**Final Supplementary Generic Environmental Impact Statement**

**For**

**New York State Department of Environmental Conservation Artificial Reef Program**

**New York State Marine and Coastal District and Surrounding Federal Waters**

**Submitted Pursuant to 6 NYCRR Part 617.10**
**By the New York State Department of Environmental Conservation,**

**On behalf of the New York State Department of Environmental Conservation,**
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**Date Accepted by NYSDEC: 04/29/2020**

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# List of Acronyms

| | |
|---|---|
| ASMFC | Atlantic States Marine Fishery Commission |
| AVHRR | advanced very high resolution radiometer |
| B.P. | Before Present |
| BOD | biological oxygen demand |
| BOEM | Bureau of Ocean Energy Management |
| CMP | Coastal Management Program |
| CONMAP | Continental Margin Mapping Program |
| CRIS | Cultural Resources Information System |
| CTD | conductivity, temperature, and depth |
| CTDEEP | Connecticut Department of Energy and Environmental Protection |
| DMR | Division of Marine Resources |
| DO | dissolved oxygen |
| ECL | Environmental Conservation Law |
| EFH | essential fish habitat |
| EIS | Environmental Impact Statement |
| EMU | ecological marine units |
| ENOW | Economics: National Ocean Watch |
| EPA | U.S. Environmental Protection Agency |
| FEAF | Full Environmental Assessment Form |
| FTU | Formazin Turbidity Unit |
| GDP | gross domestic product |
| GEIS | Generic Environmental Impact Statement |
| HPLC | high performance liquid chromatography |
| km | kilometer |
| LISEA | Long Island Sound Ecological Assessment |
| LISTS | Long Island Sound Trawl Survey |
| LWRP | local waterfront revitalization program |
| MAFMC | Mid-Atlantic Fisheries Management Council |
| MCD | New York State Marine and Coastal District |
| MLW | mean low water |
| MPA | Marine Protected Areas |
| NEFMC | New England Fishery Management Council |
| nm | nautical miles |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NYS | New York State |
| NYSDEC | New York State Department of Environmental Conservation |
| NYSDOH | New York State Department of Health |
| NYSDOS | New York State Department of State |
| NYSG | New York Sea Grant |
| NYSHPO | New York State Historic Preservation Office |
| NYSOGS | New York State Office of General Services |
| OCS | Ocean Continental Shelf |
| IDW | inverse distance weighting |
| OPRHP | New York State Office of Parks, Recreation, and Historic Preservation |
| PAR | photosynthetically active radiation |

| | |
|---|---|
| PCB | polychlorinated biphenyls |
| ppt | parts per thousand |
| Program | New York State Department of Environmental Conservation Artificial Reef Program |
| Project | Artificial Reef Program Project |
| SAV | submerged aquatic vegetation |
| SCFWH | New York State Significant Coastal Fish and Wildlife Habitat Area |
| SEQRA | State Environmental Quality Review Act |
| SGEIS | Supplemental Generic Environmental Impact Statement |
| SHPO | State Historic Preservation Office |
| SMZ | special management zones |
| SST | sea surface temperatures |
| SWAP | State Wildlife Action Plan |
| TES | threatened and endangered species |
| USACE | United States Army Corps of Engineers |
| USCG | United States Coast Guard |
| USEPA | United States Environmental Protection Agency |
| USFWS | U.S. Fish and Wildlife Service |
| USGS | United States Geological Survey |
| VTR | vessel trip reports |

# Executive Summary

## Introduction

The New York State Department of Environmental Conservation (NYSDEC) Artificial Reef Program (Program) maintains a series of reef sites in the waters of New York's Marine and Coastal District (MCD) including the Atlantic Ocean, Great South Bay and Long Island Sound. The Program, which was established in 1962, was the subject of a Generic Environmental Impact Statement (GEIS) written by NYSDEC in 1993. NYSDEC subsequently issued a permit authorizing the construction, repair and maintenance of artificial reefs in accordance with the GEIS.

In April 2018, Governor Andrew Cuomo announced the largest expansion of the artificial reef program in state history. The expansion of the artificial reef program bolstered the 12 previously permitted artificial reefs off the shore of Long Island. In 2020, Governor Andrew Cuomo announced a proposal to expand the acreage of seven existing artificial reefs and create four new artificial reef sites. These additional sites are also assessed under the evaluation criteria outlined in the scope. NYSDEC is preparing the following Supplemental Generic Environmental Impact Statement (SGEIS) for the artificial reef program project ("Project"). The Project involves expansion of the artificial reef program in an effort to enhance artificial reef habitats sited offshore.

Following completion of the original GEIS and Reef Plan in 1993, a permit was issued authorizing the construction and development of sites in Great South Bay, Long Island Sound, and the Atlantic Ocean. As the Program developed, subsequent NYSDEC and United States Army Corps of Engineers (USACE) permits were attained to allow for the placement of material on permitted reef sites to meet the specific goals of the Program as outlined in the GEIS. For over 25 years, New York State has developed artificial reefs to provide fishing and diving opportunities, enhance or restore fisheries habitat, and manage artificial reef resources as part of New York State's marine fisheries program.

As these actions are sponsored by a State Agency and this is a Programmatic Action, NYSDEC is preparing this SGEIS in accordance with the State Environmental Quality Review Act (SEQRA). The Proposed Action would update the 1993 NYSDEC GEIS and Reef Plan to address advancements in science and knowledge surrounding artificial reef development since the original GEIS was written in 1993. The SGEIS will also identify if the proposed goals and objectives stated in the GEIS/Reef Plan are being met.

## Proposed Action

The Proposed Action includes the continued use of all previously permitted reef sites (referred to hereafter as existing reefs or existing reef sites), the expansion of seven existing reef sites, and the addition of four new reef sites as shown and listed below (Figure ES-1, Table ES-1).

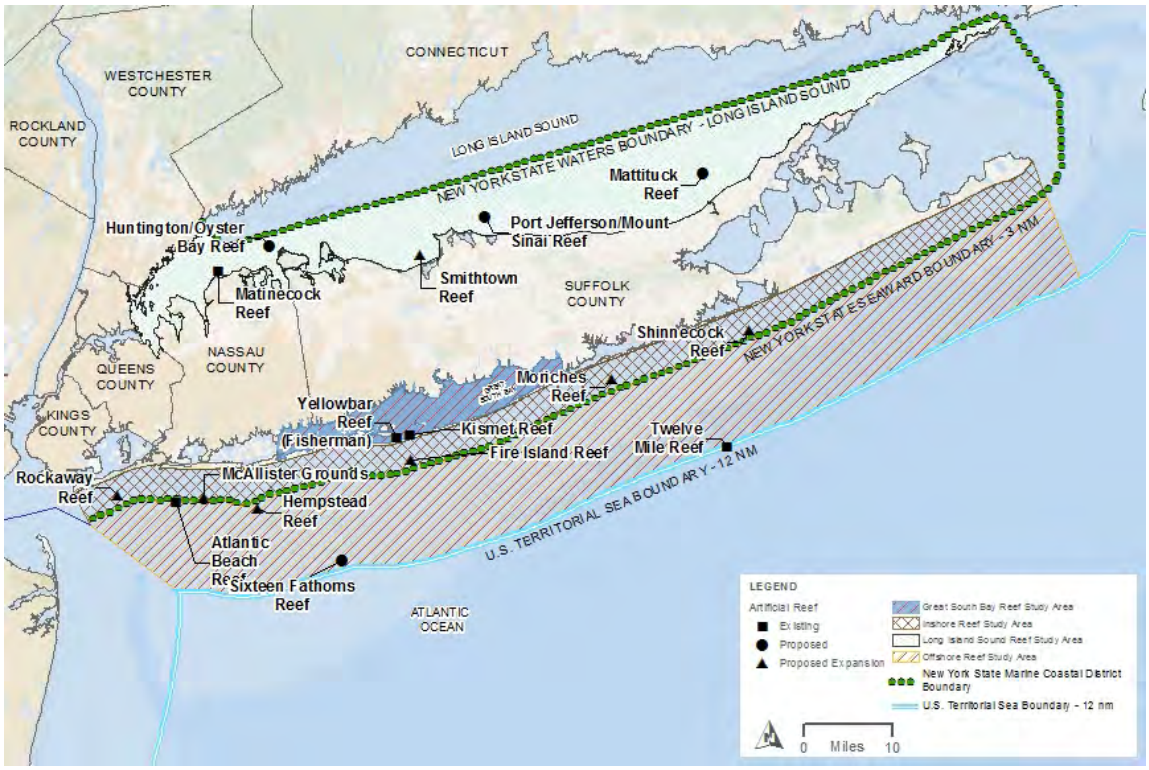



**Figure ES-1. Proposed Action Reef Locations, Modifications, and Study Area**

## Table ES-1. Reef Name, Location, and Proposed Action

| Reef | Category | Proposed Action |
|---|---|---|
| Atlantic Ocean – Inshore | | |
| Rockaway | Atlantic Ocean - Inshore | Expand to 635 Acres |
| McAllister Grounds | Atlantic Ocean - Inshore | Expand to 425 Acres |
| Fire Island | Atlantic Ocean - Inshore | Expand to 850 Acres |
| Moriches | Atlantic Ocean - Inshore | Expand to 850 Acres |
| Shinnecock | Atlantic Ocean - Inshore | Expand to 850 Acres |
| Atlantic Ocean – Offshore | | |
| Atlantic Beach | Atlantic Ocean – Offshore | Continued Use |
| Hempstead | Atlantic Ocean – Offshore | Expand to 850 Acres |
| Sixteen Fathom | Atlantic Ocean - Offshore | Create New 850 Acre Reef |
| Twelve Mile | Atlantic Ocean - Offshore | Continued Use |
| Great South Bay | | |
| Yellowbar | Great South Bay | Continued Use |
| Kismet | Great South Bay | Continued Use |
| Long Island Sound | | |
| Matinecock | Long Island Sound | Continued Use |
| Huntington/Oyster Bay | Long Island Sound | Create New 50 Acre Reef |

| Reef | Category | Proposed Action |
|---|---|---|
| Smithtown | Long Island Sound | Expand to 31 Acres |
| Port Jefferson/ Mount Sinai | Long Island Sound | Create New 50 Acre Reef |
| Mattituck | Long Island Sound | Create New 50 Acre Reef |

Artificial reefs within the Atlantic Ocean, Great South Bay, and Long Island Sound (Study Area) are developed using a patch reef system. Materials are transported to the reef site either by barge or towed out by vessel (i.e. steel barges or vessels) under Program supervision. Patch reef development includes the placement of material in discrete locations or "targets" separated by undisturbed benthic habitat. This construction method allows for the area between the patches to remain as undisturbed benthic habitat thereby reducing impacts to the benthic community (Figure ES-2). The benthic habitat between patch reefs will remain undisturbed as these areas are typically avoided by commercial fisherman due to the inability to fish these areas with dredges, trawls, and other fishing gear that is towed.

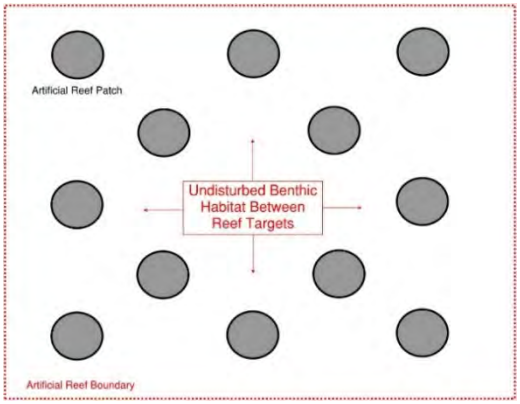



**Figure ES-2. Typical Patch Reef**

This configuration increases the enhancement of the local natural habitat by introducing profiled hard structure for colonization and reef development. The structures attract a variety of marine life including recreationally important finfish species sought by anglers and divers. Artificial reefs provide structure for the attachment of benthic organisms such as anemones, corals, sponges, hydroids, and bryozoans that would not otherwise be able to colonize on the sandy, seafloor sediments that dominate the region. These reefs also provide shelter and foraging ground for a variety of marine organisms including fish, crustaceans, and marine mammals.

### Project Location

The Project is situated within the MCD and the adjacent federal waters surrounding Long Island. The MCD includes tidal Hudson River waters south of the Governor Mario M. Cuomo Bridge, and ocean waters within three miles from the state's coastline, including the Atlantic Ocean, Long Island Sound and embayments. Artificial reefs are located within the marine and estuarine waters of the Atlantic Ocean, Great South Bay, and Long Island Sound (see Figure ES-1). Reefs are strategically located near Long Island harbors and embayments through local inlets.

### Project Purpose and Need

The purpose of the artificial reef program in New York is to fulfil its obligation under the National Fishing Enhancement Act in accordance with the standards of the National Artificial Reef Plan. Artificial reefs enhance or increase the structured marine habitat available for associated fishes and other organisms,

and provide fishing and diving opportunities for the public. Artificial reefs also provide economic benefits to local fishing/diving businesses and communities. The Project is needed to enhance or restore fishery resources and associated habitat to the maximum extent practicable utilizing artificial habitat, administer and manage artificial habitat as part of an overall fisheries management program, and to provide fishing and diving opportunities through selective placement of artificial habitat in state and adjacent Federal waters.

### Project Alternatives

The purpose and need, as well as Project objectives were the basis to determine the range of alternatives that were developed and evaluated for the Project. Consideration of reasonable alternatives is required under SEQRA.

Several potential alternatives were eliminated because it was clear that they would not meet the Project's purpose and need. The potential alternatives that remained were evaluated to identify those that would best meet the Project purpose and need and would also be reasonable in terms of engineering considerations, cost effectiveness, and environmental impacts. Based on the alternative's evaluation, five potential alternatives were evaluated further in this SGEIS.

An alternatives analysis of the following five alternatives is provided per Part 617.9(b) (5) (v) a-d. The description and evaluation of each alternative is at a level of detail sufficient to allow a comparative assessment of the alternatives discussed. A summary of the alternatives to be considered is provided in Table ES-2.

**Table ES-2. Potential Alternatives**

| Alternative | Description |
|---|---|
| 1 | **No Action**<br>The No Action alternative would encompass forgoing the development of new artificial reefs, expanding existing reefs, and continuing use of existing reefs. In this alternative reef material would continue to be placed on permitted reefs until the reef permits expire. Following permit expiration, no additional reef material would be placed for the purpose of developing artificial reefs. The potential benefits to fisheries would not be realized if reef construction stopped and no new fishing and diving opportunities would be created. Selection of this alternative would not meet the purpose and need for the Project. |
| 2 | **Proposed Project (Preferred Alternative)**<br>The Proposed Action includes the continued use of existing reef sites, the expansion of seven existing sites (Rockaway, Hempstead, Fire Island, Smithtown, McAllister Grounds, Moriches, and Shinnecock reefs) and the addition and creation of four new sites (Sixteen Fathoms, Huntington/Oyster Bay, Port Jefferson/Mount Sinai and Mattituck reefs) (Table ES-1). The Proposed Action seeks to continue the use of, expand, and enhance the existing network of artificial reefs in coastal areas and offshore by providing hard substrate that benefits fish, shellfish, and crustaceans; fishing grounds for anglers; and underwater structures attractive to scuba divers. Selection of this alternative would meet the purpose and need for the Project. |

| Alternative | Description |
|---|---|
| 3 | **Existing Artificial Reef Program with fewer expansions**<br>This alternative includes the continued use of existing reef sites, the expansion of three existing sites (McAllister Grounds, Moriches, and Shinnecock reefs) and the addition and creation of four new sites (Sixteen Fathoms, Huntington/Oyster Bay, Port Jefferson/ Mount Sinai and Mattituck reefs) (Table ES-1). This alternative seeks to continue the use of, expand, and enhance the existing network of artificial reefs in coastal areas and offshore by providing hard substrate that benefits fish, shellfish, and crustaceans; fishing grounds for anglers; and underwater structures attractive to scuba divers. However, without the expansion of additional sites, habitat creation, and angling opportunities would be reduced. Selection of this alternative is not the preferred option for the Program and EIS. |
| 4 | **Existing Artificial Reef Program (i.e. no expansions)**<br>This alternative would include the continued use of existing reefs without creation of Sixteen Fathoms, Huntington/Oyster Bay, Port Jefferson/Mount Sinai and Mattituck reefs, or the expansion of Rockaway, Hempstead, Fire Island, Smithtown, McAllister Grounds, Moriches Reef, and Shinnecock Reef. Existing reefs with capacity to receive additional reef material will continue to be developed per the Reef Plan. Without the addition of new reef sites or expansion of existing reef sites the capacity for additional materials, habitat creation, and angling opportunities would be reduced. Selection of this alternative would not meet the purpose and need for the Project. |
| 5 | **Development of Special Management Zones**<br>This alternative would continue the development of artificial reefs and utilize regulatory means and methods for fishery management. The NYSDEC would designate special management zones (SMZs) which may specify what types of activities can and cannot occur in a given region. SMZs may designate specific gear types that can or cannot be used, if fishing is permissible, and/or during what time frames those activities may occur. Selection of this alternative would meet the purpose and need for the Project; however, the Program would need to be developed for SMZ rules and is not the preferred alternative for this Program and EIS, but it remains an option that could be utilized in combination with the proposed action, should the need arise. |

## Environmental Affects

Overall, the Project is expected to provide the following benefits:

- Increase habitat complexity through placement of hard vertical structured habitat which will enhance biodiversity in the marine environment; and
- Enhance local refuge, forage, and some spawning opportunities for structure associated species; and
- Create additional angling and diving opportunities for recreational anglers, SCUBA divers, and commercial fishermen.

Potential project impacts of the Proposed Action are summarized below in Table ES-3 by resource.

## Table ES-3. Potential Project Impacts of the Proposed Action

| Physical | Potential Impacts | Mitigation |
|---|---|---|
| Bathymetry | The placement of material for the development of artificial reefs will impact local bathymetry as the material provides vertical relief to areas that were flat. Added material will have localized impacts to water flow velocities and therefore potential scour and sedimentation around the edges of the reef structures. There will be no changes in overall hydrodynamics of the water bodies. Utilization of the patch reef system results in a smaller disruption of the site's footprint. Permanent changes to localized water flow velocities are not anticipated to cause significant negative impacts as a result of placement of reef materials. | None proposed |
| Sediment | Localized changes to surficial sediment may occur following artificial reef placement at the new sites and expansions at the existing sites. Placement of reef materials will suspend some sediments, but any effects are anticipated to be localized, short-term, and settle quickly back to the seafloor. Small-scale hydrodynamic impacts are anticipated to be localized to individual patch reefs. | None proposed |
| Water Quality | Suspended sediment and turbidity impacts to surface waters would be localized and limited to construction periods. Hydrodynamic impacts are anticipated to be localized to individual patch reefs and not result in long-term regional effects. Therefore, no permanent impacts are anticipated. | None proposed |
| Air Quality | Temporary impacts to air quality from vessel towing and equipment use within the vicinity of the existing and proposed reefs would occur during placement of materials. The primary source of air emissions is generated by fuel combustion in diesel engines from commercial marine vessels such as tugs and backup power/emergency generators. Impacts to air quality are anticipated to be temporary, short-term in duration, and not cause any significant long term adverse impacts.<br><br>Potential indirect impacts to air quality could occur from the use of the artificial reef sites by local stakeholders, such as divers, anglers and recreational boaters. There may be an increase in local stakeholder use of the artificial reef sites; however, these impacts are anticipated to be short in duration and not generate emissions at a large enough scale to significantly alter air quality at the reef sites. | To mitigate potential impacts to air quality during the construction phase, vessels will comply with international standards regarding air emissions from marine vessels. |

| Physical | Potential Impacts | Mitigation |
|---|---|---|
| Noise | Impacts to ambient noise levels from vessel towing and equipment use on barges would occur during construction and placement of materials. These noise impacts will be temporary and not cause any significant long-term impacts. Noise levels would not be any greater than what is generated from existing oceangoing vessels transiting the reef areas or ambient recreational and commercial activities.<br><br>Potential impacts to marine mammals from increased underwater noise levels may occur during placement of materials and later usage from local stakeholders. However, increased underwater noise levels during construction are not anticipated to cause any adverse impacts to marine mammals as the noise levels would be temporary and short in duration. Marine mammals are anticipated to vacate areas of higher noise levels and not significantly alter their foraging, swimming speeds, or distance travelled from the noise source. | None proposed |
| Climate Change | Greenhouse gas emissions during Project construction would result from the use of marine vessels, off-road construction equipment, and worker vehicles. These impacts would be temporary and short in duration, ceasing after the Proposed Action is complete. Long-term impacts of greenhouse gas emissions from vessels utilized by local stakeholders accessing the reefs are anticipated to be minimal. The addition of artificial reefs would not contribute to sea level rise. | None proposed |
| **Biological** | **Potential Impacts** | **Mitigation** |
| Marine Plankton | The proposed Project may result in temporary turbidity increases during construction. Reefs are sited on coarse grain sediments which will resettle to the bottom rapidly.<br><br>No long-term impacts are anticipated due to the development of artificial reefs. In addition, potential impacts to the plankton community due to grazing from the increased fish population at local areas could occur. However, as the reef locations will occupy less than one percent of the surrounding waterbodies and water circulation around the reefs is constant no permanent impacts are expected. | None proposed |

| Biological | Potential Impacts | Mitigation |
|---|---|---|
| Marine Invertebrates | The proposed Project will result in the direct burial of benthic organisms at the reef locations due to placement of reef materials. The existing benthic community would be directly impacted through burial and habitat conversion, which would result in a permanent local loss including endobenthic species (i.e. Atlantic Surfclam and Ocean Quahog). In addition, there would be temporary, short term, direct impacts to the benthic community surrounding each individual artificial patch reef site due to sediment suspension during material placement, and altered sediment deposition rates and patterns due to the higher relief material disrupting ambient currents. This may lead to increased scouring in some areas and increased sediment accumulation in others.<br><br>Indirect impacts could include the introduction of non-native species which prefer reef habitats that may either displace or forage on the existing community, thus changing the benthic community structure. Furthermore, as water temperatures rise due to climate change, warm water non- native species brought by the Gulf Stream may colonize the reefs and compete with native species for habitat and food resources.<br><br>Material placement would affect approximately 3,423 acres; however, the direct impacts to benthic communities would be less due to patch reef placement. In addition, there are many more acres of benthic habitat available within the Study Area and the overall impact to the benthic community is less than 1% of the study area. In addition, vertical complex structure will provide habitat for a reef-oriented epibenthic community species, such as mussels, tunicates, anemones and encrusting polychaetes, to colonize. These species will in turn provide habitat and food resources for the new reef community as it develops into a mature artificial reef. The conversion of a low diversity benthic community to a more complex community will provide habitat and food for higher trophic levels including fish. Therefore, the expansion and development of artificial reefs provide a net benefit to the benthic community and are anticipated to offset the potential Project impacts. | To further minimize the impacts to the benthic community, the patch reef construction method will be utilized. Patch reef development includes the placement of material in discrete locations or “targets” separated by undisturbed benthic habitat. This construction method reduces overall impacts to the benthic community by creating a larger area of undisturbed habitat. |

| Biological | Potential Impacts | Mitigation |
|---|---|---|
| Fish | The development of the Proposed Action may have direct, indirect and cumulative impacts to the fish community. Short-term, temporary direct impacts are associated with sediment suspension, noise and vibration during material placement. Direct impacts are also associated with the conversion of habitat from uniform sandy and silty substrates to hard bottom substrate with vertical relief. The developed hard substrate will increase species diversity and provide areas for forage, shelter and in some cases spawning that will benefit species. In addition, a potential direct impact includes over harvest of reef species. As the reef develops, recreational and commercial fisherman may exploit the newly developed reef resulting in increased fishing pressure.<br><br>Indirect impacts to fish include introduction of non-native species. The increase of non-native species that can inhabit reef locations as species diversity and habitats change is also an indirect impact. As water temperatures increase due to climate change, non-native species may reside in the waters off of New York for longer periods and begin to inhabit artificial reefs competing with resident species for habitat and food resources.<br><br>As the overall magnitude of the Proposed Action covers 3,423 acres, the overall impact to the fish community relative to the entire Study Area is less than 1%. Even though reef structures occupy a footprint of habitat, and may displace demersal species, there are direct benefits. Artificial reefs provide stable structure, relief, crevices and interstitial spaces to create complex diverse habitat. Artificial reefs add habitat complexity and diversity to the Study Area which is dominated by open-water habitat and uniform sand substrates. The addition of the patch reefs to the existing habitats provides greater habitat complexity for fish by providing refuge and food resources and limiting commercial fishing gear types. | Loss of bottom substrate will be mitigated through the addition of complex three-dimensional hard substrate. The hard substrate will increase species diversity and provide areas for forage, shelter and in some cases spawning that will benefit species. To address over harvesting, NYSDEC marine fishing regulations have been established and are enforced to protect structure associated species from overharvesting on reef sites. |

| Biological | Potential Impacts | Mitigation |
|---|---|---|
| Essential Fish Habitat | Species with benthic life stages will experience localized direct impacts during material placement if they are in the area, while pelagic species with designated EFH will likely experience minor to no impacts as a result of the placement of artificial reef materials on the artificial reef sites. Artificial reefs will provide overall benefits to both benthic and pelagic life stages as reefs add complex vertical habitat which species will use for foraging and protection.<br><br>Potential direct temporary impacts include resuspension of sediments, noise, and vessel traffic during construction. At the reef locations there is a permanent conversion of habitat type from open bottom to complex structured habitat. Indirect impacts include the direct burial of benthic infaunal prey organisms for bottom feeding EFH species. As the Project area represents a very small percentage of foraging grounds within the Atlantic Ocean, Great South Bay and Long Island Sound and bottom-feeding fish and crustaceans will consume epifaunal organisms living on the reef, the overall indirect impact of the placement of reef materials to EFH species will be minimal.<br><br>With the exception of the sandy substrate habitats being converted to hard-bottom habitat with vertical relief, the remaining substrates within the surrounding areas in the Atlantic Ocean, Great South Bay, and Long Island sound are anticipated to function the same as pre-existing conditions, and allow the continued use by designated EFH species. The overall potential adverse impacts to EFH designated species and EFH in the Project area will be minimal. Long term impacts are associated with the permanent conversion of a limited area of sand habitat to complex hard substrate habitat with vertical relief. The development of the artificial reef sites will provide a long term benefit to benthic and pelagic species that are commercially and recreationally valuable, establish an epibenthic community and produce a more diverse and complex community. | None proposed |

| Biological | Potential Impacts | Mitigation |
|---|---|---|
| Threatened and Endangered Species | Significant permanent impacts on threatened and endangered (TES) species or habitat are not anticipated from the placement of materials at the reef sites as Atlantic sturgeon, sea turtles and marine mammals are highly migratory and their presence at the reef sites would only be transient. However, coordination and consultation with NMFS and USFWS will be conducted. There is the potential for impacts associated with placement of material including temporary suspension of sediments following material placement, minor temporary increase in vessel traffic as materials are delivered to reef sites, limited temporary noise and vibration while materials are placed, and very limited risk of materials directly striking individual organisms. The risk of an individual organism being directly struck by falling debris is extremely small due to their transient presence at the reef sites as well as the short duration and infrequent nature of material placements.<br><br>The Proposed Action will benefit TES species by creating foraging areas and protective spaces for juvenile and adult life stages. In addition, habitats between patch reefs will act as a sanctuary as commercial fishing is limited in those areas. | The placement of reef materials will take place during short intermittent periods during daylight hours which would minimize the risk of interacting with listed species. The vessels delivering reef materials to the reefs are slow moving and represent a small portion of the total vessel traffic in the Project area. |
| **Human** | **Potential Impacts** | **Mitigation** |
| Commercial Fishing | Impacts to commercial fishing due to construction are not anticipated. Commercial fishing using mobile bottom gear will be directly impacted at reef locations due to the placement of material. Commercial fishing using rod and reel may be enhanced. | Reefs will be identified on navigation charts and placement activities will be publicized in the USCG Notice to Mariners. |
| Recreational Fishing | During Project construction, recreational fishing practices are expected to be impacted as fishing could not be conducted in the area where materials are being deployed However, these impacts are anticipated to be temporary and limited to the window of construction activities. Post-construction, recreational fishermen are anticipated to benefit from the Proposed Action due to increased fishing opportunities. | Reefs will be identified on navigation charts and placement activities will be publicized in the USCG Notice to Mariners. |

| Human | Potential Impacts | Mitigation |
|---|---|---|
| Recreational Diving | During construction and expansion of the reef sites, recreational divers will experience a short-term impact by not having access to the construction area of the reefs. Recreational divers are not anticipated to be impacted by the new reef sites as these sites were devoid of reef materials that produce diving opportunities. For the expansion of existing reef sites, recreational divers would be temporarily restricted from the construction area to avoid injury and other safety concerns. This user group would only experience temporary restrictions and no significant long-term impacts would occur as a result of reef site construction and expansions. Following construction and deployment of the new patch reefs, recreational divers are anticipated to benefit from the increased diving opportunities. | Reefs will be identified on navigation charts and placement activities will be publicized in the USCG Notice to Mariners. |
| Environmental Justice | As the Proposed Action takes place away from communities, impacts to environmental justice communities are not anticipated. These communities will not experience disproportionate adverse environmental impacts as a result of the Proposed Action. | None proposed |
| Socioeconomics | By providing additional opportunities for fishing and diving, the businesses (e.g. Dive Charter Boats, Dive Shops, Party Charter Fishing Boats and Bait & Tackle Shops) and communities that support these industries are expected to see economic growth. | None proposed |
| Cultural Resources | The Proposed Action is not anticipated to significantly impact cultural resources for the reef sites. The areas of artificial reef material placement are devoid of existing structures and unlikely to impact submerged cultural resources. | Consultation with New York State Historic Preservation Office (NYSHPO) is ongoing and findings from their assessment will be updated accordingly. |
| Marine Disposal of Waste | There are no marine disposal sites located within the vicinity of the Atlantic inshore, offshore, or Great South Bay reefs. The existing and three proposed Long Island Sound reefs are not sited within any of the ocean dredged material disposal sites. Therefore, no significant impacts to marine disposal of waste site are anticipated as a result of the Proposed Action. | None proposed |
| Dredging Sand and Gravel Mining | The Proposed Action does not occur near or within designated dredging, sand and gravel mining areas. Therefore, no impacts are expected to occur. | None proposed |

| Human | Potential Impacts | Mitigation |
|---|---|---|
| Navigation | The activity of transporting of the reef material from the staging area to the deployment site may restrict maneuverability representing potential hazard to navigation. Potential groups of vessels using the reefs could also affect navigation but in a smaller localized way. No significant impacts to navigation are anticipated. | Consultation with the United States Coast Guard (USCG) and USACE will be conducted to confirm if navigation could be impacted through the Proposed Action. Consultation could include discussion of reef placement locations, potential means and methods for deployments, and clearance depths. In general, prior to artificial reef deployment, the different users of the area and potential stakeholders of the reef should be adequately informed of the reef Project and their viewpoints should be considered. |
| Offshore Energy | The Proposed Action does not occur near or within designated Bureau of Ocean Energy Management (BOEM) lease areas for offshore energy development, underwater cables, or other offshore energy resources. Therefore, no impacts are expected to occur. | None proposed |
| **Marine Regulatory Areas** | **Potential Impacts** | **Mitigation** |
| Special Management Zones/Marine Protected Areas | The Proposed Action does not occur within a SMZ or marine protected area (MPA). | None proposed |
| New York State Coastal Policies | Development of artificial reefs is consistent with New York State Coastal Policies (19 NYCRR Part 600.5) and existing Local Waterfront Revitalization Program (LWRP). | None proposed |

The 1993 GEIS and Reef Plan evaluated impacts associated with the Artificial Reef Program that included permanent changes to bathymetry, loss of open-water sandy-bottom benthic habitat, direct burial of epibenthic marine invertebrates, and reduced acreage available for mobile gear commercial fishing. The findings of the 1993 assessment identified the potential of the Program to result in temporary impacts to water quality, air quality, and noise during construction of the patch reefs. The only permanent adverse impacts identified in the document were the burial of epibenthic marine invertebrates, no additional permanent adverse impacts have been identified as a result of Program implementation. As this SGEIS is being developed to supplement the 1993 GEIS, an assessment of

EFH has been included for the new and enhanced reef areas. Recently listed TES were reviewed to determine whether the expanded Program would have the potential for adverse effects on TES. Existing conditions have been updated for reef locations that have experienced some changes due to annual storms, and inter-annual changes to aquatic species distributions and diversity. No new adverse impacts are expected to result from the expanded Program. Overall, the Program has been successful in developing productive reefs that enhance aquatic communities and provide recreational opportunities around Long Island and the expanded Program would increase those beneficial effects.

**Permits, Approvals and Agency Coordination**

Multiple State and federal Agencies are involved with different aspects of the Program. Table ES-4 outlines the permitting process that requires review and approval by Federal and State Agencies.

