE STUDIES

Neighborhood Contexts

- DENSE MIXED-USE NEIGHBORHOOD
- DENSE NEIGHBORHOOD/ SMALL LOTS
- MODERATE DENSITY NEIGHBORHOOD/MEDIUM LOTS
- LOW DENSITY NEIGHBORHOOD/ LARGE LOTS
- BARRIER BEACH

CASE STUDIES

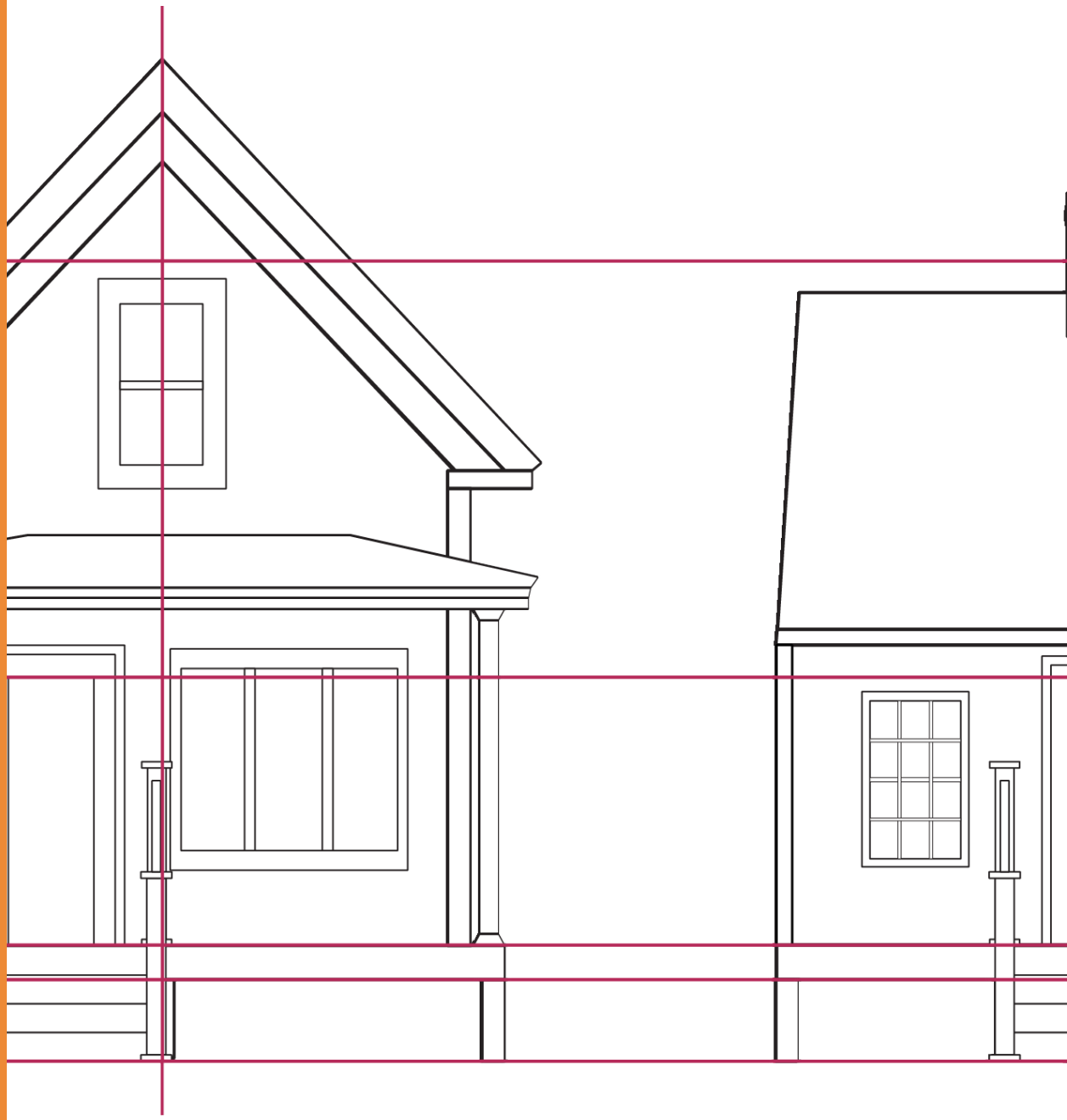
Common Building Types

- SMALL COTTAGE/SIMPLE MASS
- LARGE RESIDENTIAL STRUCTURE/ COMPLEX MASS
- SMALL COMMERCIAL/ MIXED USE BUILDING
- LARGE COMMERCIAL/ INSTITUTIONAL/MIXED USE BUILDING

CASE STUDIES

Neighborhood Contexts

The following Case Studies aim to illustrate appropriate solutions for addressing flood hazard adaptation in a variety of neighborhood settings commonly found on Cape Cod.







NEIGHBORHOOD CONTEXTS

Cape Cod has a variety of neighborhoods located within flood hazard areas, exhibiting a range of densities, mix of uses, and differing building scales. Many of these neighborhood contexts correspond closely with the Placetypes identified in the Regional Policy Plan, acknowledging a certain level of natural features, historic structures, and commercial or residential focus in an area. In identifying adaptation strategies that are most appropriate for these neighborhoods, it is also important to consider more detailed neighborhood characteristics, such as:

the general height and shape of buildings,

the proximity of buildings to each other,

building setbacks from the street,

pedestrian-oriented features like display windows and porches,

the amount and size of open yard areas and public spaces,

the prevalence of historic buildings nearby and their character-defining features.

Some adaptation strategies may not be appropriate in all neighborhoods. Strategies should be chosen for their ability to preserve important resources, both natural and cultural, and for their ability to retain those character-defining features that make a neighborhood unique.

