LONG ISLAND SOUND STUDY

HABITAT RESTORATION INITIATIVE

ANNUAL SUMMARY FOR THE YEAR 2010

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ANNUAL SUMMARY FOR THE YEAR 2010

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Cover Photo: Looking upstream at the new, fully functional channel at Bride Brook. Harry Yamalis, Connecticut Department of Energy and Environmental Protection

LONG ISLAND SOUND STUDY HABITAT RESTORATION INITIATIVE --

Annual Summary for the Year 2010

BACKGROUND

This report summarizes the accomplishments of the Long Island Sound Study's (LISS) Habitat Restoration Initiative (HRI) for year 2010, the eleventh year of implementation. The HRI is a bi-state, multi-organizational effort to restore estuarine coastal habitats in Connecticut and New York. The HRI members meet three times a year to discuss progress, share new technologies, and identify emerging issues. In 1997, the LISS HRI established the following goals:

- Restore the ecological functions of degraded and lost habitats;
- Restore at least 2000 acres of coastal habitats and 100 miles of riverine migratory corridor habitat over the next 10 years; and
- Use partnerships to accomplish the restoration objectives and to leverage limited state, local, and federal funds.

Potential restoration sites were identified through interviews with individuals knowledgeable with the states' ecosystems, and through a public nomination process. This information was compiled into a Habitat Restoration Geographic Information System, and published in a brochure called "Restoring Long Island Sound's Habitats". Implementation of HRI goals began in 1998. Twelve priority coastal habitat types have been identified by the HRI members as particularly important to sustaining the living resources of the Long Island Sound ecosystem. These habitat types are Tidal Wetlands, Freshwater Wetlands, Riverine Migratory Corridors, Submerged Aquatic Vegetation (SAV), Coastal Grasslands, Intertidal Flats, Estuarine Embayments, Coastal and Island Forests, Shellfish Reefs, Cliffs and Bluffs, Rocky Intertidal Zones, and Coastal Barriers, Beaches, and Dunes.

In 2000, eleven state, federal, municipal and non-governmental organizations signed a Memorandum of Understanding (MOU) that codified their commitment to work cooperatively on the LISS HRI goals. For more information on the habitat restoration initiative, go to: http://longislandsoundstudy.net/issues-actions/habitat-quality/background/.

The Policy Committee, comprised of the Commissioners of NYSDEC and CT DEEP[1], and Regional Administrators of EPA Regions 1 and 2, met once again in 2006 to sign a new MOU and establish updated goals for the Habitat Restoration Initiative. Many of the same partners who signed the 2000 MOU renewed their commitment that year to promote coastal habitat restoration, and a few new organizations also joined the partnership. Under the terms of the 2006 MOU, the partners resolve to:

- Work together to restore or protect an additional 300 acres of coastal habitat and open up an additional 50 miles of riverine migratory corridor to diadromous fish from January 1, 2006, to December 31, 2011, as stated in EPA's Strategic Plan, and ultimately restore 2,000 acres by 2020;

- Use partnerships to accomplish restoration objectives and leverage limited local, state, and federal funds.

The 2006 MOU can be viewed online at: http://longislandsoundstudy.net/wp-content/uploads/2010/03/Habitat_MOU06.pdf .

The Long Island Sound Study plays a major role in habitat restoration by providing annual funding to the New York State Department of Environmental Conservation's Bureau of Marine Resources and to the Connecticut Department of Energy and Environmental Protection's Office of Long Island Sound Programs (OLISP).

[1]The Connecticut Department of Environmental Protection merged with other state agencies and officially became the Connecticut Department of Energy and Environmental Protection on July 1, 2011.

2010 PROGRESS REPORT

Although the ultimate goal of habitat restoration is the implementation of projects, it can take several years of planning, design, obtaining permits and applying for grant funds before a project is ready for construction. For this reason, restoration acreages can vary considerably from year to year, and acreage alone is not a true measure of progress in the field of habitat restoration. Progress is reported by major habitat types with emphasis placed on completed projects. An introduction to each section is provided to summarize the overall work effort.

In calendar year 2010, progress was made toward the restoration goals with one very important goal being met this year. Twelve coastal habitat restoration projects were completed, totaling 204.33 acres in 2010. Three riverine migratory corridor projects were completed which now provide access to an additional 5.8 miles of migratory passageways for fish. By the end of 2010, 160.4 miles of riverine migratory corridor were opened to fish passage. Additional progress was made in other areas such as securing funding, initiating engineering design, and conducting preliminary tidal studies on other on-going projects. All targets set by the Long Island Sound Study for riverine migratory corridors have been exceeded.

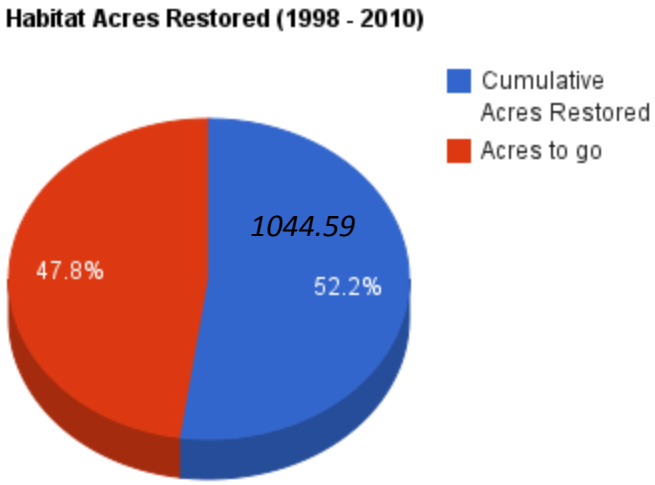


FIGURE 1. Acres restored relative to HRI goals, currently at 52.2% of the goal of 2000 acres of coastal habitats with 1044.59 acres being restored.

