# DRAFT
# WETLANDS GUIDELINES

Promulgated by the
Virginia Marine Resources Commission

Prepared by the
Habitat Management Division

with
contributions from the
Virginia Institute of Marine Science

Developed Pursuant to Chapter 13 Title 28.2, Code of Virginia

March 2021 Update

# Section I

## Introduction

The purpose of this document is to revise the existing Wetlands Guidelines to provide "minimum standards for the protection and conservation of wetlands" and to "communicate to stakeholders and regulatory authorities that it is the policy of the Commonwealth to support living shorelines as the preferred alternative" for shoreline stabilization as directed in §28.2-104.1 of the Code of Virginia. This document will aid citizens and local decision makers in making on-site jurisdictional determinations, explain the risks and benefits provided by various shoreline treatments, and identify preferred shoreline management options.

Importantly, implementation of the guidelines must be coordinated with the implementation of new Department of Environmental Quality regulations required for the consideration of climate change and sea level rise under amendments to the Chesapeake Bay Preservation Act adopted by the General Assembly in 2020. Further, implementation of the guidelines must be consistent with the Virginia Coastal Master Plan and Planning Framework authorized by Executive Order 24 (November 2018), including by using the National Oceanic and Atmospheric Administration 2017 Intermediate-High sea level rise projection (or, in the future, any updated projection based on the best available science and selected through the Coastal Master Plan process) in evaluation of all permit applications.

The Local Wetlands Boards have served the Commonwealth well since they were established in 1972 with the passage of the Wetlands Act. The public hearing process provided by the Wetlands Ordinance allows each applicant the opportunity to present their facts to the board for consideration and for the board to evaluate any public comment. These are essential elements of any permit decision along with the requirements of the ordinance, as well as the guidelines and standards that are provided in the following document. These guidelines are a key tool in performing this citizen-based administration of the program, which aims to effectively balance wetlands preservation with protection and use of private property.

Originally adopted in 1974, the Wetlands Guidelines were formally amended to include nonvegetated wetlands in 1982. The Wetlands Mitigation-Compensation Policy was added to the Guidelines when they were reprinted in 1993, following their adoption in 1989. The last amendment to Virginia's tidal wetlands guidance was an update to the Mitigation-Compensation Policy in 2005. Through this policy, the Commission encourages the compensation of all permitted tidal wetland losses provided all mitigative measures have been considered to avoid any impact. The need to compensate for all permitted wetland losses is emphasized by the Commonwealth's commitment to the restoration of the Chesapeake Bay. In 2000, Virginia, as a Chesapeake Bay Program partner, committed to "achieve a no-net loss of existing wetlands acreage and function in the signatories regulatory programs."

In addition to tidal wetlands, Virginia's coastal zone is composed of many different but highly interrelated ecological systems. These include the Commonwealth's State-owned submerged lands, which are vitally important as fish and shellfish feeding, spawning and nursery habitat, non-tidal wetlands and the adjacent riparian buffer. The latter two provide key roles in the filtering of stormwater runoff, nutrient uptake and maintenance of water quality in the Chesapeake Bay. Tidal wetlands equally provide critical habitat in support of the Commonwealth's recreational and commercial fisheries and vital ecological services required for a healthy Chesapeake Bay. Preservation of existing tidal wetlands and management strategies necessary to ensure their continued existence, therefore, is paramount given the daily stressors associated with the use or development of wetlands coupled with the added risks associated with sea level rise and climate change.

The need to incorporate additional standards, necessary for the protection and coastal resilience of Virginia's tidal wetland acreages, was addressed by the General Assembly with the passage of living shorelines legislation in 2011 and 2020. Senate Bill 964 (2011) and the resulting legislation established living shorelines as the preferred alternative for stabilizing tidal shorelines in the Commonwealth. More recently, Senate Bill 776 and the resulting 2020 legislation requires the Virginia Marine Resources Commission to promulgate and periodically update minimum standards within the Guidelines for the protection and conservation of wetlands and to approve only living shoreline approaches to shoreline stabilization, unless the best available science shows that such approaches are not suitable.