The following Case Studies aim to illustrate appropriate solutions for addressing flood hazard adaptation in a variety of neighborhood settings commonly found on Cape Cod.

NEIGHBORHOOD CONTEXTS

CASE STUDY

Dense Mixed-Use Neighborhood

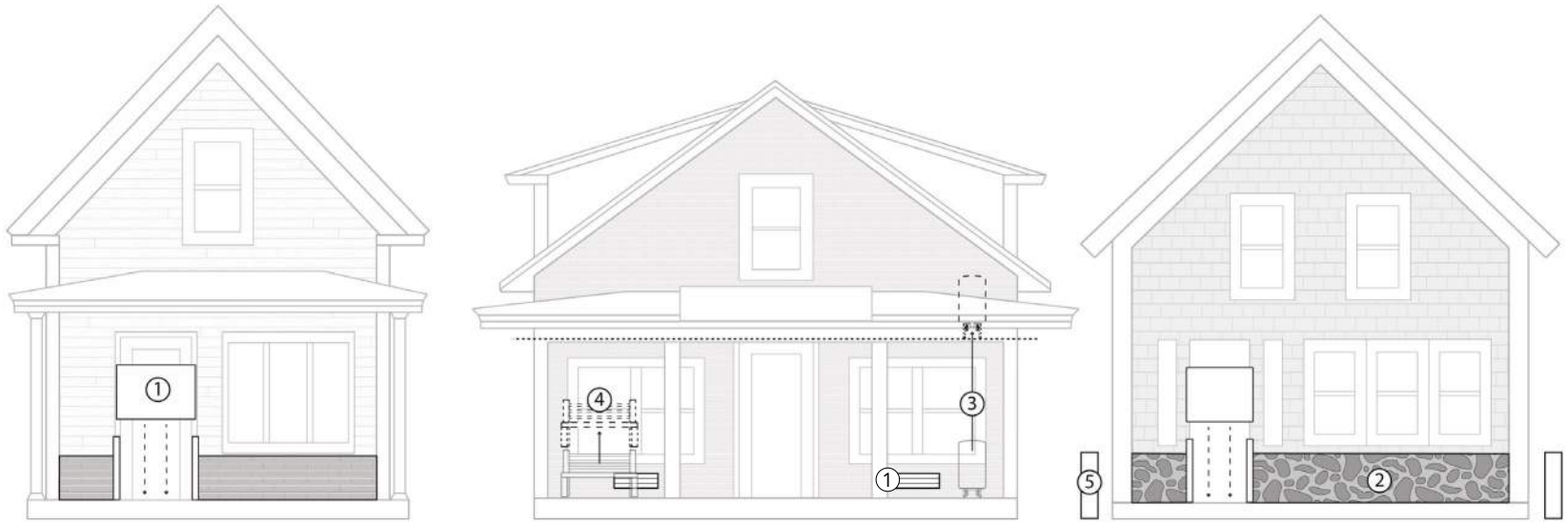
In these neighborhoods, buildings are close together and most are close to the street or sidewalk edge. There is a mix of commercial and residential uses of varying size and scale, many with sidewalk-oriented features like porches and display windows. While most Cape buildings are wood frame structures, some masonry buildings are likely in these dense, mixed-use areas.

Key tenets for adaptation:

1. Maintain main entry and stair facing the street or public space.
2. Limit expansion to preserve neighborhood building scale.
3. Provide landscaping and seating areas at street level for pedestrian interest.
4. Adopt a consistent elevation height for distinct neighborhood areas.
5. Keep parking or garage entries away from visible street frontages.
6. Limit new porch and deck areas to traditional street front or waterfront locations.
7. Define areas beneath buildings with wood skirting or landscape screening, depending on their height.

Dense Mixed Use Neighborhoods are typically found in these placetypes.

ALTERNATIVE 1: FLOODPROOFING



DENSE MIXED-USE NEIGHBORHOOD

Use a combination of floodproofing methods to address flood risk while buildings remain in their original positions

1. Masonry building: Dry floodproofing with drop-in shields, or wet floodproofing with flood vents. Seal off openings in lower level (windows, cellar entries, etc.).
2. Wood building: Reinforce the wall area below flood height with masonry to facilitate floodproofing. Consider concrete knee wall behind storefront windows.
3. Relocate equipment and spaces requiring electrical systems and other utilities to higher elevations within the building, reached either by a ramp or by internal stairs.
4. Create flexible commercial spaces on first level with furniture that can be easily lifted or stored above flood elevation, i.e., restaurant seating, gathering spaces, and other uses that do not require fixed equipment or computer networks.
5. Install framework (posts or post bases) for temporary barriers to protect individual buildings or sites. Coordinate placement with existing landscape walls and/or neighboring properties.

ALTERNATIVE 2: ELEVATE BUILDINGS

DENSE MIXED-USE NEIGHBORHOOD

Elevate buildings above flood levels and re-establish their connection to the neighborhood.

