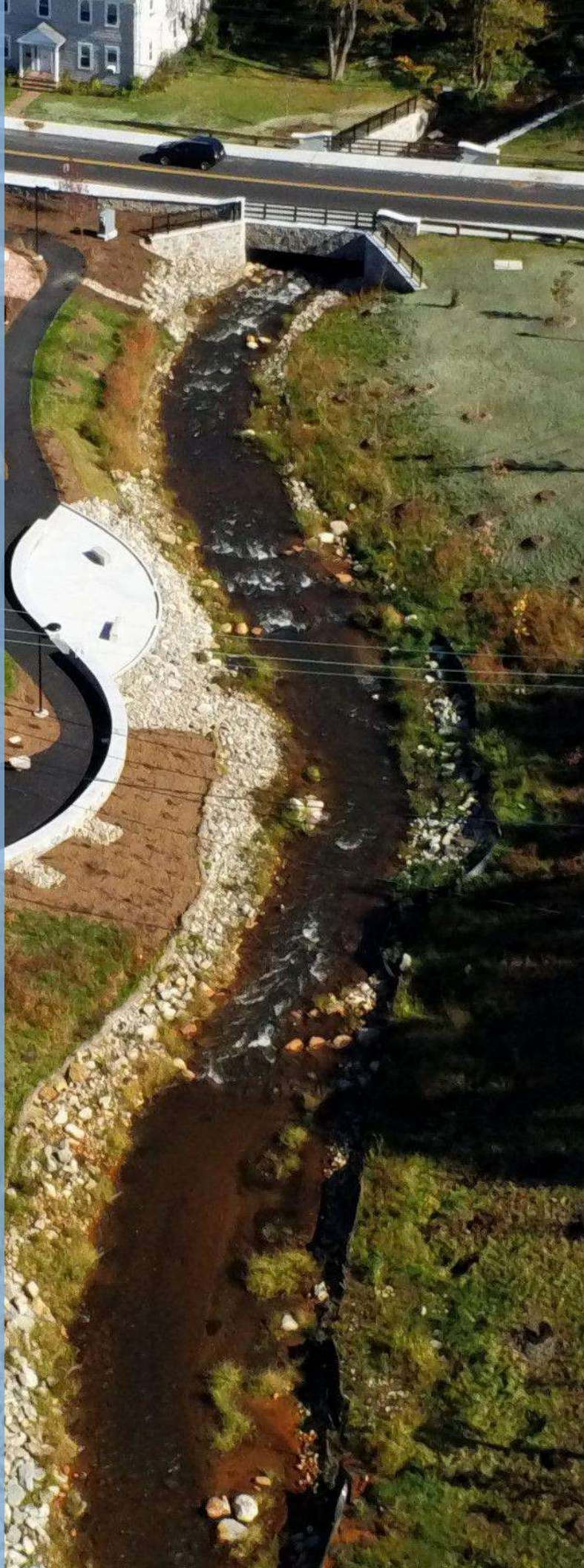
2012-2022

Town of Plymouth

The Department of Marine and Environmental Affairs

Celebrating 10 Years of Achievements



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LETTER FROM THE DIRECTOR

It's hard to believe that the Department of Marine and Environmental Affairs (DMEA) was established 10 years ago in 2012. The time has flown by for all of us. During that time DMEA has implemented day to day operations in three separate divisions: Animal Control, Harbormaster, and Natural Resources. These day-to-day operations include but are not limited to: Animal Control - animal welfare calls, shelter operations, adoptions, rabies protocols and prevention, kennel inspections, and barn inspections; Harbormaster – search and rescue, harbor operations, boating safety, enforcement, boat ramp operations, shellfish/aquaculture, mooring operations, pump-outs, and safety checks; Natural Resources – lakes and ponds water quality monitoring, open space acquisition and management, trail maintenance, habitat enhancements, shorebird monitoring, anadromous fish management, permitting, and grant writing.

We all know that there is no shortage of environmental work to be done in the Town of Plymouth. With a myriad of habitat types and corresponding plants, fish, and wildlife there is an abundance of natural resources to manage and protect. Many of these resources are truly unique. Our coastline includes Important Bird Areas (IBA's) that are part of the global migration pattern of shorebirds. Our coastal streams contain both anadromous and catadromous fish runs, and our coast is home to humpback whales, right whales, harbor porpoises, harbor and gray seals, white sharks, and a myriad of fish species. On the land side, our forests are dominated by pine barrens habitat and our landscape is dotted with coastal plain ponds and the rare plants and animals that inhabit them. Combine all of that with the long-standing growth of the community and the challenges are obvious. These challenges include protecting and managing open space, water quality and quantity issues, fisheries and shellfish protection, coastal resiliency, developing our blue economy and improving infrastructure for people as well as fish and wildlife.

The focus of this report is to celebrate the accomplishments above and beyond the day-to-day operations. We have tackled a wide array of projects. Many of these projects were long overdue, such as dredging and the T-wharf. Others had never been done before such as dam removals and large-scale cranberry bog restoration. Most, if not all, were at least partially or significantly funded through private, state, or federal grants. Many of these projects cross over to include habitat restoration, infrastructure improvements, and amenities for people. Like unique habitats, the best, most impactful projects, are full of complexity.

DMEA has become well known for its grant writing efforts. This has always been a core part of our work since we know that funding is a major reason why programs and projects aren't undertaken. We have always strived to secure funding from private, state, and federal sources to ensure that these important projects can be implemented. The vast majority of DMEA projects look to local funding only for the funds required as match.

While this booklet is intended to celebrate the 10-year anniversary of DMEA it also provides the opportunity for us to say thank you to the Town of Plymouth for its support during that timeframe. We hope that the accomplishments that are detailed in the booklet reflect favorably upon the Town. As Director, I would also like to say thank you to the dedicated staff in DMEA that comes to work each day with the goal of making Plymouth a better place to live. We look forward to another ten years trying to do the same. We hope you enjoy looking through the book. Take care.

David Gould
Director of the Department of
Marine and Environmental Affairs

"The mission of the Department of Marine and Environmental Affairs is to provide services that protect the safety of people and vessels who use our waterways and waterside facilities, including our rivers, ponds, and lakes; to provide for the protection, preservation, enhancement and safe use of the Town's natural resources, including beaches, conservation lands, and preserved open spaces; and to address environmental issues that threaten or may negatively impact the health, welfare, and quality of life of our citizens."

MEET THE STAFF

ANIMAL CONTROL

Joan Anzalone
Animal Control Officer
2012 - Present

Abby Foley
Animal Control Officer
New Hire

Lindsey Moran
Animal Control Officer
New Hire

Laurie Stundis
Animal Control Officer
1985 - 2022
Retired

Cassandra Thayer
Animal Control Officer
2016 - 2022

MEET THE STAFF

HARBORMASTER

Chad Hunter
Harbormaster
2006 - Present

Robert Bechtold
Assistant Harbormaster
2012 - Present

Robert "Mike" Dawley
Assistant Harbormaster
2015 - Present

Richard Furtado
Assistant Harbormaster
1987 - 2019
Retired

Cameron Wentworth
Assistant Harbormaster
2020 - Present

MEET THE STAFF

NATURAL RESOURCES

Mark Brulport
Natural Resources Specialist
2015 - Present

Michael Cahill
Natural Resources Specialist
2016 - Present

Nathan Cristofori
Natural Resources Specialist
2013 - Present

Krista Foster
Administrative Assistant
2019 - Present

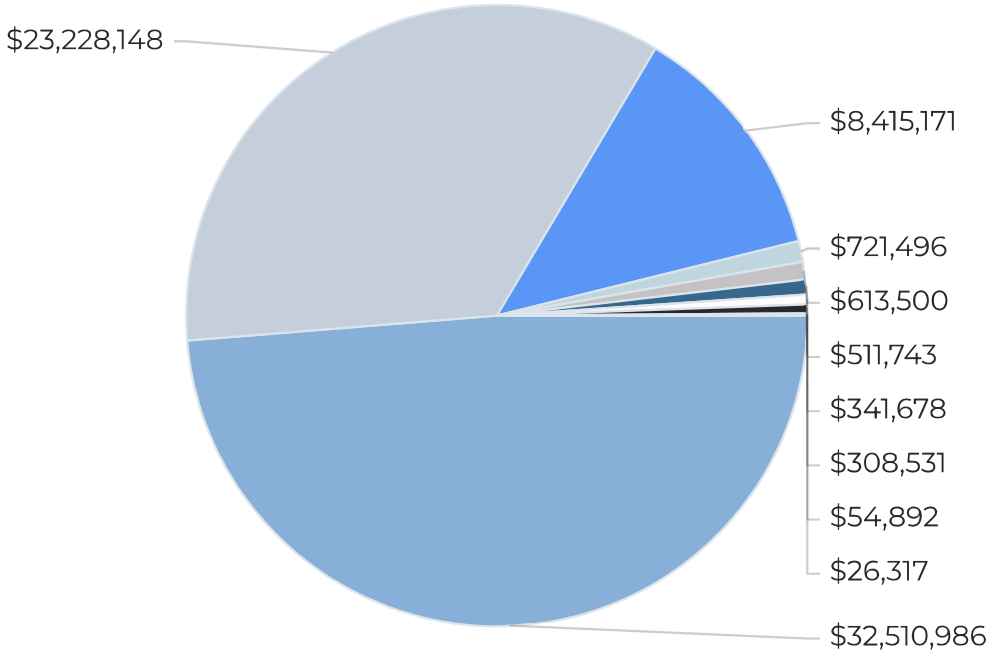
Kerin McCall
Environmental Technician
2005 - Present

