ASH CREEK ESTUARY

Master Plan

Ash Creek Conservation Association, Inc.

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“Despite all the benefits provided by wetlands, the United States loses about 60,000 acres each year.”

United States Environmental Protection Agency

http://water.epa.gov/type/wetlands/outreach/upload/overview.pdf

November 29, 2012

The Ash Creek tidal estuary is one of the few remaining relatively undeveloped tidal estuaries in the State of Connecticut. Its shellfish beds of clams and oysters are teeming with life, migratory shorebird rely on it to rest, feed, and nest. It has abundant plant life which absorbs water overflow, preventing flooding to residences and roads during storms and heavy rains. Tidal estuaries like Ash Creek contain many other varieties of flora and fauna making them one of the most biodiverse resources in all of nature.

Amazingly, this natural resource is uniquely situated in a dense, urban area, which is rare for a small tidal estuary as most of them have been filled in or destroyed by development. Bridgeport has very few natural open space areas and this is the most vibrant of them all based on its tremendous biodiversity.

The reason Ash Creek is so abundant with life is that this tidal estuary has been self-restoring itself over the past 60 years thanks to the efforts of grassroots citizen organizations. It takes foresight to protect the environment for future generations and a willingness to care about the future beyond our lifetimes. We are grateful that others did this so we can enjoy its natural beauty today and we want to do our part to help future generations enjoy it as well.

Our grant-funded scientific study of Ash Creek will provide an initial important phase of an Ecological Master Plan for the Ash Creek Tidal Estuary. In this report, scientific consultants present written descriptions of their findings illustrated with appropriate maps, photos, and drawings. They provide an assessment of the current status of the Ash Creek tidal estuary and prioritization of ecological issues. The scientific data from this study will also be used by the City of Bridgeport as they start work on a Watershed Plan for the Rooster River of which Ash Creek is the tidal outlet to Long Island Sound, with the Southwestern Conservation District, Save the Sound and Fuss & O'Neill.

Funding for this project comes through three sources: the Fairfield County Community

Foundation; the Watershed Assistance Small Grants Program, conducted in association with the Connecticut Department of Energy & Environmental Protection under Section 319 of the Clean Water Act administered by Rivers Alliance of Connecticut, and in-kind donations have also been provided by ecological consultants, Dr. Steve Danzer of Steven Danzer Ph.D. & Associates, a professional wetlands scientist, and Bryan Quinn, RLA of One Nature, a specialist in ecological habitat restoration.

Special thanks to our Advisory Committee consisting of the primary municipal and state stakeholders for the Ash Creek tidal estuary: Tom Steinke, Director of the Town of Fairfield's Conservation Department; Steve Hladun, Project Coordinator for the City of Bridgeport's Parks Department, Joe Ianniello, President of the Black Rock NRZ, and State Representative Auden Grogins for the State of Connecticut.

Mayor Finch of the City of Bridgeport called this project, "a great first step of an important initiative: to bring additional environmental stewardship and an awareness component to the benefit of the City of Bridgeport." Tom Steinke of the Fairfield Conservation Department, added that, "The members of the Ash Creek Conservation Association are tireless in their efforts to protect the creek, and their effectiveness could be focused and magnified with completion of an effective habitat master plan for the Ash Creek tidal estuary." This is a major step forward in protecting the delicate ecosystem of this small, shallow tidal estuary.

We hope you find this report interesting and that it enables you to appreciate this natural wonder in our midst even more than you have in the past.

Sincerely,

Ash Creek Board of Directors

Gail Robinson, Ph.D., President
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ASH CREEK ESTUARY MASTER PLAN

ASH CREEK CONSERVATION ASSOCIATION, INC. · DECEMBER 2012

FUNDING SUPPORT FROM THE FAIRFIELD COUNTY COMMUNITY FOUNDATION, AND PRO-BONO CONTRIBUTIONS FROM THE AUTHORS.

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The purpose of this ecological planning effort is to establish a framework for the systematic development of a comprehensive restoration plan for the enhancement, restoration, use, and management of the Ash Creek estuary.

Ash Creek is one of Connecticut's few remaining ecologically significant tidal estuaries within a densely populated urban area. Many urban tidal estuaries have been destroyed by development or are in such poor condition that they cannot provide habitat for migrating birds, wading birds, seed oysters, hard shell clams, finfish, or opportunities for valuable vegetation like saltmarsh cordgrass to grow. The presence of these species within cities offers residents and visitors a unique experience while providing the ecological community a foothold for future regeneration of ecosystem services.

Ash Creek, in contrast, provides a tremendous number of ecological services. The Ash Creek tidal estuary serves as a wildlife sanctuary for nesting birds, shellfish, and finfish. It is also a breeding ground for horseshoe crabs. The Ash Creek tidal estuary's location along the Atlantic Flyway makes it a prime stopover and feeding location for migratory shorebirds along the Connecticut shoreline. The Ash Creek tidal estuary is also an important area for seed oyster and hard shell clam beds.

In addition to its wildlife and plant habitat, the estuary provides many other services to the community. It provides opportunity for recreation such as walking, nature watching, kayaking, and non-mechanized boating. It serves as flood control for surrounding areas and captures some upstream pollutants before entering Long Island Sound. It lessens and detoxifies pollutant loads before they enter the Sound. It's tidal wetland vegetation stabilizes the shoreline and prevents erosion, and the St. Mary's sand spit buffers wave action during storms. The estuary also provides an aesthetic identity to the surrounding neighborhoods and serves as important open space. These culturally important services improves the quality of life in the local community and in turn enhances local property values.

Ash Creek is also an important part of the local heritage and community. From its earlier colonial uses as a mill site and as an avenue for transportation, to its current usage as community open space and for commercial oystering, the estuary has always

"Next to tropical rainforests, tidal wetlands are the most biologically productive resource in the world."

Connecticut Department of Energy & Environmental Protection

http://www.ct.gov/dep/lib/dep/long_island_sound/coastal_management/twbufferguidance.pdf

served as a place of communion between the local community and their natural resources.

Currently, several local schools use the estuary for environmental education. In Fairfield, the non-profit Mill River Wetland Committee has developed the River-Lab Program to provide classroom materials and activities for students, extensive training for study-trip guides, and professional development for teachers. The program uses outdoor activities to help students from Osborne Hill and Fairfield Middle School discover the principles of river basin systems and their inter-relationships with other important systems and man. In Bridgeport, the Black Rock School, St. Ann's School, the Aquaculture school, and others also use the estuary for environmental education. Of note is the fact that the estuary is bisected by the Fairfield-Bridgeport municipal boundary. This political division creates challenges, complications, and opportunities regarding local planning and management of the creek.

Until recently, traditional planning efforts have been primarily tailored to the natural resources physically located within one municipality or the other. Although Bridgeport and Fairfield have addressed Ash Creek in one form or another in their open space planning (e.g. the City of Bridgeport Open Space Master Plan, the Town of Fairfield Multiple Use Management Plan for Coastal Open Space), these planning documents tend to be specific to their municipal boundaries and rarely do they consider the estuary as a unified whole.

More recent planning efforts have attempted to move beyond the municipal boundaries.Notable efforts include the educational and advisory activities of the Ash Creek Conservation Association, and the currently-in-progress Rooster River watershed planning effort. Ash Creek, although part of the greater Rooster River watershed, is located downstream of the Rooster River, connecting the Rooster River to Long Island Sound. Unlike the Rooster River, Ash Creek is tidal. A comprehensive restoration plan for Ash Creek will serve as a contribution and a compliment to the Rooster River planning effort.

The practical implications of Ash Creek being shared by two municipalities have long

been recognized. The Ash Creek Conservation Association was formed as a unifying organization to protect and preserve the estuary. As such, the Association is ideally situated, and uniquely qualified, to be a bridge between the two municipalities and, therefore, play a central role in developing and coordinating planning efforts for the estuary.

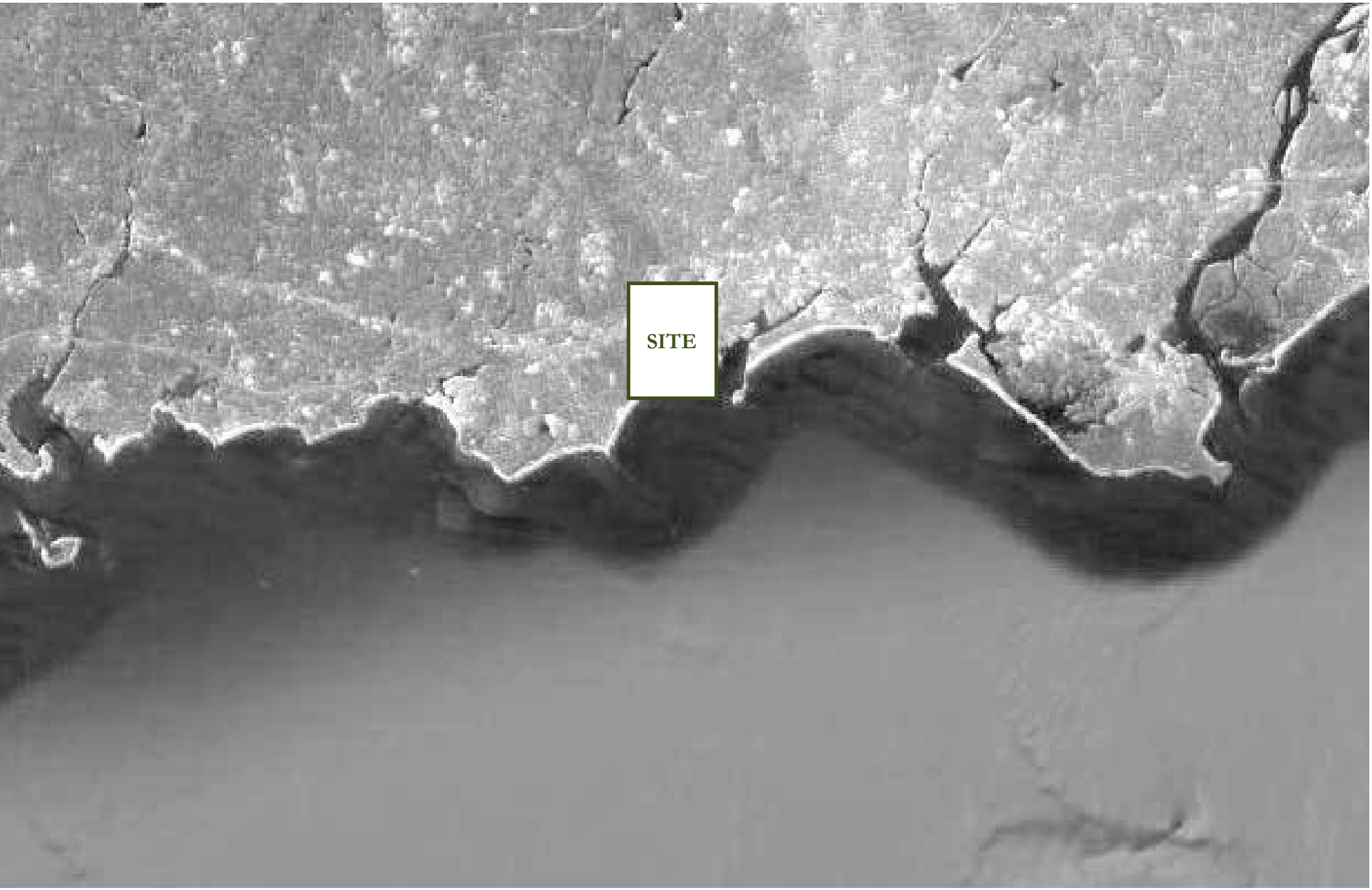
This preliminary study, generously funded by the Fairfield County Community Foundation, by the Watershed Assistance Small Grants Program conducted in association with the Connecticut Department of Energy & Environmental Protection under Section 319 of the Clean Water Act as administered by Rivers Alliance of Connecticut, and by professional pro-bono contributions, is intended to establish a trajectory towards a comprehensive strategy for the restoration, use, and management of the estuary. It is intended as a starting point; it is a way to organize thinking and concerns about the estuary. It is also a point of departure for understanding what is known about the estuary and what still needs to be known.

Once completed, the comprehensive restoration plan will be implemented by the Ash Creek Conservation Association in partnership with stakeholders. This study document will lead to future refinement and implementation of actions that will foster additional protection and more efficient management of the estuary in the shorter term. For the longer term, this study is intended to lead to the completion of a recommended ecological restoration, open space improvement, and stewardship activities within the estuary.

The following sections briefly describe the estuary's defining features, assess its ecological health, and makes recommendations for the improvement of its ecological services. It should be noted that this analysis considers human use (especially for recreation, aesthetic appreciation, and aquaculture) and ecological function.

1934 Aerial


"Migrating birds use wetlands to rest and feed during their cross-continental journeys and as nesting sites when they are at home. As a result, wetland loss has a serious impact on these species. Habitat degradation since the 1970s has been a leading cause of species extinction."
United States Environmental Protection Agency
http://water.epa.gov/type/wetlands/outreach/upload/overview.pdf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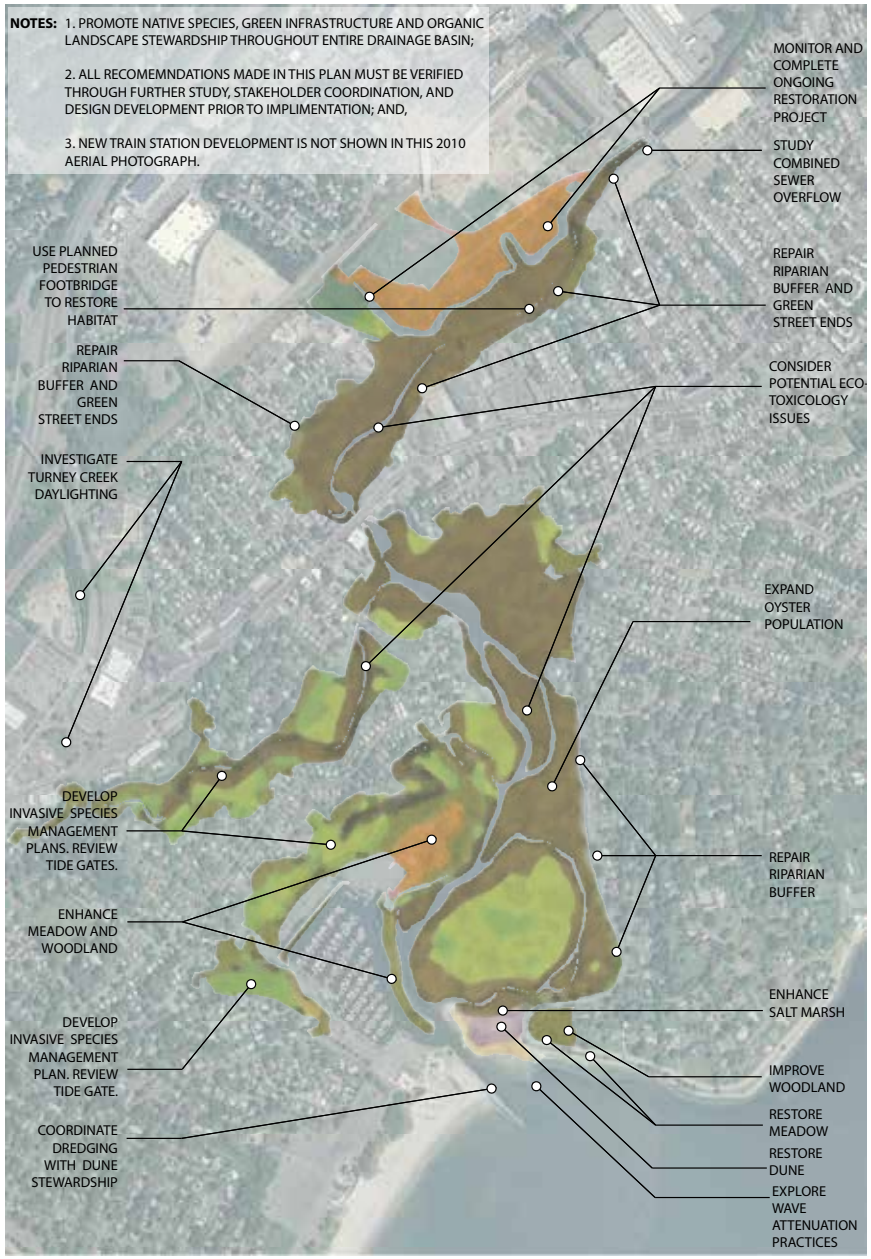
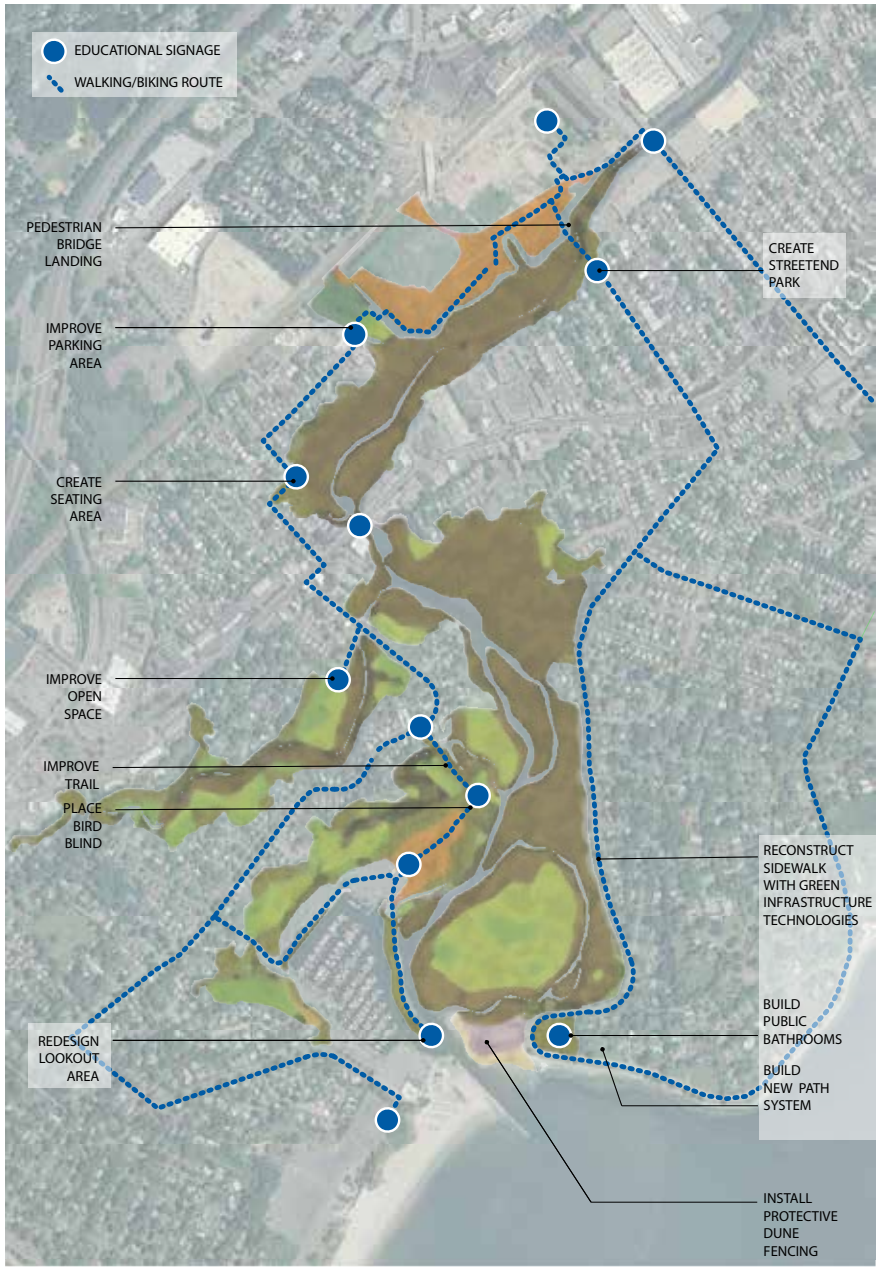


