

OUR SHORE Coastal Erosion Assessments and Site Reports: Little Diamond Island



Emma Polhemus, Shore Corps Steward, Maine Conservation Corps & Island Institute
May 2026

OUR SHORE Coastal Erosion Assessments and Site Reports: Little Diamond Island

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 Casco Bay islands as they expand NbS opportunities for public and private properties.

Alongside community partners and Island Institute staff, the Shore Corps Steward visited three coastal sites on Little Diamond Island in March 2026 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.

This report was made possible in part by the financial assistance provided by the Inflation Reduction Act administered by the Office for Coastal Management, National Oceanic and Atmospheric Administration and in partnership with the Maine Conservation Corps. The content is the responsibility of the authors.

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.

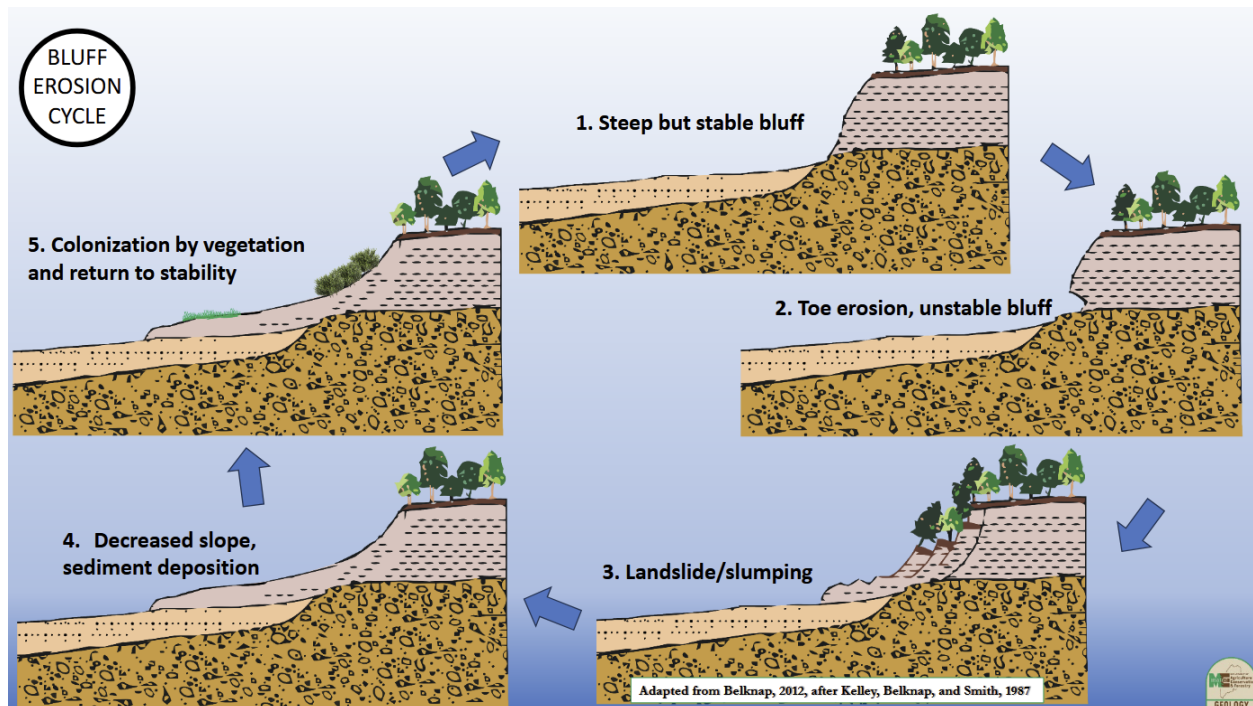
Contents

Key Terms.....	3
Mapping Tools.....	4
The OUR SHORE Quick Assessment.....	5
OURSHORE Quick Assessment: Bishop Healy Woods.....	6
OURSHORE Quick Assessment: West Shore Beach.....	17
OURSHORE Quick Assessment: Private Property.....	27
References.....	34

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: Bishop Healy Woods
Rockledge Ave, Little Diamond Island, ME

Existing Site Conditions:

Location:

Bishop Healy Woods is a 4 acre conservation property on Little Diamond Island (LDI) owned and stewarded by Oceanside Conservation Trust of Casco Bay (Fig. 1). It provides public space for low-impact outdoor recreation and shoreline access. The property is located on the northwest shore of LDI and includes two segments of shoreline. This assessment focuses on the 100 ft of shoreline north of Rands Way.

A private residential property adjacent to the northern boundary of Bishop Healy Woods is also included in this assessment. The property has a seasonal cottage and lawn area. During the fall and winter, dock floats from various residential properties are stored in the coastal wetland on and near the properties assessed (Fig. 4).

Environmental Characteristics:

The intertidal shoreline at this site is made up of sand flats and patches of salt marsh vegetation. The extent of the shoreline is included in National Wetland Inventory maps (Fig. 5). Upland of the tidal flats is a sediment bank of 3-6 feet with a slope ranging from near vertical to a more gradual 45° slope (1H:1V). Most of the bank is vegetated with shrubs, primarily speckled alder, as well as some larger trees. Upland of the bank, Bishop Healy Woods is forested, while the residential property transitions to grass lawn.

Mapped wildlife habitat types at the site include shellfish harvesting areas for softshell clams (Fig. 6) as well as high-value Tidal Waterfowl and Wading Bird Habitat (Fig. 7).

Erosion:

Signs of toe erosion are visible on the bank across the shoreline of Bishop Healy Woods and the private property. Some undercutting of the bank is present. On the private property's shoreline, a gully is also present (Fig. 8), indicating that flow of overland water is contributing to erosion and bank instability.

The site is rated as Suitable and Very Suitable for living shoreline approaches by the Maine Geological Survey (Fig. 9). A low annualized fetch, shallow intertidal area, and marsh and sediment bank shoreline types provide ideal conditions for plant establishment and living shoreline designs at the site.



Figure 1: Map of the Bishop Healy Woods property held by Oceanside Conservation Trust of Casco Bay. (OCT, 2024).



Figure 2: Photograph of the site shoreline facing north. Toe erosion including mild undercutting is visible on the bank.



Figure 3: Photograph of the site shoreline facing south, including salt marsh vegetation.



Figure 4: Photograph of the coastal wetland from the bank showing seasonal storage of docks.