The resulting 2021 revision of the Wetlands Guidelines, therefore, incorporates scientific principles emerging since the 1993 revision. Policy and management developments over this time that are, in large part, based on those advances in tidal wetlands science are thus integrated into this document. Although management progressed generally in parallel with estuarine and wetlands science over the previous half century, the policy stated by the legislature when it passed the vegetated wetlands act in 1972 remains as relevant a guiding statement today as it was then:

> *"Therefore, in order to protect the public interest, promote the public health, safety and the economic and general welfare of the Commonwealth, and to protect public and private property, wildlife, marine fisheries and the natural environment, it is declared to be the public policy of this Commonwealth to preserve the wetlands, and to prevent their despoliation and destruction and to accommodate necessary economic development in a manner consistent with wetlands preservation."*

# Section II

## Wetland Types and Properties

In the pages that follow, wetlands are re-described by type as required in the Virginia Code. The original Wetlands Guidelines recognized twelve types of vegetated wetlands (marshes) and five types of nonvegetated wetlands (tidal flats and beaches). The revised Guidelines now recognize two tidal wetland types, nonvegetated and vegetated wetlands:

### *Nonvegetated Wetlands*

Between the mean high tide line and the mean low tide line are found the non-vegetated intertidal flats and beaches. These areas, though uncovered and seemingly devoid of life during a portion of each tidal cycle, provide important habitat for a host of different marine organisms, aquatic birds and certain mammals. They also contribute to marine primary productivity and the attenuation of wave energy.

***Vegetated Wetlands***

Vegetated tidal wetlands (i.e. marshes) exist at, and upslope of mean sea level. Marshes provide the valuable ecological functions of high plant primary productivity and detritus availability; direct habitat, nursery, and refugia for aquatic fauna; water quality enhancement; and erosion control. In Virginia, tidal wetlands jurisdiction extends from mean low tide to mean high tide where no emergent vegetation exists, and from mean low tide to 1.5 times the mean tide range where marsh is present.

These newly recognized wetland types incorporate state-of-the-science understanding of wetland communities as they subsist based on tidal hydrology and their ability to provide ecological and resilience functions within the shorescape. Science has shown the multifaceted importance of tidal wetlands, regardless of landscape position, to natural ecosystems and mankind. Although distinct wetland communities exhibit varied levels of select functions, tidal wetlands show inherent consistency in their contributions to estuarine and riparian ecological health. Vegetated and non-vegetated wetlands are known to work collaboratively to provide the full suite of ecosystem functions necessary to sustain habitat, primary production, water quality, and coastal resilience. Wetlands types, therefore, should not be viewed as a method of grading importance, but only as functional categories.

The importance of understanding each tidal wetland type as worthy of equal protection to maintain comprehensive functional integrity is an accepted scientific principle. Nonvegetated and vegetated wetlands serve as a buffer between the estuary and the upland; interacting with both. Therefore, all tidal wetlands should be viewed as and managed holistically within the subaqueous to riparian buffer continuum.

# Section III

**Criteria for Determining Wetlands Jurisdiction and Evaluating Alterations of Wetlands**

This section addresses the methods for determining tidal wetlands jurisdiction, followed with a description of activities that can adversely affect tidal wetland functions. General and specific criteria that can assist in evaluating these activities against tidal wetland alterations are included.