RESTORATION PLAN



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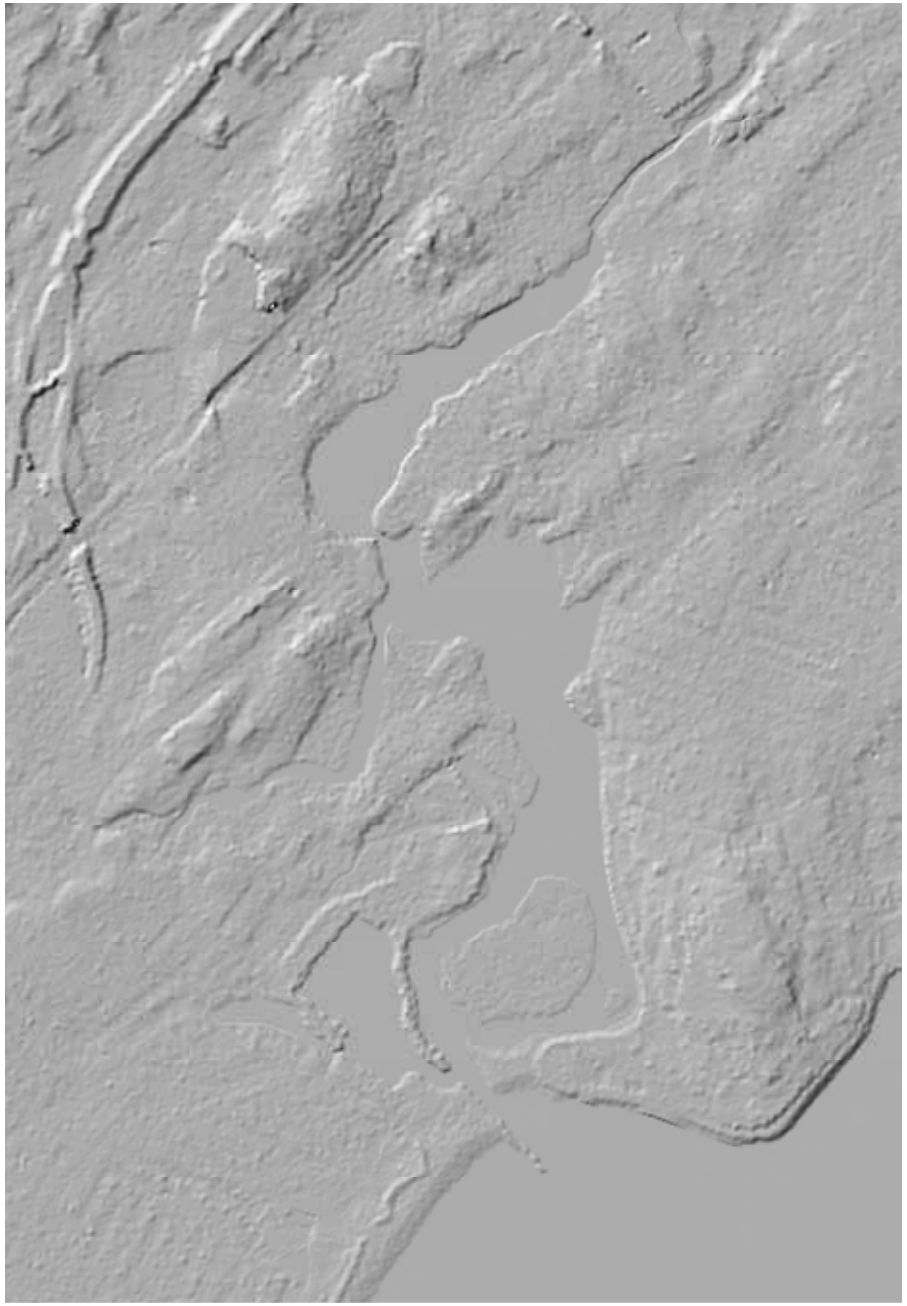

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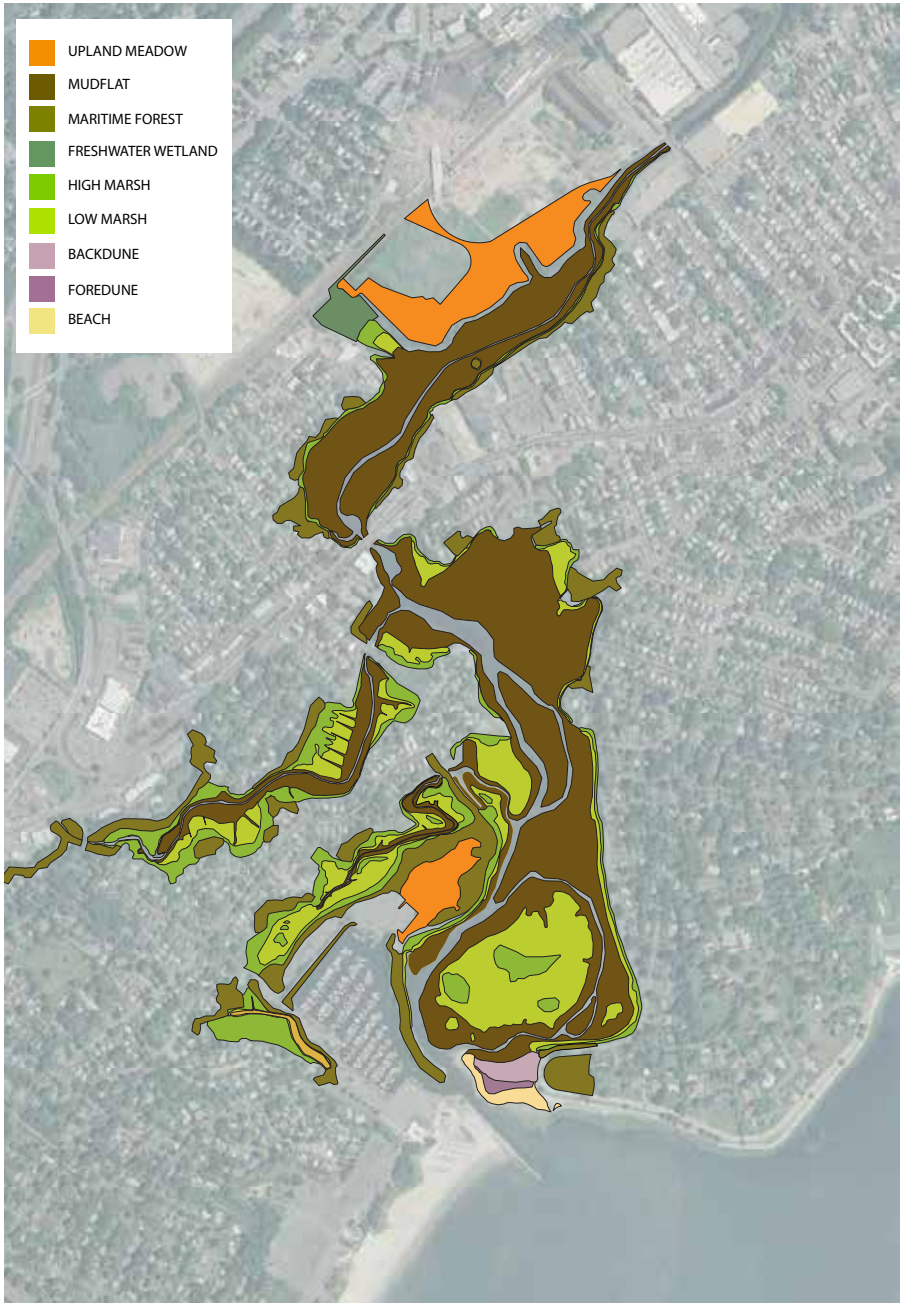
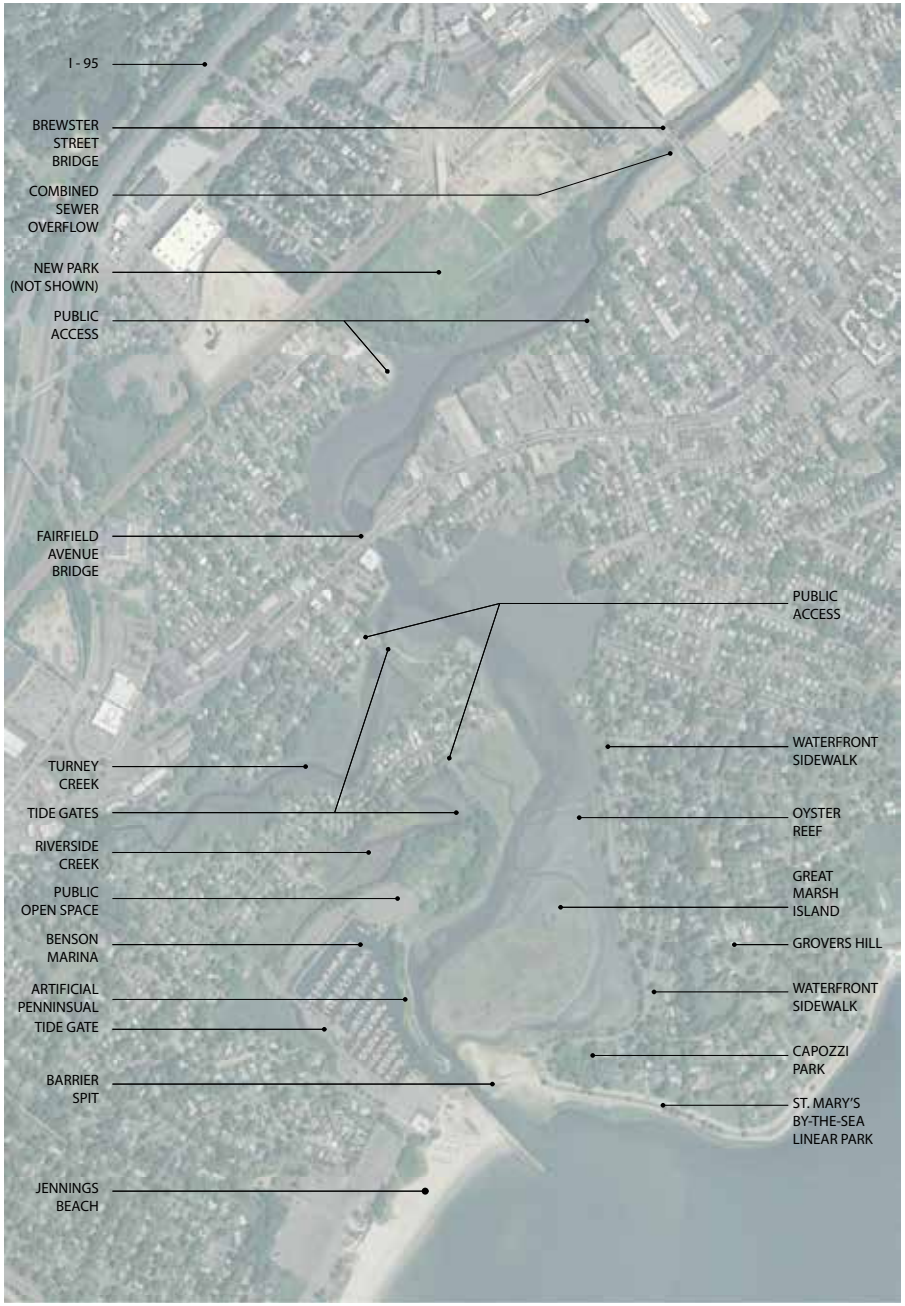
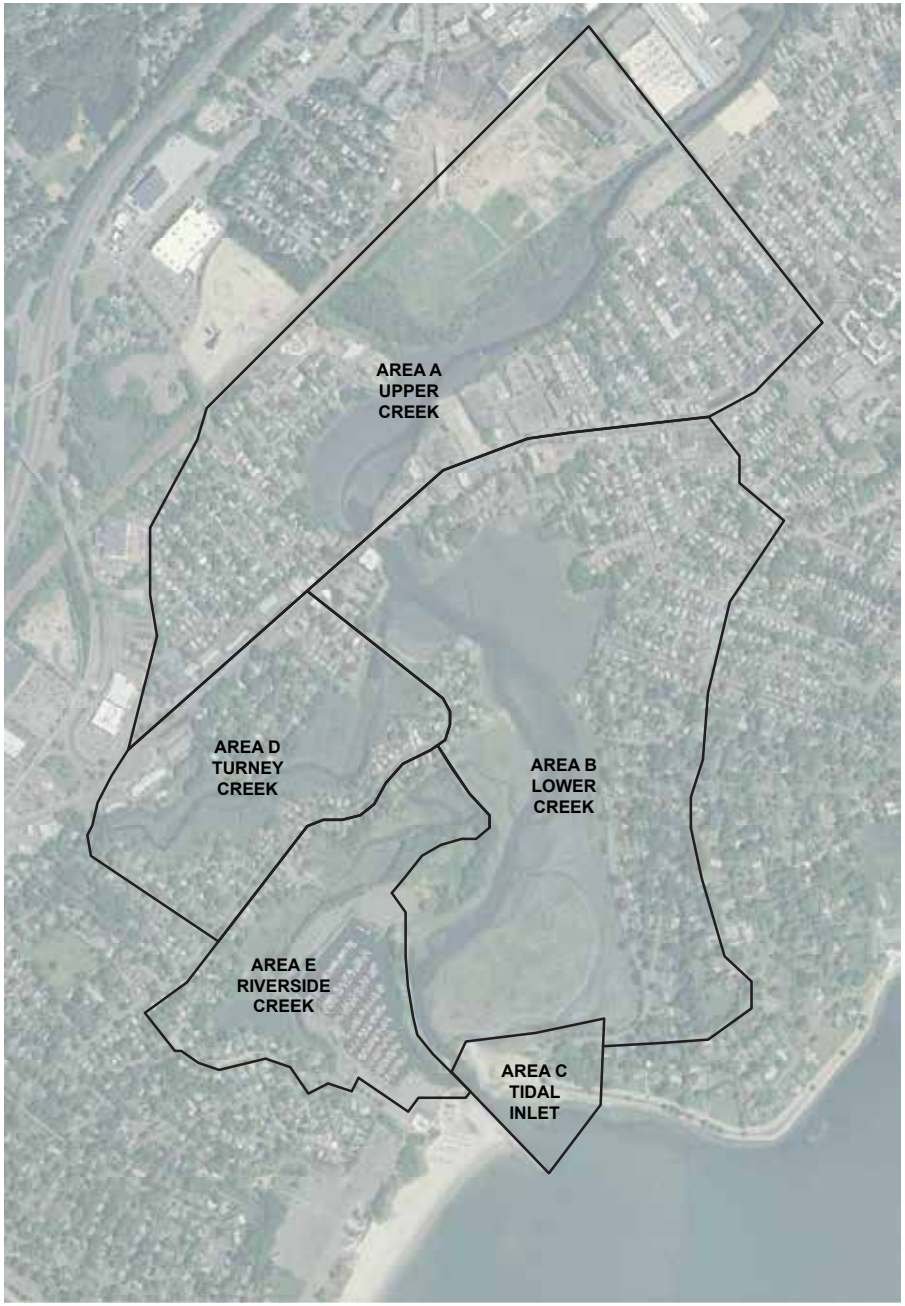