Kim Tower
Environmental Technician
2005 - Present

Marilyn Westerlind
Administrative Assistant
2003 - 2019
Retired

GRANTS & APPROPRIATIONS

Total Grant Funding Since 2012 - $66,732,462



Long Beach	$32,510,986	Plymouth Harbor	$23,228,148
River Restoration	$8,415,171	Infrastructure	$721,496
Land Acquisition	$613,500	Trail Access	$511,743
Park Rehabilitation	$341,678	Ponds	$308,531
Scientific Research	$54,892	Training/Equipment	$26,317

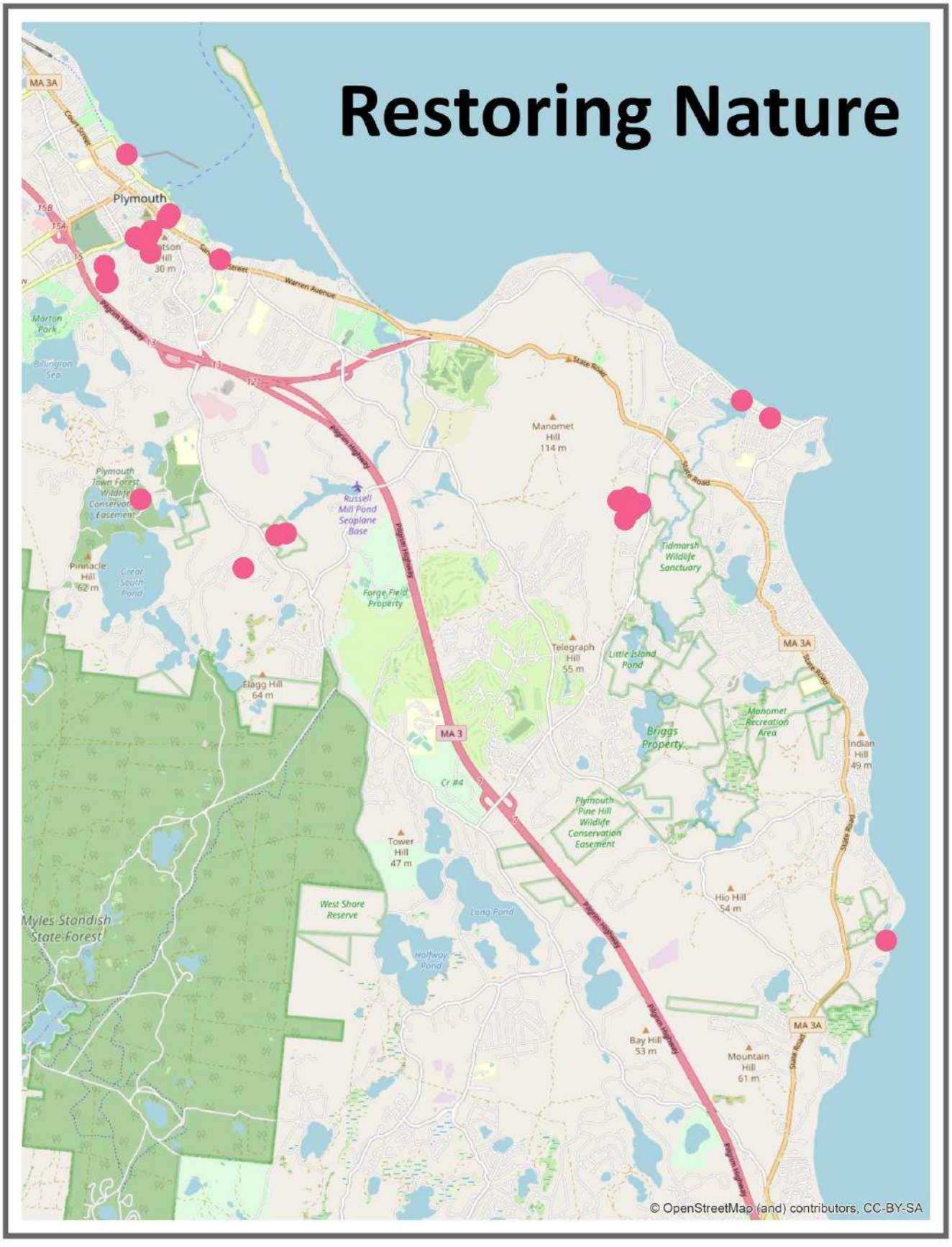
DMEA is committed to conducting environmental projects that provide value to the community. These projects range from ameliorating degraded environmental systems, to improving the welfare of animals, to encouraging economic vitality on the waterfront. In an effort to limit the cost incurred by the public, DMEA has successfully secured a number of grants. Since 2012, these grant awards total **$66,732,462**.

Section One

RESTORING NATURE

A look Back On DMEA's Ecological Restoration Projects

RESTORING NATURE



RESTORING NATURE

1 Eel River Headwaters Restoration - 2010

This ground-breaking project was the first of its kind to restore retired cranberry bogs back to natural wetlands and stream channel. The project restored over 40 acres of wetlands, removed a dam and replaced two culverts along with stormwater improvements and establishment of an Atlantic White Cedar Swamp. The project attracted both state and national attention for the comprehensive restoration approach and attention to detail.

Sawmill Pond Dam Removal - 2010 2

This 15 foot high dam was removed as part of the Eel River Headwaters Project and resulted in the stream connectivity and fish passage for river herring, brook trout, and American eel along the eel river. The dam was originally called the Barrel Stave Mill Dam and various iterations were constructed between 1700 and 1830. Removal of the dam included preserving parts of the structure for historic purposes.

3 Wellingsley Brook Restoration - 2012

This project involved the removal of 3 in-stream weirs that were barriers to fish passage for salter brook trout. Salters are brook trout that take on anadromous behavior and feed in both coastal and freshwater environments. The restored stream is relatively high gradient for a coastal stream consisting of step pools using large woody habitat and native rock and stone. It also resulted in restoration of a badly damaged side channel from previous mosquito control excavation work that incised and destabilized the channel.

RESTORING NATURE

4 Pond Rd. Stormwater Improvements - 2012

This project was identified in a study as having one of the larger stormwater inputs into Great Herring Pond. DMEA received grant funding for design and construction to install dozens underground recharge areas within the roadway to infiltrate and treat the stormwater prior to reaching Great Herring Pond The project also includes a raingarden for further treatment prior to discharging. The project has been widely successful.

5 Pond Rd. Raingarden - 2012

As part of the Pond Road Stormwater Improvements (noted above), a rain garden was installed for final treatment of stormwater prior to entering into Great Herring Pond. A raingarden is a technique utilizing plants, microbes, and engineered soils to treat stormwater runoff. This project has been successful in reducing sediments and nutrients from entering Great Herring Pond.

6 Plymco Building Abatement and Demolition - 2013

The project resulted in a half million dollar site cleanup of contaminated soil from historic mill uses along with the abatement and demolition of the old coal bin building and former Plymco mill building and the daylighting of Town Brook which was buried under the mill building in culvert pipe.

RESTORING NATURE

7 Stephens Field Abatement and Demolition - 2013

This work involved the abatement and demolition of the old AK Finney building, and removal of several underground storage tanks, oil drain pits and hydrocarbon impacted soils. This project was a necessary step prior to the rehabilitation of Stephens Field Park.

Off-Billington St. Dam Removal and Stream Restoration - 2014 8

This dam removal project resulted in a new bridge, new utilities, removal of contaminated sediment and a restored stream channel and riparian wetlands as part of the overall restoration of Town Brook.

9 Water Street Rock Ramp - 2014

This project saw the replacement of the Water Street bridge and a tidal weir that restricted fish passage. A new bridge was constructed along with removal of the weir and an engineered rock ramp with a low flow passage enabling anadromous and catadromous fish to migrate into Town Brook regardless of the tide cycle.

RESTORING NATURE

10 White Island Pond Phosphorus Inactivation Treatment - 2014

The Town received grant funding to complete an alum treatment on White Island Pond after the TMDL Study concluded that the phosphorus released by sediments was the largest contributor of phosphorus leading to summer-long cyanobacteria blooms and closures. The project has been vastly successful and to date there has not been a cyanobacteria bloom reported.