The following sections summarize restoration projects completed in 2010 by the states of Connecticut and New York. The habitat types included are tidal wetlands, riverine migratory corridors, and coastal forest. Additional details, including links to maps and pictures can be found in our habitat restoration database (http://lisshabitatrestoration.com/search.aspx).

TIDAL WETLAND RESTORATION

Ten tidal wetland restoration projects were completed in 2010 for a total of 203 acres restored and will be further discussed in the following section. Completed tidal wetland project acreage for 1998–2010 is presented in Figure 2.

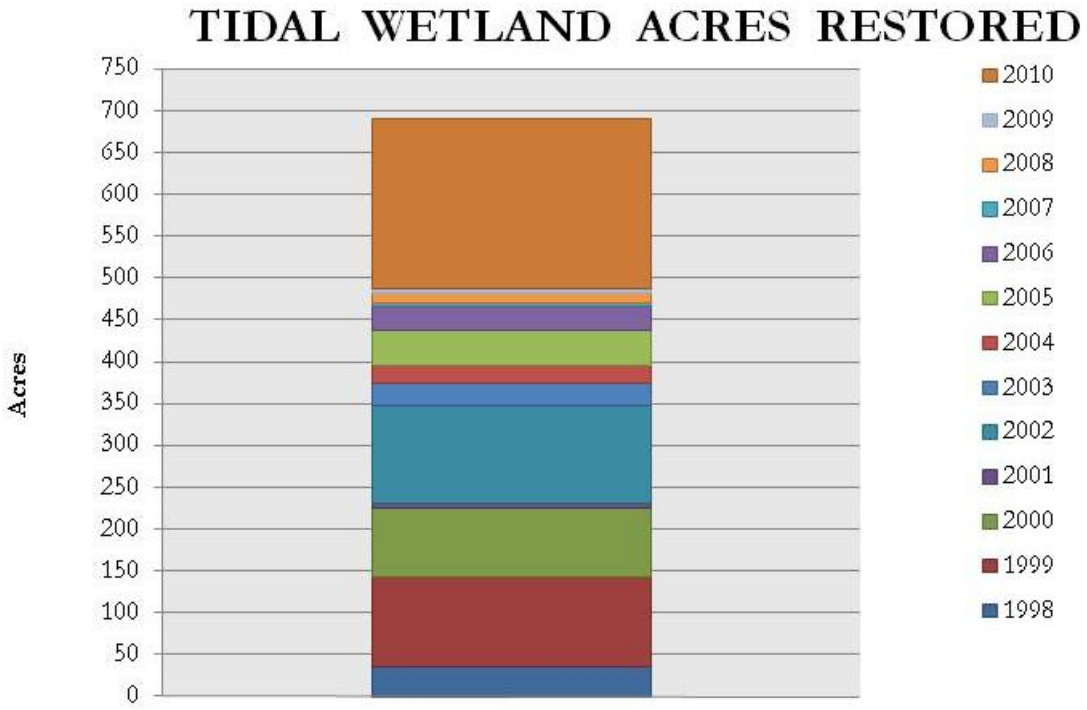


FIGURE 2. Acres of tidal wetlands restored (690.16 acres) between 1998 and 2010.

Bride Brook Restoration

State: Connecticut

Town: East Lyme

Habitat Type: Tidal Wetland, Riverine Migratory Corridor

Acres Restored: 82.4

Miles Opened: 5.1

Cause of Degradation: The mouth of Bride Brook historically was an open channel that meandered through the sandy beach and dune system. Over the course of geological time-scales, this channel also would migrate toward the east or west, never finding a true equilibrium—it reached more of a dynamic equilibrium. The east–west migration of the channel is caused by several factors, including wind, waves, tides, coastal storm influence, and long-shore currents. In 1934, the open channel was dredged and lined with riprap, and two 36-inch culverts were installed to supplement the tidal flow. The 1938 Hurricane blocked the open channel once more, and so it was abandoned at that point in time. The original culverts were removed in 1971 allowing tidal water to flow once again through an open channel. In the early 1980s, however, the existing pair of 3-foot x 5-foot x 200-foot elliptical culverts was installed under the dune in order to maintain a tidal connection to Long Island Sound without the need to routinely maintenance-dredge a naturally meandering sandy-bottomed channel. Unfortunately these pipes, which connect LIS with Bride Brook, Bride Lake, and the extensive tidal marsh system upstream of the railroad crossing, were installed at too high an elevation, were undersized, and did not allow the wetlands to drain fully at low tide. The marsh remained in a permanently flooded state, and there was excessive ponding of water as well as loss of wetland vegetation. These pipes also had deteriorated, were partially collapsed, and periodically became clogged with sand. Tidal flow was greatly reduced and fish passage was inhibited. The dunes in this area were trampled by pedestrians, evidenced by numerous trails cutting across them. These areas were be filled in with vegetation and fenced off after the construction phase of the pipe replacement project was completed.

