OUR SHORE Coastal Erosion Assessments and Site Reports: Chebeague Island

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The Maine Department of Environmental Protection (DEP) is currently developing OUR SHORE, a program that seeks to support homeowners, contractors, and communities who want to integrate nature-based strategies (NbS) into their plans for coastal resilience. The program provides informational tools in the form of a Quick Assessment to identify erosion hazards and a longer guide on how to apply NbS techniques, as well as outreach and training events for homeowners and shoreline stabilization practitioners.

In partnership with the Maine Conservation Corps, the OUR SHORE Program provides direct technical assistance on NbS to property owners and communities by placing Shore Corps Stewards with nonprofits across the state of Maine. Each Shore Corps Steward receives specialized training from the OUR SHORE program and state partners. From May 2025–May 2026, Island Institute is hosting a Shore Corps Steward, Emma Polhemus, to support the Town of Chebeague Island and other Casco Bay islands as they expand NbS opportunities for public and private properties.

Alongside Island Institute Fellow Lorren Ruscetta, Emma Polhemus visited five coastal sites on Chebeague Island in November 2025 to complete OUR SHORE Assessments of coastal erosion. The following report documents the results of these assessments along with recommended erosion management actions that align with OUR SHORE guidelines and prioritize nature-based and hybrid strategies.

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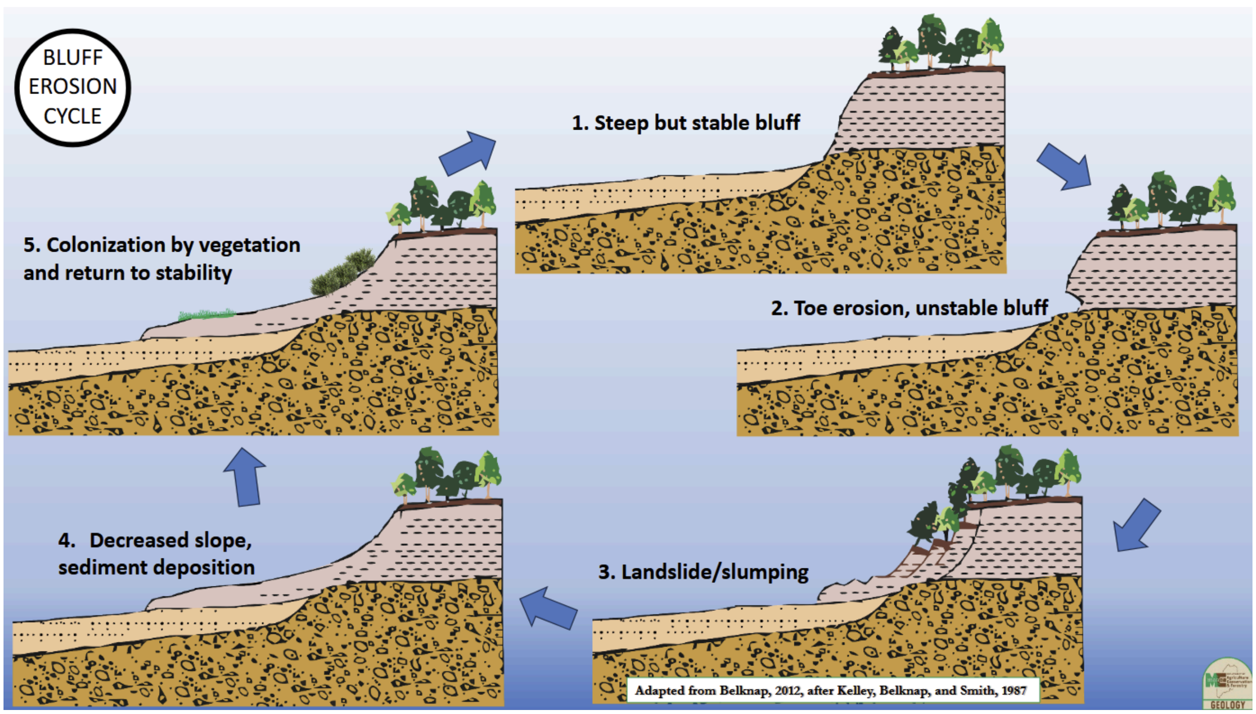
Additionally, this report was funded by the Casco Bay Estuary Partnership (CBEP) Resilient Communities Grant administered by the University of Southern Maine and in partnership with the Casco Bay Estuary Partnership.

Contents

Key Terms

Coastal bluff: A type of coastal shoreline where unconsolidated sediment (e.g. sand or clay) forms a steep slope 3 feet or taller. Coastal bluffs are located above the high tide line, and can be adjacent to different habitats like salt marshes or mud flats. The top of a bluff where flat land meets the slope is called the crest and the base of the bluff is called the toe. The slope in between the crest and toe is called the bluff face.

Bluff erosion cycle: Coastal bluffs follow a predictable geologic cycle of erosion and stability. In the bluff erosion cycle, the toe of a stable bluff is eroded, creating instability. The unstable bluff slumps, meaning that sediment from higher up the bluff falls or slides to the toe. The fallen sediment creates a more gradual slope and provides habitat for intertidal and upland vegetation, which protects and restabilizes the bluff, returning to the beginning of the cycle. The diagram below, created by the Maine Geological Survey, illustrates this cycle.



(Slovinsky, 2025)

Shoreline stabilization: Often called shoreline hardening or armoring, this typically refers to building hard, manufactured structures (like seawalls, bulkheads, and/or riprap) along a coast or water's edge to attempt to stop erosion and protect private property. Shoreline stabilization can also refer to plants and natural materials used for the same purpose.

Nature-based strategies: Strategies that utilize natural processes and ecosystems to address environmental challenges. For shoreline erosion, several nature-based solutions can be employed to manage and mitigate erosion while also providing additional benefits to the ecosystem

End-effect erosion: Worsened coastal erosion that happens at the ends of protective structures like seawalls or riprap, causing increased damage to neighboring properties by disrupting natural sediment flow, essentially pushing the erosion problem next door in a domino effect

Scouring: An effect that occurs when waves hit a hard, vertical wall. That wave energy is not absorbed; instead, it is reflected downward and sideways. This redirected, high-energy flow "scoops out" and carries away the sediment (sand, soil, and/or sea bottom) at the base of the structure and in adjacent areas. Consequences of scouring include deepening the water in front of the structure and creating more intense wave energy, degrading habitat, and the undercutting of the foundation of the hardened structure leading to failure of the structure

Fetch: The distance that wind can blow over water towards a shoreline without interruption by a land mass or structure. Shorelines with a high fetch are very exposed to wind, and therefore experience bigger waves, while shorelines with a low fetch are sheltered from wind, storms, and waves. The exposure level of a coastal site is sometimes expressed as *annualized fetch*, which combines the fetch from different directions with how often the wind was blowing in each direction during a year.

Mapping Tools

The following maps and mapping tools are referenced throughout this report:

Living Shorelines Decision Support Tool: Created by the Maine Geological Survey (MGS), this mapping tool rates stretches of shoreline from probably not suitable to highly suitable for a living shoreline design (i.e., using nature-based strategies). Suitability ratings are based on environmental factors like the shoreline geology, annualized fetch, and height and angle of the slope. This tool is a helpful starting point for deciding whether to build a living shoreline, but any site should be assessed on the ground and in detail before choosing a shoreline stabilization strategy.

Coastal Bluff Maps: The MGS Coastal Bluff Maps classify coastal bluffs as stable, unstable, or highly unstable. Stable bluffs have dense vegetation cover, gentler slopes, and no signs of erosion. Unstable and highly unstable bluffs have exposed soil on the bluff face, steeper slopes, and signs of erosion like fallen trees and displaced blocks of soil. Data for the Coastal Bluff Maps was last collected in 2020, so some bluffs mapped as stable might be unstable at present, and some unstable bluffs might have stabilized. New Coastal Bluff Maps of Casco Bay are expected in 2026.

Beginning with Habitat Maps: Beginning with Habitat is a program created by the Maine Department of Inland Fisheries & Wildlife (IF&W) to share information on plant and wildlife habitats and conservation. Since any shoreline stabilization project, whether nature-based or a hardened structure, will impact the surrounding environment, these maps can help decision-makers and project designers understand what habitats and wildlife are in the area and how to minimize negative impacts. Some of the data included in Beginning with Habitat maps also affect the permitting process. For example, shoreline stabilization permits have to undergo additional review by IF&W if the project will occur near protected habitats like high-value waterfowl and wading bird habitat.

The OUR SHORE Quick Assessment

The OUR SHORE Quick Assessment is a tool used to quickly analyze the causes and impacts of erosion at a shoreline site. The assessor ranks the site as lower, moderate, or higher instability risk based on a variety of criteria in the following categories.

Criterion	Characteristics of Lower Instability Risk	Characteristics of Moderate Instability Risk	Characteristics of Higher Instability Risk
Example: Bank Height	Low bank (less than 3 feet)	Moderate bank (3-6 feet)	High bank/bluff (over 6 feet)

Source & Severity of Erosion – Assess the locations & sources of of instability
Height & Slope Risk – Assess contributions of height, slope, and soil to instability risk
Overland Water from Land Use – Assess how property use affects stability through overland flow and groundwater
Revegetate/reconnect shoreline buffer – Assess levels of buffer vegetation for stability and habitat connection

The Quick Assessment then provides a list of possible management options based on the instability risk in each category. A complete erosion management plan is created by combining practices to address each source of instability. The Quick Assessment was designed to provide a starting point from which homeowners, contractors, municipal officials, and others can begin to consider nature-based strategies for managing erosion. It does not represent a complete environmental assessment or provide detailed erosion management plans. The complete OUR SHORE Guide and practitioner trainings provided by DEP are available to supplement the Quick Assessment when more detailed assessment or technical guidance is needed.

OURSHORE Quick Assessment: Division Point Right of Way
Division Point Rd, Chebeague Island, ME

Existing Site Conditions:

Location:

The Town of Chebeague Island maintains a 33-foot wide Right of Way (ROW) extending from the end of Division Point Road on the west side of Chebeague Island. The ROW crosses a grass lawn to a set of wooden stairs which descend a steep bluff. Below the bluff, the ROW includes an intertidal beach.

Environmental Characteristics:

The upland system of the Division Point ROW is a coastal bluff approximately 15 feet in height. The highest astronomical tide, as mapped by the Maine Geological Survey (MGS), reaches the base of the bluff (Fig. 3). Below the bluff edge, the intertidal zone is a sand and cobble beach with areas of exposed bedrock. The annualized fetch at the Division Point ROW is 0.5-1.0 miles.