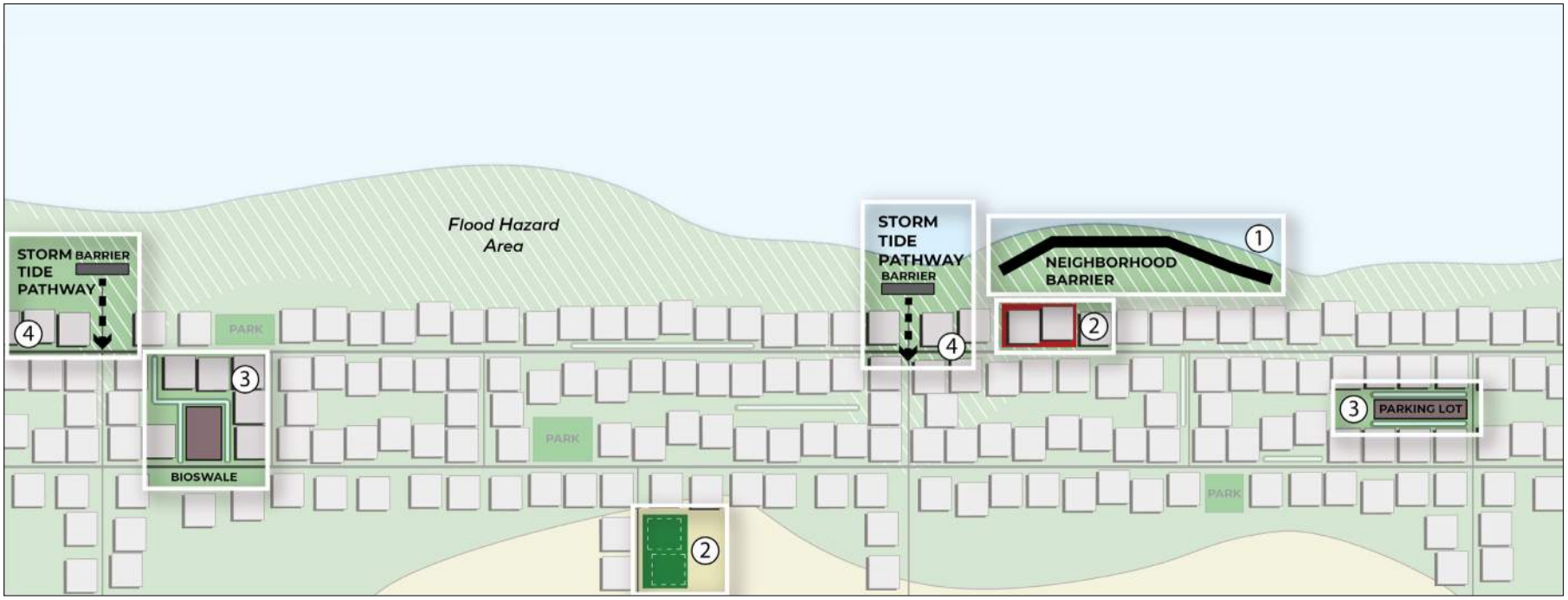
1. Identify a consistent elevation height that is appropriate for the immediate neighborhood.
2. Preserve the front entry and its connection to the street.
3. Use extended stair structures and small porches or decks to create pedestrian interest.
4. Maintain activity level along the street edge with landscaping and sitting areas and incorporate display spaces on commercial properties.
5. Retain narrow building profiles to preserve view corridors through the site.
6. Address the space under elevated buildings

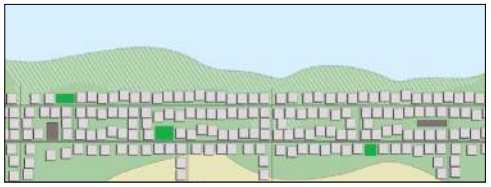
   Low elevations – adorn foundation with architectural details that relate to the building above but differentiate the extension.

   Moderate elevations – use open foundations or skirting techniques that relate to neighborhood architectural details.

   High elevations – keep open foundations and limit parking to side or rear access. Parking should be concealed behind landscape elements and not visible from the streetscape.

ALTERNATIVE 3: NEIGHBORHOOD PROTECTION





DENSE MIXED-USE NEIGHBORHOOD

Identify additional means of protecting buildings in a larger area.

1. Consider neighborhood barriers, either temporary or permanent.
2. Identify available higher elevation locations for possible relocation of most threatened and most important buildings. Relocating a building from a densely developed area may introduce a hole in the streetscape but it may be an appropriate long-term strategy for significant buildings. It may also provide an opportunity for landscape solutions like bioretention or flood storage parks that could benefit the neighborhood.
3. Make space for water within activity areas and adjacent to them, along the street edge and in rear alleys, parking areas, parklets or other open spaces that can collect stormwater during flood events but otherwise serve as recreational spaces.
4. Address storm tide pathways with permanent or temporary berms to prevent water entering at these locations where appropriate.

NEIGHBORHOOD CONTEXTS

CASE STUDY

Dense Neighborhood/ Small Lots

Sandwich's Jarvesville National Register Historic District has a collection of mostly small, low height residential buildings on small lots with modest setbacks from the road, simple building forms, and sloped roofs.

Cape Cod has numerous neighborhoods of small residential lots, many dating from early historic development periods. These neighborhoods often developed adjacent to important crossroads or natural resources and are characterized by modest buildings set close to the street edge and close to each other.

Key tenets for adaptation:

1. Maintain main entry and stair facing the street or public space.
2. Limit expansion to maintain neighborhood building scale.
3. Address short-term flood risk with temporary barriers, floodwater parks, or wet/ dry floodproofing, and long-term flood risk with elevation or relocation.
4. Provide pedestrian elements at ground level or original entry height.
5. Adopt a consistent elevation height for distinct neighborhood areas.
6. Identify neighborhood landscape features to create street interest and screen elevated buildings.
7. Limit enclosed areas based on elevation height – use less enclosure for higher elevations.
8. Limit parking under buildings to areas screened from view.