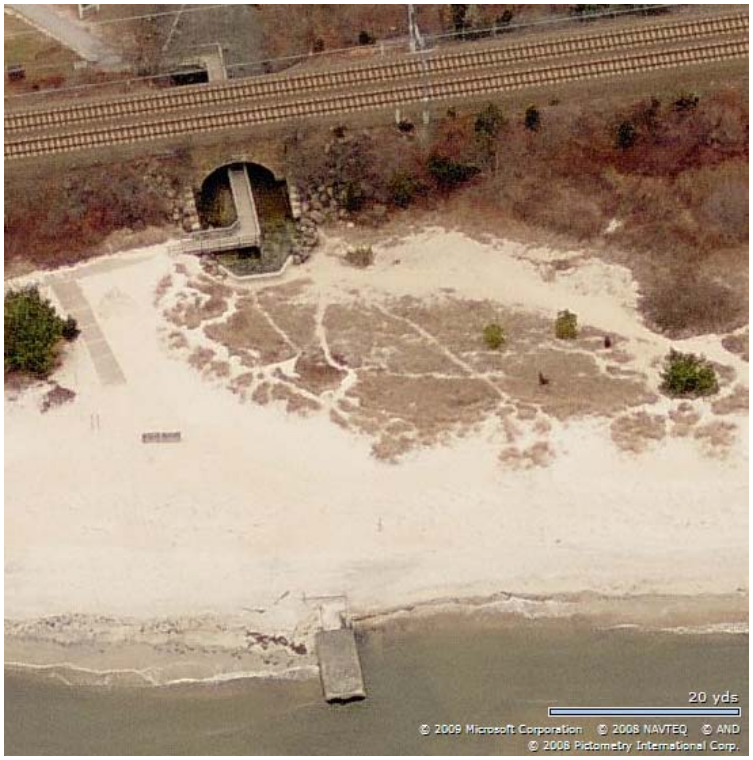
Project Description: The primary goal of this project was to replace the failing culverts with a large box culvert and open channel design. This would result in: (1) an increase the amount of tidal flushing to get more water out of the tidal marsh system during the ebb tide by eliminating the undersized culverts; and (2) an increase the annual run of alewives by improving conditions for passage at the mouth of Bride Brook (literally the first several hundred feet of this critical riverine migratory corridor). The existing pipes, a pair of 3-foot x 5-foot elliptical culverts, each approximately 200 feet long, were removed. The new design includes just 60 feet of a much larger passage way – 6-foot x 8-foot concrete box culvert, and approximately 70 feet of an open channel with armored sloped sides. The rest of the open channel is below mean high water and was left alone so that its course will be determined by the tides, longshore drift, and the natural flow of the brook. In all, approximately 82.4 acres of tidal wetlands and 5 miles of riverine migratory corridor were restored.

The adjustment of the hydroperiod and tidal amplitude will set the tidal marsh system on a trajectory toward becoming a self-maintaining ecosystem with long-term stability. Marsh plant recolonization will be a gradual process and plant distribution will be determined naturally by the tides. The number of alewives entering Bride Brook is expected to increase gradually over the next several years as well, due to the elimination of the long, narrow pipes that they had to pass through at the mouth of the brook. Better lighting within the new box culvert will also be achieved due to both the shorter lengthening the pipe, and utilizing a box culvert with a much larger opening – this also is a critical improvement in the conditions necessary for migratory fish.

A third component to this project was to allow for the natural restoration of the dune area near the railroad bridge by surrounding it with sand fence. This step began before the pipe replacement. The existing dune vegetation was transplanted out of the area of impact and relocated to other areas within Rocky Neck State Park where dunes had been trampled. In the early spring of 2010 following completion of the construction phase, the sand dune was rebuilt and replanted within the area of impact, and all transplanted areas were fenced off to protect the dune from pedestrian traffic and the creation of new pathways. A narrow portion of the dune was left unvegetated, for vehicle access, until final adjustments can be made to the mouth of the brook. Dune restoration is expected to be completed in spring 2011.

Implementation Partners: Save The Sound, a program of the Connecticut Fund for the Environment (lead); Connecticut Department of Energy and Environmental Protection - Office of Long Island Sound Programs (co-lead), State Parks Division (co-lead), and Wildlife Division; National Oceanic and Atmospheric Administration - Restoration Center; United States Fish & Wildlife Service - Southern New England/New York Bight Coastal Program; Natural Resources Conservation Service.

Funding Provided By: National Oceanic and Atmospheric Administration - Restoration Center, and American Recovery and Reinvestment Act of 2009; Connecticut Department of Energy and Environmental Protection - Supplemental Environmental Project (SEP) Funds, and Fisheries Division; Save The Sound, a program of the Connecticut Fund for the Environment; Natural Resources Conservation Service - Wildlife Habitat Incentives Program; United States Fish and Wildlife Service - Fishery Operational Needs System.



View of the Bride Brook project location prior to restoration. The original 200-foot long culverts extended from the headwall a few feet downstream of the railroad arch, to the concrete saddle that lies in the intertidal zone. Photo courtesy of Microsoft Bing maps.