As previously stated, wetlands managers are charged by Code with the preservation of tidal wetlands, while accommodating necessary economic development in a manner consistent with wetlands preservation. This coupled with the new legislative mandate to permit only living shoreline approaches to shoreline management, unless such approaches are deemed not suitable, complicates the process of providing definitive guidance in a single document for every shoreline treatment scenario likely to arise in Tidewater Virginia. When needed, jurisdictional-specific and project-specific assistance is available at request from the Virginia Marine Resources Commission's Habitat Management Division and the Virginia Institute of Marine Science's Office of Research and Advisory Services. Localities may also additionally utilize the Department of Conservation and Recreation's Shoreline Erosion and Advisory Service (SEAS) site-specific advice, if provided, and rely on the additional online tools and research provided by the VIMS Shoreline Studies Program and the Center for Coastal Resource Management (CCRM). **The totality of the aforementioned programs' research, written advice, and online tools shall constitute the best available science, on a case-by-case basis, when either the Commission or the local wetland board is attempting to determine the suitability of a living shoreline design or treatment. Additionally, all newly emerging wetlands science shall contribute to the Commission's or local wetlands boards' consideration of best available science.**

## Determining Wetlands Jurisdiction

Determining accurate tidal wetland jurisdictional boundaries is critical for fair and proper management, and must be clearly delineated and understood prior to evaluating the proposed use and development of tidal wetlands. Jurisdictions are defined in §28.2-1302 of the Virginia Code. Jurisdictional nonvegetated wetlands must be contiguous to mean low water and are located between mean low water and mean high water. Vegetated wetlands also must be contiguous to mean low water, support one or more of the plant species named in §28.2-1302, and extend "from mean low water to an elevation equal to the factor one and one-half times the mean tide range at the site of the proposed project." Jurisdictional vegetated wetlands include those that are regularly flooded and some or all of those that are irregularly flooded as described in § 28.2-1302 of the Code of Virginia. Jurisdictional boundaries can be determined by conducting onsite elevation surveys with reference to the predicted normal low and high tide lines, can be estimated using natural shoreline features and indicators, can be accurately estimated for vegetated wetlands using (if present) the saltbush community location, can be established by state regulatory and academic personnel, but often is provided by the applicant/agent using the methods just described. Regardless of method, it is highly recommended that all involved parties agree on jurisdictional boundaries prior to application development and/or processing.

## General Criteria

The reader is reminded that many proposed uses of the shoreline can be accommodated <u>with little or no loss of wetlands</u> if the following criteria are applied. The conscientious application of these criteria will materially reduce adverse environmental impacts of anthropogenic activities on the shoreline.

A. Provided marine fisheries, wetlands and wildlife resources, flood protection, and water quality are not detrimentally affected nor does a proposed use contribute to cumulative, net losses of tidal wetlands, alteration of the shoreline or construction of shoreline facilities may be justified in order to:

1. Gain access to navigable waters by:

    a. Commercial, industrial, and recreational interests for which it has been clearly justified that waterfront facilities are required and the interest is water dependent;

    b. Owners of land adjacent to waters of navigable depth or waters which can be made navigable with only minimal adverse impact on the environment.

2. Protect property from significant damage or loss due to erosion or other natural causes.

B. Alteration of the shoreline is **not** justified:

1. For purposes or activities that are non-water dependent;

2. For purposes of creating waterfront property from lands not naturally contiguous to tidal waters or for purposes of accessing waterfront property by the placement of fill material not justified by A.1 above.

3. When damage to properties owned by others is a likely result of the proposed activity.

4. When the alteration will result in the drainage or discharge of effluents or stormwater which impair wetlands, water quality or other marine resources.

5. When there are alternatives which can achieve the given purpose without adversely affecting water quality, marine fisheries, wildlife, marshes, oyster grounds or other natural resources.

**Rationale:** These criteria recognize riparian rights and reserve the shoreline for those uses or activities which require water access. These criteria also point out that activities such as dredging into the fastlands for housing developments often have a significant and long term adverse impact on the marine environment through such effects as changed upland hydrology, sedimentation, changes in water current patterns near the shoreline, and the introduction of pollutant discharges which frequently lead to closure of shellfish grounds. The dredging of channels into fastlands may also lead to deterioration of ground water by salt water intrusion into aquifers.

**C.** Utilization of open-pile type structures for gaining access to adequate water depths is required unless the construction of solid structure, dredging or filling is shown to be necessary.

