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**MEMORANDUM**

23 July 2014
File No. 38638-000

TO: Town Committee on Squibnocket
Attn: Jim Malkin, Chairman

FROM: Haley & Aldrich, Inc.
Mark X. Haley, P.E., Russell A. Schuck, P.G.
Vanasse Hangen Brustlin, Inc.
Daniel Padien

SUBJECT: Rationale for Elevated Roadway Solution
Squibnocket Road Improvements
Chilmark, Massachusetts

CC: Lawrence Lasser

In 2012, the Squibnocket Farm Homeowners Association (Association) engaged the services of Haley & Aldrich, Inc. (H&A) and Vanasse Hangen Brustlin Inc. (VHB) to identify an approach to preserving long-term and reliable vehicular and utility access to the Squibnocket Farm subdivision. At the April 2014 Annual Town Meeting, the voters of Chilmark were presented with a proposal for an elevated roadway that would simultaneously resolve the Association's access requirements and provide for access to an enlarged and improved public beach and parking area. This private-public proposal was rejected in favor of further study by a newly formed committee. The purpose of this memorandum is to inform the Town Committee on Squibnocket (Committee) about the conclusions that the project team reached with respect to the forces and factors that pose a potentially imminent and disabling threat to access, the alternative approaches that were considered as possible solutions to the problem, and the rationale for selecting the elevated roadway as the preferred solution.

## BACKGROUND

Squibnocket Road provides the only vehicular access to the Squibnocket Farm subdivision. As Squibnocket Road crosses the Town Beach Parking Lot and the sand surfaced road narrows, it is bounded by a rip-rap revetment protecting it from erosion during high tidal surges and storm events. Figure 1 is an aerial photograph of the subject area. Utilities for the Squibnocket Farm subdivision are located under the roadway and are also protected by the rip-rap revetment.


*Figure 1. Aerial View of Existing Squibnocket Causeway.*

Squibnocket Road is – at several points, and most dramatically in the area on and adjacent to the existing gate located in an area known as Money Hill – subject to extreme erosion caused by storm events and abnormally high tides, as shown on Figure 2. In fact, the Town Beach Parking Lot, Squibnocket Road and existing rip-rap revetment all routinely experience erosion and damage caused by storm events, requiring repeated repair.

*Figure 2. Town Beach Parking Lot during Hurricane Sandy.*

In accordance with 310 CMR 10.00, the regulations promulgated pursuant to the Massachusetts Wetlands Protection Act (Regulations), the Massachusetts Department of Environmental Protection (MassDEP) cannot permit "hard solutions" to a coastal erosion problem. The Regulations prohibit any effort to improve or extend the existing revetment. "Soft" solutions consisting of vegetated sand banks are permittable under the Regulations. In fact, the Association invested in a combination of sand, coir logs, and vegetative plantings to stabilize Money Hill in 2010, after being encouraged to so by MassDEP (see Exhibit A). As shown on Figure 3, the "soft solution" failed during Hurricane Sandy.

*Figure 3. The "soft-solution" before Hurricane Sandy on the left and after Hurricane Sandy on the right.*

In H&A and VHB's view, there is no question that at some point in the relatively near future the narrow neck of land separating the ocean from Squibnocket Pond will "breach" in the vicinity of the Town Beach Parking Lot or Money Hill, eliminating vehicular access to Squibnocket Farm. In the interim, the access road will continue to experience damage during storm events. It is anticipated that the damage will become worse with the passage of time. In the days following storms, while the roadway is being repaired (assuming permission is granted to perform such repairs), vehicular or utility access will be compromised or interrupted. Response to a medical, fire, or safety incident is dangerously impaired, if not eliminated, during storm events.

**REGULATORY CONTEXT**

Squibnocket Beach contains numerous local, state, and federally regulated wetland resource areas due to its location in a dynamic coastal environment. These resources extend from the easily defined land under the ocean and coastal beach to the more dynamic barrier beach composed of coastal banks and coastal dunes. Resource areas associated with Squibnocket Pond include land under water, inland bank and bordering vegetated wetlands. Overlying all of these resources are the floodplain resources bordering land subject to flooding and land subject to coastal storm flowage. Many of these resources have a state-established 100-foot buffer zone and all have a locally regulated 100-foot buffer zone.

These wetland resources are subject to overlapping local, state and federal jurisdictions. Though each regulatory body approaches protection of the natural environment in a slightly different way, generally speaking, they all seek to preserve the natural coastal systems that influence Squibnocket Beach and the surrounding areas.

The following statutes and their implementing regulations potentially control projects located within the coastal and inland resource areas present at the project site. Specific review and approval authority for each regulatory agency under the programs listed below depends on the scope of anticipated impacts to the regulated resource area in question.

- Chilmark Wetlands Protection Bylaw
- Massachusetts Wetlands Protection Act
- Massachusetts Waterways Act (Chapter 91)
- Massachusetts Clean Waters Act
- Federal Clean Water Act
- Federal Rivers and Harbors Act

As discussed below, because the preferred alternative (Elevated Roadway) can be sited and designed in a manner that avoids encroachment on areas below the mean high water mark of either the ocean or Squibnocket Pond, the only regulatory programs directly applicable to the project are the Chilmark Wetlands Protection Bylaw (Chilmark Wetlands Bylaw) and the Massachusetts Wetlands Protection Act (Act). The following narrative describes how these laws apply to the project site and influence the selection of the preferred alternative.

**Chilmark Wetlands Protection Bylaw**

The Chilmark Wetlands Bylaw is administered by the Chilmark Conservation Commission in parallel with the Act. The Act, its implementing regulations, and the Chilmark Wetlands Bylaw require an "Order of Conditions" for the alteration of any coastal resource areas or of any areas within 100 feet of such resources. Wetland resource areas protected by the Chilmark Wetlands Bylaw at the project site include coastal resource areas and their associated buffer zones:

- Land Under the Ocean
- Barrier Beach
- Coastal Dune
- Coastal Beach
- Coastal Bank
- Land Subject to Coastal Storm Flowage
- 100-foot buffer zone to Coastal Bank

The following inland wetland resource areas and buffer zones also are present at the site, each associated with Squibnocket Pond:

- Land Under Water (LUW)
- Inland Bank
- Bordering Vegetated Wetlands (BVW)
- Bordering Land Subject to Flooding (BLSF)
- 100-foot buffer zone to BVW and/or Bank

These resource areas are identified and regulated pursuant to the definitions and performance standards described in detail in the Wetlands Protection Act discussion below.

**Massachusetts Wetlands Protection Act**

The Act regulates the alteration of coastal and inland wetland resource areas for the purpose of furthering certain enumerated public and environmental interests. The Act and its implementing regulations at 310 CMR 10.00 (Regulations) are administered by the Chilmark Conservation Commission under the regulatory oversight of MassDEP. Any alteration to a state-regulated wetland resource area or work in the 100-foot buffer zone to certain resource areas requires an Order of Conditions issued by the Chilmark Conservation Commission. All Orders of Conditions are subject to review, and if necessary intervention, by MassDEP if the agency determines that a project does not meet the performance standards for work within wetland resource areas.

The following provides an overview of the coastal and inland wetland resource areas present at the project site and summarizes the performance standards for work in each. The Chilmark Conservation Commission, subject to MassDEP's oversight, has authority to confirm the boundaries of all resource areas subject to the Act and the significance of these resources to the related public interests.[1]

**Barrier Beach** means a narrow low-lying strip of land generally consisting of coastal beaches and coastal dunes extending roughly parallel to the trend of the coast. It is separated from the mainland by a narrow body of fresh, brackish or saline water or a marsh system. A barrier beach may be joined to the mainland at one or both ends.[2]

Portions of the project site are located within a barrier beach as defined the Regulations and have been preliminary mapped as such by MassDEP. These areas extend from the northern end of the existing parking lot to the northern end of Money Hill and southerly from the southern end of Money Hill for at least ½ mile. (As discussed below, Money Hill itself is likely a glacial deposit that is not a wetland resource.)

Work may be permitted on a barrier beach if it conforms to the performance standards for coastal beaches and coastal dunes (discussed below).[3]

[1] There has not yet been a precise and formal delineation of wetland resource areas located at the project site, but, based on a review of publically available maps, first-hand observation, experience, and some preliminary field investigations, there is ample information about the types and locations of resources to support the conceptual alternatives analysis presented in this memorandum. The Association will pursue a formal delineation process through the filing of appropriate paperwork (e.g., "Request for Determination of Applicability") with the Chilmark Conservation Commission at the appropriate time.

[2] *See* 310 CMR 10.29(2).

[3] *See* 310 CMR 10.29(3) *and* Chilmark Wetlands Protection Regulations Section 2.04.

**Coastal Dune** means any natural hill, mound or ridge of sediment landward of a coastal beach deposited by wind action or storm over wash. Coastal dune also means sediment deposited by artificial means and serving the purpose of storm damage prevention or flood control.[4]

Coastal dune is present at the site south of Money Hill and, in a substantially altered and degraded state – if at all – between Money Hill and the northern end of the parking lot. Work on or within 100 feet of a coastal dune may be permitted in limited cases when the construction can be completed in such a way as to not adversely affect the long-term stability of the dune, reduce the size of the dune, remove sand or disturb vegetation in a way that would destabilize the dune, modify the dune form in such a way as to increase the potential for storm or flood damage, interfere with the lateral or landward movement of the dune, or interfere with mapped or otherwise identified bird nesting habitat.[5]

The Chilmark Wetlands Bylaw generally prohibits alterations to coastal dunes[6] except when the work can be shown to avoid adverse effects on the public interests protected in the bylaw.