Dense Neighborhoods with Small Lots are typically found in the Historic Area placetype

ALTERNATIVE 1: ELEVATE BUILDINGS

Example of Low Elevation

Example of Moderate Elevation

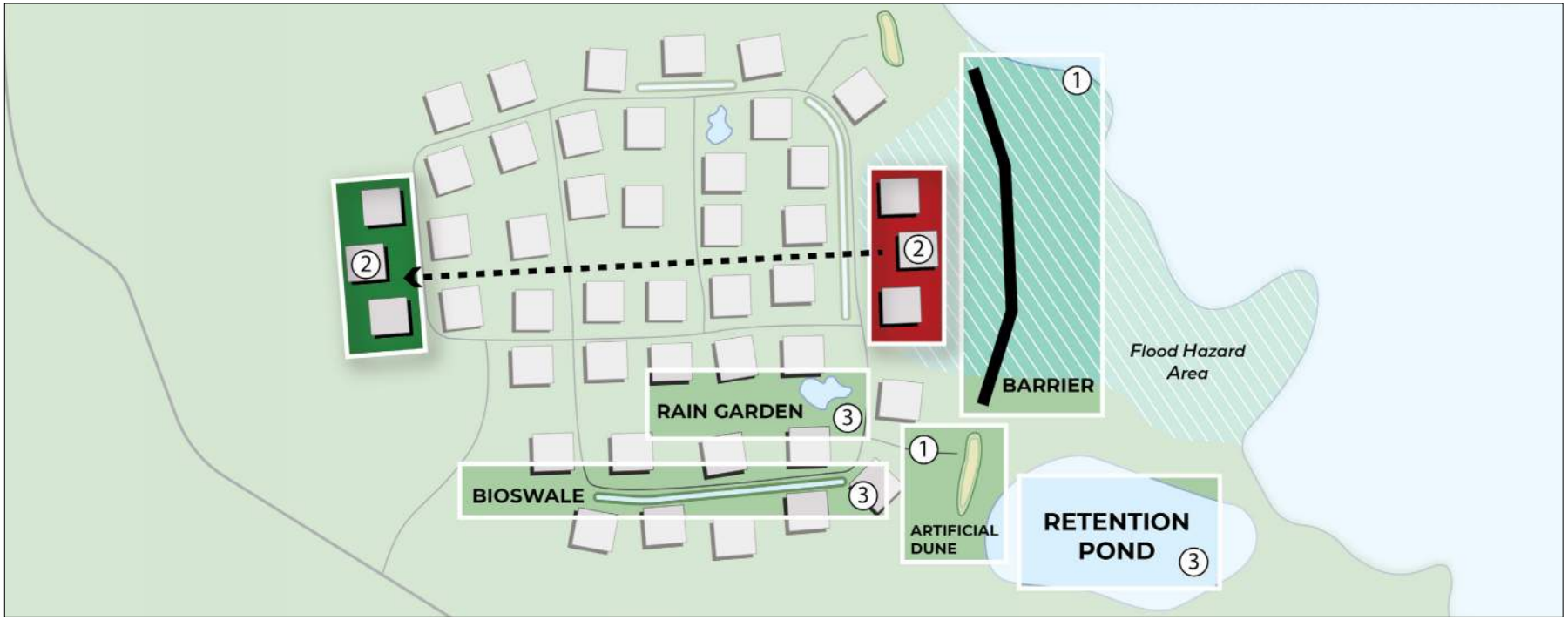
Example of High Elevation

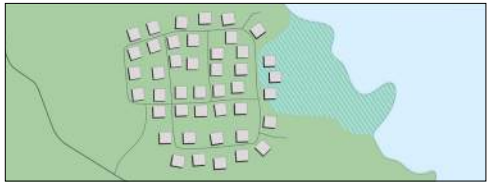
DENSE NEIGHBORHOODS/SMALL LOTS

1. Front entry - Keep orientation of front door to street or other walkway network.
2. Stair structure - Reconnect to street/ground level with simple, light massing stair structure.

   Maintain pedestrian-oriented element at same height as previous entry/porch level. Consider access stairs to shared elevated walkway with abutting properties that are very close.
3. Neighborhood character - Elevate to consistent height and use similar landscape elements such as hedges and low fences to distract from elevation changes.
4. Space under elevated buildings – Enclose with skirting for low elevation heights or leave open if area under building is large in relation to size of existing structures.

ALTERNATIVE 2: NEIGHBORHOOD PROTECTION





DENSE NEIGHBORHOODS/SMALL LOTS

(1) Consider neighborhood barrier, either temporary or permanent, to address storm tide pathways.

(2) Identify available higher elevation locations for possible relocation (target relocation for most threatened and most important buildings).

(3) Make space for water along the street edge, rear yards, parks, or other open spaces; floodwater parks can collect stormwater during flood events but otherwise serve as recreational space.

NEIGHBORHOOD CONTEXTS

CASE STUDY

Moderate Density Neighborhood/ Medium Lots

Moderate density neighborhood defined by open or enclosed one-story porches facing the street, with shallow building setbacks and informal landscaping.

These neighborhoods have a residential focus and buildings set back somewhat from the street with front or side yards and more open landscape features. In some neighborhoods, this may include Maritime Areas with non-residential water-dependent uses.

Key tenets for adaptation:

1. Maintain entry relationship to street or public spaces.
2. Restrict expansions to maintain narrow building profile.
3. Address short term by making space for water, temporary barriers or floodproofing in place, and long term with building elevation or shifting building out of flood zone.
4. In Maritime Areas, consider moving residential to upper floors and adapting first floor for flexible uses, or floodproof building at street front and elevate rear portion of building.
5. Limit enclosed areas under elevated building based on elevation height (less enclosure for high elevations).
6. Provide ground level seating or landscape features in front yard area consistent with existing neighborhood character.

