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## Habitat Management Plan for Long Beach, Stratford, Connecticut With emphasis on invasive species control



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Cover photos: clockwise from upper left – Long Beach, Long Beach after Sandy, diamondback terrapin, Long Beach West.

# Habitat management Plan for Long Beach Stratford, Connecticut

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## **Habitat Management Plan for Long Beach, Stratford, CT with emphasis on invasive species control**

### **Background**

Long and Pleasure Beaches are a single coastal barrier beach spit or ecosystem. It is the longest spit in the state, nearly 2 miles in length. An Environmental Review Team report for Pleasure Beach was conducted at the request of the City of Bridgeport (report date: May 1984<sup>1</sup>). This report identified the presence of rare plants, rare communities and rare landforms that have limited occurrence on coastal barriers along Long Island Sound. Subsequently, staff from the Coastal Area Management Program of the Connecticut Department of Environmental Protection suggested to William McCann, the former Director of the Stratford Conservation Commission, to request a review of Long Beach. It was anticipated that these two reviews would provide a complete understanding of issues related to coastal process, ecosystem health and management issues. The Long Beach ERT report was published in April 1987<sup>2</sup>. One of the important recommendations in the report was the suggestion that leasing of public lands for cottages be discontinued.

The Town of Stratford discontinued the leases and while the leases required homeowners to remove their cottages, no leasee complied with that requirement. Although the cottages were vacated, some were vandalized and several were subject to arson. In 2009, the Trust for Public Lands began raising funds for habitat restoration through cottage removal. The critical funding source would be the \$909,000.00 received under the American Recovery and Reinvestment Act of 2009. Site preparation work began in early 2010 and the project was completed in April 2011, a critical milestone to restoration of the site. Additionally, in 2011 the Town of Stratford received a Long Island Sound Futures Fund grant to develop a management plan and implement invasive species control. This report addresses the final chapter in the restoration of Long Beach; the development of a restoration plan and the removal of invasive species. In this plan, the major landforms and plant communities are identified, the status of state rare plants is discussed, and an eradication plan for invasive plant species is outlined.

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<sup>1</sup> [http://www.ctert.org/ERTWebsite/pdfs/Bridgeport\\_PleasureBeach\\_132.pdf](http://www.ctert.org/ERTWebsite/pdfs/Bridgeport_PleasureBeach_132.pdf)

<sup>2</sup> [http://www.ctert.org/ERTWebsite/pdfs/Stratford\\_LongBeach\\_171.pdf](http://www.ctert.org/ERTWebsite/pdfs/Stratford_LongBeach_171.pdf)

## Landforms

Long and Pleasure Beaches are political units within a single coastal barrier spit that lies between Oak Bluff Avenue in Stratford and the mouth of Bridgeport Harbor. There are three primary areas referred to in this report; namely Pleasure Beach, Long Beach West (LBW) and Long Beach (Figure 1). Most natural coastal barriers in Long Island Sound are narrow (100 to 400 feet wide) with a simple landscape composed of beach and a primary sand dune. LBW and Pleasure



Figure 1. The primary named features of the Long/Pleasure Beach coastal barrier spit.

Beach support a wide and complex landscape that is extremely rare in Long Island Sound (LIS) and with one exception, originate as a result of human modification. Connecticut beaches similar to this complex include Lynde Point in Old Saybrook, Milford Point in Milford and Russian or Lordship Beach in Stratford. Except for Russian Beach, these wide beaches are the result of the construction of a terminal breakwater designed to intercept along-shore sand movement that would otherwise accumulate in navigation channel. These beaches consist of a series of alternating dunes and swales, a complex called a ridge plain.

The Long Beach/Pleasure Beach complex can be divided into two beach categories: namely prograding (regressive) and retrograding (transgressive) as shown in Figure 2. The yellow arrow in figure 2 show the net direction of sediment transport in the nearshore zone. The eastern breakwater associated with Bridgeport Harbor was constructed in 1871 (1,380 feet) and was lengthened to 3,823 feet in 1907/1908. The breakwater prevents the west moving sediment to accumulate in the navigation channel and this sediment collects on the east side of the structure causing the shoreline to increase in width. Gradually the beach grew seaward (prograded) and new primary dunes formed seaward of the older dunes, thus creating an alternating series of dunes and swales called a beach ridge plain. Ridge plains form naturally where sea level is declining; however at this site, the construction of the breakwater was the causal agent. As the beach prograded, the orientation of the shoreline changed or rotated in this case towards a SSE direction.

Since there is little or no change in the shoreline position since 1984, we presume that the beach has prograded to its fullest extent and now the shoreline position is relatively stable. Surplus sediment moving along this shoreline likely flows over the breakwater and appears to move northerly along the western edge of the beach causing the harbor shoreline to prograde to the west. The majority of the beach on the western shore of Pleasure Beach formed after 1933.

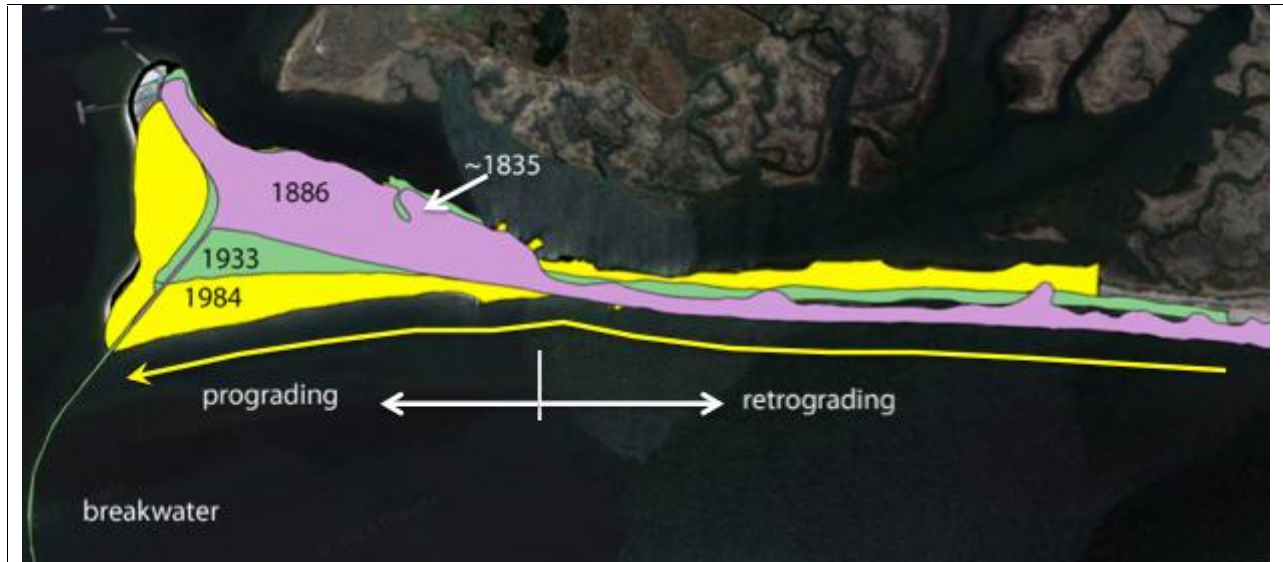


Figure 2. Pleasure Beach and Long Beach West are part of the prograding beach while Long Beach is a retrograding beach. The date ~1835 points to the location of the western end of the barrier in 1835. Construction of a breakwater prior to 1886 has caused the western beach segment to prograde. Prior to 1933, the breakwater was extended further into the Sound allow for addition progradation.