EXISTING HABITAT TYPES



EXISTING CONDITIONS



STUDY AREAS

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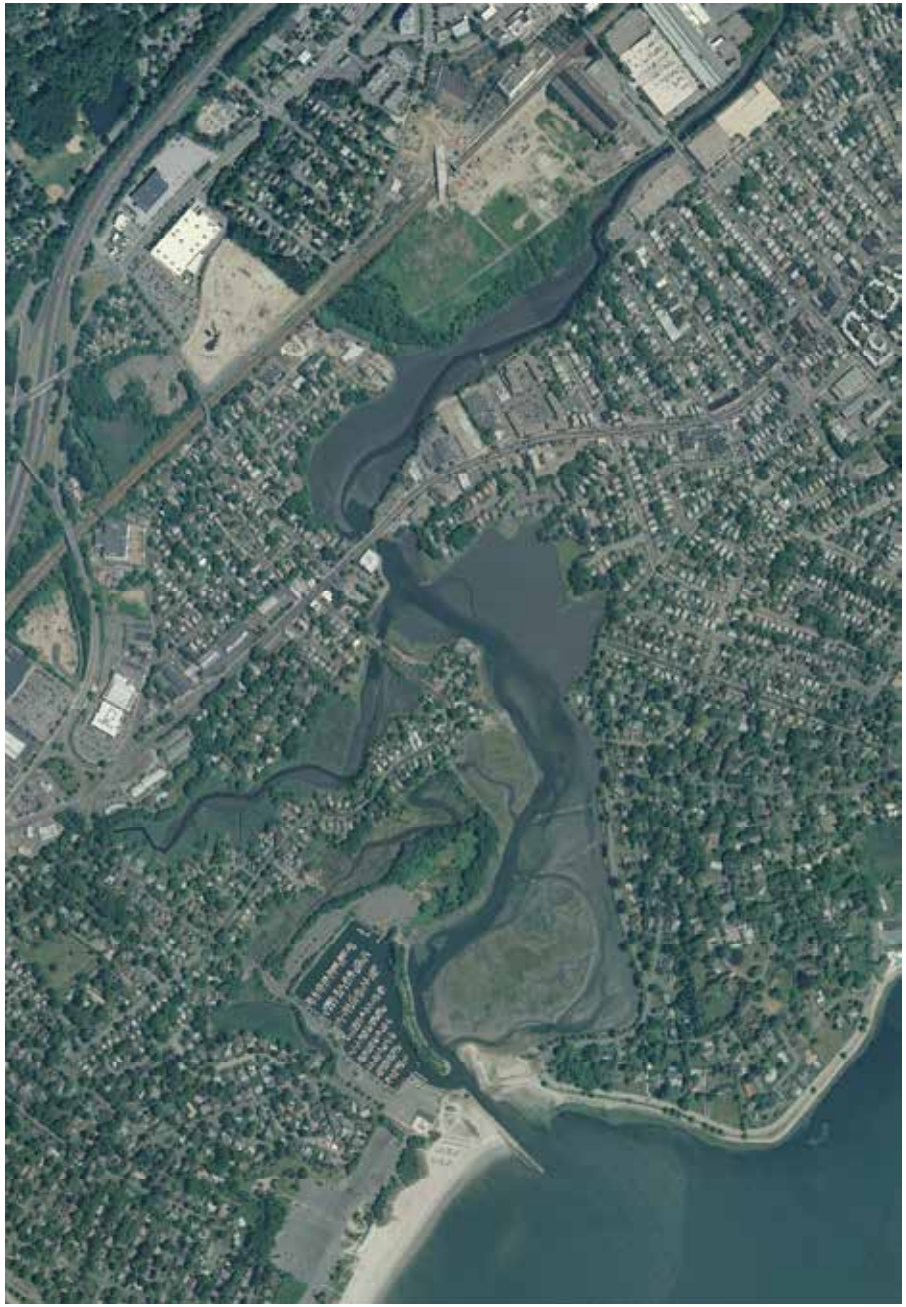
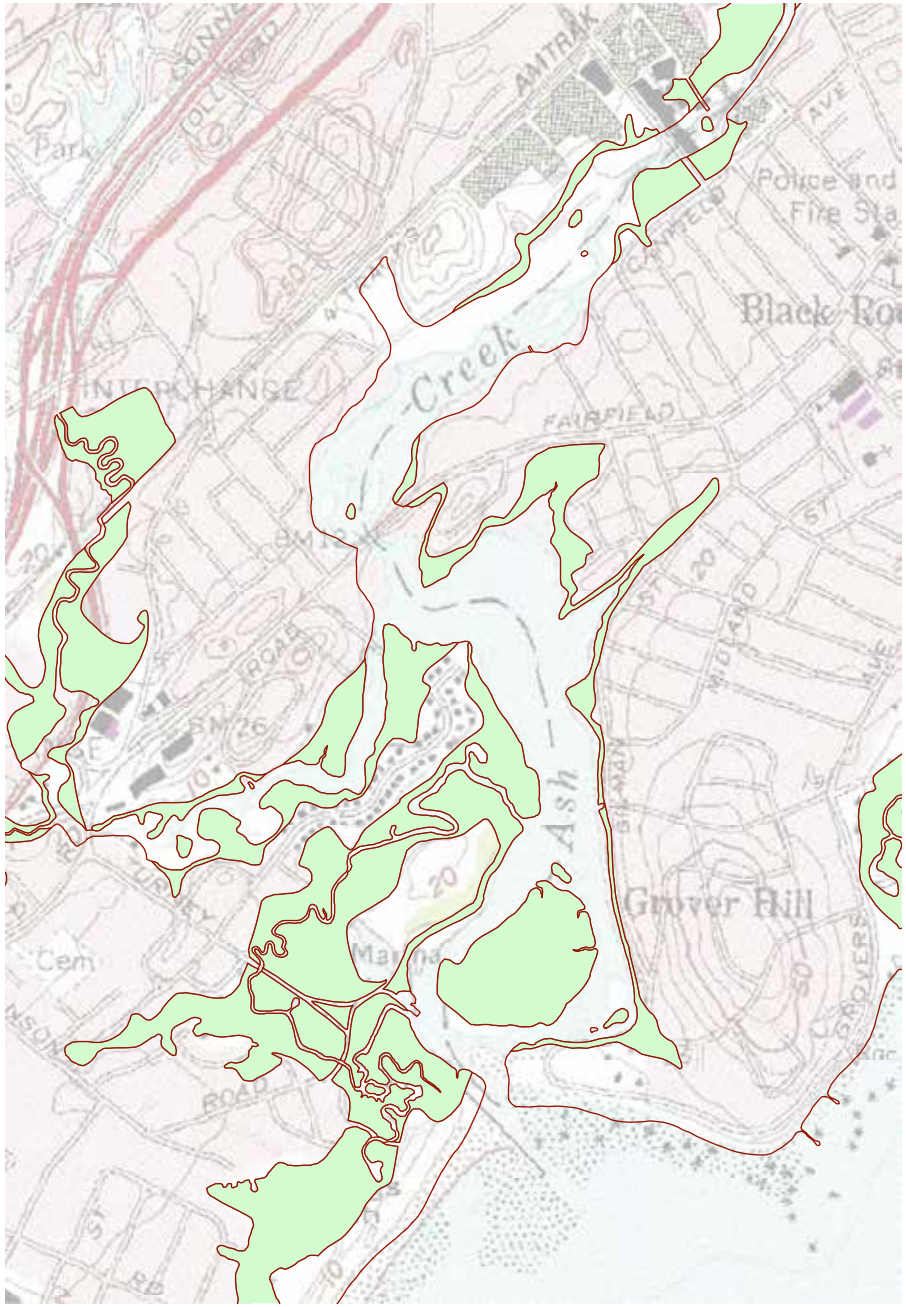
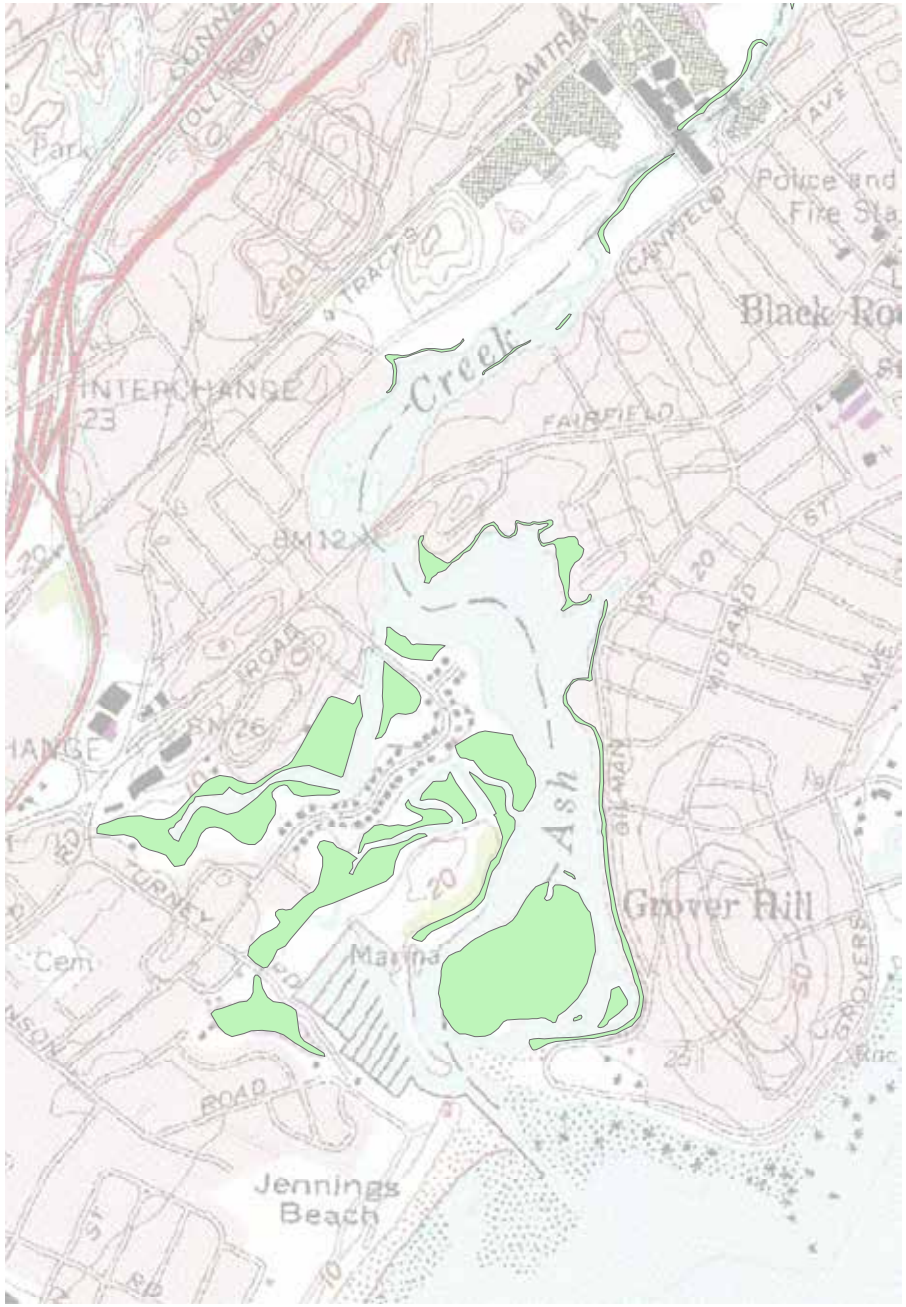


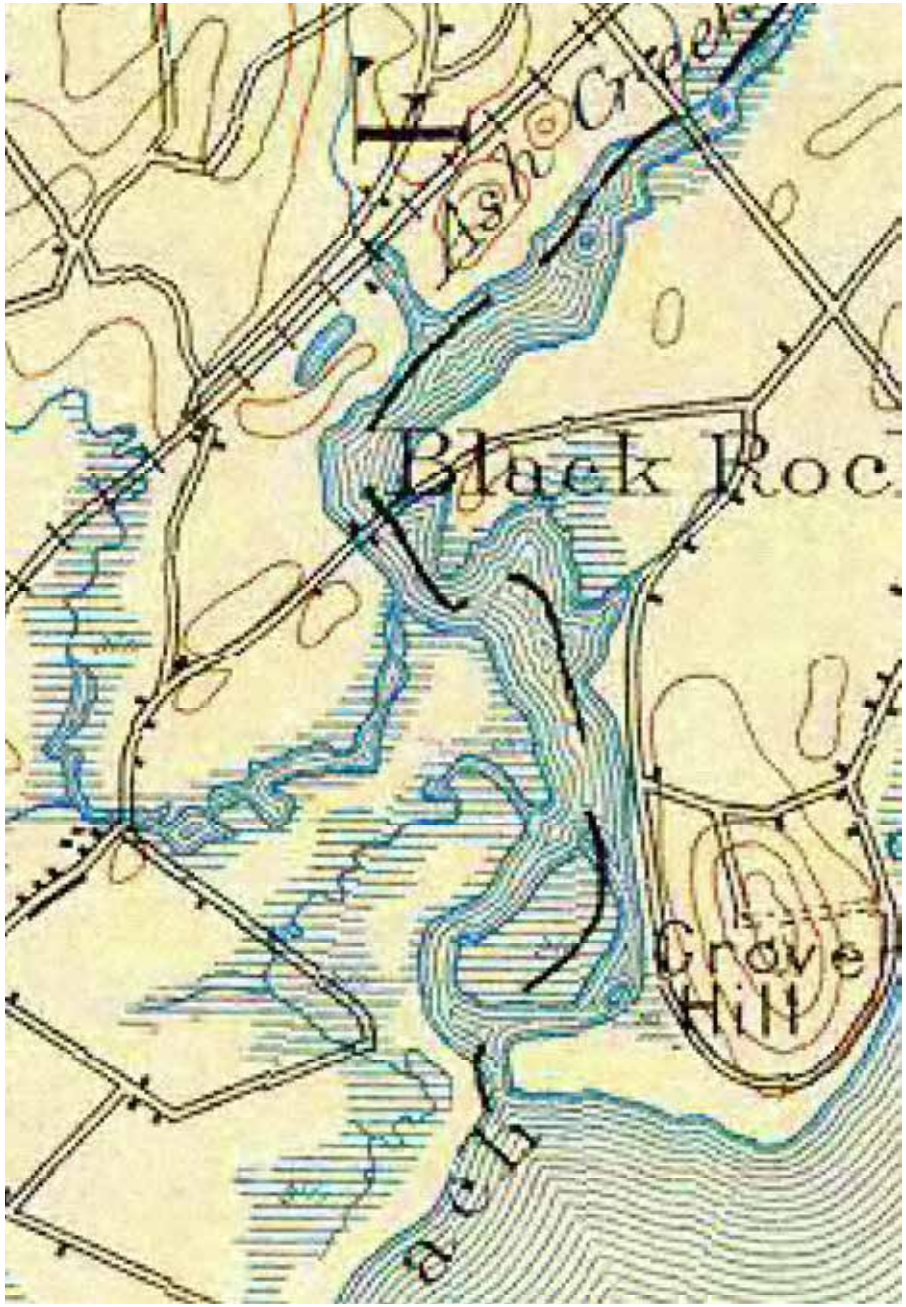
2010 AERIAL (CT DEEP)



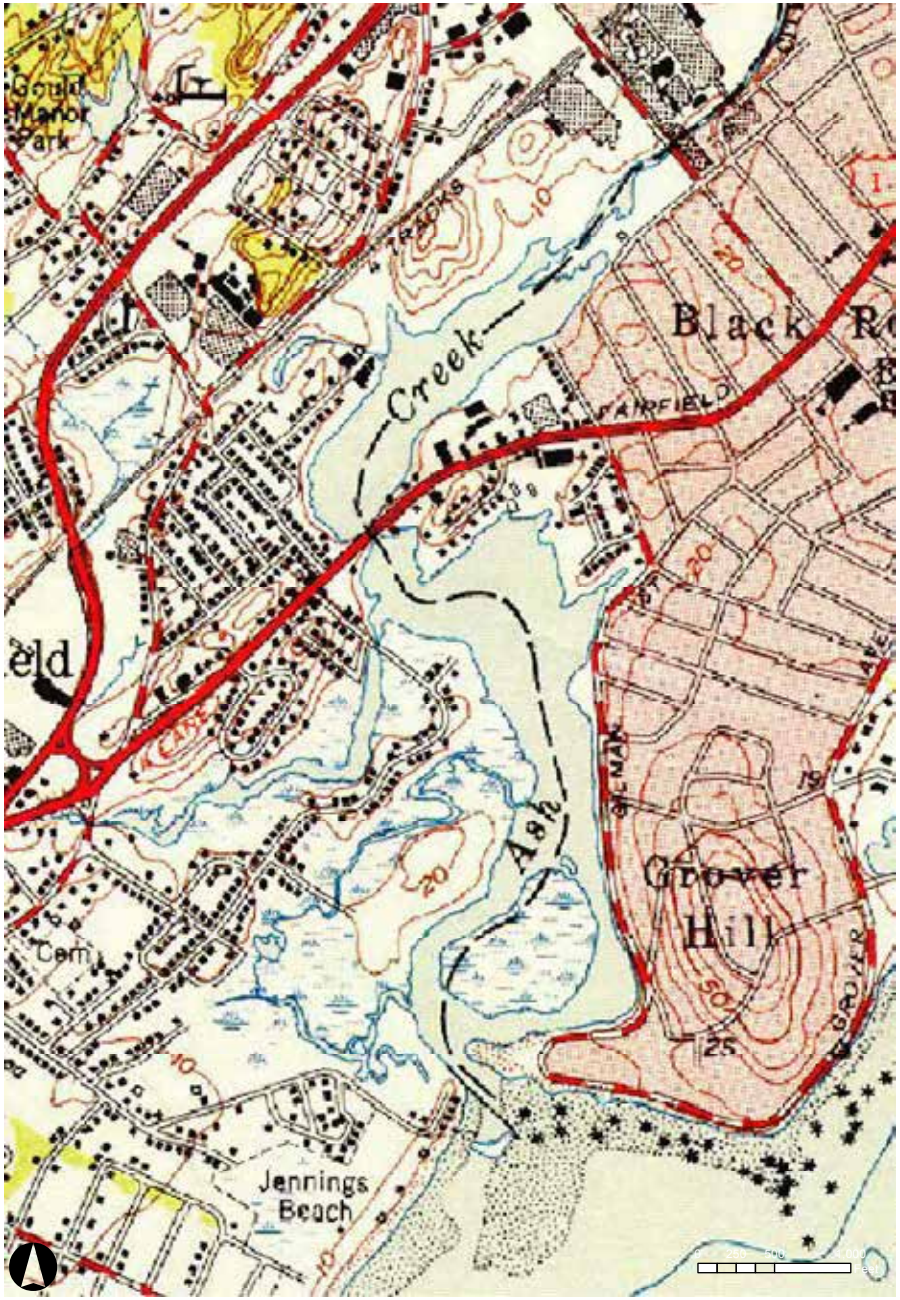
1880'S WETLANDS (CT DEEP)



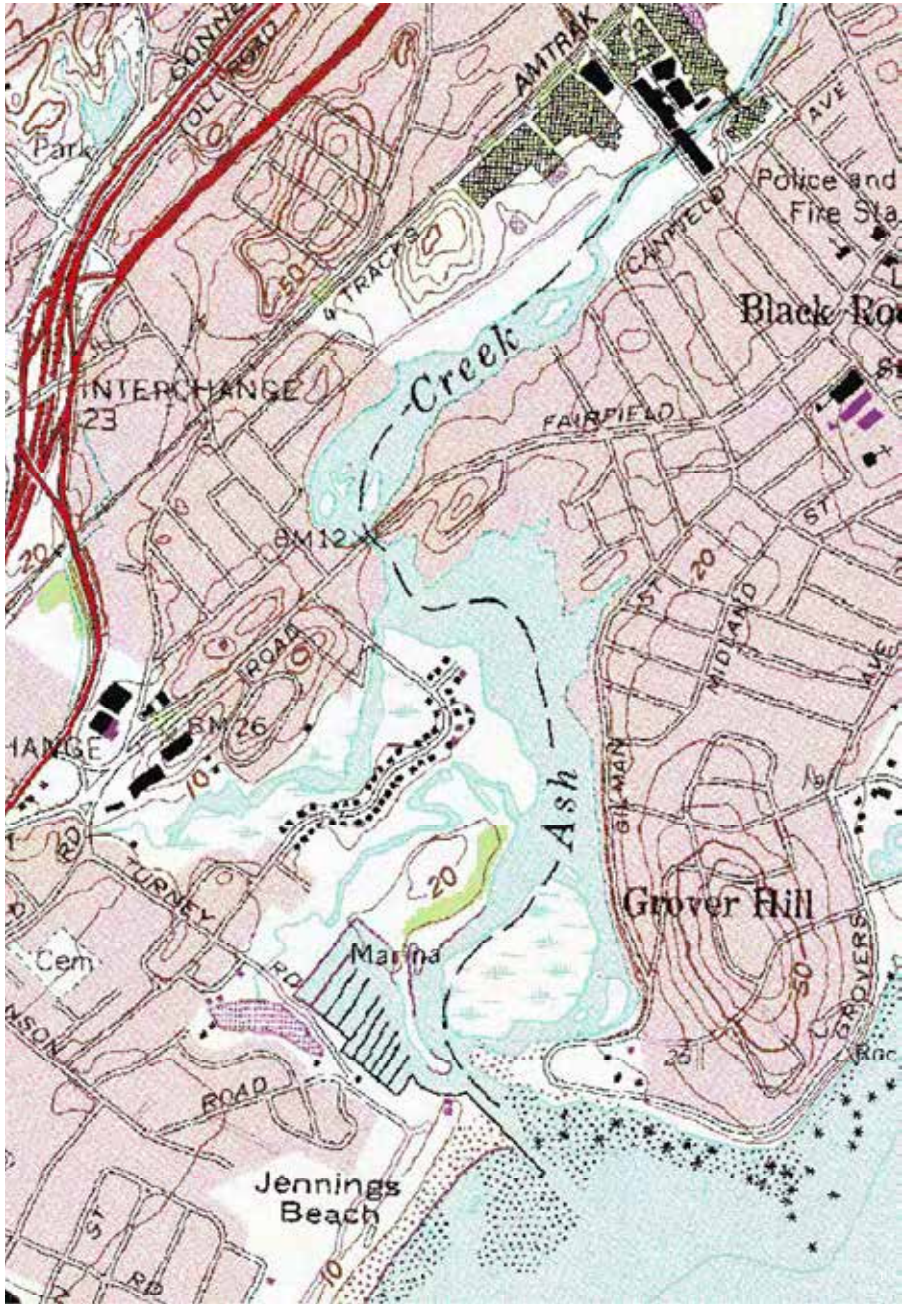
1990 WETLANDS (CT DEEP)