**Coastal Beach** means unconsolidated sediment subject to wave, tidal and coastal storm action which forms the gently sloping shore of a body of salt water and includes tidal flats. Coastal beaches extend from the mean low water line landward to the dune line, coastal bank line or the seaward edge of existing man-made structures, when these structures replace one of the above lines, whichever is closest to the ocean.[7]

Coastal beach is present at the site, limited to the ocean side of the shoreline extending landward to the base of the existing revetment and Money Hill. Work within a coastal beach may be permitted when such work will not have an adverse effect by increasing erosion, decreasing the volume or changing the form of any such coastal beach or an adjacent of downdrift coastal beach.[8]

**Coastal Bank** means the seaward face or side of any elevated landform, other than a coastal dune, which lies at the landward edge of a coastal beach, land subject to tidal action, or other wetland.[9]

Coastal bank is present at the site on the ocean side of the parking lot revetment, along Money Hill and south of Money Hill. Work on a coastal bank or within 100 feet of a coastal bank shall not have an

[4] *See* 310 CMR 10.28(2).

[5] *See* 310 CMR 10.28(3)(a)-(f).

[6] See Chilmark Wetland Protection Regulations Section 2.03(4) and 5.01.

[7] *See* 310 CMR 10.27(2) *and* Chilmark Wetland Regulation Section 2.02(1).

[8] *See* 310 CMR 10.27(4) *and* Chilmark Wetland Regulations Section 2.02(4).

[9] *See* 310 CMR 10.30(2) *and* Chilmark Wetland Regulations Section 2.05(1).

adverse effect due to wave action on the movement of sediment from the coastal bank to coastal beaches or land subject to tidal action.[10]

**Bordering Vegetated Wetlands (BVW)** means the freshwater wetlands bordering on creeks, rivers, streams, ponds and lakes. The types of freshwater wetlands are wet meadows, marshes, swamps and bogs. BVW are areas where the soils are saturated or inundated such that they support a predominance of wetland indicator plants. The ground and surface water regime and the vegetational community prevalent in each type of freshwater wetland are specified in the Act.[11]

BVW is present at the site along portions of the edge of Squibnocket Pond, as a narrow fringe in the vicinity of Money Hill and in wider areas adjacent to the existing parking lot and Squibnocket Road.

Work may be permitted in BVW provided all impacts are mitigated by compensatory wetland restoration or replacement activities undertaken in a contiguous area, and all of the performance standards established by 310 CMR 10.55 are met. These performance standards include a prohibition on altering more than 5,000 SF of BVW except in narrow cases referred to in the Regulations as "limited projects."[12] In addition to the performance standards from the Regulations, the Chilmark Wetlands Bylaw generally prohibits alterations to BVW[13] except when the work can be shown to avoid adverse effects on the public interests protected by the Chilmark Wetlands Bylaw.[14]

**Land Subject to Coastal Storm Flowage** means land subject to any inundation caused by coastal storms up to and including that caused by the 100-year storm, surge of record or storm of record, whichever is greater.[15]

Land subject to coastal storm flowage is present at the site as presently depicted on the most recently issued Flood Insurance Rate Map. While there are no state performance standards for work within Land Subject to Coastal Storm Flowage, the Chilmark Wetlands Bylaw and its implementing regulations require projects to (a) avoid adverse impacts to the ability of the land to absorb and contain floodwaters, (b) be designed to protect ground surface and salt water from pollution, and (c) avoid alteration of to land subject to coastal storm flowage which is significant to wildlife and their habitats.

The following coastal resources are located in the vicinity of the project site:

[10] *See* 310 CMR 10.30(4) *and* Chilmark Wetland Regulations Section 2.05(3).

[11] *See* 310 CMR 10.55(2) .

[12] *See* 310 CMR 10.55(4)(b).

[13] *See* Chilmark Wetlands Regulations Section 3.02(3).

[14] *See* Chilmark Wetlands Regulations Section 5.01.

[15] *See* 310 CMR 10.04.

**Land Under the Ocean** means land extending from the mean low water line seaward to the boundary of the municipality's jurisdiction and includes land under estuaries.[16]

Land Under the Ocean is present on the ocean side of Squibnocket Beach extending seaward from the mean low water line.

**Land Under Water (LUW)** means the land beneath any creek, river, stream, pond or lake. Said land may be composed of organic muck or peat, fine sediments, rocks or bedrock. The boundary of LUW is the mean annual low water level of the water body or waterway.[17]

LUW is present below the mean annual low water mark of Squibnocket Pond. Work on LUW may be permitted when projects are deemed to be adequately protective of the water carrying capacity of the waterbody, ground and surface water quality and wildlife habitat functions.

**Inland Bank** means the portion of the land surface which normally abuts and confines a water body. It occurs between a water body and a vegetated bordering wetland and adjacent flood plain, or, in the absence of these, it occurs between a water body and an upland. An inland bank may be partially or totally vegetated, or it may be comprised of exposed soil, gravel or stone. The upper boundary of an inland bank is the first observable break in the slope or the mean annual flood level, whichever is lower. The lower boundary of an inland bank is the mean annual low flow level of the water body.[18]

Inland Bank is present along the edge of Squibnocket Pond. Work may be permitted in an inland bank provided all the applicable performance standards are met, including protection of the stability of the bank, water carrying capacity, protection of water quality and wildlife habitat. [19]

**Bordering Land Subject to Flooding (BLSF)** means an area with low, flat topography adjacent to and inundated by flood waters rising from creeks, rivers, streams, ponds or lakes. It extends from the banks of these waterways and water bodies; where a bordering vegetated wetland occurs, it extends from said wetland.[20]

BLSF is present along the edge of Squibnocket Pond extending from the limit of BVW or Bank landward to elevation 7 FT (NAVD88). Work may generally be permitted in BLSF when there is no net incremental loss of flood storage.[21]

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[16] *See* 310 CMR 10.25(2) *and* Chilmark Wetland Regulations 2.01(A) and (B).

[17] *See* 310 CMR 10.56(2) *and* Chilmark Wetland Regulations Section 3.03(1).

[18] *See* 310 CMR 10.54(2) *and* Chilmark Wetland Regulations Section 3.01(1).

[19] *See* 310 CMR 10.54(4)(a)(1)-(5) *and* Chilmark Wetland Regulation Section 3.01(3) and (4).

[20] *See* 310 CMR 10.57(2)(a) *and* Chilmark Wetland Regulations Section 3.04(1).

[21] *See* 310 CMR 10.57(4)(a)(1)-(3) *and* Chilmark Wetland Regulations Section 3.04(3) and (4).

**100-foot buffer zone**- The 100-foot buffer zone extends from the landward (uphill) limit of resource areas for which buffer zones are created (not all resource areas have associated buffers (e.g., BLSF)). Buffer zones exist in the absence of other resources and do not overlap with bank, coastal bank, BVW or coastal dune.[22] Buffer zones may be altered only upon a showing that the alteration will not have a significant adverse impact on the resource area in question.

**Massachusetts General Law Chapter 91**

M.G.L. Chapter 91 and its implementing regulations (310 CMR 9.00) require a license for the construction, placement of fill or change in use of (a) land seaward of existing mean high tide; (b) land below the natural high water mark of a great pond or (c) anthropogenically filled tidelands.

The areas potentially subject to Chapter 91 at the project site are limited to the land below the natural high water mark of Squibnocket Pond and the land at Squibnocket Beach extending seaward from existing mean high water. The existing parking lot and causeway are not subject to Chapter 91 because they are above the elevation of mean high water. Although it is inevitable that any access project will be subject to the Chilmark Wetlands Bylaw and the Wetlands Protection Act, it will be possible to avoid Chapter 91 jurisdiction if no structures or fill are placed below mean high water on either the ocean or the Pond side of the project site. With slight variations, the same basic principle applies to the other regulatory programs (e.g., Federal Clean Water Act) listed earlier. The jurisdiction of those programs can either be avoided or minimized if the project is sited along or near the alignment of the existing roadway and parking area, above mean high water.

**IMPETUS FOR PROJECT**

As described above, it is our opinion that a breach will occur in the vicinity of Money Hill and the Town Beach Parking Lot. In fact, if not for the existing revetment a breach may have already occurred during some of the recent extreme events. A breach may be temporary, closing during natural, seasonal cycles of erosion and accretion; or, if substantial enough, it may effectively be permanent. As described in more detail below, if there is a breach of or significant damage to the existing roadway, the Association is arguably not entitled under the Regulations to restore the roadway to its pre-existing condition. While it is difficult to predict the specific progression and timing of the breach, the long-term trend of permanent erosion at Squibnocket Beach is clear. In the following sections we address historical erosion rates in the vicinity, the role that Sea Level Rise (SLR) and more frequent extreme weather (both brought on in part by global climate change) will play in future erosion rates.

**Historical Erosion**

The history of erosion of the Squibnocket shoreline dates back approximately 23,000 years to when the last continental glaciation (the Laurentide Ice Sheet) reached its maximum southern advance, marked by the islands in the area (see Figure 4). Long Island, Block Island, Martha's Vineyard and Nantucket, among other smaller islands, were formed as soils were pushed and piled up as a glacial moraine or deposited by glacial melt waters during the last continental glaciation. When the continental ice sheet

[22] *See* 310 CMR 10.04 *and* Chilmark Wetland Regulations Section 1.02.

started to retreat approximately 23,000 years ago and the sea level reached the elevation of the islands (i.e., sea level had dropped dramatically when all the water was in the form of ice, exposing much of the continental shelf), waves and currents began to erode and reshape the islands. As such the islands were certainly much larger approximately 20,000 years ago and may have even been connected as a long sinuous terminal moraine at one point. Deposition on the islands also occurs, but in general the islands are eroding and have been since their formation. In more recent years erosion has been monitored along much of the Cape Islands, and we can begin to quantify the rates at which erosion is occurring and assess impacts in the future.