The ROW contains mapped wetlands in the National Wetland Inventory beginning at the high tide line (Fig. 4). These coastal wetlands are also defined as high-value Tidal Waterfowl and Wading Bird Habitat, as well as shellfish habitat for blue mussels and softshell clams (Figs. 5-6)

Erosion:

In 2020, MGS evaluated the bluff at the Division Point ROW as unstable, with a gently sloping to steep slope, some areas of exposed soil on the bluff face, and bent or tilting trees present (Fig. 7). The site is an area of concern for the town, since the access stairway is at risk as the underlying bluff recedes from erosion.

Figure 1: Photo of the Division Point ROW from the upper bluff edge.

Figure 2: Photo of the Division Point ROW from the beach.

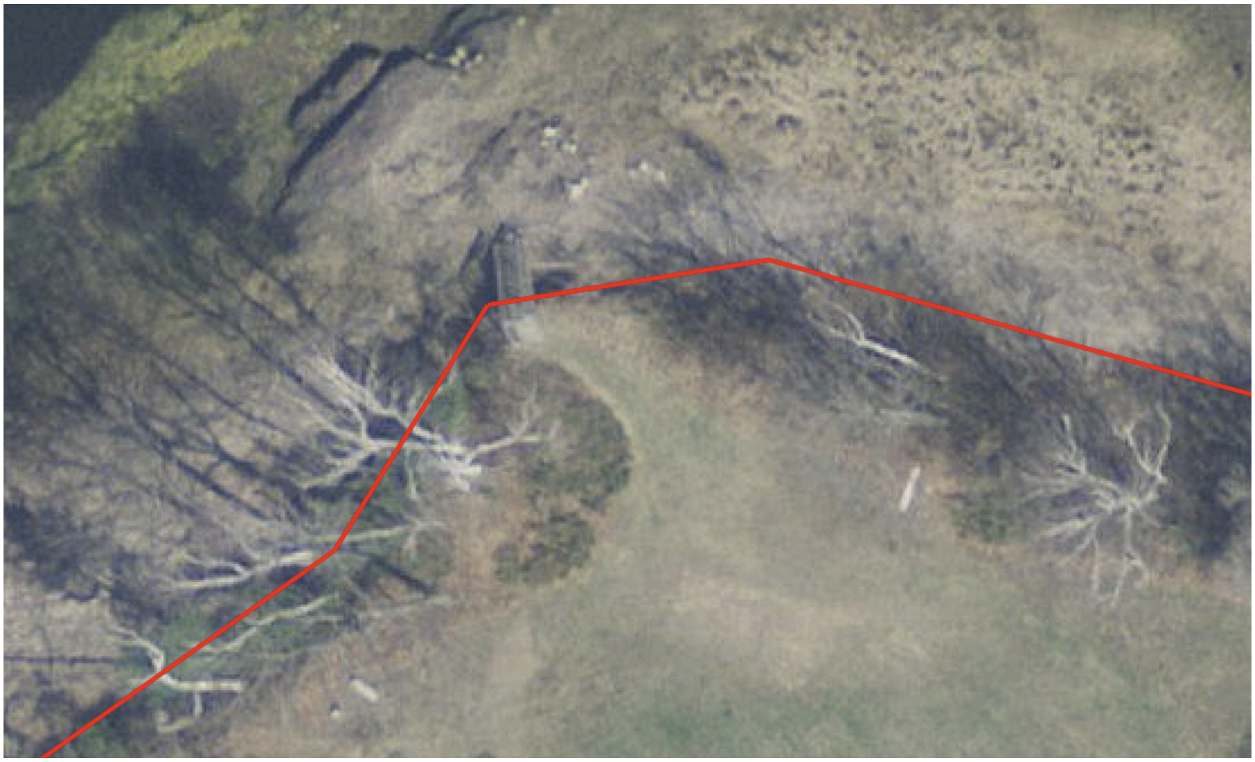


Figure 3: Maine Geological Survey map of the Division Point ROW and adjacent areas showing the highest astronomical tide elevation in red. The wooden stairs at the ROW are visible near the center of the image.

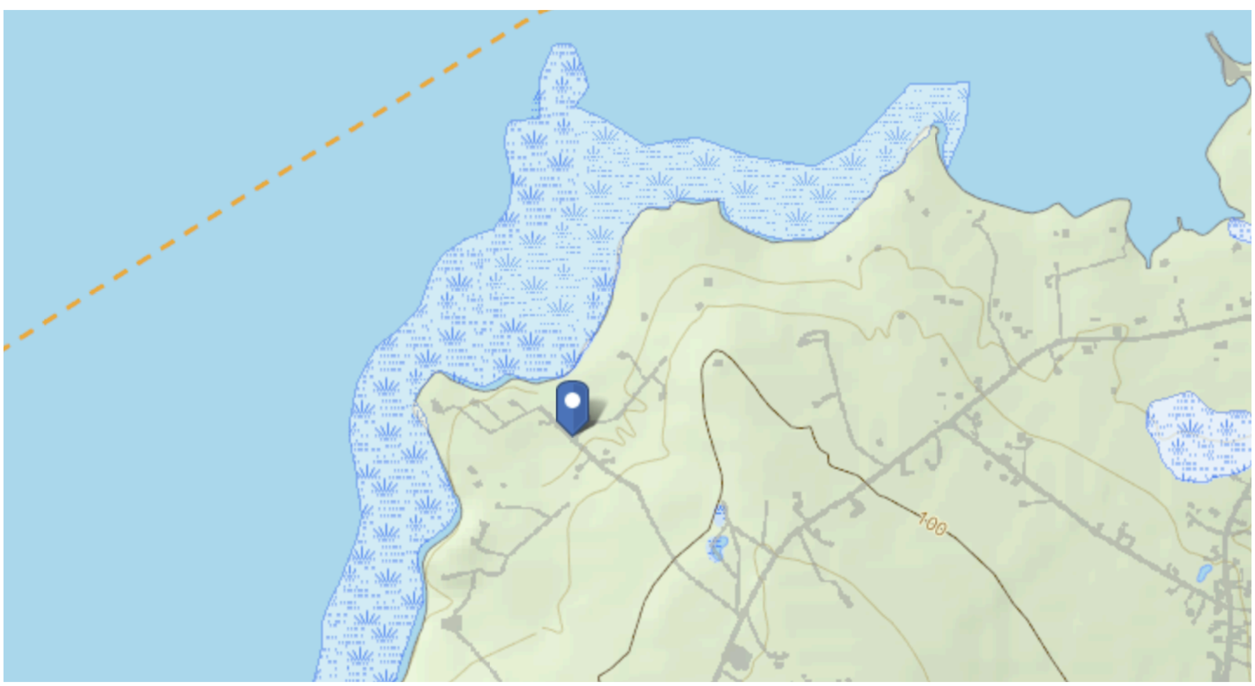


Figure 4: Beginning with Habitat map of National Wetland Inventory areas (white and blue pattern).

Figure 5: Beginning with Habitat map of shellfish harvesting areas (gray) for blue mussels and softshell clams near the Division Point ROW.

Figure 6: Beginning with Habitat map of Tidal Waterfowl and Wading Bird habitat (dark blue) near the Division Point ROW.

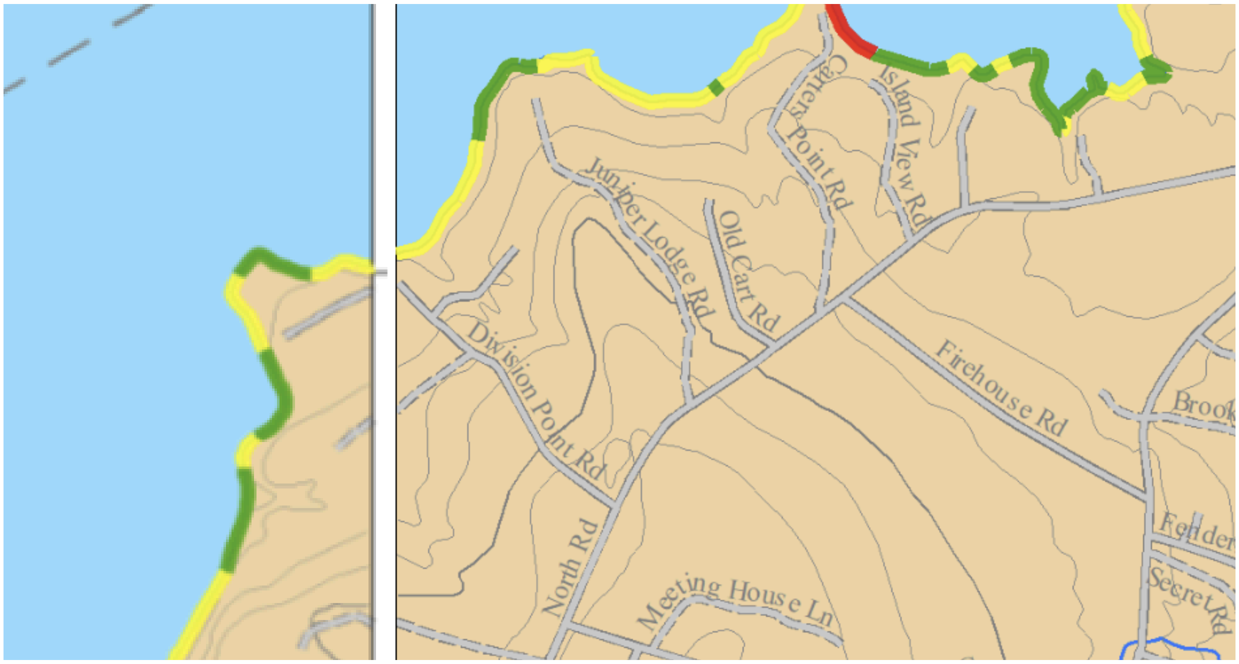


Figure 7: Maine Geological Survey Coastal Bluff Maps from 2020 including the Division Point ROW. Green indicates a stable bluff, and yellow indicates an unstable bluff.