11 Plymco Dam Removal and Stream Restoration - 2015

Located immediately upstream of the Off Billington Street Dam, this dam removal project resulted in the removal of a dilapidated structure with a new bridge and utilities and the restoration of a new stream channel with improved habitat and water quality benefitting both residents and fish and wildlife.

12 54 Taylor Ave. Abatement and Demolition - 2015

In conjunction with the Community Preservation Committee (CPC), this project resulted in the abatement and demolition of a single family dwelling and septic system resulting in nutrient reduction and land available for public use as part of the ongoing management of WHB.

RESTORING NATURE

13 161 Taylor Ave Abatement and Demolition - 2015

Partnering with the CPC, this project resulted in the abatement and demolition of a single family dwelling and septic system resulting in nutrient reduction and land available for public use as part of the ongoing management of WHB. This project also included the restoration of the dune system with Staff planting thousands of beach grass plugs that have matured into a stable dune system.

Bat Boxes - 2015 14

A volunteer Eagle Scout installed 8 free-standing bat boxes at various properties. The boxes were installed in an effort to provide bat habitat. Bats provide various ecosystem services, including insect control, seed distribution and plant pollination.

15 South St. Landfill Remediation - 2015

This project involved the excavation and trommel sorting of municipal solid waste from the soil underneath the parking lot behind the Plymouth Police Station. Additionally, a geotextile membrane barrier, landfill gas vent system, reconstructed parking lot and fence installation was undertaken. This eliminated the migration of methane from the landfill towards and into the Police Station.

RESTORING NATURE

16 Town Brook Plunge Pool - 2017

Upon out-migration, river herring are sent under the Jenney Grist Mill and subjected to an 8-foot drop, before reentering the stream. The drop caused mortality for both mature and juvenile river herring. With the help of the Massachusetts Division of Marine Fisheries (DMF), the plunge pool was constructed as a temporary solution in the winter of 2017. The Jenney Grist Mill Fishway Bypass will offer a alternative route for downstream fish passage, reducing river herring mortality by eliminating the drop.

Newfield St. Bridge Replacement - 2019 17

The project was done in conjunction with the upstream Holmes Dam removal and stream restoration. The new bridge is a box culvert allowing for fish passage and resiliency to climate events. Along with a new bridge, stormwater, sewer and water utilities were upgraded along with sidewalks, landscaping and a restored stream channel improving aquatic habitat and fish passage.

RESTORING NATURE

18 Holmes Dam Removal and Stream Restoration - 2019

This project was done in conjunction with the Newfield Street Bridge project and involved the removal of the Holmes Dam (a high hazard structure) and daylighting of Town Brook from a buried culvert along with the restoration of thousands of feet of stream channel with pools and riffles, riparian wetlands. The result was an increase from 25% fish passage to 96% fish passage along with improved water quality and aquatic habitat.

Former Revere Copper Brownfield Remediation- 2019 19

This project involved the capping of zinc-contaminated soil underneath a parking lot between Plymouth Harbor and Water St. Ongoing storm damage to the site was creating the potential eco-hazard risk of this material entering the harbor and bay. By capping the site, rebuilding the coastal revetment and removing the traditional stormwater system in favor of a bioretention facility DMEA was able to stabilize the site and protect our marine environment.

RESTORING NATURE

20 85 Beaver Dam Rd. Abatement and Demolition - 2019

This former bog screenhouse and single family home was abated and demolished as part of the restoration of the Foothills Preserve. It is now a walking path and wildflower meadow for pollinator species.

Huntley Abatement and Demolition - 2020 21

Working with the CPC, DMEA was able to abate and demolish the old dwelling on site at this location overlooking Jenney Pond. Future plans call for trail construction to enhance this piece of open space.

22 Town Forest Red Pine Barren Project - 2020

A large population of red pines were identified to be infested with red pine scale, an invasive insect. Red pine scale has been has been documented to cause mortality in red pines throughout southern New England, New York, New Jersey, and Pennsylvania. Utilizing funding from the United States Forestry Service, a 3.5 acre stand of dead Red Pines was removed. This project reduced risk of forest fire and created early successional habitat.

RESTORING NATURE

23 Foothills Stream and Wetland Restoration - 2020

This former cranberry bog was restored back to natural wetlands and stream channel along with dabbling duck habitat providing a mosaic of wetland types and diversity of habitat for fish and wildlife. The site now provides walking trails and open space.

24 Foothills Bat Box - 2021

Installed two free-standing bat boxes to afford shelter and reap the benefits of the ecosystem services that bats provide.

25 Common Loon Relocation - 2021

In 2021 DMEA participated in one of the more unique projects it has had the opportunity to be a part of. DMEA partnered with the Biodiversity Research Institute (BRI) on a common loon relocation project. The loon is a heavy, goose-sized waterbird with unique markings and an eerily beautiful call. In total, BRI translocated 11 common loon chicks from Maine to Massachusetts in 2021. Among these 11 loons, 9 of them were released on Plymouth ponds.

RESTORING NATURE

26 Foothills Osprey Platform - 2022

Installed an osprey platform at foothills to encourage nesting. DMEA staff continually monitors nests and breeding pairs to quantify population trends.

204 Long Pond Rd. Abatement and Demolition - 2022 27

This project involved the capping of zinc-contaminated soil underneath a parking lot between Plymouth Harbor and Water St. Ongoing storm damage to the site was creating the potential eco-hazard risk of this material entering the harbor and bay. By capping the site, rebuilding the coastal revetment and removing the traditional stormwater system in favor of a bioretention facility, DMEA was able to stabilize the site and protect our marine environment.

28 Jenney Grist Mill Bypass - Current

This project will involve repairs to the Jenney Pond Dam along with the construction of a bypass channel around the mill. The bypass channel will increase the limited spillway capacity of the dam making it more resilient to stronger and more frequent precipitation events as well as providing for improved upstream and downstream fish passage for river herring and American eel.

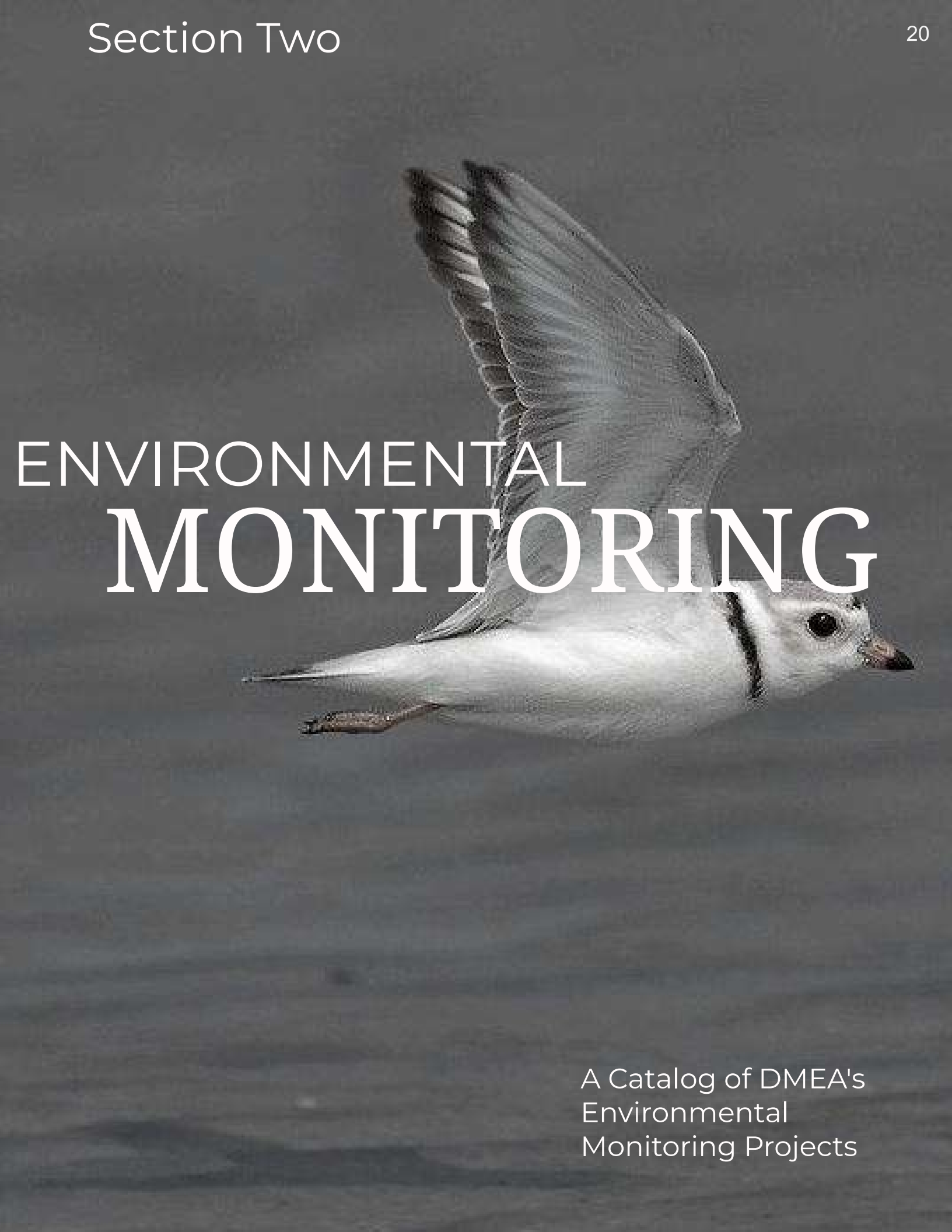
RESTORING NATURE

29 Jenney Pond Dredging - Current

This project will remove sediment that has accumulated in the impoundment since 1968 when it was last dredged. The increased depths that will be achieved will improve water quality through the removal of nutrients, resulting in higher levels of dissolved oxygen and water clarity. Submerged fish habitat will also be constructed to further enhance habitat within the impoundment.

