RESPONSE TO DMF COMMENTS ON THE NOI: ATTACHMENT TO CONSERVATION COMMISSION MEETING #3 RESPONSES

DMF 1. The performance of sand mining and beach fill as currently proposed will not address concerns regarding impacts to natural resource areas, and will, in fact, increase the amount and magnitude of impacts to fisheries resources and habitat protected under the Wetland Protection Act.

The MA Wetlands Protection Act regulations favor beach nourishment over other shoreline management strategies because it does not inhibit natural coastal processes and protects functions and values of coastal wetlands including the protection of wildlife and fisheries. The Massachusetts Coastal Zone Management (CZM) Program, its Plan, and policies also encourage beach nourishment. As proposed, the Project complies with the recently-issued guidance document, "*Beach Nourishment: Mass DEP's Guide to Best Management Practices for Projects in Massachusetts*" (March 2007), which was jointly authored by the Massachusetts Division of Marine Fisheries, Massachusetts Department of Environmental Protection, and CZM. The Proponent is committed to mitigating for any unavoidable and permanent Project-related impacts to cobble habitat to ensure no net loss in habitat functions or values.

DMF 2. All fill material should be considered sacrificial, just as it would be if deposited through natural processes, since all of it may be lost during a single storm event.

The purpose of the Project is to prevent additional Coastal Bank erosion by widening the beach to absorb wave energy, enhancing Coastal Dune resources, and stabilizing the bank face. To accomplish this, the engineered design includes a design beach and advanced nourishment: the design beach abutting the Coastal Bank will be maintained to provide requisite storm protection, while the advanced nourishment will form a seaward sacrificial beach that will erode over time. To adequately maintain the design beach and its associated level of protection, renourishment will occur when the advanced nourishment portion of the sacrificial beach has eroded away. It is conceivable that a strong storm occurring just prior to renourishment could impact the design beach itself and hence erode some of that segment of the nourishment template into the sediment transport system; however, regular monitoring efforts are designed to promote timely renourishment that will protect and maintain the design beach. The actual renourishment schedule will depend on meteorological conditions, permitting, and monitoring results.

DMF 3. Given the estimated project life of five years, and results from studies following other, less-intrusive projects suggesting a recovery time of six to ten years, it is unlikely that habitat functions and values of nearshore cobble will have returned to preconstruction levels before the next cycle of construction impact.

In the Project area, nearshore subtidal benthic ecology is characterized by two zones: an inner zone and an outer zone. The inner zone is dynamic and characterized by disturbance. Since the benthic habitat in the inner zone undergoes a regular cycle of burial under sand and subsequent re-exposure, vegetation and organisms utilizing the area are rapid colonizers adapted to regular disturbances (e.g., sand-scour and burial);

representative species include red algae such as Irish moss, wireweeds, and banded red seaweeds. The outer zone is less energetic and more sheltered, and thus provides a less ephemeral benthic habitat. Correspondingly, this outer zone is characterized by a more stable biological community that prefers less disruptive conditions and likely provides higher fish habitat function.

Once Project construction is complete, natural sediment transport processes will rework the nourishment fill and benthic organisms will re-colonize and re-establish these two zones. The majority of benthic habitat impacts will occur in the nearshore inner zone, where some cobble habitat will be buried by sand. However, some of this hard structure will be re-exposed as the sacrificial beach erodes. Resilient red algal species and other sessile benthic organisms will repopulate bare cobble substrate within the first year of exposure. Several studies suggest a 1-to-3-year recovery period is an appropriate prediction for the Project nourishment area, where re-colonization of soft sediments will occur through the migration of motile adults, vertical migration of infauna living deep within underlying substrate, and movement of infaunal organisms through sediment bedload transport. Results from a seven-year biological monitoring program conducted jointly by the U.S. Army Corps of Engineers, National Marine Fisheries Service, U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, and New Jersey Division of Fish and Game suggest recovery may occur even more rapidly (Burlas, Ray and Clarke, 2001[1]). That program monitored biological recovery following placement of more than 19 million cubic meters of sand over approximately 21 miles of high-energy beaches between Manasquan Inlet and Asbury Park, New Jersey; this effort was associated with two dredge events and a project duration of seven years. Biological monitoring showed that intertidal and nearshore species abundance, biomass, and taxa richness recovered within 2-6.5 months of filling, that offshore invertebrate biomass at the borrow site recovered in 2-2.5 years, that ichthyoplankton sustained no detectable impacts, and that finfish distribution, abundance, and food habits were unaffected.

Furthermore, the Proponent is committed to mitigating for any unavoidable, permanent impacts to cobble habitat. The mitigation, designed to ensure no net loss in habitat functions or values, will be located nearby but at a site that will not be subjected to burial.

