

# **SNEP Watershed Grants**

## **Final Report and Executive Summary**

### **Cover Information**

**Date:** January 31, 2024

**Project Name:** *Protecting Our Future Salt Marshes: Planning for Sea Level Rise and Interactive Learning for Our Community*

**Subaward Number:** #SNEPWG20-11-MASSAUD

**Subaward Period (for entire Project):** October 1, 2020 – December 31, 2023

**Subawardee Organization:** Mass Audubon

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**Reporting Period:** October 1, 2020 – December 31, 2023.

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## **0. Executive Summary**

Sea level rise is inundating marshes across the southern New England region, and threatens to submerge beaches, flood roads, and impact rivers and streams due to tidal water exposure. Impounded water on the salt marsh surface including marsh upland areas often results due to sea level rise impacts causing vegetation loss and waterlogged soils, leading to salt marsh degradation and loss of important ecosystem services and wildlife habitats. There is an immediate need to increase the resiliency and health of existing saltmarshes, and facilitate marsh migration into adjacent uplands where possible, to ensure that saltmarshes will exist in the future as seas rise, and to protect native birds and other fish and wildlife that rely on coastal habitats like Saltmarsh Sparrow (*Ammospiza caudacuta*) and Northern Diamondback Terrapin (*Malaclemys terrapin*) populations.

Buzzards Bay, MA marshes are at low elevations and are especially vulnerable to sea level rise compared to other marshes located at higher elevations. The impacts of rising sea levels in this region are compounded by the legacy of coastal agricultural and development practices on the Massachusetts South Coast. These stressors and agricultural practices have dramatically altered marsh tidal hydrology causing water to impound on the surface with vegetation loss accelerating degradation. Additional stressors include the proliferation of invasive species such as common reed (*Phragmites australis*) and other biological and physical upland barriers from agricultural and development that limit the marsh's capacity to migrate into low-lying adjacent uplands.

Restoring marsh tidal hydrology and removing barriers to inland migration are integral to maintaining saltmarsh in Buzzards Bay. Inland migration of coastal habitats is essential for long-term saltmarsh survival and coastal resilience, as the impacts of climate change and sea level rise continue to degrade saltmarshes along the coast. Although restoration tactics alone will buy time and slow down marsh degradation, strategies that promote inland migration of coastal habitats are integral to responding to sea level rise. Knowledge-sharing and outreach are needed to advance shared learning and engagement to facilitate adoption of these innovative methods across the region. Long-term resiliency requires knowledge gathering and transfer, planning, and action. Further, a thoughtful approach to engaging the coastal communities most vulnerable to climate change will help achieve equitable resilience planning in South Coast communities.

In collaboration with partners including Save the Bay, Dartmouth Natural Resource Trust (DNRT), Bristol County Mosquito Control, Atlantic Coast Joint Venture, and the Wareham Land Trust and with the gracious support of the Southern New England Program, Mass Audubon completed this novel, pilot project to begin to address the immediate need to increase the resiliency and health of saltmarshes, while concurrently restoring wildlife habitat and facilitating marsh migration into adjacent uplands. Our two-fold approach at our project sites at Allens Pond in Dartmouth and Westport, MA, and Great Neck in Wareham, MA has resulted in the **implementation of restoration management actions on ~60 coastal acres**. These restoration actions include:

- 1) The **restoration of marsh surface tidal hydrology** to dewater and revegetate ponding areas on ~40 acres of the Allens Pond Wildlife Sanctuary saltmarsh.
- 2) **Removal of several tidal restrictions and barriers** to inland migration at Allens Pond.
- 3) **Native revegetation** of ~8 acres of low-lying uplands along the Allens Pond upland/saltmarsh boundary.
- 4) **Removal of barriers to inland saltmarsh migration** at Great Marsh, including infrastructure, debris, and invasive plant infestations on 8 acres of saltmarsh and low-lying uplands.

Importantly, our project also strived to demonstrate these nature-based solutions by using our coastal wildlife sanctuary sites to share knowledge with restoration practitioners and with active community engagement and education programs throughout the Buzzards Bay region.

**Allens Pond Saltmarsh Tidal Hydrology Restoration**

Mass Audubon began the implementation of saltmarsh tidal hydrology restoration on 40 acres of Allens Pond Wildlife Sanctuary in 2021. This included the implementation and management of runnels, small channels, and maintenance of key existing ditches to drain ponding areas across 33 acres of the Allens Pond saltmarsh. Planning and wetland permitting for this work and the tidal restriction removal discussed below was begun in winter 2020 and completed in spring 2022. These restoration management actions were implemented in phases during spring and fall of 2022 and 2023 and completed in November 2023. Annual monitoring of the dewatering and revegetating of saltmarsh ponding areas was completed in September 2022 and 2023. Figures 1 and 2 provide a sample of reference images taken at monitoring locations during the project.

**Figure 1. Reference photos of a large ponding area at Allens Pond pre- (5/2022) and post-saltmarsh tidal hydrology restoration implementation.** Standing water pictured in the top left image was drained using runnels beginning in 5/2022. Water drained from the area by 9/2022 and most of the area was re-vegetated by September in the 2023 growing season.





**Figure 2. Reference photos of one-square-meter vegetation monitoring plots within ponding areas.** The image on the left was taken four months post-runnel implementation and the right image after a growing season in September 2023. Percent mean vegetation cover increased by more than 35% across monitoring plots by September 2023 and many plots had a greater than 95% increase in vegetation cover as in the plot shown below.



Tidal hydrology restoration actions also included the removal of large, discarded rocks, segments of submerged stone walls, and berms that restricted tidal flow into an additional ~8 acres of saltmarsh along its upland boundary. These restrictions were removed in phases at five key locations during spring and fall of 2022 and 2023. Figure 3 shows examples of the removal of tidal restrictions at Allens Pond implemented to drain ponding areas and restore tidal hydrology.

**Figure 3.** Large rocks (left image) and segments of submerged stone walls (right image) were removed from five key locations across Allens Pond to drain ponding water and to restore tidal hydrology to areas along the marsh/upland boundary.





***Removing Barriers to Inland Saltmarsh Migration and Restoring Low Lying Uplands Along the Allens Pond Saltmarsh Boundary***

We began to remove barriers to inland saltmarsh migration into low-lying uplands along the Allens Pond saltmarsh boundary on 8 acres of Dartmouth’s Natural Resource Trust’s (DNRT) Ocean View Farm Preserve in January 2021. This work included the implementation of invasive brush control and debris removal on 3 acres along the saltmarsh boundary and the seeding of 5 acres of adjacent hay fields with a mix of native grasses and flowers that tolerate a range of salinity and inundation. Mechanical removal of invasive brush on the saltmarsh boundary was completed with over 60 volunteers in the winter of 2021. As a follow up measure, invasive plant chemical control treatments were completed in summer 2023. Seeding of the low-lying hayfields was implemented in 2022 using a specialized drill seeder and a seed mix with over 20 plant species, with many species collected from nearby sites by volunteers. Baseline and ongoing monitoring for changes in the vegetation community were conducted in 2021 and 2023. Figure 4 (shown below) provides pre- and post-management reference photos of the invasive brush and debris removal.

**Figure 4. Reference photos of the invasive brush and debris removal along the Allens Pond saltmarsh/upland boundary at DNRT’s Ocean View Farm Preserve.** Left and center photos are arranged vertically in chronological order. The two photos in the right column were taken in 2023 and show the high saltmarsh native plants that have reestablished throughout the area since invasive brush removal in January 2021.



***Removing Coastal Infrastructure and Barriers to Saltmarsh Inland Migration at Great Neck***

Mass Audubon removed a half-acre asphalt shuffleboard court with fencing and other debris from the Great Neck project site in the winter of 2021. A management plan to convert the area to turtle nesting habitat was drafted working with Mass Audubon and MassWildlife scientists. The plan was implemented in the spring and summer of 2021 with over 20 volunteers planting over 90 native shrub and flower transplants. The area was also lightly sown with native grass seed in the fall. Monitoring for nesting turtles was conducted annually from 2021 through 2023 and turtle nests of at least two species were observed in 2022 and 2023. Figure 5 provides pre- and post-reference photos of this project.

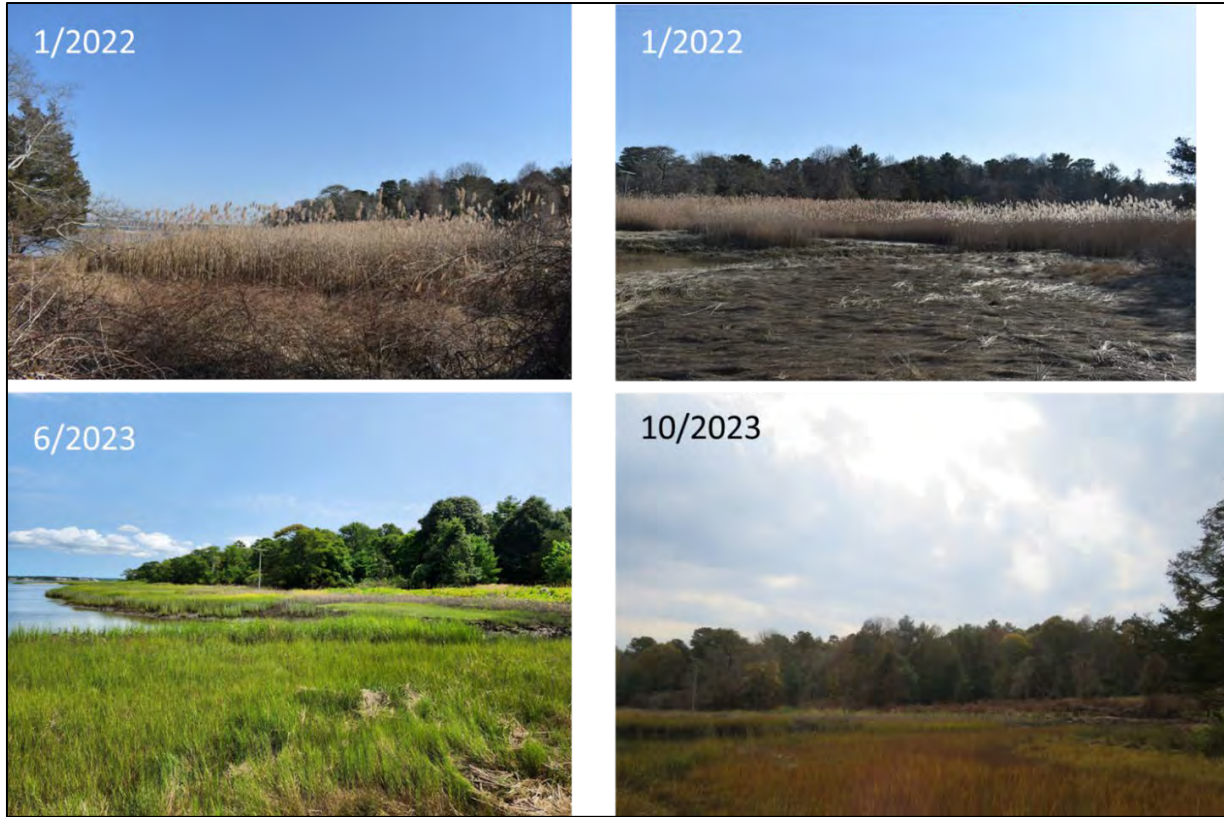
**Figure 5. Reference photos of the conversion of an asphalt shuffleboard court to turtle nesting habitat at Great Neck.** The asphalt was removed in the winter 2021 and the photos in the left column show the area pre- and post-restoration. Over 90 native shrub and flower transplants were planted by volunteers in the summer of 2021, shown in the upper right photo, and nesting turtles were detected one year after restoration. Hatched turtle eggs and nest are shown in the lower right photo.



A dense >3.5-acre stand of Common reed (*Phragmites australis*) dominated the saltmarsh platform and upland boundary along Bass Creek at Great Neck. Common reed is a nonnative, invasive grass, that is very adaptive, quick to establish and spread and difficult to control. It can take many years of repeated chemical herbicide treatments to achieve even moderate control. To restore the saltmarsh and remove this competitive, biological barrier to inland saltmarsh migration, we developed and tested a novel control method that we designed to maximize control in a single year while minimizing the use of chemical herbicide. Implementation to control the entire Common reed stand was begun in January 2022. Our management plan relied on several mechanical cuttings of the entire stand over a year. The cutting regime was designed to weaken the root system of the stand while also removing the vegetation biomass and changing its growth habitat from tall single-stemmed reeds to compact multi-stemmed reeds, which are easier to control. A single herbicide chemical control treatment was then applied to the entire stand at the end of the growing season in October 2022. Baseline and post-management monitoring were completed before management implementation in winter 2021 and post-management in spring and summer 2023. Results of monitoring indicated that we achieved over 99.9% control of the stand in only one year. Figure 6 provides pre- and post-common reed management control reference photos.



**Figure 6. Reference photos of the Common reed management control implemented on over 3.5 acres of the saltmarsh at Great Neck.** Photos are arranged chronologically in columns with pre-management photos on top.



Debris was removed and dense stands of invasive brush were controlled on over six additional acres of low-lying uplands along the Great Neck saltmarsh. Implementation began in winter 2022 with mechanical woody brush removal and repeated, and to follow up herbicide control treatments were completed by fall 2023. Figure 7 provides pre and post management reference photos of an invasive brush control and debris removal area.

**Figure 7. Mechanical brush removal was implemented to control dense, stands of invasive brush that characterized the low-lying upland areas along the saltmarsh boundary at Great Neck.** The left photo was taken during brush removal and the right photo shows the area after brush removal, follow up control treatments and seeding with native grasses.





**Outreach and Education Programming**

Mass Audubon and partners engaged over 120 volunteers that directly contributed to saltmarsh restoration. We also hosted a peer-to-peer workshop with the U.S. Fish and Wildlife Service including representatives from state and federal agencies, municipalities, and conservation organizations. Additionally, we provided education programs that served over 3,000 students in New Bedford, Fall River, and Wareham. Schools included **Durfee High School in Fall River, Wareham Middle and Elementary Schools**, and many schools in **New Bedford**. Students were invited to participate in Mass Audubon's Youth Climate Leadership Program. Our community engagement programs reached over 5,000 more people through outreach and partnerships with organizations like **Youth Opportunities Unlimited, New Bedford Boys and Girls Club**, among others. Figure 8 provides photos of peer-to-peer workshop and education and outreach events.

**Figure 8. Outreach and education events completed in 2022 including a peer-to-peer workshop shown in the upper right photo that was held at the Allens Pond saltmarsh.**



## 1. Project Report Narrative

### 1.A. Project Results

Sea level rise is inundating marshes across the southern New England region, and threatens to submerge beaches, flood roads, and impact rivers and streams due to tidal water exposure. Impounded water on the salt marsh surface including marsh upland areas often results due to sea level rise impacts causing vegetation loss and waterlogged soils, leading to salt marsh degradation and loss of important ecosystem services and wildlife habitats. There is an immediate need to increase the resiliency and health of existing salt marshes, and facilitate marsh migration into adjacent uplands where possible, to ensure that salt marshes will exist in the future as seas rise, and to protect native birds who can only live in such habitats such as Saltmarsh Sparrow.