Where the prograding and retrograding beaches intersect, the shore is stable (see Figure 2). To the east of this stable node, (see figure 2) where Long Beach is narrow and retrograding, the beach is ‘retreating’ in a landward direction. The actual width of the beach changes little over time. Coastal storm surge can cause waves to overtop the dunes and deposit sand behind the dune in the form of fan-shaped deposits called overwash sands. This deposition widens the beach and new dune formation upon the overwash sands increases beach elevation. These changes are in response to sea level rise and provide a drown-proofing mechanism. In the center of Long Beach, the mean high water shoreline has moved landward 300 feet in nearly 100 years for a rate of ~3 feet/year.

The fastland (upland) landforms have been mapped for the prograding and retrograding beaches. of the beach has been mapped as two major landform types; namely ridge plain and primary dune (figure 3). Several subforms of these habitats are also recognized (Table 1). The landform acreage includes the pre-Hurricane Irene dune extent as derived from 2010 coastal aerial photography. Table 1 also provides an estimate of the amount of dune habitat eroded by Hurricane Irene.

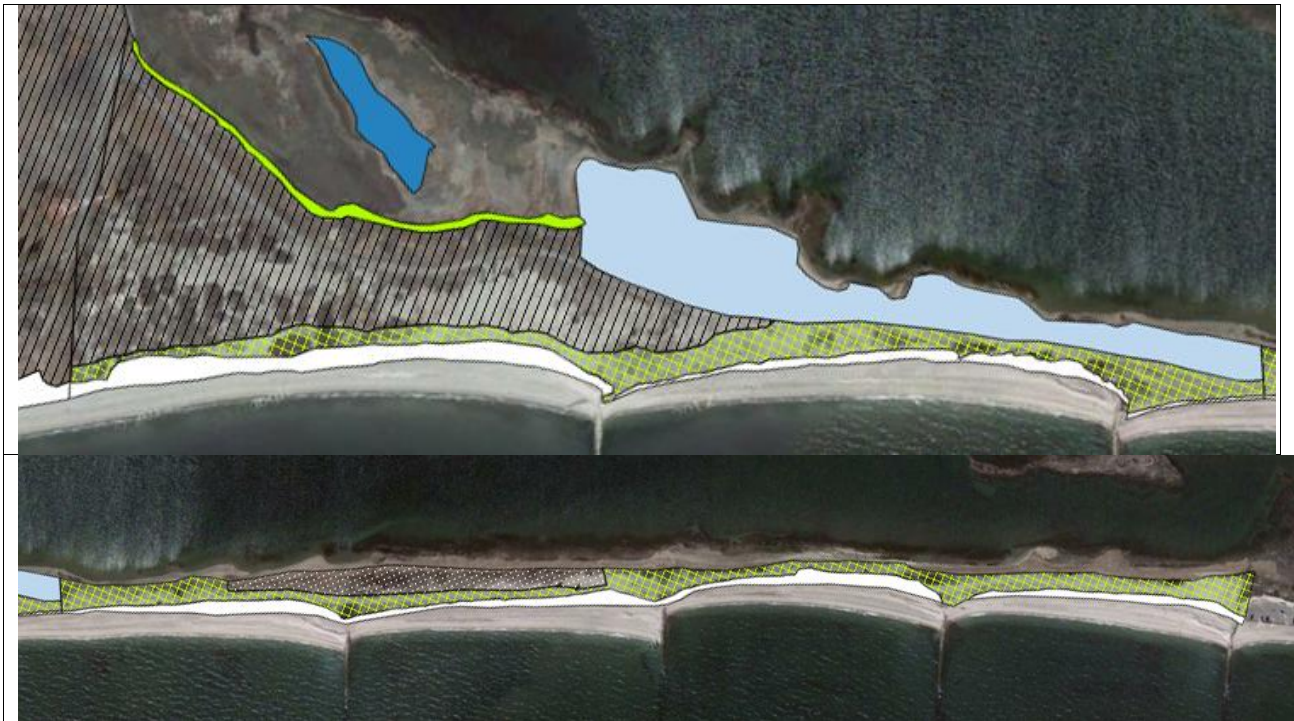


Figure 3. LBW landforms (top photo) include ridge plain (black lines), relict inlet dune (blue), berm (yellow) and eroded dune (white). Long Beach landforms (bottom photo) include primary dune (blue lines), eroded dunes (white) and backbarrier flats (cross hatch). Beach and tidal wetland are present in the imagery but not mapped.

Two other upland habitats are recognized: the man-made berm that lies between the fastland and tidal wetlands of Lewis Gut on LBW and the area that appears to have compact soils occurring on the east end of LBW and on the north side of the ‘road’. The occurrence of compacted soils is based solely on visual inspection and the predominance of ruderal vegetation.

<b>Table 1. Areal extent (acres) of landforms and subforms at the 3 beach locations.</b>		
<b>Location</b>	<b>Beach Type</b>	<b>Landforms</b>
Pleasure Beach**	prograding (66.4)	eroded dune (6.6)
		ridge plain (58.8)
Long Beach West	prograding (19.3)	eroded dune (1.6)
		primary dune (3.0)
		ridge plain (9.4)
		relict dune (0.6)
		berm (0.4)
		compact soil (4.3)
		Long Beach
		primary dune (4.8)
		backbarrier flat (1.9)

\* acres include eroded dune which are expected to reform in several years.

\*\*no landforms are mapped at Pleasure Beach except eroded dunes.

### Landform Management Recommendations:

It is estimated that approximately 4 acres of dune were eroded during Hurricane Irene. Unlike Hurricane Gloria, which in 1985, struck at low tide, Irene struck at high tide. When Irene made landfall, the storm was downgraded to a tropical storm but Irene was a slow moving storm, and in concert with high tide, created a storm surge that has a return frequency of 10 years. The temporary dune loss at Long Beach and LBW is approximately 33 percent. It is estimated that the erosion caused by Hurricane Gloria, a stronger storm, caused a loss of approximately 50% at The Strand in Waterford. These dunes reformed with little or no loss of dune area and potentially some gain.

Recommendation 1. Dunes are resilient resources and there is no evidence to suggest that replanting dune vegetation is required at Long Beach. Interpretation of the March 29, 2012 Google aerial photographs suggest that little or no dune vegetation was visible in the eroded dune areas. However, our field surveys in summer 2012 found scattered American beachgrass (*Ammophila breviligulata*) plants and so it is likely that these plants will spread jump-starting dune restoration. It is our recommendation that dune restoration be monitored to determine if there are places where planting beachgrass are needed or activities such as pedestrian access (trampling) need to be controlled. Dune recovery can be easily monitored by air photo interpretation. The Coastal Management Program of CT DEEP has recommendations for replanting dunes if needed.

It was noted that the spring deployment of string fence to protect piping plovers and least terns included former dune areas that had eroded. In some cases, the placement of the fence caused the public to walk on healthy dune and thus create new trails. It is recommended that the Conservation Commission and the US Fish & Wildlife Service develop protocols for the placement of fence, the location of walkways as appropriate, and the development of signage to balance the protection of the nesting birds, the regeneration of the dune, and appropriate public access.