DMF 4. This project proposes to begin mining sand from historic relic shoals located off Nantucket, which would begin a cycle of extraction that has no discernable endpoint, given the temporary nature of beach fill as a protective measure.

The Borrow Site contains water depths of 30-50 feet, and is not in area of "historic relic shoals". In fact, the Project does not propose any activities on shoals, and extensive modeling using state-of-the-art technology has consistently shown the Project will not detrimentally impact sediment transport, wave transformation, or ocean currents. Future

[1] Burlas, M.; Ray; G.L.; and Clarke, D. 2001. The New York District's Biological Monitoring Program for the Atlantic Coast of New Jersey, Asbury Park to Manasquan Section Beach Erosion Control Project. Final Report. U.S. Army Engineer District, New York and U.S. Army Engineer Research and Development Center, Waterways Experiment Station. http://www.nan.usace.army.mil/business/prjlinks/coastal/asbury/index.htm.

excavation activities related to renourishment events will require regulatory review and approval.

DMF 5. The sand waves and ridges that form on these [Nantucket] shoals provide refuge and shelter, particularly for juvenile life stages, and alteration or loss of these habitats can markedly affect fish development and behavior.

Project activities will not occur on any shoals. Furthermore, as explained previously, the Project will not detrimentally impact any shoals in terms of sediment transport, wave transformation, or ocean currents. Nonetheless, the Project area does contain important biological resources, and the Proponent has performed an extensive impact assessment that relies upon physical and biological survey data as well as scientific literature.

In such an assessment, it is helpful to evaluate species in groups. For example, eggs and larvae collected at the Borrow Site were primarily from groundfish species that spawn in late winter and early spring. Since dredging will occur during summer and early fall, the activity will not impact this spawning. Juvenile and adult groundfish (e.g., flounders) and pelagics will migrate to the Project area to feed during the summer months, but these individuals will be able to detect and avoid the construction activities without incurring adverse impacts. Such avoidance measures are possible because suitable habitat located nearby is sufficiently abundant to accommodate any temporarily-displaced fish populations. The vast majority of these species' habitats, located primarily where coarse-grained sediments are dominant, will remain unaltered and thus will be available for future use. Although some permanent cobble habitat burial is unavoidable, the Proponent is dedicated to providing suitable and effective mitigation to ensure there is no net loss in habitat functions or values.

DMF 6. It is highly likely that biological data collected to date are not sufficient to permit sound statistical comparisons with subsequent data collected for this project.

Specifically relating to the survey efforts and methods used in the sampling program, the Project Team disagrees with this statement. Since November 2005, the Project's fisheries consultant, Normandeau Associates, has collected an impressive volume of comprehensive fisheries data; Normandeau is a highly-respected fisheries consulting firm. These data include more than 60 days of field surveys performed on behalf of the Proponent to characterize sportfish, groundfish, shellfish, and early developmental stages of marine life and benthic habitat. Surveyors caught more than 20,000 fish and collected data at the Borrow Site using otter trawl, mid-water trawl, and rod- and-reel sampling. These data, combined with the large volume of benthic recovery data from other beach nourishment projects, formed the statistical base for conclusions regarding fish occurrence and the Project's impact assessment.

Permitting delays have pushed the proposed start of dredging to summer 2008, enabling the Proponent to collect an additional year of data. A typical sampling plan, including the one for this Project, is designed to assess seasonal variability in habitat and marine resources. While a single year of sampling is commonly accepted as providing a reasonable baseline of data, this Project is currently completing its second year of sampling. A thorough, multi-year monitoring program will assess actual recovery.

DMF 7. Sampling gear employed for fisheries surveys was too small and subject to too many external factors for the stated purpose, as well as being inappropriate for sampling several pelagic species of concern.

The fisheries sampling plan has utilized standard sampling techniques to target bottom-dwelling, pelagic, benthic, and shellfish species as well as early lifestages. The sampling plan was reviewed by representatives from fisheries agencies, including the Division of Marine Fisheries, and with the exception of pelagic species the regulatory reviewers made no comment on the methodology. Gillnets were briefly discussed for use in an alternative sampling technique for pelagic species, but the Proponent was reluctant to use gillnets because of an associated high rate of mortality; DMF stated the agency was unlikely to approve gillnet sampling for the same reason, but recommended no substitutes.

Pelagic species are highly mobile, and the Proponent employed the mid-water trawl and rod-and-reel sampling to survey these populations. Resulting data, particularly from the rod-and-reel program, are useful for assessing the abundance of sportfish species of particular interest to regulatory agencies and stakeholder groups. Pelagic species will likely remain unaffected by the construction or associated habitat impacts, since their mobility enables them to avoid Project activities and because similar suitable habitat is abundant nearby.

DMF 8. Attempts to address these deficiencies through alternative techniques such as rod and reel fishing were of very limited scope.