To address these challenges, this SNEP grant supported developing a land management plan for Allens Pond and Great Neck Wildlife Sanctuary (GNWS) that addresses the impacts of sea level rise on existing salt marsh, facilitates future salt marsh migration, and improves adjacent coastal upland habitat (Objective One). This project has also included developing interactive learning experiences to educate the public about our salt marsh restoration work, including municipalities and Environmental Justice populations (Objective Two). We collaborated with a wide network of partners on this project, including Save the Bay, Dartmouth Natural Resource Trust, Bristol County Mosquito Control, the U.S. Fish and Wildlife Service/Atlantic Coast Joint Venture, and Wareham Land Trust. This collaborative effort has developed conservation plans for key salt marshes in Southern New England, provided tools to enable additional conservation planning at many more sites, implemented pilot projects to conserve salt marshes through such marsh migration facilitation, and provided a “demonstration site” where partners can see and learn about methods to improve salt marsh resiliency.

Our two-fold approach at our project sites at Allens Pond in Dartmouth and Westport, MA, and Great Neck in Warham, MA has resulted in the **implementation of restoration management actions on ~60 coastal acres**. These restoration actions include:

- 1) The **restoration of marsh surface tidal hydrology** to dewater and revegetate ponding areas on ~40 acres of the Allens Pond Wildlife Sanctuary saltmarsh.
- 2) **Removal of several tidal restrictions and barriers** to inland migration at Allens Pond.
- 3) **Native revegetation** of ~8 acres of low-lying uplands along the Allens Pond upland/saltmarsh boundary.
- 4) **Removal of barriers to inland saltmarsh migration** at Great Marsh, including infrastructure, debris, and invasive plant infestations on 8 acres of saltmarsh and low-lying uplands.

Importantly, our project also strived to demonstrate these nature-based solutions by using our coastal wildlife sanctuary sites to share knowledge with restoration practitioners and with active community engagement and education programs throughout the Buzzards Bay region. Activities carried out to complete the project, including deliverables and milestones, are summarized in the following chart.

Related Objective and Tasks	Deliverable	Partner Responsible/ Role
<b>Objective 1.1: Develop QAPP/ land management plan</b> for Allens Pond and GNWS and identify areas that can facilitate salt marsh migration, runnel implementation, and upland habitat management.	QAPP that incorporates methodology and implementation plan for salt marsh migration facilitation and runnel implementation, as well as coastal upland habitat management for Allens Pond and GNWS to be shared with other Mass Audubon sanctuaries and partner properties	Save the Bay, Dartmouth Natural Resources Trust, and Mass Audubon APWS/GNWS staff, Mass Audubon Conservation Science Department, Town of Wareham, Wareham Land Trust

*Protecting Our Future Salt Marshes:  
Planning for Sea Level Rise and Interactive Learning for Our Community*

<b>Objective 1.1 Outcomes and Milestones Achieved</b>	<ul style="list-style-type: none"> <li>• QAPP Complete and Approved. (spring 2021).</li> <li>• <b>Land management plan</b> to further implement this work across Allens Pond and GNWS was drafted and used to further secure grant support to expand and continue outreach programming, workshops, saltmarsh tidal hydrology restoration, removal of tidal restrictions and restoration of low-lying uplands at Allens Pond and GNWS. <b>Implementation will begin January 2024.</b></li> </ul>	
<b>Objective 1.2: Collect Allens Pond and GNWS baseline data</b> (avian monitoring, vegetation, elevation, salinity)	Pre-implementation data that will be compared to post-implementation data to measure effectiveness of management action	Save the Bay, Dartmouth Natural Resources Trust, and Mass Audubon APWS/GNWS staff, Mass Audubon Conservation Science Department
<b>Objective 1.2 Outcomes and Milestones Achieved</b>	<ul style="list-style-type: none"> <li>• Vegetation and salinity baseline monitoring was completed summer 2020. SHARP completed baseline avian monitoring during summer 2021. We decided not to complete belowground biomass and soil moisture measurements because impacts to those metrics would occur beyond the timeline of this grant.</li> <li>• Baseline monitoring (vegetation, elevation, and salinity) was completed at Allens Pond by December 2021.</li> <li>• Vegetation surveys were completed along saltmarsh/grassland boundary within the restoration project area at Ocean View Farm by fall 2021.</li> <li>• Northern Diamondback Terrapin surveys were completed in late summer/fall 2022, and species of turtles were observed nesting in the turtle nesting habitat restoration area at GNWS by spring 2023.</li> <li>• The recovery of formerly ponded areas of the Allens Pond salt marsh that were restored in 2022 was assessed by Save the Bay and Mass Audubon staff in May 2023 (see photos).</li> <li>• Saltmarsh monitoring was completed at Allens Pond summer/fall 2023. Monitoring included vegetation surveys, water level monitoring, elevation monitoring, photo plots, tidal restoration, and peat island vegetation surveys.</li> <li>• Invasive Common reed (<i>Phragmites australis</i>) monitoring was completed on the saltmarsh at GNWS by summer/fall 2023.</li> <li>• Project partners from Mass Audubon, Save the Bay and Dartmouth Natural Resource Trust completed maintenance and monitoring of the 33-acre Allens Pond saltmarsh tidal hydrology restoration project area (summer/fall 2023).</li> </ul>	
<b>Objective 1.3: Complete permitting and design</b> for invasive species control, restoration planting within boathouse and squash court footprint at GNWS, as well as stone wall removal, pilot runnels, and warm season grass plantings at Allens Pond	Permits and design plans for management work	Mass Audubon APWS/GNWS staff, Mass Audubon Conservation Science Department
<b>Objective 1.3 Outcomes and Milestones Achieved</b>	<ul style="list-style-type: none"> <li>• Design for stone wall removal and runnels were completed for Allens Pond (Spring 2021).</li> <li>• Permitting completed (summer 2021).</li> <li>• Squash Court footprint removed and planted (spring 2021).</li> <li>• A Commercial Scientific Permit was submitted to NHESP (fall 2021) and we began runnel digging in winter 2022.</li> <li>• Runnel and stone wall removal designs were completed by December 2021.</li> <li>• Stone wall removal completed Spring/Summer 2022. Invasive management plan and wetland permitting for the invasive plant and restoration management for GNWS was completed winter 2022.</li> <li>• Restoration planting within boathouse and squash court footprint at GNWS was</li> </ul>	



**Protecting Our Future Salt Marshes:  
Planning for Sea Level Rise and Interactive Learning for Our Community**

	<p>completed fall 2021.</p> <ul style="list-style-type: none"> <li>• Two follow up invasive brush control treatments at the warm season grassland restoration site at OVF were completed fall 2021.</li> <li>• The Commercial Scientific Permit was granted by NHESP for runnel construction within the Diamondback Terrapin time of year restriction (spring 2022).</li> <li>• Permitting was completed and approved for runnels and stone wall removal at Allens Pond (spring 2022).</li> <li>• Required reporting for the Commercial Scientific Permit was completed and submitted to NHESP along with a permit application for runnel maintenance within the Diamondback Terrapin time of year restriction for 2023 (summer/fall 2022).</li> <li>• Warm season grass seeding at Ocean View Farm was completed in November 2022.</li> <li>• Seeded with over 20 species of flowers and grasses with varying tolerances for salinity and inundation (fall 2022).</li> <li>• A commercial Scientific Permit was granted by NHESP for runnel construction within the Diamondback Terrapin time of year restriction (spring 2023).</li> <li>• Required reporting for the Commercial Scientific Permit has been completed and submitted to NHESP (fall 2023).</li> </ul>	
<p><b>Objective 1.4: Administer invasive species treatment</b> at Great Neck Wildlife Sanctuary (GNWS).</p>	<p>Invasive species control</p>	<p>Mass Audubon APWS/GNWS staff</p>
<p><b>Objective 1.4 Outcomes and Milestones Achieved</b></p>	<ul style="list-style-type: none"> <li>• Invasive plant and restoration management plan for GNWS was implemented in 10/21 and continued through summer 2022.</li> <li>• Initial phase of invasive plant control and follow-up treatments were completed throughout the GNWS project site by winter 2022. The area was reseeded by hand with 8 different species of native plant seed.</li> <li>• The Invasive plant control completed in 2022 at Great Neck was assessed in spring 2023. Control of phragmites from the 2022 treatment was estimated to be &gt; 99.9%. Assessment of reemerging invasive brush was also conducted, and further treatments were planned after spring 2023.</li> <li>• These follow-up treatments were completed during summer/fall 2023. Photos documenting this work are included.</li> <li>• Invasive plant control and native plant revegetation on 8 acres of Ocean View Farm was assessed in July, August and October 2023. Mowing treatments were applied in July and October and follow up invasive plant control were completed in August 2023.</li> <li>• Eight acres of invasive plant control and management at Great Neck Wildlife Sanctuary were assessed and final follow-up invasive plant control treatments were completed in July and September of 2023.</li> <li>• Common reed (<i>Phragmites australis</i>) control was implemented at Great Neck on any reemerging stems in Sept 2023 and control was reassessed at 99.9%</li> </ul>	
<p><b>Objective 1.5: Remove impeding infrastructure</b> (squash court at GNWS, stone wall at APWS)</p>	<p>Provide upland space for salt marsh migration</p>	<p>Mass Audubon APWS/GNWS staff, Mass Audubon Conservation Science Department</p>
<p><b>Objective 1.5 Outcomes and Milestones Achieved</b></p>	<ul style="list-style-type: none"> <li>• The squash court was removed at GNWS by spring 2021 and planning for the Allens Pond stone wall removal was conducted.</li> <li>• Stone wall removal at Allens Pond completed in September 2022.</li> <li>• Key portions of additional stone walls on the upland Allens Pond boundary were also removed to further reduce restrictions to salt marsh tidal hydrology within the high marsh upland boundary (spring 2023).</li> </ul>	

*Protecting Our Future Salt Marshes:  
Planning for Sea Level Rise and Interactive Learning for Our Community*

	<ul style="list-style-type: none"> <li>• The bulkhead and stone berm at Fresh Pond at Allens Pond were removed and the drainage monitored in late summer/fall 2023.</li> <li>• The Fresh Pond dam at Allens Pond Wildlife Sanctuary that was restricting tidal flow into ~8 acres of high saltmarsh and low-lying uplands was removed and monitored (summer/fall 2023).</li> </ul>	
<b>Objective 1.6: Complete plantings</b> around squash court and boathouse footprint at GNWS and warm season grass planting and pilot runnels at Allens Pond	Stabilize and restore coastal habitat at GNWS and facilitate salt marsh migration at Allens Pond Ocean View Site	Mass Audubon APWS/GNWS staff, Mass Audubon Conservation Science Department
<b>Objective 1.6 Outcomes and Milestones Achieved</b>	<ul style="list-style-type: none"> <li>• Planning for pilot runnels was conducted in spring 2021.</li> <li>• 97 plants installed in squash court footprint with after school group and staff efforts in spring 2021. Species included bearberry, seaside goldenrod, sweet fern, low bush blueberry, northern bayberry, and butterfly weed. Fencing was also installed around some plants to discourage deer browsing.</li> <li>• The final 55 native plants (152 total) were transplanted by fall/winter 2021 and native grass seeding was completed by volunteer groups on the squash court and boathouse footprints at GNWS.</li> <li>• Phase 1 of runnel implementation was completed in May 2022. Runnels were delayed due to permitting.</li> <li>• Phase 2 of runnel implementation was completed in September 2022.</li> <li>• All native planting and seeding at Great Neck and Ocean View Farm completed November /December 2022.</li> <li>• The tidal hydrology restoration was assessed on the Allens Pond salt marsh in spring 2023 and runnels were maintained and expanded in May 2023 to restore tidal hydrology to over 30 acres of the salt marsh. Maintenance of 33 acres of runnels and saltmarsh tidal hydrology restoration was completed in Oct/Nov. 2023.</li> </ul>	
<b>Objective 1.7: Install educational signage</b> for the salt marsh migration and runnel pilot projects	Educational tool to describe the salt marsh migration and runnel process and the salt marsh restoration pilot projects.	Mass Audubon APWS/GNWS staff, the Wareham Land Trust and Mass Audubon's Shaping Program
<b>Objective 1.7 Outcomes and Milestones Achieved</b>	<ul style="list-style-type: none"> <li>• Panels for Great Neck and Allens Pond were drafted in fall/winter 2022 and went through approvals during 2023. Signage emphasizes each project scope and the importance of healthy saltmarshes for nature and people.</li> <li>• Panels for Great Neck and Allens Pond were approved internally by Mass Audubon in fall 2023. Designs are attached at the end of this report.</li> </ul>	
<b>Objective 2: Educate the public</b> on targeted areas for land protection and salt marsh restoration efforts within their community. <b>Transfer and share project deliverables to partners and other groups</b> throughout the SNEP region.	Educational programming and outreach materials that engage underserved communities and EJ populations on project progress and demonstrate how public can engage in environmentally smart practices (e.g. dissemination of Shaping's Low Impact Development fact sheets and presentations)	Mass Audubon APWS/GNWS staff, Mass Audubon's Shaping Program, Dartmouth Natural Resources Trust, Town of Wareham, and Wareham Land Trust
<b>Objective 2 Outcomes and Milestones Achieved</b>	<ul style="list-style-type: none"> <li>• 20 honors students from Westport High School visited the project site for a field trip and discussed the SNEP project; the students also monitored baseline data (spring 2021).</li> <li>• Created a community outreach strategy document for the project's educational plan as well as a fact sheet that was approved by partners to hand out to the</li> </ul>	

	<p>public (spring 2021).</p> <ul style="list-style-type: none"> <li>• 13 events were held with ~160 participants. These events ranged from youth programs, adult programs, zoom presentations, and high school programs all discussing the SNEP project (summer/fall 2021).</li> <li>• 9 additional events with ~250 participants held. These events ranged from guided hikes, trainings, tabling, high school programs, and climate cafes. These events occurred in environmental justice communities of New Bedford, and Wareham, as well as at the Allens Pond Sanctuary (spring 2022).</li> <li>• The project team developed and published a Story Map website discussing our work, the purpose, and the importance of the restoration work through the SNEP grant: <a href="https://arcg.is/Onye09">https://arcg.is/Onye09</a>. The Story Map can be accessed through our company website's Coastal Resilience Program page, which highlights the salt marsh restoration work at Allens Pond: <a href="https://massaudubon.org/crp">https://massaudubon.org/crp</a>. (spring 2022).</li> <li>• Created and distributed brochures discussing the project and the purpose and importance of the restoration work through the SNEP grant (spring 2022).</li> <li>• The project team conducted planning for municipal engagement during fall 2021 and implemented that plan in the spring of 2022.</li> <li>• U.S. Fish and Wildlife Service staff conducted a site visit at Allens Pond runnel and salt marsh migration sites in May 2022. Project partners and a dozen additional coastal ecology professionals gathered at Allens Pond Wildlife Sanctuary and Ocean View Farm for a site visit to the runnel and salt marsh migration sites.</li> <li>• The preliminary results of the runnel project were presented at the Restore America's Estuaries Conference in December 2022.</li> <li>• Held 5 additional events with approximately 420 participants total. The events included tabling events and climate cafes in the environmental justice communities and other communities near the restoration area (fall 2022).</li> <li>• Throughout the grant period Mass Audubon incorporated information on the SNEP restoration project into our overall education and community programming. Mass Audubon offers a Community Gathering event held monthly, a Summer Speaker Series, participated in New Bedford's Pokemon Go Global Fest, tabling events, and others where this restoration work has been highlighted (spring, summer, and fall 2023).</li> <li>• The project Story Map continues to be actively updated as notable accomplishments are made (fall 2023).</li> </ul>
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**Findings and Lessons Learned**

Mass Audubon found that its greatest challenge during the project was not anticipating enough time to complete all the required wetland permitting in order to begin implementation of the saltmarsh tidal hydrology restoration at Allens Pond in 2021. However, working with our partners and regulators and with a gracious extension from SNEP, we were able to get the work permitted and fully implemented beginning in 2022 and completed in two years as planned.