**Table ES-4. Agency Responsibility and Role for the Program**

| Federal Agency | Responsibility | Role |
|---|---|---|
| *National Oceanic and Atmospheric Administration (NOAA)* | NOAA protects and manages the resources of significant marine areas of the United States through the National Marine Sanctuaries Act (Title III of the Marine Protection, Research, and Sanctuaries Act, 16 U.S.C. §§ 1431-1445c-1). | Consultation with NOAA will take place to gather information on fisheries resources and identify potential conflicts with proposed reef sites. |
| *National Marine Fisheries Service (NMFS)* | NMFS carries out responsibilities related to conservation and management of living marine resources and their habitats under several Federal laws, including the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1801 et seq.), the Endangered Species Act (16 U.S.C. §§1531-1543), the Fish and Wildlife Coordination Act (16 U.S.C. §§1531-1543), and the Marine Mammal Protection Act (16 U.S.C. §§1361-1421h). | Coordination and consultation with NMFS will be completed to provide comments on permits and provide guidance on EFH within the reef development areas. |
| *USACE* | The USACE is responsible for regulating activities in waters of the United States under Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. §401 et seq.). The Corps also has permit authority under Section 404b of the Clean Water Act (33 U.S.C. §1344). | The Corps is the lead federal agency responsible for permitting artificial reef development under authority of the National Fishing Enhancement Act of 1984. Consultation with the Corps for assessing potential reef sites for potential impacts to submerged archaeological resources will be completed. |

| Federal Agency | Responsibility | Role |
|---|---|---|
| *USCG* | The USCG has the authority to establish safe fairways and traffic separation schemes for safe movement of vessel traffic under the Ports and Waterways Safety Act; regulates aids to navigation on offshore installations; establish safety zones around offshore facilities; enforce fisher laws; and monitor and enforce compliance with international conventions and statues on environmental protection. | Consultation with the USCG will take place to ensure reef placement does not interfere with navigation and to determine if aids to navigation are required. |
| *U.S. Fish and Wildlife Service (USFWS)* | The USFWS provides technical assistance and consultation under the Endangered Species Act, the National Environmental Policy Act, the Coastal Zone Management Act, and Section 404 of the Clean Water Act. | Coordination and consultation will occur with the USFWS to determine if there are any threatened or endangered species impacts that would result from reef development. |
| *U.S. Environmental Protection Agency (EPA)* | The USACE applies Section 404(b)(1) guidelines that were developed in conjunction with the EPA. The guidelines (40 C.F.R. Part 230) prohibit issuance of 404 permits that would cause or contribute to violations of applicable water quality standards and any discharges that would cause significant degradation to waters of the United States. Additionally, Section 404(c) authorizes the USEPA to prohibit, withdraw, or restrict the use of defined areas as a dredged or fill material disposal site in any waters of the U.S. | Provides determination on whether discharge will have unacceptable adverse effects on municipal water supplies, shellfish beds, and fishery areas, wildlife or recreational areas. |
| **State Agency** | **Responsibility** | **Role** |
| *NYSDEC* | NYSDEC is the only entity in New York that can obtain permits to build artificial reefs in marine waters of the state. | Preparation of SGEIS and permit issuance. |
| *New York State Department of State (NYSDOS)* | In 1982, the New York Coastal Zone Management Program was created to establish the boundaries of the Coastal Area where the coastal management program (CMP) applies, describe the organization structure to implement the CMP, and provide a set of statewide policies to manage resources and coordinate actions along the New York coastline. | Provides concurrence with the artificial reef program's consistency with the New York State Coastal policies as well as consistency with LWRPs within the Artificial Reef Program area. |

| State Agency | Responsibility | Role |
|---|---|---|
| *New York State Office of General Services (NYSOGS)* | The NYSOGS manages any state-owned lands under water or that were formerly under water. Structures located in, on, or above state-owned lands under water are regulated under the Public Lands Law and require authorization from the State. | A joint application for permits with the NYSOGS, NYSDEC, and NYSDOS will be submitted to the Army Corps for activities affecting coastal areas, sources of water, and endangered and threatened species. |
| *State Historic Preservation Office (SHPO) of the New York State Office of Parks, Recreation, and Historic Preservation (OPRHP)* | Oversees protected historic or archaeological resources under Section 106 Consultation, National Historic Preservation Act. | Consultation with SHPO will be conducted to determine any historic or archaeological resources within the reef development areas. |

# 1. Introduction

## 1.1 Background

In 1993 the NYSDEC completed a GEIS and Reef Plan which allowed for the issuance of a permit for the development of artificial reefs within the Study Area. As the Program developed, additional NYSDEC and USACE permits and permit modifications were attained for placement of additional material to meet specific goals of the Program outlined in the GEIS. Since then, New York State artificial reefs have been developed according to the goals of the Artificial Reef Program to provide fishing and diving opportunities, enhance or restore fisheries habitat, and manage artificial reef resources as part of an overall fisheries program (New York State Department of Environmental Conservation, 1993).

In April 2018, Governor Andrew Cuomo announced the largest expansion of the artificial reef program in state history. In 2018 and 2019, the artificial reef program enhanced the 12 existing artificial reefs off the shore of Long Island. Materials for the reef sites were strategically placed to improve New York's diverse marine life and boost Long Island's recreation, and sport fishing and diving industries.

In 2020, Governor Andrew Cuomo announced a proposal to expand the acreage of seven existing artificial reefs and create four new artificial reef sites. These additional sites are also assessed under the evaluation criteria outlined in the scope.

The Proposed Action includes the assessment of continued use of existing reef sites, including the expansion of select existing sites, and the addition and creation of new reef sites. Of the 12 existing reef sites, 7 will be assessed for expansion of the site footprint. The remaining existing sites will be developed within the previously permitted footprint. The Proposed Action also includes the addition and creation of 4 new reef sites. Each reef site to be assessed is summarized in Table 1-1 and shown on Figure 1-1. As these actions are being sponsored by a State Agency and this is a Programmatic Action, NYSDEC is preparing a SGEIS in accordance with SEQRA. The Proposed Action would update the existing NYSDEC GEIS & Reef Plan to address advancements in science and knowledge surrounding artificial reef development since the original GEIS was written in 1993. This SGEIS would also identify if the proposed Goals and Objectives stated in the GEIS/Reef Plan are being met.

NYSDEC would acquire the required State and/or Federal Permits prior to placing material at reef locations. This action is required for future reef permit acquisition to maintain, expand and develop existing site footprints and create new sites. Existing reef site locations are in the Atlantic Ocean, Great South Bay, and Long Island Sound and proposed new site locations are in Long Island Sound and the Atlantic Ocean. The reef locations are located near or accessible to Long Island harbors and embayments through local inlets. A ten year duration would be requested for future permits, which would continue the Program into the late 2020s.

**Table 1-1. Reef Location, Status, and Proposed Action**

| Reef | Location – Category | Previously Analyzed or Permitted Acreage | Development Status (%) | Proposed Action | Location Latitude / Longitude |
|---|---|---|---|---|---|
| Atlantic Ocean – Inshore | | | | | |
| Rockaway | Atlantic Ocean – Inshore | 413 | 80% | Expand to 635 Acres | 40°32.453'N / 073°50.558'W |
| McAllister Grounds | Atlantic Ocean – Inshore | 115 | 75% | Expand to 425 Acres | 40°32.207'N / 073°39.441'W |
| Fire Island | Atlantic Ocean – Inshore | 744 | 70% | Expand to 850 Acres | 40°35.863'N / 073°12.423'W |
| Moriches | Atlantic Ocean - Inshore | 14 | 90% | Expand to 850 Acres | 40°43.476'N / 072°46.479'W |
| Shinnecock | Atlantic Ocean - Inshore | 35 | 85% | Expand to 850 Acres | 40°48.135'N / 072°28.483'W |
| Atlantic Ocean - Offshore | | | | | |
| Atlantic Beach | Atlantic Ocean - Offshore | 413 | 87% | Continued Use | 40°31.792'N / 073°43.018'W |
| Hempstead | Atlantic Ocean - Offshore | 744 | 60% | Expand to 850 Acres | 40°31.107'N / 073°32.393'W |
| Sixteen Fathom | Atlantic Ocean – Offshore | 0 | Undeveloped-New Site | Create New 850 Acre Reef | 40°25.927'N / 073°21.603'W |
| Twelve Mile | Atlantic Ocean – Offshore | 850 | 5% | Continued Use | 40°36.778'N / 072°31.538'W |
| Great South Bay | | | | | |
| Yellowbar | Great South Bay | 7 | 60% | Continued Use | 40°37.974'N / 073°14.503'W |
| Kismet | Great South Bay | 10 | 85% | Continued Use | 40°38.198'N / 073°12.702'W |
| Long Island Sound | | | | | |
| Matinecock | Long Island Sound | 41 | 10% | Continued Use | 40°54.586'N / 073°37.469'W |
| Huntington/Oyster Bay | Long Island Sound | 0 | Undeveloped-New Site | Create New 50 Acre Reef | 40°57'26.05"N / 073°27'41.259"W |
| Smithtown | Long Island Sound | 3 | 80% | Expand to 31 Acres | 40°55.967'N / 073°11.100'W |
| Port Jefferson/Mount Sinai | Long Island Sound | 0 | Undeveloped-New Site | Create New 50 Acre Reef | 40°59'56.43"N / 073°4'7.635"W |
| Mattituck | Long Island Sound | 0 | Undeveloped-New Site | Create New 50 Acre Reef | 41°3'21.386"N / 072°34'24.102"W |

### 1.1.1 History of the New York State Artificial Reef Program

Artificial reefs in New York State date back to the mid-1920s when materials such as butter tubs half filled with concrete were purposefully sunk in the Great South Bay (New York State Department of

Environmental Conservation, 1993). Reefs in the Atlantic Ocean were developed in the mid-20th century such as the McAllister Grounds in 1949 and Schaefer Grounds in 1953 (New York State Department of Environmental Conservation, 1993). The New York State Artificial Reef program was started in 1962 to develop and manage artificial reefs in the state and federal waters surrounding the MCD under the Division of Marine Resources (DMR). Reefs have been purposely built based upon interest by specific recreational fishing groups with the exception of Shinnecock Artificial Reef which was built as a research project (New York State Department of Environmental Conservation, 1993). Reefs have been sited close to inlets to provide access by these groups. The early objectives for artificial reef construction were the enhancement of fishing opportunity and fishery habitat (New York State Department of Environmental Conservation, 1993). A historical (pre-1993) summary of artificial reefs that still exist within the New York State Artificial Reef Program are summarized in Table 1-2.

**Table 1-2. History of Artificial Reef Development**

| Reef Name | Year Created | 1993 GEIS Acres | Material Deployed prior to 1993 GEIS |
|---|---|---|---|
| McAllister Grounds | 1949 | 115 | Rock, brick and concrete rubble. |
| Fire Island | 1962 | 744 | 1,500 tires, 10 barges, 2 boat hulls, 2 drydocks, coal waste blocks (experimental), rock, concrete rubble, and concrete cesspool rings. |
| Rockaway | 1967 | 413 | 6,000 tires in 3-tire units, 60 steel buoys, rock, concrete slabs, concrete piles, concrete culvert, concrete decking and rubble. One tire unit is configured into a 15-tire pyramid. |
| Atlantic Beach | 1967 | 413 | 30,000 tires in 3-tire units, 404 auto bodies, 10 good humor trucks, 9 barges, the tugboat “Fran S”, steel lifeboat, steel crane and boom, concrete culvert, concrete rubble, concrete abutments and decking. |
| Hempstead | 1967 | 744 | Nine vessels, a drydock and concrete rubble. |
| Kismet | 1967 | 10 | 4,000 tires in 3- or 4-tire units, two barges, 24,000 cement blocks, concrete culvert, and concrete rubble. |
| Moriches | 1968 | 14 | 2 small wooden boats and tires |
| Shinnecock | 1969 | 35 | 3,000 tires in 3-tire units, 3 barges, a tugboat, a wood drydock, two wood boats, a steel cruiser, steel and concrete tower, and steel and concrete bridge rubble. |
| Matinecock | 1969 | 41 | No materials have been placed on this site by NYSDEC |
| Smithtown | 1976 | 3 | 22,000 tires, 5 barges, and 6 concrete-filled cylinders. |
| Yellowbar | 1977 | 7 | No material was placed by NYSDEC prior to 1993, however there were several small “wrecks” of unknown origin in the area. |

*Source:* (New York State Department of Environmental Conservation, 1993)

Twelve Mile Reef was created and permitted by the USACE in 2010. This site received its first material deployment of 2 steel vessels in 2019. Table 1-3 below includes the types of materials that currently exist at each of the reef sites.

## Table 1-3. Current Materials Found at Each Reef Site

| Reef | Category | Existing Materials at Reef Sites |
|---|---|---|
| **Atlantic Ocean - Inshore** | | |
| Rockaway | Atlantic Ocean - Inshore | 1 barge, 60 steel buoys, Tappan Zee bridge materials, rock, concrete slabs, pipes, culvert, decking, and rubble. |
| McAllister Grounds | Atlantic Ocean - Inshore | 3 vessels, 4 barges, 7 pieces of a 100' scow, 2 steel miter gates, 3 steel dam gates, 1 steel power plant turbine, rock, concrete barriers, and concrete bridge rubble. |
| Fire Island | Atlantic Ocean - Inshore | 4 vessels, 13 barges, 2 boat hulls, 6 pontoons, surplus armored vehicles, 2 drydocks, 1 steel tainter gate, 2 steel miter gates, steel bridge girders, steel lift bridge sections, steel pipe, steel lifting towers, Tappan Zee bridge material, rock, concrete cesspool rings, slabs, and rubble. |
| Moriches | Atlantic Ocean - Inshore | 12 vessels, 5 barges, surplus armored vehicles, Tappan Zee bridge materials, steel floor beams, and concrete pipes. |
| Shinnecock | Atlantic Ocean - Inshore | 8 vessels, 4 barges, surplus armored vehicles, 1 drydock, rock, a steel and concrete tower, Tappan Zee bridge materials, steel and concrete bridge rubble, steel pipes, steel beams, and steel bridge trusses. |
| **Atlantic Ocean - Offshore** | | |
| Atlantic Beach | Atlantic Ocean - Offshore | 2 vessels, 10 barges, 8 pontoons, 4 pieces of a 100' scow, surplus armored vehicles, 404 auto bodies, 10 Good Humor trucks, steel crane and boom, 27 steel buoys, 1 steel turbine rotor, steel turbine shells, steel pipe, rock, concrete and steel bridge sections, concrete barriers, concrete slabs, pipes, culvert, decking and rubble. |
| Hempstead | Atlantic Ocean - Offshore | 13 vessels, 2 barges, 2 steel power plant turbines, surplus armored vehicles, 1 drydock, Tappan Zee bridge materials, City Island bridge materials, Mill Basin bridge materials, steel bridge trusses, and concrete rubble. |
| Sixteen Fathom | Atlantic Ocean - Offshore | Undeveloped- New Site |
| Twelve Mile | Atlantic Ocean - Offshore | 2 vessels. |
| **Great South Bay** | | |
| Yellowbar | Great South Bay | 3 vessels, 1 barge, 4 pontoons, 100 concrete Reef Ball units, and concrete pipes. |
| Kismet | Great South Bay | 2 barges, concrete blocks, concrete slabs, concrete barriers, culvert, and rubble. |
| **Long Island Sound** | | |
| Matinecock | Long Island Sound | 1 barge and 7 pontoons. |
| Huntington/ Oyster Bay | Long Island Sound | Undeveloped- New Site |
| Smithtown | Long Island Sound | 2 vessels, 5 barges, steel pipes, and concrete-filled steel cylinders. |
| Port Jefferson/ Mount Sinai | Long Island Sound | Undeveloped- New Site |
| Mattituck | Long Island Sound | Undeveloped- New Site |

*Source:* (NYSDEC, NYSDEC Artificial Reefs Interactive Map, 2019)

### 1.1.2 Permit status of existing and proposed artificial reef sites

Permits have been issued by USACE and NYSDEC for the reefs as summarized in Table 1-4. The NYSDEC permit for the Hempstead, Fire Island, Moriches, and Shinnecock reefs has expired. The permit authority, permit number, issued dates and expiration dates are summarized below:

**Table 1-4. Summary of Existing USACE and NYSDEC Permits**

| Reef Name | USACE Permit No. | NYSDEC Permit No. |
|---|---|---|
| Rockaway | NAN-2015-00276, expires 10/6/2025 | 2-6309-00021/00005, expires 9/14/2025 |
| Smithtown | NAN-2018-00316, expires 6/27/2028 | 1-4734-02525/00001, expires 6/3/2028 |
| Hempstead<br>Fire Island<br>Moriches<br>Shinnecock<br>Twelve Mile | NAN-2007-00030, expires 8/5/2020 | 1-9901-0003/00015, expired 8/14/2018 |
| Atlantic Beach<br>McAllister Grounds<br>Kismet<br>Yellowbar<br>Matinecock | NAN-2019-00532, expires 7/18/2029 | 1-9901-00003/00018, expires 6/10/2029 |

For the purposes of this SGEIS, reefs have been categorized based on the water body that they exist or are proposed within. These categories include Atlantic Ocean reefs, Great South Bay reefs, and Long Island Sound reefs. Atlantic Ocean reefs have been further sub-divided based on their location relative to the State Seaward Boundary (i.e. relative to three nautical miles (nm) of the New York State Mean Low Water (MLW) line). Atlantic Ocean reefs within the three nm line are referred to as “inshore” whereas reefs beyond the three nm line are referred to as “offshore.” The discussions below use these breakdowns where resources differ.

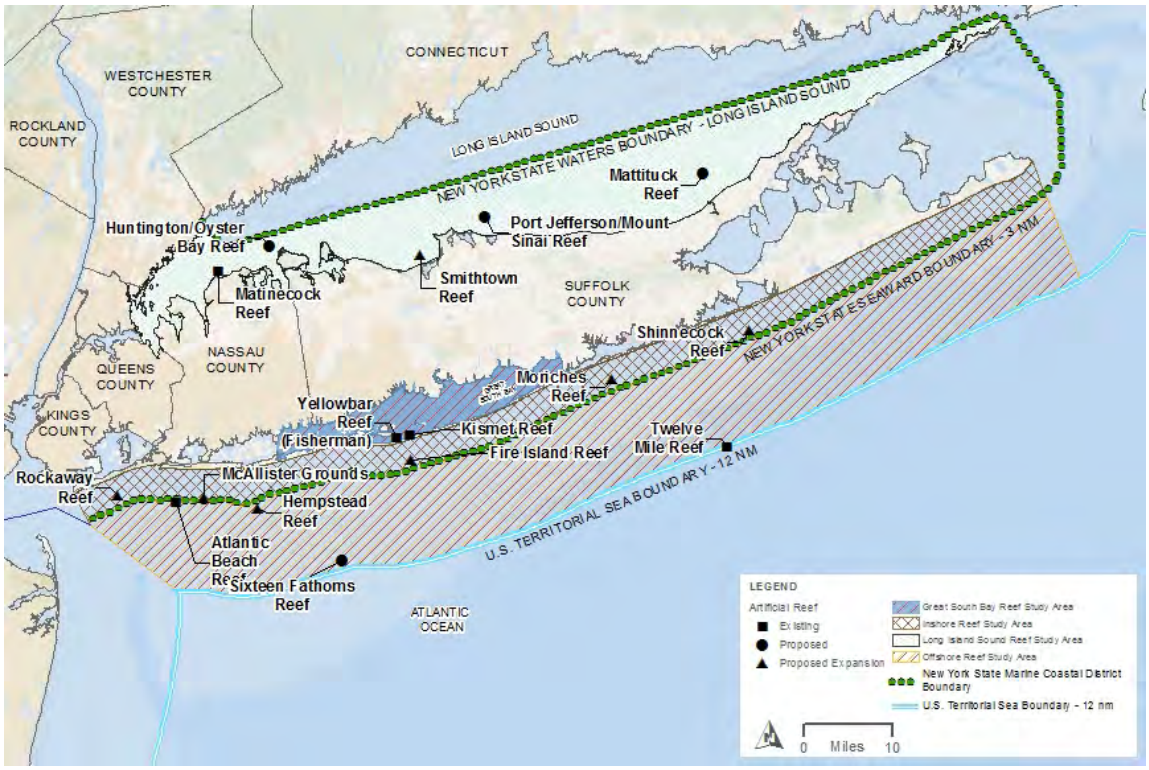



**Figure 1-1. Proposed Action Reef Locations, Modifications, and Study Area**

## 1.1.3 Summary of findings from 1993 GEIS

The 1993 GEIS was prepared as part of the New York State Department of Environmental Conservation, Division of Marine Resources Plan for development and management of artificial reefs in New York's Marine and Coastal District. The goals of the Artificial Reef Program are to provide fishing and diving opportunities by selective placement of artificial habitat in State and adjacent Federal waters; enhance or restore fishery resources and associated habitat; and administer and manage artificial habitat to ensure its rightful use as part of an overall fisheries management program. The GEIS identified policies and management strategies to achieve these goals and objectives, as well as detailed policies on the artificial reef program administration, development guidelines, and management.

The GEIS includes the description of existing natural resources, which include physical and living resources. Potential impacts of reef construction identified in the 1993 GEIS were determined to be limited in duration or temporary (i.e. suspension of sediment, changes in DO). The only unavoidable adverse impact identified in the 1993 GEIS was the smothering of benthic organisms at the reef placement locations.

Potential benefits from artificial reef construction included increased angler and diver participation, which would provide economic benefits to business supporting these industries. Commercial fisheries were not anticipated to grow as a result of reef placement. By placing artificial reefs close to major inlets it was expected that people would travel shorter distances to find good fishing opportunities.

Alternatives that were discussed in the 1993 GEIS include having no program or enhancing biological productivity and fishing opportunities through other means. If the no program option was pursued, New York State would still have responsibility for the existing structures and the potential benefits to fisheries would not be realized. Demand for artificial reefs from anglers would likely increase if this

occurred. The 1993 GEIS also describes non-structural means of enhancing biological productivity and fishing opportunities, including fish hatcheries and fertilization as alternatives to artificial reef construction and expansion. New York State currently maintains freshwater fisheries through freshwater hatcheries; however, marine hatcheries are not considered feasible for NYSDEC to implement. Hatcheries would only benefit a select species of concern and not provide the anticipated increased habitat benefits. Fertilization through the introduction of nutrients to the ecosystem in an effort to stimulate primary production and increase production of desired species is not a viable alternative. Existing anthropogenic sources of nutrients already cause adverse impacts to water quality and marine organisms. Subsequently, these alternatives were not evaluated further.

The 1993 GEIS and Reef Plan evaluated impacts associated with the Artificial Reef Program that included permanent changes to bathymetry, loss of open-water sandy-bottom benthic habitat, direct burial of epibenthic marine invertebrates, and reduced acreage available for mobile gear commercial fishing. The findings of the 1993 assessment identified the potential of the Program to result in temporary impacts to water quality, air quality, and noise during construction of the patch reefs. The only permanent adverse impacts identified in the document were the burial of epibenthic marine invertebrates, no additional permanent adverse impacts have been identified as a result of Program implementation. As this SGEIS is being developed to supplement the 1993 GEIS, an assessment of EFH has been included for the new and enhanced reef areas. Recently listed TES were reviewed to determine whether the expanded Program would have the potential for adverse effects on TES. Existing conditions have been updated for reef locations that have experienced some changes due to annual storms, and inter-annual changes to aquatic species distributions and diversity. No new adverse impacts are expected to result from the expanded Program. Overall, the Program has been successful in developing productive reefs that enhance aquatic communities and provide recreational opportunities around Long Island and the expanded Program would increase those beneficial effects.

**State and Regional Management Strategies for Reef-Associated Stocks**

As part of the Program, NYSDEC coordinates and reviews fishery management plans in a concerted effort to manage fishery resources throughout the Mid-Atlantic. Various councils, and commissions are responsible for managing the fishery resources that may utilize artificial reefs and are listed below. Individual State Artificial Reef Plans describe the goals of the programs in their respective state and how artificial reef development and guidelines are designed to enhance the use of artificial reefs as fishery management tools.

**Atlantic States Marine Fishery Commission**

The Atlantic States Marine Fishery Commission (ASMFC) is an interstate commission, established in 1942, composed of representatives from the coastal states from Maine to Florida. Each member state is represented by three commissioners that deliberate in five policy areas, including interstate fisheries management, research and statistics, fisheries science, habitat conservation, and law enforcement. The ASMFC is responsible for managing species that inhabit the Atlantic coast. Currently, there are 26 species managed by the ASFMC. Species with the potential to utilize artificial reef sites managed under this commission include bluefish (*Pomatomus saltatrix*), black sea bass (*Centropristis* striata), cobia (*Rachycentron canadum*), scup (*Stenotomus chrysops*), Spanish mackerel (*Scomberomorus maculatus*), spot (*Leiostomas xanthurus*), striped bass (*Morone saxatilis*), summer flounder (*Paralichthys dentatus*), tautog (*Tautoga* onitis), weakfish (*Cynoscion regalis*), American lobster (*Homarus americanus*), spiny dogfish (*Squalus acanthias*) and coastal sharks such as sandbar (*Carcharhinus plumbeus*), dusky (*Carcharinus obscurus*), and sand tiger (*Carcharias Taurus*) sharks.

Tautog, black sea bass, summer flounder, and scup are all jointly managed with the Mid-Atlantic Fisheries Management Council (MAFMC).

**New England Fishery Management Council**

The New England Fishery Management Council (NEFMC) was established by federal legislation in 1976 and is charged with managing fishery resources from 3 to 200 miles off the coasts of Maine, New Hampshire, Massachusetts, Rhode Island, and Connecticut. Management authority extends from the Gulf of Maine to southern New England and overlaps with the Mid-Atlantic Fishery Management Council for some species. The NEFMC manages 29 species under 9 fishery management plans, which include sea scallops (*Placopecten magellanicus*), groundfish, Atlantic herring (*Clupea harengus*), skates, monkfish (*Lophius americanus*), whiting (*Merluccius spp.*), and red crab (*Chaceon quinquedens*), as well as habitat and coral protection across all plans.

**Mid-Atlantic Fishery Management Council**

The Mid-Atlantic Fisheries Management Council (MAFMC) is a federal council that includes representatives from the New York to North Carolina coast. MAFMC is one of eight fishery management councils responsible for the management of marine fisheries in the United States Exclusive Economic Zone. The council is responsible for developing Fishery Management Plans for 14 species of fish and shellfish off the coast of the Mid-Atlantic region, including those for reef species. Fishery management plans have been developed for summer flounder, scup, and black sea bass; spiny dogfish; Atlantic mackerel (*Scomber scombrus*), squid, and butterfish; bluefish; surfclam and ocean quahog; and tilefish (*Lopholatlus spp.*).

**National Artificial Reef Plan**

The National Artificial Reef Plan was published in 1985 and developed by the Secretary of Commerce under the direction of the National Fishing Enhancement Act of 1984 (Act). In February 2007, the National Artificial Reef Plan was amended and includes guidelines for siting, construction, development, and assessment of artificial reefs. The ASMFC, NEFMC, and MAFMC took a lead role in revising the National Artificial Reef Plan through coordination of an information exchange and development of coastal and national policies for responsible stewardship of fisheries affected by artificial reef development activities. The National Artificial Reef Plan outlines the federal, state, local governments, and private roles in developing artificial reefs and establishes the siting, materials and design, regulatory requirements, construction, management, and liability guidelines. The National Reef Plan emphasizes the importance of artificial reefs as a fisheries management tool. State natural resource agencies play a vital role in ensuring the objectives of the National Reef Plan are implemented.

**New Jersey State Artificial Reef Plan**

New Jersey's artificial reef program began in 1984 and is administered under the New Jersey Department of Environmental Protection Agency's Division of Fish & Wildlife, Bureau of Marine Fisheries. The Bureau of Marine Fisheries has been involved in an intensive program of artificial reef construction and biological monitoring. The intent of the program is to enhance less than one percent of the sea floor to benefit more than 150 species of marine life that prefer structured habitat. The program has 17 artificial reef sites encompassing 25 square miles of seafloor, comprising more than 4,044 patch reefs, making it one of the largest reef programs in the U.S. (New Jersey Department of Environmental Protection, 2010) (New Jersey Department of Environmental Protection, 2017). The reefs are located within range of 12 ocean inlets from Sandy Hook to Cape May. In July 2019, the Bureau of marine Fisheries sunk one caisson gate at the Atlantic City Reef site.

The Artificial Reef Management Plan for New Jersey was developed in 1987 and revised in 2005 to address objectives of the artificial reef program, artificial reef development and maintenance, artificial reef program coordination and administration, and regulatory authorities. The plan includes objectives to: construct hard-substrate reef habitat for marine fish and invertebrates; provide spawning, nursery, refuge, and feeding area for marine life; increase diversity and abundance of marine life; create fishing grounds for hook-and-line fishermen; provide underwater structures for scuba divers; and provide economic benefits to recreational fishing and diving industries (New Jersey Department of Environmental Protection, 2005).

**Massachusetts Marine Artificial Reef Program**

The Massachusetts's Division of Marine Fisheries (DMF) develops, manages, and monitors artificial reef deployments in state waters. Artificial reef site development in Massachusetts began in the 1970s and includes the Yarmouth, Dartmouth, Brewster Island, Sculpin Ledge, and Harwich sites (Rousseau, 2008). The Massachusetts Marine Artificial Reef Plan was formulated in 2008 and provides artificial reef design guidelines, permitting, assessment and monitoring, and policy.

**Delaware State Artificial Reef Program**

Delaware began its Artificial Reef Program in 1995 and currently has 14 permitted artificial reef sites within Delaware Bay and along the Atlantic Coast. To date, recycled materials that have supported reef development include concrete culvert piping, ballasted tire units, recycled New York City subway cars, and decommissioned military vehicles (Delaware Division of Fish & Wildlife, 2016) (Loftus & Stone, 2007). The Delaware artificial reef plan was revised in 2012.

**Maryland State Artificial Reef Plan**

Maryland began its Artificial Reef Program in 1966 with the permitting of Hollicutt's Noose Reef site in the Chesapeake Bay. Materials were placed at this site in 1968 and continued into 2004. During the 1970s, additional sites were added, creating the 20 officially permitted reef sites within the Chesapeake Bay (Loftus & Stone, 2007). There are 10 additional permitted reef sites within the Atlantic Ocean and coastal bays. The Town of Ocean City has the permitting authority for the reefs in the Atlantic Ocean and coastal bays, while the Maryland Environmental Service has jurisdiction over the artificial reef sites in the Chesapeake Bay.

The Artificial Reef Management Plan for Maryland was developed in 2007 and outlines the goals and objectives of the program; state and national authority for artificial reef programs; artificial reef planning, coordination and administration; development, management, and maintenance; and regulatory agencies involved with artificial reef development.

## 1.2 Proposed Action

The Proposed Action includes the assessment of continued use of existing reef sites, the expansion of seven existing sites (Rockaway, Hempstead, Fire Island, Smithtown, McAllister Grounds, Moriches and Shinnecock reefs) and the addition and creation of four new sites (Sixteen Fathoms, Huntington/Oyster Bay, Port Jefferson/Mount Sinai and Mattituck reefs; Table 1-1 and Figure 1-1). NYSDEC will acquire the required State and Federal permits (discussed in Section 1.7) prior to placing material at reef locations. The reef locations are located near or accessible to Long Island harbors and embayments through local inlets.

Artificial reefs are developed using a patch reef system. Materials are transported to the reef site either on a barge (i.e. natural stone and concrete) or towed out by vessel (i.e. steel barges or vessels) under Program supervision. Patch reef development includes the placement of material in discrete locations

or “targets” separated by undisturbed benthic habitat. This construction method results in a larger Project footprint but allows for the area between the patches to remain as undisturbed benthic habitat thereby reducing impacts to the benthic community (Figure 1-2).

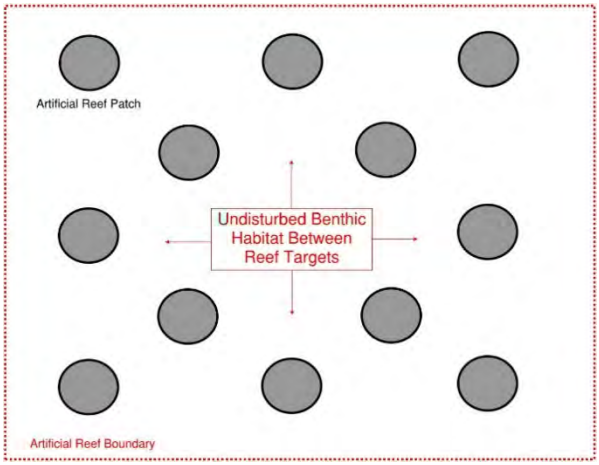



**Figure 1-2. Typical Patch Reef**

This configuration increases the enhancement of the local natural habitat by introducing profiled hard structure for colonization and reef development. The structures attract a variety of marine life including recreationally important finfish species sought by anglers and divers. Artificial reefs provide stable surfaces for attachment for benthic organisms such as anemones, corals, sponges, hydroids, and bryozoans that would not otherwise be able to colonize on the sandy, unstable seafloor sediments that are dominant in the region. These reefs also provide shelter and foraging ground for marine organisms such as structure associated fish and other demersal species (New York State Department of Environmental Conservation, 2015; New York State Department of Environmental Conservation, 2015).

## 1.3 Project Location

The Proposed Action occurs in the New York State MCD and federal-waters surrounding Long Island. Artificial reefs are located within the marine and estuarine waters of the Atlantic Ocean, Great South Bay, and Long Island Sound. Refer to Section 1.1.2, Table 1-1, and Figure 1-1 for more information.

## 1.4 Project Purpose and Need

The purpose of the artificial reef program in New York is to fulfil its obligation under the National Fishing Enhancement Act in accordance with the standards of the National Artificial Reef Plan. The Proposed Action seeks to continue the use of, expand, and enhance the existing network of artificial reefs in the Atlantic Ocean, Great South Bay, and Long Island Sound by:

- enhancing or restoring fishery resources and associated habitat, to the maximum extent practicable, utilizing artificial habitat;
- administering and managing artificial habitat to ensure its prudent use as part of an overall fisheries management program; and
- providing fishing and diving opportunities for reef-associated fishery resources by selective placement of artificial habitat in State and adjacent Federal waters.

All of these uses ultimately share the common purpose of enhancing or increasing the marine habitat available for associated fishes and other organisms. Planned manmade reefs provide local economic benefits as they are often popular attractions for recreational fishermen, divers, and some commercial fishermen.

The need for the artificial reef program is to provide complex hard bottom and vertical structure habitat to enhance fisheries and benthic communities, provide enhanced recreational fishing and diving opportunities; and offer an associated socio-economic benefit to local coastal communities.

## 1.5 Objectives of Project Sponsor

The New York State Department of Environmental Conservation is the project sponsor for the Artificial Reef Program. The goals of the Artificial Reef Program are provided below.

- to provide fishing and diving opportunities for reef-associated fishery resources by selective placement of artificial habitat in State and adjacent Federal waters;
- to enhance or restore fishery resources and associated habitat, to the maximum extent practicable, utilizing artificial habitat; and
- to administer and manage artificial habitat to ensure its prudent use as part of an overall fisheries management program.

In order to achieve these goals, the DMR needs to accomplish a number of objectives. Overall, the objective of the Project is to ensure that all artificial reefs/habitat constructed in the Marine District comply with all Federal and State rules and regulations and are consistent with State and regional management strategies for reef-associated stocks. Coordination with State and regional management strategies would ensure the continued use of and responsible stewardship of the fisheries affected by artificial reef development. To achieve this objective, the DMR will:

- construct, repair and maintain its artificial reefs as per permit requirements;
- conduct an evaluation of the effectiveness of existing artificial reefs in achieving program goals;
- survey and monitor fish and crustacean populations associated with artificial reefs to determine program effectiveness;
- site, design, and construct additional artificial reefs, as warranted, in a manner consistent with standards and permits; and
- maintain an artificial reef data collection system, coordinate with the ASMFC Artificial Reef Committee, and provide a mechanism for public dissemination of this information.

## 1.6 Project Benefits

The Artificial Reef Program provides the following benefits:

- More complex and diverse habitat, such as the conversion of a low diversity benthic community to a more complex community.
- Habitat and food for higher trophic levels, including fish.
- Greater habitat complexity for fish and other reef associated species by providing refuge and food resources and limiting commercial fishing gear types.

- Increased biodiversity while providing refuge, forage, and some spawning opportunities for the associated fish species.
- Foraging areas and protection for threatened and endangered fish larval-stage species.
- Benefits to recreational anglers, SCUBA divers, and some commercial fishermen.

## 1.7 Regulatory Framework and Permitting Requirements

Multiple State and federal Agencies are involved with different aspects of the Program. The permitting process requires review and approval by the following involved Federal and State Agencies:

- USACE
- NMFS
- USCG
- EPA
- NYSOGS
- NYSDOS
- OPRHP
- NYSDEC
- Local municipalities with an approved LWRP

A discussion of their regulatory requirements is provided in more detail below.