Hurricanes and nor'easters can cause the formation of inlet through barrier beaches. Typically these will form in gaps in the dunes, perhaps gaps created by pedestrian traffic. An inlet created at Griswold Point in Old Lyme in 1994 led the loss of the entire west end of the beach! Inlets can interrupt the alongshore transport of sand and starve 'downstream' areas such as LBW and Pleasure Beach and cause their erosion and loss. Even though Irene was a tropical storm, we note that the greatest dune losses are on the west side of each groin. It is likely that with winds from the southwest, the groins intensified the wave action in these locations. If Irene had been a stronger storm, it is possible that inlets might have formed at multiple locations and on the west side of groins!

Recommendation 2. Stratford should evaluate the benefit and liability of groins on Long Beach including the role that they might play in dune erosion and inlet formation. There

should be an assessment of how to respond to the formation of an inlet across Long Beach following a coastal storm.

At the east end of LBW, an area of ‘compact soils’ is identified. Elsewhere on LBW, including the disturbance sites at the cottages, the soils are largely aeolian sands. No physical inspection (such as soil pits) was used to define the nature of these compact soils, so their origin and nature is unknown (e.g., historic fill?). Many of the plant species that are colonizing this area are ruderal, opportunistic “weeds”, not native to Connecticut. In a few locations that has been some sand deposition and the vegetation resembles that of the natural dune system. The vegetation changes from spring to late summer were dramatic and in September much of this area was carpeted with crabgrass (*Digitaria* sp.). It is too early to predict the fate how natural restoration will proceed here. However, in the section of Pleasure Beach near the radio tower which had been compact soil used for parking, the native vegetation is returning including at least one endangered species.

Recommendation 3. Monitoring vegetation changes in this area to determine if future restoration actions are necessary. It may take a long time for this area to heal and so patience may be needed to avoid implementing unnecessary actions prematurely.

During the spring of 2012, the string fence used to create a protected area for terns and plovers was expanded to include the area of dune that was eroded during Hurricane Irene. In at least one location, this forced beach goers to walk over the dune and create a new trail through the dune vegetation. In this area, the former sand/temporary gravel road was removed by storm surge and wave action. The string fence will not interfere with the regrowth of the foreslope dune. American beachgrass will colonize this eroded dune area by rhizomes and new shoots will help to trap aeolian sand and rebuild the dune.

Recommendation 4. The town should meet with those responsible for deployment of the string fence to assure that the fence does not lead to additional dune vegetation by pedestrian traffic or interfere with the rebuilding of the dune. The dune is an essential natural barrier to prevent inlet formation, which could result in the significant loss of barrier beach including habitat for terns and plovers.

## **Vegetation and Plant Communities**

Within each landform are several plant communities, each influenced by coastal dynamics and the land-use history of the site. The extensive area of ridge plain that occurs at the Long Beach West and Pleasure Beach prograding beaches is a rare landform type and this is the best example in Long Island Sound with its greatest extent occurring in the area formerly developed with residential cottages (Long Beach West).



## Primary Dune

The primary dune parallels Long Island Sound from the parking lot west to the terminus of Pleasure Beach in Bridgeport and is shown in Figure 3. The seaward edge of the ridge plain has a primary dune. The primary dune consists of a foreslope, crest and backslope. The foreslope dune is immediately adjacent to the beach strand and receives constant supply of aeolian sand from the beach. Few species have the capacity to grow here where there is active vertical growth of sand. There is also sedimentation on the backslope dune with sedimentation decreasing with increasing distance from the dune crest.

The most important dune plant is American beachgrass (*Ammophilla breviligulata*), a cryptophyte with the perennial bud just below the soil surface. The rhizomes are capable of horizontal growth on the order of eight to ten feet per year. The shoot is capable of elongation at a rate that is dependent upon the amount of sand deposition. Several nodes are produced in a single growing season and these provide a record of sediment deposition. Active sediment deposition protects the perennial bud in the winter from desiccation. In areas with little or not sand deposition such as the ridge plain, *Ammophila* is replaced by species that are not tolerant of sand deposition.

The primary dune supports a coastal grassland dominated by *Ammophila*. *Ammophila* abundance is greatest on the foredune and decreases with increasing distance landward as sediment deposition decreases. The primary plant associates include American beach rocket (*Cakile edentula*), seaside goldenrod (*Solidago sempervirens*), cocklebur (*Xanthium strumarium*), Russian thistle (*Salsola kali*), orach (*Atriplex patula*), and others. On both the foredune and backdune saltmeadow cordgrass (*Spartina patens*) occurs in pure stands.

The backslope habitat starts at the crest of the foredune and extends to the edge of the tidal wetlands that border Lewis Gut. Here the sediment deposition rates are lower than the foredune and species diversity increases. *Ammophila breviligulata* is still dominant here, growing intermingled with *Solidago sempervirens*, *Cakile edentula*, wild lettuce (*Lactuca canadensis*), small flower evening primrose (*Oenothera parviflora* var. *oakesiana*), common milkweed (*Asclepias syriaca*), and horseweed (*Conyza canadensis*), the latter often abundant in large patches. Low thickets of beach rose (*Rosa rugosa*) also occur, growing as near monocultures with a sparse mixture of *Solidago sempervirens*, *Centaurea stoebe* and *Celastrus orbiculatus*.

## Backbarrier Flats

There is a section of Long Beach that is mapped as backbarrier flat (figure 3) which lies landward of the backslope dune. This might be a former storm overwash fan, which receives little or no aeolian sand. This habitat therefore has a more stable substrate where species such as beach sedge (*Carex silicea*), Gray's flatsedge (*Cyperus grayi*), eastern prickly pear (*Opuntia*

*humifusa*), Virginia pepperweed (*Lepidium virginicum*), *Conzia canadensis*, and Canada toadflax (*Nuttallanthus canadensis*) are prevalent, intermixed with low patches of mosses and lichens.

Other associated plants include poverty brome (*Bromus sterilis*), which can grow in large patches, wormwood (*Artemisia campestris* ssp. *caudata*), poison ivy (*Toxicodendron radicans*), cocklebur (*Xanthium strumarium*), bouncing bet (*Saponaria officinalis*), butter and eggs (*Linaria vulgaris*), Queen Anne's lace (*Daucus carota*), quack grass (*Elymus repens*), and goat's beard (*Tragopogon dubius*). Invasive plants occur in patches with tree of heaven (*Ailanthus altissima*) forming small thickets in several areas. Oriental bittersweet (*Celastrus orbiculatus*) and spotted knapweed (*Centaurea stoebe*) is also present, but is infrequent in their distribution.

### Ridge Plain

The ridge plain occurs exclusively on Long Beach West and Pleasure Beach. This plain consists of alternating low dunes and swales (Figure 4). Cottage construction and other human activities have largely erased this pattern but it is still visible but highly disturbed on the west side of Long Beach West. Here, the soil has been compacted, with asphalt remnants and demolition debris scattered throughout.



Figure 4. Dune and swales of the ridge plain at Pleasure Beach.