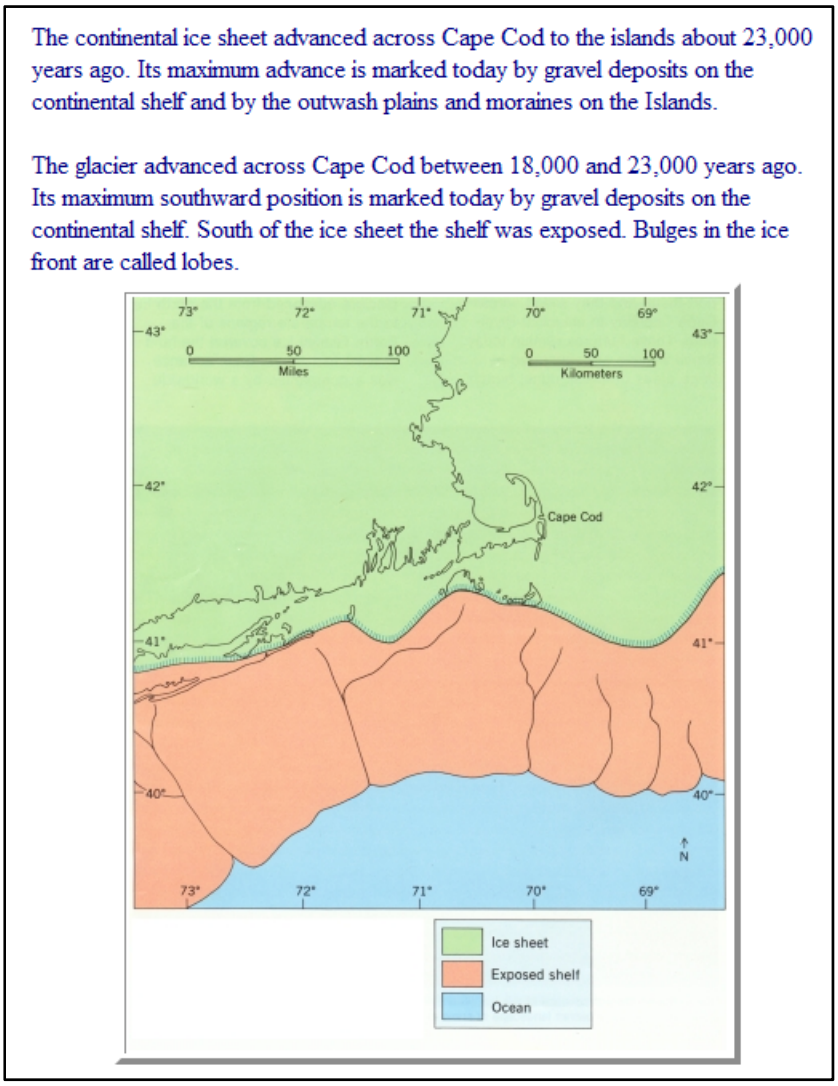


*Figure 4. Taken From* Geologic History of Cape Cod, Massachusetts *by Robert N. Oldale U.S. Geologic Survey, Woods Hole Field Center, Massachusetts –online.*

The Massachusetts Office of Coastal Zone Management has completed the Massachusetts Shoreline Change Project, which illustrates how the shoreline of Massachusetts shifted between the mid-1800s

and 2009. The information has been incorporated in a database called the Massachusetts Ocean Resource Information System (MORIS). A specialized Shoreline Change Browser has been added within the MORIS web-based coastal management tool. This Browser provides recent data on shoreline erosion and accretion (deposition) along the entire Massachusetts shoreline. This tool shows us that the Squibnocket area has continually eroded since information was first available in the late 1800s. On Figure 5 below, the average erosion rate is noted on each yellow transect. In the vicinity of the Town Beach Parking Lot, the average erosion rates range from 0.92 – 1.41 feet per year.

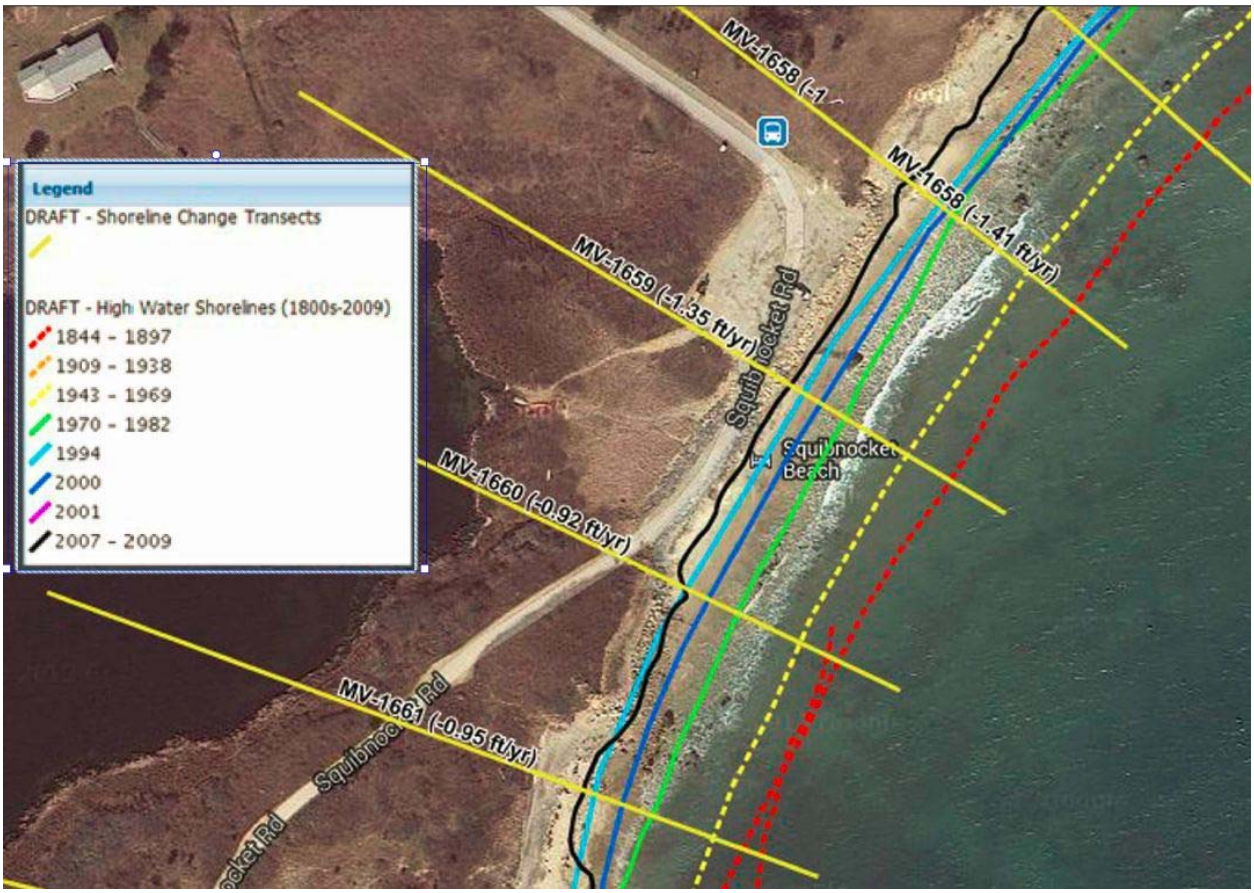


*Figure 5. Image captured from Shoreline Change Browser.*
*http://maps.massgis.state.ma.us/map_ol/czm_shorelines.php*

The Woods Hole Oceanographic Institute (WHOI) and the USGS completed a study published in 2003 showing that 68% of the Massachusetts shoreline is eroding. The study presents data for Chilmark indicating that the average shoreline change rate in Chilmark is -1.9 feet/year and that 97% of the shoreline in Chilmark is eroding, as shown on Figures 6 and 7.

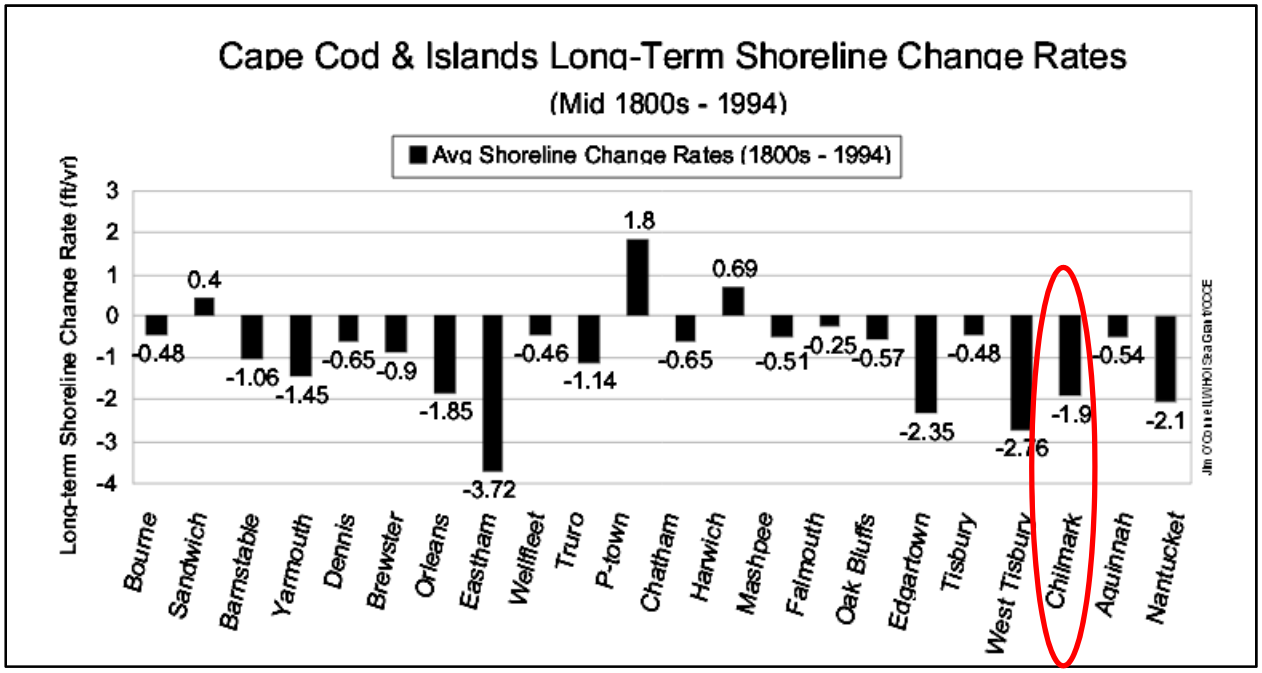


*Figure 6. Long-term average annual shoreline change rates, by town, for Cape Cod, Martha's Vineyard, and Nantucket, Massachusetts.*