### 1.7.1 Federal Agencies

**NOAA**

NOAA protects and manages the resources of significant marine areas of the United States through the National Marine Sanctuaries Act (Title III of the Marine Protection, Research, and Sanctuaries Act, 16 U.S.C. §§ 1431-1445c-1). Consultation with NOAA will take place to gather information on fisheries resources and identify potential conflicts with proposed reef sites.

**NMFS**

NMFS carries out responsibilities related to conservation and management of living marine resources and their habitats under several Federal laws, including the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §1801 et seq.), the Endangered Species Act (16 U.S.C. §§1531-1543), the Fish and Wildlife Coordination Act (16 U.S.C. §§1531-1543), and the Marine Mammal Protection Act (16 U.S.C. §§1361-1421h). Coordination and consultation with NMFS will be completed to provide comments on permits and provide guidance on EFH within the reef development areas as well as for Section 7 Endangered Species Act and MMPA

**USACE**

The USACE is responsible for regulating activities in waters of the United States under Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. §401 et seq.). The USACE also has permit authority under Section 404b of the Clean Water Act (33 U.S.C. §1344) and Section 103 of the Marine Protection, Research and Sanctuaries Act (33 U.S.C. §1413). The USACE is the lead federal agency responsible for permitting artificial reef development under authority of the National Fishing Enhancement Act of 1984. Placement of fill material or structures, such as artificial reefs, is subject to permitting under Section 404 of the Clean Water Act.

Prior to issuing any permits for placement, the USACE consults with other federal agencies including NOAA, EPA and USFWS. For the protection of submerged archaeological resources under the National Historic Preservation Act (16 U.S.C. §470 et seq.), the USACE will consult with the Advisory Council on Historic Preservation, New York SHPO, and any applicable Tribal Historic Preservation Offices, to determine whether the Proposed Action is in compliance with the National Historic Preservation Act.

**USCG**

The USCG has the authority to establish safe fairways and traffic separation schemes for safe movement of vessel traffic under the Ports and Waterways Safety Act; regulate aids to navigation on offshore installations; establish safety zones around offshore facilities; enforce fisher laws; and monitor and enforce compliance with international conventions and statues on environmental protection. Consultation with the USCG will take place to ensure reef placement that does not interfere with navigation and determine if aids to navigation are required.

**USFWS**

The USFWS provides technical assistance and consultation under the Endangered Species Act, the National Environmental Policy Act, the Coastal Zone Management Act, and Section 404 of the Clean Water Act. Coordination and consultation will occur with the USFWS to determine if there are any threatened or endangered species impacts that would result from reef development.

**USEPA**

As stated previously, the USACE has permitting authority under Section 404 of the Clean Water Act. While issuing permits, the USACE applies Section 404(b)(1) guidelines that were developed in conjunction with the EPA. The guidelines (40 C.F.R. Part 230) prohibit issuance of 404 permits that would cause or contribute to violations of applicable water quality standards and any discharges that would cause significant degradation to waters of the United States. Additionally, Section 404(c) authorizes the USEPA to prohibit, withdraw, or restrict the use of defined areas as a dredged or fill material disposal site in any waters of the U.S. if USEPA determines the discharge will have unacceptable adverse effects on municipal water supplies, shellfish beds, and fishery areas, wildlife or recreational areas.

## 1.7.2 State Agencies

**NYSDEC**

The NYSDEC is the only entity in New York that can obtain permits to build artificial reefs in marine waters of the state and in adjacent federal waters. NYSDEC derives its authority to develop and manage artificial reefs from New York State's Environmental Conservation Law (ECL), Section 11-0303. Further, ECL Article 3 and Title 3 of Article 11 give NYSDEC exclusive jurisdiction over fishery resources and ECL section 3-0301 (2) (j) states that NYSDEC is authorized to "act as the official agency of the state in all matters affecting the purposes of the department under any federal laws." Permits issued by the NYSDEC allow the placement of artificial reef material and NYSDEC reviews the impacts to water quality, fish and wildlife, and protected species.

**NYSDOS**

The NYSDOS will review the reef development's consistency with the State coastal policies, as discussed in Section 1.7.1 above.

**NYSOGS**

The NYSOGS manages any lands under water or that were formerly under water in New York State. Structures located in, on, or above state-owned lands under water are regulated under the Public Lands Law and require authorization from the State. A joint application for permits with the NYSOGS, NYSDEC, and NYSDOS will be submitted to the Army Corps for activities affecting coastal areas, sources of water, and endangered and threatened species.

**SHPO of the OPRHP**

Consultation with SHPO will be conducted to determine any historic or archaeological resources within the reef development areas.

### 1.7.3 Local Municipalities with an approved LWRP

In 1981, the New York State Legislature enacted Article 42 of the Executive Law, the Waterfront Revitalization of Coastal Areas and Inland Waterways Act. In 1982, the New York Coastal Zone Management Program was created to establish the boundaries of the Coastal Area where the coastal management program (CMP) applies, describe the organization structure to implement the CMP, and provide a set of statewide policies to manage resources and coordinate actions along the New York coastline. Article 42 also allows local governments to prepare and adopt local waterfront revitalization programs (LWRP). The New York City CMP rules apply for Rockaway Reef and the Matinecock, Smithtown and proposed Huntington/Oyster Bay, Port Jefferson/Mount Sinai, and Mattituck reefs, fall under the Long Island Sound CMP. The artificial reef program is consistent with all State Coastal policies. A detailed description of the Program's consistency with New York State Coastal policies and LWRPs is provided in Appendix A.

# 2 Environmental Setting

A desktop study of the reef areas was conducted to determine if present conditions are consistent with the affected environment described in the 1993 GEIS. In most cases the primary sources used to determine the existing conditions were studies conducted within proximity to the reef or in similar habitat conditions. However, site specific information was used where available. The current existing conditions are summarized below. For the majority of resources, the conditions remain similar, however where conditions have changed it is noted. The affected environment section is focused on the marine environment as no activities are proposed on land. In addition, the materials placed at the artificial reef sites will be submerged. Therefore, the following resources are not described: birds, bats, wetlands, and any other land resources. A screening assessment for three new potential artificial reef sites in Long Island Sound was completed to determine optimal material placement utilizing the criteria established by the Program. Site specific surveys are required for new reef sites as part of the permitting process.

## 2.1 Screening Assessment

In response to Governor Andrew Cuomo's expansion of the artificial reef program, a supplemental screening assessment memo was completed in November 2018 for three assessment areas within Long Island Sound: Huntington/Oyster Bay, Port Jefferson/Mount Sinai, and Mattituck. The assessment was conducted to identify potential reef locations along the north shore of Long Island that met the criteria outlined in Table 2-1 below. These screened artificial reef siting areas would be 50 acres in size and be included in the assessment for Long Island Sound artificial reef development.

In order to identify new artificial reef locations within Long Island Sound, siting criteria developed for the NYSDEC Artificial Reef Program were used as well as lessons learned in artificial reef development since the GEIS was published. The criteria used were established by the Program and meet the Purpose and Need which is to provide the maximum benefit to local coastal communities along the north shore of Long Island.

**Table 2-1. Criteria Used to Develop Screening Assessment for Potential Siting of Reefs**

| Resource Category | Criteria | Siting Criteria |
|---|---|---|
| Community Location | Located within proximity to major marine access areas such as marinas and/or bays | Reef to be located within five miles of major marinas or bays |
| Water depth | Sites are in area deep enough to allow for creation of significant vertical structure and habitat and be within navigability clearance depths | Reefs to be located in waters between 40 feet (12 m) and 132 feet (40 m) deep |
| Bathymetry | Locate the site to avoid unstable benthic substrate and steep slopes | Reef to be located on a bottom slope less than 45 degrees. |
| Benthic Substrate | Locate the site in areas devoid of natural hard bottom habitat such as natural rock or existing structure, and where the bottom is conducive to placement of material (i.e., not in mud) | Reefs to be located in sandy sediments and avoid silt, clay, or rocky benthic sediments |
| Water Use | Avoid commercial fishing areas, shipping lanes, underwater land ownership, existing infrastructure, and other user conflicts | Confirm sites do not contain known user conflicts |
| Dissolved Oxygen | Locate sites where dissolved oxygen can sustain biological productivity year round. | Summer benthic dissolved oxygen greater than 3.0 mg/L |
| Water Quality | Locate sites where current movement and circulation provides sufficient water flow for better water quality | Reef sites should be located in open water areas |
| Cultural Resources | Locate sites so that they avoid important cultural and historical resources | Confirm sites do not contain known cultural resources |
| Sensitive Habitats | Locate sites so that they avoid sensitive habitats | Confirm sites do not contain known sensitive habitats |

*Source*: NYSDEC, 1993

The results of the screening assessment indicated that there are potential constraints in portions of the assessment area for sediment types, shipwrecks, and potential hypoxic conditions within the Huntington/Oyster Bay and Port Jefferson/Mount Sinai reef assessment areas. The Huntington/Oyster Bay reef has been proposed within the eastern portion of the Study Area to avoid potential hypoxic conditions and shipwrecks (Figure 2-1). The Port Jefferson/Mount Sinai reef has been proposed within the southern portion of the reef assessment area to avoid silt sediment that is not conducive to material placement. Mattituck has the largest area meeting all screening criteria and the proposed reef location

is within the southwest part of the assessment area. The location selected for reef development at each proposed site satisfies the development criteria.

The Connecticut Department of Energy and Environmental Protection (CTDEEP) conducts annual trawl surveys throughout Long Island Sound to monitor abundance, biomass, and size composition of marine fishery resources to evaluate the effects of fishing and environmental conditions on living resources. Trawl towpaths used during the survey within the three potential screening areas were provided by CTDEEP on March 28, 2019. NYSDEC and CTDEEP are in coordination to avoid conflicts with artificial reef placement and trawl towpath locations. Figure 2-1 provides the potential artificial reef locations developed from the screening assessment criteria below.

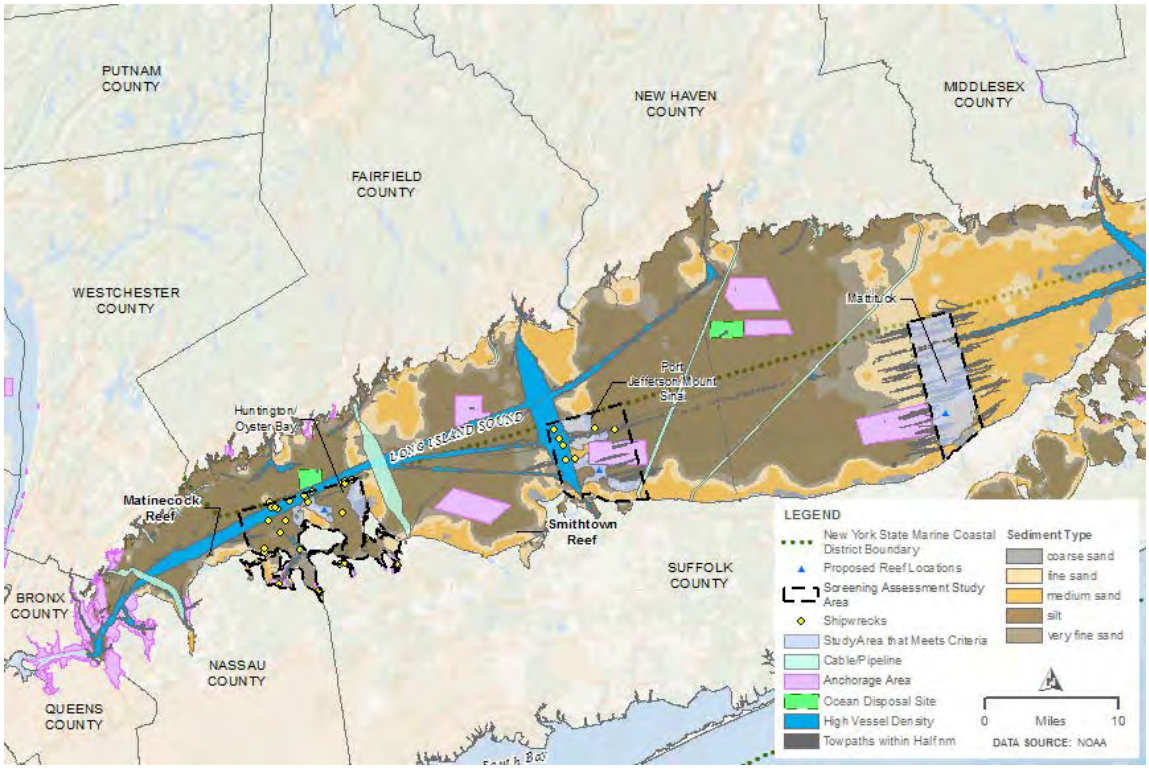



**Figure 2-1. Results of Artificial Reef Screening Assessment for Long Island Sound**

# 2.2 Physical

## 2.2.1 Bathymetry

Existing reefs and previously placed reef material has introduced a vertical profile to the water column from the surrounding habitat. Existing sites have been in place for up to several decades (Table 1-2) and bathymetry, current velocity, sediment resuspension, and sedimentation around the artificial reefs have established an equilibrium with the surrounding sediments. The following section describes the bathymetry within the study area.

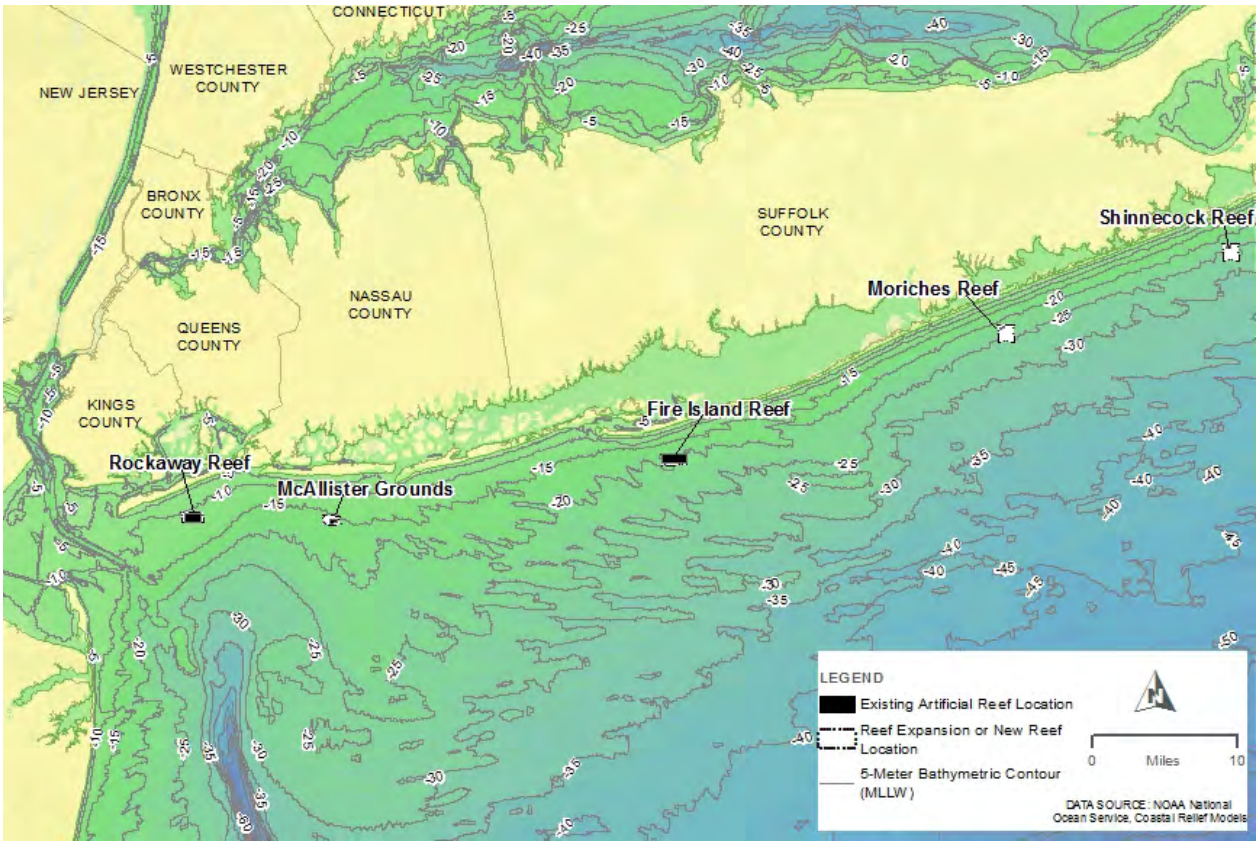
**Atlantic Ocean**

The Atlantic Ocean Continental Shelf (OCS) bathymetry consists of a gentle slope from the mean low water (MLW) mark off the southern shore of Long Island to the edge of the Atlantic OCS, with water depths ranging from 1 to 100 m (3 to 328 ft) (Menza, Kinlan, Dorfman, Poti, & Caldow, 2012). The

Menza et al. (2012) study provides bathymetry, surficial sediments, oceanographic, and deep sea coral data for ocean habitats of the New York Bight. The OCS bathymetry predominantly consists of sandy bottom devoid of large obstructions, impoundments, or other bathymetric features such as sea mounts, with the exception of the Hudson Shelf Valley which runs from the mouth of the Hudson River to the edge of the OCS (Menza, Kinlan, Dorfman, Poti, & Caldow, 2012) (Menza, Kinlan, Dorfman, Poti, & Caldow, 2012).

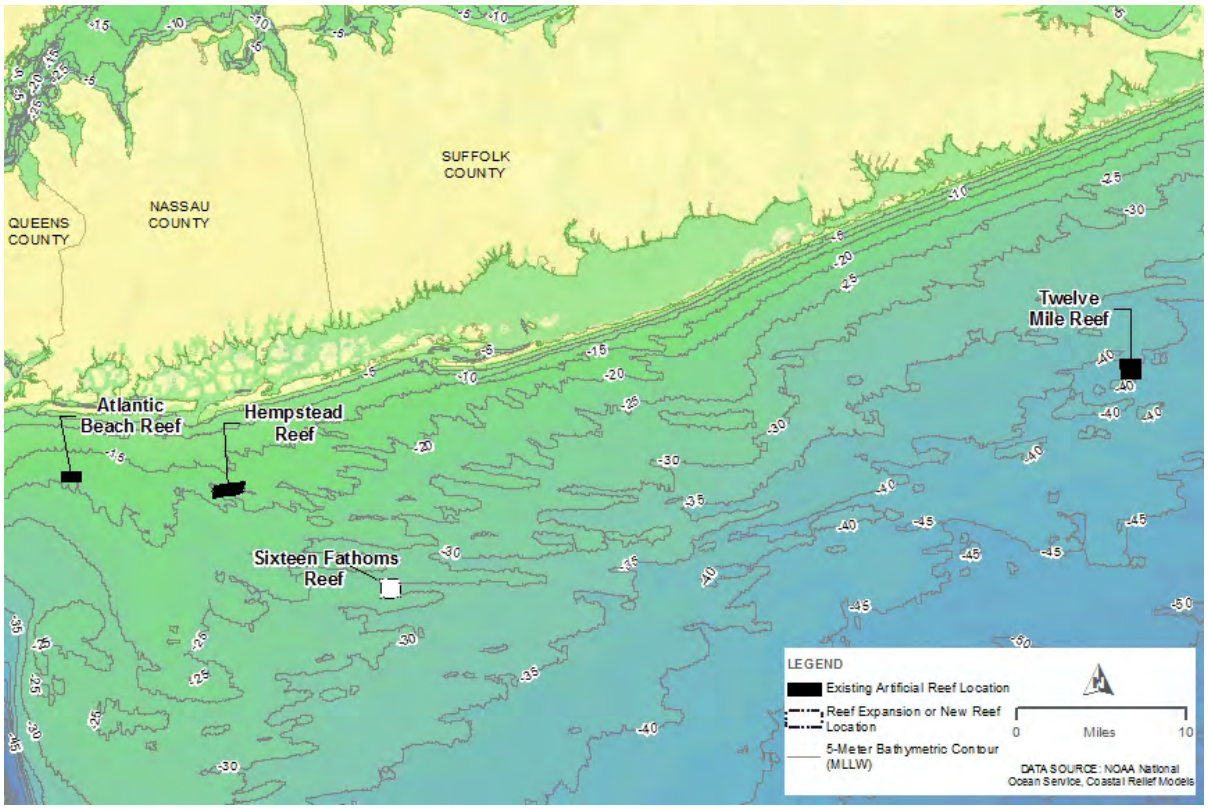
Atlantic Ocean inshore reefs are located within the New York State MCD in water depths that range from 12 to 26 meters (m) (32 to 85 ft) (New York State Deparment of Environmental Conservation, 2017). Atlantic Ocean offshore reefs are located within the Atlantic OCS in water depths that range from 15 to 40 m (50 to 143 ft) (New York State Deparment of Environmental Conservation, 2017). Atlantic Ocean reefs are in relatively flat areas with gentle slopes. Bathymetry maps with the Atlantic Ocean inshore and offshore reef sites are provided as Figure 2-2 and Figure 2-3 (National Ocean Service Office of Coast Survey, 2017). Depths at existing and proposed reef sites are listed in Table 2-2. Bathymetry imagery for the artificial reef sites from side scan sonar surveys is provided in Appendix C.

Bottom currents flow in a northeasterly to southeasterly direction between less than 0.01 m/s to 0.05 m/s at the inshore reef sites, while surface currents are approximately 0.1 to 0.2 m/s (Northeast Ocean Data, 2019). Bottom currents flow in a northeasterly direction between less than 0.01 m/s to 0.05 m/s at the offshore reef sites while surface currents are approximately 0.05 to 0.1 m/s (Northeast Ocean Data, 2019).




*Source:* (National Ocean Service Office of Coast Survey, 2017)

**Figure 2-2. Atlantic Ocean Inshore Reef Bathymetry**




***Source*: (National Ocean Service Office of Coast Survey, 2017)**

## Figure 2-3. Atlantic Ocean Offshore Reef Bathymetry

## Table 2-2. Depth at Existing and Proposed Reef Sites

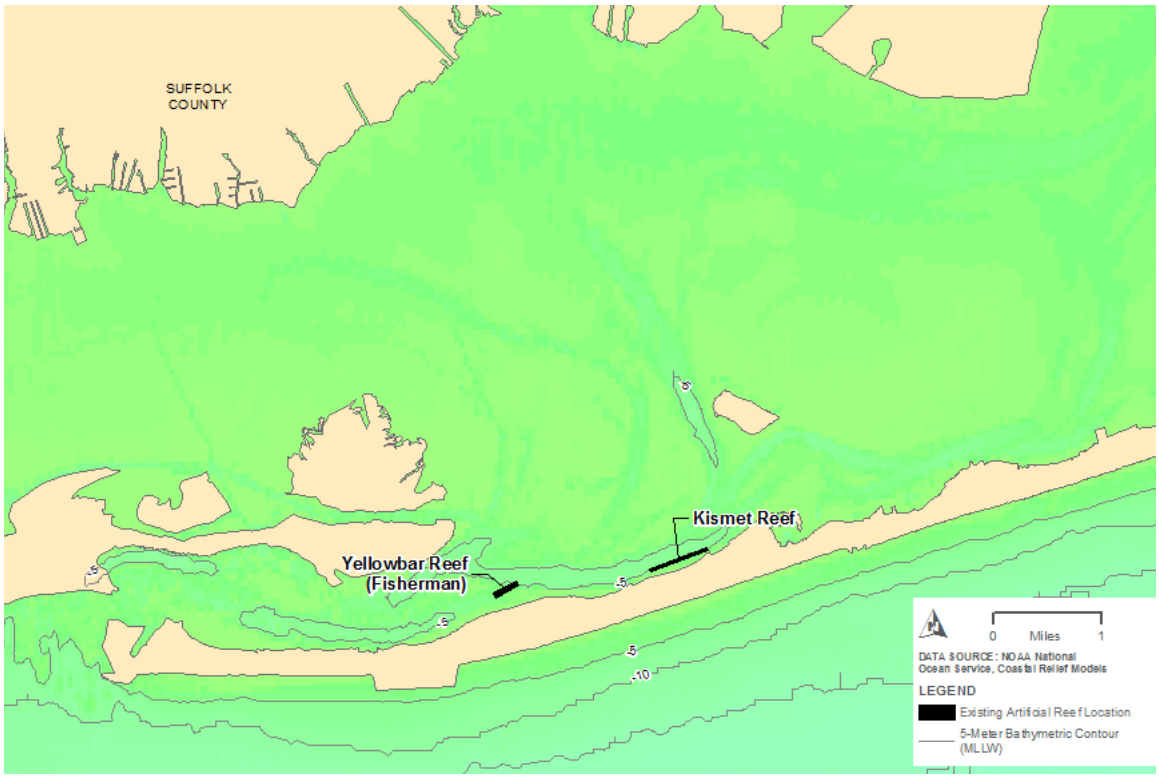
| Reef Site | Depth (ft) |
|---|---|
| **Atlantic Ocean - Inshore** | |
| Rockaway | 32-40 |
| McAllister Grounds | 50-53 |
| Fire Island | 62-73 |
| Moriches | 70-84 |
| Shinnecock | 79-88 |
| **Atlantic Ocean - Offshore** | |
| Atlantic Beach | 55-64 |
| Hempstead | 50-72 |
| Sixteen Fathom | 88-101 |
| Twelve Mile | 123-143 |
| **Great South Bay** | |
| Yellowbar | 29-38 |
| Kismet | 8-21 |

| Reef Site | Depth (ft) |
|---|---|
| **Long Island Sound** | |
| Matinecock | 30-45 |
| Huntington/Oyster Bay | 30-50 |
| Smithtown | 30-45 |
| Port Jefferson/Mount Sinai | 70-100 |
| Mattituck | 60-100 |

### Great South Bay

The Great South Bay estuary consists of an open bay, separated from the Atlantic Ocean by a long and narrow barrier island. Water Depths within the Great South Bay vary between 0 and 15 m (0 and 49 ft) (Northeast Ocean Data, 2017). Many locations within the Great South Bay are shallower compared to the other reef locations due to shifting sand bars and marshes as is typical in a bay behind barrier islands.

Great South Bay reefs are located within the Great South Bay estuary in water depths between 8 to 15 m (26 to 49 ft) (New York State Deparment of Environmental Conservation, 2017). Bathymetry within the Great South Bay is provided in Figure 2-4 below (National Ocean Service Office of Coast Survey, 2017). Depths at existing and proposed reef sites are listed in Table 2-2.




*Source:* (National Ocean Service Office of Coast Survey, 2017)

**Figure 2-4. Great South Bay Reef Bathymetry**

Figure 2-5 and Figure 2-6. The depths at both sites are similar to the depths reported on NOAA nautical charts for the area; 8 to 21 ft at Kismet reef and 29 to 38 ft at Yellowbar reef. Existing water depths are appropriate for siting shallow water reefs within Bays; however, due to control depth restrictions (16 ft at Kismet and Yellowbar), development of these reefs would be limited. Much of the eastern part of Kismet reef is too shallow to deploy reef materials.

The water depth over a few materials that were previously deployed on Kismet reef was just below the control depth (Table 2-2). This may indicate that these materials have been buried over time. Due to the strong current at both locations, sediments are readily transported and materials are known to become covered and uncovered. Any new materials deployed would require careful selection of the target location and need to be of minimal vertical relief to remain within the control depth.

Bottom currents near the Great South Bay reef sites flow in a southerly direction between 0.01 and 0.05 m/s. Surface currents flow in a southerly direction between 0.05 to 0.1 m/s (Northeast Ocean Data, 2019).


**Figure 2-5. Interpolated Kismet Reef Depths**

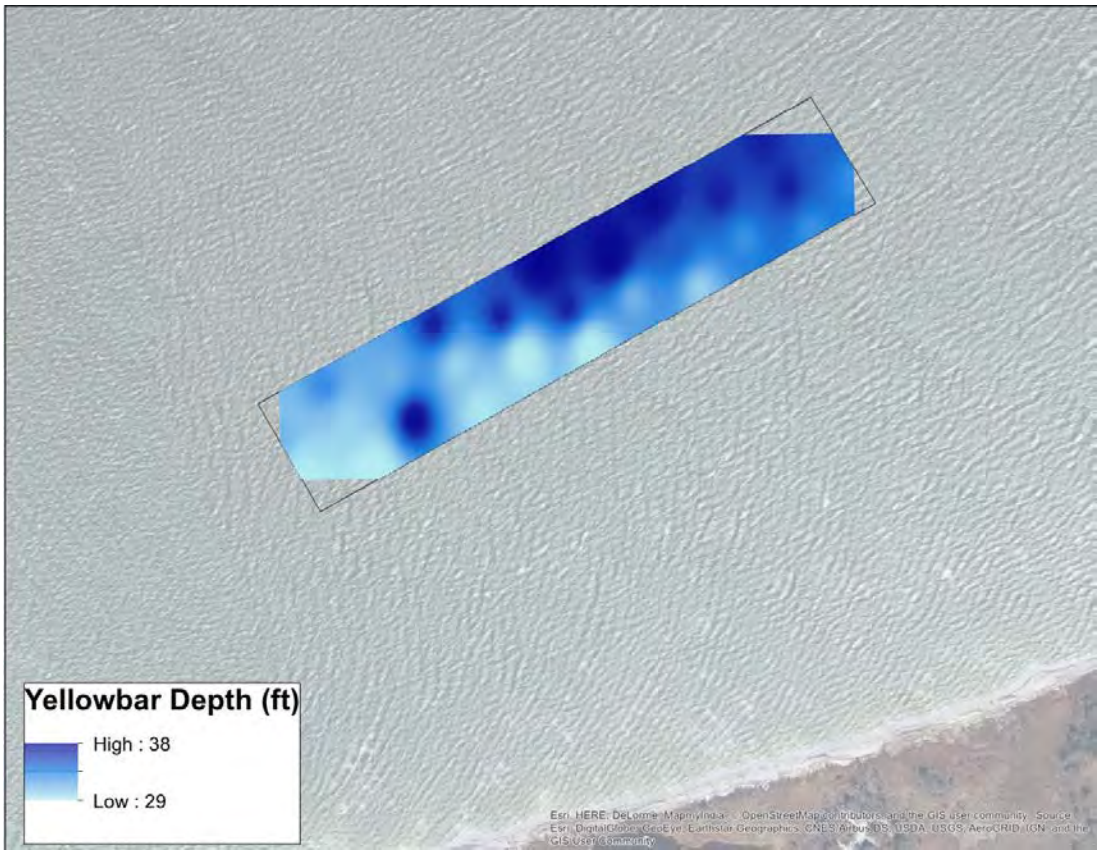



**Figure 2-6. Interpolated Yellowbar Reef Depths**

**Table 2-3. Kismet and Yellowbar Reef Materials and Depths from Survey**

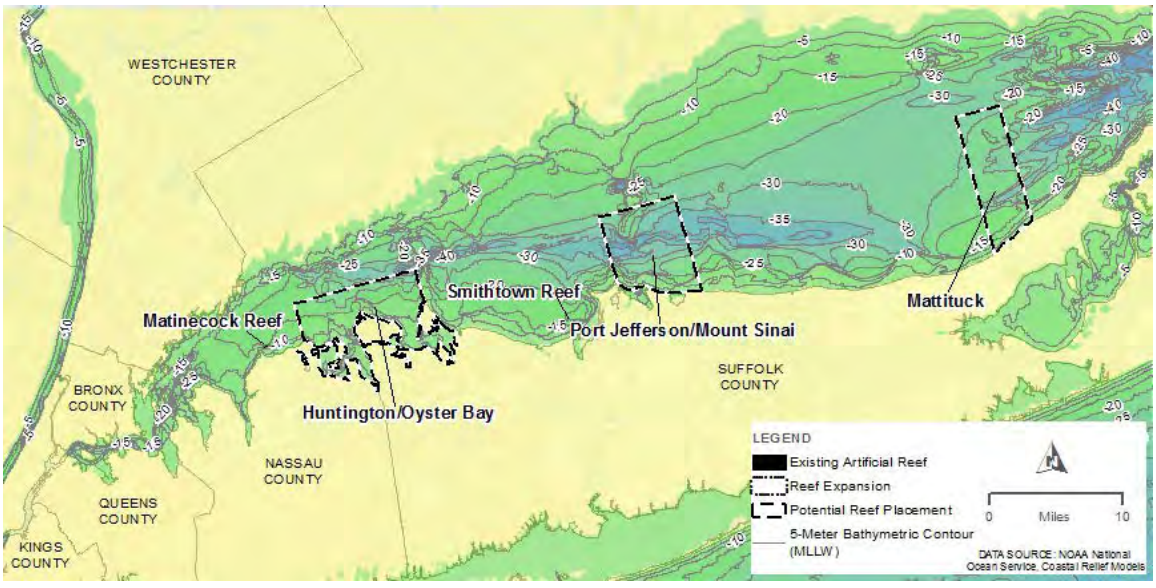
| Reef Name | Material | Depth (ft) | Adjusted Depth for Tide (ft) |
|---|---|---|---|
| Kismet | Concrete Blocks | 15.7 | 15.2 |
| Kismet | Concrete Blocks | 17.4 | 16.9 |
| Kismet | Concrete Blocks | 21.0 | 20.5 |
| Kismet | 100’ Barge | 17.1 | 16.6 |
| Kismet | 85’ Barge | 18.3 | 17.8 |
| Kismet | Concrete Ballasted Tires | 18.9 | 18.4 |
| Kismet | Concrete Ballasted Tires | 16.1 | 15.6 |
| Kismet | Concrete Culvert | 18.9 | 18.4 |
| Kismet | Rubble Pile | 16.4 | 15.9 |
| Kismet | 19 concrete road barriers | 18.7 | 16.2 |
| Yellowbar | Unknown | 28.2 | 26.9 |
| Yellowbar | Unknown | 25.3 | 24.0 |
| Yellowbar | Unknown | 24.8 | 23.5 |
| Yellowbar | Reef Balls | -- | -- |

| Reef Name | Material | Depth (ft) | Adjusted Depth for Tide (ft) |
|---|---|---|---|
| Yellowbar | 36' Steel Cruiser *Charade* | 36.2 | 34.9 |
| Yellowbar | Concrete Culvert | -- | -- |
| Yellowbar | 62' Wooden Trawler *Connie F* | 35.0 | 33.7 |
| Yellowbar | 48' Wooden Vessel *Peregrine* | 22.0 | 20.7 |
| Yellowbar | 60' Steel Barge CorEW33 | 34.1 | 32.8 |
| Yellowbar | 4 steel pontoons | 26.0 | 23.5 |

### Long Island Sound Reefs

The Long Island Sound consists of a narrow basin connected to the Atlantic Ocean via the East River in New York to the west and Block Island Sound to the east. Bathymetry within the Long Island Sound consists of depths varying between 0 and 115 m (0 to 377 ft) (Northeast Ocean Data, 2017). The Long Island Sound depths are generally shallow near shore and deepening to the center of the basin with the greatest depths found in the straight connecting Long Island Sound to Block Island Sound where depths can reach up to 115 m (377 ft) (Nature Conservancy, 2013). Depths in the western basin are typically shallower and more uniform (Nature Conservancy, 2013).