**1.B. Next Steps & Recommendations**

Our next step is to build on the collective work supported by this SNEP Watershed Implementation grant and continue to address the legacies of agriculture and infrastructure to promote saltmarsh resiliency and facilitate inland marsh migration into adjacent low-lying areas. Our plan includes implementing marsh migration and restoration methods on another 160 acres on four sites across Buzzards Bay by 2026. The next phase of the project will include saltmarsh management planning and implementation that addresses the impacts of sea level rise on existing salt marsh, facilitates future salt marsh migration, and improves adjacent coastal upland habitat at Allens Pond, Great and Cromesett Neck Wildlife Sanctuaries, and DNRT's Ocean View Farm Preserve.



With Mass Audubon's, our partner's and SNEP's growing networks, we will also continue to serve the diverse and often underserved environmental justice populations in the region with impactful peer-to-peer knowledge sharing with conservation professionals, education in schools, volunteering, and community outreach with agencies and municipalities to increase expertise on available and emerging coastal resilience solutions.

Our long-term vision is to continue this project to promote region-wide adoption of these saltmarsh migration and restoration practices that can be adapted on other Mass Audubon sanctuaries and project partners' properties throughout Southern New England. The completion of marsh restoration and inland migration on a total cumulative 200 acres of Buzzards Bay saltmarsh will serve as a significant demonstration site for municipalities and landowners across the Buzzards Bay Watershed region as well as throughout the SNEP Network and other coastal areas in New England. This work will be a partner-driven, collaborative effort to develop conservation plans and implement these strategies for key salt marshes in Southern New England, provide tools to enable additional conservation planning at many more sites, implement pilot projects to conserve salt marshes through such marsh migration facilitation, and provide "demonstration sites" where partners can see and learn about methods to improve salt marsh resiliency.

### **1.C. Compliance**

- The QAPP was submitted and approved by fall/winter 2021.
- Permitting for the Allens Pond runnel implementation was delayed due to an unforeseen time of year restriction implemented by NHESP for Northern Diamondback Terrapins.
- A Commercial Scientific Permit was granted by NHESP for runnel construction within Diamondback Terrapin Time of Year restriction in March 2022.
- All required permits for the invasive wetland plant control at Great Neck have been amended and were approved in October 2021.
- All permits for runnel implementation and stone wall removal at Allens Pond were approved in May 2022.
- All wetland permits for Great Neck Wildlife Sanctuary were revised, approved, and completed by fall/winter 2022.
- A Commercial Scientific Permit for runnel construction within the Diamondback Terrapin time of year restriction in 2023 was granted by spring 2023. All reporting requirements for the 2022 NHESP Commercial Scientific Permit were accepted by spring 2023.
- The required reports for the Commercial Scientific Permit for runnel construction within the Diamondback Terrapin time of year restriction in 2023 have been submitted (fall 2023).

### **1.D. Project Partners**

#### **Save The Bay**

- Worked with Mass Audubon on the QAPP and plans for runneling as well as provided technical advice on the overall project.
- Assisted with permit development and baseline vegetation as well as salinity monitoring at Allens Pond.
- Assisted with phase 1 of runnel implementation and led phase 2 runnel implementation in September 2022. Assisted in the monitoring of the runnel project in September 2022.
- Conducted assessment of tidal hydrology restoration implemented at Allens Pond in 2022 with Mass Audubon's Senior Conservation Ecologist.
- Joined Mass Audubon team to conduct runnel maintenance and expand runnel network and remove further tidal restrictions in the high marsh upland boundary in May 2023.
- Conducted monitoring of tidal hydrology restoration implemented at Allens Pond with Mass Audubon's Southeast Staff and Senior Conservation Ecologist in September 2023.

- Assisted with maintenance of runnels and ditches and downloading logger data in October 2023.

#### **Dartmouth Natural Resources Trust**

- Worked with Mass Audubon around plans for invasive control and field management, including planning staged with work beginning in 2021.
- Assisted with invasive control and field management at Ocean View Farm.
- Completed grassland walk with community members of restoration area at Ocean View Farm and worked with Mass Audubon on coordinating the warm season grass planting.
- Worked with Mass Audubon to complete invasive brush control and seeding with native grasses and flowers on 6 acres to complete the work at Ocean View Farm.
- Staff joined Save the Bay and Mass Audubon partners to maintain and expand salt marsh tidal hydrology restoration at Allens Pond in May 2023.

#### **Bristol County Mosquito Control**

- Worked with Mass Audubon on permit development and submitted permits for the project. Assisted with design for stone wall removal.
- Led the stone wall removal implementation at Allens Pond including offering the use of their equipment.
- Assisted in the monitoring of the runnel project in September 2022.

#### **U.S. Fish and Wildlife Service (USFWS)**

- Conducted a field visit for USFWS staff at Allens Pond runnel and salt marsh migration sites. Project partners and a dozen additional coastal ecology professionals gathered at Allens Pond Wildlife Sanctuary and Ocean View Farm on May 25, 2022, for a site visit to the runnel and salt marsh migration sites.

#### **Wareham Land Trust**

- Collaborated on education programming, including hosting tabling events and other education programming.

### **1.E. Volunteer and Community Involvement**

Mass Audubon and partners engaged over 120 volunteers that directly contributed to saltmarsh restoration. Mass Audubon implemented **177** volunteer sessions throughout this project, and these volunteers served an important role in implementing restoration actions while learning about saltmarsh resilience in the process. In total, these volunteers contributed **481 volunteer hours** toward the project, as outlined below.

- **Fall 2020: Two volunteers**, including a local college student, worked with Mass Audubon to create a plan to capture video of the asphalt removal at Great Neck Wildlife Sanctuary (including before, during, and after). This was a total of **2 volunteers** for a total of **10.5 hours** over four days.
- **Winter/Spring 2021:** Mass Audubon engaged **108 volunteers** for a total of **319 volunteer hours**. Volunteers assisted with the invasive species removal at DNRT's Ocean View Farm on eight different occasions. Additionally, **20 student volunteers** from Wareham's CARES program (a district wide out of school time program) joined Mass Audubon staff in planting 97 plants on the footprint of the asphalt court that was removed at Great Neck Wildlife Sanctuary. **Twenty Westport High School student volunteers** joined Mass Audubon staff in conducting some baseline monitoring at Allens Pond Wildlife Sanctuary as the SNEP project was integrated into their honors student field trip.
- **Summer/Fall 2021:** Mass Audubon hosted a volunteer planting day at Great Neck Wildlife Sanctuary to complete plantings around the squash court and boathouse footprint. **Three volunteers** joined us to plant 55 plants and sprinkle grass seeds within bare areas. During this timeframe we had **one volunteer** join us for 1.5 hours to conduct invasive species removal at Great Neck Wildlife Sanctuary. We had **four volunteers** complete eight Diamondback Terrapin monitoring surveys at Great Neck Wildlife Sanctuary within the project area for a total of ~20 hours. During this time period we discussed plans for multiple volunteer invasive species

removal days in 2022. Our total volunteer time contribution for this period was **24.5 hours**.

- **Winter/Spring 2022:** Mass Audubon hosted two volunteer invasive species removal days at Great Neck Wildlife Sanctuary to continue removing and treating invasives in Treatment Unit 1 and 3. These events included **eight volunteers** for a total of 24 volunteer hours. We have had **three volunteers** conduct Diamondback Terrapin monitoring surveys at Great Neck Wildlife Sanctuary within the project area for a total of ~45 hours. Our total volunteer time contribution for this period was **69 hours**.
- **Summer/Fall 2022:** **Three volunteers** conducted Diamondback Terrapin monitoring surveys at Great Neck Wildlife Sanctuary within the project area for a total of **25 hours**.
- **Winter/Spring 2023:** **Three volunteers** conducted Diamondback Terrapin monitoring surveys at Great Neck Wildlife Sanctuary for an estimated **20 volunteer hours**.
- **Summer/Fall 2023:** **Two** volunteers conducted Diamondback Terrapin monitoring surveys at Great Neck Wildlife Sanctuary for **13 volunteer hours**.

## **1.F. Outreach & Communications**

As noted earlier in this report, Mass Audubon provided education programs on this restoration project that served over 3,000 students in New Bedford, Fall River, and Wareham. Schools included Durfee High School in Fall River, Wareham Middle and Elementary Schools, and many schools in New Bedford. Students who participated were also invited to participate in Mass Audubon's [Youth Climate Leadership Program](#), a multi-level immersion out-of-school program for high school students in youth empowerment and leadership, culminating in actionable projects that combat climate change with a local focus. Our community engagement programs reached over 5,000 more people through outreach, presentations at colleges and universities, site visits and workshops, and partnerships with organizations like Youth Opportunities Unlimited, New Bedford Boys and Girls Club, among others.

### **Media resources on the project include the following:**

- **Website:** [Coastal Resilience Program](#): Mass Audubon website page discussing our coastal resilience program, highlighting the work conducted through the SNEP grant.
- **Story Map:** *Saving Our Coastlines, Habitats, and Neighborhoods* (<https://arcg.is/0nye09>) An ArcGIS story map used to show photos and share our SNEP progress with the community, project partners, and the general public.
- **Press Release** - <https://www.massaudubon.org/news/press-room/2020/epa-supports-saltmarsh-restoration-at-allens-pond-and-great-neck>
- **News Article:** [How Mass Audubon is Preserving a 'living laboratory' to Study Climate Change at Allens Pond](#)  
South Coast Today – The Standard Times News Article
- **News Article:** [Massachusetts State Senator Tours Wildlife Sanctuary in Westport to Learn about Impacts of Climate Change](#) ABC WLNE-TV News Report
- **Enews Story:** [Protecting Salt Marshes at Allens Pond](#) Mass Audubon enews story
- **Blog Post** <https://blogs.massaudubon.org/yourgreatoutdoors/salt-marsh-restoration/>
- **News Article in SouthCoast Today:**  
<https://www.southcoasttoday.com/story/news/climate-change/2021/01/24/mass-audubon-starts-project-protect-salt-marsh-climate-change/6637204002/>

### **Education activity highlights include the following:**

Mass Audubon partnered with **University of Massachusetts/Dartmouth** to conduct a **service-learning program** about the SNEP project. Seniors majoring in Graphic Design worked with Mass Audubon staff over five weeks to develop individual design projects that Mass Audubon can finalize for future outreach efforts. The service learning began with a site visit to Allens Pond where 17 students learned about salt marshes, the impact of sea level rise, and measures underway to build marsh

resilience. Final projects included PowerPoint slides, a salt marsh graphic, Instagram filters, Instagram posts, and QR-coded informational web-links.

**Plymouth High School's Environmental Science class** joined us out at Great Neck Wildlife Sanctuary to learn about saltmarsh ecosystems, Diamondback Terrapins, and invasive species and their removal techniques. The students received hands-on experience identifying and removing invasive plant species.

**Tabling Events:** Mass Audubon hosted many tabling events throughout southeast Massachusetts during the grant period, during which our staff spoke directly with hundreds of people in various communities. A trail opening event at Allens Pond Stone Barn involved a tabling component for visitors to learn about the project. Mass Audubon tabled at the local New Bedford Buttonwood Zoo's Party for the Planet Earth Day celebration. We talked with people in this environmental justice community about the salt marsh restoration work happening at Allens Pond as a result of the SNEP grant. Other locations included New Bedford Whaling Museum, Onset Bay Center (in partnership with Wareham Land Trust, the Wildlands Trust, and Buzzards Bay Coalition) at the Wild for Wareham Event, Round the Bend Farm's Pow Wow event in Dartmouth, Summer Days at Allens Pond, River Day at Westport River Watershed Alliance, UMass Dartmouth freshman orientation and Engage Fair, Pokemon Go Global Fest at the New Bedford Library, and many more.

**Climate Cafes:** These events were held at libraries and community spaces to talk about climate change in southeast Massachusetts and this SNEP project was a featured topic for these cafes throughout the project period. Locations included Wareham Library, New Bedford Public Library, and many other libraries and community spaces.

**Summer Speaker Series:** This evening program at Allens Pond Wildlife Sanctuary featured Mass Audubon staff talking with the public about the conservation, restoration, and education activities to support sustainability efforts in the region. This free event provides the opportunity to connect with community members and learn what is happening right here in Westport, Dartmouth, and the surrounding area. Mass Audubon highlighted restoration work accomplished through the SNEP grant at all Summer Speaker Series during the grant project.

**Coastal Ecology Professionals Site Visit:** On May 25, 2022, project partners and ecology professionals gathered at Allens Pond and Ocean View Farm for a site visit to the runnel and salt marsh migration sites. Organizations that participated were CZM, DER, Trustees, Boston University, UMass Boston, MA Department of Fish and Game, and UMass Amherst.

**Restore America's Estuaries:** The preliminary results of the runnel project were shared at the Restore America's Estuaries conference in December 2022.

**Presentation:** Mass Audubon's Senior Conservation Ecologist presented the SNEP 2020 project results and next steps and Save The Bay's Director of Restoration presented on salt marsh tidal hydrology restoration projects to 25+ professionals at The Southeastern Regional Planning & Economic Development District's Resilient Taunton Watershed Networks meeting in fall 2023.

**Presentation:** Mass Audubon's Senior Conservation Ecologist presented the SNEP 2020 project results and next steps to 12 graduate students and faculty for the Graduate Lecture Series at Bridgewater State University in fall 2023.