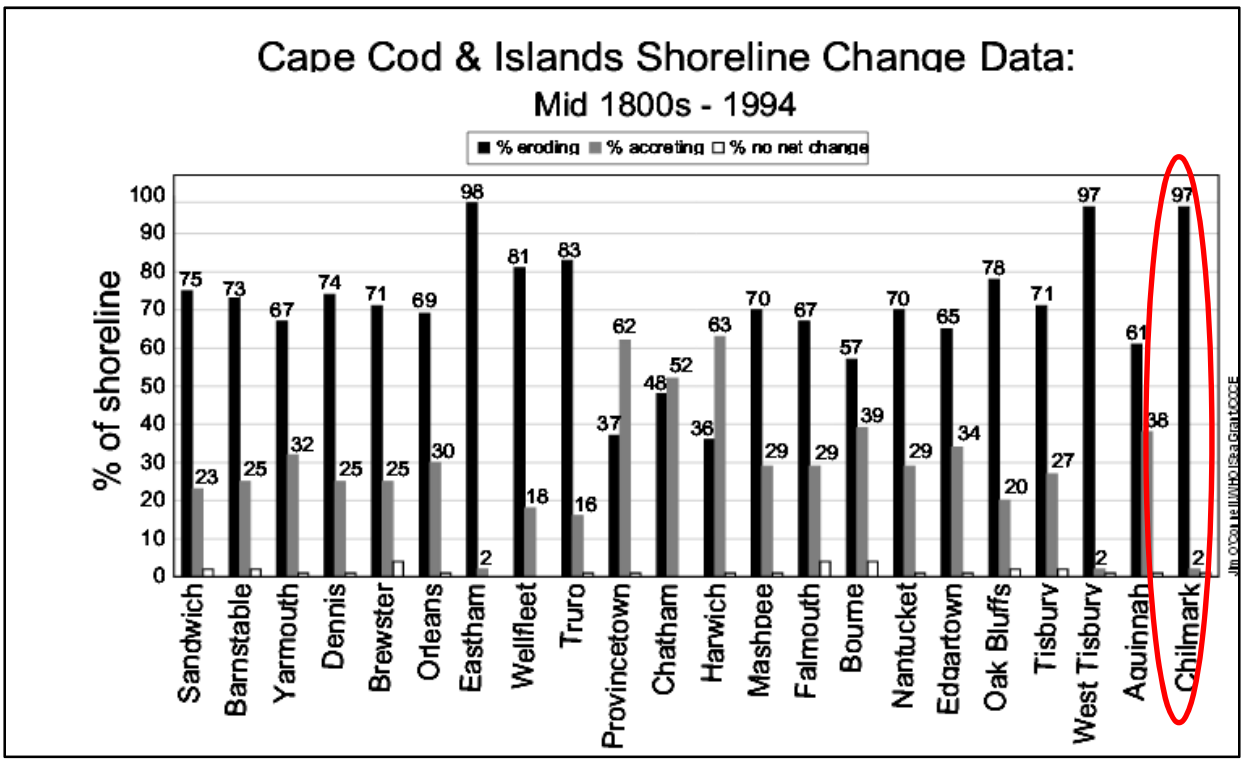


*Figure 7. Percent of linear strength of shoreline eroding, accreting and stable, by town, for Cape Cod, Nantucket, and Martha's Vineyard, Massachusetts, based on the long-term shoreline change data.*

Clearly, erosion of the shoreline is occurring at a rapid rate in the vicinity of the Town Beach Parking Lot and Money Hill. At the current rate, damage to the existing revetment and the Town Beach Parking Lot is inevitable because the revetment will be subjected to increased wave action due to the vertical and horizontal loss of the beach area in front of the revetment. In recent years storm damage along the existing causeway appears to have become more prevalent and significant. The Town and the Association have spent tens of thousands of dollars over the course of twenty years removing debris and repairing the driving surface of the existing causeway on a nearly annual basis depending on the severity of storms. During Hurricane Sandy, the utility lines which are buried along the causeway were also damaged and had to be repaired. Any options for maintaining access to Squibnocket Farm must consider the fact that erosion of the shoreline is occurring at a rapid rate currently and at a rate that will likely accelerate in the future. There is no basis for concluding that the shoreline will stabilize or accrete in this location.

**Sea Level Rise**

The Massachusetts Shoreline Change Mapping Project (updated in 2013) estimates that the high water mark at the project site moved landward between 40 and 50 feet during the period spanning 1970-1982 (baseline) and 2007-2009 (present day). As described previously, the islands have been eroding since their formation, but other causes (likely anthropogenic) have conspired to raise sea levels at an escalating rate and increase the severity and frequency of ocean storms.[23] In our opinion, the combination of increased erosion and SLR will cause a breach near the Town Beach Parking Lot. Unless a permanent remedy is implemented before a breach, the Association will be forced to deploy a barge to ferry vehicles across the breach, or to construct a bridge over the new water body. Constructing a bridge over the water will be substantially more complicated as an engineering and regulatory matter than constructing an elevated roadway (viaduct) over what is now land.

SLR will continue to affect the Squibnocket shoreline in the future, including rise in tide and storm surge elevations, and erosion in areas not previously susceptible—further exacerbating erosion rates. Specific data on sea level rise for Martha's Vineyard was not available, but sea level monitoring performed on Nantucket by the National Oceanic and Atmospheric Administration (NOAA) is a suitable corollary as the islands are similar in nature. The NOAA data from 1965 until the present shows that the rate of sea level rise is increasing. For the period 1965-2006, the rate of SLR was 2.95 mm/yr (1/10 in/yr), and the most recent estimates in 2012 have increased the rate of SLR to 3.52 mm/yr (1/7 in/yr), as shown on Figure 8.

[23] The northeastern U.S. has been identified as a "hot spot" region for sea level rise. The process is expected to move more quickly here than elsewhere in the U.S. *See* Sallenger, et al.,"Hotspot of accelerated sea-level rise on the Atlantic coast of North America," published in *Nature Climate Change*, 24 June 2012 [http://dx.doi.org/10.1038/nclimate1597].

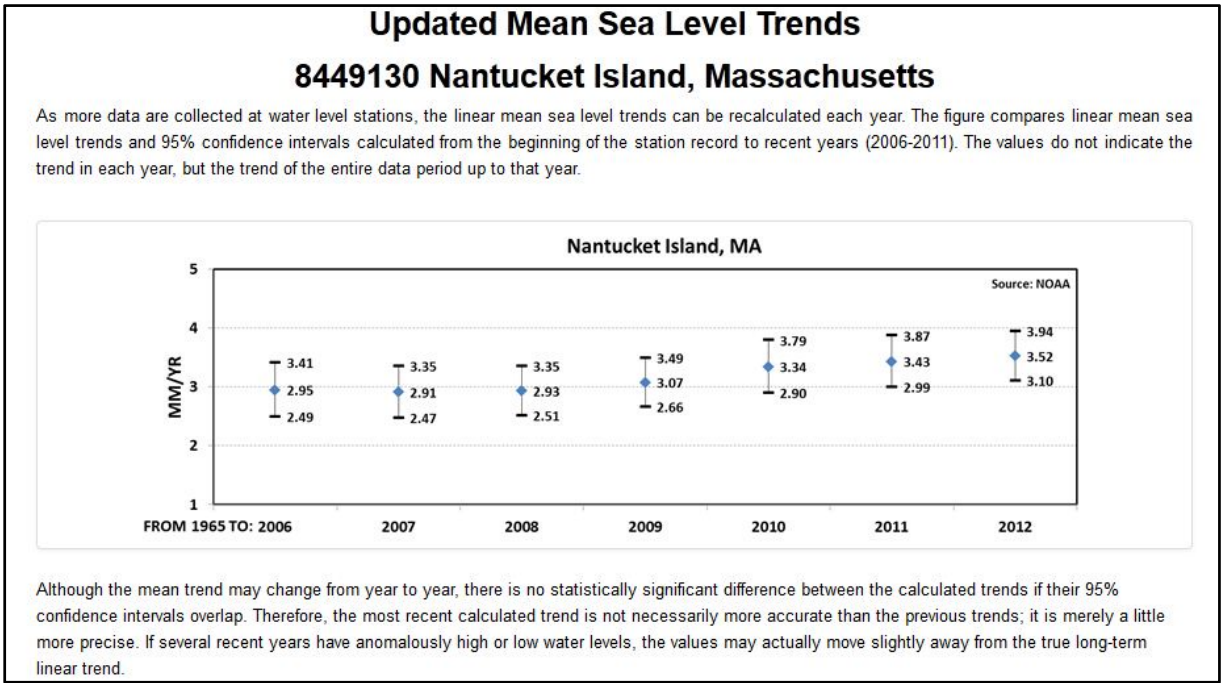


*Figure 8. Trends in sea levels for Nantucket Island, Massachusetts from 1965 to 2012.*

Climate Central (www.climatecentral.org) also presents estimates for sea level rise in Massachusetts. As shown on Figure 9 below, it projects sea level will rise 13 inches by the year 2050 on Nantucket, again the most appropriate corollary for Martha's Vineyard.