Foothills Frosted Elfin Project - Current 30

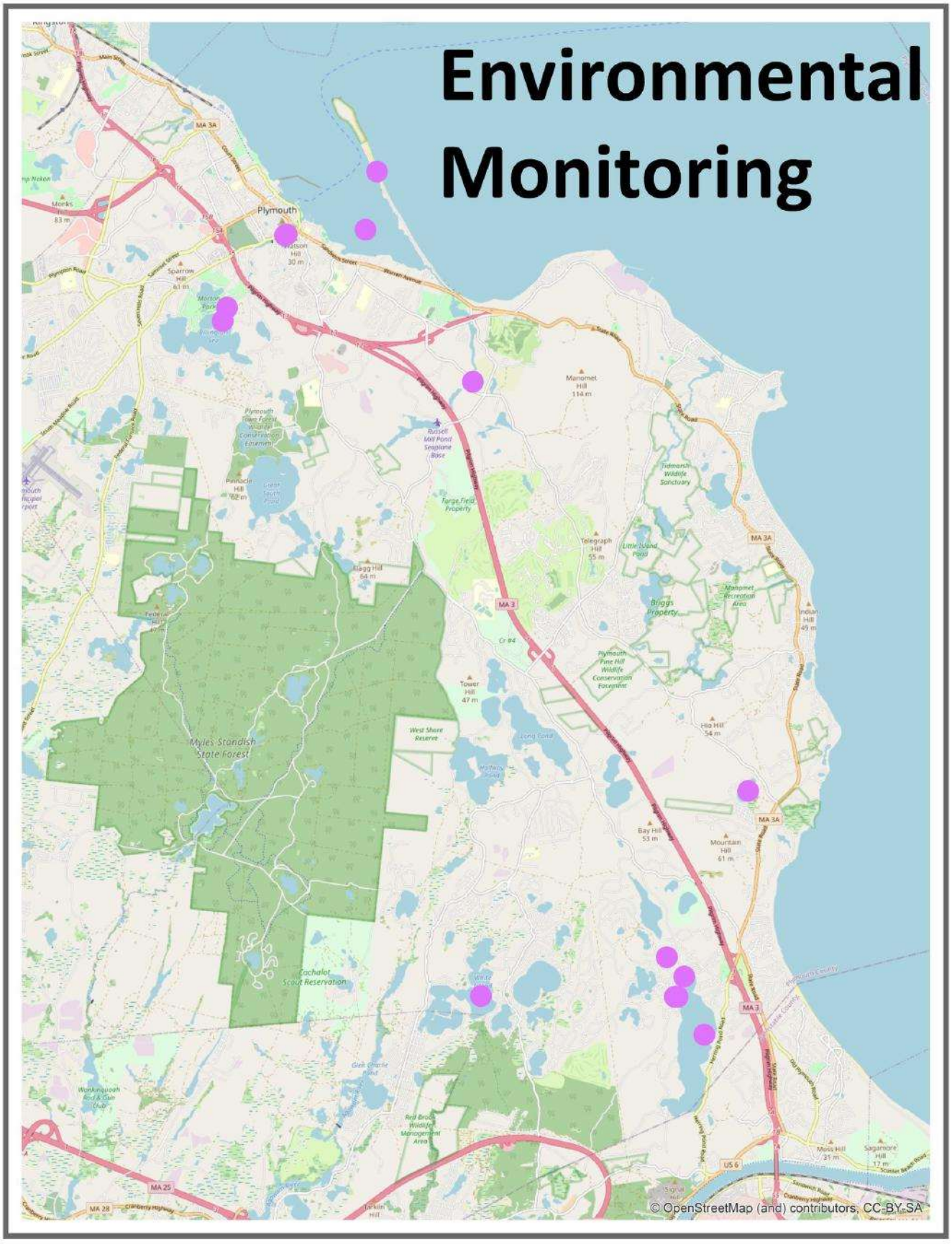
DMEA is collaborating with the Mass Audubon to establish habitat for the state-listed frosted elfin butterfly at Foothills and Tidmarsh Preserves.



ENVIRONMENTAL MONITORING

A Catalog of DMEA's Environmental Monitoring Projects

ENVIRONMENTAL MONITORING



ENVIRONMENTAL MONITORING

1 Great Herring Pond Stormwater Evaluation - 2016

Thirteen sites around Great Herring Pond were identified as having stormwater inputs, 6 of those are town-owned and were evaluated during three storm events for stormwater inputs in volume and nutrient loading. This study provided the basis for completing stormwater improvements at the two largest stormwater contributors from the findings at Pond Road and Eagle Hill Drive. Both of those projects were completed with grant funding through the Coastal Zone Management Program.

2 Plymouth Harbor TMDL Study - 2017

This study required by the Massachusetts Department of Environmental Protection (DEP), identifies the nitrogen inputs within the Plymouth-Kington-Duxbury Harbor Estuary for each Town. It provides guidance on how each Town can remediate nitrogen loading to the estuary.

3 Eagle Hill Dr. Stormwater Improvements - 2017

This project was the second site identified by the Stormwater Evaluation Study as significant contributor of phosphorus to the pond via stormwater system. DMEA received grant funding to complete design and construction of an upgraded stormwater system which improved infiltration and treatment prior to reaching Great Herring Pond.

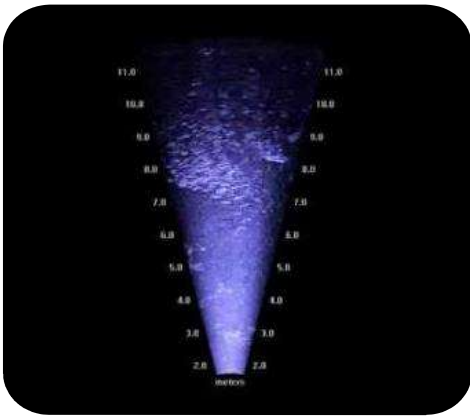
ENVIRONMENTAL MONITORING

4 Savery Pond Watershed Management Study - 2021

The Savery Pond Management Plan was done in collaboration with the Savery Pond Conservancy to conduct a diagnostic assessment of the ecosystem of Savery Pond and to identify and assess potential management options. As part of this project a management plan was developed and will be utilized in decision-making for options to improve water quality and reduce cyanobacteria blooms.

5 ARIS Sonar Study - 2021

ARIS unit was deployed at Brewster Gardens and remained in the water from April until the end of May. High resolution imaging sonar systems utilize acoustic pulses to create digital images of the water column. Throughout that period, 892 hours of sonar footage was captured. Staff is working with University of Massachusetts Dartmouth faculty and graduate students to analyze data. Data will provide insight on the life history of river herring, factors that influence their migration, and the effect of avian predation on migration.



6 Herring Ponds Watershed Management Study - Current

In late 2020, DMEA in partnership with the School of Marine Science & Technology, TMDL Solutions and the Herring Ponds Watershed Association, developed a strategy to address data gaps for Great Herring Pond and Little Herring Pond and develop a management plan based on diagnostic assessment of the ponds, including review and integration of 2021 data with previous water quality sampling data. The plan is currently in draft form and provides a reasonable understanding of the ecosystem and uses the collected information and its synthesis to identify and assess potential management options and develop a recommended management plan.

ENVIRONMENTAL MONITORING

7 Environmental DNA - Current

This work will collect and analyze water samples and use eDNA testing to document aquatic and terrestrial plants and animals within the Town Brook watershed both before and after the proposed bypass project to document changes in organisms once the watershed is fully accessible for the first time in centuries via the bypass channel.

8 Underwater Herring Camera - Current

The underwater herring camera allows for DMEA to livestream the Town Brook herring run thereby collecting counting data from people around the world during the annual migration. Since launch in 2018, participation has been garnered from individuals across all 50 states and 54 countries.