## 2. Project Budget Report

Budget Category	Total Budgeted Funds	Total Budgeted Match	Grant Funds Expended This Period	Grant Funds Expended Cumulative	Match Funds Expended This Period	Match Funds Expended Cumulative	Match Source (note cash or in-kind)
Personnel	50,790.00	30,000.00	5,616.17	50,790.00	136.44	26,018.49	Cash /In-Kind
Fringe	15,745.00	7,500.00	1,628.69	12,521.55	39.57	7,275.83	Cash
Travel	800.00	740.00	67.50	567.38		704.53	Cash
Equipment	-	-		-	-		
Supplies	41,029.00	4,624.00	3,767.82	39,303.58		3,715.33	Cash
Contractual	23,500.00	-		27,978.10		32.93	Cash
Other	4,500.00	2,200.00	4,047.52	5,202.82	1,006.23	7,347.09	Cash
<b>Total Direct</b>	<b>136,364.00</b>	<b>45,064.00</b>	<b>15,127.70</b>	<b>136,363.43</b>	<b>1,182.24</b>	<b>45,094.20</b>	<b>Cash/In-Kind</b>
Indirect	13,636.00	4,506.00	1,512.77	13,636.57	118.22	4,509.42	Cash/In-Kind
<b>Total</b>	<b>150,000.00</b>	<b>49,570.00</b>	<b>16,640.47</b>	<b>150,000.00</b>	<b>1,300.46</b>	<b>49,603.62</b>	<b>Cash/In-Kind</b>

### 2.A Budget Narrative

Due to the rising costs of contractors, and to maximize the work accomplished with grant funding, Mass Audubon implemented more of the project with full-time staff than initially expected, which resulted in higher staffing rates and lower contractual rates. This was also possible due to an increase in staff expertise in restoration and ecological management. Because of this shift in staffing capacity, Mass Audubon requested and was granted a budget amendment, reallocating budget expenses from Contractual – and Contractual-related Travel – to Supplies and Personnel. A budget amendment reflecting this update was approved on February 28, 2023. Thanks to the no-cost extension provided we have fully spent this grant and honored our match commitment as of October 2023.





Final Draft of Permanent Panel Signage: Panel Two

# Saving Salt Marshes at Great Neck



One of the world's most productive ecosystems, a salt marsh provides critical habitat and food for wildlife such as Diamondback Terrapin and Saltmarsh Sparrow. These low-lying coastal wetlands also serve as spawning and nursery habitat for fish and as homes to a variety of shellfish. Salt marshes also absorb storm surge, storm water, and wave and wind energy, protecting our coastal infrastructure and properties from damage. And salt marshes act as carbon sponges, removing 10 times more carbon from the atmosphere than a forest of the same size annually.

## Threats to Salt Marshes

Salt marshes can adapt to changing coastal conditions by migrating inland. But with continued development along the coast, and as climate change causes increased sea level rise, salt marshes have few places to go, leading to tidal flooding. Flooded salt marshes threaten the wildlife that depend on them. As extreme weather events increase in frequency, the amount of flooding that our coastal areas experience will increase.

## Protecting Salt Marshes

At Great Neck, we have restored areas surrounding the salt marsh to help facilitate the salt marsh's migration inland as sea levels rise. We removed buildings, asphalt, and invasive, non-native plant species like Common Reed that obstruct salt marsh migration. We reseeded the cleared areas with native plants to provide habitat for local wildlife such as Diamondback Terrapins, Great Blue Herons, and Mournful Doves.



## Saving Terrapins

Diamondback Terrapins make their home exclusively in brackish water, a mix of salt and fresh water, found in marshes. Although their population rebounded after they were nearly hunted to extinction in the 18th century, today they are listed as a threatened species in Massachusetts due to risks such as an increase in predation, the wildlife pet trade, car strikes on roads, and habitat loss. Mass Audubon is helping Diamondback Terrapins by restoring salt marsh migration zones and improving nesting habitat. Preparing this area for salt marsh migration will provide habitat for Diamondback Terrapins as sea level is rise.



## How You Can Help Salt Marshes

We all need to do our part to help our salt marshes thrive. You can make an impact by:

- Volunteering for local restoration projects.
- Supporting organizations that protect land, become a member, attend programs, donate.
- Advocating for salt marshes and local efforts by sharing what you've learned.

Learn more at [massaudubon.org/greatneck](http://massaudubon.org/greatneck)



Michael Cherny/Howe, a diamondback terrapin stretching its neck on its boardwalk.

**Partner Acknowledgment**  
This work is supported by a Scoussier New England Program (SNRP) awarded Grant, which is funded by the U.S. Environmental Protection Agency (EPA) through Additional Partnership Agreements.  
Additional partner agencies:  
Department of Natural Resources and Environmental Control, State of Massachusetts, Office of Planning and Economic Development, Fish and Wildlife Services, Town of Great Neck, and the Office of Planning and Economic Development, State of New York.



**4. Certification**

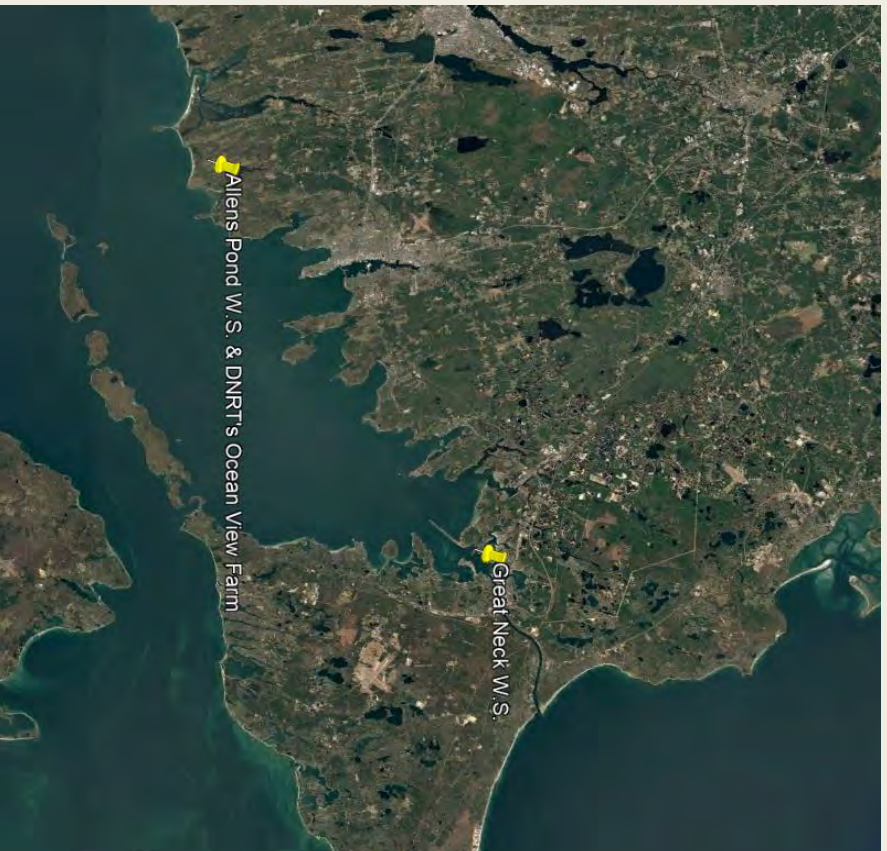
*The undersigned verifies that the descriptions of activities and expenditures in this progress report are accurate to the best of my knowledge; and that the activities were conducted in agreement with the grant contract. I also understand that matching fund levels established in the grant contract must be met.*

Grantee Signature:



Lauren Kras  
Regional Director, Southeast  
January 31, 2024  
Mass Audubon

# Protecting Buzzards Bay's Coast from Sea Level Rise



Pilot project with restoration  
management actions  
implemented across >70 acres  
on 3 sites

Gene Albanese Ph.D.  
Senior Conservation Ecologist  
SE MA, Cape & Islands



# Partners & Support

- Save The Bay
- Dartmouth Natural Resources Trust
- NOAA
- Ducks Unlimited
- Wareham Land Trust
- U.S. Fish and Wildlife Service
- Bristol County Mosquito Control





# Goals

- Increase capacity of coastal ecological communities to recover (resilience) & transition (e.g., inland migration) from the forecasted impacts of climate change & sea-level-rise
- Recover and enhance process, function & native biodiversity by mitigating the legacy impacts of anthropogenic change
- Leverage partnerships, education & outreach expertise to promote & share knowledge



# Restoration & Adaptive Management

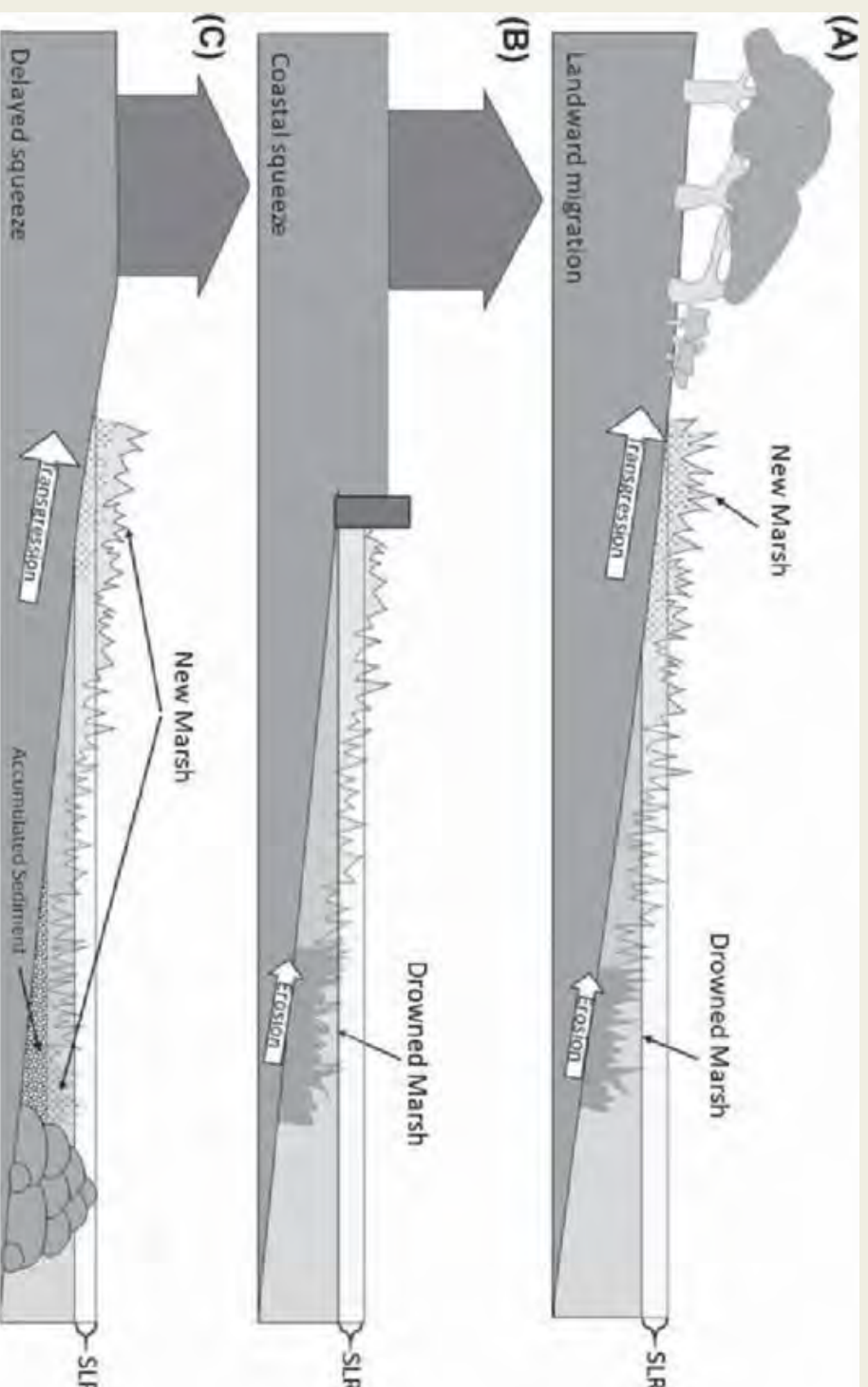
- Management prescribed to recover a systems function and structure from a disturbance event
  - Legacy of buildings, dams, agriculture, invasive species infestation
- Iterative management actions applied in phases with ongoing monitoring that continuously evaluates expectations vs. results and modifies management prescription to meet project goals

# Resistance, Transition & Resilience

- The capacity of an ecosystem to resist or withstand the impacts of a catastrophic event
  - Manage for persistence
- The capacity to transition into a fundamentally different system
  - Manage for change
- The capacity to recover or respond to a catastrophic event
  - Mix
- Single events
  - Storms, fire, drought
- Long-term change
  - Sea level rise, warmer drier climate



# Facilitating Coastal Wetland Transgression



Adopted from Coastal Wetlands, C. Perillo et. al. 2019

# Saltmarsh Tidal Hydrology Restoration

- Mitigating legacy impacts of historic land use practices & SLR
- Dewatering & revegetating ponding areas
- Removing tidal restrictions e.g., stones, debris