**Table: Sea level and high water projections throughout Massachusetts**

Sea level rise projections take into account global and local effects, and vary by site due to differences in local effects, most importantly different rates of sinking or rising land. Scenarios without global warming remove only global effects, both historical and projected. Differences in storm surge patterns and sea level projections together lead to different flood level exceedance odds in different places.

| Water level station | Reference 100-year flood level (feet)[2] | Odds of exceeding reference flood level by 2030 | | Measured historic sea level rise[4] | | Projected sea level rise by 2050[5] | |
|---|---|---|---|---|---|---|---|
| | | With global warming[2] | Without global warming[3] | Inches rise | Period of record | Inches rise 2009-2050 | 90% range |
| Boston - Boston Harbor | 5.6 | 23% | 9% | 9 | 1921-2006 | 12 | 5-22 |
| Woods Hole - Buzzards Bay | 4.8 | 25% | 8% | 8 | 1932-2006 | 12 | 5-22 |
| Nantucket Island, Nantucket Sound | 4.4 | 28% | 7% | 5 | 1965-2006 | 13 | 6-23 |
| Newport - Narragansett Bay | 4.7 | 24% | 9% | 8 | 1930-2006 | 12 | 5-22 |
| Providence - Providence River | 8.5 | 20% | 15% | 5 | 1938-2006 | 11 | 4-22 |

*Figure 9. Sea Level and High Water Projections in Massachusetts.*

Numerous studies have concluded that in addition to SLR, the incidence of extreme weather events is also on the rise. More intense storms will result in greater storm surges, threatening more coastal areas than in years past. The frequency of these intense storms is also predicted to increase, resulting in frequent higher elevation storm surges than the historic norm, causing coastal erosion further inland of the current shoreline.[24] The Federal Emergency Management Agency (FEMA) recently updated its flood insurance maps to better account for these increases in storm frequency and intensity. In 2010 FEMA published a revised map for Dukes County including Chilmark. Figure 10 shows the interpretation of flooding during a 100-year storm. As shown on the map, the Town Beach Parking Lot and existing causeway would be under two feet of water during such an event.

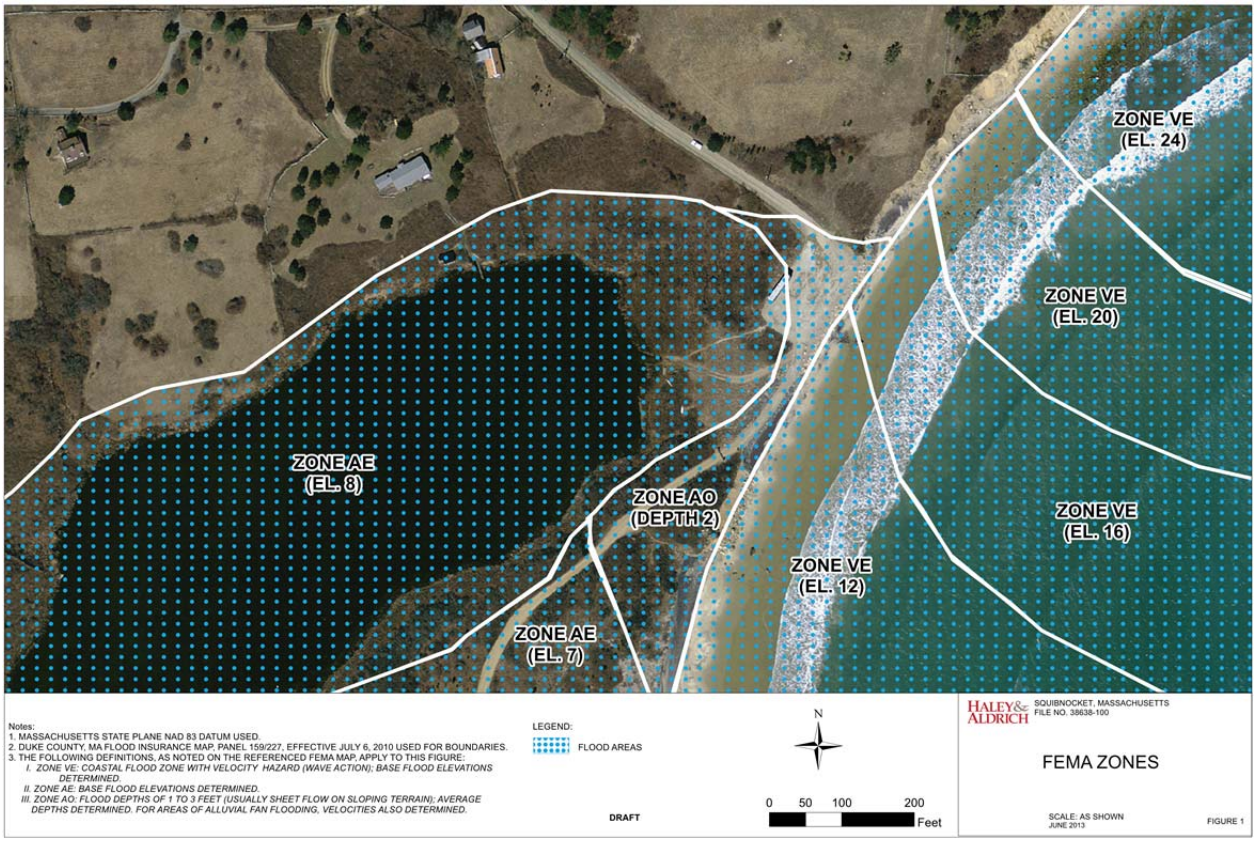


*Figure 10. FEMA Zones, 2010.*

The Intergovernmental Panel on Climate Change (IPCC), which is widely recognized as the leading international scientific organization on the assessment of climate change, has identified three primary approaches to adapting to sea level rise: retreat, accommodate, and protect.

[24] IPCC (2013). *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY.

**Retreat.** As applied in this context, retreat would involve moving the most vulnerable portions of Squibnocket Road inland and to higher elevations to avoid the coastal impacts of climate change and SLR. Moving substantially inland to adequately address the impacts of SLR is not feasible in the vicinity of the existing causeway, as there is not enough Association-controlled land between the current road and Squibnocket Pond to provide adequate protection. Retreat is not a feasible adaptation strategy in this location because of the lack of land area in which to implement a retreat strategy.

**Protection.** Most often protection is the first response considered to address SLR. However, subject to very narrow exceptions, the Regulations will not allow MassDEP to permit new "hard solutions" or armoring such as revetments or sea walls to protect the shoreline. Moreover, as sea levels rise, the effectiveness of revetments diminish, as they are more readily overtopped by frequent wave action and will inevitably succumb to more damage from extreme storms. Although a protection strategy through the use and maintenance of a revetment has protected the access to Squibnocket Farm to date, SLR and increasing storm intensity require the revetment to be enlarged and extended. As discussed in more detail in the Alternatives Analysis below, this is not possible as a regulatory matter. As shown in Exhibit A, MassDEP has already spoken to this matter directly at this site; in 2010 the Association was prevented from extending the existing revetment.

Another protective measure is a "soft armoring solution." Soft armoring solutions such as dunes, wetlands, and beach nourishment can be used to mimic naturally occurring coastal features because they allow for the natural process of accretion and erosion to occur and do not reflect and intensify wave action in the same manner as "hard solutions." At MassDEP's suggestion in 2010, the Association implemented a soft solution. The majority of this effort was washed away in the next large storm, as demonstrated in Figure 4. In fact, that portion of Money Hill has been significantly eroded in the last two years.

In summary, protection is not a feasible adaptation strategy in this location because of the prohibition on hard solutions and the inefficacy of soft solutions.

**Accommodation.** Accommodation is the third option for adapting to SLR, and is a strategy that allows continued occupation of coastal areas while changes are made to human activities or infrastructure to adapt to SLR.[25] The current proposal to construct an elevated roadway on pilings is an example of an accommodation approach to adaptation. It involves moving the roadway so that it will not be impacted by climate change or SLR for many decades. Other examples of this type of accommodation include the Deer Island Wastewater treatment facility in Boston Harbor, which was constructed 1.9 feet higher than originally designed, to account for projected sea level rise through 2050.[26] Another example of an accommodation approach to SLR adaptation is the construction of the Confederation Bridge connecting Borden, Prince Edward Island to Cape Tormentine, New Brunswick. The bridge was designed with the

[25] The Arlington Group Planning + Architecture Inc. (2013). *Sea Level Rise Adaptation Primer A Toolkit To Build Adaptive Capacity On Canada's Coast*. Retrieved from http://www.env.gov.bc.ca/cas/adaptation/pdf/SLR-Primer.pdf (Last updated Fall 2013).

[26] Gregg, R. M. (2010). *Sea Level Rise and the Construction of the Confederation Bridge in the Gulf of Saint Lawrence* [Case study on a project of Strait Crossing Bridge Limited]. Product of EcoAdapt's State of Adaptation Program. Retrieved from CAKE: http://www.cakex.org/case-studies/1085 (Last updated April 2010).

roadbed elevation set to accommodate an expected 1 meter in sea level rise that could undermine the integrity of the structure and increase erosion along coastlines.[27]

Of the three adaptation strategies identified by the IPCC, accommodation is the only feasible approach in this location. A summary of options for SLR adaptation along the Squibnocket causeway are presented in Table I below.

| Solution | Type of solution | Permittable under the Regulations | Effectiveness | | |
|---|---|---|---|---|---|
| | | | Immediate | Short Term | Long Term |
| Stabilize bank with plants & natural materials (Coir) | Protect: Soft | Yes | Uncertain | No | No |
| Expand existing revetment laterally and vertically | Protect: Hard | No | Yes | Yes | Uncertain |
| Elevated Roadway with existing revetment | Accommodate with protection using existing hard structures | Yes | Yes | Yes | Yes |
| Elevated Roadway without existing revetment | Accommodate | Yes | Yes | Yes | Yes |

*Table 1. Sea Level Rise Adaptation Options for Squibnocket.*

**ALTERNATIVES ANALYSIS**

The project team has considered several alternative approaches for addressing the Association's access issues while complying with the applicable regulations described in detail above. These alternatives were evaluated based on the following criteria:

- The alternative must provide reliable and safe access for private passenger vehicles, emergency equipment (fire tanker truck and ambulance) and reasonable construction equipment for the next 50 years.
- The Association must own or control the project site.
- The alternative must be permittable through a normal permitting process without requiring extraordinary relief, such as a state-issued variance, waiver or special legislation.
- The alternative should be able to withstand accelerating erosion, rising sea level, and increasing storm intensity without requiring significant repairs that could be implemented only at the discretion of governmental authorities.