The interior dunes and swales are largely inactive with regards to sand deposition, having been isolated from the beach, and so the soils are stable. Located interior seaward or primary dune, a rare vegetation develops, composed of a complex mosaic of herb and grass microcommunities. In the absence of active sedimentation *Ammophila* is sparse or absent. Characteristic species include wormwood (*Artemisia campestris* ssp. *caudata*), beach pinweed (*Lechea maritima*),

*Spartina patens*), purple love-grass (*Eragrostis spectabilis*), *Solidago sempervirens*, *Opuntia humifusa*. Other associated plants include *Cyperus grayii*, *Carex silicea*, *Oenothera parviflora* var. *okesiana*), *Conyza canadensis*, *Triplasis purpurea*), sweet everlasting (*Gnaphalium purpureum*), Seaside Spurge (*Euphorbia polygonifolia*), and Bastard Pennyroyal (*Trichostema dichotomum*). In one location, beach needlegrass (*Aristida tuberculosa*), New England blazing star (*Liatris scariosa* var. *novae-anglia*) sickle-leaved golden aster (*Pityopsis falcata*) and bitter panicgrass (*Panicum amarum*) are growing together.

On the western border of Long Beach West, herbaceous vegetation occurs in patches interspersed with small shrub thickets and areas of open sand. Beach plum (*Prunus maritima*) is the most common native shrub, with a few thickets composed solely of *Prunus* (see Appendix A). Other *Prunus* patches are intermixed with invasive species such as *Ailanthus altissima*, bush honeysuckle (*Lonicera* sp.), Japanese honeysuckle (*Lonicera japonica*), privet (*Ligustrum obtusifolia*), *Celastrus orbiculatus*, *Paulownia tomentosa*, *Rhus glabra*, *Populus tremuloides*, and *Toxicodendron radicans*. This habitat extends west onto Pleasure Beach intergrading with areas of minimal sand deposition, stabilized with number of reindeer lichens, cup lichens, and hair cap mosses. There are several patches of Virginia rose (*Rosa virginiana*) on the ridge plain but one of these is probably the largest colony in coastal Connecticut. A few wild black cherry (*Prunus serotina*) shrubs dot the sand plain. *Prunus serotina* is one of several species of trees that grow in the native forests of coastal barrier beaches in the northeast.

In the area of compacted soil formerly occupied by cottages, the plants are largely opportunistic annuals. Visual dominance of these varies from spring to fall giving this area a very different appearance as the seasons progress. Sandwort (*Arenaria serpyllifolia*), bracted plantain (*Plantago aristata*), and annual knawel (*Scleranthus annuus*) are spring dominants; *Daucus carota* is striking in mid-summer, followed by a dense growth of crabgrass (*Digitaria sanguinalis*) in the fall. Some areas exhibit recent sand accumulation, likely a result of hurricane Irene. Additional plants include *Linaria canadensis*, *Conzia canadensis*, tall tumbleweed (*Sisymbrium altissimum*), *Silene vulgaris*, *Lepidium virginicum*, *Bromus tectorum*, common mullein (*Verbascum thapsus*), yellow oxalis (*Oxalis stricta*), chickweed (*Cerastium* sp.), common wormwood (*Artemisia vulgaris*), six weeks fescue (*Vulpia octoflora*), *Solidago sempervirens*, polkweed (*Phytolacca americana*), and *Toxicodendron radicans*. Invasive species such as *Ailanthus altissima*, *Centaurea stoebe*, and seedlings of black locust (*Robinia pseudoacacia*) are scattered.

Remnant ornamental plantings also occur in the vicinity of the former cottages, the most problematic being *Zoysia* cf. *japonica*, an Asian lawn grass that readily spreads by shallow rhizomes and is difficult to contain and/or eradicate. Other showy ornamentals include lanceleaf tickseed (*Coryeopsis lanceolata*), a tea rose cultivar (*Rosa* sp.), sweet William (*Silene armeria*), stonecrop (*Sedum acre*), Japanese wisteria (*Wisteria floribunda*), trumpet creeper (*Campsis radicans*), and scattered lilac (*Syringa vulgaris*) and mulberry (*Morus* sp.) shrubs. This area also contains a forested border of *Robinia pseudoacacia* trees that grow on the man-made berm that

was created along the shore of Lewis Gut. Several other plants associated with the berm include common reed (*Phragmites australis*), *Silene vulgaris*, *Elymus repens*, smooth sumac (*Rhus glabra*), empress tree (*Paulownia tomentosa*), *Toxicodendron radicans*, *Opuntia humifusa*, *Solidago sempervirens*, *Spartina patens*, and *Celastrus orbiculatus*.

Also at the western border of Long Beach West is a small area dominated by switchgrass with scattered *Solidago sempervirens*, *Opuntia humifusum*, *Lepidium virginiana*, *Carex silicea*, and *Conzia canadensis*. In several locations *Panicum amarum* is present.

#### Vegetation and Plant Community Recommendations:

Removal of the invasive trees eliminate forest habitat. The native trees on Connecticut barrier beaches are *Prunus maritima* and shadbush (*Amelanchier canadensis*). *Juniperus virginiana* is a native evergreen shrub of dune swales that is salt tolerant. The *Juniperus* at Hammonasset State Park is a popular for birders to search for owls. There are only a few scattered *Juniperus* on Long Beach and LBW. Bayberry (*Morella pensylvanica*) is a native shrub of Connecticut coastal barriers that is absent on Long Beach. The berries of this shrub are used by many migratory and wintering birds.

Recommendation 1. Consider purchasing a small number of young *Prunus* and *Amelanchier* to plant on the landward side of the beach. Consider establishing a few small *Juniperus* groves on LBW. These plantings will likely require protection from deer browse until they become established.

The eastern portion of LBW mapped as a compacted soil landform is an area with many ruderal plants and substrate that is not conducive to native plants. There were also rapid seasonal changes in plants in this location including the dominance by crabgrass in late summer. There are some signs of wind blown sand accumulating in this area but it may not be sufficient for the recovery of native plants. It is noted however, that the compacted parking area beyond LBW near the antenna at Pleasure Beach is gradually converting to native plants.

Recommendation 2. Monitor vegetation change particularly at the LBW landform called compacted soil.

#### **State-listed Plant Species**

On Long Beach West, several interior dune ridges contain a number of Connecticut State-listed plants: beach needlegrass (*Aristida tuberculosa*, Endangered), sickle-leaved golden aster (*Pityopsis falcata*, Endangered), (*Panicum amarum* (Threatened), New England blazing star

(*Liatris scariosa* var. *novae-anglia*, Special Concern), Eastern prickly pear (*Opuntia humifusa*, Special Concern). These species are further described below:

*Aristida tuberculosa* is an annual grass occurs on coastal dunes from Virginia north to New Hampshire and in xeric oak-pine sandhills in the southeastern and Gulf coast states, with disjunct locations north to Minnesota and Indiana. This grass is considered rare in Indiana, Threatened in Michigan and Massachusetts, and Endangered in New Hampshire and Connecticut. In Connecticut, *Aristida* is restricted to barrier flats that have formed on a few coastal dunes in Fairfield County. *Aristida tuberculosa* is best recognized in August and September when the plants are mature and start to show the distinctive three-parted twisted awn over one inch in length. On Long Beach West, *Aristida tuberculosa* is restricted to the undisturbed ridge plain associated with the former cottages near the fenced border of Pleasure Beach. Several hundred stems in both large patches and as scatted individuals were observed in August 2012 on an interior dune ridge and a swale behind the primary dune. This species covers the greatest area of all of the listed species.



Figure 5. The twisted awns of *Aristida tuberculosa*.