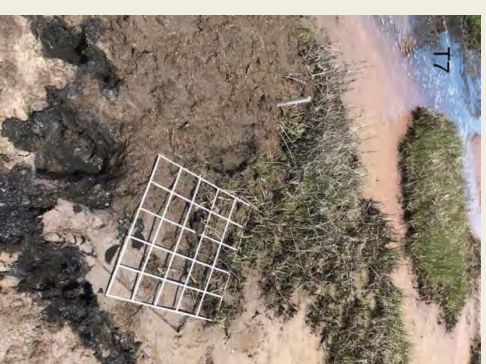




# Saltmarsh Tidal Hydrology Restoration



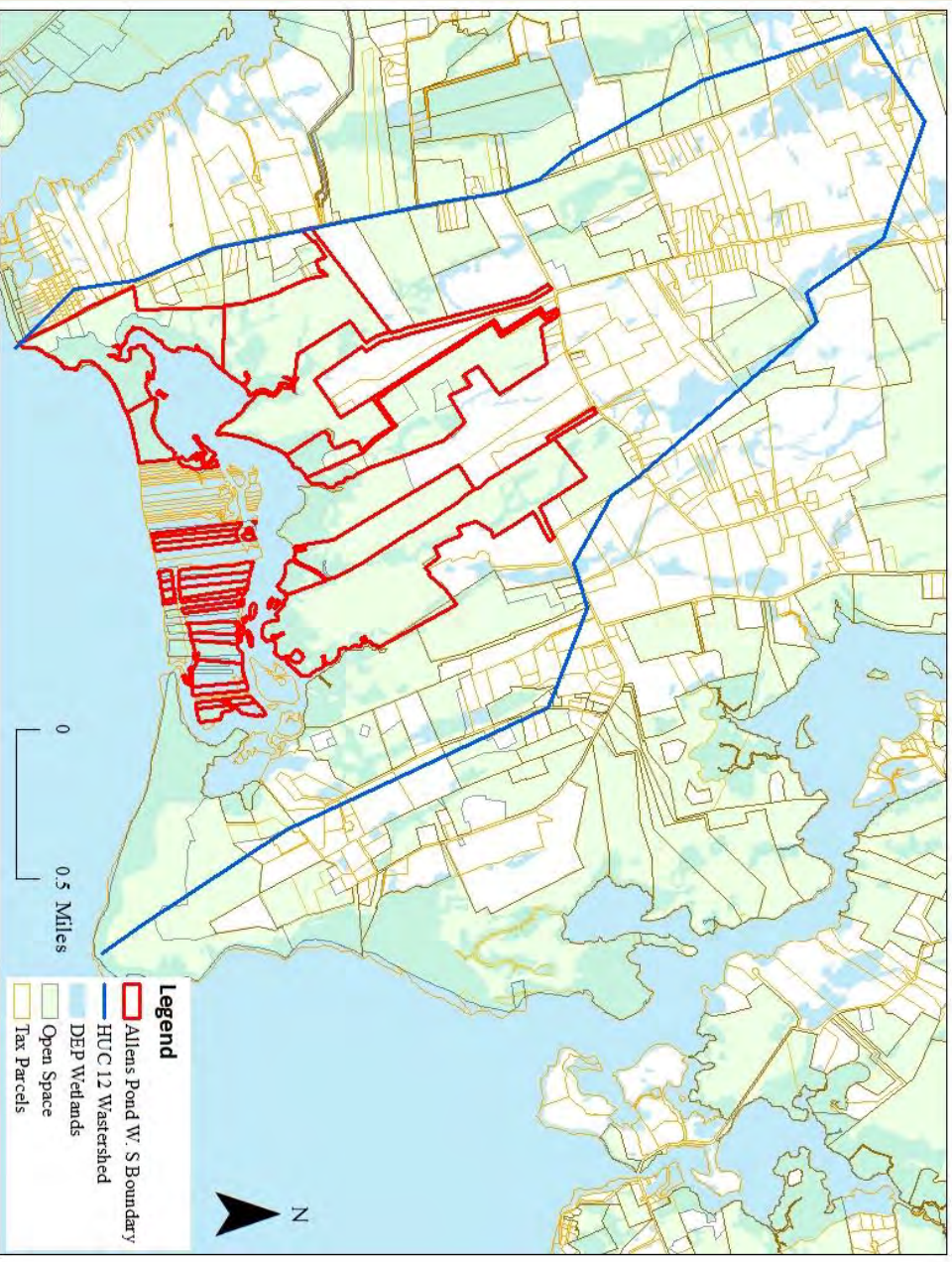
# Ditch vs. Runnel & Peat Island





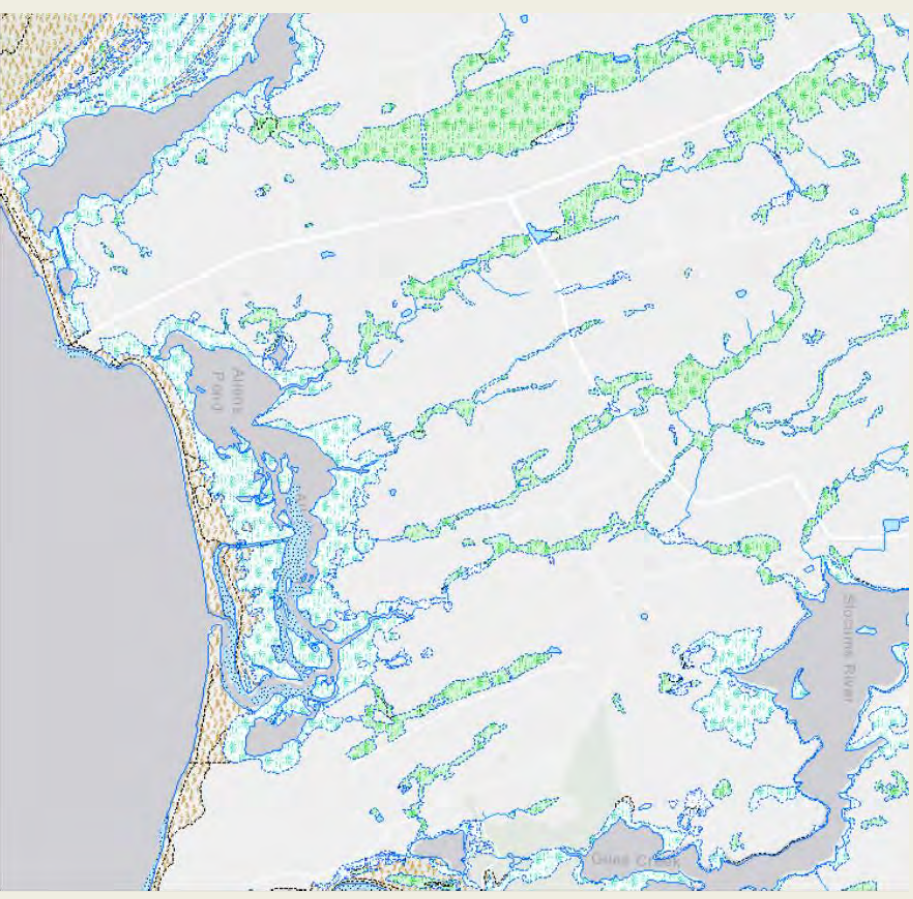
# Allens Pond Coastal Pond Watershed

- 2366ac. watershed
- APWS 611ac., OVFR 60ac., CR 295 ac.
- Pond 165ac.  
Saltmarsh 160ac.,  
Coastal dunes &  
beach 108ac.



# Allens Pond, Dartmouth, MA

- Great Pond w/managed inlet and 5 main freshwater inputs
- Managed Saltmarsh
- "Fringe" marsh
- MICROTIDAL system, range 1.4ft
- > 70 acres restored since 2021





# Allens Pond, Biodiversity Hotspot

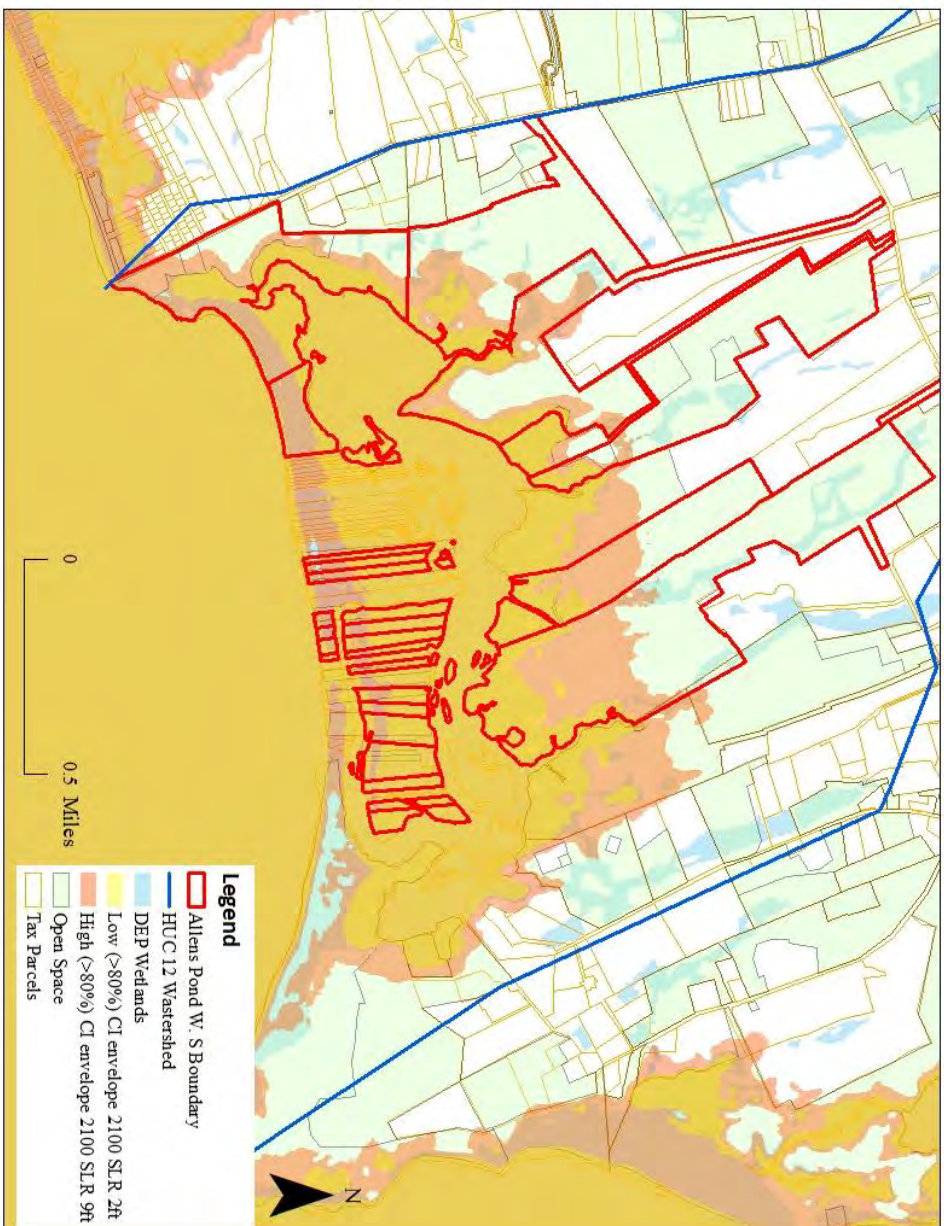


# Sea-level-rise

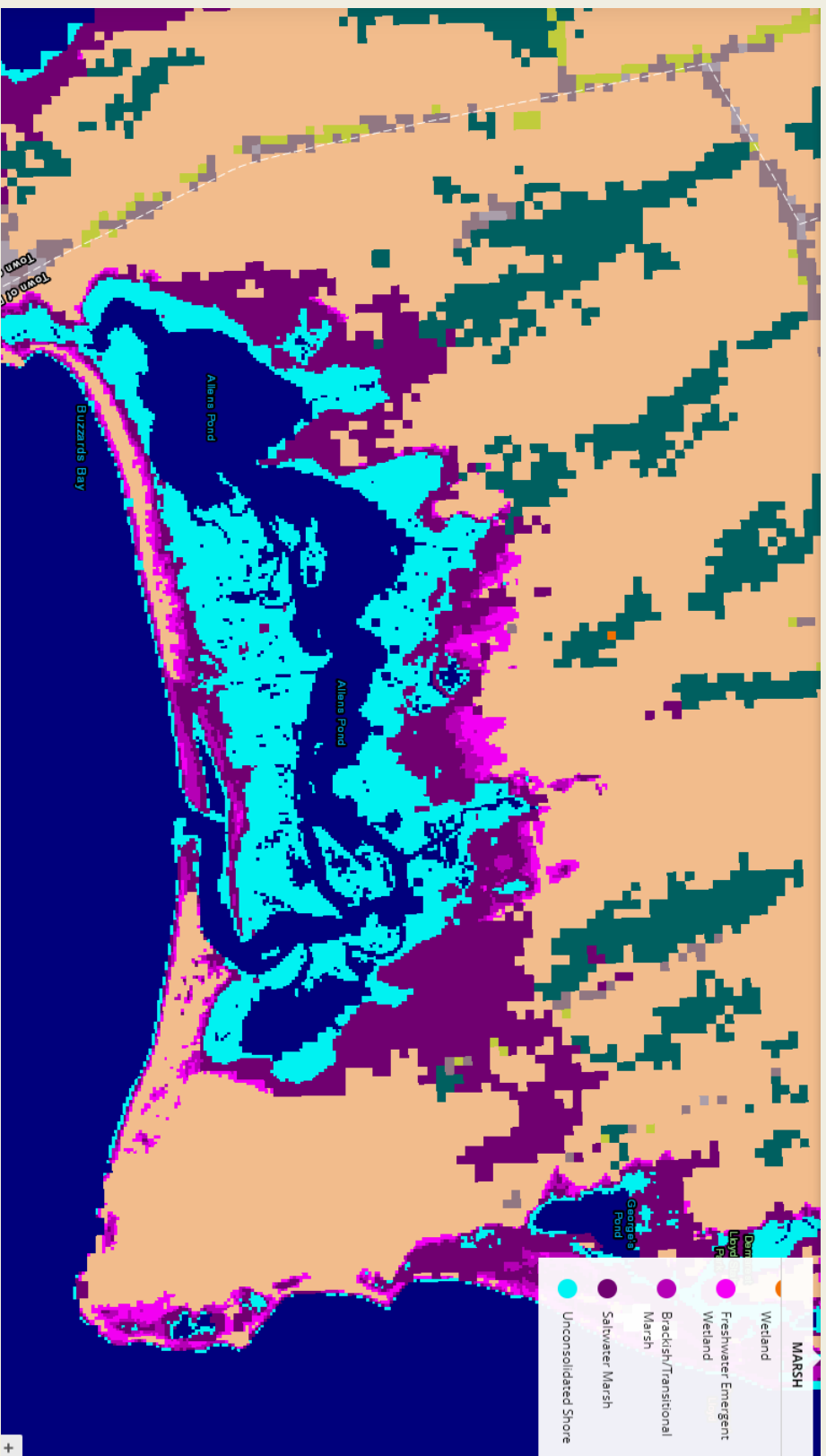




# SLR & Saltmarsh Inland Migration

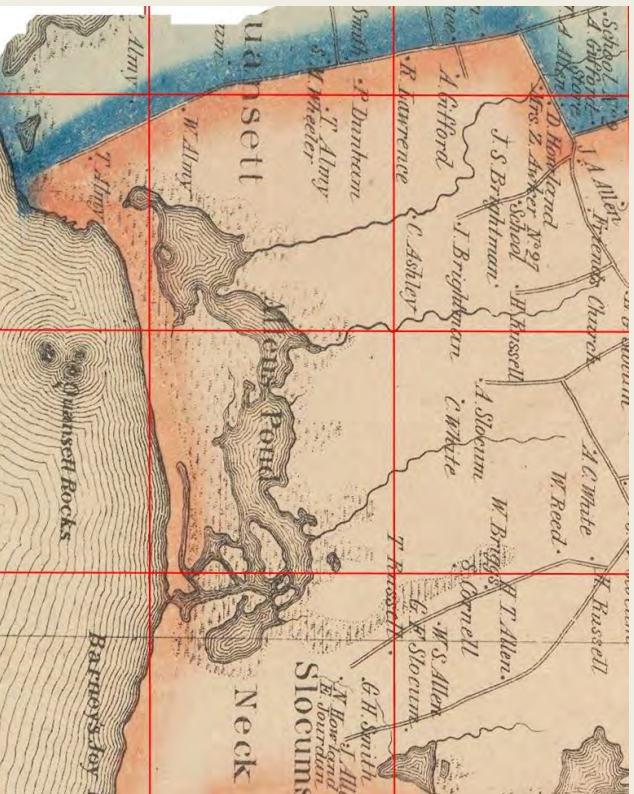


# SLR & Saltmarsh Inland Migration

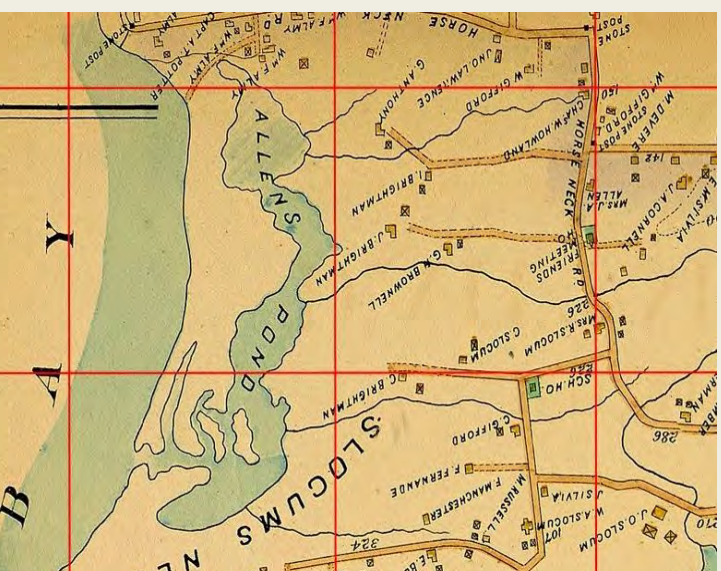


# Allens Pond, Dartmouth, MA

1858



1895





# Allens Pond, Dartmouth, MA

1938



# Allens Pond W.S. & Ocean View Farm Reserve, Dartmouth, MA

Project Area at Mass Audubon's Allens Pond W.S. and Dartmouth Natural Resources Trust's Ocean View Farm  
With Locus Map for Southern New England Estuaries Program