[27] Gregg, R. M. (2010). *Sea Level Rise and the Construction of the Confederation Bridge in the Gulf of Saint Lawrence* [Case study on a project of Strait Crossing Bridge Limited]. Product of EcoAdapt's State of Adaptation Program. Retrieved from CAKE:http://www.cakex.org/case-studies/1085 (Last updated April 2010).

- The alternative should be designed to minimize visual impact on neighboring views to the extent practicable consistent with the project's purpose.

The project team considered 4 main alternatives in selecting a preferred alternative. These were:

- Alternative 1 - No Action
- Alternative 2 – "Hard" Structural Solutions
- Alternative 3 – "Soft" Solutions
- Alternative 4 – Elevated Roadway

Based on a detailed review of each alternative in the context of the selection criteria, the project team selected Alternative 4 as the preferred alternative because it was the only alternative that could meet all selection criteria in a manner reasonably certain to achieve the project's purpose. The following narrative provides a summary of the alternatives analysis.

**Alternative 1 – No Action**

The "No Action Alternative" means maintaining the status quo and relying on the existing revetment system with reactive repairs following storm events. Based on past experience, several times each year (depending on storm activity), vehicular access would be interrupted by a significant coastal storm event with waves expected to over-wash the revetment and causeway. These storms have, with perhaps greater frequency, resulted in substantial erosion along the existing revetment. Under the No Action Alternative, the increasing frequency of these periodic events may result in sufficient damage requiring substantial roadway and utility repairs similar to or more extensive than the repairs that the Association and the Town have had to perform on an annual basis for the past 20 years.

The Association cannot simply rely on reactive measures in perpetuity because it does not have a clear right to fully restore the roadway to its pre-existing condition following a catastrophic storm event. As with Hurricane Sandy and the Northeaster of February 2013, MassDEP has issued emergency regulations allowing the repair of existing structures that sustained significant damage during the subject storm event. MassDEP issues these emergency regulations in its sole discretion. If the agency decides not to issue an emergency declaration, then the Association would have no recourse and no entitlement to repair the roadway. Any repairs would instead require discretionary permits from the Conservation Commission, which permits could be overruled by MassDEP (particularly if, as discussed below and elsewhere, the repairs involve the extension or modification of the existing hard structures that protect the roadway).

The No Action Alternative would be a reliable option only if one assumed that the Chilmark Conservation Commission, with the consent of MassDEP, will exercise its discretion, in perpetuity, to authorize emergency repairs. The No Build Alternative also relies on the assumption that routine erosion of the shoreline over the course of the next 50 years will not accelerate to the point where a new revetment is required to protect the roadway because, as explained below, a new revetment (unlike storm repairs) cannot be permitted on a discretionary basis by the Chilmark Conservation Commission or MassDEP. Relying on these assumptions provides insufficient predictability to meet the project's purpose for the following reasons:

- Based on the published shoreline erosion rates for the project site, the areas adjacent to the existing revetment will erode well before the passage of 50 years without extending the revetment. The Regulations at 310 CMR 10.30 prohibit the construction of new armoring on coastal banks where such banks serve as a sediment source. The coastal beaches north and south of the existing revetment and causeway both serve as sediment sources. The existing revetments cannot be extended without violating the Act. As shown in Exhibit A, MassDEP has already rejected a revetment extension project at the project site.
- MassDEP and local conservation commissions have taken progressively stronger positions regarding the ability of private landowners to effect suitable repairs following significant coastal storm damage, even when protecting existing homes. As shown in Exhibit B, MassDEP did not allow new hard structures to protect existing homes at Plum Island following Hurricane Sandy.
- The policy behind the regulatory prohibition of coastal engineering structures such as the existing revetment is based on the consensus that such structures:
  - Upset the natural balance of erosion and accretion of sand along coastal beaches;
  - Deflect and focus coastal wave energy from the protected areas into adjacent coastal beaches and banks, increasing erosion in these areas and disturbing the natural process for sand migration along coastal beaches by wind and wave action.

The No Action Alternative therefore does not satisfy the project criteria. It cannot provide guaranteed and reliable long-term access to the Squibnocket Farm subdivision because it relies on the unfounded assumptions that the Chilmark Conservation Commission and MassDEP will at all times exercise their discretion to allow necessary repairs, and that the existing revetment system will not require significant reconstruction or extension during that period of time.

**Alternative 2 – "Hard" Solutions**

Hard solutions are coastal engineered structures that armor the existing banks or coastal features in some fashion, including rip-rap, fitted stone, concrete, or other hard surface or structure. For the purposes of this analysis, a hard solution would be located in the following coastal wetland resource areas:

- Coastal Bank
- Coastal Dune
- Barrier Beach
- Land Subject to Coastal Storm Flowage (LSCSF)

Under this alternative, the existing revetment system would be expanded as necessary to respond to SLR and increased storm frequency and intensity.

The Act and the Regulations prohibit constructing any new hard solution. Although, hard solutions protect the sediment along the portion of the shoreline where they are sited, they prevent this sediment, or some portion of it, from being re-deposited elsewhere, which would typically happen under natural circumstances. Therefore, the practice of armoring banks removes sediment and disrupts the shoreline system as a whole. Moreover, erosion tends to be accelerated at either end of the armored portion of shoreline. It is for these reasons that MassDEP has in most cases prohibited the utilization of hard, engineered solutions to resolve coastal erosion problems.

If a coastal bank is "determined to be significant to storm damage prevention or flood control because it supplies sediment to coastal beaches, coastal dunes or barrier beaches," the Regulations at 310 CMR 10.30(3) prohibit any "new bulkhead, revetment, seawall, groin or other coastal engineering structure shall be permitted on such a coastal bank." The sole exception to this rule is made in the case of directly protecting buildings constructed prior to August 10, 1978. The areas adjacent to the north and south of the existing revetment supply sediment to the surrounding areas and, therefore, the bank is likely significant to storm damage prevention or flood control. Because the access roadway is not eligible for the sole exception to the prohibition on hard solutions, extending the existing revetment would not be permissible under the Act and Alternative 2, Hard Solutions, is not a viable alternative.

**Alternative 3 – "Soft" Solutions**

"Soft" solutions comprise a series of measures to slow coastline erosion and help stabilize coastal areas that do not involve the structural components of hard solutions. Soft solutions include activities such as beach nourishment, vegetative plantings, and the installation of coir logs or other slope stabilizers. These measures are designed to reduce the rate of erosion of a given area, while still allowing the area to supply sediment to nearby coastal beaches, coastal dunes, or barrier beaches. Soft solutions, when properly designed, are generally permissible under the Act. Soft solutions, with proper installation and maintenance, can slow, stop, and in some cases even reverse erosion in low-velocity environments.

Soft solutions installed at the project site would be anticipated to include work in the following resource areas:

- Coastal Dune
- Coastal Bank
- Land Subject to Coastal Storm Flowage (LSCSF)
- 100-foot buffer zone

MassDEP tolerates soft solutions and prohibits hard solutions because soft solutions are more likely than solid fill or armored structures to absorb wave energy (rather than deflect it) and allow the underlying coastal bank of coastal dune to serve as sediment source. Soft solutions are typically designed to retain sediment and encourage natural deposition of sand by wind and wave action. As such they easily comply with applicable performance standards.

While soft solutions may be favored by regulators, they are ineffective in high energy environments. The Association implemented soft solutions at the suggestion of MassDEP in 2010. Within one year or less, the area had been eroded essentially back to its initial condition. Particularly heavy damage occurred as a result of Hurricane Sandy in 2012. Alternative 3 – Soft Solution – has already been attempted at this location and has been demonstrated to be ineffective and unable to achieve the overarching project objective of reliable, certain long-term access.

The anticipated increase in storm intensity and frequency combined with SLR will cause further damage to this area. The southeastern facing shore of Martha's Vineyard experiences the brunt of most strong weather patterns and soft solutions have been unsuccessful in this area. Any large-scale erosion event, such as a hurricane or strong storm, could result in a breach or other damage to the roadway that would prevent access to the subdivision.

To the extent that any soft solutions could be permitted under the Act, this alternative would still not satisfy the project criteria because, like the No Action Alternative, the access would not be guaranteed to survive for anything approaching 50 years, and, following failure, which can be expected in any significant storm event, could be reconstructed only if the Chilmark Conservation Commission, with MassDEP's consent, issues discretionary approvals.

Third parties have suggested that an artificial dune system, with associated roadway, be constructed to essentially replace the existing revetment system, which would be removed. In this approach, the relocated roadway would be located at grade, behind the dune and closer to Squibnocket Pond. For the following reasons, this dune-based soft solution does not satisfy the selection criteria and will not provide a long-term solution to the Association's access problem.

- A true dune is a dynamic feature that forms when exposed sand on the beach is carried by wind forces to an area of accumulation over time. If a dune is constructed rather than allowed to form naturally, it may need frequent maintenance with a ready supply of sand. As the existing beach has been eroded over time there is a smaller area exposed to wind at low tide and no sand exposed at high tide. Furthermore, the beach area in the vicinity of the town lot contains significant gravel and cobbles further decreasing the amount of available sand supply for a dune (see Figure 11). Because of the lack of surrounding sand supply for the dune, it would be costly and time intensive to establish and maintain a man-made dune at Squibnocket. Further, as the current beach is eroding, the dune will likely serve as a source of sand for the beach and will experience significant erosion.

- The artificial dune, with a sand deficit, would quickly experience erosion at high tide and during storm surges. With the revetment removed, the rate of erosion would be exacerbated and the roadway would be even more vulnerable to damage from storms.