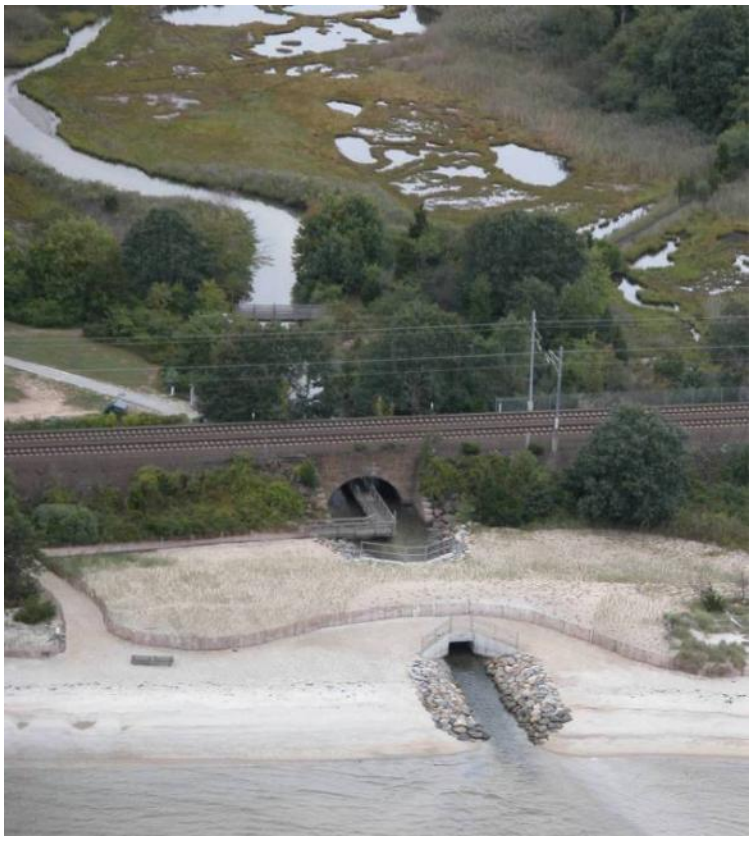


Photo of the mouth of Bride Brook after project completion, from September 2010. The new concrete box culvert and stone-lined channel have stabilized the connection between Long Island Sound the marsh system to the north. 90% of the dune planting has been completed to date, with only a narrow strip remaining. This section will be planted in spring 2011, after final modifications have been made to the armored slopes of the channel. Photo courtesy of CTDEEP.

Burritt Cove Tidal Marsh Restoration

State: Connecticut

Town: Westport

Habitat Type: Tidal Wetland

Acres Restored: 0.16

Cause of Degradation: A small tidal wetland was cut off from tidal flow many years ago when an earthen berm was installed along its western edge. Since then the area was landscaped and a pond with freshwater, non-tidal wetlands had formed. An extremely undersized, 2" diameter pipe connected the pond to Burritt Cove, but it tended to clog with sediment and organic debris rather frequently. Water also would overtop the berm on the highest high tides, but could not drain out. Water in the pond was often stagnant, and the area around the pond required almost constant maintenance. The pond also attracted geese, which contributed to the problem by increasing nutrient levels and resulted in algal blooms.

Project Description: The berm was breached, the non-functioning pipe was removed, and two channels were created to facilitate tidal flow into and out of the restored tidal marsh. Sections of the pond and the surrounding (formerly) freshwater wetlands were landscaped to restore the proper elevation for healthy tidal wetlands. After construction was completed, biodegradable coir blankets were rolled out over the area and native tidal marsh plants were planted.

Implementation Partners: Private property owners, and Connecticut Department of Energy and Environmental Protection – Office of Long Island Sound Programs.

Funding Provided By: Property owners.

Restored tidal marsh along Burritt Cove, looking upstream (north). Photo courtesy of William Kenny Associates LLC.

Duck Pond

State: Connecticut

Town: Old Lyme

Habitat Type: Tidal Wetland, Riverine Migratory Corridor

Acres Restored: 5.4

Miles Opened: 0.3

Cause of Degradation: A berm at the upstream end of the culvert in the Duck River under Library Lane blocked tidal flow, and reduced fish passage. The pond historically was used as an ice pond and was a water source for fire suppression efforts. The berm caused the water to stagnate and led to unnaturally high levels of mosquito breeding.

Project Description: The berm was removed to allow better flow of tidal water, which also greatly improved fish passage. The pond now drains at low tide and fills up again during spring high tides. Anadromous fish species, such as alewife and white perch, are now better able to through this system to their historic spawning areas.

Funding Provided By: Connecticut Department of Energy and Environmental Protection - Wetland Habitat & Mosquito Management Program

It's difficult to detect in this photo, but the cattail plants visible at the end of the short creek are growing on the earthen berm that is the cause of the ponding water and mosquito breeding. Photo courtesy of CTDEEP.

With the dike removed, water and fish can move freely between Duck Pond, the Duck River, and all other habitats beyond. Photo courtesy of CT DEEP.

Tweed – New Haven Airport Tidal Marsh Restoration

State: Connecticut

Town: New Haven and East Haven

Habitat Type: Tidal Wetland

Acres Restored: 70.5

Cause of Degradation: A series of six tidegates was installed in Morris Creek (New Haven) prior to 1915 for mosquito control. The tide gates leaked a little bit, but not enough to maintain healthy tidal wetlands. The tidegates significantly reduced upstream tidal flow during the flood tide, but flapped open during the ebb tide to drain storm water off the marsh and out of the system. The entire tidegate structure has been replaced several times since the initial installation in (prior to 1885), but their purpose had remained unchanged until the completion of this project.

Project Description: As required by the Federal Aviation Administration, Tweed-New Haven Regional Airport had to increase size of the Safety Area at the southern end of runway 2. But bringing the airport up to code meant filling in approximately 12 acres of tidal wetlands. The permit issued by CTDEEP to authorize the filling of wetlands also required compensation in the form of tidal marsh restoration. As part of this airport upgrade project, the City of New Haven agreed to upgrade the tidegate structure that lies just downstream of the airport in Morris Creek. The six flap-gates were removed and replaced with a new electronic and mechanically controlled tidegate system. Five gates are now present with two larger ones that remain open to tidal flow until water reaches the Mean High Water mark (3.5' NGVD). The other three smaller gates function as the prior flap-gates had, and all of the gates can be sealed shut to prevent tidal flooding from coastal storms.