# Saltmarsh Surface Tidal Hydrology Restoration, Dewatering & Revegetating Ponding Areas



Allen's Pond Marsh Restoration Project:  
Quick Overview





5/2022



9/2023



T4 Post

9/2022



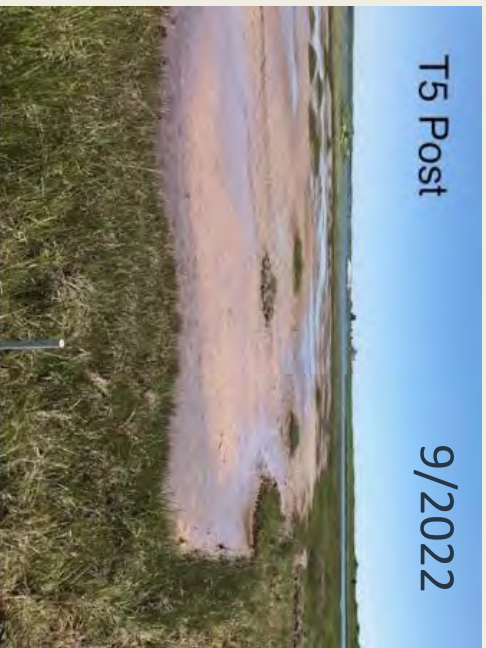




5/2022



9/2023



T5 Post

9/2022



9/2023



# Saltmarsh Surface Tidal Hydrology Restoration

9/2022



9/2023





# Saltmarsh Tidal Hydrology Restoration, Removing Tidal Restrictions



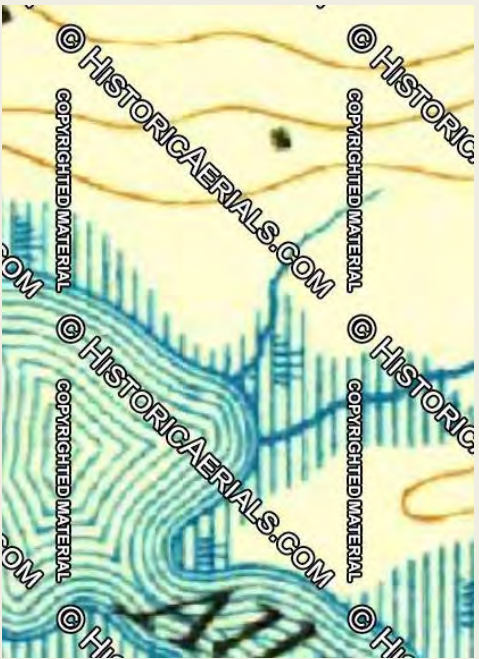
# Removing Barriers & Restoring Connectivity

Project Area at Mass Audubon's Allens Pond W.S. and Dartmouth Natural Resources Trust's Ocean View Farm  
With Locus Map for Southern New England Estuaries Program





1930



1942



1938







Fresh Pond

Dam







# Removing Barriers & Restoring Connectivity





# Removing Barriers & Restoring Connectivity

5/23



11/23



# Facilitating Saltmarsh Inland Migration

Project Area at Mass Audubon's Allens Pond W.S. and Dartmouth Natural Resources Trust's Ocean View Farm  
With Locus Map for Southern New England Estuaries Program





# DNRT's Ocean View Farm

Ocean View Farm Recommendations





# Facilitating Saltmarsh Inland Migration

2/2021



10/2022







1/2021



2/2021



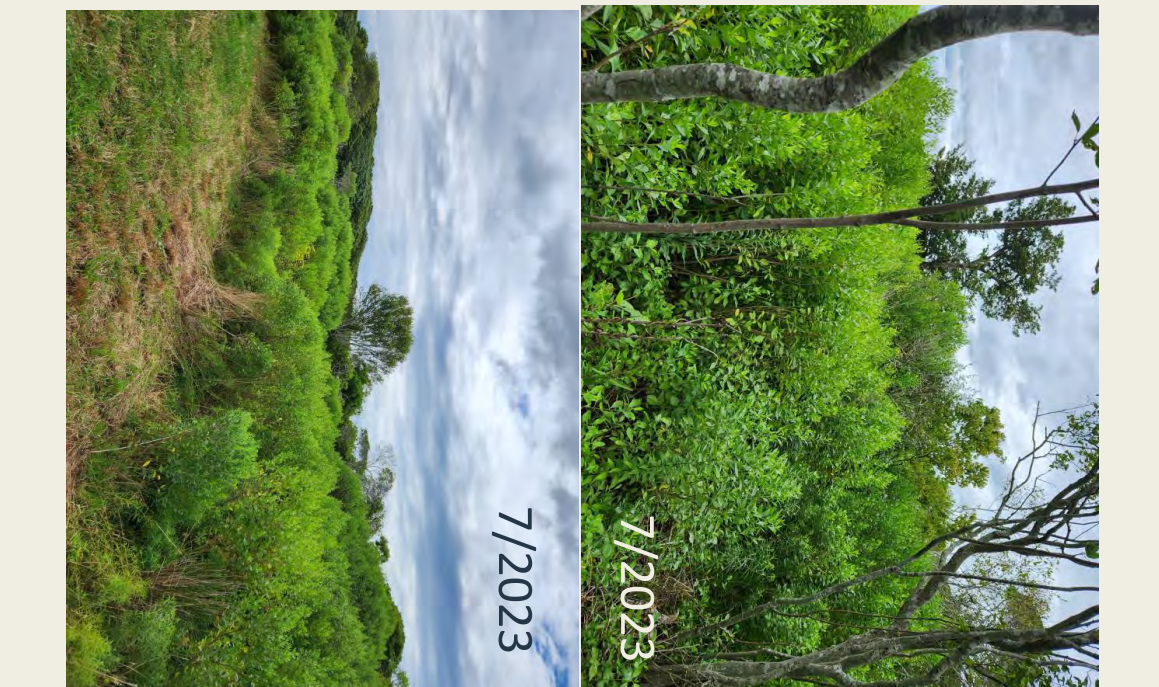
7/2022



2/2021



7/2022



7/2023

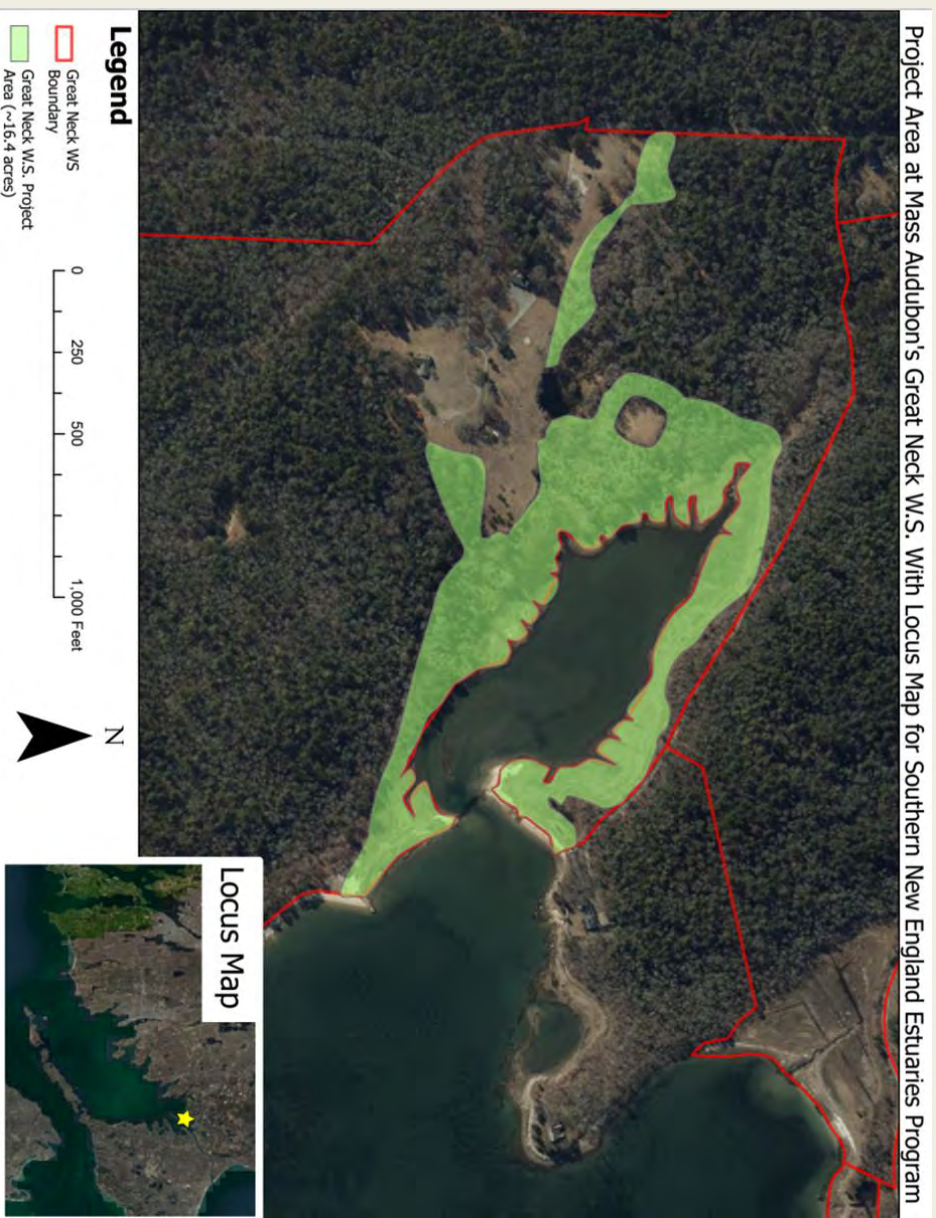


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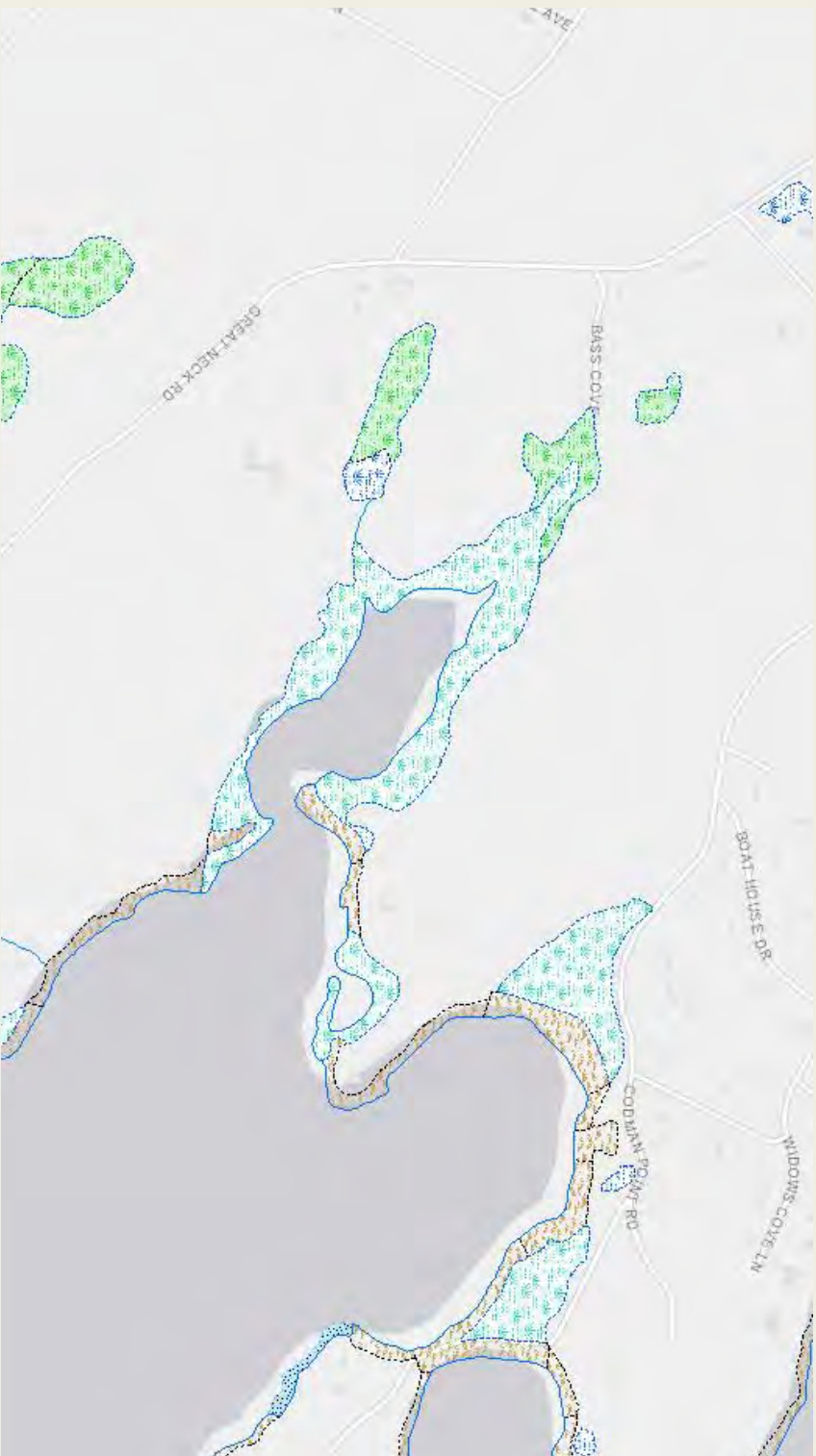


# Great Neck W.S., Wareham

- 219ac.
- 110 ac.added in 2020
- Five buildings removed & > 25ac. restored since 2020