Bathymetry at the existing Long Island Sound reef locations is relatively flat, with depths of 10 to 17 m (32-55 ft) (Table 2-3, Figure 2-7). The potential Long Island Sound reef sites are located within the Long Island Sound in water depths of approximately 12 to 40 m (39 to 131 ft) (New York State Deparment of Environmental Conservation, 2017). Bathymetry within the Long Island Sound reef sites is provided in Figure 2-7 (National Ocean Service Office of Coast Survey, 2017). Figure 2-8 provides the slope classes for Long Island Sound. All of the reef sites are located on the flat slope class. The flat slope class has a degree range from 0.05 to 0.8.




*Source:* (National Ocean Service Office of Coast Survey, 2017)

**Figure 2-7. Long Island Sound Reef Bathymetry**

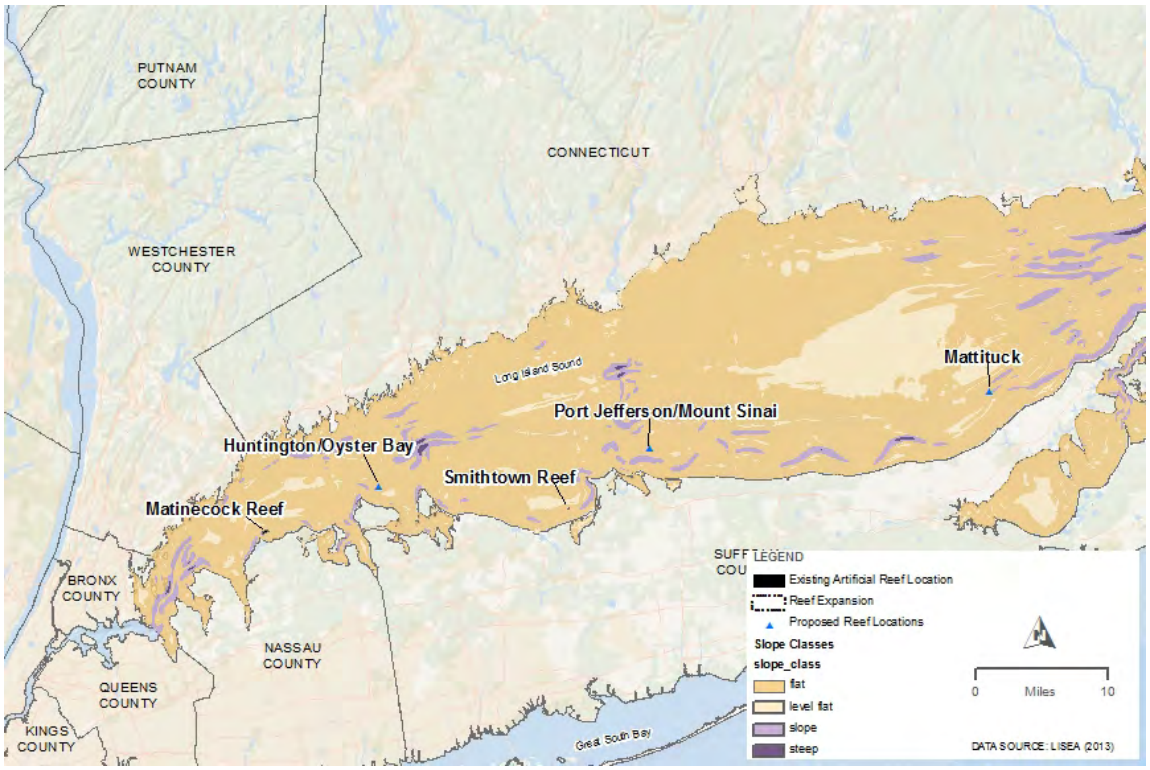



**Figure 2-8. Long Island Sound Slope Classes**

Reef material has been placed on Smithtown reef during the 1970s, 80s, and in 2018 and at the Matinecock reef site in August 2019 (Table 1-2; Table 1-5).

Expansion of Smithtown Reef has been proposed to include adjacent material deployments completed prior to the 1993 GEIS/Reef Plan.

Three new reefs have been proposed for development, which are Huntington/Oyster Bay, Port Jefferson/Mount Sinai, and Mattituck. The exact locations of these sites have yet to be determined and the depths provided for these sites are an estimate (Table 2-3).

Tidal currents are the dominant currents throughout most of Long Island Sound. Tidal currents decrease westward from the eastern entrance of Long Island Sound as the width of the Sound expands. Bottom currents at the Long Island Sound reef sites flow in a northwesterly direction and are less than 0.01 m/s to 0.05 m/s (Northeast Ocean Data, 2019). Surface currents flow in a southeasterly direction and can reach flows up to 0.1 m/s.

## 2.2.2 Sediment

**Atlantic Ocean and Great South Bay**

Coastal sediments along the eastern United States have been mapped through a variety of means and methods and compiled into the usSEABED as a single data source (Williams, et al., 2006). The usSEABED dataset provides sediment character and textural data, sediment grain size, and lithology. Sediment data collected from these surveys indicate that the sediments within the Atlantic Ocean and Great South Bay reefs are primarily sand and gravelly-sand (Williams, et al., 2006).

The U.S. Geological Survey (United States Geologic Survey, 2005-06) developed and published the Continental Margin Mapping Program (CONMAP) in 2005 which provides maps of the dominant

sediment type within the U.S. Continental Margin. Sediments were classified using the Wentworth (1929) grain scale and Shepard (1954) scheme of sediment classification. CONMAP data show that within the Moriches reef site, the predominant surficial sediment type is gravel and sand. At all other existing Atlantic Ocean and Great South Bay reefs the predominant surficial sediment type is sand (Figures 2-10 and 2-11) (United States Geologic Survey, 2005-06). In addition, CONMAP data shows that sediments at the proposed Sixteen Fathoms reef site are sand (Figure 2-10).

The Atlantic Ocean inshore and offshore reef sites consist of coarse to medium sand with a mean grain size of (0-2 φ) (Menza, Kinlan, Dorfman, Poti, & Caldow, 2012)(United States Geologic Survey, 2005-06). Sediments throughout the Great South Bay reef sites consist of medium sand with mean grain size (1-2 φ) (Menza, Kinlan, Dorfman, Poti, & Caldow, 2012).

Recent sediment samples were collected during the USACE Borrow Area Study (Tetra Tech, Inc., 2016). These sediments are similar to those at the Atlantic Ocean inshore reefs which range from 4 to 40 miles from the nearest borrow area (Figure 2-9. Sand in the Atlantic OCS is predominantly quartzose sand which lacks the affinity for binding contaminants, therefore the sediments in the area are likely uncontaminated (United States Army Corps of Engineers, 2014).

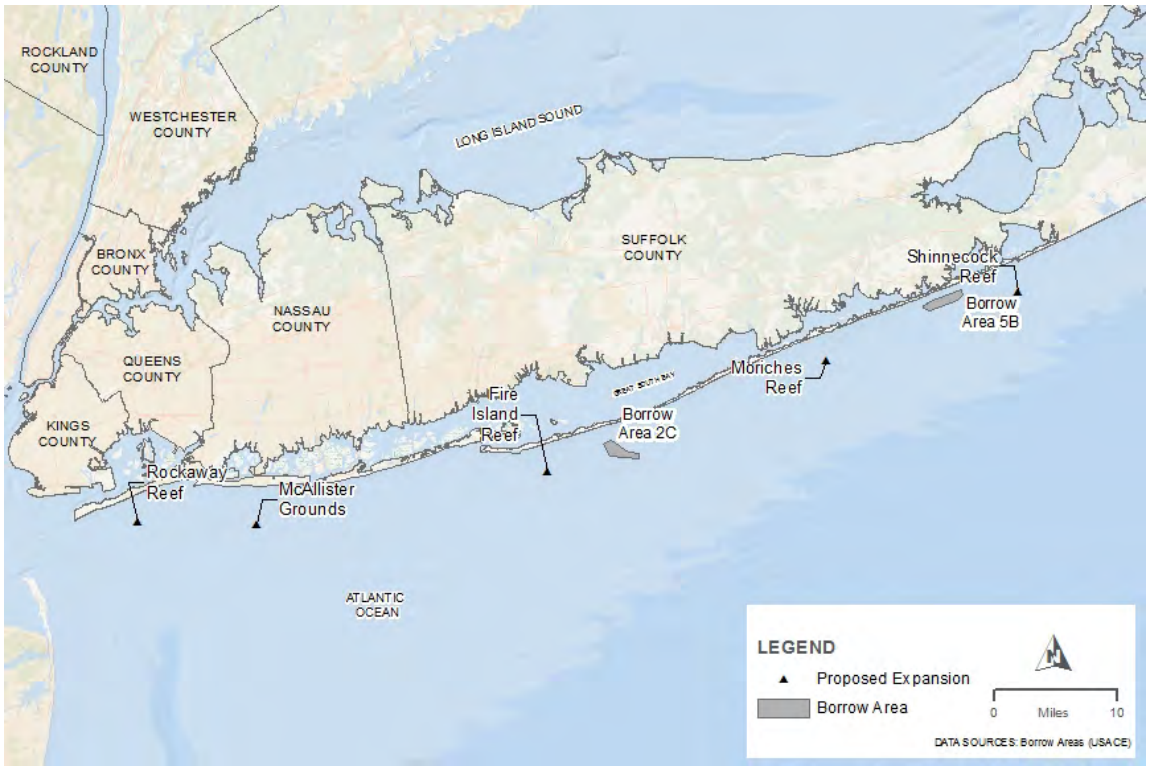
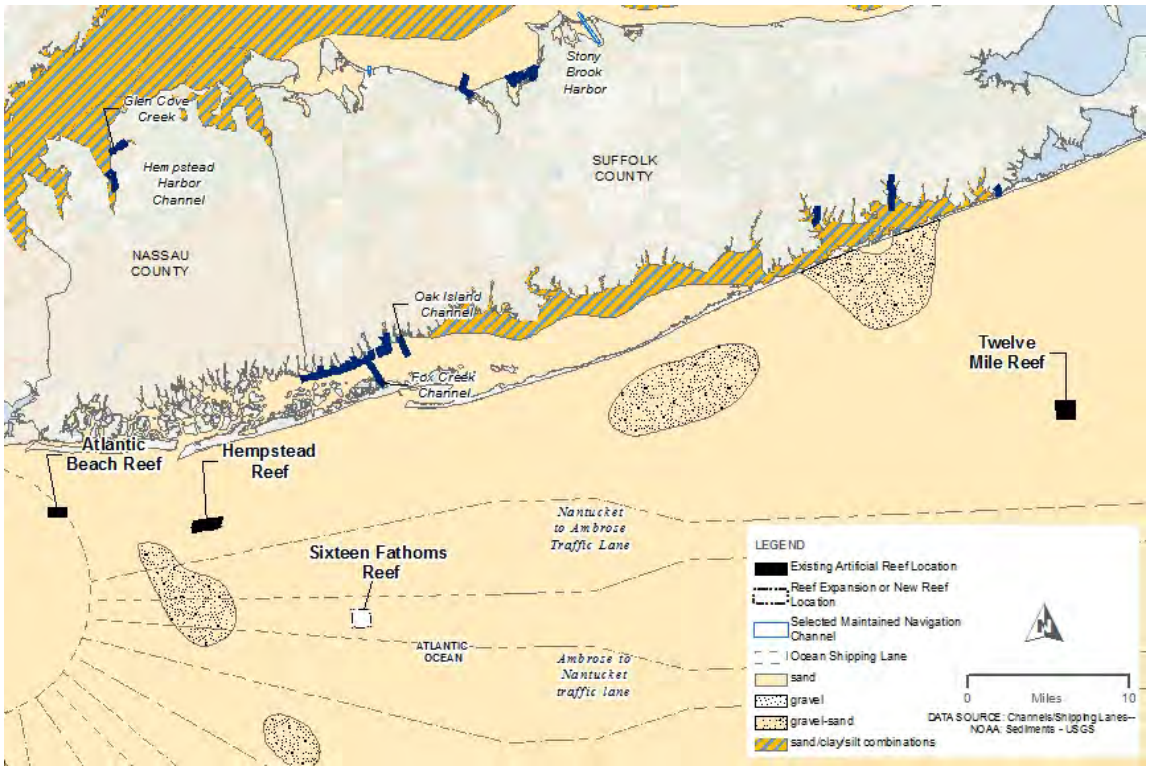



**Figure 2-9. Borrow Areas for Sediment Sampling (TetraTech Inc., 2016)**

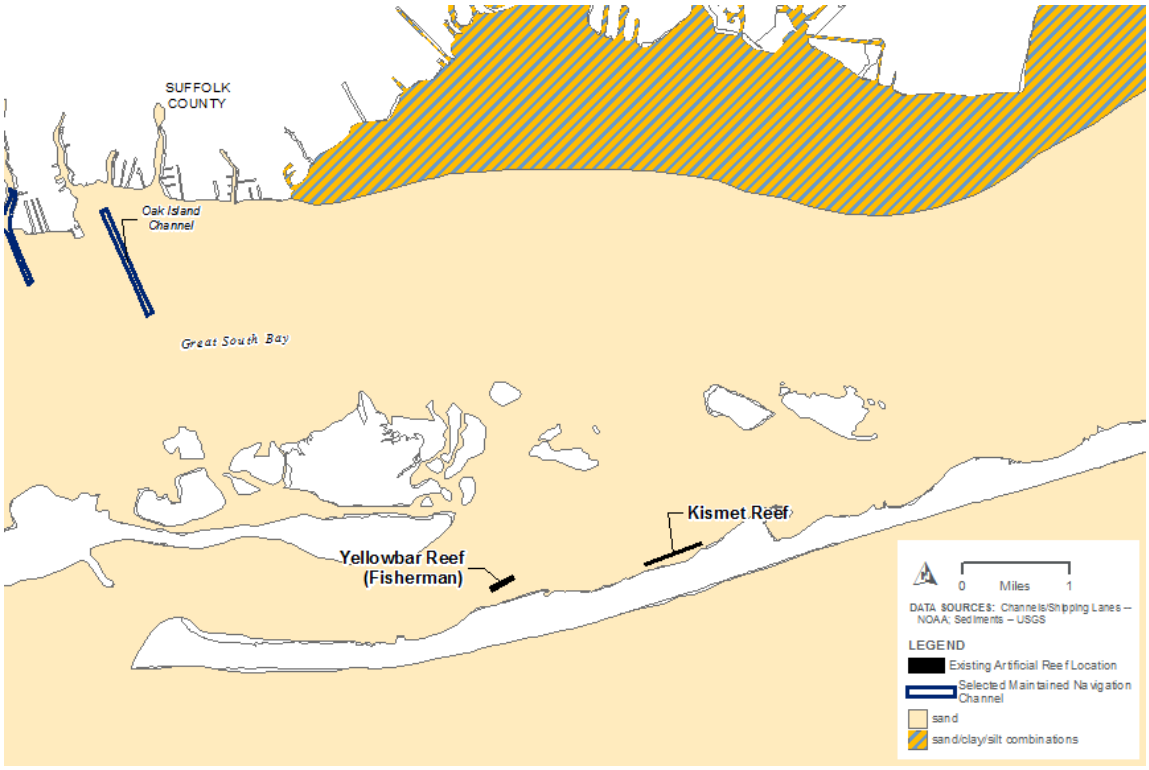



*Source:* (National Oceanagraphic and Atmospheric Administration Office of Coast Survey, 2015), (National Oceanagrpahic and Atmospheric Administration, Office of Coast Survey, 2015), (United States Geologic Survey, 2005-06)

**Figure 2-10. Atlantic Ocean Reef Sediments and Navigation Channels**

No known sediment contamination is present within the sediments in the Great South Bay (New York State Department of Environmental Conservation, 2016). To further characterize the sediment types and current condition of the bottom habitat on each Great South Bay reef site, a preliminary investigation of the benthic substrate was conducted on March 20, 2019 and April 11, 2019 by NYSDEC staff (Appendix B).

Benthic grab samples on Kismet reef mainly comprised sand, gravel, stone, and shell hash. Gravel and stone made up approximately 25-50% of each sample. Samples collected at Yellowbar reef were mainly sand, gravel, and shell hash. Each sample was 95% or more sand. Photos of the bottom at both reefs confirmed the results of the sediment collected in the grab samples. A mix of sand, gravel/stone, and shell hash was the predominant material seen in the photos. The most notable finding was the presence of a sponge at two sites on Kismet reef. The sediment types found at the reefs was consistent with sediment types reported by the U.S. Geological Society (USGS) usSEABED project.




*Source:* (National Oceanagraphic and Atmospheric Administration Office of Coast Survey, 2015), (National Oceanagrpahic and Atmospheric Administration, Office of Coast Survey, 2015), (United States Geologic Survey, 2005-06)

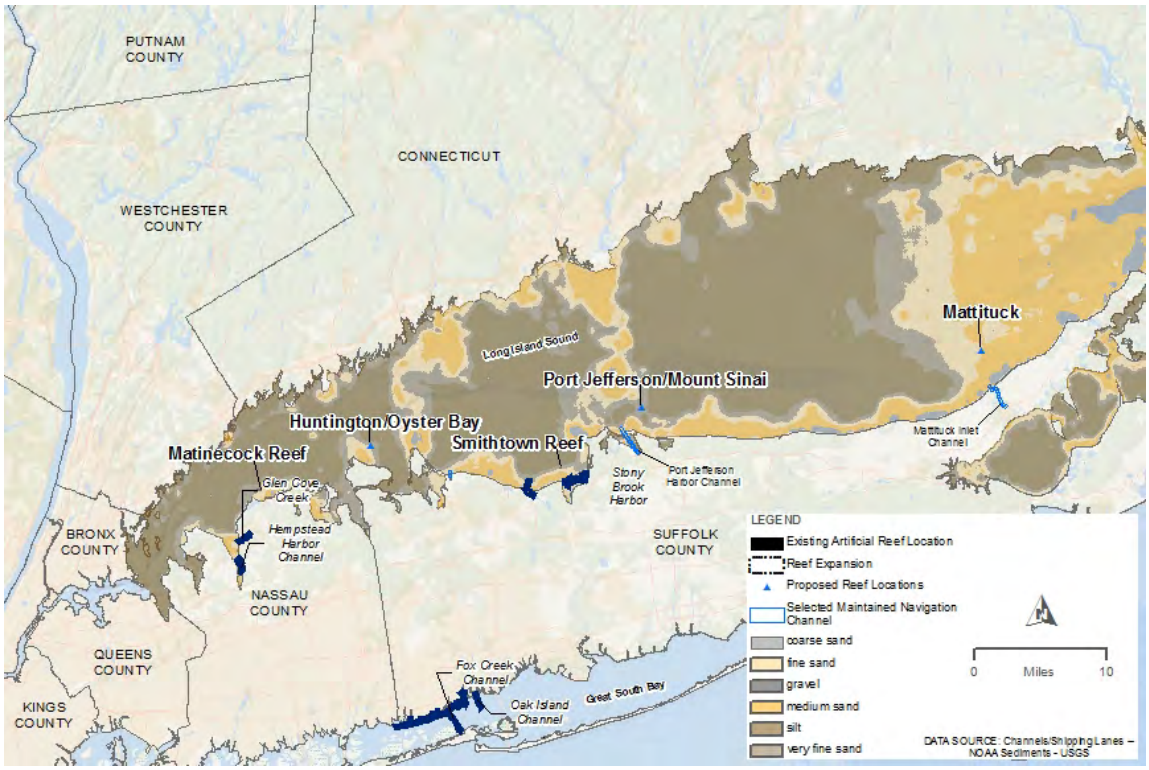
**Figure 2-11. Great South Bay Reef Sediments and Navigation Channels**

### Long Island Sound Reefs

Sediments underlying the Smithtown reef, Port Jefferson/Mount Sinai reef, and Matinecock reef consist of very fine sand with mean grain size (3-4 φ) (Menza et. al. 2012). The Huntington/Oyster Bay reef has fine sand and very fine sand with mean grain size (2-4 φ) (Menza et. al. 2012). The Mattituck reef has fine sand and medium sand with mean grain size (1-3 φ) (Menza et. al. 2012).

The Long Island Sound sediments contain legacy contaminants such as mercury, copper, and zinc from historic industrial sources that no longer exist (Latimer, et al., 2014). The 2012 Long Island Sound Study (LISS) Report provides a sediment quality index for each basin of Long Island Sound. The index includes three sediment quality component indicators: sediment toxicity as measured by the survival of a marine amphipod, concentration of sediment contaminants, and total organic carbon in the sediment (Long Island Sound Study, 2012). The Matinecock and Smithtown reefs are located in the western basin of Long Island Sound. Based on data collected from 2002 to 2006, the sediment quality index for the western basin was good for 18% of samples, fair for 36% of samples, and poor for 46% of the samples. Degrading sediment quality is contributing to the impaired water body status and is a result of the industrialized area and run off that is consistent with the western basin of Long Island Sound.

The potential Port Jefferson/Mount Sinai reef location is located in the central basin of LIS and the sediment quality index was good for 74% of samples, fair for 17% of samples, and poor for 9% of samples. The potential Mattituck reef location is located in the eastern basin of LIS and the sediment quality index was good for 69% of samples and poor for 31% of samples. Sediment characteristics for Long Island Sound reefs are shown in Figure 2-12 (United States Geologic Survey, 2005-06).




*Source:* (National Oceanagraphic and Atmospheric Administration Office of Coast Survey, 2015), (National Oceanagrpahic and Atmospheric Administration, Office of Coast Survey, 2015), (United States Geologic Survey, 2005-06)

**Figure 2-12. Long Island Sound Reef Sediments and Navigation Channels**

## 2.2.3 Water Quality

In the 1993 GEIS, water quality was not discussed at each individual reef site, but as estuarine and oceanic systems within the Marine District. The following section describes the existing water quality data within the waterbodies that contain the reef sites. Table 2-4 presents the NYSDEC water classification and ratings based on New York State (NYS) and local health departments and NYSDEC Division of Marine Resources for the year 2015-2016. The NYSDEC water classification summarized in the table below is consistent with the siting guidelines developed and identified in the 1993 GEIS (class SC or better) as the existing reef locations are located in waters designated as class SA. The impaired water body assessments are provided in Appendix D.

**Atlantic Ocean Reefs**

The NYSDEC classifies the waters of the Atlantic Ocean inshore and offshore reefs as SA saline surface waters (New York State Department of Environmental Conservation, 2015). The Atlantic Ocean inshore and offshore reef sites are given a good water quality rating based on NYS and local health departments and the NYSDEC Division of Marine Resources for the year 2015. The Atlantic Ocean inshore and offshore reef waters are able to support fishing, shellfishing, public bathing, recreation, and aquatic life. The only exception is the westernmost portion of the Long Island coastline, with urban/stormwater runoff producing pathogens that have impaired shellfishing and fish consumption. New York State Department of Health (NYSDOH) has established a precautionary health advisory to limit the number of fish consumed from this area due to possible elevated levels of polychlorinated biphenyls (PCBs) (New York State Department of Environmental Conservation, 2015). Fish consumption is identified as stressed for the entire Long Island shoreline (New York State

Department of Environmental Conservation, 2015). A summary of the surface water classifications and conditions is provided in Table 2-4.

Stony Brook University School of Marine and Atmospheric Sciences conducted water quality sampling at Atlantic Beach reef in 2014 to 2015 for density, temperature, fluorescence, and salinity. Measurements were collected with a CTD at various depths to create vertical profiles of the water column. Samples were collected in August, April, May, June, July and September. Density ranged from 1020 kilograms per cubic meter ($kg/m^3$) to 1025 $kg/m^3$, temperature ranged from 40°F to 75ºF, fluorescence ranged from 0 $mg/m^3$ to 8 $mg/m^3$, and salinity ranged from 29 parts per thousand (ppt) to 32 ppt (Warren, Peterson, & Chapman, 2017).

USACE collected water quality data between June and November 2005 along the south shore of Long Island. Temperatures ranged from 49.6 degrees Fahrenheit (°F) to 79°F from June through November 2005 and no significant differences in temperature were observed between sites (United States Army Corps of Engineers, 2016). Dissolved oxygen (DO) ranged from 4.27 milligram per liter (mg/L) to 12.8 mg/L and turbidity values ranged from 1.70 nephelometric turbidity units (NTU) to 5.4 NTU. NYSDEC conducted water quality sampling in November and December of 2010. DO in the vicinity of Rockaway reef ranged from 6.7 mg/L to 9.7 mg/L. Salinity ranged from 31.4 to 35.0 ppt. Temperature at Rockaway reef ranged from 49.3°F to 52.9°F (New York State Department of Environmental Conservation, 2015).

## Table 2-4: Inventory/Priority Waterbodies List Basin Assessment Reports

| Coastline Portion | Reefs | Assessed | Water Class | Shellfishing | Public Bathing | Recreation | Aquatic Life | Fish Consumption | Habitat/ Hydrology | Aesthetics | Pollutant | Pollutant Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Atlantic Ocean - Inshore** | | | | | | | | | | | | |
| Rockaway Point to Queens/ Nassau Line | Rockaway | Impaired Water requiring a TMDL (Integrated Reporting (IR) Category 5) | SA | Impaired | Fully Supported | Fully Supported | Fully Supported | Stressed | Good | Good | Pathogens | Urban, Storm Runoff |
| Queens/ Nassau Line to Jones Inlet | McAllister Grounds | Water Attaining All Standards (IR Category 1) | SA | Fully Supported | Fully Supported | Fully Supported | Fully Supported | Stressed | Good | Good | -- | -- |
| Fire Island Inlet to Moriches Inlet | Fire Island, Moriches | Water Attaining All Standards (IR Category 1) | SA | Fully Supported | Fully Supported | Fully Supported | Fully Supported | Stressed | Good | Good | -- | -- |
| Moriches Inlet to Shinnecock Inlet | Shinnecock | Water Attaining All Standards (IR Category 1) | SA | Fully Supported | Fully Supported | Fully Supported | Fully Supported | Stressed | Good | Good | -- | -- |
| **Atlantic Ocean - Offshore** | | | | | | | | | | | | |
| Rockaway Point to Queens/ Nassau Line | Atlantic Beach | Impaired Water requiring a TMDL (IR Category 5) | SA | Impaired | Fully Supported | Fully Supported | Fully Supported | Stressed | Good | Good | Pathogens | Urban, Storm Runoff |
| Queens/ Nassau Line to Jones Inlet | Hempstead | Water Attaining All Standards (IR Category 1) | SA | Fully Supported | Fully Supported | Fully Supported | Fully Supported | Stressed | Good | Good | -- | -- |
| Jones Inlet to Fire Island Inlet | Sixteen Fathom | Water Attaining All Standards (IR Category 1) | SA | Fully Supported | Fully Supported | Fully Supported | Fully Supported | Stressed | Good | Good | -- | -- |
| Moriches Inlet to Shinnecock Inlet | Twelve Mile | Water Attaining All Standards (IR Category 1) | SA | Fully Supported | Fully Supported | Fully Supported | Fully Supported | Stressed | Good | Good | -- | -- |

| Coastline Portion | Reefs | Assessed | Water Class | Shellfishing | Public Bathing | Recreation | Aquatic Life | Fish Consumption | Habitat/ Hydrology | Aesthetics | Pollutant | Pollutant Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Great South Bay** | | | | | | | | | | | | |
| Great South Bay, Middle | Kismet, Yellowbar | Impaired Water requiring a TMDL (IR Category 5) | SA | Stressed | Stressed | Impaired | Impaired | Stressed | Unknown | Unknown | Algal/Plant Growth, Nutrients | Urban, Storm Runoff |
| **Long Island Sound** | | | | | | | | | | | | |
| Long Island Sound, Nassau/ Suffolk | Matinecock Huntington/ Oyster Bay | Impaired Water TMDL Completed (IR Category 4a) | SA | Stressed | Stressed | Stressed | Impaired | Stressed | Good | Good | Nutrients (nitrogen), Low DO/ Oxygen Demand, Pathogens | Municipal Discharges, Combined Sewer Overflows (CSOs), Urban/ Storm Runoff |
| Smithtown Bay | Smithtown | Impaired Water TMDL Completed (IR Category 4a) | SA | Threatened | Stressed | Stressed | Impaired | Stressed | Good | Good | Nutrients (nitrogen), Low DO/ Oxygen Demand, Pathogens | Municipal Discharges (Suffolk County Sewage District #6 Sewage Treatment Plant) |
| Long Island Sound, Suffolk County, West | Port Jefferson/ Mount Sinai | Impaired Water TMDL Completed (IR Category 4a) | SA | Fully Supported | Stressed | Stressed | Impaired | Stressed | Good | Good | Nutrients (nitrogen), Low DO/Oxygen Demand, Pathogens | Municipal Discharges (Suffolk County Sewage District #6 Sewage Treatment Plant) |
| Long Island Sound, Suffolk County, East | Mattituck | Water Attaining All Standards (IR Category 1) | SA | Fully Supported | Fully Supported | Fully Supported | Fully Supported | Stressed | Good | Good | None | None |

*Source*: (New York State Department of Environmental Conservation, 2015)

### Great South Bay Reefs

The NYSDEC classifies the Great South Bay as a Class SA waterbody, meaning that the waters are suitable for shellfishing, public bathing, general recreation use and support of aquatic life. The reefs are located in the Middle Portion of Great South Bay. These waters are listed as impaired due to storm runoff, which could result in temporary algal blooms or changes in dissolved oxygen levels from nutrient loading. The impairment results in a stressed rating for shellfishing, public bathing and fish consumption (New York State Department of Environmental Conservation, 2016). Impaired waterbodies exhibit occasional water quality issues that periodically limit or restrict waterbody uses. The rating does not impact reef enhancement or development as conditions that impact water quality are episodic and temporary.

USACE collected water quality data between June and November 2005. Salinity along the Great South Bay reef sites was 17.3 ppt, but is highly variable, most likely as the result of the variable influx of freshwater from the many tributaries supplying Great South Bay (United States Army Corps of Engineers, 2016). Across all the bays (i.e. Great South Bay, Moriches Bay and Shinnecock Bay), temperature showed an expected seasonal trend with values ranging from approximately 50 degrees Fahrenheit (°F) to 79°F, DO ranged from 0.274 mg/L to 12.8 mg/L, and mean turbidity was between 1.70 NTU to 5.40 NTU (United States Army Corps of Engineers, 2016). A USGS national water information system buoy is located in West Sayville (USGS station 01306402) which provides data for sample depth, water temperature, specific conductance, ocean elevation, and salinity (United State Geological Survey, 2017). Complete data sets provided by this station were only available for the year 2018 for ocean water surface elevation, specific conductance, and water temperature. The average ocean water surface elevation was 1.483 feet (above NGVD 1929), the average specific conductance was 41,170 µS/cm, and the average temperature was 13.93°C (57.07°F). Stony Brook University maintains a data buoy in Great South Bay west of Sayville (Station 44069). Table 2-5 provides the average turbidity, salinity, and water temperature from the Stony Brook buoy for the years 2016-2018. Average turbidity for 2016 and 2017 at this station is similar to what USACE had collected in June and November 2005. Turbidity for 2018 was higher at 9.02 Formazin Turbidity Unit (FTU), but data were only available from July through November for 2018. Data for 2016 and 2017 includes the months of April through November. Salinity and temperature values are also comparable to the USACE water quality data collected.

**Table 2-5. West Sayville (Stony Brook Station 44069) Ocean Water Quality Conditions, 2016-2018**

| Parameter | 2016 | 2017 | 2018 |
|---|---|---|---|
| Average Turbidity (FTU) | 3.86 | 5.21 | 9.02 |
| Average Salinity (PPT) | 28.59 | 27.46 | 26.02 |
| Average Temperature (ºC) | 19.48 | 18.83 | 17.71 |

### Long Island Sound Reefs

The NYSDEC classifies waters of the Long Island Sound reef sites as SA saline surface waters (New York State Department of Environmenal Conservation, 2016). The water quality at the Long Island Sound reef sites is based on NYS and local health departments and the NYSDEC Division of Marine

Resources for the year 2016. These waters are generally able to support shellfishing, public bathing, and recreation but are impaired for aquatic life uses with the exception of the eastern portion of the Long Island Sound coastline in Suffolk county (New York State Department of Environmenal Conservation, 2016), (New York State Department of Environmental Conservation, 2016). Nassau/Suffolk county shoreline and Smithtown Bay are subject to low DO and high oxygen demand due to nutrient loading in the western Long Island Sound Basin (Table 2-4). The source of this nutrient loading is known to be from municipal wastewater treatment outfalls, combined sewer overflows, and stormwater runoff (New York State Department of Environmenal Conservation, 2016), which in portions of Long Island Sound results in a stressed or threatened rating for shell fishing, public bathing, and fish consumption (New York State Department of Environmental Conservation, 2016). Impaired waterbodies exhibit occasional water quality issues that periodically limit or restrict waterbody uses. The rating does not impact reef enhancement or development as conditions that impact water quality are episodic and temporary. When conditions are poor, fish will move out of the area and benthic and epibenthic invertebrates that do not survive will recolonize when conditions are favorable. Table 2-4 provides a summary of Long Island Sound reef site water quality.

Seasonal turbidity within Long Island Sound is provided in the NOAA 2012 study (Menza, Kinlan, Dorfman, Poti, & Caldow, 2012). Water-leaving radiances, or light reflected from the water, at a 670 nanometer bandwidth (Lw-670 nanometer) were used as a proxy for turbidity, and were extracted from high-resolution (~1.1 kilometer (km)) satellite data from 1998 to 2006. In general, turbidity was highest in the spring and lowest in the summer, with water-leaving radiance ranging from 0.151 to 0.097, respectively.

The 2012 LISS Sound Health Report provides a water quality index for each basin of Long Island Sound. The index comprises five water quality component indicators including dissolved inorganic nitrogen, dissolved inorganic phosphorus, chlorophyll a, water clarity, and DO. The Matinecock, Huntington/Oyster Bay, and Smithtown reefs are located in the western basin of the Long Island Sound. Based on monthly data (May to October) from 1991 to 2011, the water quality index for the western basin was good for 25% of samples, fair for 69% of samples and poor for 6% of samples. The salinity in the western end of Long Island sound is typically 23 ppt (Long Island Sound Study, 2017). Hypoxia in bottom waters occurs frequently in the western basin. The study indicates that between 1991 and 2011, waters in the Matinecock reef area were hypoxic for at least one day in 90-100% of the years surveyed, and waters in the Smithtown reef area were hypoxic for at least one day in 30-50% of the years surveyed (Long Island Sound Study, 2012). The central basin of LIS is where the Port Jefferson/Mount Sinai potential reef is located and the water quality index for the survey years was good for 57% of samples, fair for 43% of samples, and poor for 0.6% of samples. Waters in the Port Jefferson/Mount Sinai potential reef location were hypoxic for at least one day 10-20% of the years surveyed (Long Island Sound Study 2012). The potential Mattituck reef location is located in the eastern basin of LIS and has a good water quality index for 82% of samples and fair for 18% of samples. There were no poor water quality indicators for the eastern basin and waters were hypoxic for at least one day 0-10% of the years surveyed.