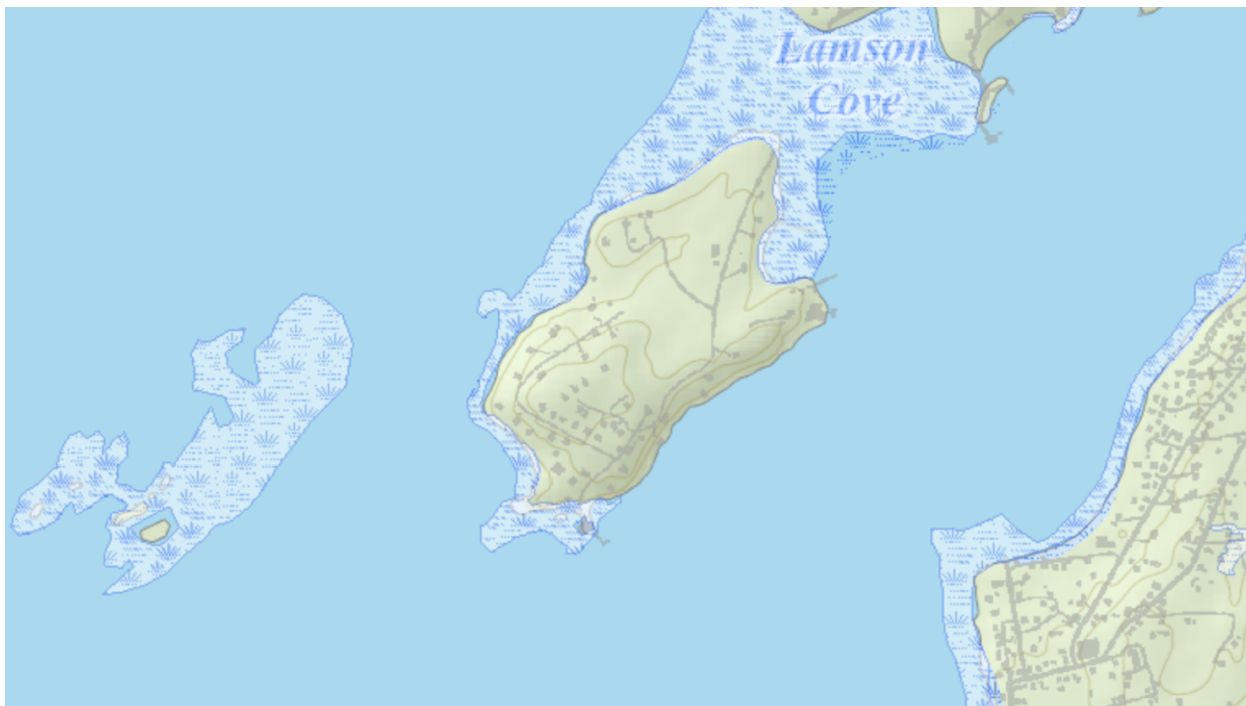


Figure 5: Beginning with Habitat map of National Wetland Inventory areas (white and blue pattern).

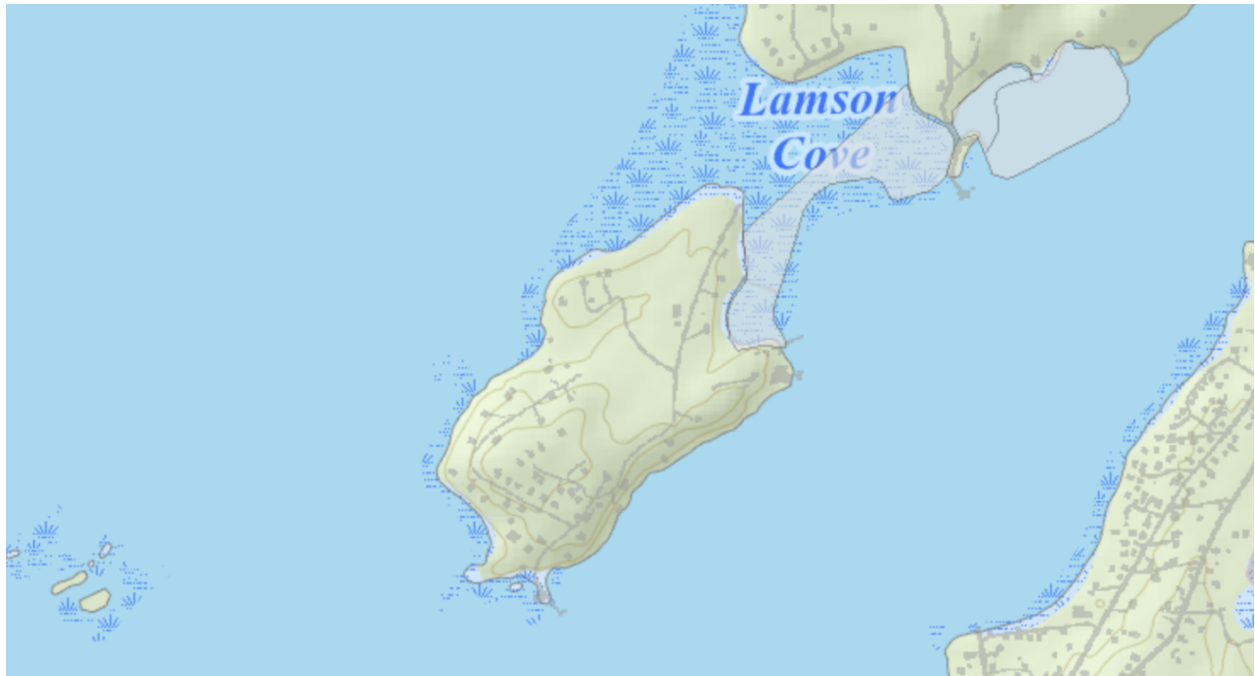


Figure 6: Beginning with Habitat map showing shellfish beds for softshell clams (gray).



Figure 7: Beginning with Habitat map showing Tidal Waterfowl and Wading Bird Habitat areas (dark blue). Habitat areas near the Bishop Healy site and Lamson Cove are designated as high value.



Figure 8: Photograph of a gully in the bank indicating surface water contributions to erosion.



Figure 9: Maine Geological Survey Living Shoreline Decision Support Tool. The light green points indicate moderate suitability for a living shoreline, and the dark green points indicate high suitability.

OUR SHORE Quick Assessment:

Source & Severity of Erosion:

Overland Erosion	High - Bank erosion is occurring with measurable change from overland flows
Groundwater	Moderate - Evidence of limited or seasonal groundwater seepage or impacts to slope
Toe Erosion	Moderate - Moderate toe erosion, beginning to slump
Wave Erosion	Moderate - Site receives some wave action, but only large storms cause erosion. Only toe is affected

Height & Slope Risk:

Bank Height	Moderate Bank (3-6 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	High - Roads, driveways, houses, or other impervious surfaces are within 25 feet of the shoreline
Overall Impact of Surface Flow	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	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:

Managing overland flow contributions:

The presence of a gully on the bank at the site indicates that concentrated flows of surface water are contributing to bank instability. Managing overland flows to reduce or prevent surface erosion will also increase overall bank stability and reduce wave and storm damage.