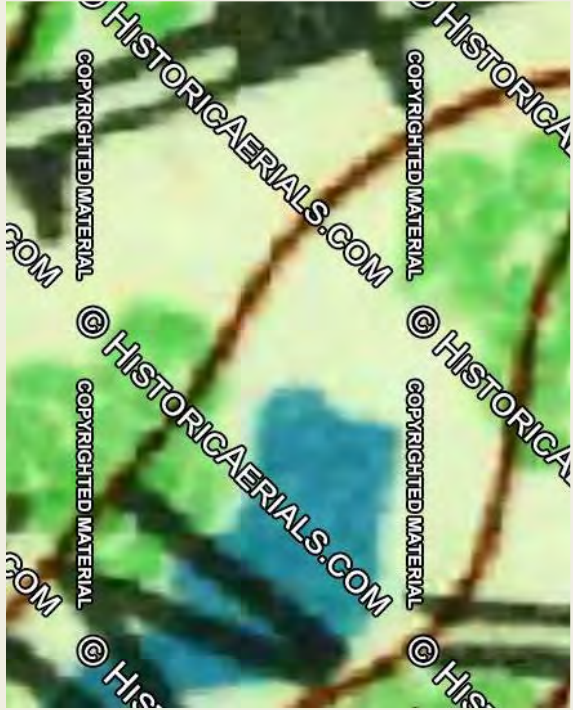


# Great Neck W.S., Wareham, MA





1943



1954



1966



1972





# Facilitating Saltmarsh Inland Migration, Removing Infrastructure & Biological Barriers

2019





# Facilitating Saltmarsh Inland Migration, Removing Infrastructure & Biological Barriers



# Facilitating Saltmarsh Inland Migration, Removing Infrastructure & Biological Barriers





# Facilitating Saltmarsh Inland Migration, Removing Infrastructure and Biological Barriers





# Facilitating Saltmarsh Inland Migration, Removing Infrastructure & Biological Barriers





# Facilitating Saltmarsh Inland Migration, Removing Infrastructure & Biological Barriers



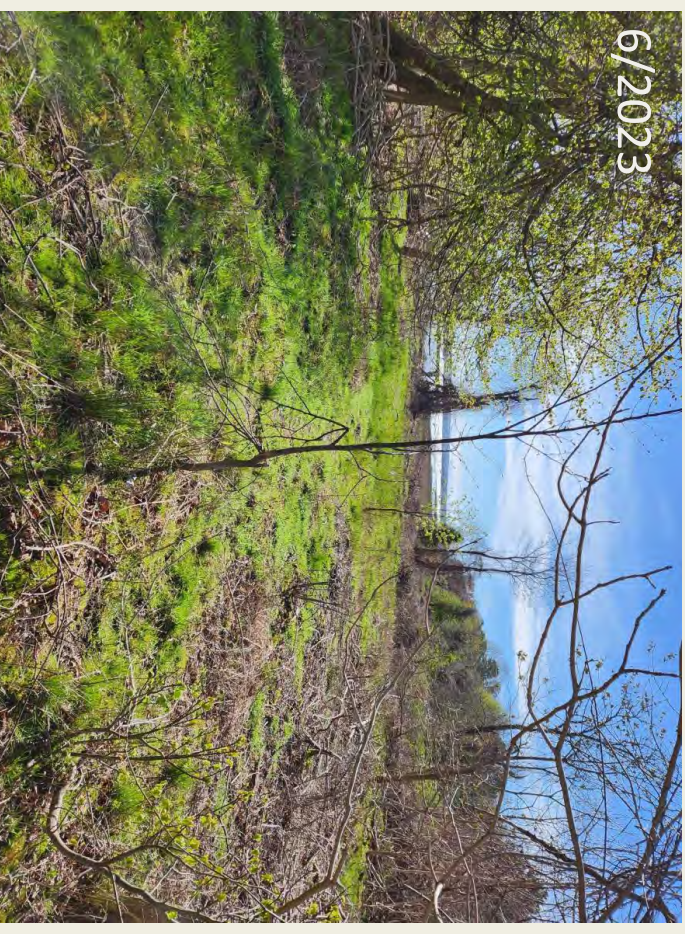


# Facilitating Saltmarsh Inland Migration, Removing Infrastructure & Biological Barriers

11/2022



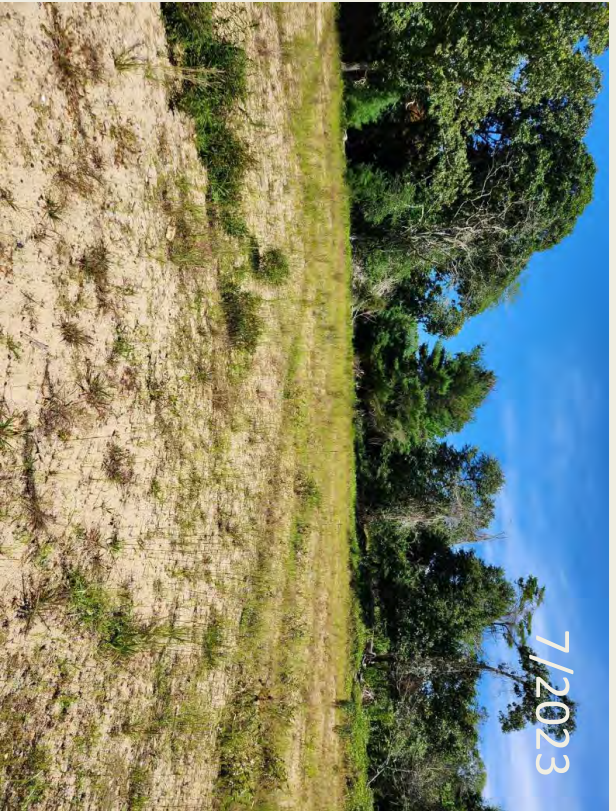
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11/2021



7/2023

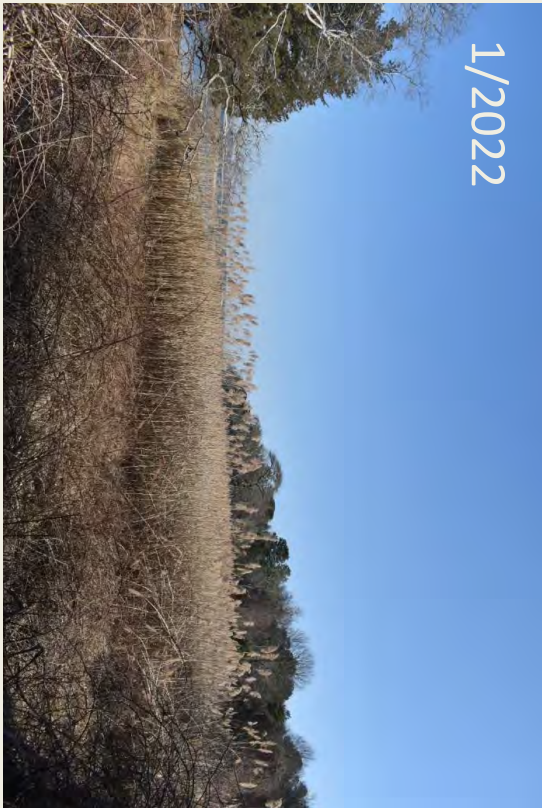


6/2022

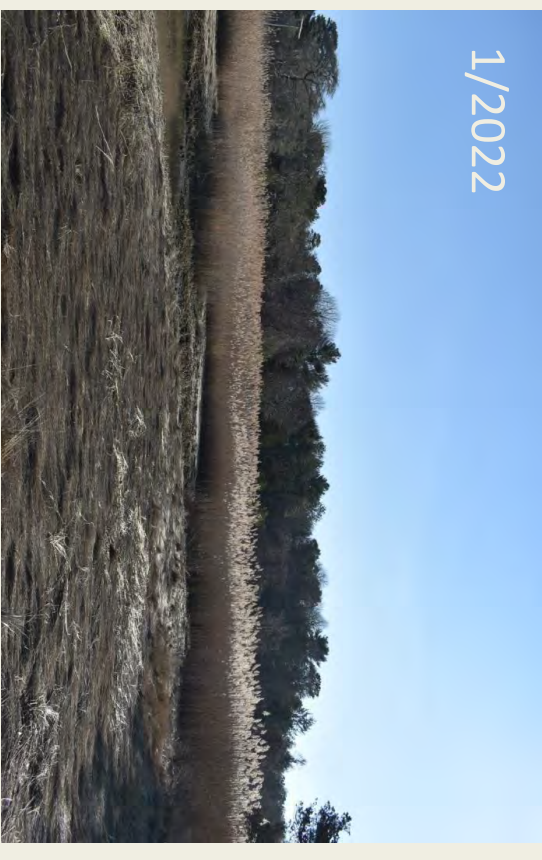




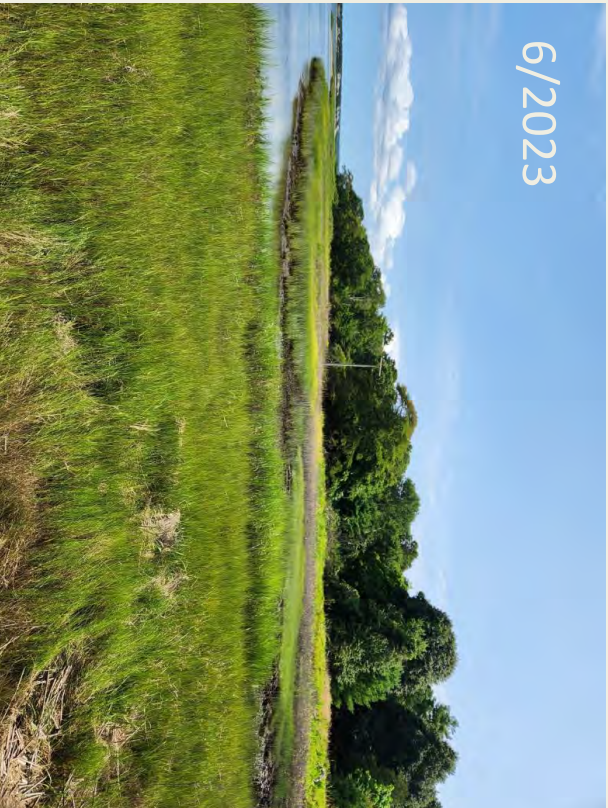
1/2022



1/2022



6/2023

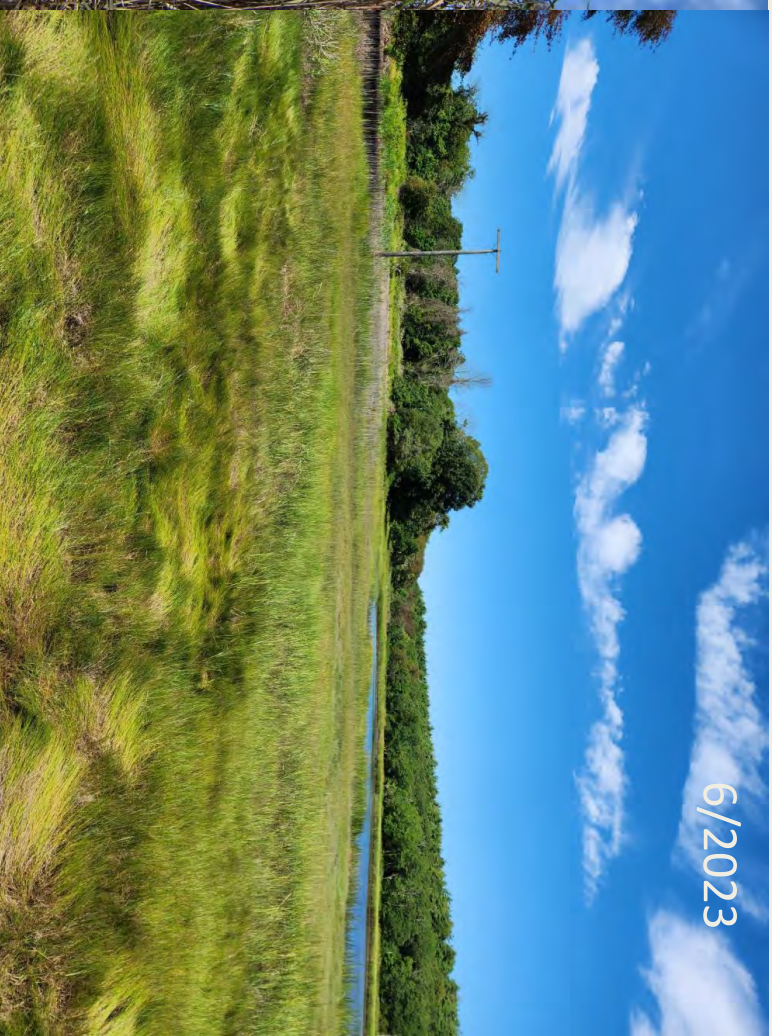


10/2023



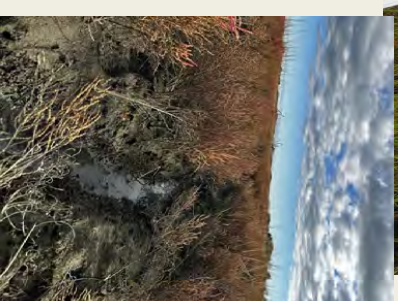
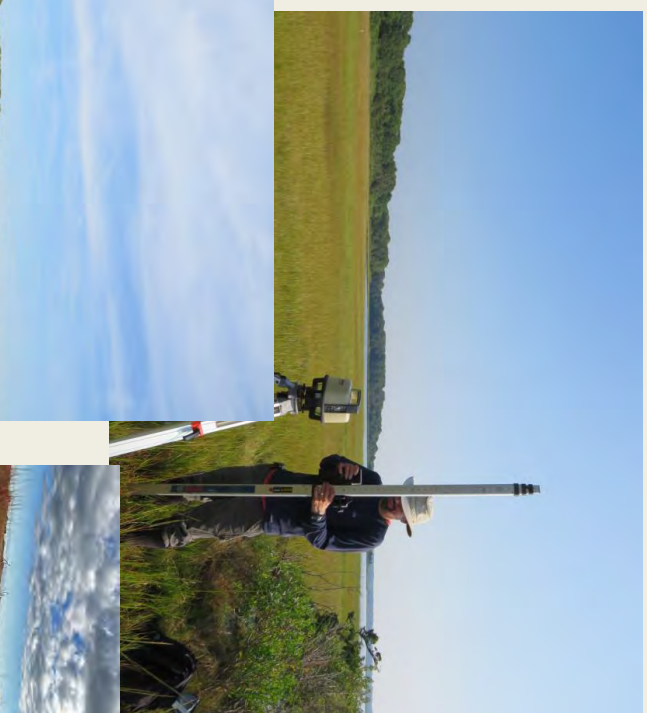