*Pityopsis falcata* is a perennial composite that grows on open sandy areas and pine barrens along the coast from Massachusetts south to New Jersey, and in the right habitat can be locally abundant. *Pityopsis* is considered Endangered in Connecticut and is rare in Rhode Island. In Connecticut, this plant is restricted to a few dune ridges and swales in Fairfield County and one dry sandy area in New Haven County. Its distinctive foliage and golden yellow flowers that bloom in July and August best recognize this plant. On Long Beach West, *Pityopsis falcata* is restricted to a small area on both sides of two cinder drives associated with the former cottages near the fenced border of Pleasure Beach. Between three and four hundred plants were observed in August 2012.

*Panicum amarum* is a coarse perennial grass that grows on coastal sand dunes from New England south and west to Mexico. *Panicum amarum* is considered Threatened in Connecticut and rare in Rhode Island. In Connecticut, this grass grows on foredunes, backslopes and swales in Fairfield, New Haven Counties and Middlesex Counties. There is a large population at Pleasure Beach discovered in 2012. This grass is best recognized by its clonal growth form and its coarse bluish, green foliage. On Long Beach West, *Panicum amarum* grows in large patches on dune and swale habitat associated with the former cottages near the fenced border of Pleasure Beach. Several clonal patches were observed in August 2012.



Figure 6. *Pityopsis falcata*.

*Liatris scariosa* var. *novae-angliae* is a showy composite that grows in all the New England states except Vermont, extending south and west to New Jersey and Pennsylvania. *Liatris* is considered Endangered in New Hampshire, Rhode Island, and New Jersey; Threatened in New York and Maine; and Special Concern in Massachusetts and Connecticut. In Connecticut, this plant has declined in its distribution occurring in several open sand plains, on bedrock outcrops and on the barrier flat of Long Beach West. Its showy spike of blue flowers that bloom in July and August best recognizes this plant. On Long Beach West, *Liatris scariosa* var. *novae-angliae* is restricted to a small area on both sides of two cinder drives associated with the former cottages near the fenced border of Pleasure beach. Thirteen stems in flower and bud were observed in August 2012, several of which appeared to be browsed by deer.

*Opuntia humifusa* is the only New England representative of the cactus family growing in dry soil and on bedrock outcrops in nearly state east of the Rocky Mountains, with the exception of Maine, New Hampshire, and Vermont. *Opuntia* is considered Endangered in Massachusetts, Special Concern in Connecticut, Rare in Pennsylvania, and Exploitably Vulnerable in New York. In Connecticut, this plant occurs near the coast on coastal dunes and exposed outcrops, with

fewer occurrences east of the Connecticut River. *Opuntia* is relatively widespread on Long Beach and Long Beach West on backslope dunes, swales and the relict inlet dune, most abundant in the area of the former cottages on Long Beach West. Several hundred “clumps” were observed in August 2012.

#### State-Listed Plant Species Recommendations:

Recommendation 1. Use a product such as deer off or fence to protect *Liatris*; monitor population status every three years (best time is August); important to control shrubs and invasive trees that cast shade; important to control *Zoysia* grass which could outcompete the listed species and important to remove *Centaurea* that is confined to eastern LBW.

#### **Invasive Plant Species**

Long Beach and Long Beach West contain a number of invasive plants. These include trees: *Ailanthus altissima*, *Paulownia tomentosa*, and *Robinia pseudoacacia*; shrubs: *Elageanus orbiculatus*, winged euonymus (*Euonymus alatus*), *Ligustrum obtusifolium*, and *Lonicera morrowii*; vines: *Celastrus orbiculatus* and *Lonicera japonica*; and herbaceous plants: *Centaurea stoebe*, Japanese knotweed (*Fallopia japonica*), and *Phragmites australis*. Several other plants, some introduced by the cottage owners, also have the potential to impact the ecological functions of this site. These include quaking aspen (*Populus tremuloides*), Japanese wisteria (*Wisteria floribunda*), trumpet creeper (*Campsis radicans*), *Aralia hispida*, and Japanese lawn grass (*Zoysia japonica*). The eradication of these plants is an integral part of the restoration of this coastal resource. A detailed invasive plant species control plan can be found in Appendix A. These species are listed as invasive species based upon an on-the-ground assessment such as spreading by vegetative means and occurrence of seedlings.

Four tree species *Ailanthus altissima*, *Paulownia tomentosa*, *Populus tremuloides*, and *Robinia pseudoacacia* are fairly abundant and spreading. These species are a high priority for control. Although most of these trees are salt pruned and appear to be drought stressed, all produce vigorous root sprouts, and two; *Ailanthus* and *Robinia* secrete alleopathic chemicals that inhibit the growth of other plants. This is evidenced by the clonal nature of their growth. Seedlings and saplings are scattered throughout Long Beach West and these trees will continue to spread as long as a seed source is present. Given their presence throughout Pleasure Beach, monitoring their recolonization after control is essential to maintain the integrity of the site.

In most cases, the “cut and paint” method of chemical control will be preferred. Using this method, trees and large shrubs are cut off at their base and an herbicide solution is sprayed or painted onto the exposed surface of the stump. Once cut, smaller trees can be left in place to decay whereas larger boles can be cut and stacked. The objective of this method is to kill both the stump and the root system, minimizing re-sprouting. Seedlings and small saplings can be hand-pulled or sprayed as appropriate.

Invasive woody shrubs and vines are less frequent in their occurrence, mostly intermixed in the *Prunus maritima* thickets on Long Beach West. The greatest threat that these species have is displacing native shrubs, herbaceous vegetation and listed species. Since most invading shrubs are intermixed with native species, the “cut and paint” method will be preferred. Smaller and/or isolated shrubs and vines can either be cut with the stumps sprayed or the above ground foliage can be sprayed carefully minimize wind drift.

For woody plants, we recommend chemical control following the guidelines provided by the Connecticut Invasive Plant Working Group:

[http://www.hort.uconn.edu/cipwg/art\\_pubs/GUIDEguideframe.htm](http://www.hort.uconn.edu/cipwg/art_pubs/GUIDEguideframe.htm).

Of the herbaceous species, the occurrence of *Centaurea stoebe* and *Zoysia* are of greatest concern. Once established, *Centaurea* can easily out-compete native plants through the production and release of catechin, a bioflavonoid that inhibits the growth of other plants. *Centaurea* is a difficult plant to eradicate. The large number of seed produced and the deep taproot make control labor intensive requiring multiple years of effort. Hand pulling is the recommended control method at this site.

*Zoysia* is an introduced species that seems to thrive along Connecticut’s coast. Spreading readily by long shallow rhizomes (Figure 7), it can quickly spread and out-compete native plants. Three small populations occur on Long Beach West, likely introduced by former cottage owners to create lawn. Japanese lawn-grass is also difficult to eradicate with multiple treatments of a non-selective herbicide such as glyphosate necessary to ensure its removal. The plants need to be actively growing prior to treatment, with treatment most effective after a period of rain. The thatch should be removed either through mechanical means or a controlled burn, and as new growth emerges, treated again. Additional treatments may be necessary to be most effective.



Figure 7. Rapid spread of *Zoysia* by rhizomes.