1895 USGS MAP



1940 USGS MAP



1997 USGS MAP

FIGURES

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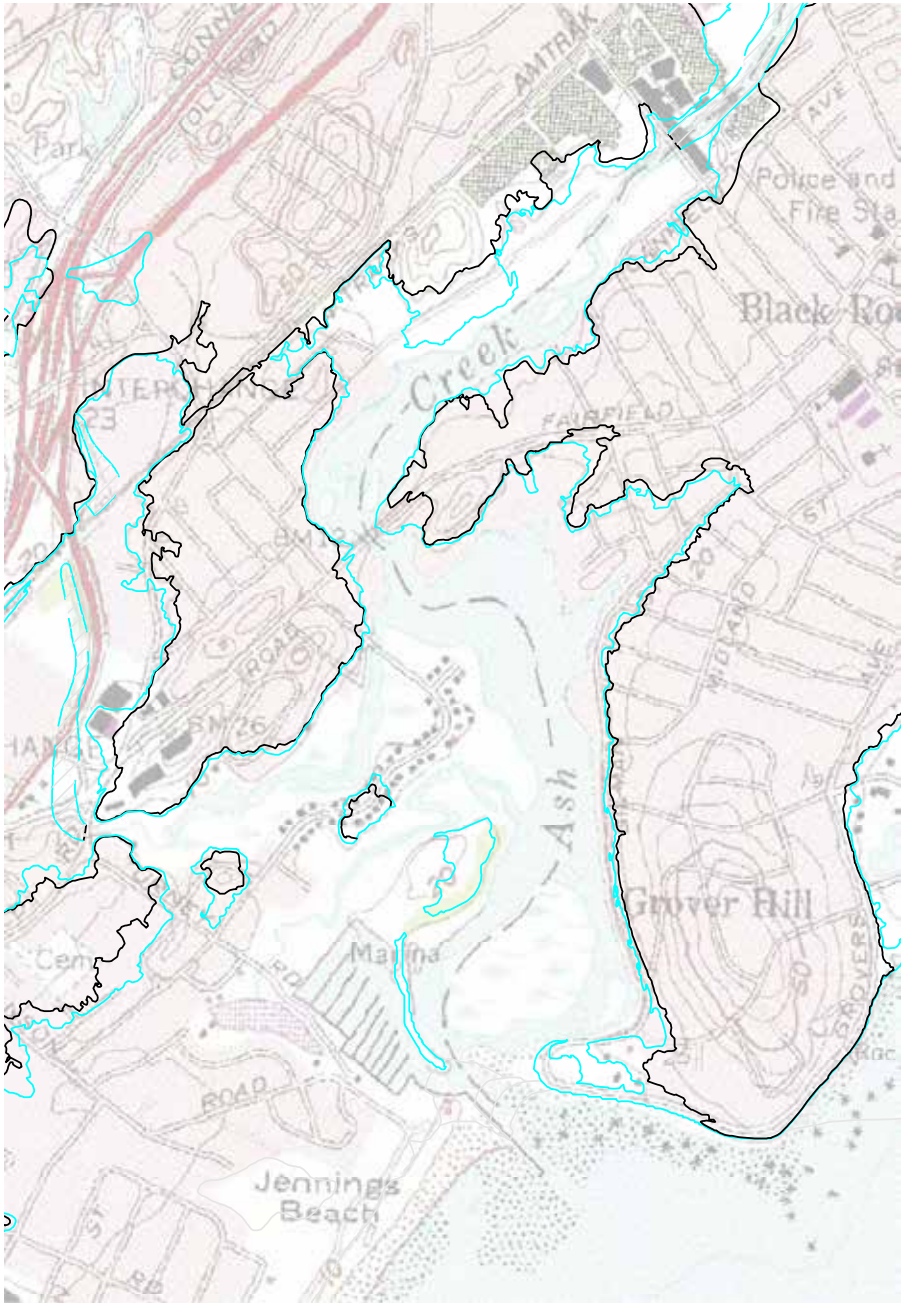
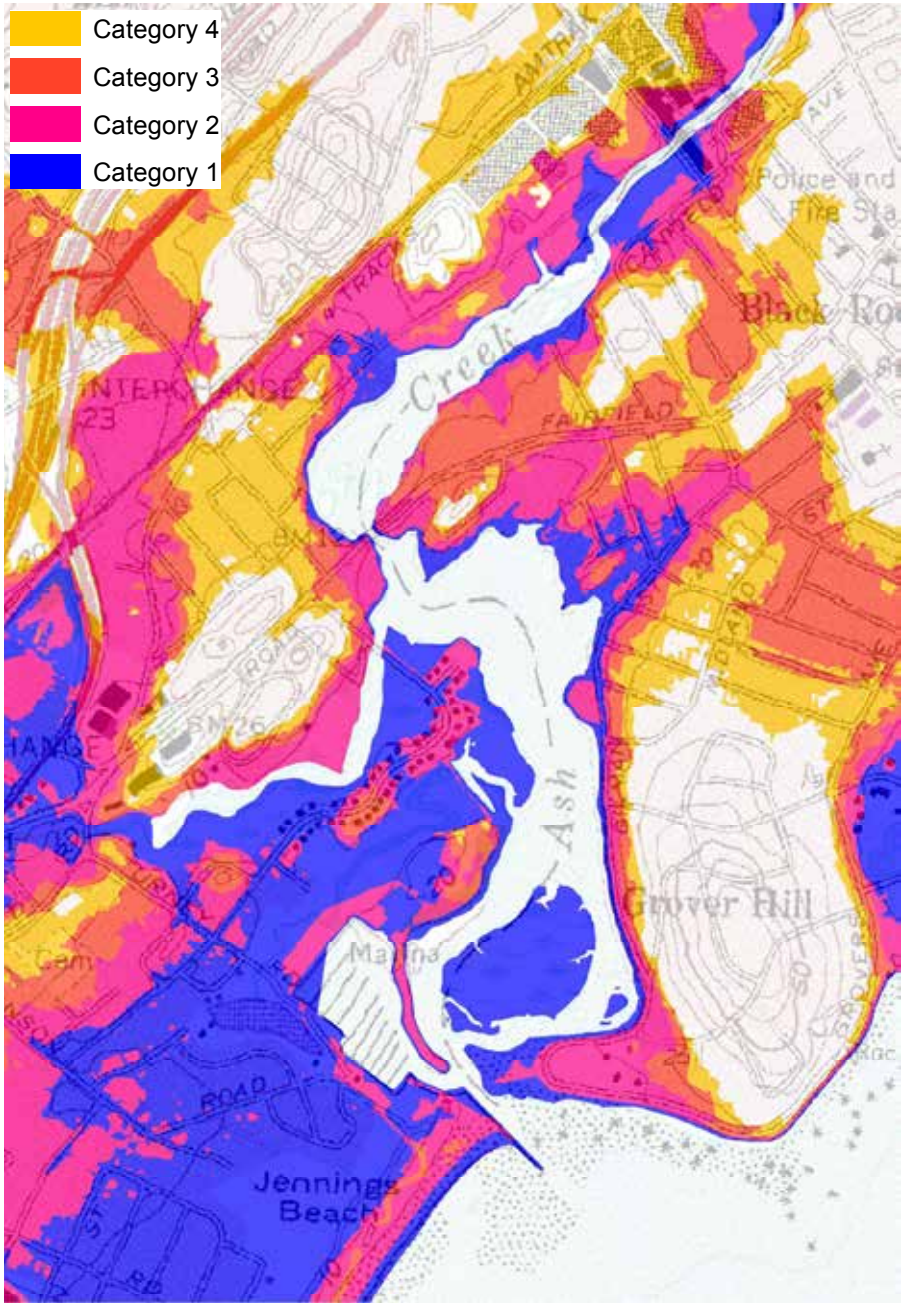
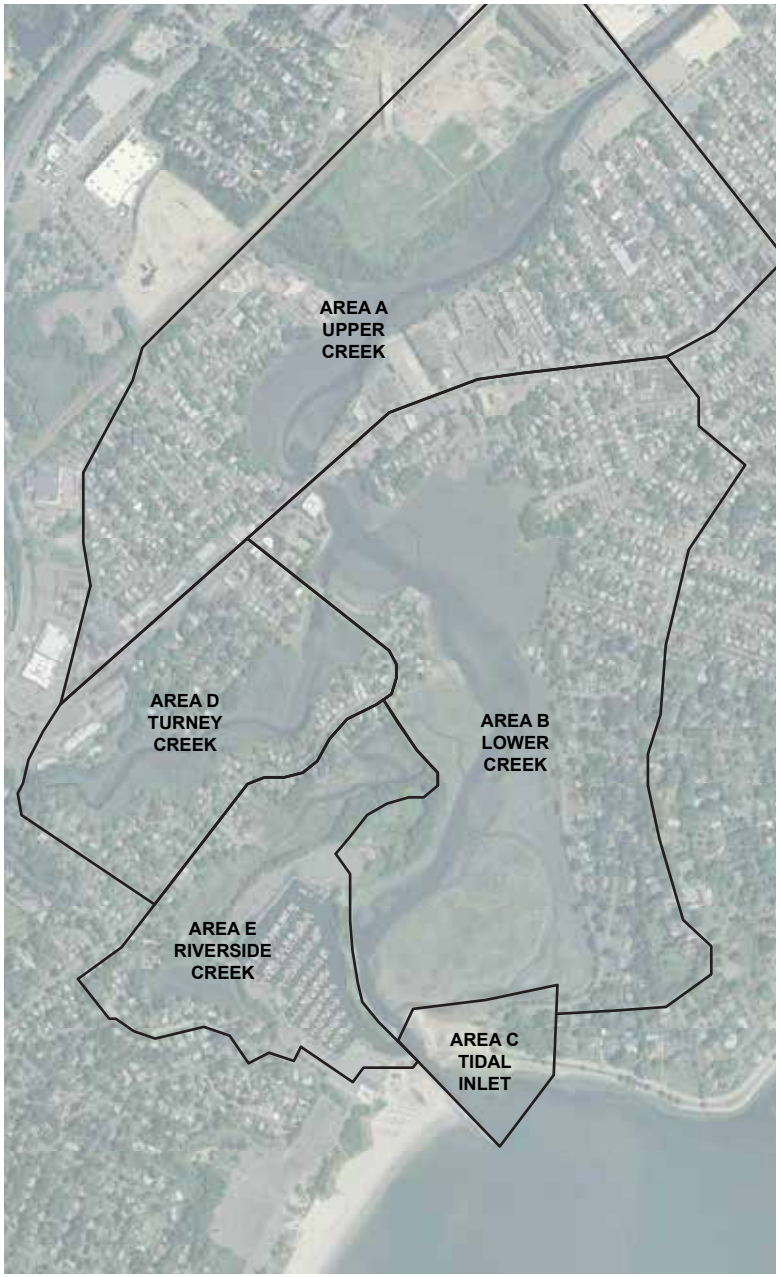


FEMA FLOOD MAP



HURRICANE SURGE MODEL (CT DEEP)

QUALITATIVE ASSESSMENT METHODOLOGY



Field visits to the tidal estuary and its adjacent environs were done in August, 2012.

The purpose behind this investigation was multifold:

1) To refine the draft habitat map;
2) To perform a qualitative assessment of the study area; and,
3) To begin to identify strategies and opportunities that will lead to habitat and water quality improvements for future Rooster River Watershed planning and educational efforts.

During the course of the 2012 field work, the study area was divided into five geographic units for assessment. The units were labeled A-E.

The geographic units simplify the tidal estuary geography for observation and understanding. They also provide a unifying framework for identifying future management needs and proscriptions.

The geographic assessment units were formulated on the basis of shared topography, hydrology, and cultural history. This particular combination of environmental and cultural criteria was chosen to reflect the current geography of the estuary system, which in turn is a result of a long series of natural events, natural processes, human management and watershed manipulation, and post-colonial settlement patterns.

Each geographic unit was visited, and qualitative observations were noted regarding notable environmental features and landforms present, overall condition, appearance and condition of aquatic and wetland habitat, general function and values, potential threats and stresses, general vegetative structure, presence of invasive vegetation, buffer conditions, ecological and landscape level connections to the upland and greater watershed, overall general uniqueness, and other management issues.

A.1 Description

This geographic assessment unit includes the portion of Ash Creek that flows from Brewster Street to Fairfield Avenue. The geographic unit is approximately 184 acres in size, of which the creek at high tide occupies approximately 22.5 acres within the geographic unit's interior.

Three environmental and cultural landscapes define this area:

1) The Ash Creek tidal waterway
2) The east bank – Bridgeport side
3) The west bank – Fairfield side

The tidal waterway flows 3500 linear feet from the Brewster Street bridge to the Fairfield Avenue bridge. The width of the waterway ranges from approximately 65 feet near the Brewster Street bridge to 560 feet upstream of the Fairfield Avenue bridge. A UI/CL&P power line crosses over the waterway south of Warsaw Street, Bridgeport and under the waterway at the Fairfield Avenue bridge . Within the waterway is the inner channel, mudflats, low marsh, high marsh, and an overhanging woody riparian buffer along certain portions of the bank of the waterway.

The defining characteristic of the tidal waterway are the mudflats. As the creek widens out, water velocity decreases, and sediments suspended in the current deposit, forming the mudflats.

The east bank is highly urbanized, and consists of medium density residential and commercial land uses, all within the Black Rock community of Bridgeport. The land has a gentle slope and was formerly farmland before urbanization. The edge of the developed portions of this area abruptly slopes down to the waterway. Most of this area is underlain by relatively thin deposits of poorly sorted, rocky, glacial till.

The west bank is located within Fairfield, and is predominately hilly with a small lowland area in its most western region. The flatter portions of this area are underlain


1934 Aerial

by deep sandy glacial outwash deposits, while the hilly portions are underlain by relatively thin deposits of poorly sorted, rocky, glacial till.

Roughly half of the west bank area (43 acres) is dominated by the Metro Center train station complex and its adjacent open areas, which have been recently re-sculpted into a reclamation meadow, with a created wetland near its western boundary. The Metro Center site was formerly a foundry used to manufacture large machine tools.

The site has been extensively remediated for the new Metro Center. According to the remediation site plan designers, the 50 years of industrial activity had resulted in the placement of over 250,000 cubic yards of casting sand (a byproduct of foundry operations) and a number of releases of volatile organic compounds and oils containing polychlorinated biphenyls. Remediation for the Metro Center involved partially reusing contaminated casting sand and soils in some of the areas. Other contaminated soils were isolated by burying them under engineered controls underneath the parking lot and in other areas. Truckloads of PCBs were removed from the site as well.

The remaining (non Metro Center) land within the west bank is covered by medium density residential development. Most of the terrain adjacent to the creek slopes moderately to steeply down to the water.

A.2 Historic Interpretation

This area of the estuary immediately abuts the railroad line, which created a major impediment to tidal flow and likely altered the plant and animal communities of the estuary significantly. The industrial legacy of this area has likely made it the most polluted of the five study areas in this report.

A.3 Qualitative Assessment of Existing Conditions and Ecological Functions

Habitat

Overall, the inner aquatic habitat of the creek appears to be in relatively good

condition. There are expansive inter-tidal mud flats located near the southern portion of the waterway that provide good habitat for invertebrate organisms.

Tidal marsh conditions are poor, however. A thin strip of Spartina alterniflora is commonly found around the perimeter of the study area, but it is constrained by robust growth of Phragmites australis. Spartina patens, and other high marsh native species, are noticeably absent. An in-progress restoration of the northeast shore of the estuary currently provides little inter-tidal marsh habitat. Riparian habitat along the shoreline varies between stands of Phragmites and salt tolerant shrubs and trees.

One of the more important environmental values of the upper creek is that it serves as the transition zone between the tidally influenced saline tidal lower creek, and the freshwater non-tidally influenced Rooster River which flows down from above the North Avenue Bridge.

Although the actual tidal limit is farther upstream, north of the I-95 crossing, the area below the Brewster Street Bridge is ecologically noteworthy since it provides the first opportunity for the channel to significantly widen out. This allows the freshwater inputs from above to dilute quickly during the larger storm events.

The widening of the river also allows sediments to deposit, forming the creek's characteristic and environmentally valuable mudflats.

Carbon Storage

The large swaths of mudflat provide significant levels of carbon storage, preventing carbon dioxide emissions, buffering the impact of global warming. Salt water wetlands and mudflats are known to sequester as much as 2000 tons of carbon per acre per year. The exact quantity of carbon fixed in this study area is unknown, but it is likely important. It should be noted that inter-tidal mudflats when inundated with water also release methane, nitrous oxide, nitric oxide, and nitrogen gases, which are also known as greenhouse gases. The net balance between carbon fixation and the release of these other greenhouse gases is unknown, but usually salt marshes release less greenhouse gases than their inland wetland complements due to alternation of the tides.

Water Quality
Mudflats typically have an abundant population of bivalve organisms such as oysters, clams, and mussels, which are known to filter and sequester pollutants out of the estuary system.

The widening of the channel also has a positive impact on water quality. Fine particles carried by swifter upstream currents settle out in the channel prior to reaching the Lower Creek and Long Island Sound.

A large Combined Sewer Overflow at the Brewster Street Bridge, and several smaller outlets likely negatively contribute to water quality.

A large stormwater outfall releases rain water into a constructed wetland system on the west bank.

Toxic impacts of urban fill (which is frequently contaminated) and the adjacent industrially-impacted landscapes may negatively impact the estuary, along with the also likely transport of various contaminants from locations farther upstream.