OUR SHORE Quick Assessment:

Source & Severity of Erosion:

Overland Erosion	High- Bank erosion is occurring with measurable change from overland flows
Groundwater	Low- No evidence of groundwater seepage
Toe Erosion	High- Bank is slumping from completely eroded toe
Wave Erosion	Moderate- Site receives some wave action, but only large storms cause erosion. Only toe is affected

Height & Slope Risk:

Bank Height	High bank/bluff (over 6 feet)
Slope Severity	High slope (> 1L:1V)
Current Slope	High - Less than half of surface has vegetation and duff layer
Soils	Moderate- Unstable soil condition or moderate erosion rate

Overland Water from Land Use:

Surface Water Flow to Bank	High- Concentrated or channelized flow is directed down the embankment with rills and gully erosion. No protection is in place.
Lawn or Bare Ground Near Bank	High- Lawn area or bare ground is located within 25 feet of the shoreline
Impervious Surface Near Bank	Moderate - No roads, driveways, houses, or other impervious surfaces are within 25 feet of shoreline
Overall Impact of Surface Flows	High- Overland flow of water is a significant contributor to instability

Revegetate/reconnect shoreline buffer:

Vegetation within 250 Feet	Low/sparse vegetation (less than 20%)
Vegetation within 25 Feet	Average vegetation (20-70% coverage)
How Natural Is the Shoreline Habitat?	High - Bank and vegetation are not altered. No riprap or hardened structures installed.

Proposed Management Actions:

The Division Point ROW is considered Moderately Suitable for a living shoreline in MGS maps due to its low fetch and shallow intertidal zone. The OUR SHORE Quick Assessment results highlight a need for upland management considerations in combination with slope stabilization measures. Currently, the impervious surfaces of Division Point Road and a large area of mowed grass contribute to excess stormwater runoff toward the Division Point ROW bluff. Low density of large and woody vegetation also reduces the amount of water uptake from the soil at the site. These two factors are likely contributing to overall bluff instability and exacerbating the impacts of wave erosion during storm events. Upland management practices to slow or divert runoff and increase groundwater uptake should be prioritized at the Division Point site. These management practices will also reduce overland erosion that is undermining the staircase foundation at the site.

The bluff at the Division Point ROW shows signs of instability characteristic of the toe erosion stage of the bluff erosion cycle. Without intervention, a coastal bluff at this stage is likely to experience slope failure and slumping, which creates an accumulation of sediment at the toe of the bluff as well as a more gradual slope of the bluff face. The accumulation of sediment provides protection to the base of the bluff and nourishes intertidal habitats like the shellfish beds at Division Point. In this manner, the bluff naturally returns to a state of stability.

At sites like the Division Point ROW, where there are no structures or critical infrastructure at the upland edge of the bluff, allowing the bluff erosion cycle to continue can be a viable management strategy. As soil is deposited at the bluff toe, the bluff will reach a stable state and the erosion rate will naturally slow without investing in costly stabilization practices. This approach also allows for natural sediment transfer to surrounding intertidal habitats, maintaining their economic, recreational, and ecological value. However, some land at the leading edge of the bluff will be lost as a result.

Active stabilization alternatives aligned with the OUR SHORE framework include regrading and revegetation of the slope, targeted riprap protection at the toe of the bluff, and addressing overland contributions. These practices may be combined to match project goals and available budget.

The impacts of sea level rise should be considered with any shoreline stabilization project, but especially in those at or near the current astronomical high tide like the Division Point ROW (Fig. 3). The Maine Climate Council has adopted a “Commit to Manage” sea level rise scenario of 1.5 feet by 2050 and 3.9 feet by 2100 (Maine Climate Council, 2020, p. 25). These conditions will expose areas higher up the bluff to more frequent inundation and wave action, which should be considered when evaluating the design life and long-term costs of management alternatives at the site.

Slope Regrading (Fig. 10):

Gradual slopes have a lower risk of slope failure and more effectively diffuse wave energy. For oversteepened slopes like the bluff at Division Point, creating a more gradual slope by cutting away soil at the top of the bank can provide a more stable foundation for green or gray stabilization techniques. The Division Point ROW is a good candidate for regrading because there are no large structures near the bank that would need to be moved. The wooden stairs would need to be relocated or replaced during the regrading process.

After regrading to a stable slope, temporary erosion control blankets and dense vegetation should be installed for long-term protection. Slope interruption techniques like contour swales or rows of coir logs placed parallel along the slope can be used to further mitigate erosion over long slopes. Slope interruptions slow the movement of runoff and receding wave spray as they flow down the bank. They are particularly beneficial as temporary protection while waiting for permanent vegetation cover to establish.

Stone Toe Protection (Fig. 11):

As with many eroding coastal bluffs, erosion at the toe or base of the Division Point bluff appears to be a significant factor in erosion of the bluff as a whole. Often, erosion occurs fastest at the toe of a bluff, creating undercut areas of the bank which slide or collapse as support is lost. The bent and leaning trees at Division Point ROW are an indicator of bank failure from toe erosion. Because the bluff is located at the highest astronomical tide line and is impacted by regular wave action, toe protection using riprap stone will likely provide the most effective protection. A riprap toe can be installed with or without major slope regrading.

Opting for targeted toe stabilization instead of placing riprap across the entire bank is recommended by OUR SHORE to minimize soil disturbance and negative impacts on shoreline habitat. Adding vegetation to the riprap design will increase resilience and longevity of the riprap and reduce the unwanted consequences of hardened structures like scouring and end-effect erosion. Vegetating riprap begins with choosing an appropriate filter layer beneath the stones. Traditional riprap designs often use plastic geotextile fabric which inhibits root growth. Replacing synthetic filter layers with graded gravel and small stones or a natural fabric like coconut coir can provide the same filter role in a design while allowing plant growth. After riprap installation, vegetation can be added by filling voids in the stone with soil, mulch, and seeds, or by installing live stakes through the stone.

Because the base of the bluff is positioned just above the highest astronomical tide line, it is critical to choose plants that are tolerant of soil saturation and occasional saltwater flooding. Options to consider are Virginia or pasture roses (*Rosa virginiana* or *Rosa carolina*) and shrubby cinquefoil (*Potentilla fruticosa*). These plants will also naturally migrate upward on the bank in response to higher tides from sea level rise, providing continued protection and long-term resilience.

Bluff and Upland Revegetation:
Adding vegetation to the bluff face and upland area is recommended regardless of which, if any, other slope stabilization methods are pursued at the site. The most effective combination of vegetation for bluff stabilization is small and medium woody shrubs combined with grasses and herbaceous plants. Over time, vegetation should densely cover the bluff face and at least 10-15 feet of the upland bank.

Leaning and Hazard Trees:
Leaning trees are common on eroding bluffs like the Division Point ROW. They may start to lean when the underlying soil is eroded, or when the tree and associated soil mass slide down the face of the bluff in a slope failure. This issue can be addressed in different ways depending on the severity of the leaning, the size of the tree, and whether the tree could fall on buildings or other structures.

The tree pictured below at the ROW site (Fig. 9) shows a moderate lean but still has large roots embedded in the slope. At this stage, the tree can be retained by packing the undercut areas beneath the trunk and roots with a mixture of gravel and erosion control mulch bundled in burlap bags. The bundles provide support to the weight of the tree while protecting the soil from further erosion. Targeted pruning of branches on the seaward side of the tree to reduce weight can also help the tree support itself.

A tree that is more severely undercut, one that is positioned where it creates a hazard, or one that is likely to pull large soil masses from the bluff if it falls may need to be cut for safety and overall bank stability. Some species of trees, if cut in the dormant season, will sprout new growth from the stump and maintain a living plant and root system. This practice is referred to as coppicing or pollarding, depending on the height of the cut. If the tree cannot be coppiced, leaving the root wad in place to minimize soil disturbance and retain the supportive structure of the roots is highly recommended. The town Code Enforcement Officer or a licensed arborist can assist with the determination of hazard trees.

Regulatory Considerations:

Vegetation can be planted within the shoreland zone without a permit. At the municipal level, slope regrading and cutting any trees in the shoreland zone require a permit from the town code enforcement officer. Riprap projects require a permit from the town planning board. Riprap installation and slope regrading will require additional state permits under the Natural Resource Protection Act. A riprap project limited to the toe of a slope as described above will qualify for an expedited Permit by Rule (PBR), while a regrading project at this scale will require an Individual Permit.

Figure 8: Maine Geological Survey Living Shoreline Decision Support Tool. The light green points along the Division Point ROW shoreline indicate moderate suitability for a living shoreline.

Figure 9: An undercut and leaning tree at the Division Point ROW.

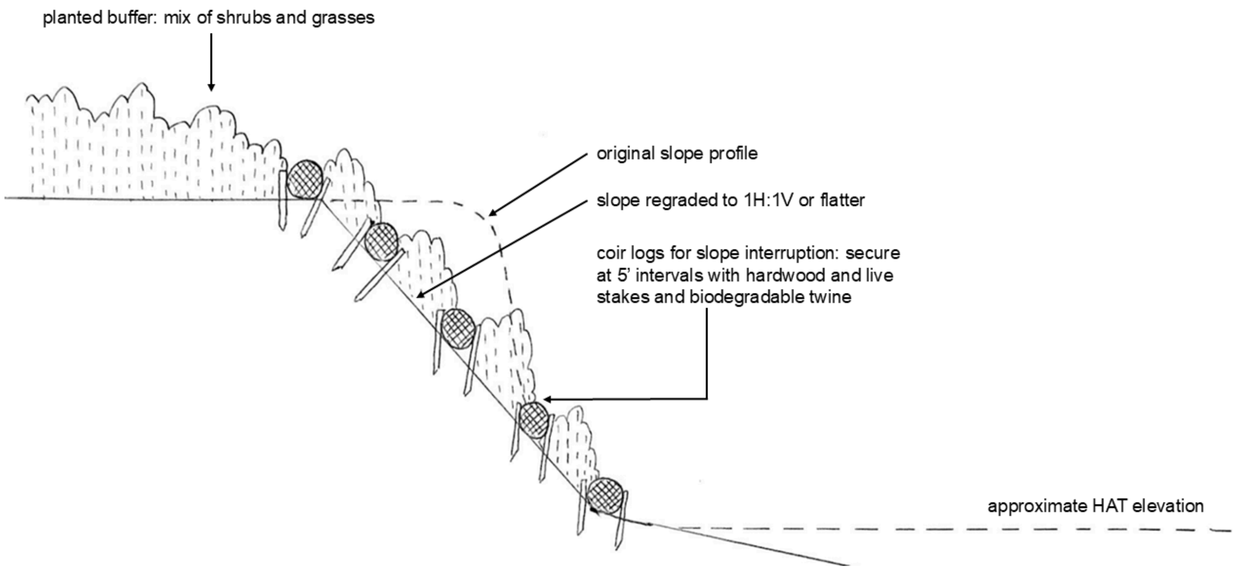


Figure 10: Cross-sectional diagrams of an erosion management alternative for the Division Point ROW combining slope regrading, coir logs for slope interruption, and a vegetated buffer.