Another herbaceous plant of concern is *Fallopia japonica*. *Fallopia* is an aggressive plant with thick, spreading rhizomes that are difficult to eradicate. Since this plant occurs only in a few clumps on Long Beach West, we recommend a combination of manual and chemical control also following the guidelines provided by the Connecticut Invasive Plant Working Group:  
[http://www.hort.uconn.edu/cipwg/art\\_pubs/GUIDE/guideframe.htm](http://www.hort.uconn.edu/cipwg/art_pubs/GUIDE/guideframe.htm)

## Appendix A. Invasive Plant Species Control Plan

For the purposes of invasive species control, Long Beach is divided into two sections (see Figure 1), Area 1 (prograding beach) and Area 2 (retrograding beach). Area 1 is known as Long Beach West (LBW), the location that had been leased for cottage construction and supports beach ridge plain with rare vegetation and five State-listed plant species. Area 2 is narrow barrier beach with primary dune that is migrating landward. The invasive species issues and priorities for each area are described below:



Figure 1. The base image is from 2012 imagery available from Google maps. Area 1 is the highest priority for invasive species control. Base aerial imagery is Google Maps March 29, 2012.

### Methodology:

A reconnaissance was conducted on May 22, 2012 to assess the distribution of invasive species and test methodologies to define the spatial extent on these species (e.g., aerial photo interpretation and delineation with GPS). Aerial photography reviewed included 2005 and 2010 summer false color infrared aerial photography for coastal Connecticut and 2012 aerials (March 29, 2012) available through Google Maps. There were minor geo-referencing differences amongst all of these sources. The Google aerials were used to delineate invasive species as this was post cottage removal. In the removal of cottages, shrubs and trees were removed making this the best base map to estimate the boundaries of invasive trees and shrubs. The Google aerials are leaf off and this increases the difficulty in defining boundaries of shrubs and trees.

Aerial photography was used to delineate ‘islands’ of shrubs/low trees and the one tall tree stand of *Robinia pseudacacia*. Tracklog was used to define boundaries for non-woody plants such as the grass *Zoysia* and the weed *Centaurea stoebe*. There are numerous scattered individuals of *Celastrus orbiculatus*. No attempt was made to record the locations of scattered individuals *Celastrus*.

Quantum GIS (QGIS) software was used to create point and polygon shapefiles. These files are in NAD83 and CT State Plane Coordinates (feet). Area (acres and/or square feet) has been computed using QGIS. For shrubs, square feet are a more useful value than acres since the footprint of the individual islands is small. Some of the islands are but several low trees or shrubs and so area **estimates** are not all that useful for contractors to estimate their work effort. Some of the larger polygons contain a mix of the native shrub Beach Plum (*Prunus maritima*),

which is to be protected, will be intermixed with invasive trees and numerous *Celastrus* vines. This too makes the use of area estimates difficult to use to assess work efforts. There are a few islands dominated by *Prunus maritima* that require little or no control and these are identified on a shapefile.

GPS was used to capture approximate boundaries for the herbaceous invasives such as the grass *Zoysia* and *Centaurea stoebe*. It is recommended that Town engage volunteers to hand pull *Centaurea* beginning at eastern Long Beach West.

#### Invasive Species Summary:

Long Beach and LBW contain a number of invasive plants (Table 1). These include trees: *Ailanthus altissima*, *Paulownia tomentosa*, and *Robinia pseudoacacia*; shrubs: *Elageanus orbiculatus*, winged euonymus (*Euonymus alatus*), *Ligustrum obtusifolium*, and *Lonicera morrowii*; vines: *Celastrus orbiculatus* and *Lonicera japonica*; and herbaceous plants: *Centaurea stoebe*, Japanese knotweed (*Fallopia japonica*), and *Phragmites australis*. Several other plants, some introduced by the cottage owners, also have the potential to impact the ecological functions of this site. These include quaking aspen (*Populus tremuloides*), Japanese wisteria (*Wisteria floribunda*), trumpet creeper (*Campsis radicans*), *Aralia hispida*, and Japanese lawn grass (*Zoysia japonica*). The eradication of these plants is an integral part of the restoration of this coastal resource. These species are listed as invasive species based upon an on-the-ground assessment such as spreading by vegetative means and occurrence of seedlings. Rugose rose (*Rosa rugosa*) has the potential to be an invasive species on barrier beach creating monospecific stands at the exclusion of all other species. There are a number of small but discontinuous shrub islands of this rose but they occupy small areas of backslope dune and are thus considered naturalized and do not warrant control.

Table 1. List of plants determined to be invasive at Long Beach.			
Scientific Name	Common Name	Threat	Comments
<b>Trees</b>			
<i>Ailanthus altissima</i>	Tree of Heavy	High	spreading
<i>Paulownia tomentosa</i>	Empress Tree	Moderate	
<i>Populus tremuloides</i>	Quaking Aspen	High	spreading
<i>Robinia pseudoacacia</i>	Black Locust	High	spreading
<b>Shrubs</b>			
<i>Aralia spinosa</i>	Hercules Club	Moderate	spreading
<i>Eleagnus umbellata</i>	Autumn Olive	Moderate	Few individuals
<i>Euonymus alatus</i>	Burning Bush	Moderate	Few individuals
<i>Ligustrum obtusifolia</i>	Privet	Low	
<i>Lonicera cf. morrowii</i>	Bush honeysuckle	Moderate	Is the dominant forestry understory at Old Black Point Beach
<i>Juniperus</i> sp.	“Carpet Juniper”	Moderate	spreading
<b>Lianas</b>			
<i>Campsis radicans</i>	Trumpet Creeper	High	spreading
<i>Celastrus orbiculatus</i>	Asiatic Bittersweet	High	spreading
<i>Wisteria floribunda</i>	Japanese Wisteria	Moderate	spreading
<b>Herbaceous Plants</b>			
<i>Centaurea stoebe</i>	Spotted Knapweed	High	Spreading, phytotoxin, highly invasive in sand dunes
<i>Fallopia japonicus</i>	Giant Knotweed	High	spreading
<i>Phragmites australis</i>	Common Reed	High	Spreading on flats
<i>Zoysia</i> spp.	Japanese Zoysia	High	Spreading, potential to become dominant plant in open and understory

## Zone 1 - Long Beach West

There are three discrete subareas within Zone 1 (see figure 2). Zone 1A is the western portion of LBW containing numerous shrub islands, one large stand of *Robinia pseudoacacia*, the turf grass *Zoysia* and the reed grass *Phragmites australis*. Zone 1B is the second highest priority and it contains a few small shrub islands, small colonies of dwarf *Phragmites australis* and *Fallopia*. Zone 1C is largely free of invasive species but there are scattered tree seedlings such as *Populus tremuloides* and scattered individuals of *Celastrus orbiculatus*. The primary control efforts here are to search for and control the listed invasive species.