Hydrologic, Biogeochemical, and Ecological Functions of the Tidal Ecosystem
The tidal area is performing and providing many valuable ecological functions that a healthy wetland and tidal ecosystem would be expected to provide. These include floodwater alteration, fish and shellfish habitat, sediment/toxicant/pathogen retention of pollutants, nutrient removal/retention/transformation, carbon fixation to reduce global warming, shoreline stabilization, wildlife habitat, (limited) recreational opportunities, and visual quality/aesthetics.

Aesthetic
The area provides a positive visual aesthetic for commuters using the new Metro-Center, for the adjacent park users, for the adjacent neighbors and other local residents. The area serves as the gateway to the estuary, especially on the Brewster Street Bridge. Street ends on both sides of the Upper Creek have relatively poor views of the water but do provide some aesthetic value. A pavement and boardwalk path system on the

northeast side of the creek provides dramatic views of the natural resource from its higher elevations.

Recreation
The area is a particularly good site for bird watching. The tidal waterway itself provides limited level recreational opportunities, as the area is attractive to small watercraft such as kayaks and canoes. Difficulty of passage under Fairfield Avenue except at high and upper mid tides restricts boating access into the area from below.

Biodiversity
The created wetland area located in the southwest corner of the Metro Center site consists of three stepped pools which enhance the biodiversity of the area by introducing additional habitat types – freshwater, brackish, and saline aquatic habitats. The boardwalk and created inland and brackish wetlands appear to be completed. The upland buffer to this area appears to be well vegetated with a mix of native and nonnative species. It is not known if this portion of the project is completed or not.

In contrast to the wetlands described in the above paragraph, the tidal wetland creation area located below the created inland and brackish wetland appears to be a work in progress. Even though there appeared to be substrate for the tidal wetland for plants to grow on, tidal vegetation was lacking.

There was also a demonstrative lack of tidal wetland vegetation colonizing the 2800 foot length of the newly created bank to the creek below the Metro Center. The banks appear to be of a grade sufficient to support high and low marsh species, and the substrate has been stabilized with coir netting and stakes. According to the set of restoration plans reviewed at the Town of Fairfield, there appears to be no intent by the project managers to actively vegetate the lower tidal interface of the bank with the creek with Spartina plugs, or any other type of tidal wetland vegetation. As a result, it is assumed that this area is supposed to re-vegetate through local seed sources. As of now, it appears that this has not been accomplished. It should be noted that natural re-vegetation usually works best when the topography is gentle enough to prevent wave action and current scouring from disturbing newly seeded areas before they have a

ECOSYSTEM SERVICES

Ecosystem services are the benefits created by ecological systems. A few examples of these services include water quality improvements, habitat for native plants and animals, climate regulation, and recreation. these benefits tend to increase or decrease in relation to the health of the ecosystem. Ecological restoration and stewardship activities are often necessary to maintain or strengthen these services for current and future generations.

chance to establish. In the case of the Upper Creek, mid to high level flow velocities through the area may preclude the ability of such a natural seedbed to become established.

A.4 Potential Threats

Volume of flow

There appears to be a high degree of potentially erosive flows within the primary channel due to large volumes of water coalescing downstream of the Brewster Street Bridge. The channel has been recently armored with rip rap. It is unclear what the final impact of this strategy will be.

Phragmites seed and rhizome source

Upstream of the Brewster Street bridge, the watercourse is less saline and more constricted. Farther upstream, the waterway flows though the Phragmites dominated marsh next to the Mountain Grove Cemetery. Seed and rhizomes from this marsh are likely transported downstream by the current and deposited on the tidal fringes of the channel.

Water Quality

According to the 2010 305b CT DEEP Water Quality Assessment, the tidal creek does not meet water quality goals for three designated uses: Marine and Aquatic Life, Recreation, and Commercial Shellfish. It should be noted that the Creek does meet designated uses for Fish Consumption. The stream segment evaluated by the CT DEEP includes both the Upper Creek and the Lower Creek.

The cause of the impairment to Commercial Shellfish use is fecal coliform, from residential development, stormwater, combined sewers, non point pollution, waterfoul, and boating discharges. The cause of the impairment to Marine and Aquatic Life use is gold and silver, from contaminated sediments and industrial discharge. The cause of the impairment to Recreation use is Enterococcus, from residential development, industrial discharges, stormwater, combined sewers, non point pollution, waterfoul, and boating discharges.

Water quality in the creek is also classified by the State of Connecticut as "SB", a less desirable classification than "SA".

Stormwater outflows
There is a major stormwater outfall located under the Brewster Street bridge. It is unclear if these outflows are retrofitted with modernized structural stormwater treatment controls or not.

A second stormwater outfall on the west bank releases at the head of the newly constructed freshwater wetland.

Stormwater runoff in this study area likely carries a variety of potentially harmful substances such as sediment, litter, dog waste, and oil.

The volume of water relative to drainage area is very high due to the relatively low permeable surface area.

Erosion from the Metro Center
The reclaimed meadow is located on a steep slope. The slope area is extensive. The potential for erosion and sedimentation from this slope depends upon the long term success of this reclamation meadow.

Impervious cover of watershed
Overall, there is a high degree of impermeable cover within the bordering residential and commercial districts. Most of the runoff flows untreated into the waterway through old stormwater outlets, or sheet flows directly from parking lots and roads down the bank with little to no vegetative buffering.

Low amounts of high marsh
There is relatively little native high marsh vegetation left in this area. Much of this is due to Phragmites colonization, human disturbances, and a general lack of available topographic habitat which in turn may be due to former manipulations of the banks of the waterway.

Success of the Metro Center mitigation high marsh wetland fringe
It is unclear at this time if the 2600 foot long mitigation project will meet its project goals – as noted in the above section, at the time of the investigation it appeared that the substrate for a fringe marsh was created and stabilized with coir and erosion netting, however, there did not appear to be any substantial discernable level of Spartina occupying the newly created landform.

Upland habitat created by new park development is in the initial phases of establishment. It may be too early to evaluate success with regard to regulatory approval criteria. Several trees along the walkway appeared to be in drought stress, and it is unclear how often, if ever, they are being watered.

Condition of Upland Buffers
The condition of the upland buffer is generally poor on both sides of the creek, with a general lack of structured native tree canopy, and a lack of area suitable for establishing a thicker overstory. On the west bank, the riparian and upland tree canopy was apparently eradicated during reclamation of the site, and a meadow installed.

The meadow enhances several ecological functions and values such as 1) beautifying the view towards the creek from the Metro-Center side; 2) promoting soil stabilization, and; 3) providing potential habitat for grassland species.

However, the conversion from forest to meadow also 1) diminishes thermal buffering for the creek, 2) decreases the wildlife habitat for forest species, and; 3) diminishes the quality of the view from the neighborhoods on the east bank towards the Metro Center.

Proposed bridge crossing
There has been discussion on the municipal level regarding a potential pedestrian bridge to be erected across the channel. The Greater Bridgeport Regional Council has recently issued an RFP for a feasibility study. To date of this report, nothing has been proposed, however, it is our understanding that the designers are looking at the Fox Street area for the crossing. If such a crossing is implemented, it could be combined

Proposed bridge crossing

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A.5 Potential Ecosystem Improvements

Aesthetic

1. Enhance native vegetation throughout the study area.

2. Monitor progress at Train Station restoration site.

3. Improve vistas across the study area through planting, placement of benches, and pathway alignment.

4. Install aesthetically pleasing dune fencing according along topographic contours.

5. Improve and create street end access and gathering spaces.

6. Reclaim upland lots with non-water dependent uses for ecological restoration purposes.

7. Ensure pedestrian footbridge meets becomes an aesthetic asset to the community.

8. Promote stormwater capture technologies including bioswales, vegetative buffer strips, rain barrel use, and permeable paving throughout the drainage area.

9. Alter street ends to create views of water.

10. Create custom signage and educational kiosks to be used throughout the Ash Creek estuary that establish a local feeling respectful of cultural and ecological conditions.

Biodiversity

1. Encourage the creation of high marsh plants besides Phragmites.

2. Educate local property owners about the value and importance of native plant species.

3. Supplemental spot planting and seeding to encourage specific native species wherever possible.

4. Develop forest management plan for forested edges.

Carbon Fixation

1. Generally encourage the restoration of native plant materials.

2. Monitor all design and construction activities to reduce use of heavy equipment or building materials with high carbon footprints.

Habitat

1. Use pedestrian footbridge as an opportunity to create and improve habitat.

2. Discourage Phragmites colonization.

3. Create green spaces at street ends.

4. Reclaim land from adjacent low lying areas currently used for non-water dependent purposes.

5. Convert public and private lawn spaces to native vegetation.

Recreation

1. Define public access points and encourage ADA accessibility.

2. Develop bikeway and pedestrian routes with location of new pedestrian bridge.

3. Install educational signage and kiosks in high traffic areas.

4. Install blinds for bird watchers.

Water Quality

1. Develop and implement a green infrastructure plan that specifically addresses street ends runoff, residential properties, and permeable pavement conversion.

2. Map and monitor all outfalls.

3. Perform regular testing to quantify upstream pollutant contribution.

4. Coordinate with upstream Rooster River watershed planning efforts to identify specific water quality improvement projects.

UNIT B. LOWER CREEK

B. 1 Description

This geographic assessment unit includes the portion of Ash Creek that flows from Fairfield Avenue to its tidal outlet to the Sound at the St Mary's sand spit. The geographic unit is approximately 190 acres in size, of which the creek at high tide occupies approximately 59 acres (excluding the 13.5 acre and 0.3 acre islands) within its interior.

The environmental and cultural landscapes that define this area include:

1. Ash Creek tidal waterway
2. Two marshy islands
3. Artificial peninsula
4. East bank residential community (Bridgeport side)
5. West bank open space and residential community (Fairfield side)

The tidal waterway gently meanders 4850 linear feet from the Fairfield Avenue Bridge to its outlet to the Sound at the St. Mary's sand spit. The direct linear distance is only 3500 feet. The width of the waterway varies from 100 feet at the Fairfield Avenue bridge to 450 feet opposite Midland Street in Bridgeport, to approximately 1500 feet wide in the lowest portion from Gilman street, Bridgeport to the peninsula opposite South Benson Marina.

Within the waterway is the inner channel, mudflats, low marsh, high marsh, and a thin overhanging woody riparian buffer. Remnants of an old road dating back to the period of 1750-1802 that linked what is now the Pennfield Mills - Ash Creek Open Space, Fairfield, to Balmforth Road, Bridgeport are still visible at low tide.

There are multiple ways for easy public access into the tidal waterway. Easy public access is possible almost anywhere from the eastern shore (Black Rock side) along Gilman Street or through the St. Mary's sand spit. Easy public access from western shore (Fairfield side) is possible through the South Benson Marina, through the Pennfield Mills-Ash Creek Conservation Area, and through the Riverside Drive-Ash

Creek Conservation Area.

The two marshy islands are located at the bottom portion of the waterway, near the tidal inlet/outlet. The larger island, known as either Great Island Marsh or Great Salt Marsh Island, is approximately 13.5 acres at high tide. Half of the island is in Fairfield and half of the island is in Bridgeport. The island was acquired for open space in 2004 by the Town of Fairfield (Fairfield) and Aspetuck Land Trust (Bridgeport).

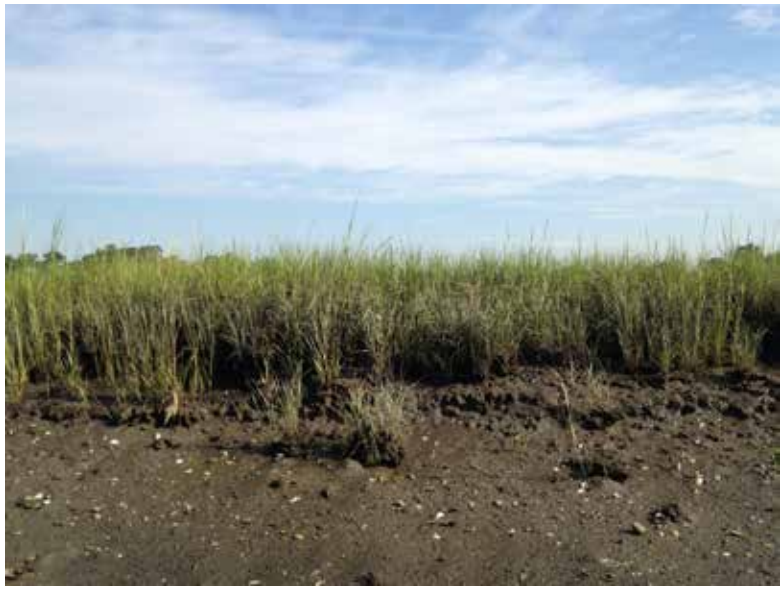
The smaller island, 0.3 acres at high tide, is located directly to the east of Great Island Marsh, off the Bridgeport shore.

Both islands have high and low marsh comprised almost completely of native species. Great Island Marsh is noteworthy for its Ospreys.

The artificial peninsula is located at the bottom of the Lower Creek on the Fairfield side of the waterway, west of the large island. It was built on dredge spoils from the adjacent marina basin, and its major design function is to shelter the marina. The peninsula is about 950 feet long and 100 feet wide. The top is flat with a trail leading to waterfront access at its tip and at its base. Frequent users of this trail include dog walkers and people wanting to fish. The top of the landform is predominately shaded by a woody canopy of Locust trees. The sides of the landform are hardened with rip rap.

The east bank residential community (Bridgeport side) is moderately to highly urbanized, and consists mainly of medium density residential land use, all within the Black Rock community of Bridgeport. There is a minor level of commercial landuse in the northern portion of the area off of Fairfield Avenue, and a pocket of higher density residential land use.

Topographically, most of the area occupies the western side of a north/south trending drumlin known locally as Grovers Hill. Drumlins are long, glacially scoured hills underlain by thick till deposits. Grovers Hill is approximately 70 feet above sea level and the highest point in the entire study area.



1934 Aerial

Gilman Street separates the residentially developed areas from the natural area of the tidal creek along most of its length. The separation of urban and natural is punctuated by a steep slope located west of the roadway right of way. There is very little natural upland area left between the roadway and the creek.

The west bank open space and residential community (Fairfield side) side is different in character from the east bank side of the tidal creek because of the higher level of undeveloped open space adjacent to the creek.

North of the peninsula is the Pennfield Mills - Ash Creek Open Space Area which is managed by the Town of Fairfield. The area was named after the tide-powered grist mill(s) constructed nearby by Peter Pennfield in 1735. More recently the site of a gravel mine and construction and dredge spoils dump, the area was acquired by the town in 1968. The upland areas were re-graded in 1985 to create a wildflower meadow, a fruit orchard, a woodlot, and a playground.

Today a semi-naturalized upland meadow exists there with a thin forest edge overhanging the creek. To the north and west of this open space, there are expansive areas of high and low marsh, as well as the tidal inlet to Riverside Creek located to the west.

Another open space area is the Riverside Drive-Ash Creek Wetland Conservation Area, also owned and managed by the Town of Fairfield. The open space consists of 2.85 acres of mainly tidal wetlands south of the Turney Creek tidegates, and a 0.2 acre shoreline floodplain parcel just north of the tidegates. The parcels were acquired by the Town of Fairfield in 1978. The area is accessible from Riverside Drive, and provides opportunities for fishing, bird and other wildlife watching, shellfishing, and access to Lower Ash Creek.

The relative natural openness of this region is punctuated by pockets of residential development along Riverside Drive, Fairfield, most of it dating back to 1917.

B.2 Historic Interpretation

This section of Ash Creek retains much of its original characteristics. The Great Marsh Island appears on early colonial maps, as does the alignment of the channel. Based on historic photos, this area was once an oystering area (and still is used for commercial "seed" oystering) and has always been noted for its remarkable aesthetic beauty. The estuary was the peaceful back side to the busy wharfs of Black Rock Harbor, which was noted for its ship building. A fort was once erected on Grover's Hill to protect against British Troops in the Revolutionary War. Various environmental advocates and advocacy groups worked throughout the 20th Century to preserve the naturalistic character of the place.

B.3 Qualitative Assessment of Existing Conditions and Ecological Functions

Hydrologic, Biogeochemical, and Ecological Functions of the Tidal Ecosystem
The tidal area is performing and providing many valuable ecological functions that a healthy wetland and tidal ecosystem would be expected to provide. These include floodwater alteration, fish and shellfish habitat, sediment/toxicant/pathogen retention of pollutants, nutrient removal/retention/transformation, carbon fixation to reduce global warming, shoreline stabilization, wildlife habitat, recreational opportunities, and visual quality/aesthetics.

Habitat and Biodiversity
The lower creek area has a significant and notably large level and variation of habitat types, including open water, mudflats, oyster reef, low marsh, high marsh, riparian areas, maritime forest, and upland meadow. These varying habitats attract a variety of wildlife and aquatic life.

Great Marsh Island is noteworthy for its Osprey habitat, as well as its intertidal and aquatic life. It is also the only section of the estuary that was not subject to mosquito ditching.

The bottom of the creek is good quality habitat for shellfish. It provides the substrate


2010 Aerial

The bottom of the creek is good quality habitat for shellfish. It provides the substrate for commercial and recreational shellfishing, especially oystering. Oysters are commercially cultivated, seasonally harvested, and then moved into deeper waters of Long Island Sound for depuration (purification) before going to market.

The open space areas on both the Bridgeport and Fairfield sides are especially noteworthy as they serve to protect and enhance the ability of the tidal ecosystem to perform its functions and values. Furthermore, the maritime forest within these areas serves as an important refuge for birds during the migration season.

Recreation

Recreational opportunities abound within the lower creek region. These include enjoying the views, walking, bird watching, wildlife appreciation, fishing, shellfishing, and boating.

There are only two large private residential docks for motorized watercraft in the creek. This minimal level of dock proliferation encourages quieter and less intrusive boating uses such as canoeing and kayaking, which in turn promotes valuable quiet moments for visitors. It also minimizes the negative impacts of motorized boating such as motor oil pollution, erosion and turbidity due to prop dredging and wake effects which lead to the smothering of seed oysters and other bottom dwelling and aquatic organisms, and the disturbance of nesting patterns of shorebirds.

The area is lacking in facilities, furnishings, and other types of park improvements such as permanent bathrooms, water fountains, bicycle racks, benches, and ADA accessible walkways.

Aesthetic

The area is especially valuable to humans due to its aesthetics. The wide visible expanse of intertidal zone is especially stunning considering its location within a dense urban region. The minimal level of dock proliferation encourages quieter and less intrusive boating uses such as canoeing and kayaking, which in turn promotes valuable quiet moments for visitors.

Overall, the area significantly contributes to the property values of the adjacent neighborhood. The creek provides scenic value, recreational opportunities without the need of a car for school children, creative opportunities for artists and photographers, bird watchers, nature lovers, quiet and contemplative experiences, and a natural buffer to screen the edge of the neighborhood from increased urban development.

The area is also of scenic value to visitors on the way to the St. Mary's by the Sea rocky shorefront, and anyone else passively driving through.