9 Annual Visual Herring Counting - Current

Volunteer herring counters perform 10 minute standardized counts to estimate the annual run size of river herring at Town Brook. The data has been instrumental in securing funds for restoration and for long-term monitoring of this valuable natural resource.

ENVIRONMENTAL MONITORING

10 Town Brook PIT Tagging Study - Current

Passive Integrated Transponders (PIT) tags are used to evaluate project success of river restoration work and has been utilized at Town Brook on several occasions. The data has proven the projects to be highly successful in passing fish and to document unique attributes like repeat spawners, length of stay in the brook, length of stay in the headwater pond (Billington Sea) and overall fish passage time through the watershed.

11 Eel River Watershed Nutrient Management Study - Current

The Town of Plymouth has a permit requirement to conduct and implement a Nutrient Management Plan per the Wastewater Treatment Facility (WWTP) Permit. As part of this requirement DMEA Staff has been conducting groundwater monitoring, surface water monitoring and environmental monitoring in the watershed and within the Eel River. The data is analyzed to measure whether the Wastewater Treatment Facility is impacting the Eel River and to implement nutrient management options should one of the water quality measures be triggered. Data is compiled and reported on an annual basis to the Department of Environmental Protection Agency.

12 Osprey Nest Survey - Current

Staff is working to continually locate and map osprey nests across Plymouth. Additionally, osprey platforms have been created at Stephen's Field, Holmes Playground, Plymouth Long Beach, and Foothills Preserve.

ENVIRONMENTAL MONITORING

13 American Eel Monitoring Program - Current

Unlike herring, eels are incapable of swimming against strong currents and are unable to use the existing fish ladder at the Jenney Grist Mill. Instead, eels can climb wet surfaces to navigate around obstacles or dams. To assist their migration and help eels make it above the dam, a 16 ft. long eel ramp was installed in 2019. This ramp extends from the Grist Mill deck above the dam to the waters below. In the four springs since 2019, 161,708 glass eels have been recorded, with a median annual population of 44,976 juvenile American eels.

NAACC Road-Stream Crossing Evaluations - Current 14

Evaluation of all road-stream crossings in town to quantify terrestrial and aquatic species passage. To date, over 30 stream crossings have been assessed within Plymouth's boundaries.

15 Pond and Lakes Stewardship Program - Ongoing

This stewardship program began in 2014 with grant funding with initially 40 ponds monitored in 2014. The program has continued on a smaller scale with the assistance of volunteers and Town Staff. Approximately 75 samples are collected each year for water quality including nutrients and chlorophyll leading to assessments of water quality and future management.

ENVIRONMENTAL MONITORING

14 Plymouth Long Beach Shore Bird Monitoring - Ongoing

Plymouth Long Beach (PLB) is an Important Bird Area for breeding and migratory shorebirds. Each season, Long Beach hosts a variety of nesting birds, including protected species such as piping plovers, least terns, and common tern, among others. The PLB Management Plan protects the breeding shorebirds and other coastal resources while providing for recreational activities, including off-road vehicle access, as allowed.

DMEA's seasonal Natural Resources staff carries out the day-to-day implementation of the PLB management plan, which includes monitoring shorebird breeding activity. Staff searches plover habitat daily, locates and monitors nests and chicks through fledging. Terns are typically monitored on a colony-wide basis. Historically, the PLB common tern colony has been one of the largest in the state but has suffered from habitat loss and heavy predation in recent years. Prior to the recent decline, staff would monitor common tern productivity by following nests in monitoring plots through hatching, and then banding and weighing the chicks regularly to predict fledging success.

The monitoring data collected daily is used to determine the extent of restrictions on vehicle access and other recreational activities based on the requirements laid out in the PLB management plan. Annual census data is submitted to the MA Division of Fisheries & Wildlife. In the 10 years since DMEA was created, PLB has gone from 15.5 pairs of nesting plovers to 47.5 pairs in 2022 and produced 424 fledglings.

PLB participates in the Massachusetts Habitat Conservation Plan for Piping Plover, which gives the Town some flexibility in managing the ever-increasing population of piping plovers. Plymouth was the first town to implement the HCP when it was approved in 2016 and has been able to provide increased access along Ryder Way each year since. Rather than closing the road when chicks hatch, the chicks are monitored intensively, and in some areas a barrier is installed. Traffic is halted only if the chicks approach or cross the road. A small least tern colony along Ryder Way is managed similarly, allowing vehicles to pass by the colony to reach recreational areas.

ENVIRONMENTAL MONITORING

White Shark Acoustic Tag Monitoring - Ongoing 15

Over the past 15 years, Chatham and surrounding coastal communities, began to experience higher frequencies of white shark sightings in locations with large harbor and grey seal populations. In response, Massachusetts Division of Marine Fisheries (DMF) staff, Greg Skomal and John Chisolm, working with the Atlantic White Shark Conservancy, began tagging white sharks on the Cape's east facing beaches with acoustic tags. The goal of this endeavor was to gain insight on white shark populations, movement, and general natural history within Massachusetts waters. By 2014, the study had evolved to incorporate a large population of tagged white sharks and numerous acoustic receiver buoys deployed on the outer cape.

A white shark incident involving kayakers off Manomet Point led to Harbormaster staff working with DMF and the Atlantic White Shark Conservancy to deploy 3 acoustic receiver buoys off the coast of Plymouth in 2014. Prior to this study, DMEA was aware that white sharks were present in Plymouth waters, but there was no estimate available on the extent of their abundance. The buoys were deployed at a water depth of 20 - 30 ft, in locations known to have extensive seal populations: Gurnet Point; Manomet Point; and Ellisville Harbor.

Since 2015, these 3 receiver buoys have been deployed and collecting data on white shark populations. However, it is critical to note that the buoys only collect data on tagged sharks. Not all sharks in Massachusetts waters are tagged, in fact, DMF estimates that at any given time, only 7-10% of sharks in an area have been tagged. Analysis has shown that the Manomet Point buoy detects the greatest number of white sharks throughout a season, followed by the Ellisville buoy, and the Gurnet Point buoy. White shark detections, at Plymouth buoys, have been steadily increasing throughout the study period. This trend has been observed in both the number of individual sharks being detected and the total detection frequency at each buoy. This suggests critical observations: 1) Plymouth is experiencing a higher number of individual tagged white sharks each year; and 2) white sharks are staying in our waters for longer periods of time, causing amplified detections. Furthermore, data from the acoustic buoys has demonstrated that white sharks are abundant not only in Cape Cod Bay, but all along the Massachusetts coast.

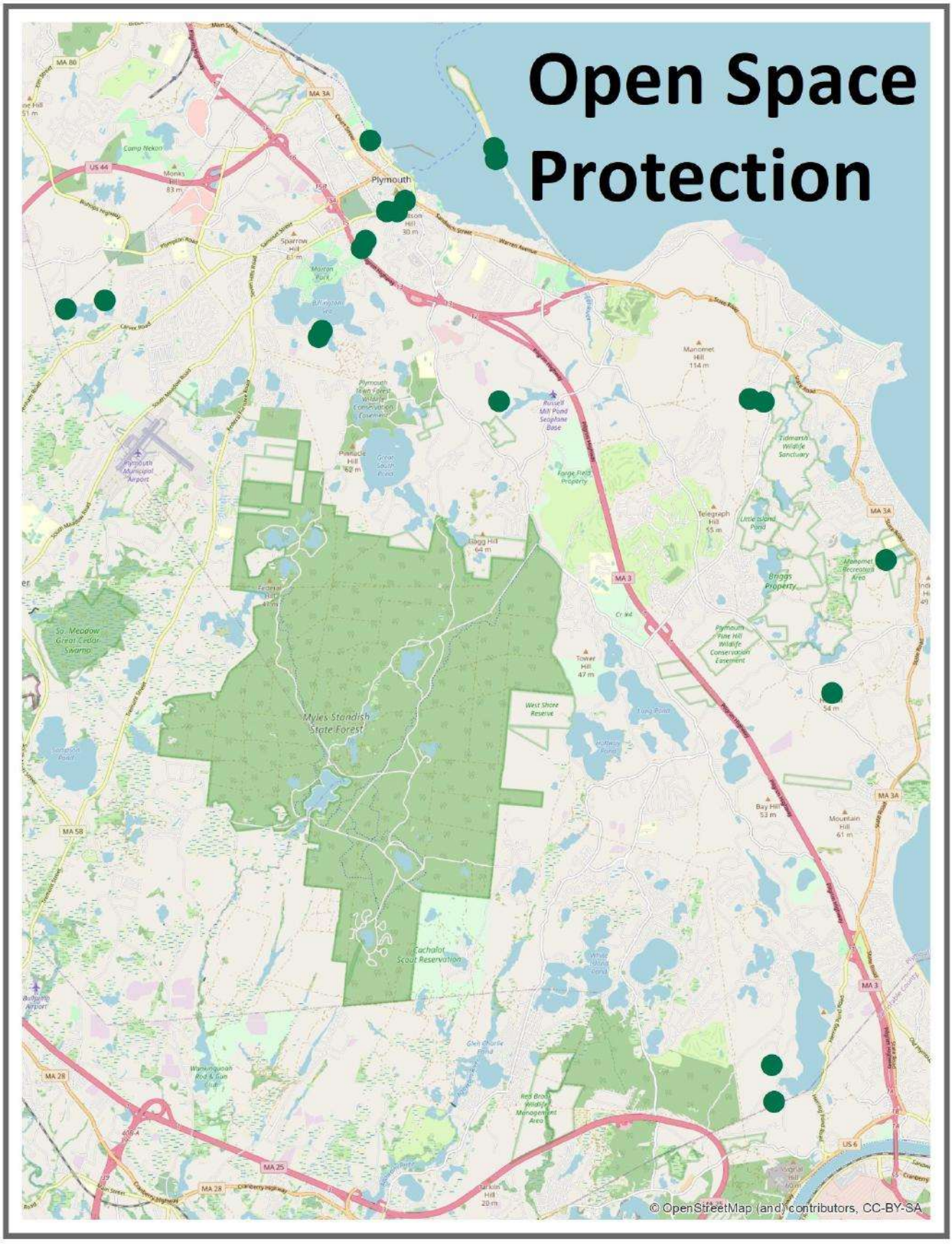
Armed with this deeper understand of white shark populations, the Town has developed policies and procedures to educate the public and provide notification/messaging in the event of a sighting or beach closure. DMEA aims to raise public awareness surrounding white sharks and continue to monitor population abundance to allow for safe and responsible coastal amenity use.