Management of overland flow at the site should incorporate the extension of the vegetated buffer on and near the bank, as well as targeted flow diversion and interruption to stabilize the gully that has already formed.

For shoreline stabilization, the recommended best practice for any site is to maintain a vegetated buffer of at least 10-15 ft in width from the top of the bank inland. This is particularly important for sites that show signs of erosion from surface runoff, because the vegetated buffer will slow down and spread out the flows of surface water, reducing their capacity to erode soil. Dense vegetation also increases the amount of surface water that is able to infiltrate into the soil, rather than continuing to run down the bank. This vegetated buffer should include densely planted native shrubs and herbaceous plants like grasses, ferns, or flowers. These plants can be added as potted nursery plants, planted by seed, or by simply choosing not to mow a designated buffer and allowing existing vegetation to expand into that area over time.

To stabilize the gully that has already formed, biodegradable slope interruptions can be installed to slow water moving through this area. While coir logs are often used, for a smaller gully like the one at this site, burlap bags filled with mulch are a cost-effective option (Fig. 10). Starting at the top of the gully, the bags should be placed in rows perpendicular to the slope and staked in place. The gully should be revegetated in combination with slope interruption practices for long-term stabilization. Using live stakes to secure the bags is recommended, as they will add additional protection and stability as the plants grow in, but untreated hardwood stakes or a combination of hardwood and live stakes may be used.

Biodegradable toe protection:

Similarly to the burlap bag method described above, coir logs can be staked in place using live stakes or hardwood stakes to provide protection to the toe of the bank where erosion impacts are concentrated. The coir log should be positioned to have good soil contact with the eroding edge of the bank, pushing it underneath any areas of undercut as necessary.

Densely planting live stakes on and in front of the toe slope will also provide stability and protection. This will be most effective along areas of the bank that are above the highest astronomical tide line and are not regularly submerged in salt water. For toe protection, the OUR SHORE guide recommends placement of live stakes approximately one inch apart. This

practice can be used alone or in combination with coir log placement. Based on the species already present on the bank, red osier dogwood would likely live stake successfully at this site.

Salt marsh protection and enhancement:

Salt marsh systems provide protection to coastal banks by reducing the energy of oncoming waves before they reach the shore. The presence of patches of salt marsh vegetation in the coastal wetland at this site indicate the possibility of salt marsh protection and enhancement as a nature-based strategy at this site. This strategy can be approached through no-cost sustainable management practices, or through active marsh restoration and enhancement.

To protect existing areas of marsh vegetation, avoid storing docks and floats on top of the marsh. Best practice is to store docks away from the entire coastal wetland and bank so vegetation in these areas is not shaded or crushed. If this is not feasible, select areas of the shore that do not have salt marsh vegetation to store docks.

Expanding the area of salt marsh through active planting and restoration techniques would provide additional protection to the bank in addition to habitat and water quality benefits. While planting additional vegetation alone may be successful, similar salt marsh projects have benefitted from the placement of a log sill to adjust marsh elevation, especially under sea level rise. Sills use natural logs anchored into the sediment at the seaward edge of the desired marsh area (Fig. 11). Sediment can be added to elevate the marsh area so it receives the correct frequency of tidal inundation. Vegetation is then planted behind this sill to establish or expand the salt marsh area. The Home Place Team has installed several successful examples of this technique along the coast of Maine; more information can be found in their presentation at the 2025 OUR SHORE conference.¹

Regulatory Considerations:

Planting native vegetation within the shoreland zone may be done without a permit if less than one cubic yard of soil is overturned; this is equivalent to 25 one-gallon potted plants, or any number of live stakes. Any other management actions described in this report, including plantings disturbing more than one cubic yard of soil, will require a municipal and state permit at minimum.

At the state level, shoreline stabilization projects, including salt marsh restoration, are licensed under the Natural Resources Protection Act. Simple projects with minimal environmental impact can be permitted under the Permit by Rule pathway, which has a shorter review period.

¹ <https://youtu.be/lqGsgzsRAgw?t=8982> or <https://www.maine.gov/dep/land/ourshore/>

This would include planting projects that require a permit, as well as the biodegradable overland flow diversion and toe protection techniques described in this report.

Projects taking place below the highest astronomical tide line will require a more extensive Individual Permit from the state and review by the U.S. Army Corps of Engineers.



Figure 10: Coir logs used to divert water and repair a gully (Photo from Cambridge Water Department).



Figure 11: Example of a log sill installed for marsh restoration. (Photo from Treyball & Bernacki, 2025).

OURSHORE Quick Assessment: West Shore Beach
Elizabeth Rd, Little Diamond Island, ME

Existing Site Conditions:

Location:

West Shore Beach is a public beach approximately 500 feet in length on the southern end of Little Diamond Island, facing Fort Gorges. The area assessed in this report is a segment of West Shore Beach, towards the southeast end, of approximately 150 linear feet. The site is bounded on one end by the Elizabeth Rd right-of-way, and on the other by a ledge outcropping perpendicular to the shoreline.

Environmental Characteristics:

The shoreline of West Shore Beach transitions from a low, gradually sloping bank towards the northwest to a taller, steeper bluff on the southeast. This bluff meets with a ledge outcrop about 6 feet tall at the southeast end of the beach. Inland of the bank, the primary land use is by private residential properties, with seasonal homes and lawns.

The entire length of West Shore Beach falls within a sand dune system mapped by the Maine Geological Survey in 2026 (Fig. 4). Sand dune vegetation is present in patches of the beach but is absent or has been overtaken by invasive *Phragmites australis* reeds in other areas.

Below the high tide line, the site is included in the National Wetland Inventory (Fig. 5). The coastal wetland is also identified as moderate value Tidal Waterfowl and Wading Bird Habitat (Fig. 6).

Of note is the presence of a rare plant included in Beginning with Habitat maps of this area (Fig. 6). Exact locations and species types of rare plants are not disclosed in public maps for conservation purposes, but their presence may be considered in the Maine Department of Environmental Protection's review of permit applications.

Erosion:

Some toe erosion is present across the length of the assessed site, but the primary area of concern is the southeast end where the higher bluff meets ledge. In this area, toe erosion is more pronounced, with a significant undercut bank and signs of slumping. Erosion in this area is likely exacerbated by waves deflected from the ledge towards the bare sediments of the bluff.



Figure 1: Northwest section of West Shore Beach with a low bank.