Flood Protection
The open space parcels serve as natural buffers to attenuate both the stormwater quantity and stormwater quality before it enters the creek. The creek serves as the major avenue for stormwater conveyance to quickly remove stormwater runoff from the adjacent neighborhoods.

B. 4 Potential Threats

CT DEEP Water Quality assessment
According to the 2010 305b CT DEEP Water Quality Assessment, the tidal creek does not meet water quality goals for three designated uses: Marine and Aquatic Life, Recreation, and Commercial Shellfish. It should be noted that the Creek does meet designated uses for Fish Consumption. The stream segment evaluated by the CT DEEP includes both the Upper Creek and the Lower Creek.

The cause of the impairment to Commercial Shellfish use is fecal coliform, from residential development, stormwater, combined sewers, non point pollution, waterfoul, and boating discharges. The cause of the impairment to Marine and Aquatic Life use is gold and silver, from contaminated sediments and industrial discharge. The cause of the impairment to Recreation use is Enterococcus, from residential development, industrial discharges, stormwater, combined sewers, non point pollution, waterfoul, and boating discharges.

Water quality in the creek is also classified by the State of Connecticut as "SB", a less

desirable classification than "SA".

Extent of Phragmites

The growth of Phragmites grows is limited in the Lower Creek area. There are some sporadic but notable stands at the end of Riverside Drive, Fairfield near the tidal gates where natural flow has been altered. There are also isolated stands surrounding a few of the stormwater outfalls along Gilman Drive, Bridgeport. These stands off of Gilman Drive are of the most concern, as they have the potential to spread along the length of the remaining high marsh areas. In most likelihood, their presence is in part due to the freshwater runoff from the stormwater system.

Gillman Street stormwater outfalls

Drainage from Gilman Street and the adjacent neighborhood is collected from a basin system from along the road into series of small PVC pipes which outlet directly into the tidal creek. Most of the outlets are located on a steep slope and lack a bottom structure to dissipate flow velocities. The erosive potential and quality of the flows through these outlets is a concern.

Decayed Phragmites

There was a moderate level of detached, dead, and decaying Phragmites along the high tide zone on the eastern bank of the tidal waterway. Likely the source of these stalks is farther upstream (Mountain Grove Cemetery region). The stalks clump together to form mats, which secure themselves near the top of high tide range and block out other plants trying to grow. These stalks appear to have a benign impact on the ecosystem but are worth mentioning due to their volume and extent. The stalks were conspicuously absent closer to the parking to the sand spit, as if they had been removed, possibly by very high tides or by people.

Tidal gates

Tide gates do not obstruct flow within this section, but they do reduce ecological connectivity of the Lower Creek with Turney and Riverside Creeks.

Buffer condition on east side
In many areas the buffer to the tidal creek on the east side is in poor condition due to inadequate widths. The available area is constrained by the road. Furthermore, the soils on the slope below the road are compacted in many areas, leading to reduced permeability and hydraulic conductivity. This discourages the establishment of vegetation, and discourages pollutant attenuation, leading to water quality impacts to the creek.

Rip-rapped peninsula
The habitat around the bottom of much of the man made peninsula sheltering the marina is hardened, limiting the potential of any future bioengineered habitat enhancements in this area. However, it is also noted that hardened habitats can serve as opportunities for the attachment of invertebrates.

Waterfront access from the peninsula
There was minor erosion due to concentrated overuse at the base and tip of the peninsula at the point of waterfront access. This access point has removed most vegetation from the immediate area and leaves the landform susceptible to erosion, especially during large storm events.

Sea Level Rise
Sea level rise may be a long term threat to the tidal wetlands as there is limited habitat area left for any future wetland to naturally create along the fringe of any future sea level rise.

Upstream Pollution
The Lower Creek is the lowest point in the watershed and therefore subject to cumulative impacts from above. These include urbanization effects, hydrological alterations, ecological habitat modifications, and generation of non point and point pollution from greater watershed, which includes the upper portions of the tidal creek and the Rooster River.

GREEN INFRASTRUCTURE

Traditional “Grey Infrastructure” engineering solutions to stormwater management direct rain water into a system of pipes, treatment plants, and engineered basins. Green infrastrucure adds plant and soil elements to the stormwater management strategies in order to create habitat, filter pollutants, reduce strees on aging or inadequate systems, and provide aesthetically attractive features.

Overuse
Heavy dog use of the sand spit and adjacent high marsh leads to the fecal pollution of the waterway and the Sound.

Heavy minimally managed recreational use of the tidal marsh adjacent to the sand spit leads to loss of plant life and accelerated erosion of the landform.

Motorized Watercraft
Increased use of the tidal creek by motorized watercraft will lead to adverse impacts to the ecosystem such as motor oil pollution, erosion, sedimentation, and increased turbidity due to prop dredging and wake effects which lead to the smothering of seed oysters and other bottom dwelling and aquatic organisms, and the disturbance of nesting patterns of shorebirds.

B. 5 Potential Ecosystem Improvements

Aesthetic

1. Enhance native vegetation throughout the study area.

2. Improve vistas across the study area through planting, placement of benches, and pathway alignment.

3. Create new community overlook area on Bridgeport side at the terminus of the promenade.

4. Work with adjacent property owners to integrate native plants into their landscape design choices.

5. Work with local stakeholders post-Hurricane Sandy reconstruction efforts to integrate native plants into redevelopment plans.

6. Promote stormwater capture technologies including bioswales, vegetative buffer strips, rain barrel use, and permeable paving throughout the drainage area.

7. Create custom signage and educational kiosks to be used throughout the Ash Creek estuary that establish a local feeling respectful of cultural and ecological conditions.

Biodiversity

1. Identify newest stands of Phragmites for removal.

2. Encourage the creation of high marsh plants.

3. Educate local property owners about the value and importance of native plant species.

4. Supplemental spot planting and seeding to encourage specific native species wherever possible.

5. Develop forest management plan for forested edges.

Carbon Fixation

1. Generally encourage the restoration of native plant materials.

2. Monitor all design and construction activities to reduce use of heavy equipment or building materials with high carbon footprints.

Habitat

1. Create a more robust native plant community along the Bridgeport side. Phase out all non-native plantings.

2. Encourage soft edge retrofits for hardened shorelines.

3. Discourage Phragmites colonization.

4. Reclaim land from adjacent low lying land currently used for non-water dependent purposes.

Recreation

1. Link bikeway and pedestrian routes with other sections of the estuary and Jennings Beach.

2. Install educational signage and kiosks in high traffic areas.

Water Quality

1. Develop and implement a green infrastructure plan that specifically addresses street end runoff, residential properties, and permeable pavement conversion.

2. Rethink road drainage on Bridgeport side to reduce flooding and runoff contamination.

3. Identify runoff pollution sources such as fertilizer, pesticide, and other potentially harmful substances.

C.1 Description

This unit includes the inlet of Ash Creek, where the waters of Long Island Sound flow into Ash Creek and where the flow from Ash Creek outlets into the Sound.

The geographic unit is approximately 10.8 acres in size, of which the water at high tide occupies about 7 acres.

The environmental and cultural features that define this area include:

1. Tidal inlet/outlet channel;
2. St. Mary's sand spit;
3. St. Mary's By the Sea rocky shorefront;
4. Forested Open Space; and,
5.Tidal creek

The tidal inlet/outlet channel is the narrow passageway between the sand spit and the Fairfield mainland. The channel area is bounded by the sand spit on its east side. The channel is bounded on the west side by rip rap lined coastline including a jetty at the terminus of Jennings Beach and an artificial peninsula that was created by dredging activities related to the construction of South Benson Marina. The channel is approximately 220 feet in width between the sand spit and the far shore. The channel is relatively deep due to regular dredging and therefore has a strong tidal current. Dredging activities in the central channel appear to be limited north of the navigable entry to Benson Marina.

The St. Mary's sand spit is a type of coastal barrier landform known as a barrier spit. Barrier spits are coastal barriers that are attached to the mainland at only one end and extend into open water. (Barrier spits can become barrier islands if they detach completely from the mainland, and conversely, a barrier spit can attach on both sides to the mainland and be called a bay barrier). The sand spit occupies approximately 2.5 acres at high tide.

1934 Aerial

The sand spit faces both inland towards the tidal creek and outward towards the Sound. The Sound facing portion of the sand spit is a fore (sand) dune environment. Vegetation is primarily characterized by low growing herbaceous plants, shrubs, and a few trees. These plants are rooted in deposits of unconsolidated loamy and course sand. The shape of taller species is impacted by the predominant onshore winds. Between the dune vegetation and the Sound is an intertidal zone of vegetated beach.

The tidal creek facing portion of the sand spit is a back dune environment. Vegetation is primarily characterized by low growing herbs, shrubs, and grasses, rooted on a deposit of unconsolidated loamy and course sand.

The St. Mary's By the Sea consists of approximately 660 feet of predominately rocky intertidal shorefront. The far most western portion of this area is sandy. Above the slope to the shorefront there is a promenade with a walking path, and a grassy strip with park benches. Grovers Avenue runs parallel to the promenade with parallel parking spaces on the Sound side of the street. The promenade is part of the City of Bridgeport St. Mary's By the Sea Park. Benches, streetlights, and occasional trash receptacles can be found up and down the promenade.

The Forested Open Space is located at the bottom of Black Rock, Bridgeport, east of the Gilman street bend. It is approximately 1.75 acres in size, and is mainly forested with a small lawn area in front with what appears to be a single infrequently maintained port-a-john. The locals refer to the area as the "bird sanctuary" although it's officially known on several maps as Capozzi Park. Vegetation within the forested portion of the open space consists of a thick woody overstory and a dense understory which is dominated by nonnative species.

The tidal creek runs along the north side of the barrier spit. It contains mudflat, low marsh, and high marsh plant communities. The walkway along Grover's Avenue rises above the eastern side of the tidal creek. The creek is discussed in greater detail in section A: Lower Creek.

C.2 Historic Interpretation

Densely packed glacial deposits formed what is known today as Black Rock during the Pleistocene era. The hilly Black Rock landform provides a hardened shoreline which partly creates the conditions for the formation of a sand spit and barrier beach (Jennings Beach) to the west. Thse sand formations, in turn, allow for the creation of the Great Marsh Island.

This area appears to have been a tidal inlet at least since the late 17th century. The sand spit and barrier beach complex, split by the Ash Creek inlet, formerly abutted a large intertidal marshland to the north (described in Section X Lower Creek) which drained into Ash Creek. Though heavily modified in the past few centuries, the sand spit appears to have retained its basic morphological character. In contrast, the barrier beach (Jennings Beach) has been heavily modified.

The channel and peninsula (Fairfield side of the study area) was created as part of the creation of Benson Marina when the former tidal marshland was dredged to make navigable harbor. Some of the dredge spoils were then used to create the peninsula and to fill in surrounding tidal wetlands. This entire area, consisting of the western edge of the study area, is now lined with medium sized rip rap.

Approximately at the same time, large rip rap was used to create the jetty along the edge of Jennings Beach. The purpose of the jetty is to capture littoral drift (i.e. to keep the beach sand from moving away from Jennings Beach) and to mitigate against dangerous currents.

The edge of the sand spit has aggraded and degraded over the years according to the influence of human activities on vegetation and by the channel maintenance. It is unknown if beach nourishment activities have taken place on Jennings Beach, or how frequently the channel is dredged. Deep waters created by dredging activities make this location a popular fishing area.

Historic dredging activities and the development of South Benson Marina have had a disturbance impact on the great marsh island since channel deepening causes stronger currents with erosive ripple effects on adjacent landforms. Dredging activities appear

2010 Aerial

to have also required mobilization of heavy equipment on the barrier spit, which has resulted in damaged habitat.

C.3 Qualitative Assessment of Existing Conditions and Ecological Functions

Aesthetic

The barrier spit offers a unique contrast to the interior sections of the estuary and the eastern rip rap shore. This creates a more diverse visitor experience. Moreover, the forms found in intertidal sandy beaches and dune environments (such as sand waves, dune geometry, and angles of repose) are typically considered aesthetically pleasing design elements. The point of the Sand Spit is a particularly beautiful place where visitors may gaze deep into clear water, out towards the horizon line above the sound, or inward to the Great Marsh. The undeveloped nature of the Sand Spit provides an aesthetic compliment to the comparatively more developed Fairfield and Bridgeport shorelines.

Biodiversity

This study area is relatively small compared to the overall size of the estuary but contains species found nowhere else in the system. In this small section there are unique habitats such as foredune, backdune, and maritime forest which attract a diversity of vertebrate and invertebrate species.

Flood and Storm Protection

This barrier spit absorbs wave action and protects interior marshland, and plays an important role in absorbing storm surges. If the spit were to be reduced in width or elevation, it could cause negative impacts especially on the Great Marsh Island. The spit also protects the St. Mary's walkway and Gilman Road from erosive wave action that could cause undercutting. The marine forest in the Capozzi Park buffers coastal winds from interior sections of the lower creek, especially the eastern shoreline. It also creates a sheltered environment for recreational walkers, bikers, and dog walkers.

Habitat

Foredune and Backdune environments in the sand spit are important habitat types for

a variety of sand loving plant and animal species. American beachgrass, in particular, is not found elsewhere in the estuary. Capozzi Park provides an important refuge for migratory and resident species of birds and insects, especially during storm events.

Recreation
The barrier spit provides important waterfront access for multiple user types including fishermen, bird watchers, sunbathers, and beachcombers. Recreational use of the rest of the public landscapes is also significant. Walkers, bikers, dog walkers, and fisherpeople all utilize the public space. The seaward views, parking availability and the promenade make this an attractive resource for recreation.

Water Quality
By decreasing wave action within the lower creek, the barrier spit calms the waterway which enables more productive sediment deposition and nutrient fixation.

C.4 Potential Threats

Erosion and deposition of the sand spit
The underlying sand spit deposits are subject to erosion during severe storms. The erosion has been accelerated in recent years due to human related activities.

Although large storm events can negatively affect and degrade the landform, on the whole this is a short term impact. The long term stability and therefore the health of the landform depends mainly on the replenishment by sand carried by the offshore currents moving westerly along the edge of the coast.

If this normal process of littoral drift is interrupted over time due to diversions from groins, jetties, or other hardened structures, there will be no current to transport and deposit the sand. Additionally, if there is a shortage of sand due to excessive shorefront development, then there will be a shortage of sand to replenish the spit sand and the landform would be expected to degrade over time. Both of these factors may be of concern to the future of this landform.

In the short term, the level of human use has a substantial impact on the stability if the landform due to the potential for humans to accelerate erosion. This impact is more pronounced when a high level of human alteration coincides with a large storm event.

The sand spit plays an important role in the function of the creek, notably by providing a unique ecology and biodiversity to the area, and by protecting the inner creek from erosive wave action during storm events, and therefore mitigating flooding to the inner creek and to inland structures. Without the sheltering from the sand spit, the Great Salt Marsh Island would erode away. The sand spit also serves as sand storage areas that supply sand to eroded beaches during storms, and serves to buffer windblown sand and salt spray from the inner shores.

The sand dunes located in the middle of the spit are an important component of the sand spit, and are absolutely vital to the protective function of the spit. By being at a higher elevation than the rest of the sand spit, they absorb the impact of storm surges and high waves. The dunes are created and maintained by wind blown sand that becomes trapped by the vegetation. Over time, the sand accretes into dunes. Any activity such as trampling or unnecessary development which disturbs the natural vegetation will also ultimately harm the sand dunes, since the natural vegetation is required to create and maintain the sand dunes. Furthermore, care should be taken in any future restoration project to ensure that the higher elevation of the dune zone is maintained so that the sand spit can fully perform all of its protective functions to the estuary.

The promenade walkway along the exposed coast shows signs of erosion damage which will eventually lead to the collapse in undermined sections.

Jurisdictional Overlap

According to Town of Fairfield documents such as their Multiple Use Management Plan for Coastal Open Space and the USGS topographic quadrangle, and several newspaper articles dating back to 1954, the Fairfield/Bridgeport municipal boundary line possibly runs directly through the sand spit, or through an accreting edge. This makes dual municipal management of the spit a complex and often neglected matter.

Because of the uncertainty of the location of the municipal boundary, often site plans for the sand spit neglect to indicate the municipal boundary in relation to the landform.

The presence of this municipal boundary triggers certain regulatory requirements that are often overlooked. All development activities that may impact the sand spit may be subject to dual regulation by BOTH the Town of Fairfield and the City of Bridgeport, and possibly the Connecticut Department of Energy and Environmental Protection (CTDEEP).

According to the CT General Statutes, even activities that are appear to be constrained to one side of the municipal boundary are likely still subject to regulation by the other municipality IF the activity is within 500 feet of the municipal boundary, or IF the activity impacts the environmental resources of the other municipality.

Alien and Invasive Species
There is a high level of invasive species growing in the shrub and herbaceous understory of the "bird sanctuary" (Capozzi Park). Non-native species have been observed in the barrier spit area. Alien and invasive species pose a threat to certain types of native plants and animals.

Sea Level Change
Predicted rises in sea level would negatively impact the integrity of the barrier spit. Under higher sea conditions, waves would more easily overtop and wrap the existing landform, causing increased erosion of the spit and lower creek habitats.

Recreational Use and Development
Heavy dog use of the sand spit and adjacent high marsh leads to the fecal pollution of the waterway and the Sound. Heavy and minimally managed recreational use of the sand spit leads to loss of plant life, and to accelerated erosion of the landform. Intensive use of the sole portable port-o-john located at Capozzi Park has led to a visually offensive and potentially unsanitary condition of the amenity.

Motorized Boats
Increased use of the channel by motorized watercraft will lead to adverse impacts to the ecosystem such as motor oil pollution, erosion, sedimentation, and increased

turbidity due to prop dredging and wake effects which lead to the smothering of seed oysters and other bottom dwelling and aquatic organisms, and the disturbance of nesting patterns of shorebirds.

Storm Events

Major storm events, such as hurricanes and Nor'easters, have the potential to cause major changes to coastal morphology and upland habitat. These events, though unpredictable, may intensify in the future as a result of climate change.

C.5 Potential Ecosystem Improvements

Aesthetic

1. Enhance native vegetation throughout the study area.

2. Improve vistas across the lower creek and the sound through planting, placement of benches, and pathway alignment.

3. Install aesthetically pleasing dune fencing along topographic contours.

4. Improve gathering spaces through use of permeable pavers, fill placement, and historically appropriate site furnishing.

5. Create custom signage and educational kiosks to be used throughout the Ash Creek estuary to establish a local feeling respectful of cultural and ecological conditions.

Biodiversity

1. Protect large sections of the barrier spit from dogs and foot traffic.

2. Supplemental spot planting to encourage specific species.

3. Develop forest management plan for Capozzi Park. Thin trees and control invasive

species to create greater plant diversity.

Carbon fixation

1. Generally encourage the restoration of native plant materials.

2. Monitor all design and construction activities to reduce use of heavy equipment or building materials with high carbon footprints.