The final result of the project yielded no net loss of tidal marsh, as new areas of wetland were restored by fill removal to make up for the authorized marsh loss. The tidal flow now reaches approximately 70.5 acres of wetlands above the tidegates. As a supplement to tidegate modification, certain areas of tidal marsh were enhanced with phragmites control, tidal creeks and ponds were created to improve flow within the system, and planting of native marsh grasses - the source of which was from the 12-acre site that was filled. Blocks of vegetated marsh peat were excavated, removed from the fill site, and relocated elsewhere within the restored marsh. The project included (1) the removal of removal of tide gate(s), and (2) other enhancements to tidal flow & circulation within the restored marsh.

Implementation Partners: Tweed-New Haven Airport Authority; City of New Haven; Town of East Haven; Connecticut Department of Transportation; Connecticut Department of Energy and Environmental Protection - Office of Long Island Sound Programs; Federal Aviation Administration.

Funding Provided By: Tweed-New Haven Regional Airport; City of New Haven; Federal Aviation Administration.

Six tidegates existed in Morris Creek downstream of the airport prior to construction (see top picture), with two in each section of the dam. The new tidegate arrangement (bottom picture) and management includes two large electronically controlled gates at each end of the dam, and three smaller mechanically operated gates in the center. These center gates operate as standard flap gates, while the other two are raised up vertically (open) at low tide, and are lowered (shut) when the rising tide reaches approximately 3.5' NGVD. Photos courtesy of Marshall W. Dennis, Wetlands & Wildlife, Inc.

Wakeman Island Tidal Marsh Restoration

State: Connecticut

Town: Fairfield

Habitat Type: Tidal Wetland

Acres Restored: 2

Cause of Degradation: One segment of a large, mosquito-ditched tidal marsh system along Pine Creek was filled between 1968 and 1974. The filled area was once part of a landfill, and not filled very deep. This area essentially occupied one of the rectangular tidal marsh panels created during the mosquito ditching process.

Project Description: As a result of unauthorized work at a boat launch in another part of town, the Town of Fairfield agreed to take on this tidal marsh restoration project as part of the requirements of a consent order issued by the CTDEEP's Office of Long Island Sound Programs. Approximately 2500 cubic yards (150-feet x 75-feet x 1 to 4-feet deep) of fill were removed from a filled section of tidal marsh. This filled section of marsh effectively cut off most of the tidal flow to a small, 2-acre pocket marsh that lies northeast of it. A tidal creek was also created through the fill removal site to increase tidal exchange between Pine Creek and the pocket marsh.

Implementation Partners: Connecticut Department of Energy and Environmental Protection - Office of Long Island Sound Programs, Town of Fairfield.

Funding Provided By: Town of Fairfield.

Photo of the area where fill was removed and a creek was excavated to help improve tidal exchange between Pine Creek and pocket marsh (background). Photo courtesy of Kevin Zawoy, CTDEEP.

West Point Road Park Tidal Wetland Restoration

State: Connecticut

Town: Branford

Habitat Type: Tidal Wetland

Acres Restored: 2.5

Cause of Degradation: Two adjacent parcels of tidal marsh were near completely cut off from tidal flow due to (1) the presence of a berm between a healthy Stony Creek marsh and the western degraded parcel; and (2) an undersized culvert connecting the eastern degraded parcel to a healthy tidal marsh system and LIS.

Project Description: As a result of unauthorized work at a seawall in another part of town, the Town of Branford agreed to take on this tidal marsh restoration project as part of the requirements of a consent order issued by the CTDEEP's Office of Long Island Sound Programs. The project included (1) the removal of 40 linear feet of berm along the western edge of the western degraded marsh parcel; and (2) installing a 30-inch diameter pipe under the dirt road that leads to the park. There was already one 30-inch pipe here, and the new one was installed next to it. 600 feet of tidal creek (4-feet wide x 2-feet deep) was created to connect the berm to the upstream end of the pipes. The spoil material from the creek excavation was placed between the ballfield and the tidal marsh.

Implementation Partners: Connecticut Department of Energy and Environmental Protection - Wetlands Habitat and Mosquito Management Program; Town of Branford.

Funding Provided By: Town of Branford.

Aerial photo of the park, project location, and surrounding features taken before construction began. The exact locations of the project's two components are circled above. Photo courtesy of Microsoft Bing Maps.

In this photo taken after project completion, the partial berm removal and the new channel are visible. The new channel allows tidal water to once again flow through the marsh located north of the ballfield, and allows tidal flushing of the marsh east of the ballfield from both the north and south. The new culvert was installed at the site indicated by the arrow. Photo courtesy Google Earth.

Continental Farm Tidal Marsh Restoration

State: Connecticut

Town: Stonington

Habitat Type: Tidal Wetland

Acres Restored: 35.8

Cause of Degradation: The primary tidal creek in this brackish marsh system had become filled in with sediments and plant debris. *Phragmites australis* started taking over. The southwestern-most portion of this system had been converted to a (barely) tidal pond during construction of a nearby home.

Project Description: The primary tidal creek and select mosquito ditches were cleaned to restore tidal flow throughout the interior of the marsh system. Some tidal ponds were also created to restore historic bird habitat that was lost to mosquito ditching. This project also included the restoration of tidal flow to the tidal pond created on a residential property, although this portion is not truly habitat restoration. The existing 12" diameter pipe incorrectly installed at 3'NGVD was replaced by the property owner with a 24" pipe at -1'NGVD, which allowed the tidal pond to return to a functioning tidal marsh.

Implementation Partners: Connecticut Department of Energy and Environmental Protection - Wildlife Division, Private Landowners.