Moderate Density Neighborhoods with Medium Lots are typically found in these placetypes

ALTERNATIVE 1: FLOODPROOF

MODERATE DENSITY NEIGHBORHOOD/MEDIUM LOTS

This may be appropriate for buildings with masonry walls or high masonry foundations, where accessibility issues are a concern, and where use of the first level is flexible.

1. Masonry building: Dry floodproofing with drop-in shields, or wet floodproofing with flood vents.
2. Wood building: Reinforce the wall area below flood height with masonry to facilitate floodproofing.
3. Seal off openings in lower level like windows, cellar entries, etc.
4. Retain street front portion of building at existing level and floodproofed, while elevating rear portion of building, relocating equipment and spaces requiring utilities to elevated portion, reached either by a ramp or by internal stairs.

ALTERNATIVE 2: ELEVATE BUILDINGS

MODERATE DENSITY NEIGHBORHOOD/MEDIUM LOTS

(1) Maintain entry relationship to street.

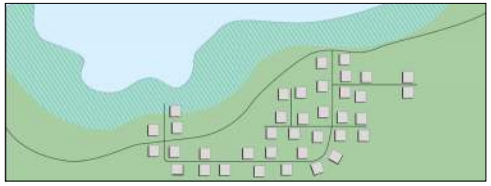
(2) Design extended stair structure to include features from neighborhood or to continue the building design (for low elevation projects, could regrade immediately adjacent to building to hide increased foundation height).

(3) Retain scale from streetscape

- Use landscape features in tiers of material to disguise the elevation level.
- Restrict expansions to a narrow profile or to the rear of the building.
- Limit the enclosed area under building and/or stairs.

(4) Reinforce neighborhood character with ground-level seating or front yard landscape features.

ALTERNATE 3: NEIGHBORHOOD PROTECTION



MODERATE DENSITY NEIGHBORHOOD/
MEDIUM LOTS

(1) Address storm tide pathways – create permanent or temporary berms to prevent water entering at these locations, where appropriate.

(2) Make space for water by creating rain gardens along the street or sidewalk edge, and accommodate water elsewhere on the site in bioswales or similar structures.

NEIGHBORHOOD CONTEXTS

CASE STUDY

Low Density Neighborhood/Large Lots

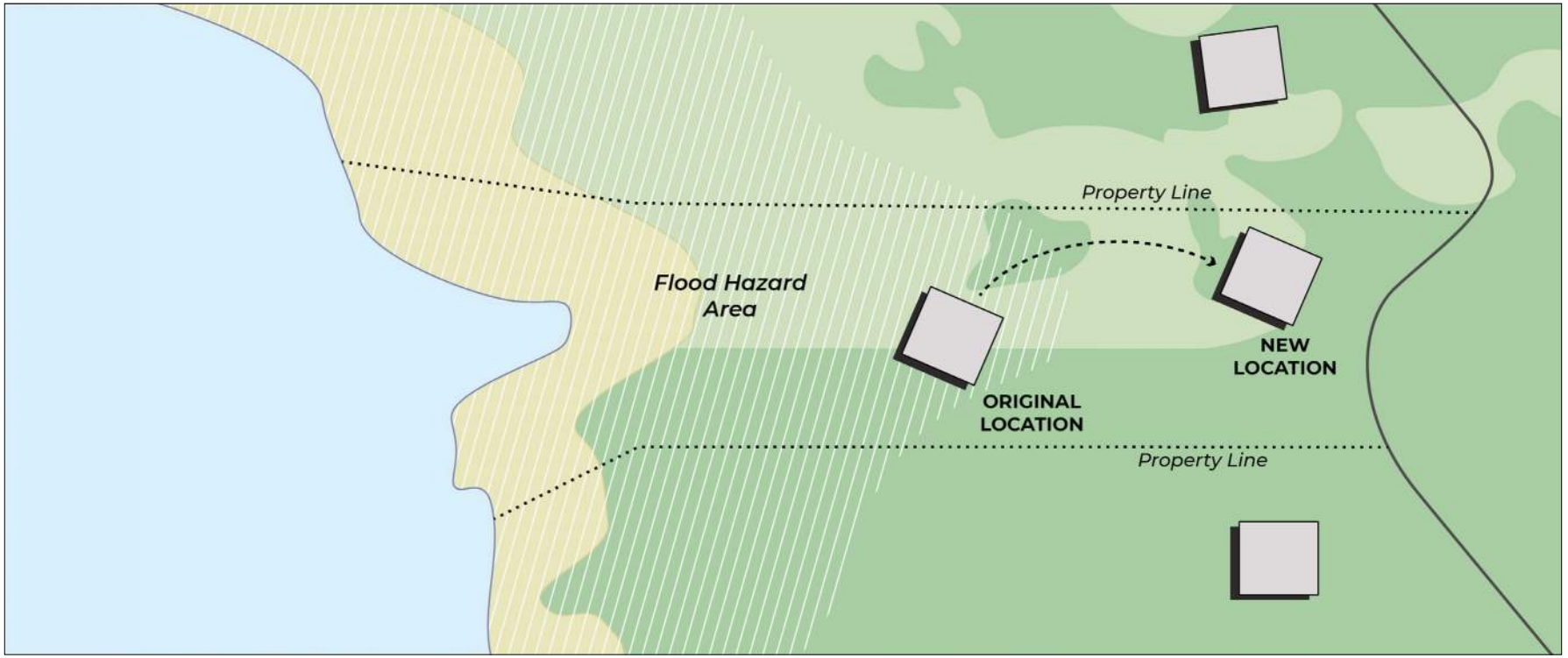
Residential neighborhoods that were established with large lots often have buildings set well back from the road edge with significant landscape areas. These properties generally have less connection to the streetscape and more flexibility to adapt or relocate outside of flood hazard areas.