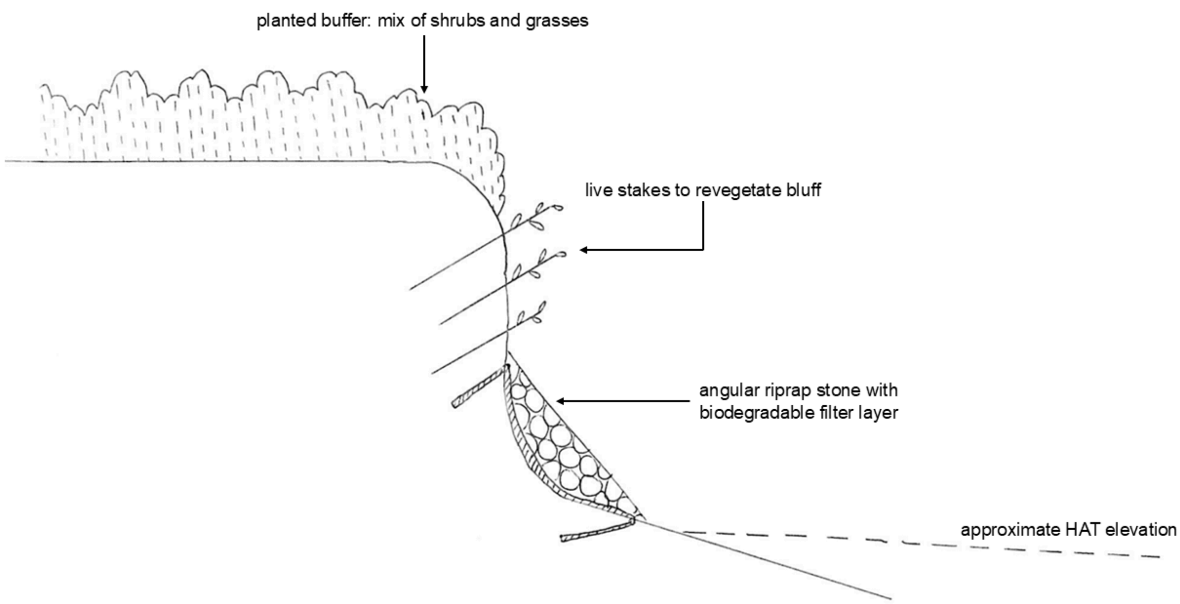


Figure 10: Cross-sectional diagrams of an erosion management alternative for the Division Point ROW using a riprap stone toe with planted vegetation on the upper bluff face and upland areas of the ROW.

OURSHORE Quick Assessment: Hamilton Beach
17 Willow St, Chebeague Island, ME

Existing Site Conditions:

Location:
Hamilton Beach is a popular public beach on the east side of Chebeague Point. The site assessed was the municipally owned Right of Way (ROW) at 17 Willow St which provides public access to Hamilton Beach. The 33 foot wide ROW provides foot access to the beach from the end of Willow St and includes a gravel parking area for 4-6 cars (Fig. 1).

The bank adjacent to the Hamilton Beach ROW is less than 3 feet tall across the width of the ROW, and both the beach and upland slope are shallow (Fig. 2). To the north and south of the ROW, this low bank gradually transitions to coastal bluffs of six feet or higher, and many of the abutting property owners have installed riprap stabilization along the bluffs in front of their properties.

Environmental Characteristics:
Beginning with Habitat maps identify moderate and high value Tidal Waterfowl and Wading Bird Habitat in the intertidal zone adjacent to the Hamilton Beach ROW (Fig. 3). Additionally, the intertidal zone of most of Hamilton Beach, including the ROW, is mapped as wetland in the National Wetland Inventory (Fig. 4). Upland of the coastal wetland, the site has been mapped as a Coastal Sand Dune by the Maine Geological Survey (Fig. 5).

Annualized fetch at Hamilton Beach, as measured by the U.S. Geological Survey, is Low (>0.5 and ≤ 1.0 miles). This indicates that the site is relatively sheltered from wind and wave energy.

Erosion:
During the winter storms in January 2024, the bank of Hamilton Beach ROW eroded an estimated 10 ft landward. Figure 1 shows the extent of this erosion: the raised, vegetated area was part of the continuous bank prior to these winter storms. Erosion from 2024 winter storms and long-term erosion has led to loss of parts of the parking area and a grassy buffer between the parking area and beach.

Figure 1: Photo of the Hamilton Beach ROW facing north. The clump of soil and grass visible in the center of the image indicates the edge of the soil and vegetation layer in this area of the ROW prior to January 2024.

Figure 2: Photo of the Hamilton Beach ROW facing inland.

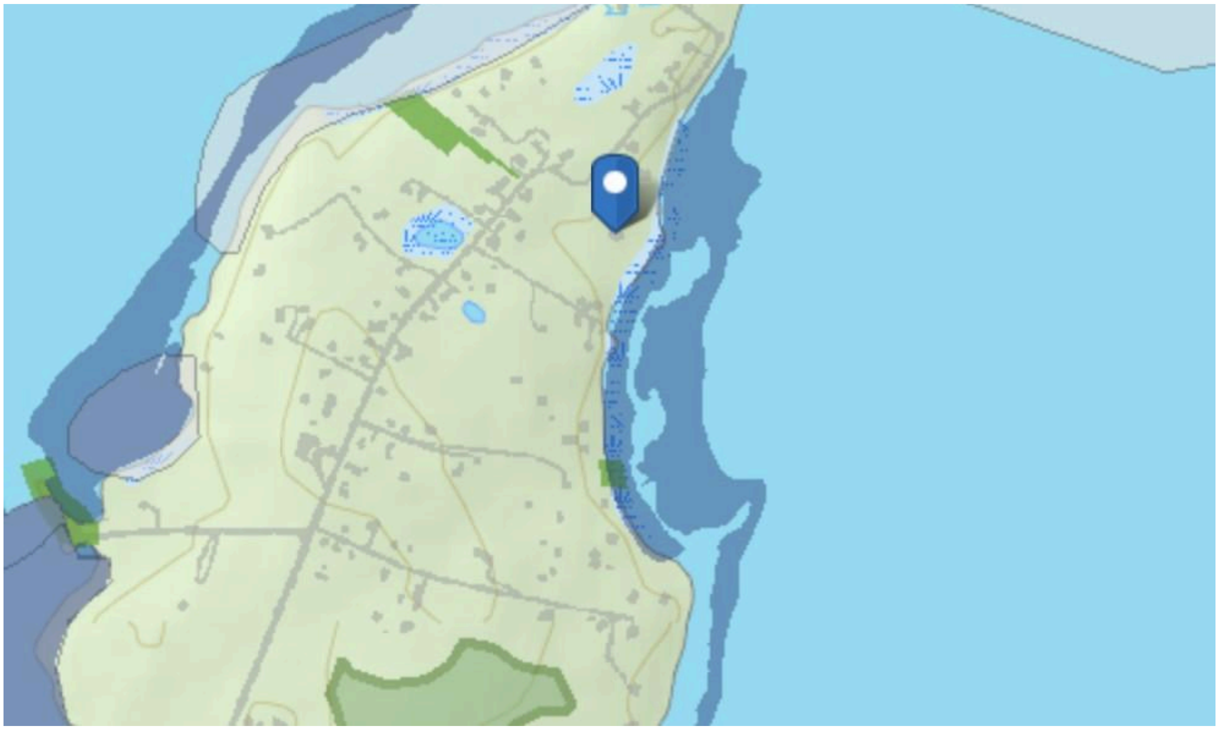


Figure 3: Beginning with Habitat map of tidal waterfowl and wading bird habitat surrounding Hamilton Beach (dark blue).

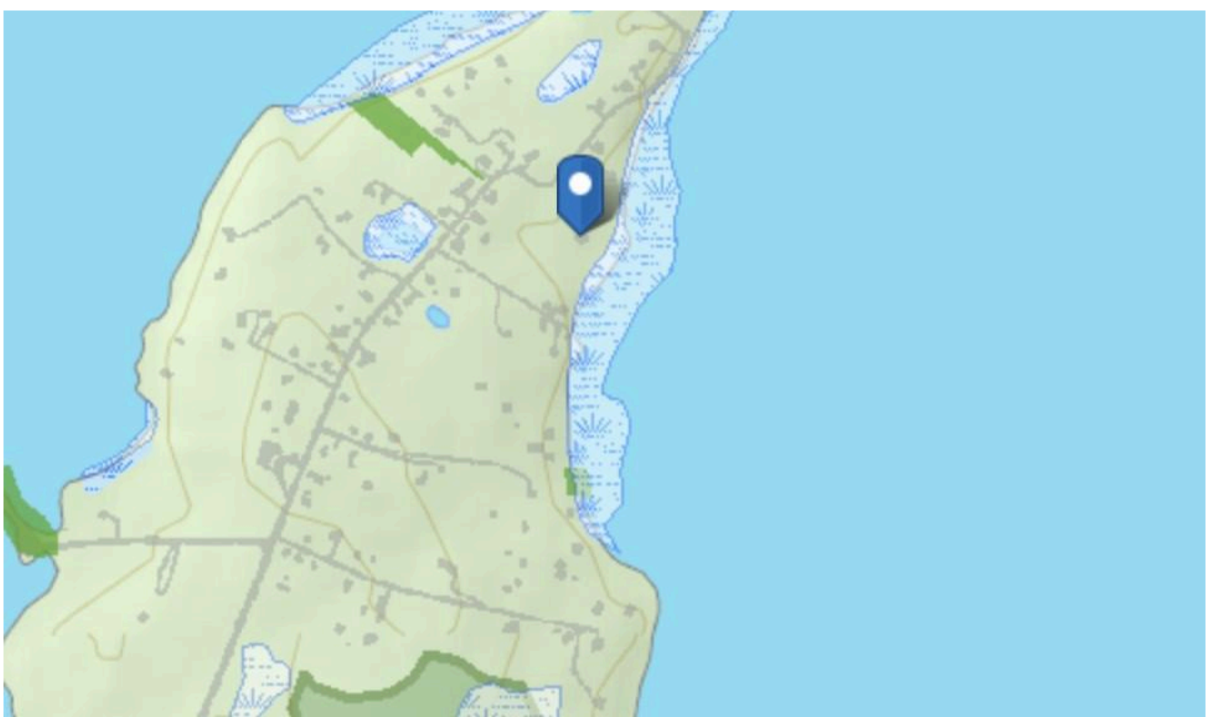


Figure 4: Beginning with Habitat map showing National Wetland Inventory areas surrounding Hamilton Beach (white with blue).