3. Manage the Bird Sanctuary to promote more standing and ground sequestered biomass. Expand the forest farther west.

4. Convert all lawn spaces to native coastal vegetation.

Habitat

1. Restore tidal salt marsh and riparian zones on the northeast side of the barrier spit.

2. Bring back coastal meadow and shrub habitat on the southwest edge of the Bird Sanctuary.

3. Convert mown lawn on promenade walkway to native shrubs and grasses.

Recreation

1. Better define access points to the barrier spit to avoid trampling native plants.

2. Install bike racks.

3. Construct new pathways through the Bird Sanctuary to counter the dominance of the road on visitor experience and to provide access to additional environmental education.

BIOREGIONAL AESTHETIC

Landscape architectural design that is based on ecological principles leads to a specific type of look and feel that varies from region to region based on local environmental factors. In addition to being aesthetically pleasing, designs based on bioregional aesthetics tend to be more resilient and easier to manage. This style of design works well with preservation efforts to protect culturally significant features.

4. Temporary toilets should be removed, added, better maintained, or replaced with permanent bathrooms.

5. Design and install a defined bikeway and sidewalk system that would create a safer and more accessible experience.

Water Quality

1. Use green infrastructure techniques to address street drainage.

2. Provide bags and signage to control dog waste. The drainage for the road can be improved using green infrastructure technologies.

3. Restore native plant communities and discourage off-trail disturbance.

D.1 Description

Turney Creek is a tidal tributary to Ash Creek. The tributary is entirely located in Fairfield. At the creek's highest point, it openly flows from near the intersection of Turney Road and Old Post Road to its tidal outlet/inlet, which is located just to the east of Riverside Drive and south of the Post Road. The tributary connects to the main Ash Creek channel in the northwest corner of the Lower Creek region.

North of the Old Post Road, Turney Creek is a buried waterway.

The greater Turney Creek geographic unit encompasses about 59 acres, of which the open water habitat occupies approximately 6.5 acres. The length of the channel, including its meanders, is about 3000 feet from its inlet/outlet to its saline/freshwater boundary.

The environmental and cultural landscapes that define this area include:

1. Turney Creek tidal waterway
2. Southern bank residential area
3. Northern bank residential area

The Turney Creek tidal waterway consists of the channel and its flanking low and high marsh areas.

Tidal flow enters Turney Creek from the main Ash Creek through a combination of old and relatively new tidal gates. These gates narrow the flow under the Riverside Drive bridge. Once flow passes through the constricted tidal gateway area, it spreads out over wide expanses of marsh for most of the remaining length of the creek. Once the waterway reaches the region in the rear of the Circle Diner (441 Post Road), the wide marshy areas disappear, and the channel becomes constrained between high sloping banks for the next 100 feet until it reaches the Old Post Road bridge.

The daylighted saline-freshwater bounday is located not far to the west opf the Old

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Post Road - approximately 75 west of the traffic triangle which joins the Old Post Road and Post Road, below the parking lot to Fairfield Wine and Spirits (957 Post Road). Another tidal spur daylights intermittenly for the next half mile until the rear of the parking lot located on the southwest corner of Grasmere Avenue and Meadowbrook Road.

Above the saline/freshwater boundary area, the creek is no longer subject to tides. The watercourse drains freshwater from the Grasmere Brook watershed located above the Old Post and Post Roads, extending as high up as the Fairfield Woods neighborhood in eastern Fairfield between Routes 58 and 59.

Within the marsh and waterway are two properties owned and managed by the Town of Fairfield – the Cambridge Street Wetland Conservation Area, and the Woods Wetland Conservation Area.

The Cambridge Street Wetland Conservation Area consists of 0.5 acres of tidal wetlands along the creek, north of Cambridge Street. It was acquired in 1988 by the Town of Fairfield as a result of delinquent taxes. The property is inaccessible through its uplands, but it can be canoed or kayaked through at high tide. It is managed by the Town of Fairfield to conserve its natural resources and to protect the ecological functions of the greater estuary, with a lesser emphasis on its use for passive recreation.

The Woods Wetland Conservation Area consists of 3.0 acres of tidal wetlands along the creek, off of Shoreham Village Drive. It was acquired as a donation from James Woods in 1988. Upland access is through a small grassy strip, and it can be canoed or kayaked through at high tide. Similar to the Cambridge Street Wetlands, it is managed by the Town of Fairfield more to conserve its natural resources and to protect the ecological functions of the greater estuary, with a lesser emphasis on its use for passive recreation.

The Southern bank residential area consists of the medium density residential neighborhoods along Cambridge Streets and along the north side of Riverside Drive. The area is predominately lowland, underlain by deep, sandy, well drained, glacial outwash lake deposits.

The Northern bank residential area consists of the medium density residential

neighborhoods of Shoreham Village and Shoreham Terrace / Riverside Drive, with a pocket of commercial/industrial development located along the Old Post and Post Roads. Much of the residential area is located on relatively gentle hills underlain by thin glacial till deposits. The hills trend to the northeast. The commercial-industrial pocket is located in a lowland area consisting of deep, sandy, well drained, glacial outwash lake deposits.

D.2 Historic Interpretation

Named after an early Fairfield family, Turney Creek was once part of a large tidal wetland system that was severely disrupted by the railroad, and later by Fairfield's expansion. With its headwaters several miles north of Fairfield, the creek today travels underground for much of its length before daylighting at the Old Post Road.

The tidal creek has also suffered from the installation of a tidal gate that was installed to reduce flood risks.

D.3 Qualitative Assessment of Existing Conditions and Ecological Functions

Hydrologic, Biogeochemical, and Ecological Functions of the Tidal Ecosystem
The tidal creek and its associated wetland areas are performing and providing many valuable ecological functions. These include floodwater alteration, fish and shellfish habitat, sediment/toxicant/pathogen retention of pollutants, nutrient removal/ retention/transformation, carbon fixation to reduce global warming, shoreline stabilization, wildlife habitat, and visual quality/aesthetics.

Flood Protection
The creek and adjacent wetlands provide important flood protection to the surrounding neighborhood through its capacity to absorb flooding during and after storm events. Its ability to provide that protection is a function of its channel capacity, and the integrity of its vegetation. The tide gates provide an additional level of flood protection from storm surges, but appear not to be high enough to protect from the most severe conditions.


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Saline/Freshwater Exchange

Of historical note is the impact to the creek by the system of tidal gates and culverts which constrain and obstruct free flow into the creek at its inlet/outlet. These gates and culverts, though improved over time, likely impact salinity levels to an unknown degree, resulting in the encroachment of Phragmites. The tall clumps of Phragmites displace high marsh vegetation, and restrict views into the interior of the marsh, impacting the aesthetics.

Turney Creek also buffers the Lower Ash Creek from the impact of freshwater from upper reaches of the watershed. The quality of freshwater outflow is also likely relatively poor due to low dissolved oxygen levels, increased water temperature, and the resultant anaerobic process.

Mosquito Ditching

The marsh was ditched in the 1870s, in 1911, and a few times more recently during the last midcentury, in an attempt to limit mosquito breeding. The ditching is still observable. The ditches divert flow away from the marshy substrate during high tides. Despite the historical ditching, the marsh substrate still appears to be physically stable.

Habitat and Biodiversity

Turney Creek still has relatively wide expanses of marsh, which enhances its habitat values. It has been suggested in the past that the area may be suitable for the recruitment and establishment of oysterbeds, however, its commercial value would be limited by the impossibility of access by any type of large watercraft.

The adjacent riparian forest (on public and private property) also provides valuable habitat.

Recreation

The lower sections of Turney Creek are accessible for canoeing and kayaking, though of limited utility due to limited length. The area is suitable for bird watching and nature appreciation. Public upland access to the tidal system is possible, but limited, through the Woods Wetland Conservation Area.

Aesthetic
The wide expanses of marsh, viewable from the backyards of the private residents and several businesses, bring exceptional aesthetic value to the community. However, in some places views are blocked due to very tall stands of Phragimtes (10+ feet in some cases).

D. 4 Potential Threats

Tidal Gates
As previously noted, flow is constricted through the inlet/outlet due to the tidal gates. Originally the tidal gates were installed as part of a flood protection project, and greatly restricted tidal exchange. This lead to noticeable impairments to the creek, and in 1979 and 1994 the Town of Fairfield Conservation Department replaced some of these gates with two new, improved 48 inch culverts with self regulating tide gates. Three older 8 foot diameter culverts with conventional tide gates were left in place. Previous assessments have noted that the newer tidal gates have improved the water quality. However, the presence of Phragmites in the vicinity of the gates suggests that flow might still be constricted to some degree. Restricted flow impacts salinity levels which in turn may encourage the recruitment and establishment of Phragmites, an invasive and alien plant.

Wetland – Upland Buffer Condition
Many of the residences along the south side of Shoreham Village Drive and the north side of Riverside Drive maintain rear lawns all the way down to the tidal wetlands or waterway channel. Ideally, there should be more natural buffer width in these yards in order to attenuate lawn pollutants such as fertilizers and pesticides.

Upstream Watershed Influences
Turney Creek not only conveys tidal flow from the main portions of Ash Creek, but also freshwater flow from the watercourse network that drains the rest of the watershed above the creek. That watershed extends far out from the local neighborhoods adjoining the tidal creek, extending deep into the eastern portion of Fairfield, all the way up to the Fairfield Woods neighborhood located between Routes

58 and 59. As a consequence, Turney Creek, which is a relatively small creek in relation to its watershed area, is fairly sensitive to storm events that may occur as far away as 3 miles upstream from its freshwater-saline boundary. The creek is also sensitive to nonpoint and point source pollutants from farther up in that watershed as well.

CT DEEP Water Quality Assessment

The 2010 305b CT DEEP Water Quality Assessment does not specify whether this creek was sampled, however, it would be expected that its water quality status would be similar to the main Ash Creek as well due to similarities in geography, suffering from impairments to Aquatic Life, Recreation, and Commercial Shellfish due to fecal coliform and other bacteria, metals, and other types of contaminated sediments.

Water quality in the creek is also classified by the State of Connecticut as "SB", a less desirable classification than "SA".

Sea level rise may be a long term threat to the tidal wetlands as there is limited habitat area left for any future wetland to naturally create along the fringe of any future sea level rise. As sea levels rise, wetland habitat may be pinched between residential properties and the rising average tide level, resulting in less and less habitat over time.

D. 5 Potential Ecosystem Improvements

Aesthetic

1. Enhance native vegetation throughout the study area.

2. Improve vistas across the study area through planting, placement of benches, and pathway alignment.

3. Work with adjacent property owners to integrate native plants into their landscape design choices.

4. Improve and create street end access and gathering spaces.

5. Examine potential for removing fill fom adjacent land to increase tidal marsh habitat, perhaps in coordination with flood mitigation efforts.

6. Work with Fairfield post-Sandy reconstruction efforts to integrate native plants into redevelopment plans.

7. Promote stormwater capture technologies including bioswales, vegetative buffer strips, rain barrel use, and permeable paving throughout the drainage area.

8. Integrate restoration with Hurricane Sandy recovery efforts.

9. Alter street ends to create views of water.

10. Create custom signage and educational kiosks to be used throughout the Ash Creek estuary that establish a local feeling respectful of cultural and ecological conditions.

Biodiversity

1. Encourage the creation of high marsh plants.

2. Educate local property owners about the value and importance of native plant species.

3. Supplemental spot planting and seeding to encourage specific native species wherever possible.

4. Develop forest management plan for forested edges.

Carbon Fixation

1. Improve tidal gates to allow more tidal flushing, thereby reducing methane and nitrous oxide releases (both greenhouse gases).

STREAM DAYLIGHTING

Many stretches of rivers and streams in the northeast United States have been buried below the ground in large culverts. This environmentally destructive practice reduces the ability of water bodies to provide flood control services, blocks the movement of fish, and has harmful downstream water quality impacts. In recent decades, many neighborhood beautification efforts have led to the excavation and restoration of buried local streams.

2. Create more wetlands.

3. Generally encourage the restoration of native plant materials.

4. Monitor all design and construction activities to reduce use of heavy equipment or building materials with high carbon footprints.

Habitat

1. Increase intertidal marsh areas through reclaiming vacant propterties.

2. Discourage Phragmites colonization.

3. Create green spaces at the end of street ends.

4. Reclaim land from adjacent low lying land currently used for non-water dependent purposes.

5. Convert mown lawn on promenade walkway to native shrubs and grasses.

6. Convert public and private lawn spaces to native vegetation.

Recreation

1. Define public access points.

2. Link bikeway and pedestrian routes with other sections of the estuary and Jennings Beach.

3. Install educational signage and kiosks in high traffic areas,

4. Improve ADA access to waterfront views.

5. Install blinds for bird watchers.

Water Quality

1. Develop and implement a green infrastructure plan that specifically addresses street ends runoff, residential properties, and permeable pavement conversion.

2. Study the function and design of all tide gates and culverts.

3. Identify runoff pollution sources such as fertilizer, pesticide, and other potentially harmful substances.

UNIT E. RIVERSIDE CREEK

E. 1 Description

Riverside Creek is located entirely within the Town of Fairfield. Although a tidal waterway, it is hydrologically connected to Ash Creek at both ends, and therefore more of an estuary than a tidal tributary. Both connections to Ash Creek are regulated by tide gates.

The upland and wetland area described for this assessment is approximately 58 acres in size. This includes 12 acres of open water within the South Benson Marina, and about 4 acres of open water in the active channel within its marsh during high tide.

The environmental and cultural landscapes that define this area include:

1. The "Northern" waterway segment (located north of Turney Road)
2. The "Southern" waterway segment (located south Turney Road)
3. The west bank (of the northern segment) lowland residential area
4. The north and south bank (of the southern segment) residential area
5. The marina
6. The artificial peninsula

The northern waterway segment begins at its connection to Lower Ash Creek underneath the earthen flood control dike located off Riverside Drive. The segment flows southerly between Riverside Drive and the Penfield Mills -Ash Creek Open space and parking area to the marina until it reaches the culvert underneath the Turney Road near the entrance to the marina. The length of this segment of waterway as it threads it way through its meanders is about 2600 feet.

The earthen flood control dike at inlet/outlet was constructed in 1957 after a series of coastal storms and hurricane for the purpose of protecting the adjoining neighborhoods from flooding. When the dike was originally constructed, a conventional tide gate was installed to allow freshwater to drain from the wetland. This tidegate prevented tidal exchange. This led to detrimental effects on the local ecology. It was replaced in 1975 by a self regulating tidegate which allowed salt water flow back

into the creek, improving the local ecology.

Within the northern waterway segment is a channel, high marsh, low marsh and forested riparian land. The tidal channel is very narrow (5-10') and provides limited mudflat habitat.

South of the Riverside Drive bend is the Riverside Drive-Ash Creek Wetland Conservation Area, consisting of 2.85 acres of mainly tidal wetlands south of the Turney Creek tidegates, and a 0.2 acre shoreline floodplain parcel just north of the tidegates. The parcels were acquired by the Town of Fairfield in 1978. The area is accessible from Riverside Drive, and provides opportunities for bird and other wildlife watching, shellfishing, and access to Lower Ash Creek.

The southern waterway segment is the portion of the creek that flows southerly from the culvert underneath Turney Road (across from the "headwaters" of the northern waterway segment) near the entrance to the Marina. From the culvert, the creek flows southerly approximately 200 feet where it joins the tidal wetland complex in the rear of the residences located along Milton Street and Oyster Road. The creek then flows easterly until it ultimately connects back into the marina basin through a 48 inch culvert with conventional tidal gate and a 24 inch self regulating tide gate located underneath the marina access drive.

The Town of Fairfield owns and manages the 3.1 acres of wetlands and adjacent uplands in the rear of Milton Street and Oyster Road, west of the marina basin. This area is designated as the Milton Street – Oyster Road Wetland Conservation Area, and was acquired in stages from 1939 to 1968. Dredge material from the marina was placed in this area in the 1960s and 70s. The wetland is degraded due to the lack of tidal exchange, and mainly functions as stormwater detention for the adjacent area.

Within the southern waterway segment is a channel and low marsh dominated by Phragmites.

The west bank lowland residential area includes the medium density residential neighborhood located on the southern side of Riverside Drive and the neighborhood

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located on the southern side of Riverside Drive and the neighborhood located both sides of Concord Street. These residences are located on the west bank to the northern segment of the waterway. These neighborhoods occupy a lowland area, and are built over deep, sandy, well drained, glacial outwash lake deposits.

The north and south bank residential area includes the medium density residential neighborhoods located on the north and south banks of the southern segment of the creek. These areas include Milton Street, the end of Clinton Street, and the north side of Oyster Road. These neighborhoods occupy a lowland area similar to the west bank lowland residential area, and are built over deep, sandy, well drained, glacial outwash lake deposits. These areas were once tidal wetland.

The marina includes the 12 acres of the open water basin, the parking lot to the Town of Fairfield Penfield Mills - Ash Creek Open Space and marina, and the paved access drive alongside the boating slips. The South Benson Marina is owned by the Town of Fairfield.

The basin was dredged out of marshland in 1964, and expanded again in 1970 and 1981, along with the parking areas. The spoils were placed in various places; along what is now the peninsula, within the area which now constitutes the meadow in the Pennfield Mills -Ash Creek Open Space area, and in the existing parking areas. The basin was previously tidal wetland.

The artificial peninsula is located between the marina and the bottom of the Lower Creek. It appears to be built of dredge spoils from the adjacent marina, and its major design function is to shelter the marina. The peninsula is about 950 feet long and 100 feet wide. The top is flat with a trail leading to waterfront access at its tip and at its base. Frequent users of this trail include dog walkers and people wanting to fish. The top of the landform is predominately shaded by a woody canopy of Locust trees. The sides of the landform are hardened with rip rap.

E.2 Historic Interpretation

Historical maps indicate that this southern segment was originally not connected to the northern segment. It was its own tidal creek flowing east/west. The current watershed to the creek extends 1200 feet from its most western remaining extent, to near the intersection of South Benson and Old Post Roads. Very likely the historical creek extended up into the top of this area. Overtime, the western extension of the creek was filled, and the neighborhoods constructed on top of it. The eastern portion of the creek was somewhat preserved, and was reengineered to be connected to the northern segment in the area located above Turney Road, near the entrance to the marina.

Since the southern segment is connected to the northern segment, and both segments connect to Ash Creek (The lower creek area and the marina basin respectively), it is theoretically possible for the creek to accommodate tidal flow into its interior segments from either inlet side. However, it appears that in most likelihood this does not occur. Continuous bidirectional tidal flow is reduced due to the conventional tidal gates that connect the creek to the marina basin. It appears that these constraints probably keep more of the flow from the southern segment from flowing north than vice versa.

E.3 Qualitative Assessment of Existing Conditions and Ecological Functions

Habitat and Biodiversity
Riverside Creek contains significant amounts of low and high tidal marsh. High marsh is dominated by Phragmites while the low marsh is dominated by Spartine alternaflora. A thin strip of mudflat exists along the narrow tidal creek.