# Facilitating Saltmarsh Inland Migration, Removing Infrastructure & Biological Barriers





# Research, Monitoring & Knowledge Sharing





# Education & Outreach Programs

- Over 120 volunteers directly supported restoration management
- >3000 Students in Fall River, New Bedford & Wareham
- >5000 People engaged through outreach programs

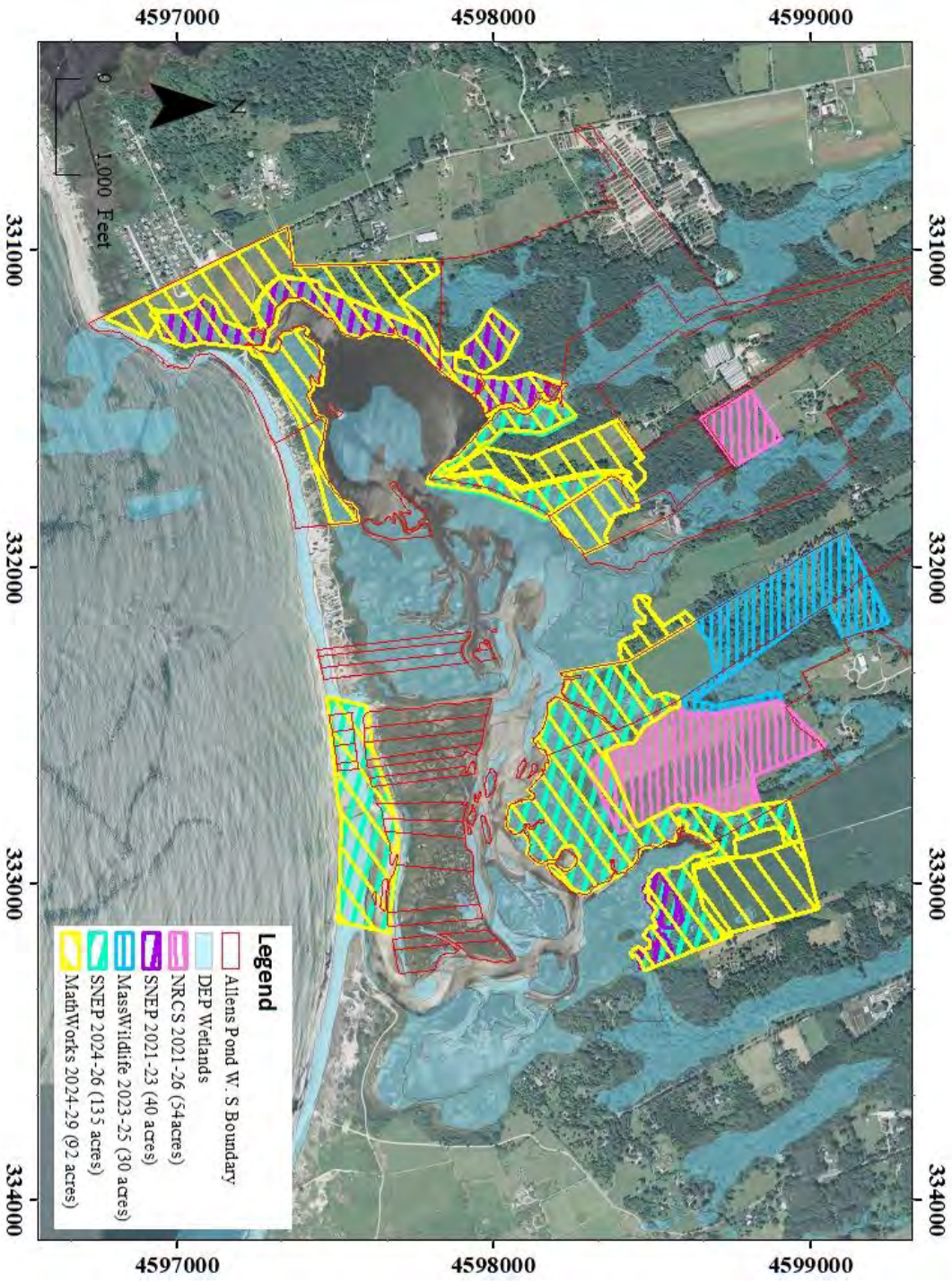


# Next Steps

- 2023 SNEP Stormwater & Natural Infrastructure Grant
  - Over 190 acres across 4 sites in Dartmouth & Wareham, MA
  - Allens Pond, Ocean View Farm, Great & Cromesett Neck's
    - Continue and expand research, monitoring & planning
    - Develop Allens Pond inlet management plan
    - Remove tidal restrictions & barriers to inland saltmarsh migration
    - Restore low-lying upland areas & saltmarsh tidal hydrology
    - Peer-to-peer knowledge sharing workshops
    - Public outreach programs







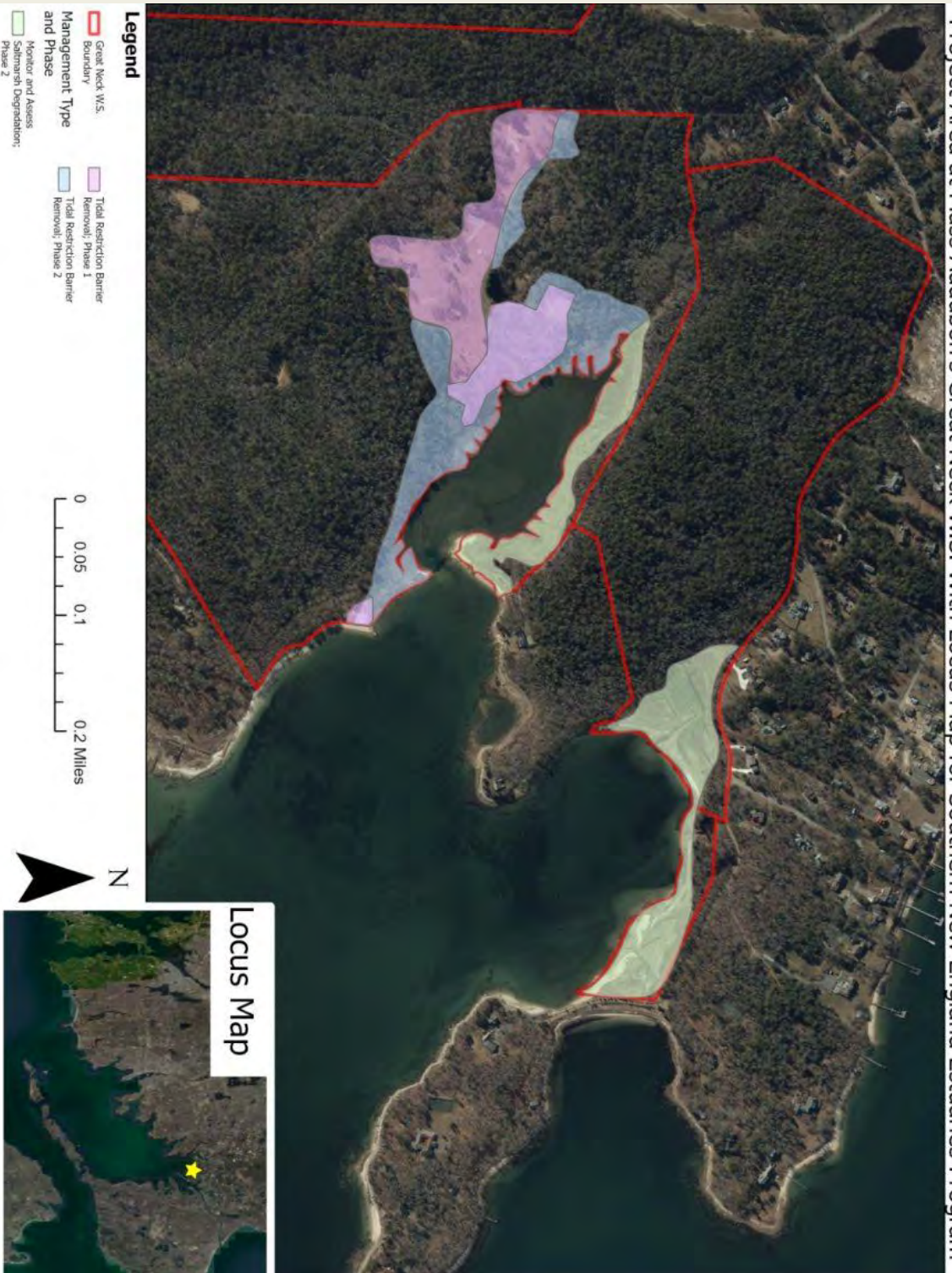


Project Area at Mass Audubon's Allens Pond W.S. and Dartmouth Natural Resources Trust's Ocean View Farm  
With Locus Map for Southern New England Estuaries Program





Project Area at Mass Audubon's Great Neck W.S. With Locus Map for Southern New England Estuaries Program



Project Area at Mass Audubon's Cromeset Neck and Marks Cove W.S. With Locus Map for Southern New England Estuaries Program





Photo ID 1  
Before



Photo ID 1  
After



*Great Neck Wildlife Sanctuary Before and After Photos*



Photo ID 2  
Before



Photo ID 2  
After



*Great Neck Wildlife Sanctuary Before and After Photos*



Photo ID 3  
Before



Photo ID 3  
After





Photo ID 4  
Before



Photo ID 4  
After





Photo ID 5  
Before



Photo ID 5  
After





Photo ID 6  
Before



Photo ID 6  
After





Photo ID 7  
Before



Photo ID 7  
After





Photo ID 8  
Before



Photo ID 8  
After





Photo ID 9  
Before



Photo ID 9  
After





Photo ID 10  
Before



Photo ID 10  
After





Photo ID 11  
Before



Photo ID 11  
After





Photo ID 12  
Before



Photo ID 12  
After





Photo ID 13  
Before



Photo ID 13  
After



# Saving Salt Marshes at Allens Pond



One of the world's most productive ecosystems, a salt marsh provides critical habitat and food for birds such as Osprey and Saltmarsh Sparrow. These low-lying coastal wetlands also serve as spawning and nursery habitat for fish and as homes to a variety of shellfish. Salt marshes also absorb storm surge, storm water, and wave and wind energy, protecting our coastal infrastructure and properties from damage. And salt marshes act as carbon sponges, removing 10 times more carbon from the atmosphere than a forest of the same size annually.

## Protecting Salt Marshes

To protect the salt marsh at Allens Pond, we are restoring the natural tidal flow of water, known as hydrology. One method to accomplish this is installing small, shallow channels called runnels, that drain excess water from a flooded marsh into nearby creeks and waterways. This alleviates flooding stress and plant die-off and promotes marsh revegetation to minimize future degradation of the marsh.



## Threats to Salt Marshes

Salt marshes can adapt to changing coastal conditions by migrating inland. But with continued development along the coast, and as climate change causes increased sea level rise, salt marshes have few places to go, leading to tidal flooding. Flooded salt marshes threaten the wildlife that depend on them. As extreme weather events increase in frequency, the amount of flooding that our coastal areas experience will increase.

## Saving a Marsh Bird




Over the past several decades, the global population of Saltmarsh Sparrows has dropped from over 200,000 to under 50,000. Much of this decline is due to the increasing frequency of salt marsh flooding, as Saltmarsh Sparrows nest and lay their eggs exclusively in the marsh vegetation.

Mass Audubon is helping Saltmarsh Sparrows by protecting and restoring the salt marsh. The restored marsh hydrology will reduce flooding and salt marsh loss, increasing the amount of habitat available for Saltmarsh Sparrows to nest and successfully raise their young.



## How You Can Help Save Salt Marshes

We all need to do our part to help our salt marshes thrive. You can make an impact by:

-  Volunteering for local restoration projects.
-  Supporting organizations that protect land, become a member, attend programs, donate.
-  Advocating for salt marshes and local efforts by sharing what you've learned.

Learn more at [massaudubon.org/allenspond](https://massaudubon.org/allenspond).

### Partner Acknowledgment

This work is supported by a Southeast New England Program (SEEP) Watershed Grant, which is funded by the U.S. Environmental Protection Agency (EPA) through a partnership with Rhode Island's SEEPs (E2).  
A special thank you to the following partners: U.S. Environmental Protection Agency, Department of Natural Resources Trust (DNR), State of New Hampshire, Washington Field and Trout, U.S. Fish and Wildlife Service, Town of Dartmouth, Bristol County Massachusetts.

Nesting Saltmarsh Sparrows © Tofer Carlson, Saltmarsh Sparrow © Andy Eckerson



# Saving Salt Marshes at Great Neck



One of the world's most productive ecosystems, a salt marsh provides critical habitat and food for wildlife such as Diamondback Terrapin and Saltmarsh Sparrow. These low-lying coastal wetlands also serve as spawning and nursery habitat for fish and as homes to a variety of shellfish. Salt marshes also absorb storm surge, storm water, and wave and wind energy, protecting our coastal infrastructure and properties from damage. And salt marshes act as carbon sponges, removing 10 times more carbon from the atmosphere than a forest of the same size annually.

## Protecting Salt Marshes

At Great Neck, we have restored areas surrounding the salt marsh to help facilitate the salt marsh's migration inland as sea levels rise. We removed buildings, asphalt, and invasive, non-native plant species like Common Reed that obstruct salt marsh migration. We reseeded the cleared areas with native plants to provide habitat for local wildlife such as Diamondback Terrapins, Great Blue Herons, and Monarch butterflies.



## Threats to Salt Marshes

Salt marshes can adapt to changing coastal conditions by migrating inland. But with continued development along the coast, and as climate change causes increased sea level rise, salt marshes have few places to go, leading to tidal flooding. Flooded salt marshes threaten the wildlife that depend on them. As extreme weather events increase in frequency, the amount of flooding that our coastal areas experience will increase.

## Saving Terrapins

Diamondback Terrapins make their home exclusively in brackish water, a mix of salt and fresh water, found in marshes. Although their population rebounded after they were nearly hunted to extinction in the 19th century, today they are listed as a threatened species in Massachusetts due to risks such as an increase in predation, the wildlife pet trade, car strikes on roads, and habitat loss.

Mass Audubon is helping Diamondback Terrapins by restoring salt marsh migration zones and improving nesting habitat. Preparing this area for salt marsh migration will provide habitat for Diamondback Terrapins as sea levels rise.



### Partner Acknowledgment

This work is supported by a Sustainable New England Program (SNEP) Watershed Grant, which is funded by the U.S. Environmental Protection Agency (EPA) through a partnership with the Massachusetts State Office of Energy and Environmental Affairs (SEEA). Diamondback Terrapin Hatchling © Leah Desrochers. Washington and Fred, U.S. Fish and Wildlife Service, Iowa Department, Bristol County Massachusetts.

## How You Can Help Save Salt Marshes

We all need to do our part to help our salt marshes thrive. You can make an impact by:

- Volunteering for local restoration projects.
- Supporting organizations that protect land, become a member, attend programs, donate.
- Advocating for salt marshes and local efforts by sharing what you've learned.

Learn more at [massaudubon.org/greatneck](https://massaudubon.org/greatneck).

Monarch © Cheryl Rose, Diamondback Terrapin Hatchling © Leah Desrochers