- The road at grade behind the dune may also experience sand infilling as the artificial dune

*Figure 11. Image showing cobbly beach seaward of town lot revetment.*

erodes and sand is blown inland. This could hinder access and make it very difficult for service vehicles to access the Squibnocket Farm subdivision. The eroding dune could also deposit significant sand into Squibnocket Pond, the impact of which would need further study.

- The road at grade behind the dune would be located in the buffer zone of Squibnocket Pond or in wetland resource areas. Constructing the road in this location would require substantial fill activities in resource and buffer, perhaps in excess areal limits established in the Regulations.[28]

- The road at grade behind the dune would, if it could be built originally, also succumb to erosion over time once the dune is breached and access would be interrupted when this occurs. Once a breach occurs, the Regulations and other laws would make it either very difficult to repair the breach with new fill or install a bridge in lieu of fill.

The dune alternative, which is, in effect, an elaborate soft solution that incorporates a newly constructed roadway, would be expected to require work within the following wetland resource areas:

- Coastal Beach
- Coastal Bank
- Coastal Dune
- Barrier Beach
- Bordering Vegetated Wetlands (BVW)
- Inland Bank
- Land Subject to Coastal Storm Flowage
- Bordering Land Subject to Flooding
- 100-foot buffer zone

Presumably, the removal of the existing parking lot, revetment and causeway – by itself - could be designed to comply with the applicable performance standards and would receive an Order of Conditions. However, the construction of a new roadbed behind the newly constructed dune would be more problematic and may not be able to be designed to meet applicable performance standards. The work would be expected to require the alteration of greater than 5,000 SF of BVW. If greater than 5,000 SF of BVW alteration is required, the project would need to be approved as a "limited project" under the Regulations and would require a variance under the Chilmark Wetlands Bylaw for work in BVW. This alternative would also require large-scale compensatory mitigation at a ratio of at least 1:1 in a location adjacent to the impacted area.[29] (The need to find a location for compensatory mitigation could violate the selection criterion relating to Association ownership or control of the project site.) The project would also need to meet the coastal dune performance standards, which is a difficult task as the principal standards prohibit any work which would remove sand from a barrier beach or destabilize the coastal dune. The construction of a new paved or armored roadway would adversely affect the

[28] The Regulations prohibit the filling of over than 5,000 s.f. of bordering vegetated wetlands. 310 CMR 10.55(4).

[29] Third parties have suggested that the analog is Gurnet Road at Duxbury Beach. There are many reasons why the Gurnet Road is not a suitable precedent. Among them, is that Gurnet Road, which runs the length of Duxbury Beach and is set back from the ocean by several hundred feet, was originally constructed in the early 1900s, well prior to the enactment of the Act and other environmental laws.

migration of sand by wind and wave and is unlikely to withstand MassDEP review even if the Chilmark Conservation Commission approved the work.

**Alternative 4 – Elevated Roadway**

The Elevated Roadway Alternative refers to a pile-supported structure supported by abutments at each end to land the roadway and provide a structurally stable roadway. In the Superseding Order of Conditions issued by MassDEP and attached as Exhibit A, MassDEP suggested that the roadway be moved. The Elevated Roadway Alternative is responsive to this suggestion. As described above, simply moving the road laterally towards Squibnocket Pond is fraught with design, site control, regulatory and effectiveness issues. Moving the roadway vertically, however, is a solution that comports with MassDEP's advice and that can be feasibly designed and permitted. In fact, in March 2013, MassDEP Commissioner Kenneth Kimmell issued a letter to Plum Island residents who were responding to significant storm damage to structures on a barrier beach, warning them against installing permanent hardened structures that did not comply with regulations governing work on barrier beaches. (See Exhibit B) In this letter, the Commissioner recommended elevating homes on piles.

The piles for the elevated roadway could be installed with a minimum of ground disturbance and the northern abutment could be placed outside of any local or state-regulated wetland resource area, minimizing direct impacts to wetlands. Work is anticipated to be required within the following resource areas:

- Barrier Beach
- Land Subject to Coastal Storm Flowage
- Bordering Land Subject to Flooding
- Bordering Vegetated Wetland
- 100 foot buffer zone

Direct alterations to coastal and inland wetland resource areas would be minimal in the Elevated Roadway Alternative because the northern abutment could be constructed on uplands and the length of the roadway would be supported on piles and not on solid fill. The elevated roadway's cumulative footprint within wetland resources would be limited to the piles, each of which (in the conceptual design) has a footprint of approximately 1.4 square feet. Impacts to BVW would be limited to the footprint of the few piles installed along the edge of Squibnocket Pond. Impacts to BLSF and LSCSF would also be limited to the installation of piles along the length of the elevated roadway. These piles would have no impact on flood storage or flood flow patterns, and would easily comply with the performance standards for BLSF. There are no corresponding performance standards for work in LSCSF.

While this alternative would require work within a barrier beach system, the work required to install the piles could be completed in a manner that avoids the destabilization of any coastal dune that may be present underneath the degraded existing parking and roadway area. (Formal wetlands delineation work will determine whether soil conditions in this area are consistent with the sub-grade presence of any vestigial coastal dune).

The Elevated Roadway Alternative appears to be fully permittable under the Act and the Chilmark Wetlands Bylaw. In fact, the pile-supported structure is the most likely of all considered alternatives to

meet all applicable performance standards while also satisfactorily achieving project purposes. As described below, it can be designed on land owned or controlled by the Association to provide guaranteed long-term access to the Squibnocket Farm subdivision. Any repairs that may be necessary following a storm event would not require discretionary approval by the Chilmark Conservation Commission or MassDEP because the repairs would likely be confined to the elevated roadbed itself (which will not be a regulated resource). As discussed below, the Elevated Roadway has been designed to minimize adverse impact on the neighboring views.

The following table summarizes the alternatives analysis:

| Criteria | Alternative | | | | |
|---|---|---|---|---|---|
| | No Action | Hard Solutions | Soft Solutions: general | Soft Solution: Dune | Elevated Roadway |
| Reliable Long-Term Access | No | Potentially | No | No | Yes |
| Association Controls Site | Yes | No | Yes | Yes | Yes |
| Permittable | Present: Yes<br>Future: No | No | Yes | No, because of roadway fill. | Yes |
| Able to Withstand Accelerating Erosion | No | Yes, with ongoing maintenance, repair and replacement | No | No. | Yes |
| Able to Minimize Visual Impacts | No | Yes | Yes | Yes | Yes |

*Table 2. Alternatives Analysis Summary.*

**DESIGN OF THE ELEVATED ROADWAY**

The elevated roadway is currently in the conceptual design stage. In order to meet the project objectives, the elevated roadway must be sited on land owned or controlled by the Association and to survive and remain usable for at least 50 years, in light of historic and predicted erosion rates. In its current stage of design, the elevated roadway is aligned as shown in Figure 12 below, with both landing areas (abutments) on parcels either owned or under Association control. The southwestern abutment is approximately 92 ft from the existing shoreline, and with local erosion rates according to the Shoreline Change Browser of approximately 0.92 ft per year, the abutment has an approximate design life of 100 years. If Money Hill is confirmed to be a glacial till knob through further onsite investigations, it is likely that the till and boulders in the area will further reduce the pace of erosion and the abutment would last for more than 100 years. The northeastern abutment is approximately 150 ft from the

existing shoreline and high water line, and with local erosions rates of approximately 1.41 ft per year, the northeastern abutment has a design life of over 100 years as well. Similarly, if the parking lot and revetment are left in place, the pace of erosion would be further decreased and the abutment could last even longer. In our opinion, the elevated roadway would have a useful life far longer than the 50-year project objective regardless of whether the existing revetment is retained or removed.


*Figure 12. Proposed alignment of Elevated Roadway.*

The Association directed us to design the elevated roadway in a manner that minimizes visual impacts from surrounding properties, and have asked that the elevation of the roadway be designed to exceed the elevation of the 100 year storm. The current conceptual design is shown on Figure 13 below. The 2013 draft FEMA flood elevation at the project site is El. 15.0, and the driving deck of the roadway is proposed at El. 15.0 – the lowest feasible elevation in order to minimize the visual profile of the roadway and withstand the 100-year storm. Additionally, the piles, abutments, and deck are designed not only for standard HS20-44 truck loadings for emergency vehicle access, but also for wave action forces up to El. 15.0 in case the deck is temporarily overtopped in a storm event.

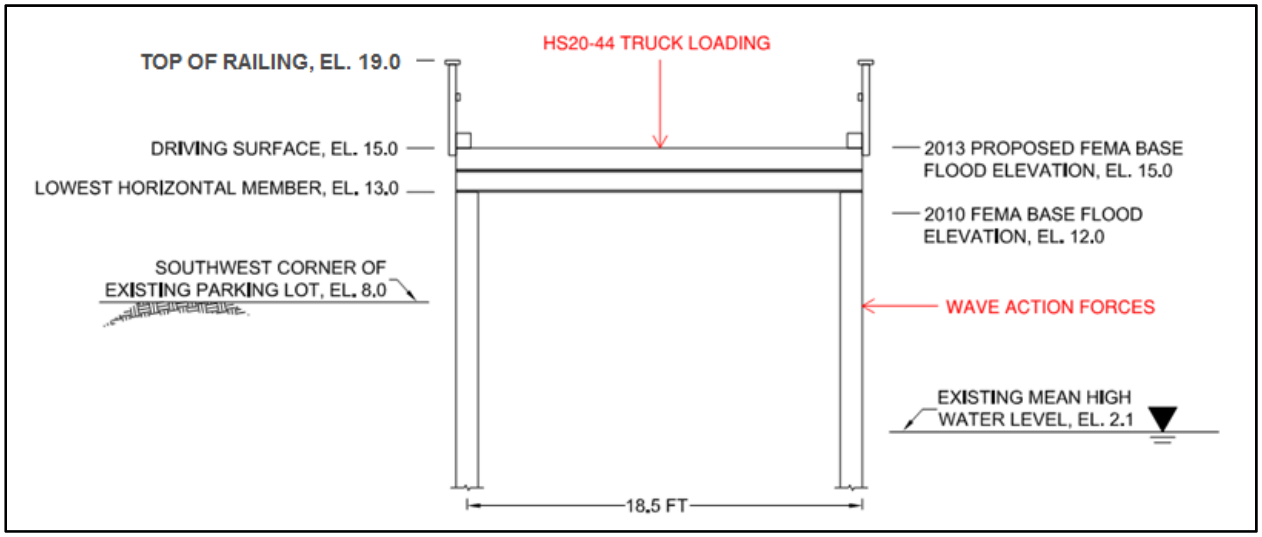


*Figure 13. Longevity of Elevated Roadway Deck.*

The Association further directed that the elevated causeway use materials that preserve the rustic Chilmark atmosphere. The proposed elevated causeway would be built using concrete-filled steel piles and a precast concrete deck, with wooden railings and curbs (as depitcted in Figure 14 below). This will be almost identical in image to the dock in Menemsha, and will be designed to withstand sea level rise, erosion, and strong wave forces while keeping a minimal visual profile and fitting in with the town's current infrastructure.