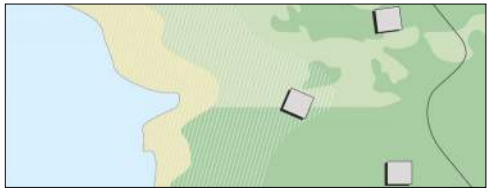
Key tenets for adaptation:

1. Use landscape elements in groupings and tiers to reconnect building to the landscape.
2. Maintain pedestrian-oriented element at street front if one existed originally.
3. Address short term by floodproofing or removing/relocating parts of building that are within the flood zone, and long term by building elevation or relocation.
4. Make space for water on site.
5. Limit deck expansion to one or two building facades to limit building silhouette.
6. Limit enclosed areas under the building based on elevation height.

Low Density Neighborhoods with Large Lots are typically found in these placetypes.

ALTERNATIVE 1: RELOCATE BUILDING





LOW DENSITY NEIGHBORHOOD/
LARGE LOTS

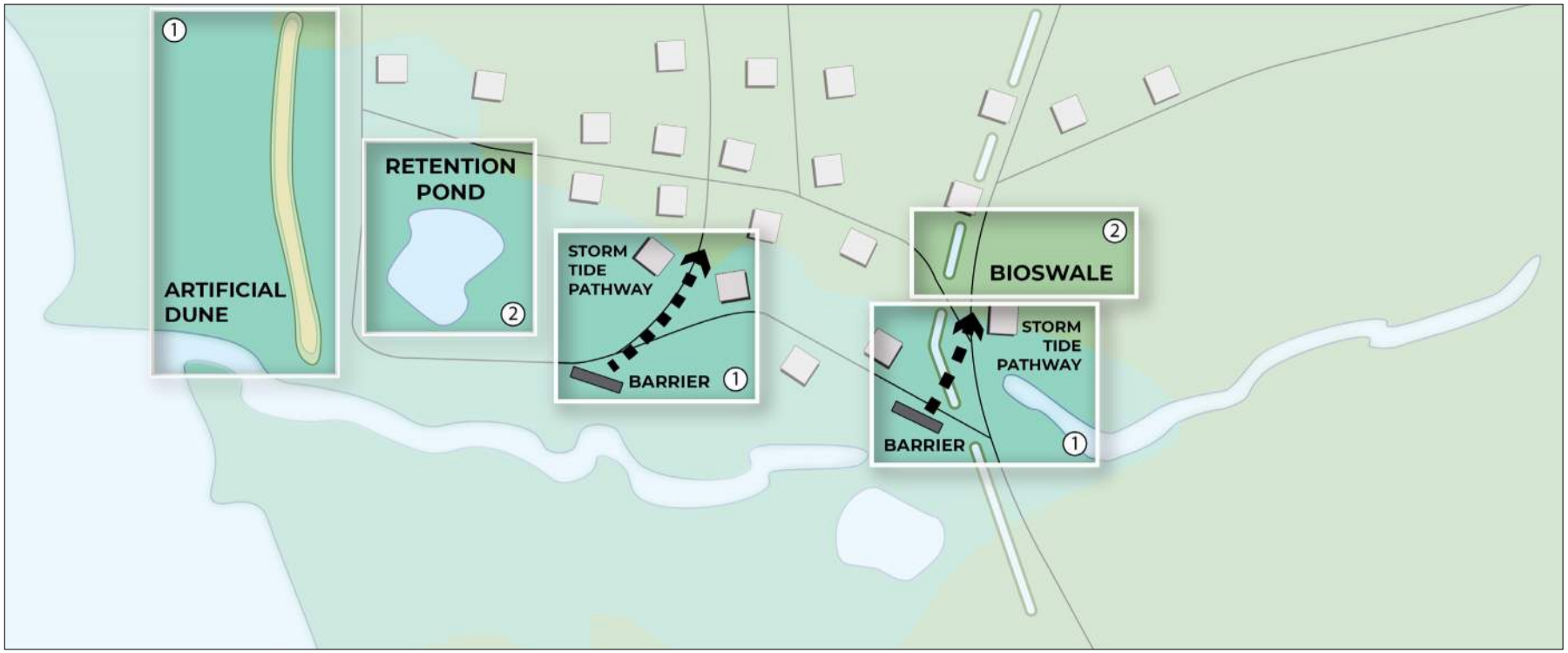
(1) Relocate building outside flood hazard area.

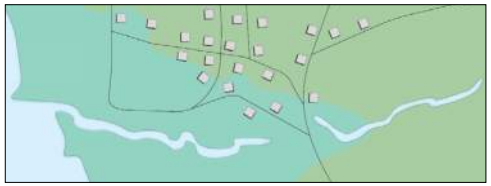
ALTERNATIVE 2: ELEVATE BUILDINGS

LOW DENSITY NEIGHBORHOOD/
LARGE LOTS

1. Adjust topography to raise ground level adjacent to building and lower ground level in other locations for no net increase in ground level throughout the site.
2. Use landscape elements in tiers to transition from ground level to entry level.
3. Make space for water in low lying areas of the site.
4. Maintain small porch/deck area in traditional location and stairs visible from the street.
5. Include pedestrian elements at street edge (low fence and plantings).

ALTERNATIVE 3: NEIGHBORHOOD PROTECTION





LOW DENSITY NEIGHBORHOOD/
LARGE LOTS

(1) Address storm tide pathways – create permanent or temporary berms or barriers to prevent water entering at these locations, where appropriate.

(2) Make space for water on individual lots and/or in the neighborhood by creating stormwater retention areas, bioswales, and other water features as part of site landscaping.