**Rationale:** The construction of solid structures, or the conduct of dredging and filling operations, often causes irretrievable loss of wetlands through their direct displacement or by indirect effects of sedimentation or altered water currents. Open-pile type structures permit continued tidal flow over existing wetlands and subtidal areas, avoid potential sedimentation problems, future maintenance dredging, and have less effect on existing water current patterns.

**D.** Shoreline alterations should be designed and constructed to resist coastal storm-level hydrological energy that may reasonably be expected at the project site.

**Rationale:** High intensity storms of marine origin are frequent in the mid-Atlantic region and Chesapeake Bay. Shoreline alterations that are generally proposed to address coastal resiliency and control active erosion should ensure that the stabilizing objectives address the most erosive conditions predictable to the project site. This will reduce the likelihood of future adverse environmental impacts from storm events associated with structural failure, reduce maintenance and repair costs, and decrease or eliminate added shoreline disturbances.

**E.** Living shorelines should be considered the first alternative as an approach to address shoreline stabilization and tidal wetlands sustainability in response to sea level rise.

**Rationale:** It is critical to maintain tidal wetland resources and thus their important functions as sea level rises. Properly designed and constructed living shorelines provide a platform for future landward migration.

**Specific Criteria**

The following specific criteria are established for use in the design, evaluation or modification of individual projects. Specific strategies should attempt to incorporate environmental protection and resiliency as elements of the landowner's desired project objectives.

**A. Shoreline Protection Strategies**

1. Living shoreline considerations. Numerous hydrological and geological factors, and shoreline energy potential need to be assessed when evaluating and determining if the shoreline situation is conducive to supporting a living shoreline approach. If considered to be an effective shoreline stabilizing method, the proper dimensions and design require thorough planning to address site-specific conditions that include bank height and condition, upland structure proximity and vulnerability, offshore water depth and sediment consistency, presence and proximity of submerged aquatic vegetation, potential maximum storm wave conditions, conditions of adjacent shorelines, and sunlight availability. Please see *Living Shoreline Design Guidelines for Shore Protection in Virginia's Estuarine Environments.*

**Rationale:** When properly chosen as a viable stabilization strategy, located, designed, and constructed, living shorelines can address shoreline stabilization objectives while providing an opportunity for resource sustainability. Not only should there be considerations specifically for tidal wetlands vegetation, submerged aquatic vegetation and riparian communities (which need room to migrate with rising sea levels) also play important roles in estuarine water quality, habitat, and wave attenuation and thus require integration with living shoreline strategies.

2. The placement of offshore breakwater or submerged, nearshore sills parallel to a portion of shoreline, that elevate the height of an existing beach and retain the sand

nourishment or create a protected living shoreline between the structures and the shoreline, is a reasonable strategy consideration in higher hydrological energy shoreline situations. Both breakwaters and sills must be specifically designed for the shoreline segment in question.

**Rationale:** Properly located, designed, and constructed breakwaters and sills are effective at attenuating wave energy and supports the sustainability of the landward beach or living shoreline. Depending on the dimensions of the beach and living shoreline, they can also function to dampen storm waves.

3. Shoreline protection structures are justified only if there is active, detrimental shoreline erosion which cannot be otherwise controlled by use of a living shoreline or if there is a need to retain sand nourishment or support natural beach accretion. If hardening the shoreline, or a portion of the shoreline, is deemed necessary then incorporation of living shoreline elements into the project design should be done where possible and functional.

**Rationale:** A structural approach to shoreline stabilization may be necessary in response to hydrological and geological shoreline factors, and/or to sufficiently address erosion control. However, hardened shorelines typically result in direct and/or indirect adverse impacts to tidal wetlands and adjacent subaqueous bottomlands. They also create barriers to tidal wetland migration with sea level rise. The Commonwealth discourages the unnecessary use of riprap and bulkheading and views shoreline hardening as an alternative only when absolutely necessary. Shoreline modification to address upland and landscape issues other than stormwater runoff is highly discouraged.