In 1994, CTDEEP established 48 sampling stations within LIS to monitor hypoxia during the summer months of June, July, August, and September (CTDEEP 2018). There are 47 active stations and 17 of these stations are sampled year-round. The in-situ monitoring parameters include DO, percent saturation, temperature, salinity, conductivity, depth, and Photosynthetically Active Radiation (PAR). Chemical monitoring parameters include dissolved silica, particulate silica, particulate carbon, dissolved organic carbon, dissolved nitrogen, particulate nitrogen, ammonia, nitrate and nitrite, particulate phosphorus, total dissolved phosphorus, orthophosphate, chlorophyll a, total suspended

solids, and Winkler Dissolved Oxygen. Biological Oxygen Demand (BOD), zooplankton, phytoplankton, and High Performance Liquid Chromatography (HPLC) for analysis of phytoplankton pigments are also monitored. Station 2 is located in the western basin of LIS and is within the vicinity of Matinecock reef. Due to the hypoxic conditions that can result in warm weather months and when poor current movement and circulation occur in the western basin of LIS, DO was examined at this station. DO data is provided in Table 2-6 from 2012-2017 sampling events in the months of June, July, August, and September.

**Table 2-6. Dissolved Oxygen Data from CTDEEP Station 2 2012-2017 Summer Sampling Events near Matinecock Reef**

| Dissolved Oxygen (mg/L) | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|
| Minimum | 1.23 | 1.78 | 1.78 | 2.84 | 2.05 | 2.16 |
| Maximum | 8.96 | 11.58 | 13.25 | 13.65 | 9.93 | 11.48 |
| Average | 4.97 | 5.93 | 5.96 | 5.70 | 5.55 | 5.60 |

Based on a review of water quality data described above, on average from 1994 – 2017 approximately 40 days were recorded of DO less than the New York State Section 703.3 SA waterbody minimum of 3.0 mg/L. Therefore, low DO is episodic and does not impact reef siting or location.

**Table 2-7. Dissolved Oxygen Data from CTDEEP Station 15 2012-2017 Summer Sampling Events Near Smithtown Reef**

| Dissolved Oxygen (mg/L) | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|
| Minimum | 3.13 | 3.98 | 4.22 | 4.15 | 3.77 | 3.70 |
| Maximum | 8.47 | 9.10 | 8.73 | 8.89 | 9.30 | 8.44 |
| Average | 5.34 | 6.17 | 6.19 | 6.36 | 5.67 | 5.76 |

**Table 2-8. Dissolved Oxygen Data from CTDEEP Station 4 2012-2017 Summer Sampling Events Near Huntington/Oyster Bay Potential Reef Location**

| Dissolved Oxygen (mg/L) | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|
| Minimum | 2.09 | 3.05 | 3.55 | 3.89 | 2.85 | 3.23 |
| Maximum | 8.95 | 10.67 | 9.48 | 11.37 | 8.57 | 11.66 |
| Average | 5.53 | 6.70 | 6.85 | 6.45 | 5.50 | 6.08 |

**Table 2-9. Dissolved Oxygen Data from CTDEEP Station 20 2012-2017 Summer Sampling Events Near Port Jefferson/Mount Sinai Potential Reef Location**

| Dissolved Oxygen (mg/L) | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 |
|---|---|---|---|---|---|---|
| Minimum | 3.13 | 3.98 | 4.22 | 4.15 | 3.77 | 3.70 |
| Maximum | 8.47 | 9.09 | 8.73 | 8.89 | 9.30 | 8.44 |
| Average | 5.33 | 6.17 | 6.19 | 6.36 | 5.67 | 5.76 |

CTDEEP water quality buoys were within the vicinity of the Huntington/Oyster Bay, Port Jefferson/Mount Sinai, and Smithtown reefs (Table 2-7 through Table 2-9). The DO values at these stations had averages above 5 mg/L during the summer sampling events, which is sufficient for Long Island Sound's estuarine life. There are two water quality buoys within the vicinity of the potential Mattituck reef site, but data was not available for 2012 through 2017. Because Mattituck is located in the eastern basin, the DO is likely able to support estuarine life.

### 2.2.4 Air Quality

The New York State Ambient Air Monitoring Program was established by the NYSDEC to monitor ambient air quality across the state. The primary purpose of the monitoring network is to measure ambient air concentrations of pollutants regulated by the National Air Monitoring Network and the State and Local Air Monitoring Stations Network. Real time direct reading measurements include particulate matter ($PM_{2.5}$), ozone ($O_3$), nitrogen dioxide ($NO_2$), sulfur dioxide ($SO_2$), and carbon monoxide (CO). The NYSDEC has four air quality monitoring sites on Long Island, located from west to east at Eisenhower Park, Babylon, Holtsville, and Riverhead. This area is known as Region 1. In 2017, ozone was the only measurement exceeding the Federal Ambient Air Quality Standard at the Babylon and Riverhead monitoring stations (New York State Department of Environmental Conservation, 2017). Air quality at the existing and proposed reef sites is likely to be equal to or better than that measured at the Region 1 air monitoring stations.

### 2.2.5 Noise

Current existing ambient underwater noises near the reef sites are attributed to boat, larger vessel traffic, and recreational watercrafts, such as jet skis. Other activities such as military training exercises and offshore energy development within the New York Bight are also sources of anthropogenic noise. Several studies have established levels of sound exposure that could negatively impact marine mammals and fish; however, there is not sufficient data to assess and understand the extent of harmful noise exposure (Chytalo, 2017). Temporary construction-related noises during reef placement would occur. Refer to the Commercial and Recreational Fishing sections for more information on vessel traffic within the reef areas (Sections 2.3.1 and 2.3.2).

### 2.2.6 Climate Change

**Atlantic Ocean Reefs**

Data on the effects of climate change and risk for the State of New York was gathered by the New York State Energy Research and Development Authority (NYSERDA). The sea level is anticipated to rise 3-8 inches by the 2020s, 9-21 inches by the 2050s, and 14-39 inches by the 2080s (Horton, Bader,

Rosenzweig, DeGaetano, & Solecki, 2014). The annual temperature trend has been increasing 0.33°F per decade and the annual precipitation trend is increasing 0.76 inches per decade for the Long Island region.

**Great South Bay Reefs**

Sea surface temperatures (SST) are provided in the NOAA 2012 study (Menza, Kinlan, Dorfman, Poti, & Caldow, 2012). SST were obtained by averaging monthly composites from Advanced Very High Resolution Radiometer (AVHRR) data from 1985 to 2001, obtained from instruments mounted on NOAA satellites. SST is generally highest in summer and lowest in winter, with temperatures ranging from 25.8 to 2.1ºC, respectively.

See Atlantic Ocean Reefs for climate change predictions.

**Long Island Sound Reefs**

Based on NOAA's 2012 study, SST is generally highest in summer and lowest in winter, with temperatures ranging from 25.8 to 2.1ºC, respectively. The 2012 LISS Sound Health Report provides temperature and sea level information for the sound. Additionally, the report discusses a change in the spring freshet, an indicator of when winter weather turns to spring, in the Connecticut River. Based on data from 1930-2010 the spring freshet is occurring 10 days earlier than in 1930. The mean winter water temperatures are increasing throughout southern New England, based on data from 1880 to 2010. Monitoring data from Kings Point, NY indicates that sea level rise is occurring at a rate of approximately one inch per decade, based on data from 1930 to approximately 2010. A similar trend has been observed at other stations in Long Island Sound and throughout southern New England.

# 2.3 Biological

## 2.3.1 Marine Community

**Plankton**

**Atlantic Ocean Reefs**

Zooplankton biomass from near-surface plankton tows are included in the NOAA 2012 study (Menza, Kinlan, Dorfman, Poti, & Caldow, 2012). Data for this study were taken from the NOAA NMFS' Copepod database that contained 3,122 records from 1966-2001. Observations were grouped by season to provide best linear unbiased prediction of the intermediate values, to temporally and spatially show zooplankton biomass in the Atlantic Ocean.

Fall zooplankton biomass ranged from lows of 0.024 ml/$m^3$ to highs of 0.828 ml/$m^3$. Zooplankton biomass was greatest in the fall, with relatively high biomass south of Long Island, particularly within and southwest of Great South Bay, and biomass decreasing with distance from shore. All Atlantic Ocean reef sites were in areas of relatively high levels of zooplankton biomass for the season except Shinnecock and Twelve Mile reefs which had moderate zooplankton biomass.

In winter, zooplankton biomass ranged from 0.029 ml/$m^3$ to 0.362 ml/$m^3$ and was heterogeneously distributed. Zooplankton biomass remained relatively high south and west of Great South Bay, and in bands offshore, but was moderate along eastern Long Island. Fire Island reef had moderately high zooplankton biomass levels in winter while the remaining reef sites had moderate biomass levels for the season.

In spring, zooplankton biomass ranged from 0.128 ml/$m^3$ to 0.486 ml/$m^3$. Zooplankton south of Long Island was patchy, with low zooplankton biomass levels in the nearshore waters of eastern Long Island

and patches of relatively high biomass in nearshore waters of western Long Island and offshore. All Atlantic Ocean reef sites had moderate to high biomass in spring except Shinnecock and Twelve Mile, which had moderate zooplankton biomass levels for the season.

In summer, zooplankton biomass ranged from 0.072 ml/$m^3$ to 0.741 ml/$m^3$ and was heterogeneously distributed. The nearshore waters along westernmost Long Island had relatively high zooplankton biomass, while the majority of the Long island nearshore waters had moderate zooplankton biomass. Areas offshore had bands of moderately high biomass. Hempstead, McAllister Grounds, Rockaway and Atlantic Beach reefs had moderately high to high zooplankton biomass and the remaining Atlantic Ocean reefs had moderate zooplankton biomass in summer.

Egg and larval EFH were identified for butterfish, cobia, king mackerel (*Scomberomorus cavalla*), monkfish, red hake (*Urophcis chuss*), scup, silver hake, Spanish mackerel, summer flounder, winter flounder (*Pseudopleuronectes americanus*), windowpane flounder (*Scophthalmus aquosus*), and several shark species near the Rockaway reef (Transco, 2013).

**Great South Bay Reefs**

The Great South Bay reef sites displayed high levels of zooplankton biomass in the fall, moderately high levels in winter and spring, and moderate levels in summer (Menza, Kinlan, Dorfman, Poti, & Caldow, 2012).

The larger mesoplankton of Great South Bay are dominated by copepods, with large populations developing during the summer and spring months (New York Sea Grant, 2001). Among Ichthyoplankton, bay anchovy (*Anchoa mitchilli*) eggs and larvae are dominant (New York Sea Grant, 2001).

Recent research conducted at Stony Brook University School of Marine and Atmospheric Sciences indicates that the plankton community (both eukaryotes and bacteria) in Great South Bay changes at a scale of weeks, and brown tides (*Aureococcus anophagefferens)* are having an impact on the plankton and bacteria community (Stony Brook University School of Marine and Atmospheric Sciences, 2011).

**Long Island Sound Reefs**

Chlorophyll-*a* concentrations were extracted from high resolution satellite data from 1998 to 2006. Chlorophyll a concentrations are used as a proxy for primary productivity, and thereby can be used as an indicator for the presence of phytoplankton (Menza, Kinlan, Dorfman, Poti, & Caldow, 2012). Concentrations within Long Island Sound were highest in summer and lowest in winter ranging from approximately 44 to 21 mg/$m^3$, respectively (Menza, Kinlan, Dorfman, Poti, & Caldow, 2012). Zooplankton and ichthyoplankton concentrations within Long Island Sound were not analyzed as part of this study.

Near surface biomass of zooplankton were interpolated for LIS using point data obtained from the NOAA NMFS's copepod database (2014). This database spans from 1966 to 2001 and does not include larval fish. The zooplankton biomass during the fall decreases across LIS from east to west, with a high of 1.29 milliliters per cubic meter (mL/$m^3$) to a low of 0.011 mL/$m^3$. During the winter, zooplankton biomass is highest near the central basin, with a high of 2.17 mL/$m^3$ and is lower near the eastern and western basins. This trend is also evident in the summer, with the highest zooplankton concentrations in the central basin at 2.89 mL/$m^3$.

**Invertebrates**

**Atlantic Ocean Reefs**

Common benthic invertebrates within the Atlantic Ocean inshore and offshore reef sites include polychaete worms (Annelida) including the polychaete species *Scolelepsis;* amphipods (Arthropoda); isopods (Isopoda); sand dollars and sea stars (Echinodermata); horseshoe crabs (*Limulus polyphemus*); mollusks (Mollusca ) including *Yoldia and Donax species of bivalves*; and decapods (Decapoda) including mole crabs and various epibenthic species of shrimp. Jellyfish (Cnidaria) are also common.

Diver and baited remote underwater video (BRUV) surveys were completed on the Atlantic Beach and Hempstead reefs. These surveys identified American lobster, rock crab (*Cancer irroratus*), spider crab (*Libinia spp.*), common sea star (*Asterias rubens*), blue mussels (*Mythlius edulis*), barnacles, northern star coral, sea anemones (*Actiniardia spp.*), purple-spined sea urchins (*Arbacia punctulata*), orange tunicate spp., yellow sponge spp., brittle star (*Ophiophois spp*.), waved whelk (*Buccinum undatum*), and scale worm (*Polynoide spp.*) (Warren, Peterson, & Chapman, 2017).

Commercially important species, include Atlantic surf clamsurfclam (*Spisula solidissima*), ocean quahog (*Artica islandica*), American lobster, longfin squid (*Doryteuthis pealeii*), northern short-finned squid (*Illex illecebrosus*), and various crab species are also located within the Atlantic Ocean inshore reef sites (United States Army Corps of Engineers, 2016).

**Great South Bay Reefs**

Invertebrates common to sand and gravel habitat in the Great South Bay include polychaetes such as yellow-jawed clam worm (*Nereis succinea*), Dumeril's clam worm (*Platynereis dumerillii*), orbiniid worm (*Haploscoloplos fragilis*), feather-duster worm (*Sabella microphthalma*), opal worm (*Arabella iricolo*r), opal worm (*Lumbrineris brevipes*), common bamboo worm (*Clymenella torquata*), and thread worm (*L. tenuis*); the bivalves northern dwarf-tellin (*Tellina agilis*), northern quahog (*Mercenaria mercenaria*), Morton egg cockle (*Laevicardium mortuni*), slipper shell (*Crepidula fornicata*), blue mussel (*Mytilus edulis*), and Atlantic awningclam (*Solemya velum*); amphipods such as *Corophium* sp., *Lysianopsis alba, Paraphoxus spinosus*, and saltmarsh flea (*Orchestia grillus*); the isopod Baltic isopod (*Idotea balthica);* the decopods sand shrimp (*Crangon septempinosa*), marsh grass shrimp (*Palaemonetes vulgaris*), mud crab (*Dyspanapeus sayi*), green crab (*Carcinus maenas*), blue crab (*Callinectes sapidus*), and Atlantic mud crab (*Panopeus herbstii*); as well as red beard sponge (*Microciona prolifera*) and comb jelly (*phylum Ctenophora*) (United States Army Corps of Engineers, 2005) (United States Army Corps of Engineers, 2016) (U.S. Fish and Wildlife Service 1997) (New York Sea Grant, 2001).

NYSDEC completed a preliminary investigation of the benthic characteristics of Kismet and Yellowbar artificial reef sites on March 20, 2019 and April 11, 2019. Two benthic samples were collected on each reef site using a ponar grab and infaunal organisms were sieved and collected for analysis. Benthic infauna was comprised of copepods, shrimp, barnacles, molluscs (blue mussel), crepidula, other unknown molluscs, marine worms, a hermit crab and a hydroid.

Commercially and recreationally valuable species include blue mussel, ribbed mussel, blue crab and softshell clam (*Mya arenaria*).

**Long Island Sound Reefs**

Common benthic invertebrates found in Long Island Sound surficial sand habitat include polychaetes such as *Polygordius spp. Ampharete artica, Aricidea catherinensis, Tharyx sp., Harmothoe sp.,*

*Nephtys picta, and Spiophanes bombyx;* amphipods including *Ampelisca vadorum, Leptocheirus pinguis, Phoxocephalus holbolli, and Unciola irrorata;* Cirripeds such as acorn barnacle *(Balanus amphitrite)*; Decapods such as Atlantic mud crab (*Panopeus herbstii)* and tube pea crab *(Pinnixa sp.)*; bivalves including the traverse ark clam (*Anadara transversa),* waved astarte *(Astarte undata),* salt water clam *(Lyonsia hyaline),* and blue mussel *(Mytilus edulis);* Gastropods including mud snail *(Ilyanassa trivittata),* and moon snail *(Naticidae spp.)* (Long Island Sound Cable Fund Steering Committee, 2015).

Average faunal abundances were greatest in sand and lowest in sandy muds (Long Island Sound Cable Fund Steering Committee, 2015). In addition, in areas with periods of poor water and sand quality, the benthic community will be comprised of additional opportunistic species such as *Mulina lateralis* and Capitellidae worms.

The 2012 LISS Sound Health report provides a benthic quality index for benthic macroinvertebrates for each basin of Long Island Sound. The index is based on a measure of benthic community diversity and presence and abundance of pollution-tolerant species. Based on data collected from 2002 to 2006, the benthic quality index for 49% of the western basin was good and 51% poor, 95% of the central basin was good and 5% poor, and 75% of the eastern basin was good and 25% poor. Matinecock, Smithtown, and Huntington/Oyster Bay reefs are in the western basin and are likely to include more pollution tolerant species. Port Jefferson/Mount Sinai reef is in the central basin and Mattituck reef is in the eastern basin where pollution tolerant species are less abundant.

Commercially important invertebrate species include lobsters, oysters, hard clams, and horseshoe crab. Lobster harvests continue to decrease as a result of increasing water temperatures and environmental stressors and clam harvests are steadily increasing (Long Island Sound Study, 2012). Oyster harvests are low compared to historic harvest data but are increasing (Long Island Sound Study, 2012). Horseshoe crab abundance has increased or remained steady in western Long Island Sound, but is declining in the east (Long Island Sound Study, 2012).

**Fish**

**Atlantic Ocean Reefs**

Numerous adult and juvenile populations of fish occur within the Atlantic Ocean inshore and offshore reef sites. Common fish species include hake (*Gadidae* spp.), red hake (*Urophycis chuss*), herring species (Clupeidae spp.), Atlantic butterfish (*Peprilus triacanthus*), Atlantic mackerel, bluefish, scup, striped bass, cunner (*Tautogolabrus adspersus*), tautog (*Tautoga onitis*), black sea bass, cod (*Gadus spp.*), northern searobin (*Prionotus carolinus*), goby (*Gobiosoma spp.*), clearnose skate (*Raja eglanteria*), gray triggerfish (*Balistes capriscus*), conger eel (*Conger oceanicus*), rock gunnel (*Pholis gunnellus*), winter skate (*Leucoraja ocellata*), little skate (*Leucoraja erinacea*), smooth dogfish (*Mustelus canis*), spiny dogfish, striped searobin (*Prionotus evolans*), and dusky shark (*Caracharhinus obscurus*). Benthic finfish species that occur within the Atlantic Ocean reef sites include American sandlance (*Ammodytes americanus*), monkfish, summer flounder, windowpane flounder, and winter flounder (Warren, Peterson, & Chapman, 2017) (Tetra Tech, Inc., 2016) (United States Army Corps of Engineers, 2016).

**Great South Bay Reefs**

Frisk and Munch (2008) conducted fisheries surveys in Great South Bay near the reef locations. Surveys were conducted using otter trawls in water depths from 2- 13 meters. Scup, blue fish, summer flounder, striped searobin, windowpane flounder and clearnose skate were collected. Forage fish species are found throughout the various aquatic habitats in the bay at different times of the year and

provide important forage for commercially and recreationally important species including summer flounder, winter flounder, bluefish, striped bass, weakfish, and tautog (*Tautoga onitis*). Common forage species in Great South Bay include Atlantic silverside (*Menidia menidia*), bay anchovy (*Anchoa mitchilli*), mummichog (*Fundulus heteroclitus*), striped killifish (*Fundulus majalis*), sheepshead minnow (*Cyprinodon variegatus*), fourspine stickleback (*Apeltes quadracus*), threespine stickleback (*Gasterosteus aculeatus*), northern pipefish (*Syngnathus fuscus*), and American sandlace (*Ammodytes americanus*) U.S. Fish and Wildlife Service (1997). Reef species, including tautog, cunner, and black sea bass, use Great South Bay as a nursery area because the vegetative areas provide cover and are rich in prey species; all three species can also be found at artificial reefs in the bay. Other common aquatic species occurring in the backbarrier lagoon systems of Long Island include, American eel (*Anguilla rostrata*), spot, Atlantic croaker (*Micropogonias undulatus*), northern kingfish (*Menticirrhus saxatilis*), and northern puffer (*Sphoeroides maculatus*).

**Long Island Sound Reefs**

The 2012 LISS report provides information on the abundance of finfish in LIS. Finfish data has been collected by the CTDEEP Long Island Sound Trawl Survey (LISTS) since 1984. An annual finfish biomass index and forage fish index were developed to gauge the overall status of the species. The biomass index is the average total weight of all finfish collected in each trawl sample and is used to measure fish abundance. The forage fish index is a composite of 14 common species that are important components of the food web. This index is used as an indicator of a sufficient food base to support a variety of species in the Sound. The finfish biomass index shows little variability, with a general range of approximately 33 kg/tow to 70 kg/tow, indicating ecosystem stability. The forage fish index also shows little variability. The lack in variability in these two indices reflects stability in the ecosystem (State of Connecticut Department of Energy and Environmental Protection, 2015).

The 2015 NY State Wildlife Action Plan (SWAP) provides a list of fish species found in aquatic habitats around the state, including marine and estuarine habitats (New York State Department of Environmental Conservation, 2015). CT DEEP conducts monthly trawl surveys throughout Long Island Sound. The 2014 trawl survey was conducted between New London and Greenwich, CT including waters from 5 to 46 meters in depth in Connecticut and New York Waters (State of Connecticut Department of Energy and Environmental Protection, 2015). Site specific locations could not be teased out, however the species summarized below are representative of those found in similar water depths to the reef areas.

### Table 2-10: Summary of Species Collected During the 2014 CTDEEP LISTS Survey

| Common Name | Scientific Name | Quantity Collected ( # of individuals) |
|---|---|---|
| Alewife | *Alosa pseudoharengus* | 84 |
| American lobster | *Homarus americanus* | 20 |
| American sand lance | *Ammodytes americanus* | 1 |
| American shad | *Alosa sapidissima* | 16 |
| Atlantic croaker | *Micropogonias undulatus* | 1 |
| Atlantic herring | *Clupea harengus* | 227 |
| Atlantic menhaden | *Brevoortia tyrannus* | 24 |
| bay anchovy | *Anchoa mitchilli* | 43 |

| Common Name | Scientific Name | Quantity Collected ( # of individuals) |
|---|---|---|
| black sea bass | *Centropristis striata* | 290 |
| blue runner | *Caranx crysos* | 2 |
| blueback herring | *Alosa aestivalis* | 5 |
| Bluefish | *Pomatomus saltatrix* | 749 |
| Butterfish | *Peprilus triacanthus* | 14,783 |
| channeled whelk | *Busycotypus canaliculatus* | 4 |
| clearnose skate | *Raja eglanteria* | 23 |
| common razor clam | *Ensis directus* | 1 |
| crevalle jack | *Caranx hippos* | 1 |
| Cunner | *Tautogolabrus adspersus* | 1 |
| fourbeard rockling | *Enchelyopus cimbrius* | 2 |
| fourspot flounder | *Paralichthys oblongus* | 131 |
| hickory shad | *Alosa mediocris* | 5 |
| Hogchoker | *Trinectes maculatus* | 21 |
| horseshoe crab | *Limulus polyphemus* | 141 |
| inshore lizardfish | *Synodus foetens* | 3 |
| knobbed whelk | *Busycon carica* | 7 |
| lion's mane jellyfish | *Cyanea capillata* | 32 |
| little skate | *Leucoraja erinacea* | 98 |
| longfin inshore squid | *Loligo pealeii* | 2,763 |
| Lookdown | *Selene vomer* | 1 |
| mantis shrimp | *Squilla empusa* | 80 |
| Moonfish | *Selene setapinnis* | 417 |
| northern kingfish | *Menticirrhus saxatilis* | 17 |
| northern pipefish | *Syngnathus fuscus* | 1 |
| northern searobin | *Prionotus carolinus* | 309 |
| oyster toadfish | *Opsanus tau* | 1 |
| planehead filefish | *Monacanthus hispidus* | 1 |
| purple sea urchin | *Arbacia punctulata* | 3 |
| red hake | *Urophycis chuss* | 39 |
| rough scad | *Trachurus lathami* | 1 |
| Scup | *Stenotomus chrysops* | 6,666 |
| silver hake | *Merluccius bilinearis* | 16 |
| smallmouth flounder | *Etropus microstomus* | 30 |

| Common Name | Scientific Name | Quantity Collected ( # of individuals) |
|---|---|---|
| smooth dogfish | *Mustelus canis* | 294 |
| Spot | *Leiostomus xanthurus* | 6 |
| spotted hake | *Urophycis regia* | 63 |
| striped bass | *Morone saxatilis* | 6 |
| striped searobin | *Prionotus evolans* | 366 |
| summer flounder | *Paralichthys dentatus* | 101 |
| surfclam | *Spisula solidissima* | 2 |
| Tautog | *Tautoga onitis* | 56 |
| Weakfish | *Cynoscion regalis* | 2,536 |
| windowpane flounder | *Scophthalmus aquosus* | 398 |
| winter flounder | *Pseudopleuronectes american* | 144 |
| winter skate | *Leucoraja ocellata* | 19 |
| **Total Individuals Collected** | | 31,046 |

NYSDEC conducts an annual Western Long Island Beach Seine Survey in the bays of western Long Island to tag sub-adult striped bass and estimate total annual survival rates. The surveys began in 1984 and have had consistent methodology starting in 1987. Other important commercial and recreational fish species are counted, identified, and measured along with the striped bass. Species sampled during the 2016 survey included alewife (*Alosa pseudoharengus*), American eel, American shad (*Alosa sapidissima*), Atlantic menhaden (*Brevoortia tyrannus*), Atlantic needlefish (*Strongylura marina*), Atlantic tomcod, bay anchovy, tautog (*Tautoga onitis*), black sea bass (*Centropristis striata*), blueback herring (*Alosa aestivalis*), bluefish, cunner (*Tautogolabrus adspersus*), feather blenny (*Hypsoblennius hentz*), fourspine stickleback (*Apeltes quadracus*), gizzard shad (*Dorosoma cepedianum*), grubby sculpin (*Myoxocephalus aenaeus*), hickory shad (*Alosa mediocris*), killifish sp. (*Fundulus* sp.), lined seahorse (*Hippocampus erectus*), naked goby (*Gobiosoma bosci*), northern kingfish, northern pipefish (*Syngnathus fuscus*), northern puffer, northern searobin, pinfish (*Lagodon rhombodies*), scup, northern stargazer (*Astroscopus guttatus*), oyster toadfish (*Opsanus tau*), seaboard goby (*Gobiosoma ginsburgi*), sheepshead minnow (*Cyprinodontidae variegatus variegatus*), smallmouth flounder (*Nematops microstom*), spot (*Leiostomus xanthurus*), spotted hake (*Urophycis regius*), striped anchovy (*Anchoa mitchilli*), striped burrfish (*Chilomycterus schoepfi*), striped searobin (*Prionotus evolans*), summer flounder, weakfish (*Cynoscion regalis*), white mullet (*Mugil curema*), white perch (*Morone americana*), windowpane flounder, and winter flounder.

### 2.3.2 Essential Fish Habitat

A description of the existing EFH species data, based on the National Marine Fisheries Service (NMFS) EFH assessment within the Study Area is included. Consultation with NMFS EFH will occur prior to issuance of the SGEIS and will be provided.

EFH data for Long Island Sound, Great South Bay, and the Atlantic Ocean is available on the NOAA EFH mapper website (National Oceanic and Atmospheric Administration, 2017). Additionally, the *Guide to Essential Fish Habitat Designations in the Northeastern US* was completed to provide a quick

reference to determine the species and life stages of fish, shellfish, and mollusks for which EFH has been designated in a particular area. The EFH assessment is included as Appendix E.

### 2.3.3 Threatened and Endangered Species

The USFWS, NOAA and New York State identify the sensitive biological species potentially present in the marine environment within their respective jurisdictions. Currently 14 federally listed species have the potential to occur at the reef sites, 12 of which are endangered and 2 are threatened. Sixteen state listed species have the potential to occur, of which 12 are endangered and 4 are threatened. In addition, 3 species of concern may occur, all of which are birds that may feed in the area. Table 2-11 identifies federally and state listed species with potential to occur at the reef sites.

**Table 2-11 Federally and State Listed Species**

| Common Name | Scientific Name | Federal Status | State Status | Atlantic Inshore/ Offshore | Great South Bay | Long Island Sound |
|---|---|---|---|---|---|---|
| Blue whale | *Balaenoptera musculus* | E | E | X | X | X |
| Fin whale | *Balaenoptera physalus* | E | E | X | | X |
| Humpback whale | *Megaptera novaeangliae* | E | E | X | | X |
| North Atlantic Right whale | *Eubalaena glacialis* | E | E | X | | X |
| Sei whale | *Balaenoptera borealis* | E | E | X | | X |
| Sperm whale | *Physeter macrocephalus* | E | E | X | | X |
| Green sea turtle | *Chelonia mydas* | T | T | X | X | X |
| Hawksbill sea turtle | *Eretmochelys imbricata* | E | E | X | X | X |
| Kemp's or Atlantic Ridley | *Lepidochelys kempii* | E | E | X | X | X |
| Leatherback | *Dermochelys coriacea* | E | E | X | X | X |
| Loggerhead | *Caretta caretta* | T | T | X | X | X |
| Atlantic sturgeon[1] | *Acipenser oxyrhynchus oxyrhynchus* | E,T | E | X | X | X |
| Shortnose Sturgeon | *Acipenser brevirostrum* | E | E | X | X | X |
| Black Skimmer | *Rynchops niger* | N/A | SC | X | X | X |
| Common loon | *Gavia immer* | N/A | SC | | X | |

| Common Name | Scientific Name | Federal Status | State Status | Atlantic Inshore/ Offshore | Great South Bay | Long Island Sound |
|---|---|---|---|---|---|---|
| Common tern | *Sterna hirundo* | N/A | T | X | X | X |
| Least tern | *Sternula antillarum* | N/A | T | X | X | X |
| Osprey | *Pandion haliaetus* | N/A | SC | | X | X |
| Roseate tern | *Sterna dougallii dougallii* | E | E | X | X | X |

E = Endangered, T = Threatened, SC = Special Concern, N/A = Not Applicable

[1]-Atlantic sturgeon have five distinct population segments (DPS). The New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPSs are federally listed as endangered while the Gulf of Maine DPS is federally listed as threatened (Melnychuk, Dunton, Jordaan, McKown, & Frisk, 2016).

**Atlantic Ocean Reefs**

Atlantic sturgeon have five distinct population segments (DPS). The New York Bight, Chesapeake Bay, Carolina, and South Atlantic DPS are federally listed as endangered while the Gulf of Maine DPS is federally listed as threatened (Melnychuk, Dunton, Jordaan, McKown, & Frisk, 2016). Genetic testing of sturgeon collected during trawl surveys off the coast of Long Island indicate that the majority of fish collected (87%) were from the endangered New York Bight DPS, and the majority of these originated in the Hudson River (O'Leary, Dunton, King, Firsk, & Chapman, 2014).

In the New York Bight, adult Atlantic sturgeon make spring spawning migrations to the freshwater portions of coastal rivers. Outside of spawning seasons, adult and sub-adult Atlantic sturgeon reside in marine habitats and are generally found in waters less than 50m. Sub-adult Atlantic sturgeon have been shown to have a significant preference for depths of <20m while in the marine environment (Dunton et al. 2015). Atlantic sturgeon move broadly throughout the season, with occurrence peaks in spring and fall, and sturgeon are less common along Long Island in summer (Dunton et al. 2015). (Melnychuk, Dunton, Jordaan, McKown, & Frisk, 2016). Therefore, Atlantic Sturgeon may be present in the reef areas but are likely less common in summer.

In addition to federally and state listed marine mammals, marine mammals are also protected under the Marine Mammal Protection Act. Non-listed marine mammals that occur within the Atlantic Ocean inshore and offshore reef sites include the pygmy-sperm whale (*Kogia breviceps*), northern minke whale (*Balaenoptera acutorostrata*), bottlenose dolphin (*Tursiops truncates*), short-beaked common dolphins (*Delphinus deplphis*), and harbor seals (*Phoca vitulina*) (United States Army Corps of Engineers, 2016). In addition, the North Atlantic right whale has the potential to exist at offshore reef sites.

The OBIS-SEAMAP provides density models prepared by the United States Navy in 2007 and updated in 2012 (OBIS, 2012). Minke whales were sighted throughout the Atlantic offshore sites. There were 50 bottlenose dolphins sighted south of Rockaway reef in 2010 (OBIS, 2012). Bottlenose dolphin have been documented at Atlantic Beach reef (Kagueux, Wikgren, & Kenney, 2010) (Wirth and Warren 2019). Harbor porpoise (*Phocoena phocena*) were identified multiple times throughout the Atlantic Ocean reef areas from 1986 to 2006. One humpback whale was sighted near Atlantic Beach reef in

1988. Harbor seals (*Phoca vitulina vitulina*) occur from September through late May along the coast of Long Island and are commonly recorded near Cupsogue Beach (near the Moriches reef) from November to mid-May (NOAA 2019) (CRESLI 2018) (Coastal Research and Education Society of Long Island, Inc., 2003).

The North Atlantic Right Whale Consortium (NARWC) manages and updates observation data within the New York Offshore Planning Area, which extends from 1,500 feet off the southern shore of Long Island and New York City to the edge of the continental shelf, with data spanning from 1978 to 2006. Small-toothed whales, large toothed whales, and cetaceans had relatively low abundances throughout the Atlantic Ocean reef sites. Endangered baleen whales had a low relative abundance, with the exception of Twelve Mile reef, where baleen whales had a medium abundance (Kagueux, Wikgren, & Kenney, 2010).

Several species of sea turtles have the potential to be found within the New York Bight continental shelf. These species include loggerhead sea turtle, green sea turtle, hawksbill sea turtle, leatherback sea turtle, and Kemp's ridley sea turtle (New York State Department of State, 2013). The New York Offshore Atlantic Ocean Study (2013) documented 1,640 observations of sea turtles in the New York Bight, with the majority being loggerhead sea turtles (1,236 observations) and the remaining observations consisting of a combination of green sea turtle, hawksbill sea turtle, leatherback sea turtle, and Kemp's ridley sea turtle (New York State Department of State, 2013). Sea turtles typically utilize the New York Bight as a migratory path between feeding grounds and nesting sites (New York State Department of State, 2013). Sea turtles are unlikely to be found in the area of the Atlantic Ocean inshore reef sites, and if observed would be in the summer to fall timeframe as they move through to other foraging grounds (New York State Department of State, 2013). New York waters are typically "nursery" grounds for young, immature turtles. There are no known nesting locations along southern Long Island so any turtles observed would be migrating through the area (New York State Department of Environmental Conservation, 2005).