### Zone 1A.

The primary area for invasive species control is LBW, the upland area is approximately 11 acres but the estimate area for invasive species control is listed in Table 1. The recommended control is to cut and paint all trees and shrubs with the exception of Quaking Aspen (*Populus*

*tremuloides*). Wild black cherry (*Prunus serotina*) and beach plum (*Prunus maritima*) are native and are to be protected and not treated. The few black cherry trees should be be flagged in advance of implementing the recommended controls. To simplify the control plan, it is

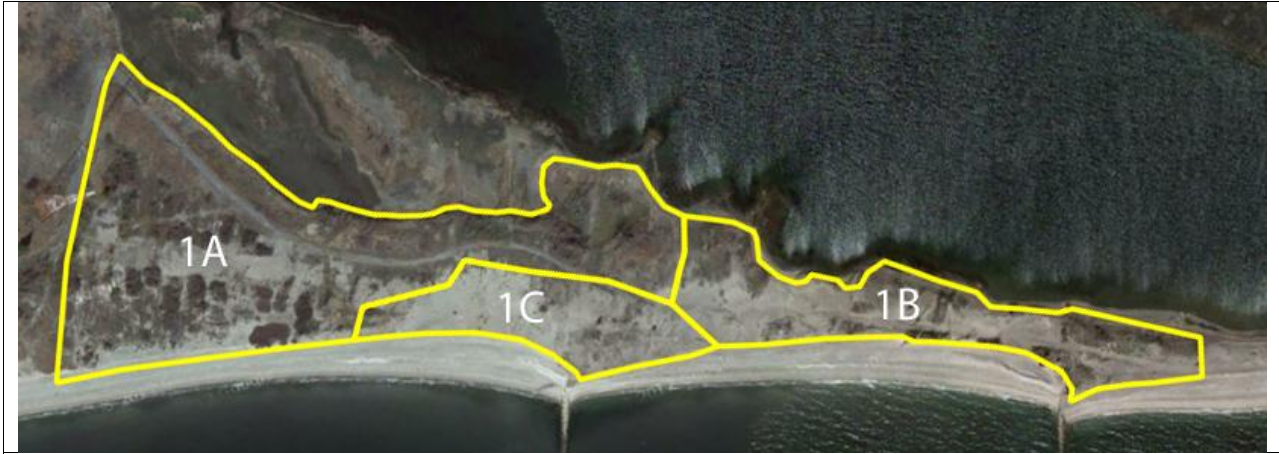


Figure 2. Shows the three subzones at Long Beach West (Zone 1).

suggested that any shrub that is not *Prunus maritima* be treated and thus it is not necessary to identify individual trees and shrubs before treating. Identification of *Prunus maritima* is key to applying control measures in Zone 1A. Also identification of *Populus tremuloides* is necessary for it requires a herbicide treatment such as basal injection.



Figure 3. Zone 1A showing the primary control areas: *Robinia pseudoacacia* (green), shrub islands (white), *Zoysia* (yellow), and *Phragmites australis* (lavender). Light blue areas correspond to shrub islands dominated by the native *Prunus maritima* to be protected.

Species/Target	Area	Sites	Treatment
<i>Robinia</i> (trees)	0.65 acres	1	cut & paint
Shrub Islands	70089 SF (1.6 acres)	24	Cut & paint except for <i>Populus tremuloides</i> (basal injection)
<i>Phragmites</i>	0.42 acres	1	herbicide
<i>Zoysia</i>	7,256 SF	4	herbicide & rake; retreat

- A. *Robinia* Stand. Along the north side of LBW is a man-made berm upon which support a linear stand of *Robinia pseudoacacia* with a 0.65 acre footprint. There are a few invasive species associated with this stand including *Lonicera morrowii*, *Eleagnus umbellata* and *Paulownia tomentosa*, which need to be treated.

Recommended control: Cut close to ground; paint stump with herbicide. Cut and stack wood at a designated area. The trees should be cut and the wood stacked at a location approved by the town (consider the upland between this site and the *Phragmites* site to the east).

Rationale: There are numerous seedings throughout the ridge plain and unless the source is removed, this species will continue to spread and threaten state listed plants and rare coastal vegetation.

- B. Shrub Islands. There are approximately 24 ‘shrub islands’ that contain invasive shrubs and low trees with an estimated area of 1.6 acres. An additional 10 islands have been identified which are dominated by *Prunus maritima* and should not be cut or treated. However any invasive species present in these islands should be treated. A few of the larger islands have numerous *Prunus maritima* within and care should be taken to not cut and treat the *Prunus*. With one exception, any shrub/tree species that is not *Prunus* should be cut and treated. In this regard, the key to a successful control program is the ability to recognize *Prunus*. The one native tree that requires identification is *Populus tremuloides*, which requires a treatment such as basal injection of herbicide. There is a single colony of *Juniperus horizontalis*, which may require a treatment such as picloram and tebuthiuron to the soil.

A complication for the western most portion of shrub islands is the presence of rare plants. The rare plant area should be delineated with stakes and string/rope prior to the start of any work commencing to minimize trampling. Shrub removal should be done in a manner that avoids entering this protected area.

Recommended control: Cut and paint trees and shrubs. *Celastrus* is common in many of these islands and so control methods may vary from cut and paint to spraying vines with the appropriate herbicide. Figure 4 shows the area that contains state listed plants species. This area should be clearly delineated. Shrub islands on the border should have plants cut and removed in a manner that does not walk through this protection zone. Two islands are within this boundary – a clearly defined route from ingress and egress should be established to minimize impact on the habitat of listed plants species.



Figure 4. Protection zone to be delineated prior to invasive species control in order to avoid trampling the habitat of state listed species.

Rationale: All of the non-native shrubs/trees in these islands have the potential to spread at LBW and to simplify the control method it has been recommended that all be cut and treated while protecting the native *Prunus maritima*.

- C. *Phragmites*. There is a 0.42-acre *Phragmites* colony on upland sands. Within this site are a few shrubs and trees namely: *Robinia pseudacacia*, *Eleagnus umbellata* and *Celastrus orbiculatus*.

**Recommended control:** Cut and paint for the trees/shrubs. Treat *Phragmites* with a herbicide and then remove standing growth (e.g., a controlled burn or mow). Retreat any new growth (pump sprayer/spray bottle).

Rationale: The *Phragmites* on the dry sands of LBW is not as robust and dense as in brackish wetland areas but this colony is expanding primarily by rhizomes. Treatment will restore habitat for native dune plants.

- D. *Zoysia*. There are two areas with remnant *Zoysia* lawn that are expanding. The larger site is expanding into the adjacent shrub islands. Two small colonies were found on the south side of the former access road and there may be other patches to control. Prior to control, search the adjacent lands to identify and additional colonies that need to be controlled.

Recommended control: Herbicide actively growing plants (early summer) following rain (stimulates growth). Remove thatch and within two weeks retreat any new growth. Retreat as necessary. Japanese lawn-grass is also difficult to eradicate with multiple treatments of a non-selective herbicide such as glyphosate necessary to ensure its removal. The plants need to be actively growing prior to treatment, with treatment most effective after a period of rain. The thatch should be removed either through mechanical means or a controlled burn, and as new growth emerges, treated again. Additional treatments may be necessary to be most effective.

Rationale: These small lawn remnants are actively spreading. They form dense turf, which has the potential to spread throughout the ridge plain and threaten rare plants and rare plant communities.

#### Zone 1B.

This zone (4.0+ acres) at the east side of LBW contains a few shrub islands and small patches of *Phragmites australis*. The easternmost shrub island near the groin supports the liana *Wisteria floribunda* growing on the ground. Nearby are a few *Campsis radicans* vines. The primary species in the shrub islands are *Ailanthus altissima* and *Celastrus orbiculatus*. The inverted L-shaped polygon in the middle of Figure 5 contains *Ailanthus* and *Populus tremuloides*. Present in this area is Japanese knotweed (*Fallopia japonica*). There is also a single *Paulownia tomentosa* to be treated east of the *Wisteria* patch.