Figure 2: Southeast section of West Shore Beach with a taller, steeper coastal bluff.



Figure 3: Southeast section of West Shore Beach where the sediment bluff meets bedrock.



Figure 4: Coastal Sand Dune Geology map of West Shore Beach. Sand dune systems are indicated in yellow and dune areas at risk of erosion in red.

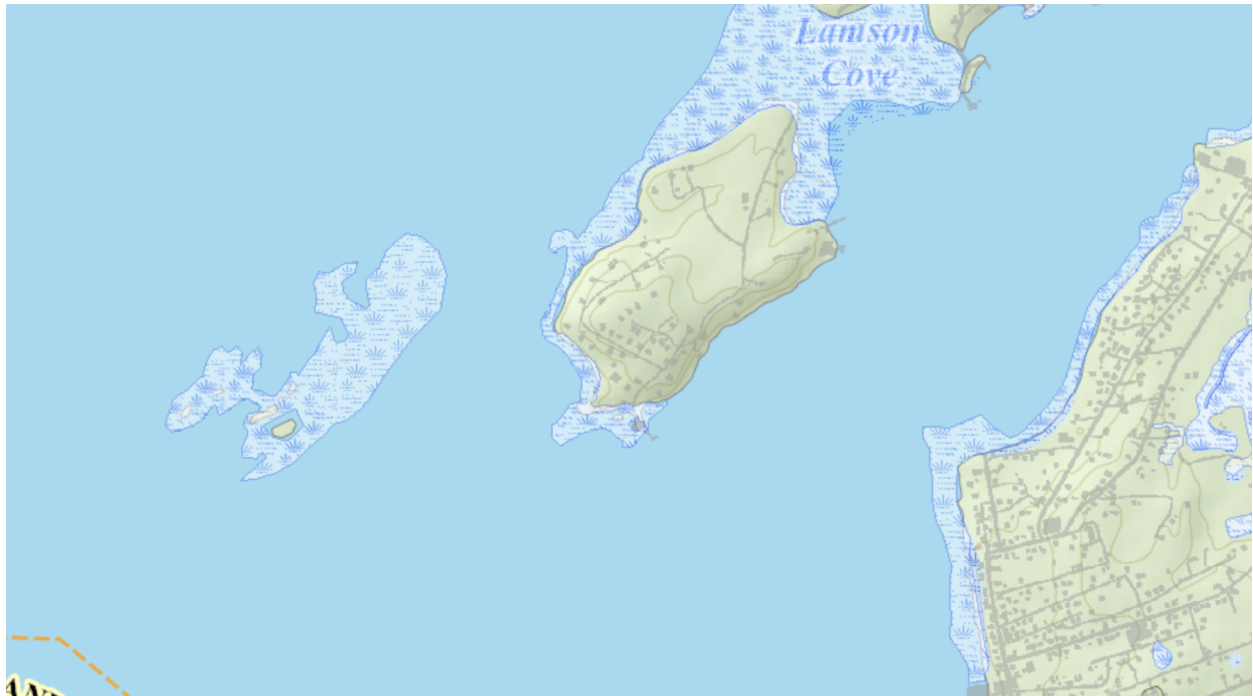


Figure 5: Beginning with Habitat map of Little Diamond Island showing National Wetland Inventory areas (white and blue pattern).

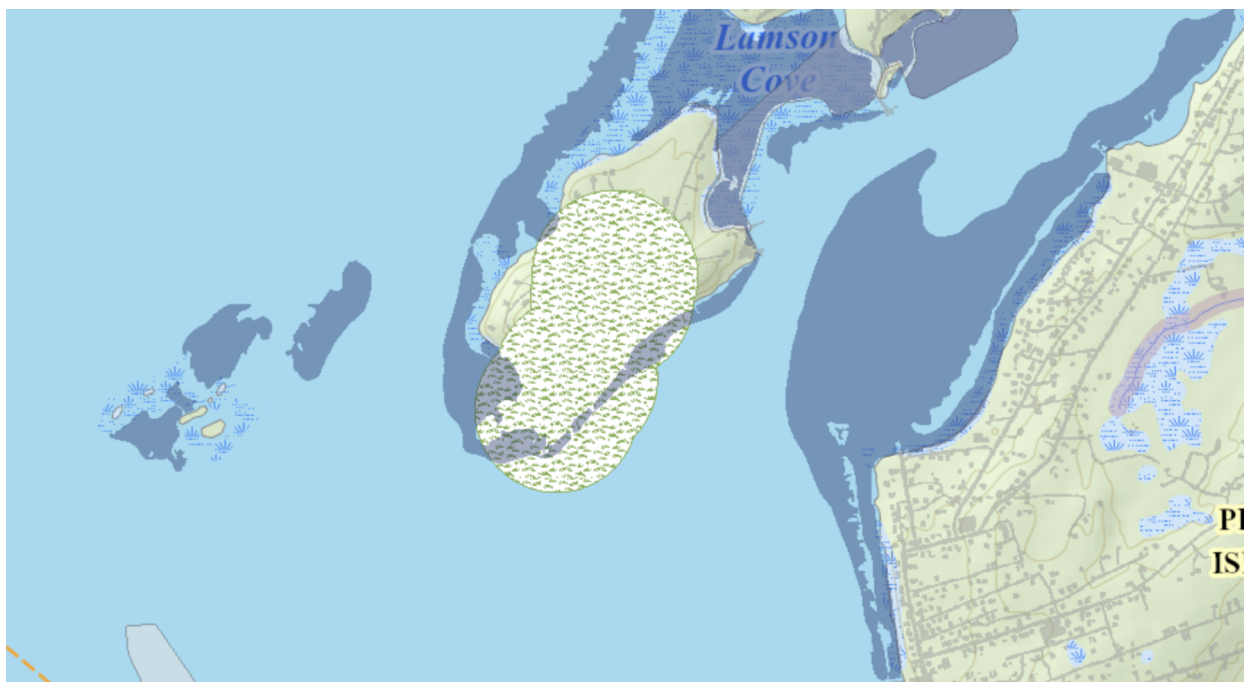


Figure 6: Beginning with Habitat map of Little Diamond Island showing Tidal Waterfowl and Wading Bird habitat (dark blue) and documented rare plant habitat (white and green pattern).

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	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	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 Flow	Moderate - Moderate Overland Impact from surface water

Revegetate/Reconnect Shoreline Buffer:

Vegetation Within 250 Feet	Sparse vegetation (less than 20%)
Vegetation Within 25 Feet	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:

Increased buffer vegetation:

Riparian buffers are an important component of all shoreline stabilization projects. Buffer vegetation helps to reduce groundwater saturation and slow the flow of surface runoff, which increases bank stability. The root systems of buffer plants also help to hold soil in place on the bank. A buffer of at least 10-15 feet of densely planted native vegetation is recommended for improving shoreline stability. The buffer should include a mix of native plants including woody shrubs or small trees and groundcover plants like grasses, ferns, and flowers.