Funding Provided By: Connecticut Department of Energy and Environmental Protection - Wetland Habitat & Mosquito Management Program; Connecticut Duck Stamp Program; Private property owners.

Clearing of peat, sediments, and plant debris from an old ditch that had become filled in. The tidal exchange to this area of the Continental Farm tidal marsh was restricted, allowing *Phragmites australis* to come in and out-compete the native marsh grasses. Photo courtesy of CTDEEP.

Bar Beach Lagoon

State: New York

Town: Port Washington

Habitat Type: Tidal Wetland

Acres Restored: 0.2

Cause of Degradation: The project site had been historically filled with industrial debris.

Project Description: This project is a continuation of a restoration project completed in 2003, located in a public park near an industrially developed area within Hempstead Harbor. The project entailed removal of debris, fill, and invasive species. The site was re-graded and planted with *Spartina alterniflora*. Goose exclusion fencing was utilized to discourage grazing on the young plants. Erosion control fencing also was used to better allow plants to take root. This was the third phase of restoration within the lagoon.

Implementation Partners: Town of North Hempstead

Funding Provided By: Town of North Hempstead

Smooth cordgrass (*Spartina alterniflora*) plantings on the newly re-graded portion of Bar Beach Lagoon. Picture provided by the Town of North Hempstead.

Mattituck Barge Removal

State: New York

Town: Mattituck

Habitat Type: Tidal Wetland

Acres Restored: 0.5

Cause of Degradation: Mattituck Creek has long been utilized for commercial purposes, being the easternmost major waterway on the North Fork. The project site was previously an offloading point for barges carrying bluestone, which was used in the eastward expansion of the Long Island Expressway.

Project Description: Through various land acquisitions, the New York State Department of Environmental Conservation was able to piece together enough land to open a public boat launch facility on Mattituck Creek. Much of the site had previously been under industrial uses over the previous 50 years and the shoreline in the vicinity of the barge removal offered little habitat value. The parcel containing the remnant barge had been an offloading site for bluestone that was being used during the eastward expansion construction of the Long Island Expressway. After the business was no longer profitable the bulkhead began to fall into dis-repair. As part of the public access project, the old barge was removed as was some of the debris from the bulkhead. The shoreline was re-graded and native salt marsh plants were planted. Goose exclusion fencing was used to discourage birds from feedings on the young plantings. After the plantings have become established, the remaining sections of bulkheads will be cut down, creating a low-sill bulkhead to allow additional tidal flow to the shoreline.

Implementation Partners: New York State Department of Environmental Conservation, Town of Southold and the Southold Town Trustees

Funding Provided By: U. S. Fish and Wildlife Service, sport fish restoration program

Picture of remnant barge area prior to removal and the condition of the bulkhead that fell into disrepair. Photo by Heather Young, NYSDEC.

Picture of same area after barge removal. The shoreline has been re-graded and planted with tidal wetland species. Remaining sections of bulkhead will be removed after plants have become more established. At this point, plants have been in the ground for a few months. Photo by Heather Young, NYS DEC.

Turtle Cove

State: New York

Town: Bronx

Habitat Type: Tidal Wetland

Acres Restored: 4

Cause of Degradation: An old horsecar corridor cut off tidal flow to a formerly connected tidal wetland. In the mid-1990's a culvert was re-designed to improve tidal flow to the Turtle Cove South from Eastchester Bay. Turtle Cove North was still blocked from receiving tidal flow from the remnants of a berm that used to serve as the thoroughfare for a horsecar during the early 1900's.

Project Description: The culvert was re-modified to allow greater tidal connectivity to Eastchester Bay. The former horsecar road was breached to allow tidal flow to reach Turtle Cove North, and a bridge was constructed over the opening to allow the public to better view the restoration site. Volunteers were used to plant upland plants during the project period. For more project pictures please, including aerials from the 1920's of the project site check our habitat restoration database (http://lisshabitatrestoration.com/search.aspx).

Implementation Partners: New York City Department of Parks & Recreation, New York State Department of Environmental Conservation, Metropolitan Transportation Authority, New York City Department of Transportation.

Aerial images of the project area in 2008 during invasive control treatments and in 2011, after the berm had been breached, where the new channel can faintly be seen. Aerial photo from 2008 is courtesy NYS Digital Orthoimagery program, 2011 aerial is courtesy United State Department of Agriculture's National Agriculture Imagery Program.

RIVERINE MIGRATORY CORRIDOR RESTORATION

The Connecticut Riverine Migratory Corridor (RMC) team, led by the CT DEEP Inland Fisheries Division, completed three migratory fish passage projects resulting in 5.8 additional river miles now accessible to anadromous finfish. The three RMC projects are summarized in the preceding tidal wetlands section and the freshwater wetlands section that immediately follows this overview.

The 10-year goal (1998–2008) for this habitat type is to open up 100 currently inaccessible river miles to diadromous fish. Due to success in reaching the goal, the 2006 MOU added an extra 50 miles to the HRI goal to be reopened to migratory fish passage by 2011, this goal was met in 2007. To date, 160. river miles have been restored through fish passage projects such as dam modifications or dam removal. River mileage for projects completed in 1998–2010 is presented in Figure 3. No individual project summaries follow in this section as the RMC projects for 2010 were multi-faceted projects that are described in the tidal wetland and freshwater sections of the annual report. For those projects, RMC miles opened is listed in addition to the acres restored.