Figure 5: Coastal Sand Dune Geology of Chebeague Point including Hamilton Beach (MGS). Yellow lines delineate areas of sand dune, and red lines indicate areas at risk of erosion based on predicted sea level rise.

OUR SHORE Quick Assessment:

Source & Severity of Erosion:

Overland Erosion	Moderate- Bank is eroding with observable change and loss from overland flows
Groundwater	Low- No evidence of groundwater seepage
Toe Erosion	High- Bank is slumping from completely eroded toe
Wave Erosion	Moderate - Site receives some wave action, but only large storms cause erosion. Only toe is affected.

Height & Slope Risk:

Bank Height	Low Bank (less than 3 feet)
Slope Severity	Low Slope (less than 3L:1V
Current Slope	Moderate - More than half of surface has vegetation and duff layer
Soils	Low - Soils contain mix of sediments and stone; fairly stable soil condition

Overland Water from Land Use:

Surface Water Flow to Bank	High - Concentrated or channelized flow is directed down the embankment.
Lawn or Bare Ground Near Bank	High - Lawn area or bare ground is located within 25 feet of the shoreline
Impervious Surface Near Bank	High - Roads, driveways, houses, or other impervious surfaces are within 25 feet of the shoreline
Overall Impact of Surface Flows	High - Overland flow of water is a significant contributor to instability

Revegetate/reconnect shoreline buffer:

Vegetation within 250 Feet	Average vegetation (20-70% coverage)
Vegetation within 25 Feet	Low/sparse vegetation (less than 20%)
How Natural Is the Shoreline Habitat?	High - Bank and vegetation are not altered. No riprap or hardened structures installed.

Proposed Management Actions:

The Maine Geological Survey Living Shoreline Decision Support Tool identifies Hamilton Beach as Moderately to Highly Suitable for a living shoreline design due to the low fetch, gradual slopes, and presence of sand dune and mudflat habitats (Fig. 6). Likewise, results of the OURSHORE Quick Assessment support the selection of a nature-based strategy (NbS) for this site while prioritizing management of overland water contributions to instability. The site has a lower slope failure risk because of the low bank height and shallow grade. These factors also increase the feasibility of successful vegetation establishment for NbS. OUR SHORE recommended management actions based on the Quick Assessment results include installing biodegradable toe protection, creating a vegetative buffer, and minimizing runoff from roads and parking areas. As a mapped sand dune system, there is also the potential to use sand dune restoration at the site as a nature-based erosion control tool.

Biodegradable and Living Toe Protection:

This method uses biodegradable materials, often coconut coir logs, to protect and stabilize the base, or toe, of the eroding slope. The coir logs are staked and anchored in place against the eroding toe. Native plants are introduced using various methods, so as the coir logs biodegrade over a period of 8-10 years, mature vegetation replaces the logs as the primary source of protection and stability. Revegetation of this area should focus on restoring a combination of native shrubs, grasses, and groundcover plants to create a strong network of root systems and aboveground plant material.

Native vegetation may also be installed as toe protection without additional supportive materials. This is a lower-cost alternative, but new plantings will be more vulnerable to storm damage and erosion in the first few years before they establish mature root systems.

Enhanced Vegetative Buffer:

Increasing vegetation between upland and shoreline areas mitigates multiple causes of erosion by protecting the soil surface, stabilizing soil with belowground root systems, and slowing the flow of runoff. To maximize erosion control benefits, a vegetative buffer should be at least 10 ft in depth perpendicular to the shoreline. At the Hamilton Beach ROW, the parking area currently constrains the potential buffer width, but a buffer as close to 10 ft as feasible should be considered.

Effective vegetative buffers for erosion control include a densely planted mix of native trees, shrubs, grasses, and groundcover. Resources like the Cumberland County Soil and Water Conservation District and Maine Natural Areas Program Fact Sheets can help determine plants that are well suited to the site conditions, including plants tolerant of salt spray and sandy soil.

Clearly defining a walking path through the buffer with mulch or crushed stone is recommended to keep foot traffic from damaging buffer plantings.

Managing Road and Parking Runoff:
Concentrated overland flow of water from Willow St and the Hamilton Beach parking area are contributing to instability and erosion of the site. Managing this flow appropriately will prevent overland erosion and reduce the severity of wave and storm erosion through increased stability. Oftentimes, improved buffer vegetation is sufficient to slow runoff and mitigate erosion from overland flow. If overland flow continues to form gullies through the buffer, targeted riprap stabilization combined with vegetation can provide additional protection where runoff travels down the bank.

Natural or Reinforced Sand Dune Restoration:
MGS indicates that this area historically contained a sand dune system. Due to natural erosion, development, or a combination of multiple factors, there is no longer a sand dune present on site. Restoration of a natural or reinforced sand dune, including replacement of sand and installation of native dune grasses, could be an effective method of mitigating erosion and restoring habitat value of the site. However, dune restoration would be more successful and cost-effective over a larger scale rather than only within the bounds of the 33 ft ROW, which would require the involvement of neighboring property owners.

Regulatory Considerations:

Hand-planting of native vegetation is permissible without a permit in most cases. This includes installing live stakes, spreading seeds, or installing up to 25 1-gallon potted plants per year as long as only hand tools are used.

Any other management options recommended in this report will require a permit from the ME Department of Environmental Protection (DEP) under the Natural Resources Protection Act and a permit from the Code Enforcement Officer under the Shoreland Zoning Ordinance. This includes biodegradable toe protection such as coir logs and the addition of fill including sand to restore a dune structure.

Since the site is located within a coastal sand dune, NRPA permits will additionally need to be reviewed by the Maine Geological Survey (MGS). It is recommended that you consult with MGS prior to submitting an application to ensure that the project will meet their standards and recommendations, particularly if the project includes dune restoration.

Figure 6: Living Shoreline Decision Support Tool map of Chebeague Point including Hamilton Beach. Green points indicate scores of Moderately Suitable (light green) and Highly Suitable (dark green).

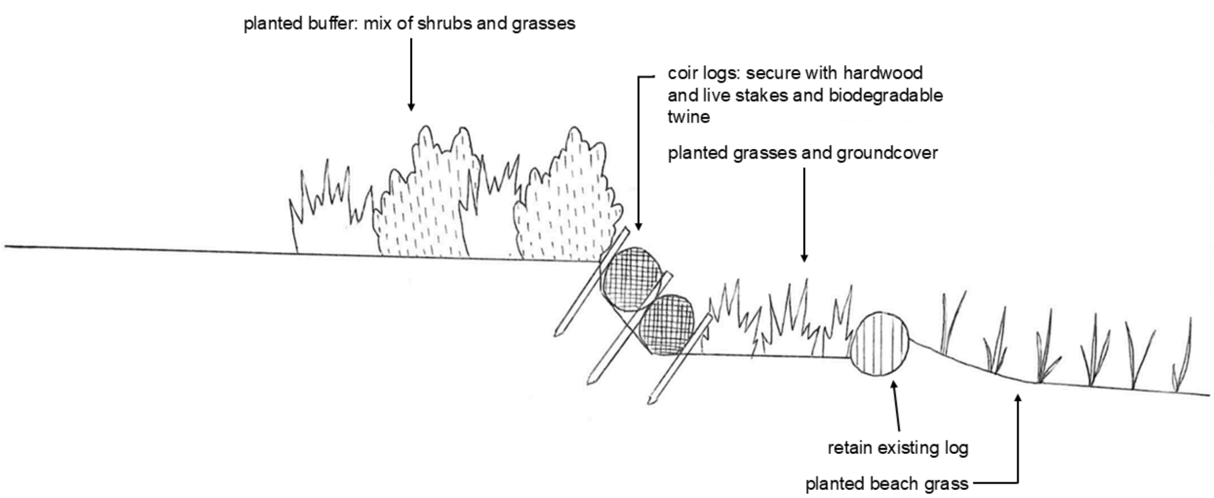


Figure 7: Cross-sectional diagram of recommended erosion management techniques at the Hamilton Beach ROW including coir log installation and replanting vegetation.

OURSHORE Quick Assessment: South Shore Drive Right of Way
Chebeague Island, ME

Existing Site Conditions:

Location:
South Shore Drive parallels the shoreline along Coleman Cove and the Western Landing on Chebeague Island. The Town of Chebeague Island has a 40 foot wide Right of Way (ROW) containing the road, the seaward coastal bluff, and a maintained path to access the shoreline (Figs. 1-2).

Environmental Characteristics:
The shoreline of South Shore Drive is a coastal bluff system approximately 15-20 ft tall (Figs. 3-4). Seaward of the bluff is a cobble and sand beach. There are large boulders aligned on the beach below the mean high water level, which appear to have been placed as an attempt to protect the bluff from erosion (Figs. 3-4).

The intertidal zone adjacent to South Shore Drive is a federally mapped wetland (Fig. 5). It provides habitat for softshell clams in Coleman Cove and for sea scallops further offshore (Fig. 6). The area is also considered High Value Tidal Waterfowl and Wading Bird Habitat (Fig. 7).

Erosion:
The bluff at South Shore Drive was damaged during the winter storms of 2024, exacerbating existing bluff erosion. The bluff slope has areas of bare soil, there are leaning trees indicating slope failure, and the bluff edge has receded closer to the existing road. This infrastructure risk led the Town to contract GEI Consultants, Inc. (GEI) to conduct a site assessment and provide conceptual design alternatives to stabilize the bluff. Two short-term alternatives were provided in the report: a toe stone riprap revetment with a vegetated upper bank, or a full slope riprap revetment. The goal of this report is to support the Town in selecting a stabilization option by providing information on how state OUR SHORE guidance may align with project design for South Shore Drive.