4. Rock revetments are the preferred alternative if a living shoreline would not achieve the project objectives.

**Rationale:** Vertical retaining structures tend to reflect wave energy that negatively impacts adjacent wetland and/or subaqueous natural resources. They can also create negative effects upon neighboring properties. Waves, whether from natural causes or from boat wakes, are better absorbed or dissipated by riprap revetments. In addition, the slope and open spaces in riprap structures provides suitable, but not optimal, habitat for crabs and small fish.

5. If an erosion control structure, such as a bulkhead or seawall, is deemed necessary over all alternative approaches, it should ordinarily be placed as far landward as possible. Placing the structure landward of tidal wetlands jurisdiction should be seriously considered.

**Rationale:** Landward placement reduces or eliminates direct impacts to tidal resources, but can promote secondary impacts from reflected wave energy and riparian hydrological exchange. Vertical structures also eliminate the ability of tidal wetlands to migrate landward in response to sea level rise.

6. The placement of a groin or series of groins on eroding shorelines in an effort to trap sand and build up a beach is justified primarily when there is sufficient sand in the littoral

drift system, but in certain shoreline circumstances sand can be artificially placed. Groins may also be a preferred option if properly functioning groins already exist in the section of shoreline in question. When groins are considered justified they should be low profile in design and only as long as is necessary to trap sand drifting in the littoral zone. Ideal groin length can be determined by examining the sand fillets in existing groins along the same shoreline reach or can be based on the width of the local beach.

**Rationale:** Groins are designed to trap sand and build beaches. When groins and groin fields function properly, they can provide a functional level of erosion control but can also deprive downdrift shorelines of sand and thus may accelerate erosion to adjacent properties. This is highly dependent on the amount of sand available in the system. The low-profile groin is designed to resemble the natural beach slope and allow sand to by-pass and thus nourish downstream properties once the groin has filled. Groins which are too long for the existing beach may shunt sand out to deeper water thus making it unavailable to downdrift properties. If sand availability is limited, groin cells may require continued placement of sand to maintain erosion control function. In these situations, alternative strategies should be considered.

7. The use of jetties at the entrance of a channel in order to maintain navigable depths or protect the entrance from wave attack is justified only when there is a clear and demonstrated need for such a structure and adjacent properties will not be significantly adversely affected.

**Rationale:** Jetties attempt to prevent the littoral drift from entering the channel by trapping sediment moving along the shoreline. Sand tends to accumulate on the updrift side of a jetty and sediments are transported away from the jetty on the downdrift side. This can often result in accelerated erosion of the downdrift shoreline.

# Section IV

### Minimum Standards – Protection and Conservation of Wetlands

Pursuant to § 28.2-1308 of the Code of Virginia, the Commonwealth’s existing standards below currently apply to the use and development of wetlands and shall be considered by the Commission and any local wetlands board in the determination of whether any permit should be granted or denied:

1. Wetlands of primary ecological significance shall not be altered so that the ecological systems in the wetlands are unreasonably disturbed; and

2. Development in Tidewater Virginia, to the maximum extent practical, shall be concentrated in wetlands of lesser ecological significance, in vegetated wetlands which have been irreversibly disturbed before July 1, 1972, in nonvegetated wetlands which have been irreversibly disturbed prior to January 1, 1983, and in areas of Tidewater Virginia outside of wetlands.

In deciding whether to grant, grant in modified form or deny a permit, to ensure protection of tidal wetlands, shorelines and sensitive coastal habitats from sea level rise and coastal hazards, the following additional minimum standards shall also be considered by the Commission and all local wetland boards pursuant to § 28.2-1302.9 and § 28.2-1302.10.3 of the Code:

3. Applications proposing non-living shoreline erosion control projects which include removal of vegetation, construction access or land disturbance within the Resource Protection Area (RPA) shall not be considered complete and scheduled for a public hearing by the board until the receipt of an approved Water Quality Impact Assessment (WQIA) and erosion and sediment control plan, if required by the local government pursuant to the Chesapeake Bay Protection Act.