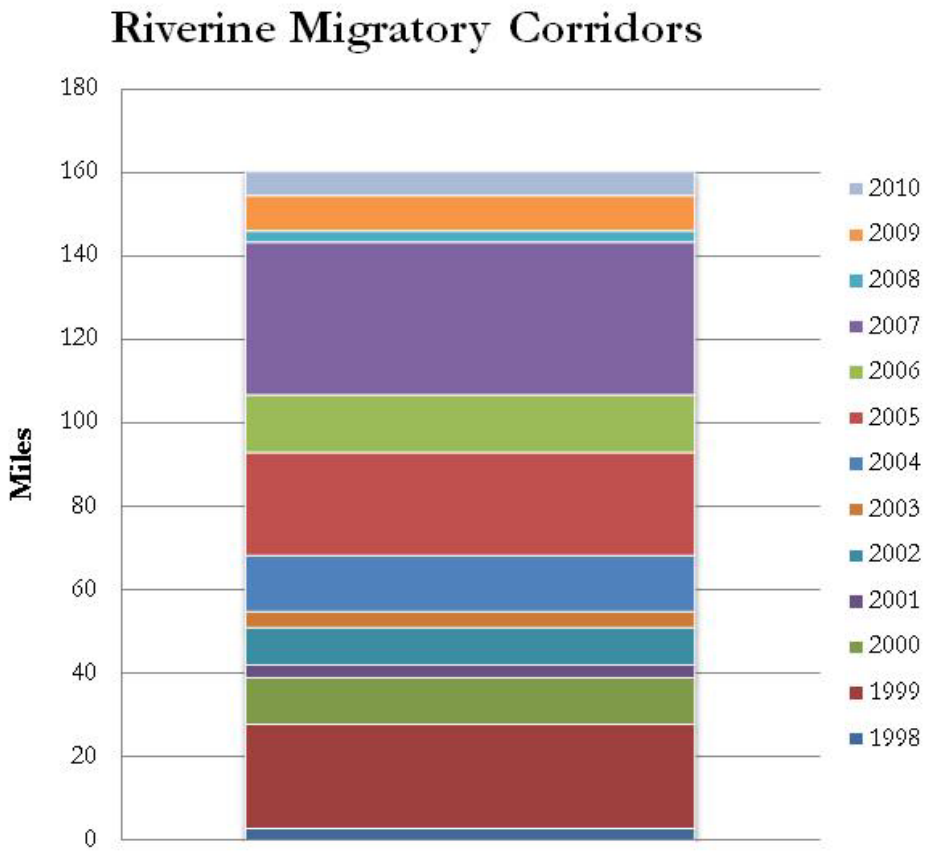


FIGURE 3. Cumulative river mileage (160.4 miles) for RMC projects completed between 1998–2010.

Connecticut's RMC team also worked on 28 other projects that were in various stages of development. Three projects that included fish passage benefits were completed in 2010 and were

directly associated with the restoration of another habitat type. These projects are listed below and can be found in other portions of the 2010 annual report.

- 5.2 miles of Brides Brook, East Lyme, CT. Please see the Brides Brook project summary in the Tidal Wetlands chapter of this report.

- 0.3 miles of the Duck River, Old Lyme, CT. Please see the Duck Pond project summary in the Tidal Wetlands chapter of this report.

- 0.4 miles of an unnamed tributary of the Nissequogue River, Kings Park, NY. Please see the Harrison Pond project summary in the Freshwater Wetlands chapter of this report.

Freshwater Wetland

The term 'freshwater wetlands' is used collectively to describe the diverse range of non-saline (and non-tidally influenced) ponds, bogs, fens, swamps, and marshes found in the world. The U.S. Fish and Wildlife Service wetland classification system created by Cowardin et al. (1979)[1] categorizes freshwater wetlands in the United States as palustrine, lacustrine, or riverine systems. The classification system also addresses deep-water habitats where the substrate is predominantly non-soil and flooding is permanent, but those types of wetlands generally are not included in the Long Island Sound Study Habitat Restoration Initiative.

Palustrine Systems

Palustrine wetland systems are defined by Cowardin et al. (1979) as non-tidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens; or they may be non-vegetated, shallow water areas (less than six feet deep) with no wave formed or exposed bedrock shoreline features. To be considered palustrine, these non-vegetated areas must be less than 20 acres in size.

Riverine Systems

Riverine communities are defined by Cowardin et al. (1979) as "all wetlands and deep water habitats contained within a channel" except those that are dominated by persistent emergent vegetation, trees or shrubs (palustrine), or have more than 0.5 ppt ocean derived salinity (estuarine, marine). Community types are classified by the rate of water flow, which, in turn, dictates the substrate composition and faunal and vegetation types present. Although the Cowardin et al. system also includes tidally influenced, freshwater, non-persistent emergent riverbank vegetation, such as wild rice, all tidally influenced wetland restoration sites were included in the **Tidal Wetlands Restoration** chapter of this report.

Restoration Objectives

The major cause of wetland degradation is the alteration of the hydrology in the wetland system. This alteration may be caused by a number of activities such as draining, filling, and impounding. In the past, surface water supplies to wetlands have been diverted for drinking water reservoirs, flood control projects, cooling of industrial plants, and irrigation of crops. Other degradation may be caused by chemical inputs to wetlands, or invasion by exotic species. While degradation is caused by unique combinations of circumstances in each affected wetland, some general causes and restoration methods can be outlined. These methods include fill removal, invasive species control, relocation of excessive runoff, and other hydrological modifications.

In New York, one freshwater wetland restoration project was completed during 2009, for a total of 0.5 acres restored.

[1] Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe 1979. Classification of Wetlands and Deepwater Habitats of the United States. U.S. Fish and Wildlife Service, FWS/OBJ.79/31. Washington, DC. 103 pp.

