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## **20.0. LAND SUBJECT TO COASTAL STORM FLOWAGE**

### **20.1. Land Subject to Coastal Storm Flowage (LSCSF)**

a) Preamble. Land Subject to Coastal Storm Flowage (LSCSF) is significant to storm damage prevention and flood control. LSCSF is also likely to be significant to the protection of wildlife habitat and the prevention of water pollution.

Velocity zones (V-zones) and overwash zones (AO-zones) of LSCSF (V-zones especially so) are areas which are subject to hazardous flooding, wave impact, and, in some cases, significant rates of erosion as a result of storm wave impact and scour. V- and AO-zones in coastal areas are generally subject to repeated storm damage which can result in loss of life and property, increasing public expenditures for storm recovery activities, historic taxpayer subsidies for flood insurance and disaster relief, and increased risks for personnel involved in emergency relief programs. Alteration of land surfaces in Stillwater zones (A-zones) could change drainage characteristics that could cause increased flood damage on adjacent properties.

A number of complex and inter-related factors determine the wave height and the landward extent of wave run-up in V- and AO-zones, including shoreline orientation, nearshore/offshore bathymetry, onshore topography, wave fetch, storm frequency and magnitude, and the presence of coastal engineering structures. The topography, soil characteristics (e.g., composition, density, and shape of soil material), vegetation, erodibility and permeability of the land surface within V- and AO-zones are critical characteristics which determine how effective an area is in dissipating wave energy and in protecting areas within and landward of these zones from storm damage and flooding. The more gentle and permeable a seaward-sloping land surface is, the more effective that land surface is at reducing the height and velocity of incoming storm waves. Wave energy may be expended by eroding and transporting materials comprising the land surface within the V- and AO-zones, as well as by percolation or the downward movement of the stormwater runoff through more permeable land surfaces, thereby lessening the effects of backrush, scour and erosion.

Development in V- and AO-zones poses environmental problems since construction and development activities can impair or destroy those characteristics cited above which are critical to the stated values.

Dredging or removal of materials within V- and AO-zones acts to increase the landward velocity and height of storm waves, thereby allowing storm waves to break further inland and to impact upland and wetland Resource Areas which might not otherwise be

impacted. Filling and the placement of solid fill structures within V- and AO-zones may cause the refraction, diffraction and /or reflection of waves, thereby forcing wave energy onto adjacent properties, natural resources, and public or private ways potentially resulting in otherwise avoidable storm damage. When struck with storm waves, solid structures within V- and AO-zones also may increase localized rates of erosion and scour (Shore Protection Manual, U.S. Army Corps of Engineers, 1984, V.1, pp.5-3 and 5-5).

LSCSF (the coastal floodplain) buffers and protects upland areas from severe storm conditions. Since the floodplain contains areas where the water table is close to the surface (as well as other wetland Resource Areas) pollutants in a flood plain, including contents of septic systems and fuel tanks, may affect public or private water supplies, groundwater quality, wildlife, fisheries and shellfish during a storm. Direct and collateral damage to man-made structures in the floodplain is caused by wave impacts and inundation by floodwaters and storm-driven debris. Protecting lives and property in floodplains during a storm can be expensive to the Town of Duxbury and unsafe for its police, fire, and medical personnel involved in such efforts. Hardened surfaces deflect wave energy; they do not dissipate it. Soft structures and surfaces dissipate wave energy and protect property. Desires of property owners to protect themselves from the effects of storms can lead to pressure on the Town and its regulatory bodies to erect engineering structures in wetlands which can have detrimental effects on wetland values.

Certain portions of LSCSF are significant to the protection of wildlife habitat; these significant wildlife habitat areas include all areas within the 10-year floodplain that are within a zone 100 feet landward of any other coastal or freshwater Resource Area, except for those portions which have been so extensively altered by human activity that their important wildlife habitat functions have been effectively eliminated.

Coastal floodplain areas are often low-lying areas that are ecologically transitional areas between marine/estuarine ecosystems and upland areas. Resource Areas within the 10-year floodplain are important habitats for a large variety of wildlife species, including a number of rare species. Salt marshes provide habitat for many crustaceans and mollusks and serve as critical nursery areas for numerous finfish species which in turn provide food for species higher in the food chain, including birds, mammals, and others. These Resource Areas provide important over-wintering and stopover areas for many species of waterfowl.

Areas of coastal floodplains adjacent to other wetland Resource Areas provide important wildlife functions, such as nesting and roosting habitat, rare species habitat, and wildlife corridors connecting coastal resources with freshwater wetland resources. The coastal floodplain serves as a transitional zone which is needed to protect the habitat values of coastal wetland resources.

Certain portions of LSCSF are significant to the prevention of pollution. These significant pollution prevention areas include all areas within the 100-year floodplain that are within 100 feet of any other coastal or freshwater Resource Area. These pollution prevention areas can mitigate adverse effects associated with human disturbance and pollutants.