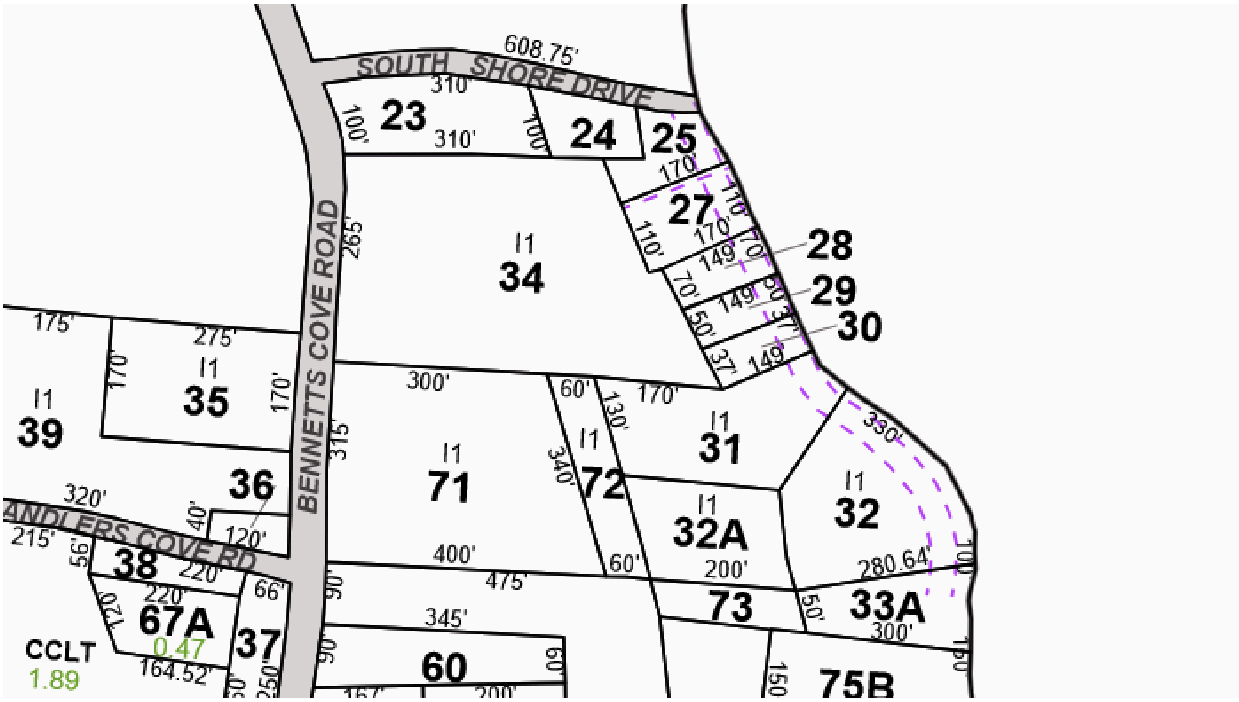


Figure 1: Town of Chebeague Island zoning map showing the location of the South Shore Drive ROW in pink dashed lines.

Figure 2: The dirt road and bluff edge included in the S Shore Dr ROW.

Figures 3 & 4: Photos showing sections of the bluff including access stairs, fallen and leaning trees, and rocks placed in a previous shoreline protection attempt.

Figure 5: Beginning with Habitat map showing National Wetland Inventory maps in white patterned with blue.

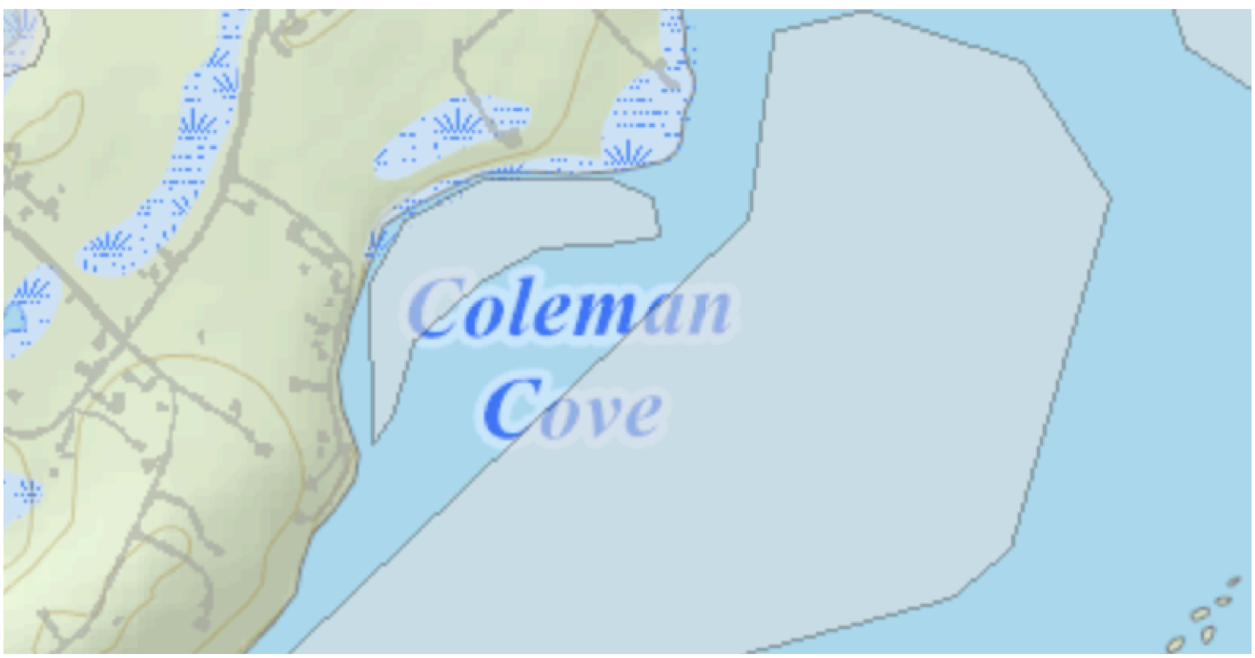


Figure 6: Beginning with Habitat map showing shellfish habitat in gray. Shellfish habitats shown are for softshell clam (nearshore area) and sea scallops (further offshore).

Figure 7: Beginning with Habitat map showing Tidal Waterfowl and Wading Bird Habitat in dark blue.

OUR SHORE Quick Assessment:

Source & Severity of Erosion:

Overland Erosion	Moderate- Bank is eroding with observable change and loss from overland flows
Groundwater	Moderate- Evidence of limited or seasonal groundwater seepage or impacts to slope
Toe Erosion	High- Bank is slumping from completely eroded toe
Wave Erosion	High- Site is exposed to wave action and increased impacts from severe storms. Waves erode toe and bank.

Height & Slope Risk:

Bank Height	High bank/bluff (over 6 feet)
Slope Severity	High slope (>1L:1V)
Current Slope	High- Less than half of surface has vegetation and duff layer
Soils	Moderate- Unstable soil condition or moderate erosion rate

Overland Water from Land Use:

Surface Water Flow to Bank	Moderate- Some concentrated or channelized flow is directed toward the eroding bank resulting in minimal sheet or rill erosion
Lawn or Bare Ground Near Bank	High- Lawn area or bare ground is located within 25 feet of the shoreline
Impervious Surface Near Bank	High- Roads, driveways, houses, or other impervious surfaces are within 25 feet of the shoreline
Overall Impact of Surface Flows	Moderate- Moderate overland impact from surface water

Revegetate/reconnect shoreline buffer:

Vegetation within 250 Feet	Average vegetation (20-70% coverage)
Vegetation within 25 Feet	Low/sparse vegetation (less than 20%)
How Natural Is the Shoreline Habitat?	Moderate- Bank impaired by riprap/hardened structures, but vegetation is present

Integrating OUR SHORE Principles:

Minimize Intervention: OUR SHORE always recommends minimizing intervention and soil disturbance in stabilization projects. Choosing to use a riprap revetment only on the toe with vegetation on the upper bank, as described in the first short-term alternative provided by GEI, meets this recommendation. This hybrid approach preserves most of the natural function of the shoreline while protecting the slope and preventing erosion and slumping.

Use Biodegradable Materials:

Synthetic materials used in shoreline stabilization projects often have the unintended effect of preventing vegetative growth. Replacing synthetic materials with biodegradable alternatives provides media for plants to grow in, which helps connect structural components to the soil through root systems, thereby increasing the durability of the project. In either stabilization alternative, this goal can be met by choosing a graded gravel layer or biodegradable filter fabric instead of a synthetic geotextile as a filter layer beneath the riprap stone.

Revegetate and Restore Shoreline Buffer:

Vegetation increases the durability and resilience of shoreline stabilization projects, helps to address groundwater contributions to instability, and increases the habitat value of the shoreline. The toe stone riprap revetment already achieves this goal. For a full-slope revetment, a plan to revegetate as much of the revetment as possible should be put in place. Riprap projects have been successfully revegetated by leaving planting pockets for mature trees or shrubs between the stones, installing live stakes through the riprap, or filling voids in the stones with a planting media and seeds. Planting a vegetated buffer above the riprap, as described in the GEI report, is highly encouraged in addition to vegetating the revetment.

OURSHORE Quick Assessment: Private Property A
Chebeague Island, ME

Existing Site Conditions:

Location:

The site described in this report is a private property located between the boatyard and Central Landing on the east side of Chebeague Island. The property contains approximately 175 linear feet of shoreline along a coastal bluff system. Built structures on the property include a house, positioned approximately 40 feet inland of the upper bluff edge, and a set of wooden stairs to access the shoreline.

Environmental Conditions:

A seasonal stream or drainage crosses the property to the north of the house, traveling down the bluff through a narrow gully. Across the width of the property, the shoreline consists of a coastal bluff up to 20 feet tall, with the bluff face covered with vegetation in some areas and exposed soil in others. Exposed areas of the bluff show that the bluff sediment consists of layers of sandy and clay sediments. The current Highest Astronomical Tide elevation reaches the toe of the bluff. Landward of the bluff, the intertidal area is a gradually sloping rocky beach with areas of exposed ledge near the base of the bluff. Inland Fish & Wildlife identifies High-Value Tidal Waterfowl and Wading Bird Habitat and shellfish beds for softshell clam in the adjacent intertidal and nearshore areas.

Erosion:

The coastal bluff system at the site was characterized as Unstable by the Maine Geological Survey in 2020. Signs of erosion observed at the site visit indicate that the bluff has likely progressed from Unstable to Highly Unstable. Some factors indicating a progression to Highly Unstable classification observed at the site were fallen trees on the bluff and displaced blocks of sediment from the bluff face (Fig. 3). The progressive instability at this site aligns with the coastal bluff erosion cycle, wherein increased toe erosion leads to slope failure which then restabilizes the bluff. However, severe storms including the winter storms in 2024 have exacerbated erosion at the site, and the property owner is concerned about bluff retreat encroaching on the house.