[2] Persistent emergent plants are those that leave all or a visible portion of their foliage above the saturation zone or water surface during the dormant season. Conversely, non-persistent emergents are those plants that leave no portion of their foliage visible during the dormant season.

Harrison Pond Dam Removal

State: New York

Town: Kings Park

Habitat Type: Freshwater wetland, Riverine Migratory Corridor

Acres Restored: 0.5

Miles Opened: 0.4

Cause of Degradation: A small dam blocked fish movement from the Nissequogue River, located in Harrison's Pond Park. The dam, which had been in place for centuries, had partially breached in 2004 during a rain event.

Project Description: The pond had been created over 200 years ago to harvest ice, but during a rain event in September 2004, the small dam failed. This project not only restored freshwater wetland habitat and allowed fish access for the first time in centuries, it also allowed for rehabilitation of the park. The remnant dam structure was removed, re-establishing fish passage for the first time in 200 years. Non-native vegetation around the former pond was removed and replanted with native species. This project marks the first dam removal on the New York portion of the Long Island Sound, on Long Island's only north shore river. In addition to the ecological benefits of dam removal, the project provided for park renovation and public education about the park's habitat. Previously the pond had been fenced off and surrounded by non-native shrubs, which blocked the view of much of the pond.

Implementation Partners: Town of Smithtown

Funding Provided By: Town of Smithtown and National Fish and Wildlife Foundation's Long Island Sound Futures Fund

After the dam was removed, small fish now have access to the tributary that used to feed into Harrison Pond. Photo taken by Heather Young, NYS DEC.

Beaches, Barriers and Dunes

Coastal barriers, beaches, and dunes occur along the shoreline of Long Island Sound and are formed by a delicate balance of erosion, water currents, and wind currents. The presence or absence of sand along the shores of Long Island Sound is the result, in part, of Southern New England's glacial history, resulting in a striking difference in the beaches and dunes found in Connecticut (narrower, low-elevation dunes) versus those found on the north shore of Long Island (wider and much taller dunes).

In the formation of coastal barriers, sand is carried by longshore currents and is deposited in long strips that build parallel to the shoreline. These beaches often extend across the mouths of rivers and bays resulting in a reduced opening to the Sound. As these barriers grow in length and width, dunes may be formed by wind. As these barriers grow, the area behind them becomes more and more protected from wind and wave energy (hence the name barrier beach), allowing for the development of sandy or muddy intertidal flats, formation of estuarine embayments, and creation of tidal wetlands.

All coastal beach habitats are very harsh environments for plants and animals alike. The soils are composed of siliceous sand, quartzite gravel and rock, or a mixture of the two. These soils are often acidic, excessively well-drained, and subject to huge fluctuations in temperature on a daily basis, or even within a tidal cycle. The sand is extremely unstable and plants must be able to adapt to rapid exposure and burial. Salt spray is another important controlling factor in plant distribution. In order for any vegetation to become established on this substrate, it must be tolerant of salt spray, which is toxic to most terrestrial plants. American beachgrass (*Ammophila breviligulata*) is the most common plant species found on our dunes, one of the few native plants that can survive in the sandy and salty environment.

Beaches and dunes serve as critical habitats for several rare, threatened, and endangered species, both plant and animal. Animals that utilize the beach-dune ecosystem during critical life stages include diamondback terrapins and piping plover. Coastal dunes are formed by a combination of wind and wave action, the presence of debris, such as driftwood, or vegetation will encourage sand accumulation in beach environments. Sand will move on and off the beach-dune system during storm events. In addition to being critical habitats in their own right, beaches and dunes serve as the first line of protection for other critical habitats during storm events. These habitats may include estuarine embayments, coastal ponds and inter-dunal swales. Beaches and dunes are not static features; seasonal changes are a part of normal coastal processes. The beach-dune system can be further impacted by natural forces including inlet migration and natural erosion processes events which can be seasonal in nature, however it is important to note that sediment transport may be disrupted by anthropogenic features such as groins or jetties. Major causes of degradation to the beach-dune ecosystem are development and pedestrian foot traffic.

In New York, one beach restoration project was completed during 2010, for a total of 0.37 acres restored.

Bittner Preserve Bulkhead Removal

State: New York

Town: Southold

Habitat Type: Beach

Acres Restored: 0.37

Cause of Degradation: A bulkhead was built to protect a home built near the Sound. During high tides, the bulkhead cut off public access along the beach and was not sustainable over the long term to continue maintaining.

Project Description: This property was publically acquired in 2008. Since the acquisition, the Town of Southold has been removing the site's structures, effectively "un-developing" the site. The house on the property previously had been directly at the Sound's edge, protected by a bulkhead that restricted public access along the beach. The house was demolished and the bulkhead was removed, allowing the beach to restore naturally. In the future, the Town will restore the dune, allowing natural processes to do much of the work. As part of the deconstruction process, many materials were taken from the site for re-use elsewhere, including pallets of bricks and large boulders that had been set in front of the bulkhead as an extra line of defense. Please keep checking the database additional pictures and for future pictures of the beach recovery process.

Implementation Partners: Town of Southold

Funding Provided By: Town of Southold, New York State Department of State - Local Waterfront Revitalization Program

Bittner property after house was demolished and prior to bulkhead removal. Notice high tide line halfway up the face of the bulkhead, which restricted public access along beach. Photo taken by Lillian Ball

Beach area after bulkhead removal. Boulders have been removed for re-use at another location. Photo taken by Heather Young, NYS DEC.