Vegetated buffers can be expanded or created over time using various methods. In areas adjacent to existing native plants, the buffer can be expanded passively by leaving the area unmowed and allowing vegetation to spread over time. In larger bare or grassy areas, seeds, live stakes, or purchased container plants are all suitable methods of revegetating.

Especially in lower areas of the bank with shallow slopes, establishing a functional vegetated buffer may be sufficient to stop problem erosion without any further intervention. In steeper areas, some amount of toe erosion and slumping will likely continue since the current bluff face does not have vegetation to stabilize it. However, when combined with resilient plants that can re-root after disturbance, this cycle of bluff erosion and slumping can create a naturally stable vegetated bank over time (see “Bluff Erosion Cycle” in Key Terms). Given that there are no structures immediately adjacent to the shoreline, a cost-effective management option that could be considered at the site is establishing a vegetated buffer of resilient plants, combined with adaptive management including replanting deposits of sediment at the toe as necessary when slumping occurs. Recommended resilient plants for shoreline environments can be found in the Cumberland County Soil and Water Conservation District’s Coastal Planting Guide.

Slope regrading:

Steep slopes, such as the bluff section at the West Shore Beach site, can be regraded to a more gradual slope as part of a stabilization design. This provides a better surface for plants to establish, and reduces weight on the toe of the slope that may otherwise lead to slumping. Slopes are generally regraded to a 45° angle (1H:1V) or shallower.

Because regrading will expose large areas of bare soil during construction, it is important to install temporary erosion control, like a natural fiber blanket, to protect the slope. Long-term protection and stability in slope regrading is provided by dense, mature vegetation. When the slope is regraded, native vegetation should be planted as live stakes, potted plants, or seeds. Plants and erosion control blankets require monitoring and maintenance in the first few years to ensure that the slope is adequately protected and good vegetation cover is achieved.

Stabilizing the ledge transition zone:

The shoreline erosion is most severe where the unconsolidated soil bluff abuts ledge. Because wave energy deflected from this naturally occurring hard structure is exacerbating erosion here, a more structural intervention may be necessary. Bioengineering techniques combining plants with natural structural components like coir logs or wood beams can provide stability and protection in targeted areas and are easily blended with natural shorelines in areas with less erosion.

Bioengineering options for this section of shoreline include encapsulated soil lifts or a living crib wall. Natural fiber blankets and coir logs can be used to establish and protect the toe of a series of terraces called soil lifts (Fig. 7). Vegetation is then planted in the flat areas of each terrace for long term stability. For coastal areas, a double layer of fiber blankets around each soil lift is recommended to prevent damage if debris hits the lifts during a storm. Encapsulated soil lifts, also called engineered bank cores, are considered suitable for high energy coastal environments.

A living crib wall utilizes a similar series of terraces with the vertical surfaces protected by wooden beams (Figs. 8-9). In a crib wall design, however, the structure is supported and anchored by a series of wooden frames that extend horizontally into the bank. Each of these designs should be tapered in height and keyed into the bank where the structure transitions to natural shoreline to prevent end effect erosion.

A vegetated riprap stone toe could also be considered in the most severely eroded section. Planting within the riprap with live stakes or container plants is important to increase the structure's durability in storm conditions, and to attenuate wave energy so it is not deflected to neighboring sections of shoreline. If riprap is used, OUR SHORE principles recommend minimizing this intervention to the most impacted section of shoreline, and using nature-based stabilization on the remainder of the bank.

Sand Dune Restoration:

Maine Geological Survey maps identify West Shore Beach as a sand dune system. While some sand dune vegetation is present, it does not extend across the entire shoreline. However, environmental conditions at the site are likely conducive to dune restoration. Restoring dune grasses to the beach can mitigate erosion by reducing wave energy hitting the bank. Over time, dune vegetation traps wind-blown sand and builds up taller mounded deposits which provide additional protection from waves.