**Great South Bay Reefs**

Potential federally and state listed species are included in Table 2-11. Minke whale occur in nearshore waters throughout the year and bottlenosed dolphin occur within the Great South Bay during summer and fall. Harbor seals occur frequently within Great South Bay in winter and use haulout sites along both sides of Fire Island Inlet, and Grey seal (*Halichoerus grypus*) have been sighted in the same areas (USFWS 1997). Harbour porpoise sightings in Great South Bay have occurred during April and May (Sadove and Cardinale 1993). Juvenile Atlantic ridley sea turtles, juvenile loggerhead turtles, and juvenile and adult green sea turtles regularly use Great South Bay (USFWS 1997).

**Long Island Sound Reefs**

Harbor seals, bottlenose dolphin and humpback, fin, and the North Atlantic right whales have the potential to occur in Long Island Sound waters (Waring et. al 2012) (Coastal Research and Education Society of Long Island, Inc., 2003). Harbour porpoise sightings in Long Island Sound have occurred from January to March (Sadove and Cardinale 1993).

Several species of sea turtles have the potential to be found within the Long Island Sound. These species include loggerhead sea turtle, green sea turtle, hawksbill sea turtle, and Kemp's ridley sea turtle (New York State Department of Environmental Conservation, 2005).

# 2.4 Human

## 2.4.1 Commercial Fishing

**Atlantic Ocean Inshore Reefs**

Commercial fishing occurs throughout the Atlantic Ocean inshore reef sites areas for fluke, skate, sand dab, squid, bluefish, striped bass, butterfish, black sea bass, tautog, monkfish, sea scallops, surfclams, and whiting. Various gear types including dredges, gillnets, and trawls are used by commercial fishers near the Atlantic Ocean inshore reef sites (Scotti, Stent, & Gerbino, 2012). The annual trawl efforts in the vicinity of Atlantic Ocean inshore reef sites are summarized in Table 2-12. Commercial state vessel trip reports (VTR) provided by the NYSDEC document the species caught from 2011 through 2016. These species included American eel, Atlantic cod (*Gadus morhua*), Atlantic menhaden, black sea bass, tautog, bluefish, conger eel, gray triggerfish, northern puffer, oyster toadfish, pollock (*Pollachius virens*), red hake, scup, smooth dogfish, searobin, striped bass, summer flounder, common thresher shark (*Alopias vulpinus*), weakfish, and winter flounder.

The 2012 NYSDEC Surfclam Assessment Report reported surfclam estimates from Rockaway to Montauk Point. The surfclam population assessment from 2002 was 18.6 million industry bushels and by 2005 the population declined to 10.1 million industry bushels (NYSDEC 2013). Subsequent surveys confirmed that through 2012 show a continued decline in surfclam numbers and biomass (to 5.2 million industry bushels in 2012) in the Atlantic Ocean south of Long Island. Areas sampled from 0-2 miles from shore between Rockaway Inlet and Jones Inlet, from 1-2 miles from shore between Jones Inlet and Fire Inlet, and from 0-1 mile from shore between Fire Inlet and Moriches Inlet had a greater degree of biomass loss (NYSDEC 2013). There has also been a shift in age abundance toward a greater proportion of the population consisting of older clams and decline in younger clams (NYSDEC 2013).

**Table 2-12. Annual Trawl Effort in the Vicinity of Atlantic Ocean Inshore Reefs**

| Atlantic Ocean Inshore Reefs | Annual Trawl Effort (days) |
|---|---|
| Rockaway Reef | 1,000 – 5,000 |
| McAllister Grounds Reef | 10,000 – 25,000 |
| Fire Island Reef | 1,000 – 5,000 |
| Moriches Reef | 5,000 – 10,000 |
| Shinnecock Reef | 25,000 – 79,000 |

*Source*: (Scotti, Stent, & Gerbino, 2012)

**Atlantic Ocean Offshore Reefs**

Commercial fishing occurs throughout the Atlantic Ocean near the offshore reef sites for fluke, skate, sand dab, squid, bluefish, striped bass, butterfish, black sea bass, tautog, monkfish, sea scallops, and whiting. Various gear types including dredges, gillnets, and trawls are used by commercial fishers near the Atlantic Ocean inshore reef sites (Scotti, Stent, & Gerbino, 2012). The annual trawl efforts in the vicinity of Atlantic Ocean offshore reef sites are summarized in Table 2-13. Commercial state VTR data provided by the NYSDEC document species caught within offshore reef areas from 2011 through

2016. These species included albacore tuna (*Thunnus alalunga*), amberjack (*Carangidae spp.*), American eel, American shad (*Alosa sapidissima*), Atlantic bonito (*Sarda sarda*), Atlantic cod, Atlantic croaker, Atlantic herring, Atlantic mackerel, Atlantic menhaden, bigeye thresher (*Alopias superciliosus*), bigeye tuna (*Thunnus obesus*), black sea bass, tautog, whiting, bluefin tuna (*Thunnus thynnus*), bluefish, butterfish, conger eel, dolphinfish (*Coryphaena hippurus*), American goosefish (*Lophius americanus*), gray triggerfish, little tunny (*Euthynnus alletteratus*), longfin squid, northern kingfish, northern puffer, oyster toadfish, pollock, red hake, scup, spot (*Leiostomus xanthurus*), silver hake, skipjack tuna (*Katusuwonus pelamis*), smooth dogfish, summer flounder, striped bass, swordfish, shortfin mako (*Isurus oxyrinchus*), tigershark (*Galeocerdo cuvier*), common thresher shark, tilefish, weakfish, white hake (*Urophycis tenuis*), white marlin (*Kajikia albidusi*), winter flounder, windowpane flounder, winter skate, yellowfin tuna (*Thunnus albacares*), and yellowtail flounder (*Pleuronectes ferruginea*).

### Table 2-13. Annual Trawl Effort in the Vicinity of Atlantic Ocean Offshore Reefs

| Atlantic Ocean Offshore Reefs | Annual Trawl Effort (days) |
|---|---|
| Sixteen Fathom Reef | 1,000 – 5,000 |
| Twelve Mile Reef | 1,000 – 5,000 |
| Hempstead Reef | 5,000 – 10,000 |
| Atlantic Beach Reef | 10,000 – 25,000 |

*Source:* (Scotti, Stent, & Gerbino, 2012)

**Great South Bay Reefs**

Commercial fishing occurs throughout the Great South Bay, primarily out of the Captree port, for fluke, black sea bass, scup, bluefish, and cod. Hook and line are primarily used on boats out of Captree, but dredge, gillnet, and trawl gear types may also be used for commercial fishing near the Great South Bay reef sites (Scotti, Stent, & Gerbino, 2012). Atlantic menhaden, Atlantic silverside, tautog, longfin squid, striped bass, Spanish mackerel, spot, summer flounder, weakfish, and winter flounder species were all documented catches at Great South Bay Reefs (NYSDEC, Reef landings, 2016).

**Long Island Sound Reefs**

Information on shellfish harvests is discussed in the 2012 LISS Health Report and additional information on oyster, hard clam, lobster, and horseshoe crab harvests is available on the LISS website. Lobster harvests have declined dramatically since 1999 when the harvest peaked at over 8 million pounds, with harvests of less than 200,000 pounds per year from 2013 to 2015 (LISS 2019). Commercial oyster harvests peaked in 1992 with nearly 120,000 bushels harvested in New York water of Long Island Sound, then declined due to a parasitic disease to harvest less than 9,000 bushels in 1999 (LISS 2019). Harvests in New York waters have fluctuated between 2000 and 2010, but have averaged around 37,000 bushels a year over that period. Other invertebrates commercially harvested in the sound include oyster, clams, horseshoe crab, squid and whelk. Commercial shellfish activity in New York is focused on wild harvest, with a small percentage of grounds cultivated for oysters and clams under lease (Long Island Sound Inventory and Science Subcommittee of the Blue Plan Advisory Committee, 2018). The total bushels of all types of shellfish (oysters, clams, mussels, scallops) from

designated LIS harvest areas were provided by the NYSDEC Shellfish Management Unit from 2010 through 2017 (New York State Department of Environmental Conservation, 2019). Table 2-14 below provides the shellfish harvest area and total number of bushels of shellfish harvested within the vicinity of the artificial reef sites. The area of the reef sites represents a negligible percentage of the total shellfish harvest areas in Long Island Sound, less than 1%.

**Table 2-14. Shellfish Harvest Totals for the Long Island Sound Artificial Reef Sites.**

| Artificial Reef Site | Shellfish Harvest Area | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | Total |
|---|---|---|---|---|---|---|---|---|---|---|
| **Matinecock & Huntington/ Oyster Bay** | LS1 | 5,438 | 12,012 | 24,489 | 53,927 | 74,666 | 51,942 | 44,136 | 34,731 | 301,340 |
| **Huntington/ Oyster Bay** | NS2 | 65,177 | 58,625 | 77,788 | 103,888 | 96,258 | 98,684 | 100,884 | 73,899 | 675,203 |
| **Huntington/ Oyster Bay** | NS3 | 22,526 | 12,783 | 12,121 | 23,348 | 46,160 | 28,444 | 27,284 | 20,240 | 192,907 |
| **Smithtown** | NS4 | 4,189 | 1,600 | 2,770 | 4,012 | 4,867 | 4,577 | 4,069 | 2,855 | 28,939 |
| **Port Jefferson/ Mount Sinai** | NS5 | 8,767 | 6,547 | 9,624 | 13,941 | 14,669 | 11,813 | 5,295 | 3,803 | 74,458 |
| **Port Jefferson/ Mount Sinai and Mattituck** | LS2 | 183 | 2,452 | 5,244 | 7,380 | 6,923 | 4,656 | 5,686 | 3,319 | 35,843 |
| **Mattituck** | NS7 | 13 | 241 | 888 | 814 | 3,691 | 338 | 658 | 916 | 7,559 |

*Source:* (New York State Department of Environmental Conservation, 2019)

Many commercially important finfish such as flounder species, scup and striped bass are also found in the Sound (Long Island Sound Study, 2017). A commercial fishing ban is in place for Atlantic sturgeon, American shad, and anadromous river herring (New York State Department of Environmental Conservation, 2018). NYSDEC collects data for commercial fishing within New York State Marine Fishing Areas. American eel, American lobster, Atlantic menhaden, bay anchovy, black sea bass, tautog, bluefish, cunner, filefish (*Monacanthidae spp.*), oyster toadfish, scup, summer flounder, smooth dogfish, striped bass, triggerfish, weakfish, windowpane flounder, and winter flounder were the majority of the species commercially collected from 2011-2016 (New York State Department of Environmental Conservation, 2017).

## 2.4.2 Recreational Fishing

**Atlantic Ocean Inshore Reefs**

Recreational state VTR's provided by the NYSDEC document the species caught from 2011 through 2016. Recreational VTR's only cover party/charter boat fishing and are not required by private recreational fishers. Recreational species caught include all commercially fished species (see Commercial Fishing section) in addition to albacore tuna, Atlantic mackerel, bluefin tuna, dolphinfish,

goosefish, little tunny, ocean pout (*Zoarces americanus*), shortfin mako, American dab (*Hippoglossoides platessoides*), and yellowtail flounder.

NYSDEC has conducted aerial surveys from 1995-present to document vessels on the artificial reef that are recreationally fishing or diving. Boats are classified as either small or large recreational fishing vessels. The survey occurs on all currently permitted artificial reef sites except for Twelve Mile Reef. Table 2-15 presents the total number of boats participating in recreational fishing, small and large, counted near the Atlantic Ocean inshore reef sites for the years 2016-2019 (New York State Department of Environmental Conservation, 2017).

**Table 2-15. Number of Recreational Boats Counted During NYSDEC Aerial Boat Count 2016-2019, Atlantic Inshore Reefs**

| Atlantic Ocean Inshore Reefs | 2016 | | | | | | | | 2017 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | May 19 | Jun 4 | Jun 19 | Jul 15 | Jul 22 | Aug 4 | Sep 16 | Sep 17 | Jun 1 | Jul 19 | Aug 17 | Aug 20 | Oct 6 | Oct 21 |
| Rockaway | 6 | 1 | 15 | 16 | 7 | 4 | 12 | 5 | 2 | 5 | 6 | 25 | 5 | 49 |
| McAllister Grounds | 3 | 2 | 37 | 17 | 27 | 15 | 5 | 5 | 1 | 2 | 3 | 19 | 1 | 27 |
| Fire Island | 4 | 3 | 28 | 6 | 12 | 11 | 10 | 6 | 4 | 6 | 2 | 45 | 0 | 12 |
| Moriches | 0 | 0 | 1 | 4 | 0 | 2 | 2 | 5 | 0 | 2 | 0 | 11 | 0 | 12 |
| Shinnecock | 1 | 0 | 2 | 15 | 8 | 19 | 14 | 15 | 3 | 6 | 5 | 29 | 0 | 27 |

| Atlantic Ocean Inshore Reefs | 2018 | | | 2019 | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Jun 29 | Aug 24 | Aug 25 | Aug 20 | Aug 24 | Sep 27 | Oct 25 | Nov 3 | |
| Rockaway | 8 | 47 | 58 | 7 | 17 | X | 31 | 8 | 334 |
| McAllister Grounds | 5 | 22 | 31 | 2 | 1 | 8 | 12 | 9 | 259 |
| Fire Island | 8 | 31 | 57 | 13 | 20 | 8 | 63 | 2 | 356 |
| Moriches | 0 | 12 | 11 | 1 | 18 | 2 | 9 | 7 | 99 |
| Shinnecock | 7 | 39 | 62 | 16 | 37 | 7 | 5 | 4 | 313 |

Note: Numbers may include some commercial fisherman who use rod and reel as these are not distinguishable using this type of survey.

X – Airport flight restriction in effect at site area. Was unavailable for vessel count observation.

### Atlantic Ocean Offshore Reefs

Recreational state VTR's for party/charter boat fishing provided by the NYSDEC document the species caught from 2011 through 2016 within offshore reef areas. Recreational species caught at the offshore reefs include albacore tuna, Atlantic bonito, Atlantic cod, Atlantic croaker, tautog, black sea bass, bluefish, blue shark (*Prionace glauca*), cunner, dolphinfish, filefish, little tunny, longfin mako (*Isurus paucus*), northern kingfish, northern puffer, king mackerel, ocean pout, red hake, scup, silver hake, spot, shortfin mako, skipjack tuna, striped bass, summer flounder, common thresher shark, tilefish, triggerfishes, weakfish, white marlin, white perch, winter flounder, and yellowfin tuna. Table 2-16 presents the total number of boats participating in recreational fishing, small and large, counted on or near the existing Atlantic Ocean offshore reef sites for

the years 2016-2019 (New York State Department of Environmental Conservation, 2017). There is no data for Twelve Mile Reef because the survey does not cover this reef. Data from Marine Cadastre National Viewer were used to approximate the number of vessel trips from 2015 through 2017 for Twelve Mile Reef and the proposed Sixteen Fathom artificial reef sites (Table 2-17).

### Table 2-16. Number of Boats Counted During NYSDEC Aerial Boat Count 2016-2019, Atlantic Offshore Reefs

| Atlantic Ocean Offshore Reefs | 2016 | | | | | | | | 2017 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | May 19 | Jun 4 | Jun 19 | Jul 15 | Jul 22 | Aug 4 | Sep 16 | Sep 17 | Jun 1 | June 15 | Jul 19 | Aug 17 | Aug 20 | Oct 3 | Oct 21 |
| Atlantic Beach | 4 | 4 | 9 | 15 | 47 | 14 | 5 | 5 | 1 | 0 | 2 | 4 | 46 | 0 | 39 |
| Hempstead | 1 | 2 | 8 | 20 | 6 | 12 | 4 | 8 | 3 | 4 | 2 | 5 | 36 | 2 | 17 |

| Atlantic Ocean Offshore Reefs | 2018 | | | 2019 | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | June 29 | Aug 24 | Aug 25 | Aug 20 | Aug 24 | Sep 27 | Oct 25 | Nov 3 | |
| Atlantic Beach | 7 | 40 | 65 | 6 | 18 | X | 42 | 18 | 391 |
| Hempstead | 3 | 75 | 71 | 20 | 10 | 8 | 14 | 8 | 339 |

Note: Numbers may include some commercial fisherman who use rod and reel as these are not distinguishable using this type of survey.

X – Airport flight restriction in effect at site area. Was unavailable for vessel count observation.

### Table 2-17. All Vessel Transit Counts 2015-2017, Proposed Atlantic Offshore Reefs

| Atlantic Ocean Offshore Reefs | 2015 | 2016 | 2017 |
|---|---|---|---|
| Sixteen Fathom | 1-25 | 1-25 | 1-25 |
| Twelve Mile | 1-25 | 1-25 | 1-25 |

*Source:* (United States Department of Commerce, NOAA, National Ocean Service, Office of Coastal Management, 2017)

### Great South Bay Reefs

Recreational fish species caught from 2011 through 2016 within the Great South Bay reef areas include black sea bass, tautog, bluefish, gray triggerfish, red hake, scup, smooth dogfish, striped bass, summer flounder, searobin, weakfish, and windowpane flounder (NYSDEC, Reef landings, 2016). Table 2-18 presents the total number of boats participating in recreational fishing, small and large, counted near the existing Great South Bay reef sites for the years 2016-2019 (New York State Department of Environmental Conservation, 2017).

**Table 2-18. Number of Boats Counted During NYSDEC Aerial Boat Count 2016-2019, Great South Bay Reefs**

| Great South Bay Reefs | 2016 | | | | | | | | 2017 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | May 19 | Jun 4 | Jun 19 | Jul 15 | Jul 22 | Aug 16 | Sep 16 | Sep 17 | Jun 1 | Jun 15 | Jul 19 | Aug 17 | Aug 20 | Oct 3 | Oct 21 |
| Yellowbar | 2 | 1 | 4 | 4 | 4 | 13 | 5 | 10 | 4 | 1 | 1 | 0 | 3 | 2 | 2 |
| Kismet | 5 | 5 | 4 | 2 | 5 | 7 | 5 | 2 | 2 | 2 | 1 | 0 | 0 | 2 | 16 |

| Great South Bay Reefs | 2018 | | | 2019 | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Jun 29 | Aug 24 | Aug 25 | Aug 20 | Aug 24 | Sep 27 | Oct 25 | Nov 3 | |
| Yellowbar | 8 | 1 | 1 | 0 | 2 | 2 | 3 | 1 | 74 |
| Kismet | 16 | 1 | 1 | 1 | 3 | 4 | 4 | 8 | 96 |

Note: Numbers may include some commercial fisherman who use rod and reel as these are not distinguishable using this type of survey.

### Long Island Sound Reefs

The 2012 LISS Sound Health report provides information on recreational anglers, indicating that according to NOAA approximately 7.4 million fish were caught in Long Island Sound by recreational anglers (Long Island Sound Study, 2012). Fish species caught by recreational anglers in Long island Sound include Atlantic menhaden, black sea bass, tautog, bluefish, cunner, oyster toadfish, scup, smooth dogfish, striped bass, summer flounder, searobin sp., weakfish, and winter flounder (NYSDEC, Reef landings, 2016). These anglers took 2.15 million boat trips in 2011. Overall, recreational boating density is high within Long Island Sound and near Matinecock and Smithtown reefs.

Table 2-19 presents the total number of boats participating in recreational fishing, small and large, counted near the existing Long Island Sound reef sites for the years 2016-2019 (New York State Department of Environmental Conservation, 2017). Table 2-20 provides the approximate vessel counts for the proposed Long Island Sound reef sites from 2015 through 2017 using the Marine Cadastre National Viewer. These counts include all vessel traffic within the vicinity of the three proposed reef sites.

## Table 2-19. Number of Boats Counted During NYSDEC Aerial Boat Count 2016-2019, Long Island Sound Reefs

| Long Island Sound Reefs | 2016 | | | | | | | | 2017 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | May 19 | Jun 4 | Jun 19 | Jul 15 | Jul 22 | Aug 4 | Sep 16 | Sep 17 | Jul 1 | Jun 15 | Jul 19 | Aug 17 | Aug 20 | Oct 3 | Oct 21 |
| **Matinecock** | 0 | 3 | 7 | 3 | 3 | 1 | 3 | 3 | 1 | 2 | 2 | 0 | 4 | 3 | 5 |
| **Smithtown** | 3 | 1 | 0 | 1 | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 2 | 3 | 1 | 7 |

| Long Island Sound Reefs | 2018 | | | 2019 | | | | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | Jun 29 | Aug 24 | Aug 25 | Aug 20 | Aug 24 | Sep 27 | Oct 25 | Nov 3 | |
| **Matinecock** | 5 | 5 | 8 | 1 | 2 | 3 | 5 | 5 | 74 |
| **Smithtown** | 1 | 3 | 4 | 1 | 1 | 0 | 7 | 1 | 49 |

Note: Numbers may include some commercial fisherman who use rod and reel as these are not distinguishable using this type of survey.

## Table 2-20. All Vessel Transit Counts 2015-2017, Proposed Long Island Sound Reefs

| Long Island Sound Reefs | 2015 | 2016 | 2017 |
|---|---|---|---|
| **Huntington/Oyster Bay** | 26-50 | 76-100 | 76-100 |
| **Port Jefferson/Mount Sinai** | 1-25 | 1-25 | 26-50 |
| **Mattituck** | 1-25 | 1-25 | 1-25 |

*Source:* (United States Department of Commerce, NOAA, National Ocean Service, Office of Coastal Management, 2017)

### 2.4.3 Recreational Diving

Recreational diving is an important activity in the coastal waters around Long Island. Artificial reefs provide additional opportunities for divers to enjoy the underwater environment. Divers utilize artificial reef sites to observe and photograph marine life and for underwater fishing. Although data is not available to quantify the number of dives at each artificial reef site, divers are known to have utilized various artificial reef sites including Rockaway, McAllister Grounds, Fire Island, Moriches, Shinnecock, Atlantic Beach, and Hempstead reefs (Point 97, 2015). Deployment of additional materials and the creation of new reef sites will create additional locations for divers to utilize meeting the project purpose and need.

### 2.4.4 Environmental Justice

The NYSDEC's Office of Environmental Justice addresses environmental justice issues related to minority, low-income, and Native American communities.

The Proposed Action takes place away from these communities and adverse impacts on minority or low-income populations are not anticipated as a result of reef construction and expansions. The Proposed Action may positively affect these communities by increasing tourism and creating more recreational opportunities.

### 2.4.5 Socioeconomics

Artificial reefs provide a location where recreational anglers and divers can take advantage of aggregated populations of marine species for fishing or viewing. Reefs have shown to be beneficial to the local economies through economic activity such as increased expenditures, tax revenues, incomes and jobs (market values) associated with recreational and commercial fishing and diving (Adams et al. 2006) (Pendleton 2004). In addition, reefs provide the value of additional and improved recreational opportunities that may not be apparent in the market (non-market values) (Pendleton 2004). Non-market value has been demonstrated and beaches, parks, and natural dive sites have been shown to generate substantial economic value to local communities beyond the expenditures generated by these resources (Cesar 2000 and Pendleton 1995).

Across the country economic expenditures (market value) by recreational divers on artificial reefs have been shown to range from $64 per person-day in California, to as high as $223 per person-day in Florida, while non-market value ranged from $10 to $75 per person-day (Pendleton 2004). Florida has currently deployed approximately 2,700 artificial reefs that have resulted in increased use by recreational divers and anglers. In Southwest Florida alone, use of artificial reefs resulted in annual expenditures of over $253 million, with over $90 million related to the for-hire fishing sector (guides, charter, and party boats) (Adams et al. 2006).

Elsewhere around the world, artificial reefs have enhanced recreational fishing revenues in Taiwan. One study documented yearly economic values of boat fishing and scuba diving to be $37 million and $52 million, respectively and concluded that the development of recreation activities on and around artificial reefs would provide substantial economic benefit (Chen et al. 2013).

NOAA established the Economics: National Ocean Watch (ENOW) that contains data on the revenue of business activities associated with marine construction, living resources, offshore mineral extraction, ship and boat building, tourism and recreation, and marine transportation, which creates the total ocean economy. In the Long Island communities near the reef sites, the ocean economy

directly accounts for a portion of the economy as do establishments related to the ocean economy. The tourism and recreation sector and marine transportation account for a large portion of the local economies.

### 2.4.6 Cultural Resources

**Atlantic Ocean and Great South Bay Reefs**

According to the OPRHP Cultural Resources Information System (CRIS), no historic or archeological sites are present within the Atlantic Ocean or Great South Bay reef sites (New York State Office of Parks, Recreation, and Historic Preservation, 2017). Consultation with NYSHPO is provided in Appendix H.

BOEM conducted a study within the Atlantic OCS (from 3 miles to the Economic Exclusion Zone) to gather information on historic shipwrecks, past landscapes, human settlement patterns, and site formation and preservation conditions for the development of offshore wind planning. Large expanses of the continental shelf were dry during the last glacial maximum and are now submerged. The report indicates that the outer continental shelf off the south shore of Long Island has a high sensitivity to include submerged settlements of Paleoindian and later periods, from 70 meters to more shallow areas (TRC Environmental Corporation, 2012). Any Paleoindian sites would be subsurface.

While several wrecks were found in proximity to various reef sites, no historic shipwrecks were found on any of the Atlantic and Great South Bay reef sites (NOAA Database). Nearby wrecks include the vessel Mistletoe near Rockaway reef and the Zeeliner wreck near Fire Island reef. Various other obstructions and wrecks are found near McAllister Grounds, Moriches, and Shinnecock reefs. Consultation with NYSHPO is provided in Appendix H.

The tugboat Fran S sank in Jones Inlet in the 1970's, was salvaged and towed to the Atlantic Beach reef and purposefully re-sunk two years later (Aqua Explorers, Inc., n.d.). Two unknown obstructions are in the vicinity of Atlantic Beach reef (National Oceanic and Atmospheric Administration, 2017). The Andy Pierce shipwreck is located close to Hempstead reef, in addition to several unknown obstructions (National Oceanic and Atmospheric Administration, 2017). Consultation with NYSHPO is provided in Appendix H.

**Long Island Sound**

According to the New York State OPRHP CRIS, no historic or archeological sites are present within the Long Island reef sites (New York State Office of Parks, Recreation, and Historic Preservation, 2017). Shipwreck data were readily available through NOAA's Office of Coast Survey Wrecks and Obstructions Database (National Oceanic and Atmospheric Administration, 2017). There are approximately 7 shipwrecks within the Port Jefferson/Mount Sinai reef placement area and 25 within the vicinity of the proposed Huntington/Oyster Bay reef. There are no shipwrecks located near the proposed Mattituck reef.

The waters of Huntington and Oyster Bay are assessed as having high archaeological sensitivity due to submerged Paleoindian settlements (United States Army Corps of Engineers, 2010). The Long Island Sound Blue Plan inventoried available historic and archaeological data sources and was unable to identify data for submerged or coastal locations recognized by tribes as having historical or cultural significance (Long Island Sound Inventory and Science Subcommittee of the Blue Plan Advisory Committee, 2018). Additional data on historic shipwrecks and Paleoindian cultural resources located in or near the Long Island Sound reef sites is not readily available and will be acquired through consultation with NYSHPO (Appendix H).

## 2.4.7 Marine Disposal of Waste

There are no marine waste disposal sites located near the existing or proposed reef sites (National Oceanic and Atmospheric Administration, 2017). The marine ocean disposal sites can be seen in relation to the reef sites in Figure 2-13 below (United States Department of Commerce, NOAA, National Ocean Service, Office of Coastal Management, 2017).

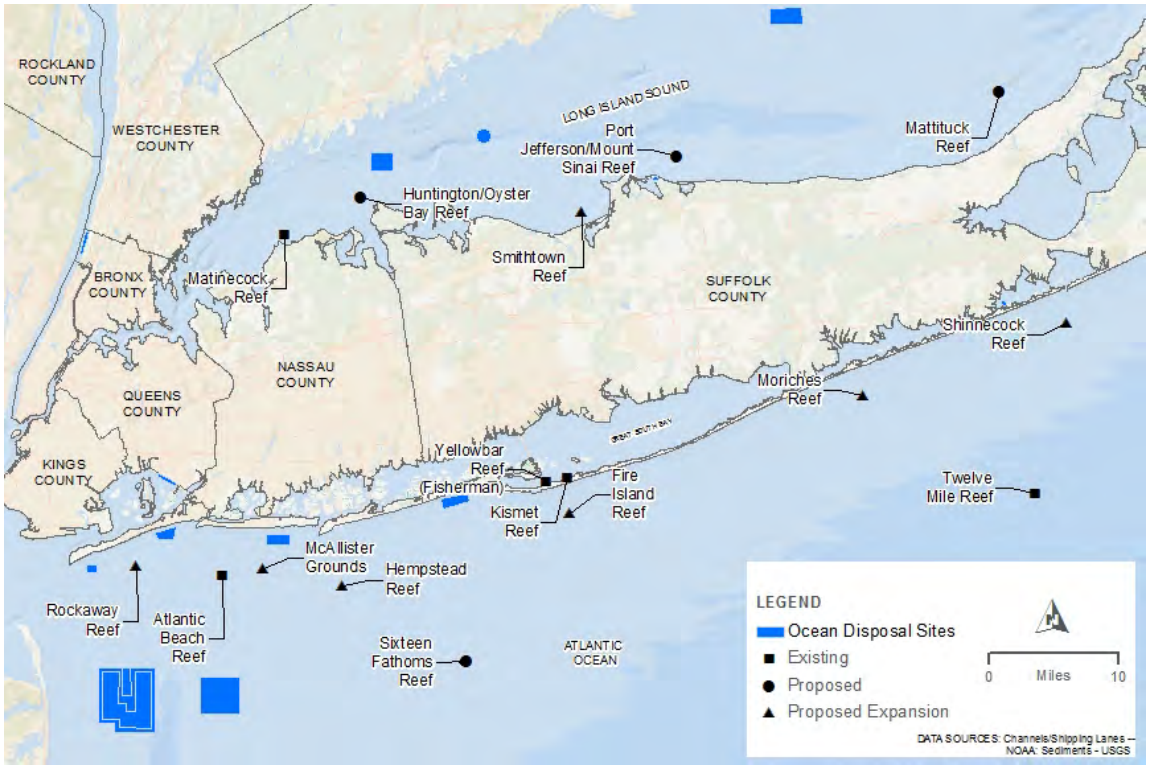



**Figure 2-13. Marine Ocean Disposal Sites in Relation to the Artificial Reef Sites.**

## 2.4.8 Dredging, sand and gravel mining

There are no dredging, sand, or gravel mining areas or borrow areas within the Atlantic Ocean, Great South Bay or Long Island Sound reef sites.

## 2.4.9 Navigation

**Atlantic Ocean and Great South Bay Reefs**

State and federal navigation channels are provided in Figure 2-10. There are no state and federal navigation channels in the vicinity of the Atlantic Ocean or Great South Bay reef sites.

Rockaway reef, Atlantic Beach reef and McAllister Grounds are approximately 4.3, 7.4, and 10.4 nm from the Ambrose channel, respectively. Rockaway reef and Atlantic Beach reef are located within a precautionary area for the Nantucket to Ambrose shipping lane. Fire Island is approximately 6 miles from the Fox Creek Channel, which is located within the Great South Bay.

Hempstead reef is approximately 1.7 nm from the Nantucket to Ambrose shipping lane, Twelve Mile Reef is approximately 4.3 nm from the Nantucket to Ambrose shipping lane, and the proposed Sixteen Fathoms reef site would be located between the Nantucket to Ambrose and Ambrose to Nantucket shipping lanes. Yellowbar and Kismet are 3.5 and 4.3 nm from the Oak Island Channel, respectively.

**Long Island Sound Reefs**

The Matinecock reef site is approximately 3.4 nm from the Glen Cove Creek navigation channel. Smithtown reef is approximately 1.7 nm from the Stony Brook Harbor navigation channel, and the proposed Port Jefferson/Mount Sinai reef site is approximately 2.6 nm from the Port Jefferson Harbor channel. The proposed Mattituck reef site is approximately 2.6 nm from the Mattituck Inlet Channel. The proposed Huntington/Oyster Bay reef is approximately 6nm northwest from an unnamed channel. Coordination with the U.S. Coast Guard will be conducted prior to siting any expansions or new artificial reef locations.

### 2.4.10 Offshore Energy

**Atlantic Ocean and Great South Bay Reefs**

Cable and pipeline GIS shapefiles were reviewed and mapped in the vicinity of the Atlantic Ocean and Great South Bay reef sites (Figure 2-14). A cable/pipeline area is located below the southwestern edge of Rockaway reef that prohibits dragging. An adjacent submarine cable with unknown spatial information was verified in June 2009. This same submarine cable, as well as two other submarine cables verified in 2009 and 2001, are located below the Atlantic Beach and Hempstead reef sites and are in a range of 0.14 nm and 0.57 nm of the McAllister Grounds expansion area. Twelve Mile reef is approximately 0.43 nm from a submarine cable. The proposed Sixteen Fathoms reef site has a submarine cable approximately 0.75 nm north and east of the site's northeast corner.

There are no submarine cables or pipeline areas within one nm of Yellowbar, Kismet, Fire Island, Moriches, or Shinnecock reefs.

There are no mapped BOEM Lease areas within 15 nm of the Atlantic Ocean inshore or Great South Bay reef sites or within 2 nm of the Atlantic Ocean Offshore reefs (Figure 2-15). Twelve Mile reef is approximately 2.6 nm from a BOEM Planning Area and the proposed Sixteen Fathoms reef is 4.6 nm from the BOEM Lease Area (Figure 2-15).