Where the proposed shoreline treatment is a living shoreline project or related activity, the locality otherwise approves of the project, the projects maintains or establishes a vegetative buffer inland of the living shoreline and minimizes land disturbance to the maximum extent practicable, the board may schedule the public hearing without the requirement of an approved Water Quality Impact Assessment.

In all cases, mature trees should be preserved and utilized in the project design, to the maximum extent practicable, consistent with the best available technical advice and permit conditions or requirements.

4. Project review of any proposed uses or development of tidal wetlands shall include data derived from an onsite analysis, provided on scaled drawings, minimally to include the square footage of existing and resulting tidal wetland types, existing and proposed grade elevations and slope, mean high, mean low and the 10-year storm event water levels as calculated by NOAA and FEMA, existing bathymetric elevations to the minus 1-foot mean low water elevation and the current shoreline condition of adjacent properties to include any existing treatments. Additional consideration of shoreline variables shall also be given to fastland bank condition, bank height, bank composition, nearshore stability, upland land use/proximity to infrastructure/cover, width and elevation of backshore region, and boat wakes;

5. Project review of any proposed uses or development of tidal wetlands shall also include data derived from existing online advisory tools, engineering analyses or other online tools that facilitate the measurements of fetch, depth offshore, shoreline morphology, shoreline orientation, nearshore morphology, submerged aquatic vegetation (SAV), tide range, storm surge frequency, erosion rate, design wave determination, and sea level rise. Project review shall include the consideration of the statement required by Section 28.2-1302B of the Code of Virginia that thoroughly reflects and documents the analysis undertaken by the applicant *indicating whether use of a living shoreline as defined in §28.2-104.1 for a shoreline management practice is not suitable, including reasons for the determination*, which must be provided with any proposal. The public hearing may not be scheduled prior to the receipt of this information. Applications are considered incomplete until this information is provided as part of the application to the Commission or local wetland board staff.

In addition to the consideration of the aforementioned minimum standards deemed necessary to ensure the conservation and protection of tidal wetlands, the Commission or board shall evaluate all proposed shoreline treatments utilizing the best available science provided in the record, as previously defined in Section III of the Guidelines, and determine the site's *suitability* to be protected with a living shoreline treatment. To further guide the Commission and local wetland boards, a site shall be deemed suitable for a living shoreline treatment unless the applicant demonstrates, using the best available science, that such treatment would not effectively protect the property and natural resources in question. This determination must incorporate consideration of long-term sustainability and coastal resilience, and local geological and hydrological factors and other environmental factors contributing to erosion.

In those cases where the best available science identifies a living shoreline treatment as suitable but the applicant claims increased costs would prevent the use of such a treatment, the Commission or board shall work with the applicant to evaluate and reduce such costs, or to realign the project landward of the limits of tidal wetlands jurisdiction as defined by Section 28.2-1302.2 of the Code of Virginia. Should this latter approach be agreed to by the applicant during the public hearing, the matter shall only be removed from the Commission or board's further consideration as a non-jurisdictional request upon receipt of revised project drawings reflecting the modified alignment. Such projects would then be subject to the Commonwealth's statutory requirements of the Chesapeake Bay Preservation Act. If the applicant remains unwilling to use this approach, or to utilize a living shoreline treatment where suitable, the Commission or board shall deny the application.

# Section V

**Best Available Science Resources**

Virginia Institute of Marine Science Office of Advisory Services

Virginia Institute of Marine Science Shorelines Studies Program

Virginia Institute of Marine Science Center for Coastal Resources Management

Department of Conservation Recreation – Shoreline Erosion Advisory Service (SEAS)

All newly emerging wetlands science

# Glossary

In the course of considering applications for permits pursuant to the Wetlands Zoning Ordinance various terminology may be used.  As such the following definitions apply.

***Armor***

Larger stone used as the outer layers of a revetment directly exposed to wave action (see also ***Stone size***).