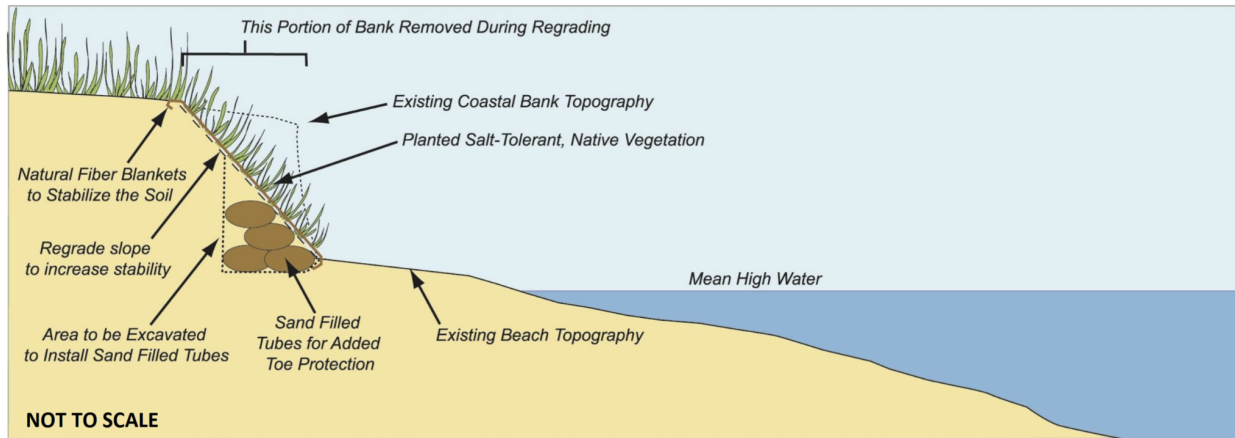
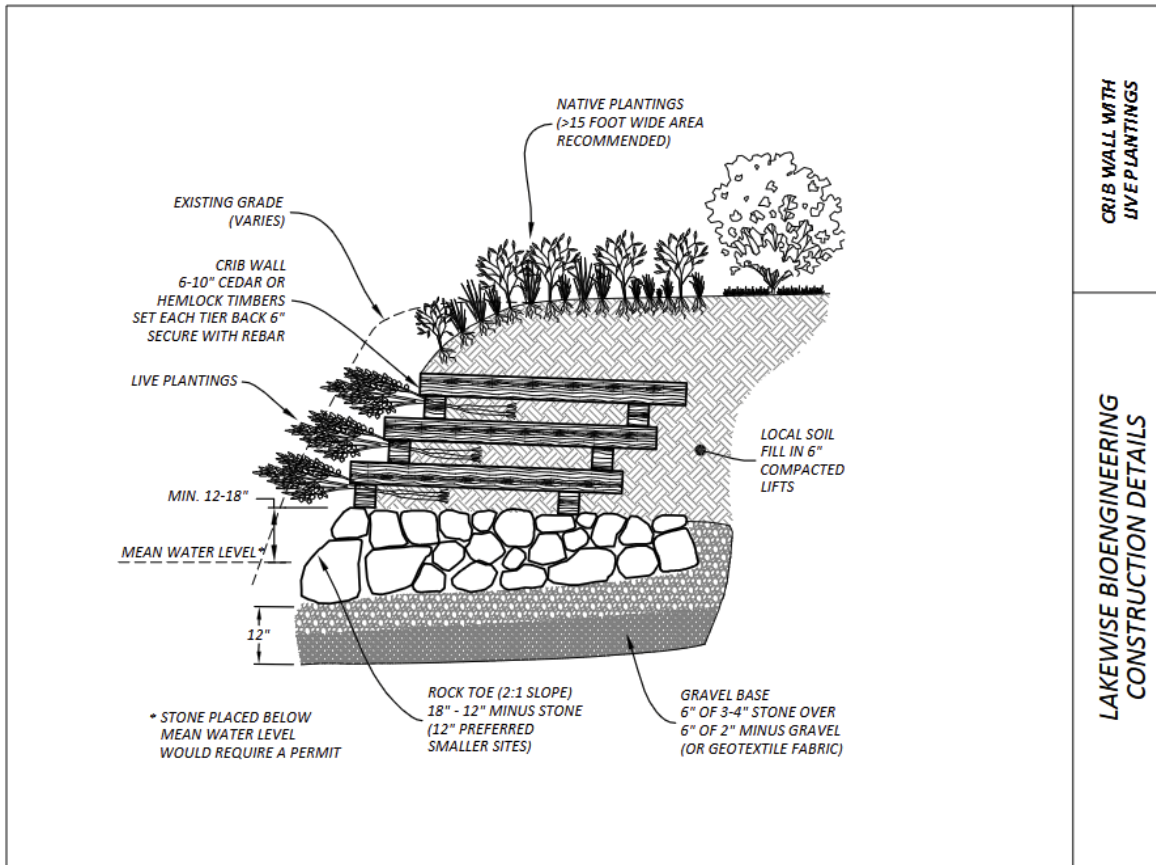


Figure 7: Example cross-sectional plan of a bank with an engineered core of soil lifts from *Living Shorelines in New England: State of the Practice*.



Figure 8: Example of a living crib wall from the Vermont Bioengineering Manual.



Plan design: Watershed Consulting Associates, LLC.

Figure 9: Example cross-sectional plan of a living crib wall from the Vermont Bioengineering Manual.

OURSHORE Quick Assessment: Private Property
Little Diamond Island, ME

Existing Site Conditions:

Location:

This report describes a private residential property located on the south end of Little Diamond Island, near the Casino and ferry dock. The property includes approximately 140 ft of shoreline frontage. On the lot is a seasonal cottage located about 30 ft from the highest astronomical tide line.

Environmental Characteristics:

The shoreline environment of the site is a gravel and stone beach which meets ledge at the western end of the property. Large stones and debris have been placed on the upper beach, likely in a past shoreline stabilization effort. Above the high tide line is a moderate bank up to 3 ft in height. Exposed soil on the face of the bank shows two distinct soil layers, a surface layer of coarser sediment and organic matter, and a deeper layer of finer clay. Vegetation on the property is primarily lawn grass, with a row of Rugosa roses at the edge of the bank and some patches of invasive Japanese knotweed.

The intertidal zone in front of the site is designated as a wetland in the National Wetland Inventory (Fig. 5). The wetland area is considered moderate value Tidal Waterfowl and Wading Bird Habitat (Fig. 6). Rare plant habitat is also mapped in the area. Exact locations and species of rare plants are not disclosed in state habitat maps, but this information may be used to inform state permit applications (Fig. 6).

Erosion:

The property owners have noticed erosion of the bank, especially during the winter storms in 2024. The edge of the bank has retreated several feet inland towards the porch of the cottage. Rocks which were previously positioned against the edge of the bank have also been shifted away from the bank and down the beach by wave action in storms.



Figure 1: Photograph of the easternmost section of the shoreline at the site.



Figure 2: Photograph of the central section of the shoreline at the site.



Figure 3: Photograph of the westernmost section of the shoreline at the site.



Figure 4: Photograph showing the two distinct soil layers of the coastal bank at the site. Small eroded channels called rills are visible in the bottom clay layer where groundwater is exiting the bank and running downslope.