Despite the self regulating tidal gates which allow tidal exchange, there are still a few stands of Phragmites near the northern segment's inlet, and a few stands within the waterway of the northern segment. There are also dense stands of Phragmites within the southern segment, especially in the Milton Street – Oyster Road Wetland Conservation Area. The tall clumps of Phragmites displace high marsh vegetation, and restrict views into the interior of the marsh, impacting the aesthetics.


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Hydrologic, Biogeochemical, and Ecological Functions of the Tidal Ecosystem
The tidal creek and its associated wetland areas are performing and providing many valuable ecological functions. These include floodwater alteration, fish and shellfish habitat, sediment/toxicant/pathogen retention of pollutants, nutrient removal/ retention/ transformation, carbon fixation to reduce global warming, shoreline stabilization, wildlife habitat, and visual quality/aesthetics.

Saline/Fresh Water Exchange
Of historical note is the impact to Riverside Creek by the artificially created system of tidal gates and culverts for floodwater control and to accommodate flow underneath the roadways. These constrain and obstruct free flow into the creek at its inlet, at its connection to the marina basin, and through the culvert underneath Turney Road. These gates and culverts likely impact salinity levels.

Flood Protection
Overall, The creek provides important flood protection to the surrounding neighborhood through its capacity to absorb flooding from rainfall during and after storm events. Its ability to provide that protection is a function of its channel capacity, and the integrity of its vegetation. It does not provide any significant storage capacity during tidal flood events.

The culvert underneath Turney Road, near the marina entrance, appears to be undersized, causing surface flooding along the entrance way road after storm events, and constricting tidal exchange during normal tidal cycles.

The channel is quite deeply entrenched near its outlet to the marina basin, probably due to obstructions in the outlet to the marina basin during storm events.

The Milton Street – Oyster Road Wetland Conservation Area serves as a natural stormwater detention basin for the adjacent community. However, sometimes it has been responsible for back flooding to the adjacent neighborhood during storm events when the culvert to the marina basin has been blocked on the seaward side due to debris during high tide.

Recreation
Recreation in the creek is limited to the northern segment is limited to shallow watercraft such as kayaks and canoes. Public access is only through the steep slope adjacent to the meadow in the Penfield Mills-Ash Creek Conservation Area, or from the parking area to the open space and marina, or from the flood control dike. There is public signage to the south of the bend in Riverside Drive.

Aesthetics
The northern segment of Riverside Creek, as viewed from the backyards of the residences along Riverside Drive and from the parking lot of the marina and town owned open space, is aesthetically pleasing and therefore brings value to the neighborhood and surrounding areas. Tall stands of Phragmites limit viewsheds.

Mosquito Ditching
Mosquito ditching of the marsh areas during the last two centuries has also permanently impacted the marsh. The ditching is still observable. The ditches divert flow away from the marshy substrate during high tides. Despite the historical ditching, the marsh substrate still appears to be physically stable.

E. 4 Potential Threats

Tidal Gates and Culverts
As previously noted, flow is constricted through the inlets of both sides of the creek due to the tidal gates and culverts. Restricted flow may impact salinity levels which in turn may encourage the recruitment and establishment of Phragmites, an invasive vegetation.

Wetland – Upland Buffer condition
Many of the residences along the banks of the creek maintain rear lawns all the way down to the tidal wetlands or waterway channel. Ideally, there should be more natural buffer width in these yards in order to attenuate lawn pollutants such as fertilizers and pesticides.

Fire
Dense stands of Phragmites are a fire hazard in areas such as the Milton Street – Oyster Road Wetland Conservation Area.

There have been reports of fires in the past in the northern segment downstream from the flood control dyke before the improved self regulating tide gate was installed. The improved tide gate has increased salinity levels, decreasing the extent of Phragmites in that area.

Impervious Surfaces
The parking lot for the marina and open space area is impervious. Drainage off of this surface is predominately sheet flow, with little or no attempt to mitigate the impact of nonpoint pollutants from the impervious surfaces into the creek. Rooftops on houses also significantly reduce permeable land.

Marina Boat Basin
Usage of the boat basin is high, with the frequent motorboat traffic and the use of the moorings. It is likely that that the motorized watercraft generate petroleum byproducts which become a source of local contamination to the marina basin and Ash Creek. It is likely that the watercraft serve as vectors for the transport of invasive plant species. It is likely that wake effects and prop dredging from the boats would cause erosion of the basin sides and floor.

CT DEEP Water Quality assessment
The 2010 305b CT DEEP Water Quality Assessment does not specify whether this creek was sampled, however, it would be expected that its water quality status would be similar to the main Ash Creek as well due to similarities in geography, suffering from impairments to Aquatic Life, Recreation, and Commercial Shellfish due to fecal coliform and other bacteria, metals, and other types of contaminated sediments.

Water quality in the creek is also classified by the State of Connecticut as “SB”, a less desirable classification than “SA”.

Sea Level Rise
Sea level rise may be a long term threat to the tidal wetlands as there is limited habitat area left for any future wetland to naturally create along the fringe of any future sea level rise.

E.5 Potential Ecosystem Improvements

Aesthetic

1. Enhance native vegetation throughout the study area.

2. Improve entryway to public open space at the Marina.

3. The bench at the end of the peninsula faces the backside of the sign and should be re-oriented. In general, vistas should be improved across the study area through planting, placement of benches, and pathway alignment.

4. Work with adjacent property owners to integrate native plants into their landscape design choices.

5. Improve and create street end access and gathering spaces.

6. Examine potential for removing fill from adjacent land to increase tidal marsh habitat, perhaps in coordination with flood mitigation efforts.

7. Work with Fairfield post-Sandy reconstruction efforts to integrate native plants into redevelopment plans.

8. Promote stormwater capture technologies including bioswales, vegetative buffer strips, rain barrel use, and permeable paving throughout the drainage area.

9. Integrate restoration with Hurricane Sandy recovery efforts.

BIODIVERSITY

Biodiversity is a fundamental requirement for ecosystem health. By maintaining diverse sets of plant and animal species, ecosystems tend to be more resilient to harmful impacts. In addition, there are many types of beneficial relationships between species that are still waiting to be discovered. Conservation of threatened native species should be fundamental to landscape development and management activities.

10. Add native vegetation to parking islands near the public open space at the peninsula.

11. Alter street ends to create views of water.

12. Create custom signage and educational kiosks to be used throughout the Ash Creek estuary that establish a local feeling respectful of cultural and ecological conditions.

Biodiversity

1. Encourage the creation of high marsh plants.

2. Educate local property owners about the value and importance of native plant species.

3. Increase salinity in tidal creeks to allow greater salinity.

4. Supplemental spot planting and seeding to encourage specific native species wherever possible.

5. Develop forest management plan for forested edges.

Carbon Fixation

1. Improve tidal gates to allow more tidal flushing, thereby reducing methane and nitrous oxide releases (both greenhouse gases).

2. Create more wetlands.

3. Generally encourage the restoration of native plant materials.

4. Monitor all design and construction activities to reduce use of heavy equipment or building materials with high carbon footprints.

Habitat

1. Increase intertidal marsh areas through reclaiming vacant properties.

2. Discourage Phragmites colonization.

3. Create green spaces at the end of street ends.

4. Reclaim land from adjacent low lying land currently used for non-water dependent purposes.

5. Convert mown lawn on promenade walkway to native shrubs and grasses.

6. Convert public and private lawn spaces to native vegetation.

Recreation

1. Define public access points.

2. Link bikeway and pedestrian routes with other sections of the estuary and Jennings Beach.

3. Install educational signage and kiosks in high traffic areas.

4. Improve ADA access to waterfront views.

Water Quality

1. Develop and implement a green infrastructure plan that specifically addresses street ends runoff, residential properties, and permeable pavement conversion.

2. Study the function and design of all tide gates and culverts.

3. Identify runoff pollution sources such as fertilizer, pesticide, and other potentially harmful substances.

UNIT E RIVERSIDE CREEK

RECOMMENDED NEXT STEPS

1. Work with stakeholders to prioritize above recommendations. Under ACCA's leadership, a series of meetings to be held with key local, state, and national stakeholders to review the proposals made herein.

2. Continue this report's Phase 1 efforts towards developing a phase 2 comprehensive Ecological Restoration Plan. Under ACCA's leadership this document should be created in order to guide future restoration and stewardship activities. The plan should include advanced levels of scientific and regulatory analysis. It should gain support from all key stakeholders and be formally adopted by the State, Bridgeport, and Fairfield. Components of the plan should include advanced design and cost estimates, stewardship budget, invasive species management recommendations, planting specifications, potential benefits, as well as goals, quantified objectives, and milestones.

3. Integrate recommendations with post-Hurricane Sandy recovery efforts. Hurricane Sandy caused tremendous damage to coastal areas throughout the region. As property and infrastructure is repaired, upgraded, and replaced, the recommendations of this master plan should be taken into consideration. Examples might include:

i.) Dune restoration efforts;
ii.) Upgrading storm sewers;
iii.) Dredging and sand placement activities;
iv.) Forest management;
v.) Expansion of permanent oyster reefs;
vi.) Creation of wetlands, uplands, and other flood control technologies;
vii.) Integration of native plants into private and public properties; and,
viii.) Improvement of buffer wetland systems.

4. Perform community outreach to improve citizen understanding and stewardship of the estuary. This might include, for example, installation of signage and educational kiosks, information placed on the ACCA website, public presentations, and environmental education work.

5. Investigate wetland mitigation opportunities. Development related impacts to natural resources often carries with them requirements to mitigate other areas in relatively close proximity to the location of the original impacts. Because Ash Creek is situated within a dense urban area where development damages are common, the estuary could play a key role in satisfying any future mitigation projects in coordination with the Fairfield and Bridgeport Wetland Agencies and/or other appropriate government agencies and commissions. To better understand this opportunity, the comprehensive restoration plan should identify stand alone restoration projects that may be implemented individually.

6. Implement wayfinding, environmental kiosks, and signage. Consistent signage is an excellent way to create a sense of place and ownership around a natural resource. To execute this best, an overall look and feel should be established by a professional design company. The tone set by the signage should respect cultural and ecological integrity. It should be obvious, but not intrusive. Signage should rely on universal graphic symbols understandable to people from multiple cultural backgrounds. All signage should be integrated with educational kiosks in look and feel.

7. Perform engineering review of tide gates. All tide gates in the estuary should be inspected to ensure they are operating according to their design requirements. Alternative types of tide gates should be considered to encourage greater salinity within tidal creeks.

8. Develop a Green Infrastructure Plan. All drainage areas that lead to the estuary should be thoroughly mapped to identify potential impacts. Green infrastructure technologies should be identified that are appropriate for watershed and sewershed. A strategic implementation plan should be enacted to over time.

9. Investigate whether a River Commission or a Harbor Management Plan for Ash Creek is an appropriate approach to protecting the Ash Creek tidal estuary. Public Act 95-333 enables municipalities to establish river commissions for the goal of coordinating and managing the development, protection, and preservation of important natural resources in river corridors bordering or lying within these

municipalities. Such an inter-municipal commission would provide a valuable joint municipal vehicle towards management of the creek. Alternatively, a Harbor Management Plan could be developed. Currently no harbor management plan exists that focuses specifically on Ash Creek alone. Such a plan could be important to the continued health of the creek as it can contain CT DEEP approved regulations and environmental policy specific to the creek on issues such as appropriate recreational boating practices and future user conflicts. ACCA is uniquely positioned within the community to play a vital role in coordinating and codifying such a plan. Both options (the River Commission or the Harbor Management Plan) should be further investigated to determine which would promote the best joint municipal approach to protecting the Ash Creek tidal estuary.

10. Continue to work with the City of Bridgeport to enhance their capabilities to manage the estuary from an ecological perspective. The City has indicated is willingness to work with community groups such as Ash Creek towards a common goal of environmental stewardship. ACCA is uniquely positioned to offer additional technical and policy advisory support to the City, and should continue to develop its ties with the town government and its land-use commissions. Furthermore, the Black Rock NRZ Strategic Plan has developed some good recommendations with regard to the municipal management of Ash Creek which deserve consideration. These include:

i.) Adoption of a city ordinance that requires substantive review of any construction, such as docks and piers, built out into Ash Creek.

ii.) Adoption of a conservation overlay for any proposed project that involves property adjacent to Ash Creek. This conservation overlay should address any issues of run-off control, non-point pollution remediation, erosion, and invasive species plantings.

iii.) Support the planting of native species and low-impact landscaping along the outlet of Ash Creek and into the St. Mary's by the sea area.

iv.)The formation of a Bridgeport Conservation Commission with an independent, elected Chair, to review as appropriate any and all development activities proposed for the city. The specific make-up and function of this commission should be based on best practices already established by many Connecticut cities.

11. Continue to work with the Town of Fairfield to enhance their capabilities to manage the estuary from an ecological perspective. Fairfield has historically been very aggressive in favor of environmental management of the creek. ACCA is uniquely positioned to offer additional technical and policy advisory support to the Town, and should continue to develop its ties with the town government and its land-use commissions.

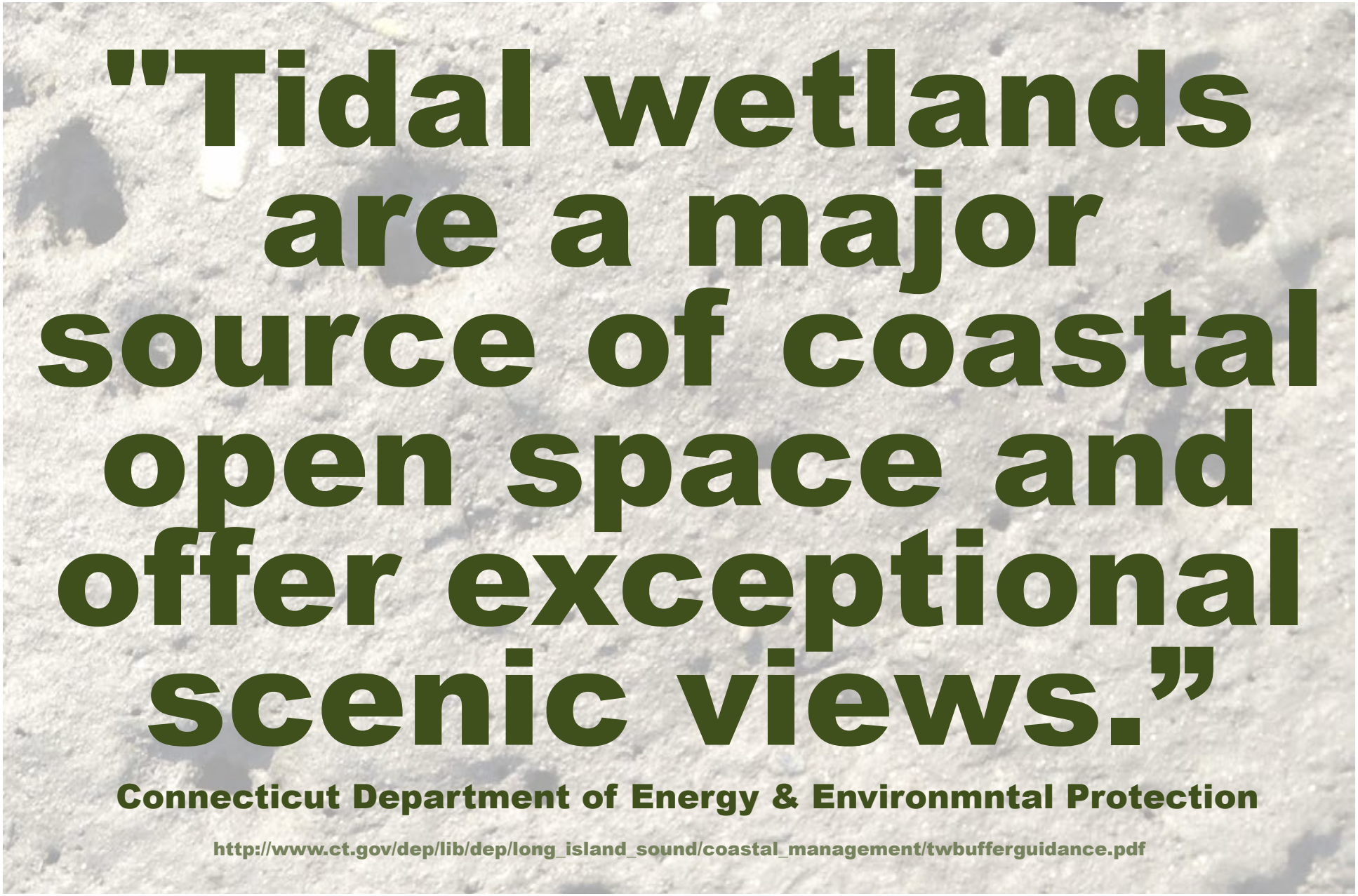
12. Develop planting specifications and design alternatives for the St. Mary's Sand Spit. Because the City of Bridgeport appears to have a rapid timeline for the restoration of the Sand Spit, ACCA should develop detailed planting and design specifications in the near future to ensure the Spit's restoration adheres to the recommendation of this report.

13. Encourage land-use practices that protect, maintain, and enhance the sand dunes on the St. Marys Sand Spit. The barrier sand spit plays an important role in the function of the creek, notably by protecting the creek from erosive wave action during storm events, and by providing a unique ecology and biodiversity to the area. Its flood and erosion protection to the estuary is very significant. The sand dunes are a vital component to the landscape of the spit. They should be protected along with the natural processes that create them. Excessive human disturbance to the barrier spit and especially to the sand dunes should be minimized so that the resource can continue to exist and provide its function to the estuary into the future. Municipal land-use practices which allow and promote the continued trapping of sand, the preservation and restoration of the dunes, and the stability of native vegetation should be encouraged.

14. Coordinate with Rooster River Watershed Plan. It is recognized that Ash Creek, although tidal, is linked to the Rooster River and still within the Rooster Watershed. The Rooster River Watershed Plan is currently in its initial stages of development. As the Rooster River Watershed plan initiative consolidates, the Ash Creek efforts should be adopted into that plan as appropriate.

15. Investigate restoration opportunities in upper reaches of Turney Creek. The headwaters of the creek are unclear at this time, but appear to be on the west side of the Kings Highway exit on Interstate 95. The creek then appears to run primarily underground until emerging at the Old Post Road. It may be possible to enhance or restore the creek in certain sections. This could have important implications on water quality and would undoubtedly restore important habitat to the area.

16. Re-enforce and develop more extensive relationships with environmental education organizations, including local school districts. The estuary is already studied by students at numerous surrounding schools. These relationships should be continued. Relationships with higher education facilities should also be considered.


"Tidal wetlands are a major source of coastal open space and offer exceptional scenic views."
Connecticut Department of Energy & Environmntal Protection
http://www.ct.gov/dep/lib/dep/long_island_sound/coastal_management/twbufferguidance.pdf