***Bank height***
Approximate height of the upland bank above mean low water.

***Bathymetry***
The topography, or contours, of a waterway correlated to water depths.

***Beach***
The shoreline zone comprised of unconsolidated sandy material upon which there is mutual interaction of the forces of erosion, sediment transport and deposition extending from the low water line landward to the uplands.

***Best Management Practice (BMP)***
Measures that have the combined effect of ensuring project integrity for the design life of the project while minimizing the potential adverse impacts associated with construction and maintenance.

***Beach nourishment***
Placement of good quality sand along a beach shoreline to raise the elevation of the nearshore area.

***Breakwater***
A structure usually built of rock positioned a short distance from the shore. The purpose is to deflect the force of incoming waves to protect a shoreline.

***Bulkhead***
A vertical structure that acts as a retaining wall usually constructed parallel to a shoreline.

***Buried toe***
Trenched seaward toe of a revetment to help prevent scour and shifting of the structure.

***Core stone***
Smaller stone used as the base of a revetment to provide a stable base for armor stone.

***Downdrift***
The resulting direction material is carried as waves strike a shore and move “down” along a shoreline.

***Ecosystem Services***
Components of nature, directly enjoyed, consumed, or used to yield Human well-being.

***Fetch***

The distance along open water over which wind blows. For any given shore, there may be several fetch distances depending on predominant wind directions, but there is generally one fetch which is longest for any given shoreline exposure.

***Filter cloth***
Synthetic textile placed between bulkhead sheeting and backfill or underneath a revetment to prevent soil loss yet provide permeability.

***Gabion***
A basket or cage filled with stone, brick or other material to give it a weight suitable for use in revetments or breakwaters. In the marine environment, usually made with galvanized steel wire mesh with a PVC coating.

***Groin***
A rigid, vertical structure extending perpendicular to shore to trap transporting sand or other material down a shoreline.

***Groin field***
A series of several groins built parallel to each other along a shoreline.

***Headland***
A point of land jutting out into a body of water or a shoreline section less resistant to erosion process than adjacent shorelines.

***Halophyte***
A plant that naturally grows where it is affected by salinity in the root area or by salt spray.

***Hydrophyte***
Plants that have adapted to living in or on aquatic environments

***Jetty***
A structure similar to a groin, but typically designed to prevent shoaling of a navigation channel.

***Joint Permit Application*** or ***JPA***
The standard Joint Permit Application for shoreline stabilization structures and other activities conducted in wetlands and the marine environment. The applicant completes one form and submits to either local agency or VMRC, which is responsible for distributing to local, state and federal permitting and advisory agencies (e.g. VIMS, Dept. of Wildlife Resources, Dept. of Conservation & Recreation, Dept. of Environmental Quality, US Army Corps of Engineers).

***Incidental effects***
Indirect impacts of an activity or structure, such as those resulting from redirected wave energy, trapped sand or sedimentation.

***Littoral transport***

The movement of sand and other materials along the shoreline in the littoral zone, or the area between high and low watermarks during non-storm periods.

***Low profile***
The recommended design for groins with a channelward elevation no greater than mean low water to allow sand bypass to continue once the groin cell is filled, reducing the potential for adverse downdrift effects.

***Marsh fringe***
A band of marsh plants which runs parallel to a shoreline.

***Marsh toe revetment***
A low revetment built to protect an eroding marsh shoreline.

***Mean low water***
The average height of low waters over a nineteen year period. Virginia is a low water state, meaning private property extends to the mean low water line.

***Mean tide range***
The vertical distance between mean high water and mean low water.

***Nearshore***
A term referring to the area close to the shore but still partly submerged. This area is where sand bars and shoals often form.

***Pressure treated***
The process of preserving wood by impregnating it with chemicals to reduce or retard invasion by wood destroying organisms.

***Reach***
A discrete portion of a shoreline somewhat homogeneous in its physical characteristics and upon which there are mutual interaction of the forces of erosion, sediment transport, and accretion.