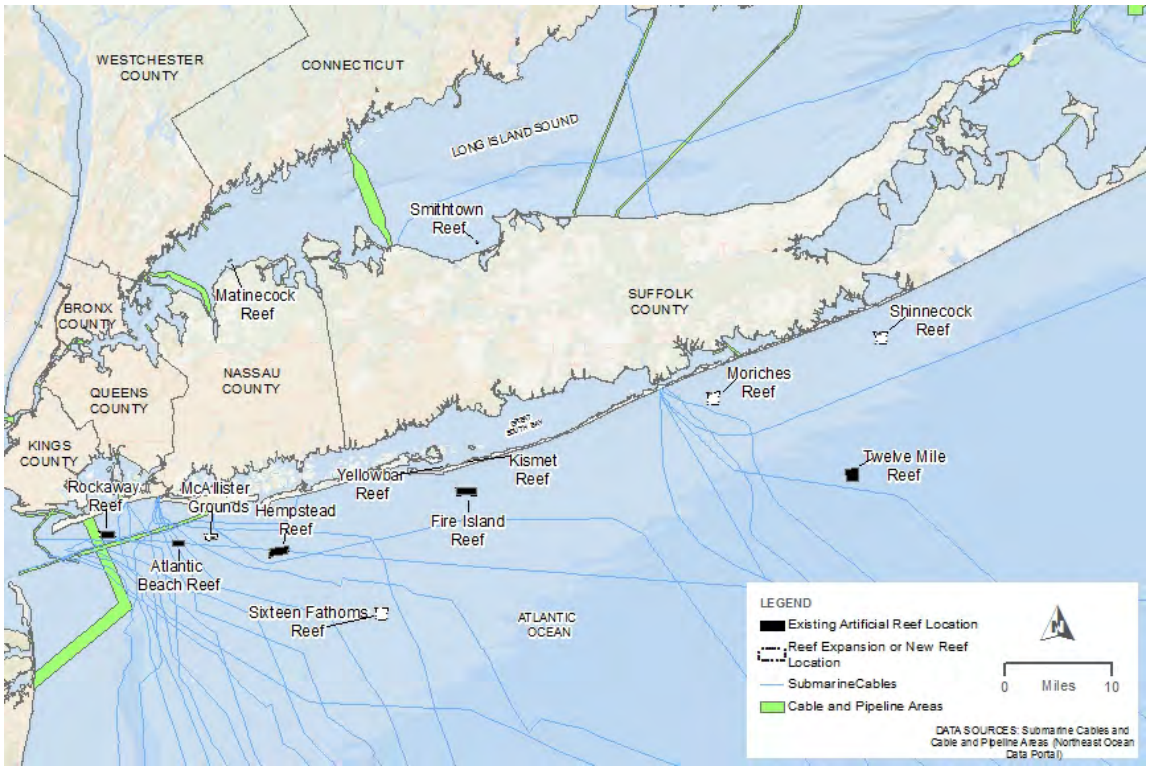



**Figure 2-14. Submarine cables and pipeline areas near the Atlantic Ocean and Great South Bay Reef Sites**

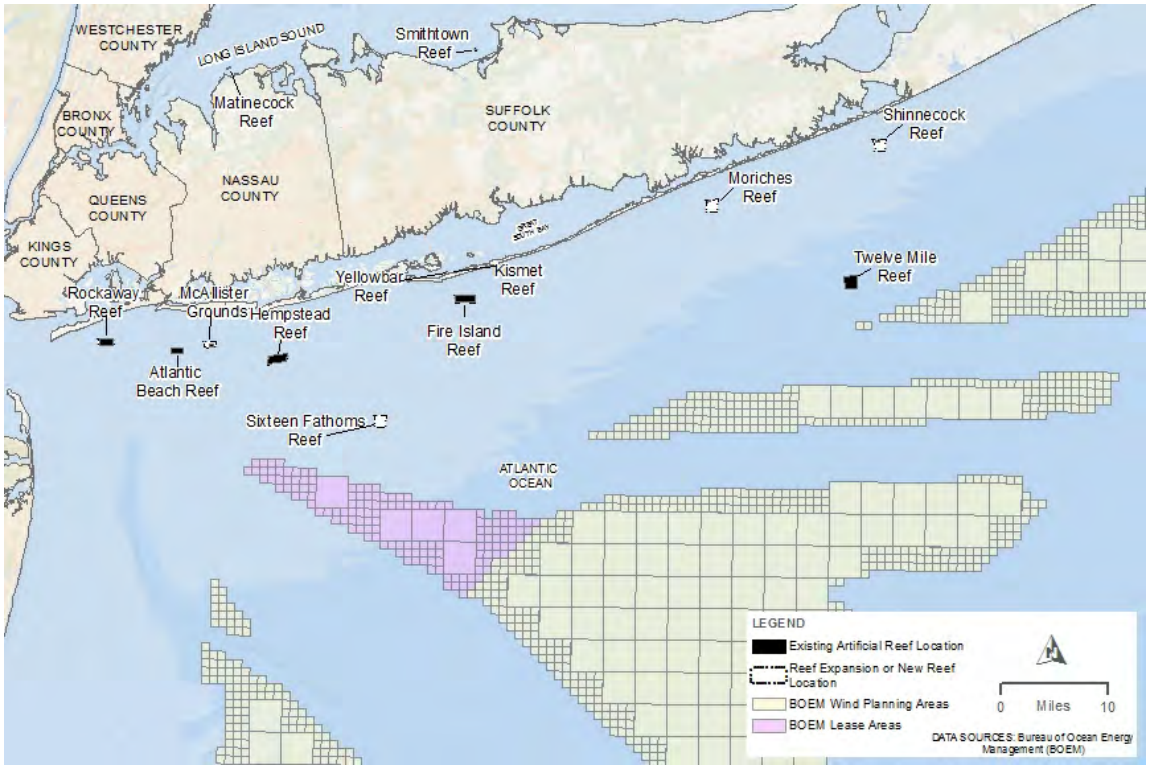



**Figure 2-15. BOEM Offshore Wind Planning Areas and Lease Areas.**

**Long Island Sound Reefs**

Cable, pipeline, and anchorage areas within the vicinity of the Long Island Sound reef sites are shown on Figure 2-16. An anchorage area is approximately 0.5 mile to the north of the Port Jefferson/Mount Sinai proposed reef site. An anchorage area is located 1 mile to the west of the proposed Mattituck site. There are no cable or pipelines near the existing or proposed reef sites. There are no BOEM Wind Planning Areas or Lease Areas within Long Island Sound.

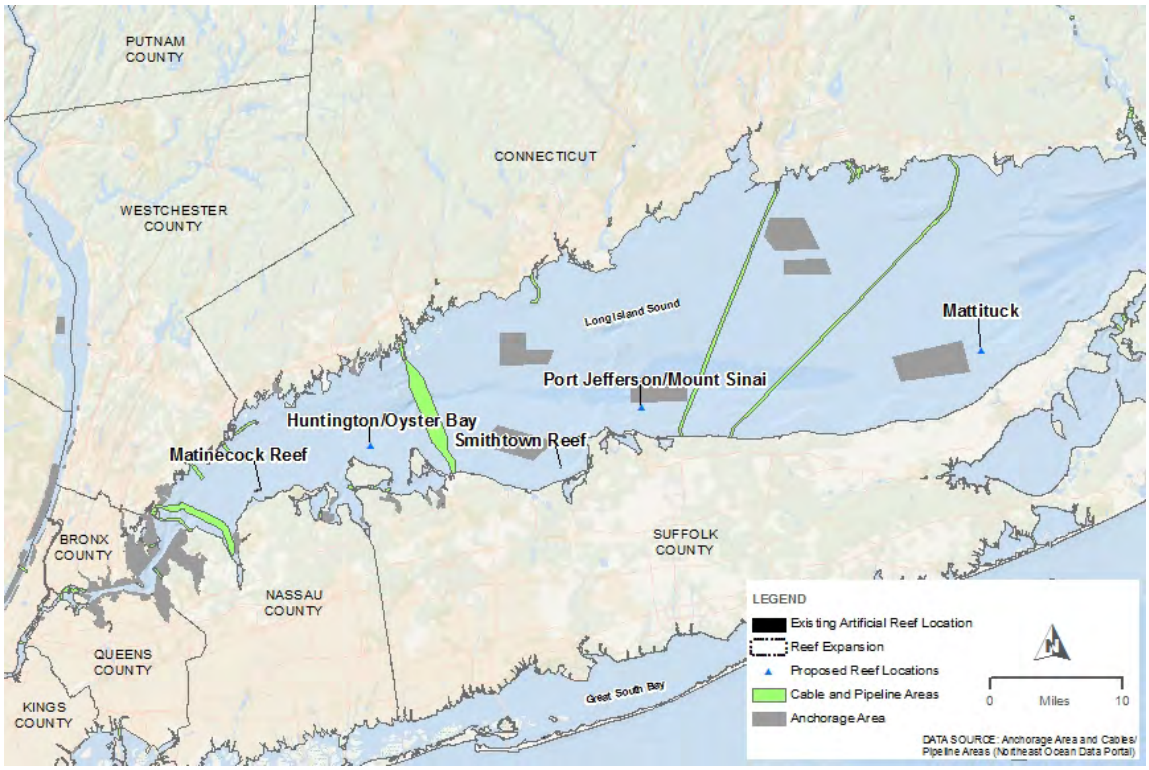



**Figure 2-16. Cable/Pipeline and Anchorage Areas near the Long Island Sound Reef Sites**

# 2.5 Marine Regulatory Areas

## 2.5.1 Special Management Zones and Marine Protected Areas

Special Management Zones and Marine Protected Areas are areas where some form of management is in place. New York State can develop SMZs within state waters and may request that the Mid Atlantic Fishery Management Council (MAFMC) designate reef sites in federal waters as special management zones (SMZ). The MAFMC may prohibit or restrain the use of specific types of fishing gear that are not compatible with the purpose of the artificial reef within the SMZ (50 CFR § 648.148).

Marine protected areas (MPAs) in the U.S. come in a variety of forms and are established and managed by all levels of government. The term Marine Protected Area encompasses a variety of conservation and management methods in the United States (such as marine sanctuaries, estuarine research reserves, ocean parks, and marine wildlife refuges) and may be established to protect ecosystems, preserve cultural resources such as shipwrecks and archaeological sites, or sustain fisheries production (NOAA 2019).

**Atlantic Ocean Reefs**

There are no special management zones within the Atlantic Ocean inshore or offshore reef sites.

The Atlantic Ocean inshore and offshore reef sites lie within Federal MPAs including the Waters off New Jersey Closure MPA, Mid-Atlantic Coastal Waters Area MPA, and Southern Nearshore Trap/Pot Waters MPA (National Oceanic and Atmospheric Administration, 2017). All three Federal MPAs are managed under NMFS for uniform multiple uses and contain commercial fishing restrictions in this area.

**Great South Bay Reefs**

Great South Bay East-West, located along the south shore of Long Island, north of the Great South Bay reef sites is a designated New York State Significant Coastal Fish and Wildlife Habitat Area (SCFWH) (Figure 2-18 below) (NYSDOS, 1999). The Great South Bay-West SCFWH includes a habitat impairment test that must be applied to any activity that is subject to consistency review under federal and State laws, or under applicable local laws contained in an approved local waterfront revitalization program. Any actions that would destroy the habitat or significantly impair the viability of the habitat shall not be undertaken.

Kismet reef lies within Federal Marine MPAs and Yellowbar reef is adjacent to Federal MPAs. The Federal MPAs where the reefs occur include the Waters off New Jersey Closure MPA, Mid-Atlantic Coastal Waters Area MPA, and Southern Nearshore Trap/Pot Waters MPA. The three Federal MPAs are managed under NMFS for uniform multiple uses and contains commercial fishing restrictions in this area.

**Long Island Sound**

Lloyd Point, Oyster Bay, Cold Spring Harbor, and Caumsett State Park, located south and east of the proposed Huntington/Oyster Bay reef, are designated as New York State Significant Coastal Fish and Wildlife Habitat Areas (SCFWH). Port Jefferson Harbor, Port Jefferson Beaches, and Mount Sinai Harbor are also designated SCFWH areas in proximity to the proposed Port Jefferson/Mount Sinai reefs. Hempstead Harbor, located west of the Matinecock reef is a designated New York State SCFWH. Figure 2-17 below provides the location of these SCFWH.

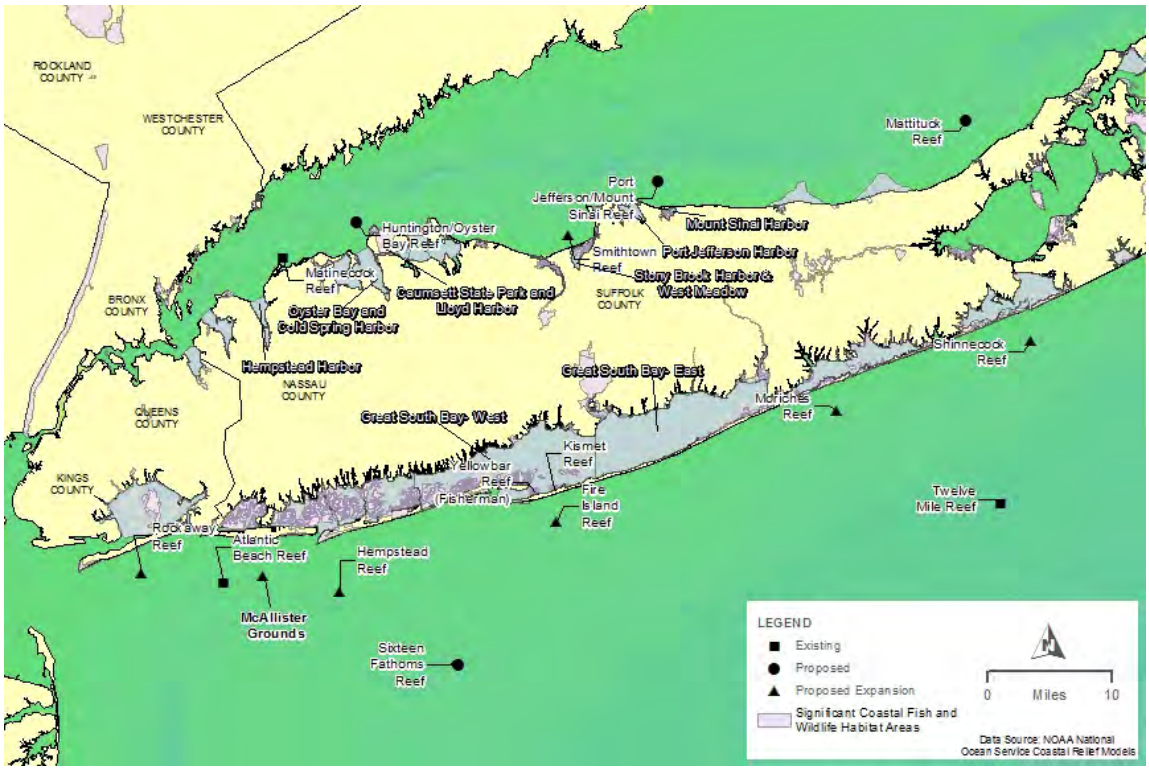



**Figure 2-17. Map of Significant Coastal Fish and Wildlife Habitat Areas.**

Based on the NOAA MPA Inventory interactive map, Long Island Sound is mapped within the Southern Nearshore Trap/Pot Waters MPA. It is managed by the NMFS with a uniform Multiple Use level of protection and natural heritage as the Primary Conservation Focus (National Oceanic and Atmospheric Administration, 2016).

## 2.5.2 Local Waterfront Revitalization Programs.

The NYSDOS Long Island Sound Coastal Management Program provides information including location on special coastal areas including maritime centers, waterfront redevelopment areas, and regionally important natural areas (New York State Department of State, 1999). A Maritime Center and Waterfront Redevelopment Area is identified at Glen Cove, near the Matinecock and Huntington/Oyster Bay reefs. A Waterfront Redevelopment Area is also identified to the west of the Smithtown reef in Smithtown, and a Regionally Important Natural Area is identified at Sunken Meadow – Nissequogue River, also west of the Smithtown reef area. A Waterfront Redevelopment Area is identified to the west of the Port Jefferson/Mount Sinai assessment area in Port Jefferson. Regionally Important Natural Areas are identified at Lloyd Neck – Eatons Neck near the Huntington/Oyster Bay reef; Mount Sinai that is near the Port Jefferson/Mount Sinai reef; and the Riverhead Bluffs that are west of the Mattituck reef. This document also provides management objectives for these areas.

**New York City**

New York City's LWRP was approved on February 3, 2016, and serves as a long-term management program for the City's 520 miles of natural, public, redeveloping and working waterfronts, and waterways in between. Working with the NYS Department of State, the City can identify specific projects to revitalize the working waterfront, while protecting habitat, natural resources, and water quality. Appendix B contains the summary of the LWRP coastal policies and activities allowed and whether the artificial reef program is consistent. The policies of the City's LWRP include:

- Support and facilitate commercial and residential redevelopment in areas well-suited to such development;
- Support water-dependent and industrial uses in New York City coastal area that are well-suited to their continued operation;
- Promote use of New York City's waterways for commercial and recreational boating and water-dependent transportation;
- Protect and restore the quality and function of ecological systems within the New York City coastal area;
- Protect and improve water quality in the New York City coastal area;
- Minimize loss of life, structures, infrastructure, and natural resources caused by flooding and erosion, and increase resilience to future conditions created by climate change;
- Minimize environmental degradation and negative impacts on public health from solid waste, toxic pollutants, hazardous materials, and industrial materials that may pose risks to the environment and public health and safety;
- Provide public access to, from, and along New York City's coastal waters;
- Protect scenic resources that contribute to the visual quality of the New York coastal area; and
- Protect, preserve, and enhance resources significant to the historical, archaeological, architectural, and cultural legacy of the New York coastal area.

# 3 Environmental Impacts Part 617.9(b) (5)

An evaluation of impacts include short and long term direct and indirect impacts as a result of the Proposed Action. As impacts are similar for the Program, they are summarized below by resource and not reef location.

## 3.1 Physical

### 3.1.1 Bathymetry

With the Proposed Action, the vertical relief in these areas would change and possibly lead to changes in localized water flow velocities and directionality in the vicinity of the reefs, which may cause scour and deposition of benthic sediments. Small-scale hydrodynamic impacts are anticipated to be localized to individual patch reefs. Any scouring and deposition is anticipated to settle quickly in the immediate vicinity of the reefs following placement and not cause any long-term impacts to bathymetry. Permanent changes to localized water flow velocities are not anticipated to cause long-term, direct impacts as a result of placement of reef materials.

### 3.1.2 Sediment

Localized changes to surficial sediment may occur following artificial reef placement at the new sites and expansions of the existing sites. During the screening assessment for the three new Long Island Sound sites, sediments consisting of predominately sand were chosen over those made up of muddy, silt bottoms. Placement of reef materials will suspend some sediments, but is anticipated to be

localized, short-term, and settle quickly back to the seafloor because of the predominately sandy substrates. Finer sediments may be redistributed in the vicinity of the reef area, but not cause any adverse long-term impacts to surficial sediment. The patch reef system results in a smaller disruption of the site's benthic footprint and therefore reduces impacts to the benthic community that may occur as a result of redistribution of finer sediments. Converting uniform sandy habitat to complex hard bottom substrate with vertical relief is a long-term permanent impact to the seabed. However, there are no significant impacts to sediment quality and type as a result of artificial reef material placement. Material will be placed within 3,423 acres; however, due to patch reef placement direct impacts will be less. The existing sediment habitat area is large and the overall impact to surface waters is small, less than 1%.

### 3.1.3 Water Quality

The Proposed Action would have short-term direct impacts on surface waters during construction as material is placed. During placement of material there will be a temporary suspension of sediments and an increase in turbidity. The existing water bodies are large and the overall impact to surface waters is small.

The potential impacts from sediment suspension, increases in turbidity, and local sediment deposition from construction are anticipated to be short in duration and minor in geographic space relative to the surrounding water bodies. Suspended sediment and turbidity impacts to surface waters would be localized and limited to construction periods. Therefore, no permanent impacts to surface waters will occur as a result of this action. Following construction, a new hydrodynamic equilibrium will be established within each reef site that is typical of patch reefs and beneficial to reef species. Hydrodynamic impacts are anticipated to be localized to individual patch reefs and not result in degradation of water quality. As the new hydrodynamics would be highly localized and de minimus relative to the surrounding area, there would be no long-term impact to regional hydrodynamics, turbidity, or suspended sediments that could cause long-term impacts to water quality.

### 3.1.4 Air Quality

Temporary impacts to air quality from vessel towing and equipment use within the vicinity of the existing and proposed reefs would occur during construction from placement of materials. The primary source of air emissions are generated by fuel combustion in diesel engines from commercial marine vessels such as tugs and barges and backup power/emergency generators. Impacts to air quality are anticipated to be temporary, short-term in duration, and not cause any significant adverse impacts long-term. To mitigate potential impacts during the construction phase, vessels will comply with international standards regarding air emissions from marine vessels.

Potential indirect impacts to air quality could occur from the use of the artificial reef sites by local stakeholders, due to an increase in vessel traffic and boat engine emissions. However, these impacts are anticipated to be short in duration and not generate emissions at a large enough scale to significantly alter air quality at the reef sites. Therefore, no significant impacts to air quality would result long-term from the Project.

### 3.1.5 Noise

Impacts to ambient noise levels from vessel towing and equipment use on barges would occur during construction and placement of materials. These noise impacts will be temporary and short-term in duration, and not cause any significant long-term impacts to noise levels. Noise levels would not be

any noisier than the existing oceangoing vessels transiting the reef areas. Potential increased short-term impacts to noise from the usage of artificial reefs by local stakeholders may occur following placement of materials. Noise limitations are not expected to be exceeded at any reef sites.

Potential impacts to marine mammals from increased underwater noise levels may occur during construction from placement of materials and later usage from local stakeholders. Various reports have shown behavioral responses of whales to mid-frequency active sonar (MFAS) and changes in sound pressure. These behavior responses include cessation of deep feeding, increased swimming speeds, and directed travel away from the sound source (Martin, Martin, Matsuyama, & Henderson, 2015) (Miller, et al., 2015).

The increased underwater noise levels during construction are not anticipated to cause any adverse impacts to mammal species as the noise levels would be temporary and short in duration. Marine mammals are anticipated to vacate the area of higher noise levels and not significantly alter their foraging, swimming speeds, or distance travelled from the noise source. Noise levels are not anticipated to be any louder than the existing vessels traveling through the area. Impacts to marine mammals from increased noise levels from local stakeholders utilizing the reef areas are anticipated to be similar to those noise levels experienced pre-construction. Therefore, significant impacts to mammal species from construction noise and those associated with recreational vessels would not occur long-term.

### 3.1.6 Climate Change

Greenhouse gas emissions during Project construction would result from the use of marine vessels, off-road construction equipment, and worker vehicles. These impacts would be temporary and short in duration, ceasing after the Proposed Action is complete. Potential indirect impacts affecting greenhouse gas emissions after Project completion from recreational and commercial fishing could occur; however, these impacts are anticipated to be short in duration and not generate emissions at a large enough scale to significantly alter greenhouse gas emissions at the reef sites. Therefore, Long-term impacts on greenhouse gas emissions from vessels utilized by local stakeholders to access the reefs are anticipated to be minimal.

## 3.2 Biological

### 3.2.1 Marine Community

**Plankton**

At reef sites, there may be direct impacts from temporary turbidity increases from reef construction which may impact plankton within the water column. These impacts are anticipated to be temporary as the predominately sandy sediments would fall quickly out of the water column and plankton would readily recolonize. In addition, potential indirect impacts to the plankton community due to grazing from increased fish abundance at the reefs could occur but is not anticipated to cause long-term permanent impacts to the plankton community. The reef locations occupy less than 1% of the surrounding waterbodies and no permanent, long-term impacts are expected to occur to plankton communities.

**Invertebrates**

At the reef sites, substrates which are composed of primarily uniform sediments will be replaced with hard bottom habitat and vertical relief. The existing benthic community would be directly impacted through burial and habitat conversion, which would result in a permanent local loss including endobenthic species (i.e. Atlantic Surfclam and Ocean Quahog). In addition, there would be

temporary, short term, direct impacts to the benthic community surrounding each individual artificial patch reef site due to sediment suspension during material placement, and altered sediment deposition rates and patterns due to the higher relief material disrupting ambient currents. This may lead to increased scouring in some areas and increased sediment accumulation in others. Increased fish abundance on the reefs may increase predation pressure on the existing benthic community.

In addition to direct impacts, the Proposed Action may have indirect impacts to the benthic community. Indirect impacts could include the introduction of non-native species which prefer reef habitats that may either displace or forage on the existing community. Furthermore, as water temperatures rise due to climate change, warm water non- native species brought by the Gulf Stream may colonize the reefs and compete with native species for habitat and food resources.

Cumulative impacts to the benthic community include, reduction of benthic sand habitat, increases in bottom disturbance and possible suspension of sediments due to multiple users (i.e. fishing). Increases in bottom disturbance may result in additional losses and changes to the endobenthic community.

Placement of materials may occur on up to 3,423 acres of the seafloor; however, due to patch reef placement, direct impacts to the benthic community would be less. In addition, there are many more acres of benthic habitat available within the Study Area and the overall impact to the benthic community is small, less than 1%. Vertical complex structure will also provide habitat for a reef-oriented epibenthic community to colonize and develop. Reef-oriented epibenthic species such as mussels, tunicates, anemones and encrusting polychaetes will in turn provide habitat and food resources for the new reef community as it develops into a mature artificial reef. The conversion of a low diversity benthic community to a more complex community will provide habitat and food for higher trophic levels including fish. Therefore, the expansion and development of artificial reefs will likely offset any negative impacts to the benthic community by providing a more diverse and complex community.

**Fish**

The development of the Proposed Action may have direct, indirect and cumulative impacts to the fish community. Overall these impacts will be temporary and for a limited duration during construction.

Temporary direct impacts are associated with sediment suspension, noise and vibration during material placement. These impacts are short in duration and local to reef sites, as they are limited to construction periods. Temporary impacts would also include small changes in hydrodynamics at the reef edges. Direct impacts are associated with the conversion of habitat from uniform sandy and silty substrates to hard bottom substrate with vertical relief. The hard substrate will increase species diversity and provide areas for forage, shelter and in some cases spawning that will benefit species. In addition, a potential direct impact includes over harvest of reef species. As the reef develops, recreational and commercial fisherman may exploit the newly developed reef resulting in increased fishing pressure. NYSDEC marine fishing regulations have been established and are enforced to protect structure associated species from overharvesting on reef sites.

Indirect impacts to fish include introduction of non-native species. The increase of non-native species that can inhabit reef locations as species diversity and habitats change is an indirect impact. As water temperatures increase due to climate change, non-native species may reside in the waters off of New York for longer periods and begin to inhabit artificial reefs competing with resident species for habitat and food resources.

Increases in bottom disturbance, suspension of sediment and increases in vessel traffic, noise and vibration may have impacts on the fish community and essential fish habitat by temporarily displacing species or modifying habitat.

While the overall magnitude of the Proposed Action covers 3,423 acres, the overall impact to the fish community and EFH relative to the entire Study Area is small, less than 1%. Even though reef structures occupy a footprint of habitat, and may displace demersal species, there are also direct benefits including providing stable structure, relief, crevices and interstitial spaces to create complex diverse habitat. Artificial reefs add habitat complexity and diversity to the Study Area, which is dominated by open-water habitat and sand uniform substrates. The addition of the patch reefs to the existing habitats provides greater habitat complexity for fish by providing refuge and food resources.

Demersal fish species, like tautog, summer flounder, Atlantic cod, sea robin, scup, and black sea bass, frequent reef sites to feed on reef-associated species as well as take advantage of the enhanced benthic community found around the reef. Structure associated and migratory species that use artificial reefs for foraging, shelter, and spawning will benefit from the development of complex, three-dimensional habitat. Overall, artificial reefs lead to increased biodiversity while providing refuge, forage and some spawning opportunities for the associated fish species.

### 3.2.2 Essential Fish Habitat

In general, species with benthic life stages will experience localized direct impacts during material placement if they are in the area, while pelagic species with designated EFH will likely experience minor to no impacts as a result of the placement of artificial reef materials. Artificial reefs will provide overall benefits to both benthic and pelagic life stages as reefs add complex vertical habitat which species will use for foraging and protection.

Potential direct temporary impacts include resuspension of sediments, noise, and vessel traffic during construction. At the reef locations there is a permanent conversion of habitat type from relatively featureless bottom to complex structured habitat. Indirect impacts include the direct burial of benthic infaunal prey organisms for bottom feeding EFH species. As the Project area represents a very small percentage of foraging grounds within the Atlantic Ocean, Great South Bay and Long Island Sound and bottom-feeding fish and crustaceans will consume epifaunal organisms living on the reef the overall indirect impact of the placement of reef materials to EFH species will be minimal.

With the exception of the sandy substrate habitats being converted to hard-bottom habitat with vertical relief, the remaining substrates within the surrounding areas in the Atlantic Ocean, Great South Bay, and Long Island sound are anticipated to function the same as pre-existing conditions, and allow the continued use by designated EFH species. The overall potential adverse impacts to EFH designated species and EFH in the Project area will be minimal. Long term impacts are associated with the permanent conversion of a limited area of sand habitat to complex hard substrate with vertical relief. The development of the artificial reef sites will provide a long term benefit to benthic and pelagic species, structure oriented species that are commercially and recreationally valuable, and establish an epibenthic community providing a more diverse and complex community. For more information regarding the EFH assessment refer to Appendix E.

### 3.2.3 Threatened and Endangered Species

State and federal threatened and endangered species (TES) including turtles, sturgeon and marine mammals may be found seasonally within the reef areas. Significant permanent impacts on TES species or habitat are not anticipated from the placement of materials at the reef sites as Atlantic

sturgeon, sea turtles and marine mammals are highly migratory and their presence at the reef sites would only be transient, however, coordination and consultation with NMFS and USFWS will be conducted.

There is the potential for impacts associated with placement of material including temporary suspension of sediments following material placement, minor temporary increase in vessel traffic as materials are delivered to reef sites, limited temporary noise and vibration while materials are placed, and very limited risk of materials directly striking individual organisms. The placement of reef materials will take place during short intermittent periods during daylight hours. The vessels delivering reef materials to the reefs are slow moving and represent a small portion of the total vessel traffic in the Project area and would not substantively increase the risk of vessel strike for listed species. The risk of an individual organism being directly struck by falling debris is extremely small due to their transient presence at the reef sites as well as the short duration and infrequent nature of material placements.

Direct impacts and cumulative impacts may be associated with vessel strikes and potential turtle entrapment which, through the use of best management practices, would be avoided. No indirect impacts are anticipated. While there is the potential for increased recreational fishing activity at the reef sites following development, this is unlikely to substantively increase the risk to listed species as these areas are already highly trafficked with recreational vessels.

The Proposed Action will benefit TES species by creating foraging areas for all life stages and increasing complex habitat for shelter.

# 3.3 Human

## 3.3.1 Commercial Fishing

Minimal to no impacts on commercial fishing would occur during construction through displacement of gear or fishing location. Following construction, potential negative impacts to commercial fishermen, if any, includes the reduction of areas where mobile gear can be used such as bottom trawls, mid-water trawls, and shellfish dredges. Bottom trawling for finfish and dredging for shellfish over or near an artificial reef is typically avoided due to the potential for snagging or fouling equipment. Therefore, commercial fishing with mobile gears would be impacted in the reef areas. Fixed gear (i.e. lobster pots) and hook and line fishermen are anticipated to benefit from the proposed Project as the reefs will create additional fishing opportunities. NYSDEC has the regulatory authority to limit gear usage that could impact reef usage.

However, the limited amount of reef structure being expanded upon and proposed is not expected to support a significant commercial fishery. In New Jersey, the use of lobster pots and gill nets were restricted due to fouling of fishing gear from rod and reel anglers (National Oceanic and Atmospheric Administration, 2018). Special Management Zones were established for the 13 New Jersey artificial reef sites under the black sea bass provisions of the Summer Flounder, Scup, and Black Sea Bass Fishery Management Plan to reduce user group conflicts and maintain the intended socioeconomic benefits of the artificial reef sites (National Oceanic and Atmospheric Administration, 2018). Similar strategies could be employed in New York to reduce conflicts among user groups. Coordination with commercial fishing organizations and individuals will be completed to avoid conflicts. Pre-construction surveys of the new artificial reef sites will be conducted to avoid commercially valuable species that would be adversely affected by reef construction, such as surfclams and ocean quahog.

### 3.3.2 Recreational Fishing

During Project construction, recreational fishing practices are expected to be impacted as fishing would not be able to be conducted during placement of materials. However, these impacts are anticipated to be temporary and limited to the window of construction activities. A communication plan to inform recreational fishermen of construction commencement will be provided to avoid any conflicts.

Recreational fishermen are anticipated to benefit from the Proposed Action due to increased fishing opportunities. Conflicts may arise between different user groups, such as commercial fishermen, recreational boaters, and scuba divers, but are anticipated to be avoided through prior coordination with all stakeholders. The additional new reef sites and expansion of existing sites will provide more opportunities for all user groups to benefit from the artificial reef program development.

### 3.3.3 Recreational Diving

During construction and expansion of the reef sites, recreational divers will experience a short-term, temporary impact by not having access to the reefs. Recreational divers are not anticipated to be impacted by the new reef sites as these sites were devoid of diving opportunities pre-artificial reef construction. For the expansion of existing reef sites, recreational divers would be temporarily restricted in the construction area to avoid injury and other safety concerns. This user group would only experience temporary impacts and no significant permanent impacts long-term would occur as a result of reef site construction and expansions.

Following construction of the new artificial reefs, recreational divers are anticipated to benefit long-term because of the increased diving opportunities. The new and expanded reef sites will provide additional locations for viewing and studying fish, underwater photography and thus significantly benefit this user group. Further, diving related businesses are expected to economically benefit from the availability of more diving sites (refer to Section 3.3.5 for further discussion). Expansion of the already existing reefs will provide more diving opportunities and overall reduce potential conflicts among user groups.

### 3.3.4 Environmental Justice

As the Proposed Action takes place away from communities, impacts to environmental justice are not anticipated. Environmental justice groups and their relation to the proposed reef expansions and new reef sites are discussed in Section 2.3.4. These communities will not experience disproportionate adverse environmental impacts as a result of the Proposed Action.

### 3.3.5 Socioeconomics

Commercial and recreational fisheries, as well as recreational diving will likely benefit from the expansion of existing reefs, addition of new artificial reef sites, and the continued placement of materials on existing reefs. The deployment of new artificial reefs may drive economic growth through direct (market value) and indirect (non-market value) expenditures related to fishing and diving and through the value of improved recreational opportunities (Adams et al. 2006, Pendleton 2004, Chen et al. 2013)..

If reef use by out of town users increases, additional economic growth from establishments related to the ocean economy may occur resulting in increases in the recreation and tourism and marine transportation sectors. Recreational dive operators may see an increase in economic returns from

more diving site opportunities. There could also be an increase in recreational for-hire fishing, providing additional revenue to local businesses.

### 3.3.6 Cultural Resources

According to the OPRHP CRIS, no historic or archeological sites are present within the reef sites (New York State Office of Parks, Recreation, and Historic Preservation, 2017). Consultation with NYSHPO is ongoing and any findings from their assessment will be updated accordingly. While the areas off Long island Sound are identified as high sensitivity for Paleoindian settlement, any settlements are likely buried and placement of materials on the surface for artificial reef development are unlikely to impact these archeological resources. Wrecks within the Port Jefferson/Mount Sinai reef site would be avoided when deploying materials. Wrecks located near the reef sites may increase use by divers due to additional nearby features of interest.

### 3.3.7 Marine Disposal of Waste

There are no marine disposal sites located within the vicinity of the Atlantic inshore, offshore, or Great South Bay reefs. Currently, three ocean dredged material disposal sites have been designated by the USEPA in Long Island Sound. The three proposed Long Island Sound reefs will not be sited within any of the ocean dredged material disposal sites. Therefore, no significant impacts to marine disposal sites are anticipated as a result of the Proposed Action.