*Figure 14. Rendering of the Conceptual Design.*

**CONCLUSION**

The forces and factors that threaten access to Squibnocket Farm are inexorable. Charged with identifying a solution that is constructible, permittable, likely to survive with minimal repair requirements for at least 50 years, and sited on land controlled by the Association, H&A and VHB have selected the Elevated Roadway Alternative for the reasons explained in this memorandum. As demonstrated through the private-public concept that was presented to Town Meeting, the single-lane elevated roadway presented here can easily be adapted for public usage if that would assist the Town in resolving its public beach access issues. We look forward to discussing our work with the Committee and to answering your questions.

*Enclosures*.

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**EXHIBIT A**

**Superseding Order from DEP**

COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY & ENVIRONMENTAL AFFAIRS
**DEPARTMENT OF ENVIRONMENTAL PROTECTION**
SOUTHEAST REGIONAL OFFICE
**20 RIVERSIDE DRIVE, LAKEVILLE, MA 02347 508-946-2700**

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lieutenant Governor

IAN A. BOWLES
Secretary

LAURIE BURT
Commissioner

OCT 19 2010

Vineyard Open Land Foundation
c/o Vineyard Land Surveying & Engineering
P.O. Box 421
West Tisbury, Massachusetts 02575

RE: CHILMARK – Wetlands
File No. SE 12-606
Superseding Order of Conditions
Denial

Dear Vineyard Open Land Foundation:

Following an in-depth review of the above-referenced file and in accordance with Massachusetts General Laws, Chapter 131, Section 40, the Department of Environmental Protection has issued the enclosed Superseding Order of Conditions. This Superseding Order denies the project as proposed. The Department has determined that the project area is significant to the statutory interests of storm damage prevention and flood control.

The project proposes the construction of a 175- foot long rock revetment along an eroding coastal bank to protect Squibnocket Farm Road. The proposed revetment would be located on a Coastal Beach, Coastal Bank and within land subject to coastal storm flowage. The Department has determined that the Coastal Bank is significant to storm damage prevention and flood control because it supplies sediment to nearby coastal beaches and coastal dunes. The Federal Emergency Management Agency (FEMA) has mapped the project area as being within Flood Zone V5 (elevation 13).

The Wetland Regulations for Coastal Banks at 310 CMR 10.30(3) state, in part, that "a coastal engineering structure shall be permitted when required to prevent storm damage to buildings constructed prior to the effective date of 310 CMR 10.21 through 10.37 (August 10, 1978)". In this case, the proposed revetment is designed to protect a road and not a building. As such, the proposed revetment does not meet the performance standard at 310 CMR 10.30(3).

In addition, the Department has determined that the proposed revetment would affect the ability of the coastal beach to change its form in response to changes in wave conditions and would interfere with the ability of the coastal beach and coastal bank to erode and act as a sediment source for nearby coastal beaches and dunes. Furthermore, the proposed revetment would enhance scour by reflecting wave energy thereby leading to the narrowing and lowering of the coastal beach. As a result, the Department has determined that the proposed revetment would increase erosion, decrease the volume, and change the form of the coastal beach. Therefore, the Department has determined that the proposed revetment would not comply with the performance standards imposed for Coastal Beaches at 310 CMR 10.27 (3) and Coastal Banks at 310 CMR 10.30 (3) & (4).

Please be advised that the Department would encourage the applicant to reconsider the focus of coastal erosion control at this site towards soft solutions such as beach nourishment, as per 310 CMR 10.27 (5), bio-engineered solutions such as coir logs and/or vegetative plantings and away from hard structural solutions. Beach nourishment can be an effective means of retarding shoreline erosion while affording protection to nearby infrastructure and enhancing wildlife habitats. The Department would also encourage the applicant to consider shifting the location of Squibnocket Farm Road landward as erosion of the shoreline progresses.

Please be reminded that the proposal exceeds the wetland threshold as found in the Massachusetts Environmental Policy Act (MEPA) Regulations at 301 CMR 11.03(3)(b)(1a). However, because the Department has judged that the project as proposed cannot be allowed under the provisions of Massachusetts General Laws, Chapter 131, Section 40, the Department is of the opinion that it is not in the best interest of any party involved to require the submittal of an Environmental Notification Form (ENF) at this time. Please be advised that, in the event the enclosed Superseding Order of Conditions is appealed, the Department will require the submittal of an ENF and the completion of the MEPA review process in accordance with 310 CMR 10.07 of the Wetlands Protection Act Regulations before issuing a Final Order of Conditions.

In the opinion of the Department the reasons given here are sufficient to justify this Superseding Order of Conditions. However, the Department reserves the right, should there be further proceedings in this matter, to raise additional issues and present further evidence as may be appropriate.

If you have any questions concerning this matter, please contact Jim Mahala at (508) 946-2806.

Very truly yours,

Elizabeth A. Kouloheras

Elizabeth A. Kouloheras
Bureau of Resource Protection

K/JM

Enclosure
CERTIFIED MAIL #7008 0150 0003 5434 1816

cc: Chilmark Conservation Commission

Wampanoag Tribe of Gay Head (Aquinnah)
Tribal Historic Preservation Office
20 Black Brook Road
Aquinnah, MA 02535

Massachusetts Historical Commission
220 Morrissey Boulevard
Boston, MA 02125

**EXHIBIT B**

**25 March 2013 Letter from DEP to Homeowners**

Commonwealth of Massachusetts
Executive Office of Energy & Environmental Affairs

Department of Environmental Protection
One Winter Street Boston, MA 02108 • 617-292-5500

DEVAL L. PATRICK
Governor

TIMOTHY P. MURRAY
Lieutenant Governor

RICHARD K. SULLIVAN JR.
Secretary

KENNETH L. KIMMELL
Commissioner

March 15, 2013

Dear Homeowner,

Recent storm events have had a devastating impact on coastal areas in Massachusetts, including Plum Island. I have personally viewed the impacts caused by these storms and understand the adversity and challenges you face on Plum Island.

MassDEP recognizes how difficult it must be for you as a homeowner dealing with the impacts of these storms and that actions to protect property in the aftermath of these events are understandable. We are concerned, however, that some of the recent actions taken do not comply with Massachusetts statutes and regulations. This is particularly true with respect to the installation of "hard" structures such as cement blocks and deposition of rocks or "riprap" on the dunes and barrier beach in front of many homes. Our longstanding and consistent position, which is widely shared by the scientific community and many other states, is that such structures can do more harm than good, by reflecting wave energy and causing greater erosion impacts to homeowners on both sides of the hard structure. Hard structures also starve the beach fronting these homes of a necessary sediment source that supports a healthy coastal dune system, which provides the most effective storm damage protection to structures on coastal dunes. And ultimately armoring of the dune will not prevent wave run up, overtopping, and flooding during storms, and erosion and undermining will occur behind the riprap.

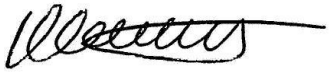
There are short-term measures that are allowable and that have been proven effective, such as beach and dune nourishment/restoration and installation of coir sand tubes/envelopes. We urge you to consider these measures. Please be advised that in the coming weeks, MassDEP will be evaluating the work being performed on Plum Island. To the extent that work being performed is not in compliance with state regulations, in all likelihood you will be required to take necessary corrective actions once the threat of winter storms have abated. This may include removing any hard structures that have been installed.

Again, we recognize the difficult situation you are facing. MassDEP is committed to working with homeowners, the Town of Newbury, elected officials and other state and federal agencies to develop and implement effective solutions on Plum Island. In the short term, we are exploring with our partner agencies whether emergency funds can be made available to assist with effective short-term solutions, such as coir sand tubes, or other effective emergency restoration efforts. We are also exploring whether there are available supplies of compatible sand for beach nourishment.

We also need to focus on long-term solutions. Unfortunately, global climate change means more frequent and violent storms, and sea level rise will hasten the rapid loss of shoreline that you have experienced in recent years. We all need to be cognizant of this fact and make informed decisions to protect homes by moving them out of harm's way. This likely means moving them back and/or placing them on pile supported structures. We are currently working with our state agency partners to determine if there may be funding available to support such efforts to protect property, individuals and infrastructure from natural hazards.

MassDEP remains committed to working with the Plum Island community to find solutions that will protect the environment, safety and property of Plum Island residents.

Sincerely,



Kenneth Kimmell
Commissioner, Massachusetts Department of Environmental Protection

Ecc: Joseph Story, Chair, Newbury Board of Selectmen
Tracy Blais, Newbury Town Administrator
Doug Packer, Newbury Conservation Agent
State Senator Bruce E. Tarr
State Representative Leonard Mirra
Bruce Carlisle, Director, Office of Coastal Zone Management
Phillip Griffiths, Undersecretary, Executive Office of Energy and Environmental Affairs