Natural or relatively undisturbed coastal floodplains can reduce erosion and sedimentation, and in a vegetated state can prevent pollutants contained in surface runoff from directly entering waterways and other wetland areas during flood events. While erosion of stream banks and shorelines is an important natural process, the design and management of activities in the floodplain should aim to avoid excessive erosion (and thus possible pollutant-laden runoff) due to human activities.

b) Wetland Values and Presumption of Significance. Whenever a proposed project involves removing, filling, dredging, altering or building upon on LSCSF, the Commission shall presume that the land is significant to the protection of the following wetland values: protection of public or private water supply, protection of groundwater; flood control; erosion and sedimentation control; storm damage prevention, including coastal storm flowage; prevention of water pollution; protection of fisheries; protection of shellfish; protection of wildlife and wildlife habitat; and protection of rare species habitat, including rare plant and animal species. These presumptions may be overcome only upon a clear showing that LSCSF does not play a role in protecting one or more of the wetland values given cited above.

c) Definition. LSCSF means land subject to any inundation caused by coastal storms up to and including that resulting in a 100 year flood as designated by the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM), surge of record, or flood of record, whichever is greater. One hundred year flood (or base flood as it is also referred to) means the flood having a one percent chance of being equaled or exceeded in any given year. The seaward limit is mean low water.

Velocity Zones (including V-, VE-, and Va-30) are those portions of LSCSF which are coastal high hazard areas or areas of special flood hazard extending from the mean low water line to the inland limit within the 100 year floodplain supporting waves greater than three feet height.

AO-Zones are those portions of LSCSF which are subject to inundation by moving water (usually sheet flow on sloping terrain) where average depths are between one and three feet. In Massachusetts, coastal AO-zones are commonly associated with 'overwash' and generally border on the landward side of V-zones.

A-zones (including A-, AE-, A1-30 & and A99) are those portions of LSCSF which are subject to inundation by types of 100 year flooding where stillwater flooding predominates.

AH-zones are those portions of LSCSF which are subject to shallow flooding, usually ponding resulting from overwash, where average water depths are between one and three feet.

Overwash – that portion of storm wave uprush that carries over the crest of a berm, dune, or man-made structure, often times depositing sediment or other storm laden material.

d) Performance Standards. When a LSCSF is determined to be significant to a wetland value, the following regulations shall apply:

- (1) A proposed project shall not cause any adverse effect or cumulative adverse effect upon the wetland values of LSCSF.
- (2) When LSCSF is significant to protection of wildlife habitat, a proposed activity shall not impair the capacity of LSCSF to provide important wildlife habitat functions.
- (3) When LSCSF is significant to pollution prevention, a proposed activity shall not cause ground, surface or salt water pollution triggered by coastal storm flowage or flooding. For those areas within at least 100 feet of another Resource Area, activities shall minimize adverse effects in order to maintain the capability to remove suspended solids and other contaminants from runoff before it enters other Resource Areas.
- (4) For activities proposed in A-zones, the historic rate of relative sea level rise in Massachusetts of 1 foot per 100 years shall be incorporated into the project design and construction.
- (5) The following activities proposed within Velocity zones (V-zones) are likely to have an adverse effect on the protected values and are therefore prohibited:
  - a) New construction or placement of new structures, including buildings, sheds, and garages. Existing buildings may be renovated or reconstructed but must be built using flood-resistant construction.
  - b) Additions to existing structures, including additional floors on the existing structures.
  - c) Impermeable paving for new or existing roads, driveways and parking lots.
  - d) New or proposed expansions of coastal engineering structures unless such structures are of a loose, sloped-stone design.
  - e) New or expanded septic systems.
- (6) The following activities proposed within AO-Zones are likely to have an adverse effect on the protected values and are therefore prohibited:
  - a) New construction or placement of new structures, including buildings, sheds, and garages, or walls on vacant lots.
  - b) New or proposed expansions of coastal engineering structures unless such structures are of a loose sloped-stone design.
  - c) New or expanded septic systems.

- (7) Notwithstanding the above, the Commission may permit the following activities in V-zones and AO-zones provided that the applicant demonstrates to the satisfaction of the Commission that best available measures are utilized to avoid or minimize adverse effects on all wetland values of all Resource Areas:
- a) Beach, dune and bank nourishment and restoration projects that incorporate natural vegetative cover and do not otherwise impede the landward migration of these landforms over time.
  - b) Elevated pedestrian walkways that are minimal.
  - c) Docks and piers, provided they meet the performance standards specified in DWR 23.6.
  - d) Projects to restore salt marsh, freshwater wetland, shellfish habitat or fisheries.
  - e) Improvements necessary to maintain the structural integrity or stability of existing coastal engineering structures.
  - f) Projects and activities associated with water-dependent uses such as boat yards, yacht clubs, and maritime schools.
  - g) Dredging, including maintenance dredging.
- (8) Notwithstanding the above provisions, no project may be permitted which will have any adverse effect on specified habitat of rare vertebrate or invertebrate species, as identified by procedures established under 310 CMR 10.37.
- (9) Refer to DWR 23.0 et seq. for additional project-specific performance standards.
- (10) Performance standards for activities or work proposed in buffer zone to LSCSF are specified in DWR 23.0.
- (11) The Commission may impose such additional requirements as are necessary to protect the wetland values protected under the Bylaw.