Section Three

OPEN SPACE PROTECTION

DMEA's Efforts to Improve Public Access, Trail Connectivity, and Preserve Open Space

OPEN SPACE PROTECTION



OPEN SPACE PROTECTION

1 Plymco Land Acquisition - 2012

This acquisition was made possible thanks to partnership with the CPC. When purchased, the property was a degraded, contaminated mill site and impoundment. Now, the parcel hosts a pocket park and serves as permanently protected open space in the downtown area.

2 Long Beach Land Acquisition & Transfer - 2013

DMEA worked with Long Beach private property owners on a land acquisition (2011) and transfer (2013) that kept a cottage on the tax roll, protected shorebird habitat and increased beachfront property available for 4x4 vehicle access by 200 linear feet.

3 Trailhead Kiosks - 2014

DMEA received grant funding to purchase and install several high quality trail head kiosks at Town Owned open space parcels. In addition, the grant funding included the printing of hundreds of trail maps that are utilized at each kiosk.

OPEN SPACE PROTECTION

4 Massey Land Acquisition & Demolition - 2014

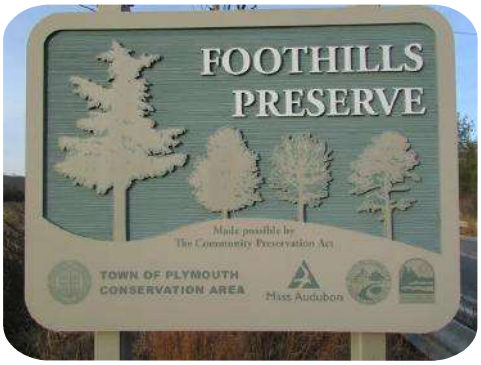
The Town of Plymouth acquired the Massey property on Long Beach in 2013. In 2014, DMEA worked with DPW to demolish the severely damaged existing cottage to return the property to open space, providing habitat for nesting shorebirds. The beachfront and harborside portions of this property are available for public use.

5 Black Cat Preserve Acquisition - 2015

This land acquisition is located in the upper part of the Town Brook watershed, and has a wonderful trail system with two pedestrian bridges, significant topography changes, and an overlook of an adjacent pond. DMEA partnered with CPC to make this acquisition possible.

6 Foothills Preserve Land Acquisition - 2017

Working with CPC, DMEA purchased this property in 2017. This acquisition permanently protects the upper part of the Manomet Brook watershed to ensure water quality, habitat protection and passive recreation.



OPEN SPACE PROTECTION

7 Conservation Area Signage - 2017

DMEA installed signage at Russell and Sawmill Pond Conservation Area and Russell Mill Pond Conservation Area calling attention to the properties.

8 Black Cat Footbridges - 2018

DMEA staff built two bridges to span gaps as a result of water control structure removals.

9 Darby Pond Land Acquisition - 2018

The acquisition of these cranberry bogs eliminated a source of water withdrawal from Darby Pond and eliminated the use of herbicides, pesticides and fertilizers immediately adjacent to the Zone 1 of the Darby Pond wellhead and within the drinking water supply Zone II area. In addition, this property offers passive recreation walking trails for the public to enjoy.

OPEN SPACE PROTECTION

10 Dixon Preserve Acquisition - 2018

Working with CPC, the Dixon Preserve at Hio Hill was purchased in 2018. The 88-acre parcel offers spectacular views, as the elevation reaches 204 feet above sea level. The property offers parking and hiking trails.

11 Long Beach Lot O-2 Parking Area - 2018

DMEA worked on abating and, with DPW, demolishing a structure on a former lease at Long Beach. A small parking area was created within the footprint of the structure and driveway that provides increased vehicle access near the 4x4 Crossover. An osprey nest platform was added to an existing pole in the fall of 2019 after a pair of ospreys nested on the dilapidated pier structure on the property, and the ospreys moved to the platform in 2020 and nested successfully each year since.

12 Holmes Park Rehabilitation - 2019

Completed in conjunction with the Holmes Dam Removal Project, this work saw a rehabilitation of the dilapidated park with a new skatepark, basketball court, paths, lighting, landscaping and stream overlooks providing both passive and active recreational opportunities.

OPEN SPACE PROTECTION

13 Comassakumkanit Preserve Acquisition - 2019

DMEA partnered with CPC to purchase this property in 2019. This land acquisition adds to the protection of the Herring Ponds watershed, a designated Area of Critical Environmental Concern (ACEC). It is immediately adjacent to conservation land protected by the Elbow Pond development making for a large area of habitat and passive recreation.

Town Brook Footbridge - 2020 14

Rebuilt an existing footbridge over Town Brook at wider dimensions to accommodate Parks Department maintenance equipment.

15 Pedestrian Bench Installation - 2020

Installed 9 pedestrian resting benches on various properties. The Trails Committee built and installed a number of these on their own with our permission.

OPEN SPACE PROTECTION

16 Foothills Footbridges - 2021

Built three bridges to span gaps as a result of water control structure removals, and protect wetland streams.

Siever Land Acquisition - 2021 17

This land acquisition adds to the open space in and around Russell Mill and the Eel River watershed and provides habitat, passive recreation and nutrient reduction in line with the Eel River Nutrient Management Plan.

18 Darby Pond Well Protection Land Acquisition - 2021

The acquisition of these cranberry bogs eliminated the primary source of water withdrawal from Darby Pond and eliminated the use of herbicides, pesticides and fertilizers immediately adjacent to the Zone 1 of the Darby Pond wellhead.

OPEN SPACE PROTECTION

19 Indian Brook Conservation Area Trail - 2021

Indian Brook is 210 acre conservation area. The trail is a 1.1 mile long out-and-back trail originating at the Manomet Recreational Fields that was completed in early 2021 with a kiosk installed fall of that year. A bench is located at the end of the trail.

Jenney Footbridge Replacement - Current 20

The current wooden footbridge is in fair to poor condition and replacement will allow for it to be ADA compliant thereby linking the ADA compliant sidewalks at Jenney Park to the ADA compliant paths and sidewalks at Willard Place, Newfield Street and Holmes Park.

21 Plymco Footbridge - Current

This project in conjunction with the CPA and DPW resulted in the construction of sidewalks along the former Plymco impoundment and a new footbridge at the Billington St/Westerly Road intersection. This work now affords the opportunity to walk from Brewster Gardens to Morton along a combination of trails and/or sidewalk for the first time. The trail that will be contiguous upon completion is called the Pilgrim Trail.

OPEN SPACE PROTECTION

Seaside Trail Improvements - Current 22

This project will provide for a safe pedestrian crossing at Nelson Street and an extension of the trail from Nelson Street to Lothrop Street bringing the path closer to the downtown/harbor district and making the trail ADA compliant.

23 Whispering Woods Walking Trail - Current

DMEA is working to establish a new walking trail with signage and a parking area at the Whispering Woods Preserve. The preserve encompasses 34 acres and offers a 0.84 miles long walking trail. Once the parking area is completed, this new trail will be promoted by DMEA for recreational use.