Figure 1: A gully on the property that contains an intermittent stream.

Figure 2: Partial view of the bluff face and intertidal zone. Bare soil on the lower bluff indicates eroding areas from wave action.

red.

Figure 3: Partial view of the bluff face and intertidal zone. A tree stump that has fallen as a result of erosion and slope failure is visible near the center of the photo.

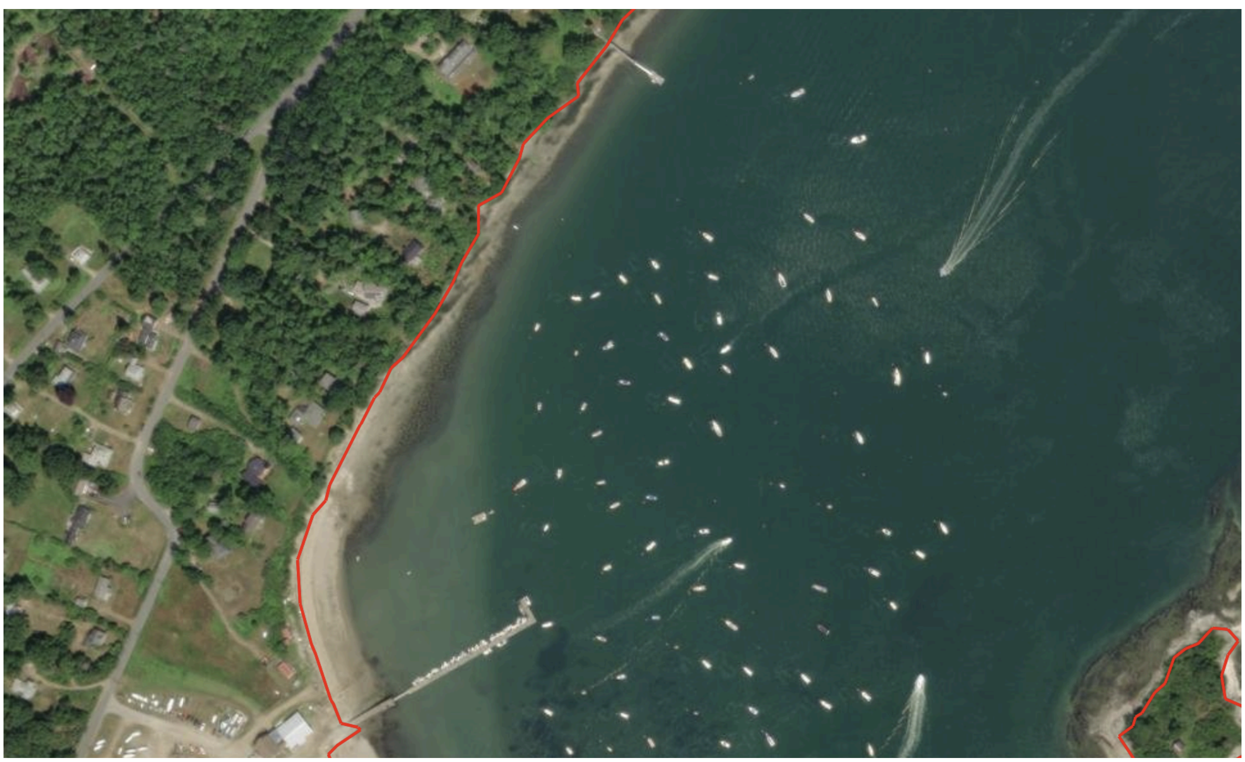


Figure 4: Maine Geological Survey map indicated the Highest Astronomical Tide elevation in red.

Figure 5: Beginning with Habitat map of the site showing nearby Tidal Waterfowl and Wading Bird Habitat (dark blue) and shellfish beds (gray).

Figure 6: Maine Geological Survey Coastal Bluff Map of the assessed property and surrounding areas created in 2020. Yellow indicates Unstable bluffs and green indicates Stable bluffs.

Figure 7: Large block of displaced soil at the base of the bluff.

OUR SHORE Quick Assessment:

Source & Severity of Erosion:

Overland Erosion	Low - No recent bank erosion or loss from overland flows
Groundwater	Moderate - Evidence of limited or seasonal groundwater seepage or impacts to slope
Toe Erosion	High - Bank is slumping from completely eroded toe
Wave Erosion	Moderate- Site receives some wave action, but only large storms cause erosion. Only toe is affected

Height & Slope Risk:

Bank Height	High bank/bluff (over 6 feet)
Slope Severity	High slope (>1L:1V)
Current Slope	Moderate - More than half of surface has vegetation and duff layer
Soils	Moderate - Unstable soil condition or moderate erosion rate

Overland Water from Land Use:

Surface Water Flow to Bank	Moderate - Some concentrated or channelized flow is directed toward the eroding bank resulting in minimal sheet or rill erosion
Lawn or Bare Ground Near Bank	High - Lawn area or bare ground is located within 25 feet of the shoreline
Impervious Surface Near Bank	Moderate - No roads, driveways, houses, or other impervious surfaces are within 25 feet of shoreline
Overall Impact of Surface Flows	Moderate - Moderate overland impact from surface water

Revegetate/reconnect shoreline buffer:

Vegetation within 250 Feet	Average vegetation (20-70% coverage)
Vegetation within 25 Feet	Low/sparse vegetation (less than 20%)
How Natural Is the Shoreline Habitat?	High - Bank and vegetation are not altered. No riprap or hardened structures installed

Proposed Management Actions:

Groundwater Mitigation:

When bluff soils become oversaturated with groundwater, the bluff becomes weaker and more vulnerable to wave erosion and slumping. Soils that have layers of clay, as seen at this site, become saturated quickly since groundwater cannot infiltrate through these impermeable layers and becomes trapped in the bluff. The most straightforward method of mitigating groundwater saturation is by replacing turf grass with shrubs and native, deep-rooted herbaceous plants, which uptake more water from the soil. It is recommended that at least the first 10-15 feet of land from the upper bluff edge are vegetated for improved stability.

Toe Protection:

Based on the level of bluff instability and the proximity of the house to the eroding bluff edge at this site, a partial riprap revetment to support and protect the toe slope may be appropriate. Targeting riprap stabilization only in the most impacted areas of the bank minimizes the project cost and environmental impacts. At this site, erosion is most severe at the toe. The upper bluff has been indirectly impacted by slumping of unsupported sediment blocks, but intact vegetation on the upper bluff indicates that direct wave impacts are minimal above the toe. OUR SHORE guidelines recommend the use of a biodegradable filter fabric such as coconut coir rather than synthetic geotextile filter fabric to create the foundation behind riprap. A biodegradable fabric allows for revegetation of the riprap over time, increasing stability of the installation and restoring habitat.

Bluff Vegetation:

Above the riprap toe, OUR SHORE guidelines recommend maintaining or restoring a densely vegetated slope with a mixture of shrubs, small trees, and herbaceous plants. Shrubs and small trees provide the benefits of strong, extensive root systems without the additional weight and erosion hazard that large trees may cause on steeper slopes. When viewing the bluff from the beach, the area to the left of the access stairs is thickly vegetated with small fir trees, bayberry shrubs, and other small woody plants. These plants appear to have survived through the severe winter storms in 2024 and continue to provide effective protection to the upper bluff face. This area will provide an effective reference for selecting vegetation well-suited to the environmental conditions of the site. Replicating the density and composition of this reference area across the bluff will increase soil protection and resilience. Additional recommendations for resilient, salt-tolerant native plants suitable for coastal shoreline stabilization can be found in the attached planting guides.

Hazard Tree Management:
Trees can create increased erosion risks on steep or failing slopes, since they can pull large amounts of soil with the root wad. When trees on a slope get undercut by erosion or they are leaning severely, cutting the tree should be considered as an erosion management strategy. However, tree roots also provide stability to soil, and this protective capacity can be preserved by leaving trees that are not leaning in place, and retaining the root wad in place when trees have to be cut. A licensed arborist or the town Code Enforcement Officer can help you determine whether a tree is a hazard.

Regulatory Considerations:

Planting vegetation may be done without a permit, as long as only native vegetation is planted and only hand tools are used. Cutting trees in the shoreland zone does not require a permit, but must follow the applicable land use standards in the Town of Chebeague Island Shoreland Zoning Ordinance. The Code Enforcement Officer must be consulted prior to removing any hazard trees within 75 feet of the shoreline.

Riprap stabilization of the bluff toe as described above will require a permit from the ME Department of Environmental Protection under the Natural Resources Protection Act (NRPA). If the riprap revetment extends the full width of the property, it will require an Individual Permit. If the riprap is placed on 125 linear feet of shoreline or less, the expedited Permit by Rule application may be used. Any permanent shoreline stabilization, including riprap, also requires a permit from the Town of Chebeague Island Planning Board.

Figure 8: Grass lawn extending to the bluff edge. Planting denser, taller vegetation in this area will help reduce groundwater saturation and increase bluff stability.

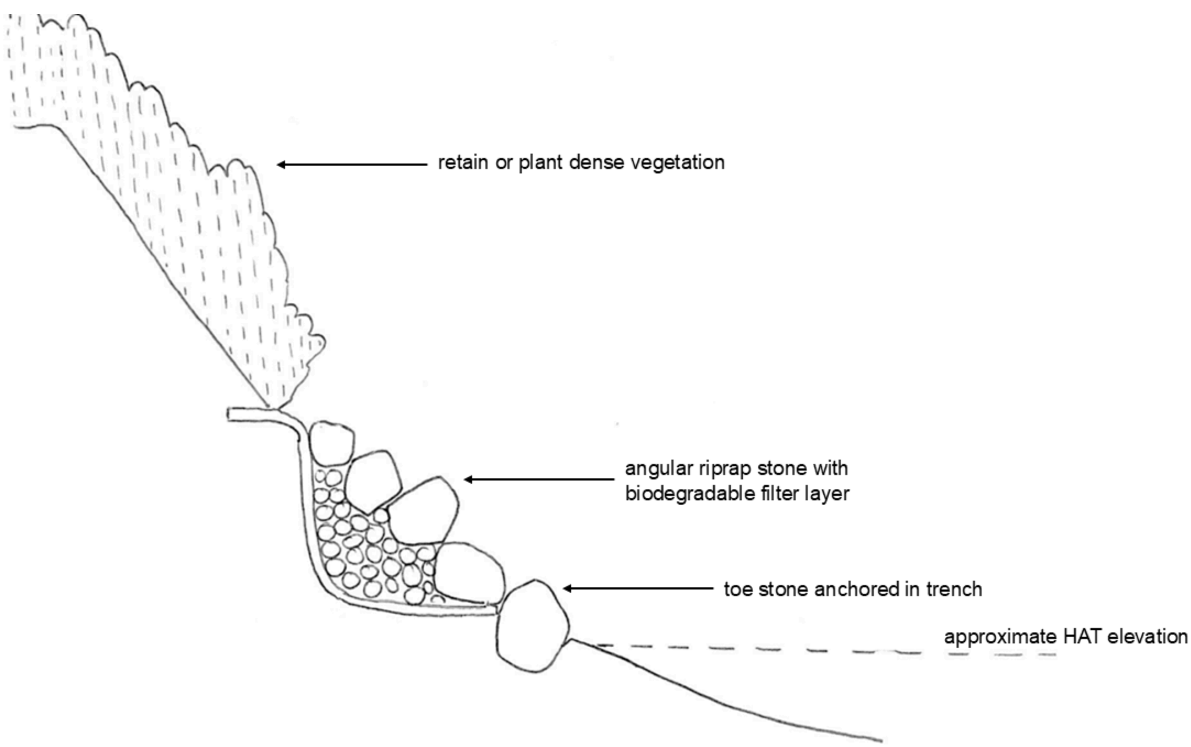


Figure 9: Diagram of recommended stabilization techniques utilizing a riprap stone toe with native vegetation on the upper bluff.