## **20.2. Barrier Beaches**

a) Preamble. Barrier beaches protect landward areas from flooding and erosion because they provide a buffer to storm waves and to sea levels elevated by storms. Barrier beaches provide protection from wave action for such highly productive areas as salt marshes, estuaries, tidal flats, lagoons, harbors, salt ponds, and freshwater marshes and ponds, which are in turn important to fisheries, shellfish, wildlife and rare species where they occur. This system of interrelated coastal Resource Areas containing a barrier beach is called a barrier beach system. The along-shore movement of beach sediment caused by wave action maintains barrier beaches. The coastal dunes, beaches, and tidal flats of a barrier beach system are made up of sediment supplied by wind action, storm wave overwash, and tidal inlet deposition. Barrier beaches in Massachusetts undergo a landward or along-shore migration caused by the landward and along-shore movement of sediment by wind, storm waves, and tidal current processes. The continuation of these processes maintains the volume of the landform which is necessary to carry out its storm and flood buffer functions. The ability of barrier beaches to respond to wave action, including storm overwash sediment transport is critical to the protection of the wetland values of barrier beaches. Barrier beaches in a natural condition are aesthetically attractive and provide opportunities for recreational fishing, shellfishing, swimming, and navigation.

b) Wetland Values and Presumption of Significance. Whenever a proposed project involves removing, filling, dredging, altering or building upon a barrier beach or within a minimum distance of 100 feet of a barrier beach or a barrier beach system, the Commission shall presume that the barrier beach is significant to the protection of the following wetland values: flood control; erosion and sedimentation control; storm damage prevention, including coastal storm flowage; protection of fisheries; protection of shellfish; protection of wildlife and wildlife habitat; protection of rare species habitat, including rare plant and animal species; protection of recreation, protection of aquaculture, and protection of aesthetics. These presumptions may be overcome only upon a clear showing that the barrier beach does not play a role in protecting one or more of the wetland values given above.

c) Definition – Same as 310 CMR 10.29 (2).

d) Performance Standards. When a Barrier Beach or land within a minimum distance of 100 feet of a Barrier Beach is determined to be significant to a wetland value, the following regulations shall apply:

- (1) No proposed project which may cause an adverse effect or cumulative adverse effect upon the wetland values of a Barrier Beach or Barrier Beach System shall be permitted.
- (2) No new coastal revetments or hard coastal engineering structures of any type shall be constructed on a barrier beach.

- (3) No activities or structures shall be permitted which prohibit the natural movement of sand and water along the beach, or which prohibit the inland migration of the barrier beach.
- (4) No activities or structures shall be permitted which increase storm damage, erosion, sedimentation, flooding of adjacent properties or Resource Areas, or which cause adverse effects on the wetland values.
- (5) Notwithstanding the above provisions, no project may be permitted which will have any adverse effect on specified habitat of rare vertebrate or invertebrate and rare plant species, as identified by procedures established under 310 CMR 10.37.
- (6) Refer to DWR 23.0 et seq. for additional project-specific performance standards.
- (7) Performance standards for activities or work proposed in the buffer zone to a Barrier Beach are specified in DWR 22.0.
- (8) The Commission may impose such additional requirements as are necessary to protect the wetland values protected under the Bylaw.

## **21.0. RIVERS**

### **21.1. Riverfront Area**

a) Preamble. Riverfront areas are likely to protect private or public water supply, protect groundwater, provide flood control, provide erosion and sedimentation control, provide storm damage prevention, prevent pollution, protect land containing shellfish, provide wildlife and wildlife habitat, protect fisheries, provide rare species habitat where rare species occur, and provide recreational and aesthetic values. Land adjacent to rivers and streams can protect the natural integrity of these water bodies. The presence of natural vegetation within riverfront areas is critical to sustaining rivers as ecosystems and providing these public values. The riverfront area can prevent degradation of water quality by filtering sediments, toxic substances (such as heavy metals), and nutrients (such as phosphorus and nitrogen) from stormwater, nonpoint pollution sources, and the river itself. Sediments are trapped by vegetation before reaching the river. Nutrients and toxic substances may be detained in plant root systems or broken down by soil bacteria. Riverfront areas can trap and remove disease-causing bacteria that otherwise would reach rivers and coastal estuaries where they can contaminate shellfish beds and prohibit safe human consumption. Natural vegetation within the riverfront area also maintains water quality for fish and wildlife.

Where rivers serve as water supplies or provide induced recharge to wells; the riverfront area can be important to the maintenance of drinking water quality and quantity. Land along rivers in its natural state with a high infiltration capacity increases the yield of a water supply well. When riverfront areas lack the capacity to filter pollutants,