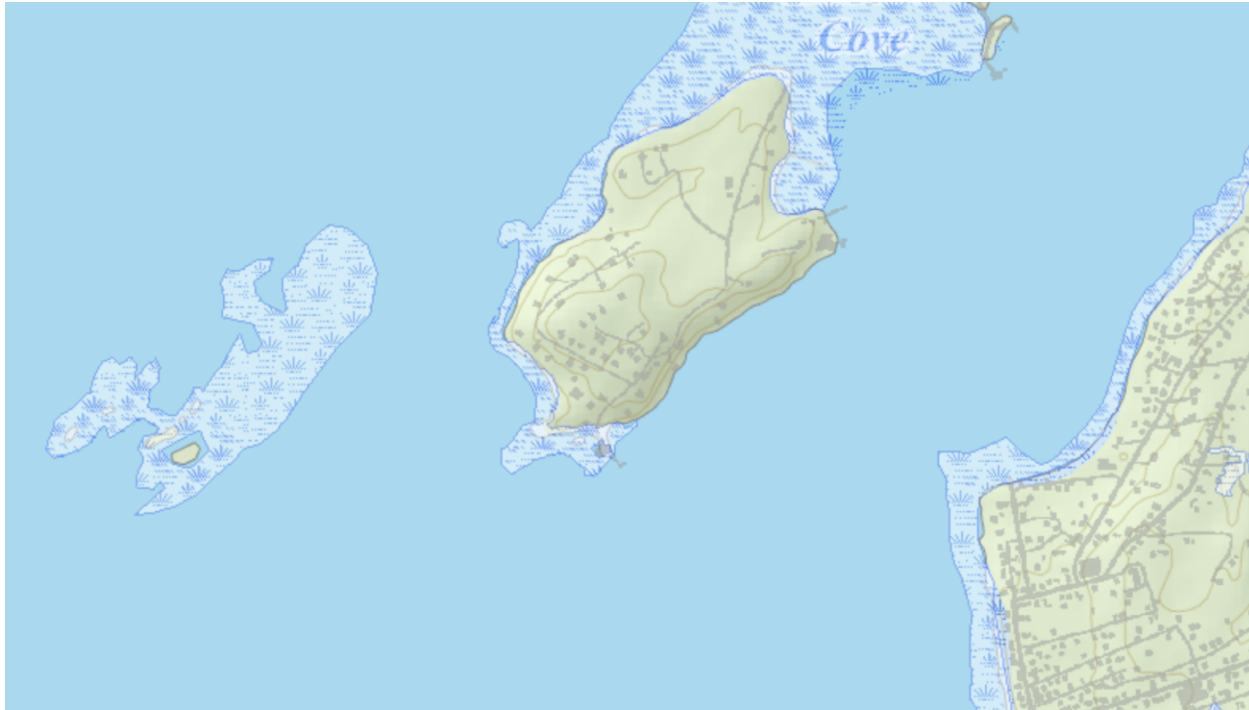


Figure 5: Beginning with Habitat map showing National Wetland Inventory areas (blue and white pattern).

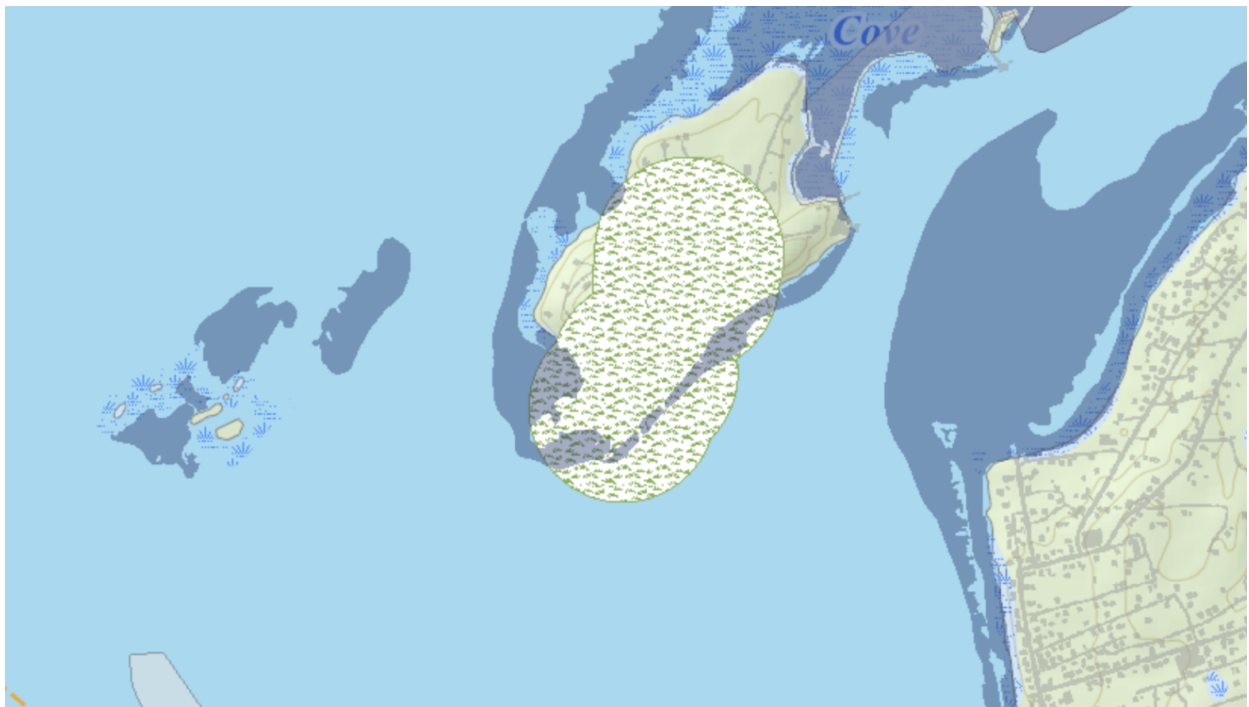


Figure 6: Beginning with Habitat map showing Tidal Waterfowl and Wading Bird (dark blue) and rare plant (green and white pattern) habitat areas.

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	Moderate Bank (3-6 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 Flow	Moderate - Moderate Overland Impact from surface water

Revegetate/Reconnect Shoreline Buffer:

Vegetation Within 250 Feet	Sparse vegetation (less than 20%)
Vegetation Within 25 Feet	Sparse vegetation (less than 20%)
How Natural is the Shoreline Habitat	Moderate - Bank impaired by riprap/hardened structures, but vegetation is present OR is pruned, mowed, or otherwise altered

Proposed Management Actions:

Riprap Revetment with OUR SHORE Considerations:

A structural approach to shoreline stabilization such as a riprap revetment is recommended at this site given the cottage's location near the eroding bank edge. When riprap or other hardened structures are necessary, the OUR SHORE program recommends several design considerations to increase the structure's resilience to storms and minimize negative impacts to neighboring properties and shoreline habitat.

Riprap revetments should include a filter layer beneath the stone which allows groundwater to drain while holding fine soil particles in place. Traditionally, plastic geotextile fabrics have been used as this filter layer, but these fabrics prevent plants from rooting into the underlying soil. Research shows that vegetated riprap is more resistant to displacement by waves than unvegetated riprap because the root systems provide connectivity between the stones and soil. Substituting plastic geotextiles for an alternative filter layer like a natural fiber blanket or gravel and small stones allows for successful revegetation, creating a more durable design.

While riprap without a plastic filter layer will slowly revegetate over time, OUR SHORE recommends adding plantings to the riprap design during installation to speed up the revegetation process. Planting "pockets" can be intentionally left between stones to add mature container plants, or growing media and seeds can be spread across the riprap after installation. Live stakes, branch cuttings of quickly-rooting shrubs and trees, can also be planted through gaps in the stones during or after installation. Resources like the Cumberland County Soil and Water Conservation District's coastal planting guide can help you identify salt-tolerant plants that will successfully grow on the shoreline.

Groundwater Management:

Groundwater seeps were visible on the bank during the site visit. This is common when a subsurface clay layer is present in the soil, since groundwater infiltrates very slowly into the clay, causing pooling and horizontal movement above this layer of the soil. A saturated bank is more vulnerable to slumping and erosion by waves. When groundwater seeps are present, integrating an appropriate filter layer into riprap designs is critical.