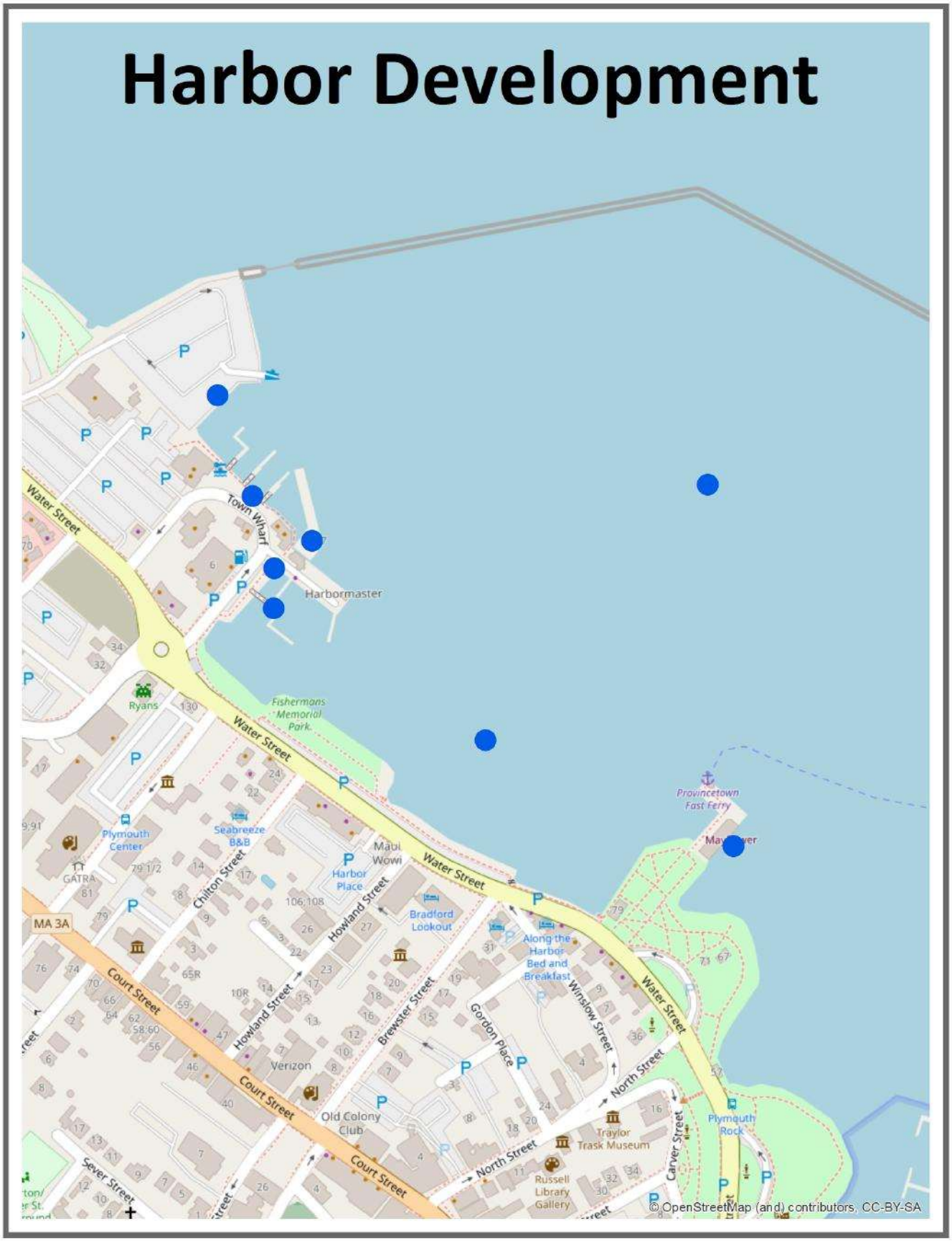
Plymouth Long Beach Recreational Fishing Pier - Current 24

This project will evaluate alternatives and design and permit a reconstructed pier structure on the harborside of Long Beach that will increase public access at Long Beach and may accommodate uses such as fishing access and a water shuttle.

HARBOR DEVELOPMENT

Steps That DMEA Has Taken To Improve Economic Vitality In The Waterfront District

HARBOR DEVELOPMENT



HARBOR DEVELOPMENT

1 Fuel Tank Replacement and Soil Remediation - 2012

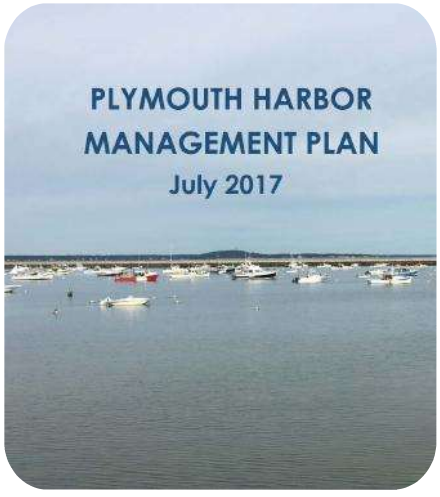
In 2012, the project removed 4 single wall tanks and remediated contaminated soil. It replaced the four tanks with 2 double walled, alarm ready tanks and added an oil/water separator to collect any surface spills before entering the harbor.

2 Town Wharf - 2017

DMEA received state funds to repair the bulkhead under Town Wharf along with wave fence, pile and cross-bracing repairs, replacement of hardware and other improvements to Town Wharf to ensure it is adequately maintained as the critical piece of marine infrastructure that it is.

3 Harbor Management Plan - 2017

DMEA sought out funding to support the development of a Harbor Plan. The plan involved community input and laid plans for current and future harbor work and projects and is utilized by both DMEA and the Harbor Committee as they pursue improvements to the harbor.



HARBOR DEVELOPMENT

4 T-Wharf Reconstruction - 2017

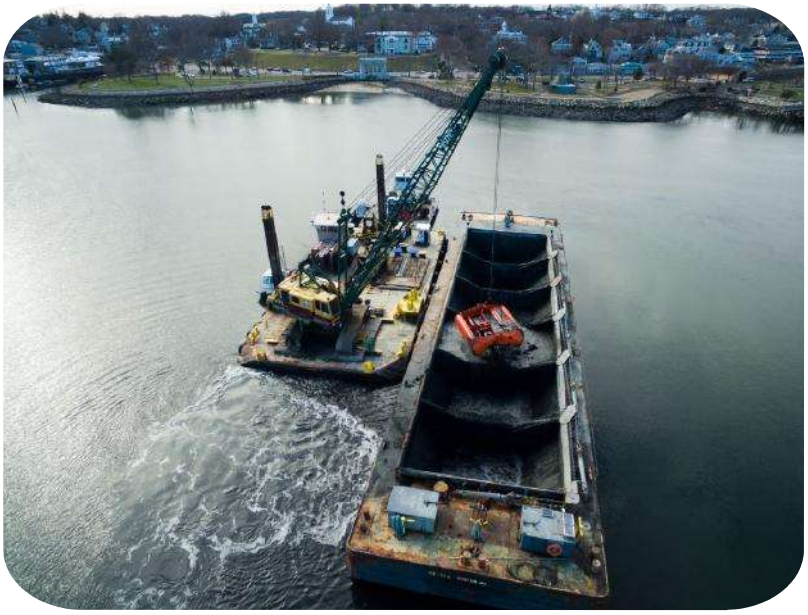
DMEA partnered with the Commonwealth to reconstruct the T-Wharf and make it available to the commercial fleet as it had been closed for several years due to its poor condition. It is a completely new structure with stormwater controls, winches, lighting, berth space and plenty of open area for use.

5 State Pier Dolphin Clusters - 2019

DMEA received state funding to have the two dolphin clusters replaced next to the Mayflower II berth upon completion of dredging. Both clusters were in such poor condition as to be unusable before replacement.

HARBOR DEVELOPMENT

6 Plymouth Harbor Dredging - 2019 - 2021



Dredging occurred in multiple phases over multiple years and involved local, state and federal funding. The ACOE dredged the federal navigation channel, mooring basin and turning basin. Over the course of several winters the Commonwealth and Town dredged in and around T-Wharf, Town Wharf and the berth for the Mayflower II.

7 Maritime Facility - 2020

DMEA received several rounds of state funding to assist the Town in the construction of the new Maritime Facility that includes not only office space but meeting space, public restrooms and transient boating facilities for those visiting Plymouth by boat.