***Resilience***

The capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, health, the economy, and the environment.1 Similarly, we define adaptation as adjustment in natural or human systems to a new or changing environment that exploits beneficial opportunities or moderates negative effects.

***Return walls***
Bulkhead end sections perpendicular to the shoreline to tie the bulkhead into the upland and prevent the bulkhead from being flanked as the shoreline continues to retreat on either side of the structure.

***Revetment***

A sloped structure constructed with large, heavy stone, often in two layers, used to anchor the base of the upland bank. The size of a revetment is dictated by the energy of the shoreline environment where it is proposed.

***Riprap***
Stone that is hard and angular that will not disintegrate from exposure to water or weathering.

***Scarp***
A low steep slope caused by wave erosion.

***Seawall***
A vertical wall or embankment, usually taller and larger than a bulkhead.

***Shoal***
A shallow area in a waterway, often created by nearby sandbars or sandbanks.

***Shore orientation***
The compass direction the shoreline faces. Some directions are more prone than others to the erosive forces of storm events.

***Sill***
An erosion protection measure that combines elements of both revetments and offshore breakwaters. Sills are usually built of stone, low in profile and built close to shore.

***Sediment barrier*** or ***Silt screen***
Structures placed at the toe of a slope or in a drainageway to intercept and detain sediment and decrease flow velocities. Barriers may be constructed of posts and filter fabric properly anchored at the base or hay bales staked in place end to end.

***Sheet pile***
A wooden plank or steel sheet used in the construction of bulkheads and groins.

***Slope***
Degree of deviation of a surface from the horizontal; measured as a numeric ratio, percent or in degrees. When expressed as ratio, the first number is the horizontal distance and the second is the vertical distance.

***Splash apron***
A structural component, often of rock, used to prevent forceful waves from scouring out material from the top of a revetment or bulkhead.

***Spur***
A vertical structure normally used perpendicular to groins to redirect incoming waves to allow a sheltered area in the lee and promote the accumulation of sand.

***Stone size***

Classes of riprap stone based on weight per VDOT specifications

| | |
|---|---|
| ***Class A1*** | 25-75 pounds, ≤ 10% weighing more than 75 lbs, "man-sized" |
| ***Class 1*** | 50-150 pounds, 60% weighing more than 100 lbs |
| ***Class 2*** | 150-500 pounds, 50% weighing more than 300 lbs |
| ***Class 3*** | 500-1,500 pounds, 50% weighing more than 900 lbs |
| ***Type 1*** | 1,500-4,000 pounds, average weight 2,000 lbs |
| ***Type 2*** | 6,000 – 20,000 pounds, average weight 8,000 lbs |

***Storm surge***
The resulting temporary rise in sea level due to large waves and low atmospheric pressure created during storms.

***Subaqueous*** or ***Submerged lands***
The ungranted lands beneath the tidal waters of the Commonwealth extending seaward from the mean low water mark to the 3 mile limit.

***Submerged aquatic vegetation (SAV)***
Rooted plants found in shoal areas of Chesapeake Bay which provide important ecological roles, such as providing food, shelter and oxygen as well as trap sediment and dissipate wave energy.

***Time-of-year restrictions***
Restrictions that limit construction projects during periods of heightened sensitivity for species of concern, such as anadromous fish, nesting shorebirds, shellfish, submerged aquatic vegetation (SAV), and threatened and endangered species, such as the bald eagle and northeastern beach tiger beetle.

***Tombolo***
The area of accumulated beach material in the lee of a breakwater structure.

***Wave climate***
The average wave conditions as they impact a shoreline, including waves, fetch, dominant seasonal winds and bathymetry.

***Wave energy***
The force a wave is likely to have on a shoreline depending on environmental factors, such as shore orientation, wind, channel width, and bathymetry.

***Wave height***
The vertical measurement of a single wave from its base or trough to its top or crest.

***Wetland type***
A class of wetlands described by predominant vegetation, or in the case of nonvegetated wetlands, by substrate.

..