Excess groundwater saturation can also be managed through land use decisions. Large, deep rooted plants are able to take up more water from the soil than turf grass, leading to decreased soil saturation and improved bank stability. Replacing as much lawn area as possible near the bank with densely vegetated buffers will enhance the stabilization provided by riprap. A buffer of 10-15 ft in width at minimum across the entire shoreline is recommended for shoreline stabilization benefits.

This recommendation is applicable to nearby sites as well. The adjacent property to the west, a Little Diamond Island Association property used for annual bocce events, was discussed during the site visit as a potential location for enhancement of a vegetated buffer. Increased buffer vegetation on this parcel would help mitigate groundwater saturation along the shoreline of the property as well as adjacent properties to either side. This could be accomplished in a cost-effective manner by designating areas of the property to stop mowing, allowing native vegetation to grow into these areas over time.

Structural Relocation:

With the cottage's proximity to the shoreline and highest astronomical tide line, relocation of the cottage further inland and away from the hazards of both erosion and coastal flooding was discussed at the site visit. Parcel size and road setback restrictions limit the feasibility of relocation at this site, but sites with similar characteristics may consider relocation of structures out of harm's way as a long-term management strategy.

Regulatory Considerations:

Any riprap structure placed along a shoreline will require a municipal and state permit. When riprap is being installed to protect a structure near the shoreline, such as the cottage at this site, a simplified state permitting process called a Permit by Rule can sometimes be used. To qualify for a Permit by Rule, projects must follow design criteria to minimize the structure's environmental impacts, such as installing a vegetated buffer along the upland edge of riprap and planting native vegetation within gaps in the riprap. A Permit by Rule may be used for up to 125 linear feet of shoreline stabilization on a coastal wetland, so eligibility of a riprap stabilization project at the site would depend on exact placement of the design.

Vegetation for the purpose of establishing a buffer can be planted in the shoreland zone without a permit if less than one cubic yard of soil is overturned. This is considered equivalent to planting 25 one-gallon container plants. Planting methods like seeding or live staking which do not contribute to soil disturbance may be done without restriction.

References

- Bryant, M., Barnhardt, W. A., Dickson, S. M., Kelley, J. T., & Slovinsky, P. A. (2020). *Coastal bluffs in the Portland East quadrangle, Maine*. Maine Geological Survey, Open-File Map 20-15, map, scale 1:24,000. https://digitalmaine.com/mgs_maps/2129
- CBIOOnlineVideo. (2025, December 3). *Our SHORE Roundtable* [Video]. Youtube. <https://youtu.be/lqGsgzsRAgw?t=8990>
- Fisher, J. M., & Yakovleff, D. (2017). *Coastal Planting Guide: Planting for Stabilization on Maine's Coastal Bluffs*. Cumberland County Soil and Water Conservation District. <https://www.northeastoceancouncil.org/wp-content/uploads/2019/04/Attachment-E2-Maine-Coastal-Planting-Guide-November-2017-For-Booklet-Printing-Release-Version-1.1.pdf>
- Maine Climate Council. (2020). *Maine Won't Wait: A Four-Year Plan for Climate Action*. https://www.maine.gov/future/sites/maine.gov.future/files/inline-files/MaineWontWait_December2020.pdf
- Maine Department of Inland Fisheries and Wildlife. (n.d.). *Beginning with Habitat Map Viewer*. <https://webapps2.cgis-solutions.com/beginningwithhabitat/mapviewer/>. Accessed January 8, 2026.
- Maine Geological Survey. (2023). *Living Shorelines Decision Support Tool*. <https://experience.arcgis.com/experience/b6c1ce1407254bd0af0758057c8b562c/>. Accessed January 8, 2026.
- Maine Geological Survey. (2025). *Maine Highest Astronomical Tide Line*. <https://experience.arcgis.com/experience/034f72b66c4b4ecc9c944f69165659ea/>. Accessed January 8, 2026.
- New Hampshire Department of Environmental Services Coastal Program. (2020). *Planting Guide for Tidal Shoreline Erosion Management in New Hampshire*. <https://www.des.nh.gov/sites/g/files/ehbemt341/files/documents/tidal-erosion-planting-guide.pdf>
- Oceanside Conservation Trust of Casco Bay. (2020). *Our lands*. <https://oceansideconservationtrust.org/our-lands/>
- Oceanside Conservation Trust of Casco Bay. (2024). *Bishop Healy Woods* [Map]. https://www.dropbox.com/scl/fo/bpvhm9pr6lv7kyqrbo6h/AFdFRTnwyqaohP6UBSonglw/LittleDiamond?preview=OCT_BishopHealy_20240924.jpg&rlkey=4nspb6eis2mgbxvn8r2lubcv0&subfolder_nav_tracking=1&st=y9ujl212&dl=0
- Slovinsky, P. A., & Dickson, S. M. (2026). *Coastal sand dune geology: West Shore Sandy Beach, Portland, Maine*. Maine Geological Survey, Open-File Map 26-173, aerial photo, scale 1:4,800. *Maine Geological Survey Maps*. 3508. https://digitalmaine.com/mgs_maps/3058

- Slovinsky, P. (2025, November 20). *Assessing Impacts to Coastal Bluffs: The Geological Perspective* [Conference presentation]. Shoreline Stabilization Practitioner Roundtable and Q&A (Applying Nature-Based Solutions (NBS) to Shoreline Erosion), Orono, ME, United States.
https://www.maine.gov/dep/ftp/climate/OURSHORE/MDEP_OUR_SHORE_NBS_Shoreline_2025_Peter_Slovinsky_Assessing_Impacts_to_Coastal%20Bluffs.pdf
- Treyball, R., & Bernacki, P. (2025, November 20). *Living shoreline stabilization: Marshes to buffer zones* [Conference presentation]. Shoreline Stabilization Practitioner Roundtable and Q&A (Applying Nature-Based Solutions (NBS) to Shoreline Erosion), Orono, ME, United States.
https://www.maine.gov/dep/ftp/climate/OURSHORE/archive/MDEP_OUR_SHORE_NBS_Shoreline_2025_Bernacki.pdf
- Vermont Agency of Natural Resources. (2022). *Vermont bioengineering manual: A technical manual for lakeshore contractors and homeowners*.
https://dec.vermont.gov/sites/dec/files/documents/BioEngineeringManual_Final.pdf
- Virginia Department of Transportation. (n.d.). *Vegetated riprap*.
http://www.extranet.vdot.state.va.us/locdes/hydraulic_design/nchrp_rpt544/content/html/Veg_RipRap/Veg_RipRap.html
- Woods Hole Group, Inc. (2017). *Living shorelines in New England: State of the practice*. Conservation Gateway, The Nature Conservancy.
<https://www.conservationgateway.org/collections/land/living-shorelines-new-england-state-of-the-practice/>