NEIGHBORHOOD CONTEXTS
CASE STUDY

Barrier Beach

Barrier beaches are important natural resource areas with high scenic and environmental value. These same values have long attracted residential development of varying scales, but erosion and migrating coastal resources create significant challenges for buildings in these areas.

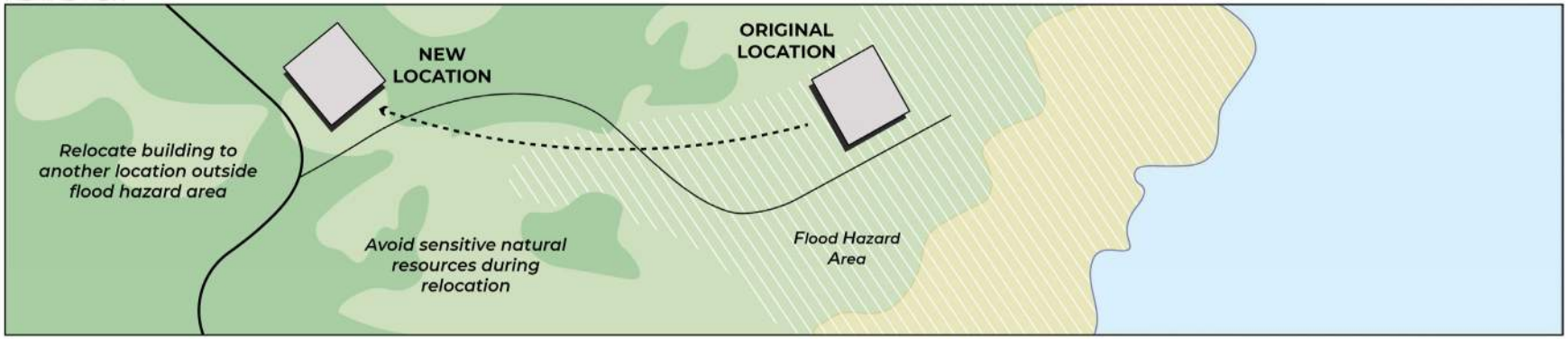
Key tenets for adaptation:

1. Protect environmental resources.
2. Limit building silhouette.
3. Limit new deck and porch areas.
4. No enclosed areas below building.
5. No expansion of buildings (except for relocated utilities and access stairs).
6. Discourage raised septic systems or raised ground levels that channel flood water.

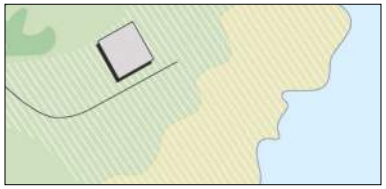
Barrier Beaches are typically found in the Natural Area placetype.

ALTERNATIVE 1: RELOCATE

AERIAL VIEW



PERSPECTIVE VIEW



BARRIER BEACH

Provide long-term protection for both the building and for adjacent natural resources in an area of high erosion rates.

1. Move building to a new location outside the flood hazard area.
2. Avoid sensitive natural resources during relocation.

ALTERNATIVE 2: ELEVATE BUILDINGS

BARRIER BEACH

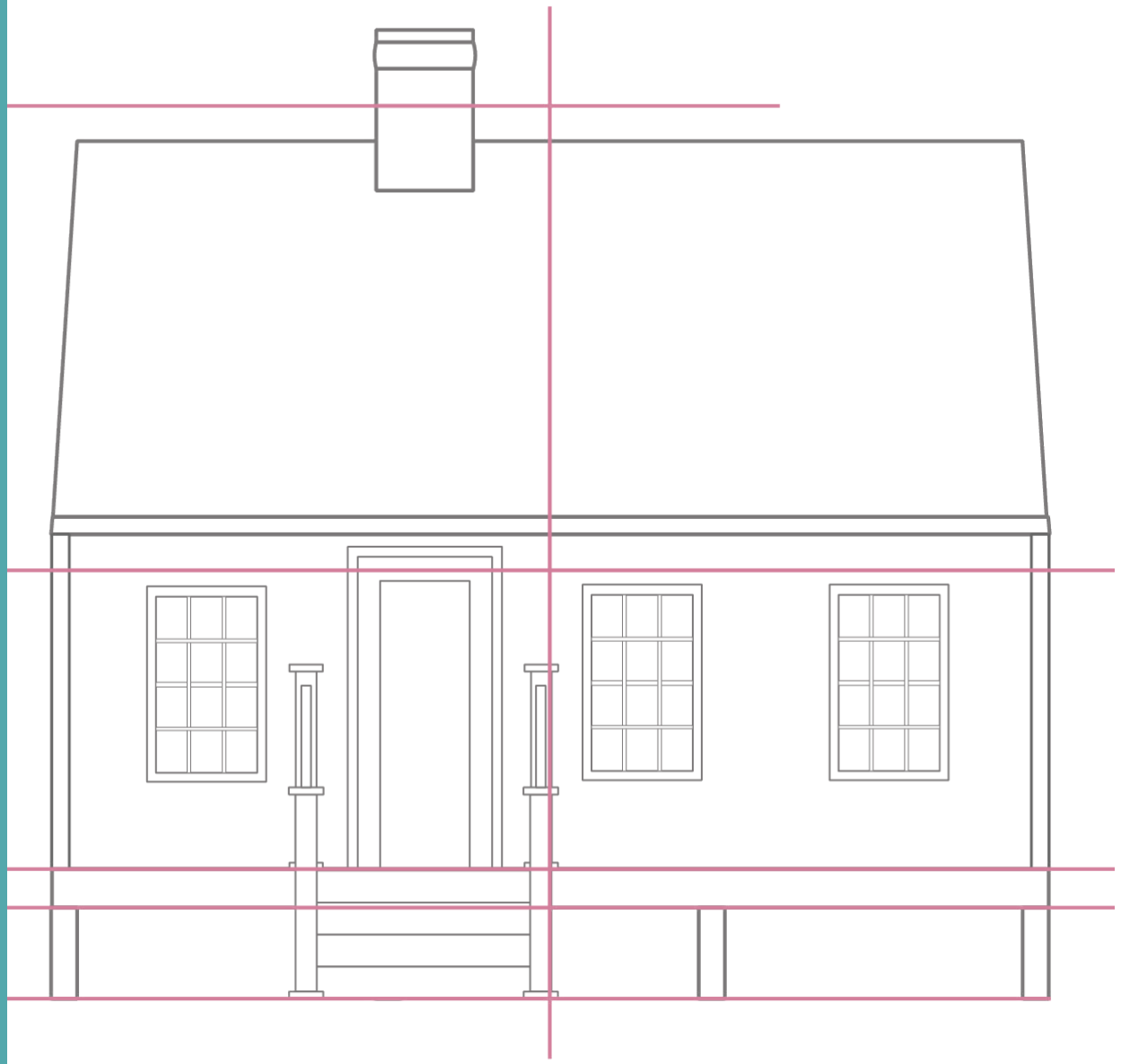
Lift the building above flood levels, designing carefully to accommodate migrating dunes and coastal resources and to limit visual impacts.