OURSHORE Quick Assessment: Private Property B
Chebeague Island, ME

Existing Site Conditions:

Location:

The site assessed in this report is a private residential property near Central Landing on the east side of Chebeague Island. The property has approximately 90 feet of shoreline frontage and includes a seasonal house, lawn, and stairs for shoreline access. The shoreline consists of a coastal bluff above a ledge and sand beach, and the house is positioned approximately 40 feet from the upland edge of the bluff.

Environmental Characteristics:

The property is bounded on the north by a small seasonal stream fed by a culvert at the top of the property (Fig. 1). The shoreline forms a coastal bluff landward of a sand beach with exposed ledge interspersed. The bluff height ranges from 15-20 feet across the width of the property, and the bluff face is vegetated with mature trees and a dense cover of invasive bittersweet, with some exposed areas of bare soil (Figs. 2-3). Exposed areas of the bluff face show distinct layers of sand and clay soil that make up the bluff (Fig. 4). Nearby intertidal habitats include moderate-value Tidal Waterfowl and Wading Bird Habitat and softshell clam beds (Fig. 5).

Erosion:

The coastal bluff at this property was mapped as stable in the northern section and unstable in the southern section in 2020 (Fig. 6). The bluff has been eroded and damaged during storms in the last several years, leaving signs of instability such as leaning trees, exposed sediment, and blocks of displaced sediment at the bluff base (Fig. 3). Erosion of the bluff is more severe near the drainage ditch on the north boundary of the property. The property owner at the site has hired a coastal protection contractor to install bank protection, and site plans are in development. The goal of this report is to provide options for hybrid green-gray stabilization options and overland water management strategies that can be integrated into the site design.

Figure 1: The culvert and seasonal stream located at the north edge of the property.

Figure 2: Partial view of the bluff and beach at the site photographed from the low water line.

Figure 3: Partial view of the bluff and beach. Exposed soil and displaced soil blocks are visible.

Figure 4: Close-up photo of the bluff sediment taken near the access stairs. Layers of sandy and clay soils are visible.

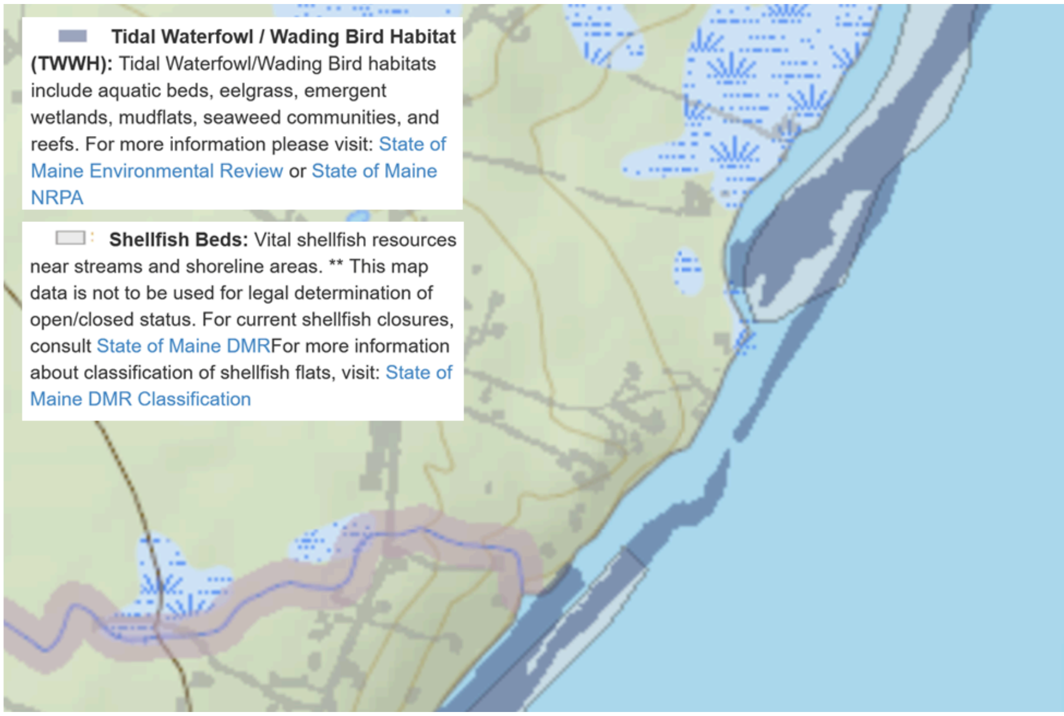


Figure 5: Beginning with Habitat map of the site showing nearby Tidal Waterfowl and Wading Bird Habitat (dark blue) and shellfish beds (gray).

Figure 6: Maine Geological Survey Coastal Bluff Map of the site and surrounding areas created in 2020. Yellow indicates Unstable bluffs and green indicates Stable bluffs.

OUR SHORE Quick Assessment:

Source & Severity of Erosion:

Overland Erosion	Moderate- Bank is eroding with observable change and loss from overland flows
Groundwater	Moderate- Evidence of limited or seasonal groundwater seepage or impacts to slope
Toe Erosion	High- Bank is slumping from completely eroded toe
Wave Erosion	Moderate- Site receives some wave action, but only large storms cause erosion. Only toe is affected

Height & Slope Risk:

Bank Height	High bank/bluff (over 6 feet)
Slope Severity	High Slope (> 1L:1V)
Current Slope	Moderate- More than half of surface has vegetation and duff layer
Soils	Low- Soils contain mix of sediments and stone; fairly stable soil condition

Overland Water from Land Use:

Surface Water Flow to Bank	High- Concentrated or channelized flow is directed down the embankment with rills and gully erosion. No protection is in place
Lawn or Bare Ground Near Bank	High- Lawn area or bare ground is located within 25 feet of the shoreline
Impervious Surface Near Bank	Moderate- No roads, driveways, houses, or other impervious surfaces are within 25 feet of shoreline
Overall Impact of Surface Flows	High- Overland flow of water is a significant contributor to instability

Revegetate/reconnect shoreline buffer:

Vegetation within 250 Feet	Average vegetation (20-70%)
Vegetation within 25 Feet	Average vegetation (20-70%)
How Natural Is the Shoreline Habitat?	High- Bank and vegetation are not altered. No riprap or hardened structures installed.

Integrating OUR SHORE Principles:

Groundwater Mitigation: Woody plants and other deep-rooted vegetation take up water from the soil, mitigating groundwater saturation. Replacing some of the grass lawn near the bluff edge with larger, deeper-rooted plants will improve water uptake and overall bank stability. The recommended width for planted buffers is at least 10-15 feet wide where space allows. If view obstruction is a concern, there are many native woody shrubs like creeping juniper and sweet-fern that grow low to the ground but still have well-developed root systems.

Bank Vegetation:

The property owner at the site has contracted with a coastal protection practitioner to design a riprap-based shoreline stabilization for their property. For projects using riprap, OUR SHORE recommends integrating as much vegetation as possible into the design to minimize the impacts of a riprap shoreline on neighboring properties and habitat quality. Recommended actions are planting a vegetative buffer at the landward edge of the riprap design, and installing vegetation within and over the riprap stones when feasible. Vegetation also strengthens the connection between riprap and the underlying soil when a biodegradable filter fabric like coconut coir or a graded stone and gravel bed is used instead of synthetic geotextile filters. During installation, riprap may be vegetated by leaving designated planting gaps for mature nursery-grown plants. Riprap can also be vegetated during or after installation using live stakes or by filling voids in the stone with soil, mulch, and seeds.

OUR SHORE also encourages using the minimal amount of intervention in shoreline stabilization projects. Some coastal bluffs can be effectively stabilized when riprap is installed only at the toe of the bluff, with vegetation on the upper slope.

Hazard Tree Management:

Many of the mature trees on the bluff face are leaning as a result of bluff slumping. Trees leaning to the extent of those at this site create an erosion hazard, because they are likely to pull masses of soil away from the bluff when they fall. Some of the trees on the bluff will be removed if a riprap stabilization project is installed, but management should be considered for any trees left standing after the riprap is installed. Hazard tree management on shorelines seeks to balance the risk of erosion from falling trees with the soil stabilization benefits of tree root systems. When trees are severely leaning, the recommended course of action is often cutting the tree but leaving the stump and root wad in place.

Addressing Stream Erosion:

The drainage ditch that borders this site to the north appears to be contributing to bluff instability and erosion impacts. Further assessment of the drainage system would be needed to fully address the erosion occurring as a result of the stream. However, there are general recommendations for managing erosion in and around streams that could be applied to the site. The culvert at the top of the property appears undersized, which increases the velocity and erosive capacity of the stream during heavy rain events. The Maine Audubon StreamSmart program recommends sizing culverts at 1.2 times the natural width of the stream for unrestricted flow. Stream channel modifications to increase fallen logs and other coarse woody debris or minor streambed regrading to create pooling areas are common techniques for slowing the flow of a stream to mitigate erosion.

Figure 7: Lawn area on the property extends to the bluff edge. Adding shrubs and deep-rooted herbaceous plants to this area will increase groundwater uptake and bank stability.

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