Figure 5. Zone 1B is the eastern portion of Long Beach West.

Recommended control: Shrubs will be cut and sprayed except for *Populus tremuloides* which requires basal injection of herbicide. *Phragmites* should be treated with herbicide and this control can probably be done with backpack sprayer. *Campsis* might be controlled through removal of the vines. *Wisteria* should be cut and painted with either glyphosate or triclopyr.

Rationale: All of the target non-native species in this area are showing signs of spreading and are thus considered invasive and warrant control measures.

### Zone 1C.

This zone, nearly 3 acres in extent, is devoid of shrub islands and trees. The dominant plants are grasses and herbs. There are however a few individual shrubs such as *Lonicera morrowii*, *Celastrus orbiculatus* and scattered seedlings such as *Populus deltoides*. In the center of the image (Figure 6), the ‘shrubby’ island is a dense growth of tall *Artemisia vulgaris*. This colony has the potential to spread and dominate the ridge plain and thus should be removed by hand.



Figure 6. Zone 1C is an area which will require spot control of scattered invasive species.

**Recommended Control:** Walk the area in a systematic manner to locate and control non-native shrubs and tree seedlings. Given the sandy nature of the soils, *Celastrus* and seedlings might be controlled by hand pulling or using a weed wrench. It is expected that there will be seedlings of *Robinia pseudoacacia* that require removal.

**Rationale:** Seedlings such as *Populus* and *Robinia* if allowed to remain will grow and become future invasive shrublands that will require control and will become a source of seeds that will colonize natural habitat. The few individuals of *Artemisia vulgaris* are very robust (see figure 7) and since they have the potential to spread and displace native vegetation, it is suggested that these plants be hand pulled and then monitored for new growth.



Figure 7. Tall *Artemisia vulgaris* with the native *Artemisia caudata* in the foreground.

## Zone 2.

This zone is nearly 9 acres (see Figure 8) in extent and contains some scattered colonies or individuals of *Eleagnus umbellata*, *Ailanthus altissima*, *Phragmites australis* and *Celastrus orbiculatus*. There is one large shrub island that is 7000 square feet in extent that in the center contains *Ailanthus altissima*, *Populus tremuloides* and *Celastrus orbiculatus*. The east side is *Ailanthus* and the west side is *Celastrus*. On the north side *Phragmites australis* is present but it was not determined if any of this lies in wetland and thus requires a pesticides permit for treatment. It is suggested that this stand of grass not be treated but be assessed for treatment at a future date.



Figure 8. Invasive species distribution in Zone 2.

**Recommended Control:** Shrubs, with the exception of *Populus*, should be cut and painted. The best treatment for *Celastrus* in the shrub island needs to be determined (e.g., cut and paint versus an herbicide spray). Scattered *Celastrus* plants should be hand pulled or sprayed. As noted in other zones, *Populus* requires a different herbicide treatment such as basal injection.

**Knapweed:** Knapweed (*Centaurea stoebe*) is a biennial herb that is present throughout Long Beach (Zone 2) and is confined to portions (eastern) of Zone 1. It is recommended that Knapweed be controlled by hand pulling and that the initial control focus on Long Beach West. As shown in Figure 9, *Centaurea* is abundant in two locations but otherwise occurs at a series of points with but a few individuals. *Centaurea* occurs in multiple locations on Long Beach and is abundant at many locations. There are few species that co-exist with *Centaurea* that is likely the result of exuding catechin from roots.

**Recommended control:** Organize volunteers to hand pull plants before the plants set seed. The first priority is to focus on the Long Beach West area first and then time and volunteers available, tackle the Knapweed concentration areas at Long Beach. If plants are in flower, it should be assumed that seeds may be available and thus harvested plants should be bagged and removed offsite.

Volunteers should wear gloves as the phytotoxin can cause an allergic reaction such as a rash. Ideally volunteers would return for several years to harvest any regrowth.

Rationale: *Centaurea* is evidently spreading and where it is abundant, alleopathy is causing a decline in native plant species. Unless this species is controlled, there is a risk that native plant communities and potentially the rare plants will decline in the future. Field observations suggest that there is sand erosion at locations where *Centaurea* is the dominant species.



Figure 9. Distribution of *Centaurea* at Long Beach West (top image) and Long Beach (bottom image).

#### Special Considerations:

The USFWS will need to advise about what if any seasonal restrictions on invasive species control activities are required to avoid impacts to Piping Plover. The LBW activities are remote from Plover nesting. Logistically, it might be desirable from an invasive species control (shrub and trees) at LBW to use small boat access to get equipment on-site such as chain saws and backpack sprayers. Personnel could walk from the Long Beach parking lot to LBW. For cottage removal, the closure window extended to September 15. A late date such as this will make herbicide treatment ineffective.

At Long Beach, there are but a few small *Ailanthus* trees to be cut and painted. These small diameters trees cut be cut with a cordless reciprocating saw. The same is true for the few *Eleagnus* present.

It would be helpful for USFWS to review the proposed control activities and advise on seasonal restrictions. Also, the placement of Osprey platforms at Long Beach West creates potential conflicts between public access in general and potentially invasive species control. It is not expected that invasive species control near platforms will require significant time but control

cannot be done without working in the vicinity of the platforms. Ospreys are not a protected species at this time.

Contractors should consult with the town and Connecticut Department of Energy and Environmental Protection regarding the herbicides proposed to make certain all are allowed and to determine if any permits are required

**Appendix B. Images or hyperlinks to images of invasive species on Long Beach**

<b>Species</b>	<b>Image</b>
<i>Ailanthus altissima</i> – Tree-of-Heaven; small trees/shrubs; compound leaves.	
<i>Aralia spinosa</i> – Devil's Walking Stick	<a href="http://plants.usda.gov/java/profile?symbol=arsp2">http://plants.usda.gov/java/profile?symbol=arsp2</a>
<i>Campsis radicans</i> – Trumpet flower	

*Celastrus orbiculatus* –  
Asiatic Bittersweet



*Centaurea stoebe* -  
Knapweed





*Eleagnus umbellata* –  
Autumn Olive





*Euonymus alata*. – Burning  
Bush





<p><i>Fallopia japonica</i> – Japanese Knotweed</p>	
<p><i>Juniperus horizontalis</i> – Creeping Juniper</p>	<p><a href="http://tinyurl.com/8b76obz">http://tinyurl.com/8b76obz</a></p>
<p><i>Ligustrum obtusifolia</i></p>	<p><a href="http://plants.usda.gov/java/profile?symbol=LIIA">http://plants.usda.gov/java/profile?symbol=LIIA</a></p>
<p><i>Lonicera morrowii</i></p>	<p><a href="http://www.invasive.org/browse/detail.cfm?imgnum=2308047">http://www.invasive.org/browse/detail.cfm?imgnum=2308047</a></p>
<p><i>Paulownia tomentosa</i> – Empress Tree</p>	

<p><i>Phragmites australis</i> – Common Reed</p>	
<p><i>Populus tremuloides</i> – Quaking Aspen</p>	
<p><i>Robinia pseudoacacia</i> – Black Locust</p>	<p><a href="http://plants.usda.gov/java/profile?symbol=rops">http://plants.usda.gov/java/profile?symbol=rops</a></p>

*Wisteria floribunda* –  
Japanese Wisteria



*Zoysia* sp. – grass