1. Maintain or reduce existing square footage to reduce environmental impact – expand only for relocated utilities and access stairs.
2. Limit porches or decks to small areas and only one or two locations -- porches and decks that encircle the building increase the silhouette significantly and are inconsistent with the traditional designs.
3. Keep area under building open to maintain views and allow sand to pass beneath – no enclosures for storage or access are allowed in a dune.
4. Design access with a narrow silhouette – parallel the side or front of the building, or provide access from underneath the building.

CASE STUDIES

Common Building Types

The following Case Studies illustrate techniques that are appropriate for flood hazard adaptation in specific building types that are common to Cape Cod. Wood frame buildings are the norm in the region, so the examples are all constructed of wood.



COMMON
BUILDING TYPES
CASE STUDY

Small Cottage/ Simple Mass

Cape Cod is known for the residential building type that carries its name - the Cape Cod House - a modest, wood-frame building with a steeply pitched roof. For much of the Cape's history, small scale residential buildings have been based on this simple precedent.

1. Extend stairs simply to front or side with small open portico.
2. Screen increased height of foundation or space below building with layers of vegetation or skirting, depending on height and character of surrounding neighborhood.
3. Use narrow front decks in high activity areas to break up height increase and maintain interest at the street front.
4. Limit additions to small forms that hug the rear or side of building.
5. Keep porches and decks to small portions of the facade.
6. Incorporate details from local traditions such as small roof dormers, railing details, and landscape fencing.

COMMON
BUILDING TYPES
CASE STUDY

Large Residential Structure/Complex Mass

Greek Revival and Victorian architectural styles from the Cape's later historic development periods produced more complex and larger residential buildings, often with multiple ells and roof forms.

1. Extend stairs to entry simply to front or side depending on elevation and building setback.
2. Screen increased height of foundation or space below building with layers of vegetation or skirting, depending on height and character of surrounding neighborhood.
3. Use narrow front decks or extended steps in high activity areas to break up height increase and maintain interest at the street front.
4. Limit additions to small forms that hug the rear or side of building or add dormer to roof.
5. Incorporate details from local traditions such as railing details, and landscape fencing that echoes the rhythm of window openings .

COMMON
BUILDING TYPES
CASE STUDY

Small Commercial/ Mixed Use Building

The region's small commercial buildings often mimic residential forms with front porches or display windows added to support commercial uses. Many of those located in the vicinity of harbors are early maritime industrial structures with a narrow profile facing the street.

1. Floodproof in place, if building materials are adequate and ground-floor uses can accommodate it, with floodproof materials below BFE/freeboard, and drop-in barriers for door and window openings below BFE/freeboard.
2. Extend stairs to entry simply to front and incorporate seating within the stair structure when possible.
3. For lower elevations, design skirting to complement the existing building materials. Inset skirting several inches from edge and finish with a dark color to differentiate from the building mass. For higher elevations, consider leaving the area open below as an alternative to skirting.
4. Limit additions to small forms that hug the rear or side of building or add dormer to roof.
5. Create interest at pedestrian level below BFE by adding display windows, porches, window boxes, or interesting patterns in foundation materials.
6. Incorporate landscape details with plantings, seating areas, pervious paving, low fences, or LID at ground-level.

COMMON BUILDING TYPES

CASE STUDY

Large Commercial/ Institutional/Mixed Use Building

These public structures typically have the same pitched roof forms found on smaller buildings in the region, but in a larger scale and with more architectural ornamentation. These buildings often have multiple entries with accessibility concerns and have a significant presence on the street due to their size.

1. Floodproof in place, if building materials are adequate and ground-floor uses can accommodate it, with floodproof materials below BFE/freeboard, and drop-in barriers for door and window openings below BFE/freeboard.
2. Extend stairs to entry simply to front when possible or add additional entrance for greater accessibility.
3. Screen increased height of foundation or space below building with layers of vegetation or skirting, depending on height and character of surrounding neighborhood.
4. Allow dormer additions to upper levels to compensate for the loss of lower level areas that can't be elevated.
5. Design a series of platforms to soften the increase in elevation and provide usable public space.

FLOOD AREA DESIGN GUIDELINES FOR CAPE COD

2023

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