### 3.3.8 Dredging, sand and gravel mining

The Proposed Action does not occur near or within designated dredging, sand and gravel mining areas. Therefore, no impacts are expected to occur.

### 3.3.9 Navigation

The reefs are not sited within navigation channels. Reef construction activities involve the movement of barges loaded with materials or movement of scrap vessels by towing through heavily trafficked navigation lanes. However, these actions are very infrequent and are short in duration. On-site operations can occur for periods of six hours or more with the vessels used circling the reef site. In addition, boaters may be attracted to the activity causing a temporary navigation hazard. To minimize the hazard, deployment will occur during daylight hours, radio and radar contact among the vessels involved will be maintained, the U.S. Coast Guard will be notified prior to activity and a lookout vessel may be posted to warn boaters.

Materials will be placed in compliance with USACE permits and will minimum depths over the reef to minimize conflicts with navigation.

### 3.3.10 Offshore Energy

The Proposed Action does not occur near or within designated BOEM lease areas for offshore energy development, underwater cables, or other offshore energy resources. Therefore, no impacts are expected to occur.

## 3.4 Marine Regulatory Areas

### 3.4.1 Special Management Zones and Marine Protected Areas

The Proposed Action does not occur within a SMZ but does occur within MPAs. Consultation with NMFS and NYSDEC will be conducted as part of SEQRA to confirm that current or planned SMZs or MPAs are not impacted or if SMZs are planned at a later date.

### 3.4.2 New York State Coastal Policies

The Proposed Action will be developed in compliance with the New York State Coastal Policies (19 NYCRR Part 600.5) and existing LWRP. The development of artificial reefs is expected to be consistent with those policies. Refer to Appendix A for consistency with New York State Coastal policies.

## 3.5 Cumulative Impacts

The Proposed Action requires an analysis of cumulative impacts as required by SEQRA (§617.9 (b)(5)(iii)(a)). According to SEQRA, cumulative impacts occur when multiple actions affect the same resources and can occur when the incremental or increased impacts of an action, or actions, are added to other past, present and reasonably foreseeable future actions (New York State Department of Environmental Conservation, 2019). Furthermore, cumulative impacts can result from a single action or from a number of individually minor but collectively significant actions taking place over a period of time. Cumulative impacts must be assessed when actions are proposed, or can be foreseen as likely, to take place simultaneously or sequentially in a way that the combined impacts may be significant (New York State Department of Environmental Conservation, 2019).

There are no actions beyond the Proposed Action that are proposed or foreseen that could result in potential impacts that when combined with the Proposed Action would lead to cumulative effects. The New York State MCD and bordering United States federal waters are utilized by multiple public and private entities for recreation, energy development, commercial fishing and restoration which do not have the potential to result in cumulative impacts during the development of the Proposed Action. There are no energy development activities near the artificial reef sites that could cause potential impacts during the development of the Proposed Action. Maintenance dredging normally occurs within federal navigation channels, which are not near the artificial reef sites. Dredging or other marine construction activities are not anticipated to cause potential impacts that when combined with the Proposed Action would result in cumulative impacts. Further, there are no planned ocean disposal sites or borrow areas occurring during the development of the Proposed Action. Cumulative impacts are not anticipated to result from the Proposed Action.

## 3.6 Summary of Permanent Impacts and Mitigation

Permanent impacts at proposed and expanded reef sites include changes to the bathymetry, benthic communities, and use of certain commercial gears on the sites. Bathymetry on artificial reef sites will change from relatively flat featureless bottoms to vertical structured habitats. The potential impacts to navigation will be mitigated by maintaining clearance depths and the vertical clearance above the structures. The existing benthic community will be directly impacted through burial and habitat conversion, which could result in a permanent loss of endobenthic species, such as Atlantic surfclam and ocean quahog. This impact will be mitigated through the use of patch reef construction and avoidance of siting new reef sites in areas currently populated with these species. Up to 6,812 acres

of open-water benthic habitat will no longer be available for commercial harvest by mobile gear fisherman (i.e. dredge, trawl, and/or gillnet). This area represents a minor percentage (less than 1%) of the available open-water benthic habitat available for commercial harvest. Coordination with local stakeholders will mitigate this impact by avoiding important commercial fishing grounds when siting artificial reefs. The proposed new and expanded reefs are anticipated to benefit commercial pinhookers, commercial trap fisherman, recreational anglers, and divers.

# 4 Alternatives Analysis (617.9(b) (5) (v) a-d)

As required by SEQRA (6 CRR NY Part 617.9[b] [5] [v]), the project sponsor (NYSDEC) must consider a range of alternatives to the Proposed Action, including the No Action alternative. The alternatives analysis provides a description and evaluation of the range of reasonable alternatives to the action that are feasible, considering the purpose and need of the Project.

As this SGEIS is an update to an existing Program, alternatives that are outside the scope and study area of the Program were reviewed but not included. Therefore, alternatives reviewed are limited to existing reef sites and study areas within Long Island Sound, Great South Bay, and the Atlantic Ocean which were screened and meet the reef siting criteria. In addition, alternatives were evaluated based on technical and economic feasibility. For example, marine fish hatcheries were not included in the alternatives analysis as they did not meet the Program Purpose and Need and are not economically feasible. Table 4-1 provides a summary of the potential Project impacts as a result of the five alternatives.

## 4.1 No Action

The No Action alternative evaluates the adverse or beneficial site changes that are likely to occur in the reasonably foreseeable future, in the absence of the Proposed Action. The No Action alternative provides a baseline for evaluation of impacts and comparisons of other impacts.

Under the No Action alternative, no new artificial reefs would be developed and existing reefs would not be expanded. No new permits would be acquired. Under this alternative, reef material would continue to be placed on permitted reefs until the existing reef permits expire. Approximately 2,111 additional acres of artificial habitat could be created under this alternative. The existing reefs would not be maintained and the NYS Artificial Reef Program as described in the 1993 GEIS would not be fully developed.

Although artificial habitat would continue to be enhanced under the No Action alternative for a limited time, enhancement would be at a much smaller scale than that which would be realized under the Proposed Action. Artificial reef habitat would not be maintained, and increased long-term fishing and diving opportunities, as well as the beneficial economic impacts, would not be realized. Lack of maintenance over the long-term may even result in the burial or displacement of several existing reefs which would reduce the value of the created habitat. Without maintenance of the reefs, the habitat quality of those sites would degrade, and productivity would decrease. In addition, recreational benefits would be reduced over time.

In summary, the No Action alternative does not meet the objectives of the Program and therefore does not meet the Purpose and Need of the Project.

## 4.2 Proposed Action

The Proposed Action alternative includes: the continued use of existing reef sites, the expansion of seven existing sites (Rockaway, Hempstead, Fire Island, Smithtown, McAllister Grounds, Moriches and Shinnecock Reefs) and the addition and creation of four new sites (Sixteen Fathoms, Huntington/Oyster Bay, Port Jefferson/Mount Sinai and Mattituck Reefs). Artificial reefs have been and would continue to be developed using the patch reef system. NYSDEC would acquire the required State and Federal permits prior to placing material on reef locations to maintain, expand and develop existing site footprints and create new sites.

The deployment of artificial reef materials has the potential to cause short-term impacts to benthic community which are a food source to EFH species. Changes to bathymetry due to placement of materials would occur (i.e., physical impacts) and the existing benthic community would be directly impacted through burial and habitat conversion, which would result in a long-term local loss including endobenthic species (i.e. Atlantic Surfclam and Ocean Quahog). Those species and life stages that are structure oriented or utilize coarse habitats such as boulders or cobbles would experience a long-term gain of habitat and benefit of the addition of complex vertical habitat. In addition to providing physical shelter for benthic species the artificial reef materials would provide substrate for encrusting organisms that would otherwise be unable to colonize the sandy habitats. Up to 3,423 acres of open-water benthic habitat would no longer be available for commercial harvest by mobile gear fisherman (i.e. dredge, trawl, and/or gillnet) and about 6,812 acres of artificial habitat would be created and maintained.

## 4.3 Existing Artificial Reef Program with fewer expansions

This alternative includes: the continued use of existing reef sites, the expansion of three existing sites (McAllister Grounds, Moriches and Shinnecock Reefs) and the addition and creation of four new sites (Sixteen Fathoms, Huntington/Oyster Bay, Port Jefferson/Mount Sinai and Mattituck Reefs). Artificial reefs have been and would continue to be developed using the patch reef system. NYSDEC would acquire the required State and Federal permits prior to placing material on reef locations to maintain, expand and develop existing site footprints and create new sites.

The deployment of artificial reef materials has the potential to cause short-term impacts to benthic community which are a food source to EFH species. Changes to bathymetry due to placement of materials would occur (i.e., physical impacts) and the existing benthic community would be directly impacted through burial and habitat conversion, which would result in a long-term local loss including endobenthic species (i.e. Atlantic Surfclam and Ocean Quahog). Those species and life stages that are structure oriented or utilize coarse habitats such as boulders or cobbles would experience a long-term gain of habitat and benefit of the addition of complex vertical habitat. In addition to providing physical shelter for benthic species the artificial reef materials would provide substrate for encrusting organisms that would otherwise be unable to colonize the sandy habitats. Up to 2,111 acres of open-water benthic habitat would no longer be available for commercial harvest by mobile gear fisherman (i.e. dredge, trawl, and/or gillnet).

Approximately 5,500 acres of artificial habitat would be created and maintained under this alternative. Artificial reef habitat would provide new and additional fishing and diving opportunities, which would result in beneficial economic impacts. However, since this alternative limits the expansion of existing sites, it would reduce habitat creation, economic benefits, and fishing and diving opportunities.

## 4.4 Existing Artificial Reef Program (i.e. no expansions)

The fourth alternative is the continuation of the existing Program without any creation of new or expansion of existing reefs. Use would continue at the existing reefs and the proposed Sixteen Fathoms, Huntington/Oyster Bay, Port Jefferson/Mount Sinai, and Mattituck reefs would not be created. In addition, Rockaway, Hempstead, Fire Island, Smithtown, McAllister Grounds, Moriches and Shinnecock reefs would not be expanded. As described in the 1993 GEIS, existing reefs with capacity to receive additional reef material will continue to be developed and artificial reefs would continue to be maintained and managed, per the existing Program.

This alternative does not meet the objectives of the Program because the capacity for additional materials and habitat creation would be greatly reduced without the addition and expansion of reef sites. The artificial habitat would provide additional fishing and diving opportunities on sites already permitted, but not to the extent of the Proposed Action.

Direct impacts on threatened and endangered species would be avoided by placement of reef materials taking place during short intermittent periods during daylight hours, which would minimize the risk of interacting with listed species. The vessels delivering reef materials to the reefs are slow moving and represent a small portion of the total vessel traffic in the Project area. The deployment of reef materials has the potential to cause short term direct impacts to benthic fish species due to the temporary increase in turbidity in the bottom and water column. There is the potential for impacts associated with placement of material including temporary suspension of sediments following material placement, minor temporary increase in vessel traffic as materials are delivered to reef sites, limited temporary noise and vibration while materials are placed, and very limited risk of materials directly striking individual organisms. In addition, mortality to existing benthic species would occur during placement of materials within the footprint of the permitted reef sites. Under this alternative, benthic habitat will no longer be available for commercial harvest by mobile gear fisherman (i.e. dredge, trawl, and/or gillnet) within the existing site footprints.

## 4.5 Development of Special Management Zones

This alternative includes the development of artificial reefs as described in the Proposed Action and establishes some or all of the reefs as special management zones (SMZ). SMZs are established as regulatory management areas to protect natural resources and mitigate potential conflicts. For example, SMZs may designate specific gear types that can or cannot be used, and/or during what time frames those activities may occur at the artificial reef sites. NYSDEC has the regulatory authority to limit activity and regulate reefs within state waters. In order to designate a SMZ in federal waters, a request is made by Federal or State Agencies then a SMZ monitoring team composed of members of staff from MAFMC, NMFS Northeast Region, and NMFS Northeast Fisheries Service Center evaluates the request for a SMZ using the following criteria:

- Fairness and equity;
- Promotion of conservation;
- Avoidance of excessive shares;
- Consistency with the objectives of fisher management plans, the Magnuson-Stevens Act, and other applicable law;
- The natural bottom in and surrounding potential SMZs; and
- Impacts on historical uses.

If the regional Administrator reviews and concurs with the MAFMC's recommendation, the proposed rule will be published in the Federal Register with the recommendations. Once SMZs are established, NYSDEC would be able to plan, design, and develop artificial reefs with specific management objectives and would be supported by the regulatory language for the SMZ. This action could increase recreational fishing at the SMZ reef sites by limiting gear types within the reef.

The SMZ Alternative would meet the objectives of the program and therefore the purpose and need. Therefore, it remains an option that could be utilized in combination with the proposed action, should the need arise.

## Table 4-1. Alternatives Analysis

| Resource | No Action[1] | Proposed Action | Existing Artificial Reef Program with fewer expansions | Existing Artificial Reef Program (i.e., no expansion) | Development of Special Management Zones |
|---|---|---|---|---|---|
| Bathymetry | No impacts to bathymetry would result under this alternative. | Short-term, small-scale hydrodynamic impacts are anticipated to be localized to individual patch reefs. Permanent changes to localized water flow velocities would not cause long-term, direct impacts as a result of reef development. | Short-term, small-scale hydrodynamic impacts are anticipated to be localized to individual patch reefs. Permanent changes to localized water flow velocities would not cause long-term, direct impacts as a result of reef development. | Existing reef sites would experience short-term, small-scale hydrodynamic impacts that are anticipated to be localized to individual patch reefs. Permanent changes to localized water flow velocities would not cause long-term, direct impacts as a result of reef development. | Same impacts anticipated as the Proposed Action. |
| Sediment | No impacts to sediment would result under this alternative. | Long-term permanent impacts from converting sandy habitat to complex hard bottom substrate with vertical relief. Impacts from suspension of sediments during reef material placement would be localized, short-term, and sediment would settle quickly back to the seafloor due to predominately sandy substrates in the Project Area. | Long-term permanent impacts from converting sandy habitat to complex hard bottom substrate with vertical relief. Impacts from suspension of sediments during reef material placement would be localized, short-term, and sediment would settle quickly back to the seafloor due to predominately sandy substrates in the Project Area. | Existing reef sites would experience long-term permanent impacts from converting sandy habitat to complex hard bottom substrate with vertical relief. Impacts from suspension of sediments during reef material placement would be localized, short-term, and sediment would settle quickly back to the seafloor due to predominately sandy substrates in the Project Area. | Same impacts anticipated as the Proposed Action. |
| Water Quality | No impacts to water quality would result under this alternative. | Short-term temporary impacts to surface waters due to suspension of sediments and turbidity increases. No permanent impacts to water quality as a result of the Proposed Action are anticipated. | Short-term temporary impacts to surface waters due to suspension of sediments and turbidity increases. No permanent impacts to water quality as a result of this alternative. | Existing reef sites would experience short-term temporary impacts to surface waters due to suspension of sediments and turbidity increases. No permanent impacts to water quality as a result of the existing Program. | Same impacts anticipated as the Proposed Action. No permanent impacts to water quality as a result of the development of SMZs. |
| Air Quality | No impacts to water quality would result under this alternative. | Temporary, short-term impacts from vessel towing and equipment use. No long-term, permanent impacts to air quality anticipated. Potential indirect impacts to air quality from increased fuel consumption by use of local stakeholders; however, these impacts would be short in duration and not generate emissions at a large enough scale to significantly alter air quality. | Temporary, short-term impacts from vessel towing and equipment use. No long-term, permanent impacts to air quality anticipated. Potential indirect impacts to air quality from increased fuel consumption by use of local stakeholders; however, these impacts would be short in duration and not generate emissions at a large enough scale to significantly alter air quality. | Existing reefs would experience temporary, short-term impacts from vessel towing and equipment use. No long-term, permanent impacts to air quality anticipated. Potential indirect impacts to air quality from increased fuel consumption by use of local stakeholders; however, these impacts would be short in duration and not generate emissions at a large enough scale to significantly alter air quality. | Same impacts anticipated as the Proposed Action. SMZ could regulate the number of commercial fishing vessels within the reef areas and reduce the amount of emissions generated. |

| Resource | No Action[1] | Proposed Action | Existing Artificial Reef Program with fewer expansions | Existing Artificial Reef Program (i.e., no expansion) | Development of Special Management Zones |
|---|---|---|---|---|---|
| Noise | No impacts to noise would result under this alternative. | Noise levels are not anticipated to be any louder than the existing vessels traveling through the area. Potential permanent impacts to noise from the usage of artificial reefs by local stakeholders, such as divers, anglers, and researchers, may occur following placement of materials. The reef sites are far from shore and will likely not exceed any noise limitations within the area. | Noise levels are not anticipated to be any louder than the existing vessels traveling through the area. Potential permanent impacts to noise from the usage of artificial reefs by local stakeholders, such as divers, anglers, and researchers, may occur following placement of materials. The reef sites are far from shore and will likely not exceed any noise limitations within the area. | Noise levels at the existing reefs are not anticipated to be any louder than the existing vessels traveling through the area. Potential permanent impacts to noise from the usage of artificial reefs by local stakeholders, such as divers, anglers, and researchers, may occur following placement of materials. The reef sites are far from shore and will likely not exceed any noise limitations within the area. | Same impacts anticipated as the Proposed Action. |
| Climate Change | No impacts to climate change would result under this alternative. | Temporary, short-term impacts from use of marine vessels, off-road construction equipment, and worker vehicles. Long-term impacts on greenhouse gas emissions from vessels utilized by local stakeholders to access the reefs are anticipated to be minimal. | Temporary, short-term impacts from use of marine vessels, off-road construction equipment, and worker vehicles. Long-term impacts on greenhouse gas emissions from vessels utilized by local stakeholders to access the reefs are anticipated to be minimal. | Existing reef sites would experience a temporary, short-term impact from use of marine vessels, off-road construction equipment, and worker vehicles. Long-term impacts on greenhouse gas emissions from vessels utilized by local stakeholders to access the reefs are anticipated to be minimal. | Same impacts anticipated as the Proposed Action. Development of SMZ may limit the amount of greenhouse gas emissions from commercial vessels. |
| Plankton | No impacts to plankton would result under this alternative. | Short-term direct impacts from turbidity increases. No long-term impacts to plankton communities anticipated. | Short-term direct impacts from turbidity increases. No long-term impacts to plankton communities anticipated. | Existing reef sites would experience short-term direct impacts from turbidity increases. No long-term impacts to plankton communities anticipated. | Same impacts anticipated as the Proposed Action. |
| Invertebrates | No impacts to invertebrates would result under this alternative. | The existing benthic community would be directly impacted through burial and habitat conversion, which would result in a permanent local loss including endobenthic species (i.e. Atlantic Surfclam and Ocean Quahog). There would be temporary, short term, direct impacts to the benthic community surrounding each individual artificial patch reef site due to sediment suspension during material placement, and altered sediment deposition rates and patterns due to the higher relief material placed disrupting ambient currents. This | The existing benthic community would be directly impacted through burial and habitat conversion, which would result in a permanent local loss including endobenthic species (i.e. Atlantic Surfclam and Ocean Quahog). There would be temporary, short term, direct impacts to the benthic community surrounding each individual artificial patch reef site due to sediment suspension during material placement, and altered sediment deposition rates and patterns due to the higher relief material placed disrupting | The existing benthic community would be directly impacted through burial and habitat conversion, which would result in a permanent local loss including endobenthic species (i.e. Atlantic Surfclam and Ocean Quahog). There would be temporary, short term, direct impacts to the benthic community surrounding each individual artificial patch reef site due to sediment suspension during material placement, and altered sediment deposition rates and patterns due to the higher relief material placed disrupting ambient currents. This | Same impacts anticipated as the Proposed Action. |

| Resource | No Action[1] | Proposed Action | Existing Artificial Reef Program with fewer expansions | Existing Artificial Reef Program (i.e., no expansion) | Development of Special Management Zones |
|---|---|---|---|---|---|
| | | may lead to increased scouring in some areas and increased sediment accumulation in others. The Proposed Action may have indirect impacts to the benthic community. Indirect impacts could include the introduction of non-native species which prefer reef habitats that may either displace or forage on the existing community, thus changing the benthic community structures. Furthermore, as water temperatures rise due to climate change, warm water non-native species brought by the Gulf Stream may colonize the reefs and compete with native species for habitat and food resources. Cumulative impacts to the benthic community include, reduction of benthic sand habitat, increases in bottom disturbance and possible suspension of sediments due to multiple users (i.e. fishing). Increases in bottom disturbance may result in additional losses and changes to the endobenthic community.<br>The magnitude of additional direct impacts to the benthic community is 3,423 acres; however, there are many more acres of benthic habitat available within the Study Area and the overall impact to the benthic community is small, less than 1%. In addition, vertical complex structure will provide habitat for a reef-oriented epibenthic community to colonize and develop. The conversion of a low diversity benthic community to a more complex community will provide habitat and food for higher trophic levels including fish. The expansion and development of artificial reefs provide a net benefit to the benthic | ambient currents. This may lead to increased scouring in some areas and increased sediment accumulation in others.<br>This alternative may have indirect impacts to the benthic community. Indirect impacts could include the introduction of non-native species which prefer reef habitats that may either displace or forage on the existing community, thus changing the benthic community structures. Furthermore, as water temperatures rise due to climate change, warm water non- native species brought by the Gulf Stream may colonize the reefs and compete with native species for habitat and food resources. Cumulative impacts to the benthic community include, reduction of benthic sand habitat, increases in bottom disturbance and possible suspension of sediments due to multiple users (i.e. fishing). Increases in bottom disturbance may result in additional losses and changes to the endobenthic community. The magnitude of additional direct impacts to the benthic community is 2,111 acres; However, the capacity for additional materials and habitat creation would be reduced under this alternative. | may lead to increased scouring in some areas and increased sediment accumulation in others. The Existing Program alternative may have indirect impacts to the benthic community. Indirect impacts could include the introduction of non-native species which prefer reef habitats that may either displace or forage on the existing community, thus changing the benthic community structures. Furthermore, as water temperatures rise due to climate change, warm water non- native species brought by the Gulf Stream may colonize the reefs and compete with native species for habitat and food resources. Cumulative impacts to the benthic community include, reduction of benthic sand habitat, increases in bottom disturbance and possible suspension of sediments due to multiple users (i.e. fishing). Increases in bottom disturbance may result in additional losses and changes to the endobenthic community. However, the capacity for additional materials and habitat creation would be greatly reduced under this alternative. | |

| Resource | No Action[1] | Proposed Action | Existing Artificial Reef Program with fewer expansions | Existing Artificial Reef Program (i.e., no expansion) | Development of Special Management Zones |
|---|---|---|---|---|---|
| | | community and are anticipated to offset the potential Project impacts. | | | |
| Fish | No impacts to fish would result under this alternative. | Impacts to fish will be temporary and for a limited duration during construction. Temporary direct impacts are associated with sediment suspension, noise and vibration during material placement. These impacts are short in duration and local to reef sites, as they are limited to construction periods. Temporary impacts would also include small changes in hydrodynamics at the reef edges. Direct impacts are also associated with the conversion of habitat from uniform sandy and silty substrates to hard bottom substrate with vertical relief. The hard substrate will increase species diversity and provide areas for forage, shelter and in some cases spawning that will benefit species.<br>Indirect impacts to fish include introduction of non-native species. The increase of non-native species which can inhabit reef locations as species diversity and habitats change is also an indirect impact. Increases in bottom disturbance, suspension of sediment and increases in vessel traffic, noise and vibration may have impacts onto the fish community and essential fish habitat by temporarily displacing species or modifying habitat.<br>As the overall magnitude of the Proposed Action covers 3,423 acres, the overall impact to the fish community relative to the entire Study Area is small, less than 1%. Even though reef structures occupy a footprint of habitat, and may | Impacts to fish will be temporary and for a limited duration during construction. Temporary direct impacts are associated with sediment suspension, noise and vibration during material placement. These impacts are short in duration and local to reef sites, as they are limited to construction periods. Temporary impacts would also include small changes in hydrodynamics at the reef edges. Direct impacts are also associated with the conversion of habitat from uniform sandy and silty substrates to hard bottom substrate with vertical relief. The hard substrate will increase species diversity and provide areas for forage, shelter and in some cases spawning that will benefit species.<br>Indirect impacts to fish include introduction of non-native species. The increase of non-native species which can inhabit reef locations as species diversity and habitats change is also an indirect impact.<br>Increases in bottom disturbance, suspension of sediment and increases in vessel traffic, noise and vibration may have impacts onto the fish community and essential fish habitat by temporarily displacing species or modifying habitat. As the overall magnitude of this alternative covers 2,111 acres, the overall impact to the fish community relative to the entire Study Area is small, less than 1%. However, the | Impacts to fish will be temporary and for a limited duration during construction. Temporary direct impacts are associated with sediment suspension, noise and vibration during material placement. These impacts are short in duration and local to reef sites, as they are limited to construction periods. Temporary impacts would also include small changes in hydrodynamics at the reef edges. Direct impacts are also associated with the conversion of habitat from uniform sandy and silty substrates to hard bottom substrate with vertical relief. The hard substrate will increase species diversity and provide areas for forage, shelter and in some cases spawning that will benefit species.<br>Indirect impacts to fish include introduction of non-native species. The increase of non-native species which can inhabit reef locations as species diversity and habitats change is also an indirect impact. Increases in bottom disturbance, suspension of sediment and increases in vessel traffic, noise and vibration may have impacts onto the fish community and essential fish habitat by temporarily displacing species or modifying habitat. However, the capacity for additional materials and habitat creation would be greatly reduced under this alternative. | Same impacts anticipated as the Proposed Action. |

| Resource | No Action[1] | Proposed Action | Existing Artificial Reef Program with fewer expansions | Existing Artificial Reef Program (i.e., no expansion) | Development of Special Management Zones |
|---|---|---|---|---|---|
| | | displace demersal species, there are direct benefits. Artificial reefs provide stable structure, relief, crevices and interstitial spaces to create complex diverse habitat. Artificial reefs add habitat complexity and diversity to the Study Area, which is dominated by open-water habitat and sand uniform substrates. The addition of the patch reefs to the existing habitats provides greater habitat complexity for fish by providing refuge and food resources and limiting commercial fishing gear types.<br>Overall the impact to fish species is beneficial as the productivity of the artificial reef leads to increased biodiversity while providing refuge, forage and some spawning opportunities for the associated fish species. | capacity for additional materials and habitat creation would be reduced under this alternative. | | |
| EFH | No impacts to EFH would result under this alternative. | Species with benthic life stages would experience long-term direct impacts, while pelagic species with designated EFH will experience minor to no impacts from sandy substrate habitats being converted to hard-bottom habitat with vertical relief. The Proposed Action would provide a long-term benefit to benthic and pelagic species, structure oriented species that are commercially and recreationally valuable, and establish an epibenthic community, providing a more diverse and complex community. | Species with benthic life stages would experience long-term direct impacts, while pelagic species with designated EFH will experience minor to no impacts from sandy substrate habitats being converted to hard-bottom habitat with vertical relief. The development and expansion of some artificial reefs would provide a long-term benefit to benthic and pelagic species, structure oriented species that are commercially and recreationally valuable, and establish an epibenthic community, providing a more diverse and complex community. However, the capacity for additional materials and habitat creation would be reduced under this alternative. | Species with benthic life stages would experience long-term direct impacts, while pelagic species with designated EFH will experience minor to no impacts from sandy substrate habitats being converted to hard-bottom habitat with vertical relief. The development of the existing artificial reefs would provide a long-term benefit to benthic and pelagic species, structure oriented species that are commercially and recreationally valuable, and establish an epibenthic community, providing a more diverse and complex community. However, the capacity for additional materials and habitat creation would be greatly reduced under this alternative. | Same impacts anticipated as the Proposed Action. |

| Resource | No Action[1] | Proposed Action | Existing Artificial Reef Program with fewer expansions | Existing Artificial Reef Program (i.e., no expansion) | Development of Special Management Zones |
|---|---|---|---|---|---|
| TES | No impacts to TES would result under this alternative. | Temporary suspension of sediments, minor temporary increase in vessel traffic, and limited temporary noise and vibration would impact TES. There is limited risk of materials directly striking individual organisms during placement. Significant permanent impacts on TES or habitat are not anticipated from the placement of materials at the reef sites as Atlantic sturgeon, sea turtles and marine mammals are highly migratory and their presence at the reef sites would only be transient. The Proposed Action would benefit TES by creating foraging areas and protection for juvenile life stages. | Temporary suspension of sediments, minor temporary increase in vessel traffic, and limited temporary noise and vibration would impact TES. There is limited risk of materials directly striking individual organisms. Significant permanent impacts on TES or habitat are not anticipated from the placement of materials at the reef sites as Atlantic sturgeon, sea turtles and marine mammals are highly migratory and their presence at the reef sites would only be transient. The Proposed Action would benefit TES by creating foraging areas and protection for juvenile life stages. However, the capacity for additional materials and habitat creation would be reduced under this alternative. | At the existing reef sites, temporary suspension of sediments, minor temporary increase in vessel traffic, and limited temporary noise and vibration would impact TES. There is limited risk of materials directly striking individual organisms. Significant permanent impacts on TES or habitat are not anticipated from the placement of materials at the reef sites as Atlantic sturgeon, sea turtles and marine mammals are highly migratory and their presence at the reef sites would only be transient. The Proposed Action would benefit TES by creating foraging areas and protection for juvenile life stages. However, the capacity for additional materials and habitat creation would be greatly reduced under this alternative. | Same impacts anticipated as the Proposed Action. |
| Commercial Fishing | No impacts to commercial fishing would result under this alternative. Benefits to commercial fishing would not be realized. | Potential long-term negative impacts to commercial fishers include the reduction of areas for users of mobile gear. However, the limited amount of reef structure being expanded upon and proposed would not support a significant commercial fishery. Commercial fishers using rod and reel may experience temporary impacts during material placement and would benefit from additional structured habitat. | Potential long-term negative impacts to commercial fishers include the reduction of areas for this user group and the reduction in use of mobile gear. However, the limited amount of reef structure being expanded upon and proposed would not support a significant commercial fishery. Under this alternative, the reduction of commercial fishing areas and the benefit to commercial rod and reel fishers would be less when compared to the Proposed Action. | No impacts to commercial fishing during construction. Potential long-term negative impacts to commercial fishers include the reduction of areas for this user group and the reduction in use of mobile gear. However, the limited amount of reef structure being expanded upon and proposed would not support a significant commercial fishery. Under this alternative, the reduction of commercial fishing areas for this group would be less when compared to the Proposed Action. | Same impacts anticipated as the Proposed Action. Development of SMZs may decrease the amount of commercial fishing area available to this user group, |
| Recreational Fishing | No impacts to recreational fishing would result under this alternative. Benefits to recreational fishing would not be realized. | Short-term, temporary impacts to recreational fishing practices during material placement. Following construction, recreational fishermen are anticipated to benefit from the Proposed Action due to increased fishing opportunities. | Short-term, temporary impacts to recreational fishing practices during material placement. Following construction, recreational fishermen are anticipated to benefit from the existing Program due to increased | Short-term, temporary impacts to recreational fishing practices during material placement. Following construction, recreational fishermen are anticipated to benefit from the existing Program due to increased fishing opportunities. However, the | Same impacts anticipated as the Proposed Action. Development of SMZs may decrease the amount of recreational |

| Resource | No Action[1] | Proposed Action | Existing Artificial Reef Program with fewer expansions | Existing Artificial Reef Program (i.e., no expansion) | Development of Special Management Zones |
|---|---|---|---|---|---|
| | | | fishing opportunities. However, the capacity for additional materials and increased recreational fishing opportunities would be reduced under this alternative. | capacity for additional materials and increased recreational fishing opportunities would be greatly reduced under this alternative. | fishing area available to this user group, |
| Recreational Diving | No impacts to recreational diving would result under this alternative. Benefits to recreational diving would not be realized. | This user group would only experience temporary, short-term impacts during material placement and long-term benefits would occur due to increased diving opportunities. | At the existing reef sites, this user group would only experience temporary, short-term impacts during material placement and no significant permanent impacts long-term would occur. However, the capacity for additional materials and increased scuba diving opportunities would be reduced under this alternative. | At the existing reef sites, this user group would only experience temporary, short-term impacts during material placement and no significant permanent impacts long-term would occur. However, the capacity for additional materials and increased scuba diving opportunities would be greatly reduced under this alternative. | Same impacts anticipated as the Proposed Action. Development of SMZs may regulate the reef areas available to this user group. |
| Environmental Justice | No impacts to environmental justice communities would result under this alternative. | No impacts to environmental justice communities would result under this alternative. | No impacts to environmental justice communities would result under this alternative. | No impacts to environmental justice communities would result under this alternative. | No impacts to environmental justice communities would result under this alternative. |
| Socioeconomics | No impacts to socioeconomics would result under this alternative. | Increased fishing and diving would result in socioeconomic benefits. | Increased fishing and diving would result in socioeconomic benefits. | Minimal to no impacts to socioeconomics would result under this alternative. | Minimal to no impacts to socioeconomics would result under this alternative. |
| Cultural Resources | No impacts to cultural resources would result under this alternative. | The areas of artificial reef material placement are devoid of existing structures and unlikely to impact submerged cultural resources. No long-term impacts to cultural resources are anticipated. | The areas of artificial reef material placement are devoid of existing structures and unlikely to impact submerged cultural resources. No long-term impacts to cultural resources are anticipated. | The areas of artificial reef material placement are devoid of existing structures and unlikely to impact submerged cultural resources. No long-term impacts to cultural resources are anticipated. Impacts would be limited to the reef areas already permitted under this alternative. | Same impacts anticipated as the Proposed Action. |
| Marine Disposal of Waste | No impacts to marine disposal of waste would result under this alternative. | No impacts to marine disposal of waste would result under this alternative. | No impacts to marine disposal of waste would result under this alternative. | No impacts to marine disposal of waste would result under this alternative. | No impacts to marine disposal of waste would result under this alternative. |
| Dredging, Sand, and Gravel Mining | No impacts to dredging, sand, and gravel mining would result under this alternative. | No impacts to dredging, sand, and gravel mining would result under this alternative. | No impacts to dredging, sand, and gravel mining would result under this alternative. | No impacts to dredging, sand, and gravel mining would result under this alternative. | No impacts to dredging, sand, and gravel mining would |

| Resource | No Action[1] | Proposed Action | Existing Artificial Reef Program with fewer expansions | Existing Artificial Reef Program (i.e., no expansion) | Development of Special Management Zones |
|---|---|---|---|---|---|
| | | | | | result under this alternative. |
| Navigation | No impacts to navigation would result under this alternative. | No impacts to navigation would result under this alternative. | No impacts to navigation would result under this alternative. | No impacts to navigation would result under this alternative. | No impacts to navigation would result under this alternative. |
| Offshore Energy | No impacts to offshore energy would result under this alternative. | No impacts to offshore energy would result under this alternative. | No impacts to offshore energy would result under this alternative. | No impacts to offshore energy would result under this alternative. | No impacts to offshore energy would result under this alternative. |

Note [1] – These impacts reflect what would happen once current permits expire.

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