HARBOR DEVELOPMENT

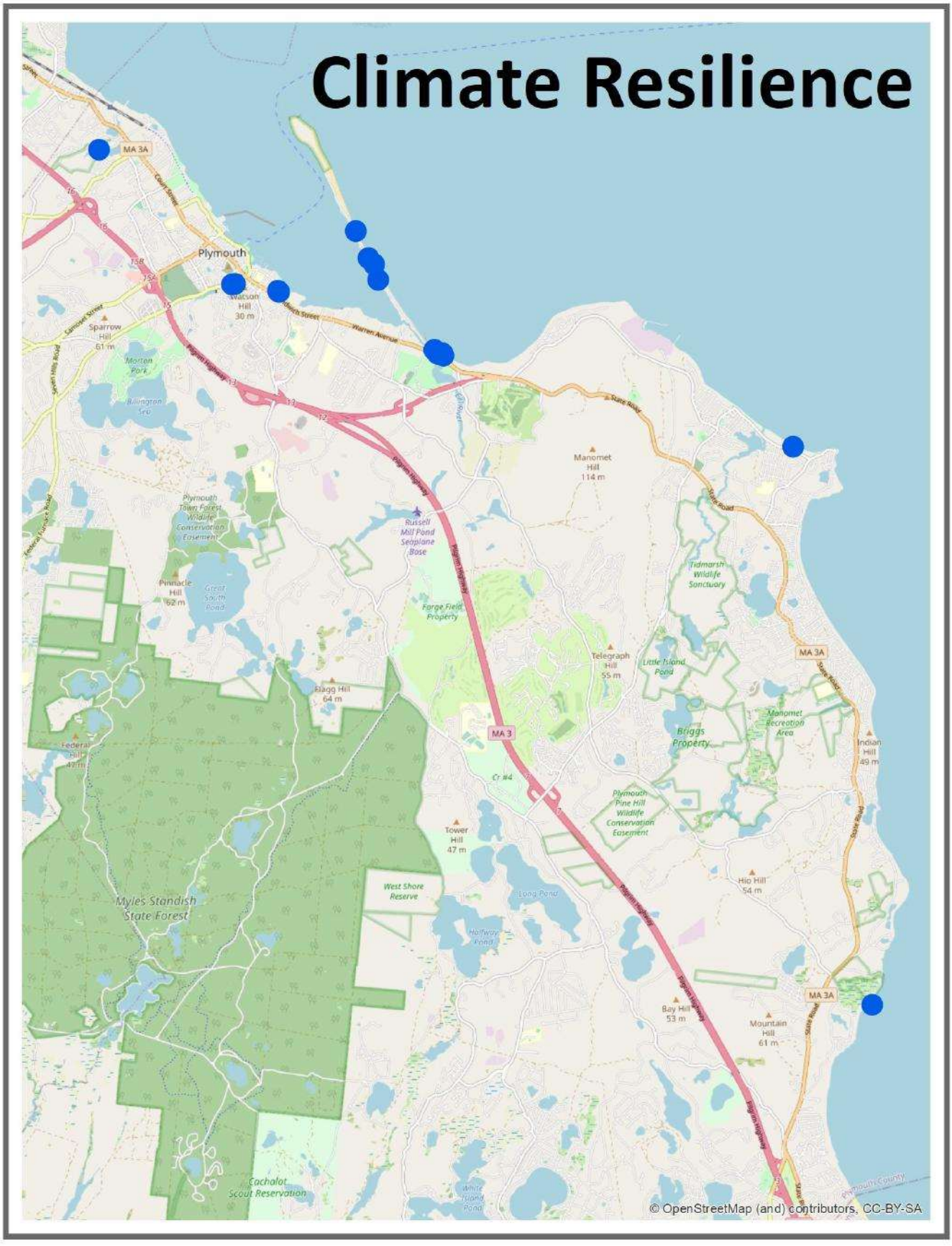
8 Town Wharf Bulkhead - 2022

The Town Wharf bulkhead structure located between Wood's Seafood and Lobster Hut supports parking and pedestrian access via a pile-supported structure. It was in poor condition and DMEA was able to secure state funding to repair the bulkhead and install all new piles, cross-bracing, pile caps and concrete decking and to add lights to the pedestrian boardwalk.

CLIMATE RESILIENCE

An Overview of Projects That Have Bolstered Plymouth's Shoreline In the Face of Climate Change

CLIMATE RESILIENCE



CLIMATE RESILIENCE

1 Long Beach Dike Repairs - 2013

The Long Beach dike protects not only Long Beach but Plymouth Harbor and the downtown waterfront area as well. DMEA worked with the Army Corps of Engineers and Plymouth DPW to repair several areas of the stone dike that had been damaged during coastal storms.

2 Warrens Cove Resiliency Study - 2015

A grant from the MA Office of Coastal Zone Management's Green Infrastructure Program funded this project that evaluated alternatives to reduce storm damage in Warrens Cove including nourishment, groins, offshore reefs and wave attenuating devices, dune building, relocation of the mouth of the Eel River and seawall/revetment repair. The study identified mixed sediment nourishment as the most beneficial in terms of resiliency, dissipation of wave energy and reduction of impacts to landward infrastructure.

3 Nourishment of Overwash Areas on Long Beach - 2016

This project nourished 12 eroded overwash areas at Long Beach with about 15,000 tons of mixed sediment material consisting of sand, gravel and cobble. During coastal storms, waves crashing over the Long Beach dike scour sand from overwash areas as water rushes over the beach to the harbor. The larger size of the gravel and cobble absorbs more wave energy and increases resiliency of these erosion-prone areas. This project was funded through the MA CZM's Coastal Resiliency Grant Program.

CLIMATE RESILIENCE

4 Long Beach Dike Repairs - 2017

DMEA worked with the Army Corps of Engineers to repair several areas where stones had been dislodged during storms to restore the integrity of the structure that protects Long Beach, Plymouth Harbor and the downtown-waterfront area during coastal storms.

5 Ellisville Harbor Inlet Stabilization Study - 2017

This study was completed and developed alternatives to providing a more sustainable tidal inlet system servicing the Ellisville Harbor and Marsh estuary system. It provided an in-depth alternatives analysis of potential structural and non-structural measures that could be utilized to maximize both the health of the salt marsh resources and provide a more consistent supply of sediments to downdrift beaches.

6 Centerhill Dune Establishment - 2018

Rebuilt a sand dune that was breached during the March 2, 2018 storm. The dune was then planted with beachgrass, to stabilize the sediment.

CLIMATE RESILIENCE

7 Warrens Cove Revetment Reconstruction - 2018

The Town received a grant through the state's Dam and Seawall program to repair and reconstruct 720 linear feet of revetment in Warrens Cove. The revetment required maintenance to continue to provide storm damage reduction benefits along Warrens Cove and the landward infrastructure including Pilgrim Sands Hotel and the former Bert's Restaurant.

8 Plymouth Beach Seawall Repair- 2020

With funding provided through the state's Dam & Seawall grant program, this project reconstructed 600 linear feet of seawall and revetment that replaced a failed portion of the Plymouth Beach seawall. The new wall was built with a deeper footing and a crest elevation 1.5ft higher than the previous wall to reduce storm overtopping that damages landward infrastructure including the Plymouth Beach parking lot and degrades habitat in the adjacent Eel River.

9 White Horse Beach Dune Nourishment - 2021

This project was conducted in 2 phases - the first half was in the winter of 2020 and the second in the winter of 2021. The dune was nourished to provide additional protection from severe storms and wave attenuation. After the nourishment, 3,000 plugs of beach grass were planted to stabilize the system.

CLIMATE RESILIENCE

10 Russell Sawmill Dam Repairs - 2021

The dam repairs brought this structure into compliance with the MA Office of Dam Safety Standards through repairs to the flume box structure, headwalls, construction of upstream and downstream cutoff walls and the armoring of the upgradient and downgradient slopes.

11 Long Beach Point Habitat Stabilization - 2022

Over a multi-year period, DMEA staff and volunteers planted beachgrass and installed sand fence following a plan approved by MassWildlife to stabilize nesting habitat at the point of Long Beach. The point has been severely eroded by increasingly severe coastal storms and much of the habitat formerly used by common terns has eroded away or become unsuitable. Common terns, least terns and piping plovers have begun nesting in these stabilized dune areas.

CLIMATE RESILIENCE

12 Long Beach Mixed-Sediment Nourishment - Current

This project will nourish 270,000 square feet of eroded beach along a 2,000 linear-foot stretch of the Long Beach with a mix of sand, gravel and cobble that is compatible with the native beach sediment. This nature-based approach aims to increase the resiliency of the barrier beach that protects Plymouth Harbor and the downtown-waterfront area, restore shorebird nesting habitat, reduce repetitive maintenance, protect public and private access as well as the adjacent private properties, and enhance the beach's ability to mitigate increasingly severe storm events.

Jenney Pond Dam Repairs - Current 13

Dam repairs will bring Jenney Pond dam into compliance with the MA Office of Dam Safety standards and improve public safety and overall aesthetics of the site through new sidewalks, improved stormwater treatment, new lighting and landscaping.

SUPPORTER APPRECIATION

In conclusion, DMEA would like to thank all our project partners, volunteers, collaborators, and public supporters. These projects would not be possible without your efforts. DMEA staff appreciates the opportunity to continue these ongoing projects and commence new projects over the next 10 years.

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