The purposes of rod-and-reel sampling were two-fold. The first purpose was to collect data (e.g., location, size, and preferred prey) on sportfish species landed in the Project area. The resulting dataset enabled the Proponent to compare species presence and optimal landing locations with habitat information. The second purpose was as a useful tool to reach out to and engage with fishermen. Sampling events enabled the Proponent to directly provide fishermen with technical information regarding the Project while also gaining insight from their first-hand knowledge of fishing in the area. In both respects, the information collected greatly enhanced the Proponent's ability to design a Project that could best protect fisheries and fishermen.

DMF 9. Project reports refer to missed or reduced data collection activities due to inclement weather and sea state. Such conditions will also greatly affect the ability of small-scale trawl gear to tend bottom or otherwise fish as designed, limiting their effectiveness.

Sampling surveys were not performed when weather conditions created a safety risk or could have detrimentally affected the efficiency of equipment. Challenges and/or delays relating to weather or sea state are inevitable when performing fieldwork in an environment as active and dynamic as the Project area. However, these conditions did not generate significant data gaps, and hence did not materially reduce the overall usefulness or validity of the comprehensive data collection program.

DMF 10. Of particular concern for review of this NOI under MA WPA, sea conditions prevented performance of the critical dredge efficiency evaluation for

surf clam sampling and may have affected actual dredge operation. As a result, characterization of this resource reported in the NOI may not be representative of existing relative abundance.

Sampling was performed with a commercial-style surf clam dredge. Challenging weather conditions during the sampling program prevented a diver from being in the water to calculate the efficiency of the dredge. Based on the best scientific literature available, therefore, the data analysis assumed a harvesting efficiency of 65%. This rate is a conservative estimate given sea conditions and the spectrum of efficiencies available from the literature. We believe the data provide an accurate assessment of surf clam populations at the Borrow Site.

DMF 11. Due to cost considerations, attempts to use benthic sampling and community structure as a proxy for evaluating finfish habitat functions and values commonly are undertaken. However, they cannot be considered truly representative of finfish needs or usage as they are by nature generalized and not designed to target the habitat of a particular species.

Evaluating habitats rather than individual species is a fundamental principle in ecology not because of cost but because of the temporal variability of species occurrence. Benthic habitats exhibit relatively consistent conditions that are not typically characterized by dramatic annual variability. The high-energy Project area is characterized by dynamic sand transport and in that sense exhibits regular change; however, these active conditions are themselves relatively constant and do not exhibit great variability. Experts in the field of beach nourishment impact assessment agree that measuring changes in benthic communities as a result of construction is the best way to gauge habitat impacts and recovery for beach nourishment projects (Saloman, Naughton, and Taylor, 1982[2]; Johnson and Nelson, 1985[3]).

DMF 12. The selection of only one year of sampling effort as the study duration remains problematic. The collection of one year's worth of data is generally considered a pilot study and the results are used to calculate the amount and intensity of effort needed to answer stated question or make desired comparisons.

See response to DMF 6. The Project's bottom trawl sampling has extended over two full years, and ichthyoplankton sampling has captured two complete spawning seasons.

DMF 13. As defined by the FEIR, biological sampling is only taking place within a single area of the shoals. As such, there can be no comparison of impact severity between this and other potential mining sites. Scientifically-sound sampling effort should be applied to all candidate-mining sites with suitable sediment grain size to allow a true analysis of alternative sites.

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[2] Saloman, C.; Naughton, S.; and Taylor, J. 1982. *Benthic community response to dredging borrow pits, Panama City Beach, Florida*. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Fort Belvoir, VA. Miscellaneous Report Number 82-3. 138 pp.

[3] Johnson, R. and Nelson, W. 1985. *Biological effects of dredging in an offshore borrow area*. Florida Scientist, Number 48. Pp. 166-188.

It is common practice to narrow the range of possible borrow sites by using existing data from maps, research, previous surveys, and knowledge of environmental conditions before performing more in-depth, resource-intensive analyses of the most promising alternatives and preferred site. It is unrealistic, unreasonable, and indeed unprecedented, to expect any project to collect detailed information from every potential borrow site. Borrow sites must satisfy certain criteria required to achieve Project objectives, and if a particular site does not satisfy these "exclusionary criteria", its elimination from further consideration is valid and appropriate (see Section 2 of the NOI Application). For example, the Proponent collected sediment samples from a variety of potential borrow sites to identify areas containing beach-compatible sand comparable in grain size or coarser-grained than the native beach. Sites lacking compatible sand were excluded from further consideration. This alternatives analysis followed the Highway Methodology and was presented to the U.S. Army Corps of Engineers and resource agencies (including DMF); a refined version was presented in the FEIR, which was deemed acceptable by the Secretary of Environmental Affairs. To request that the Proponent revisit the alternative analysis process is inappropriate.

Data from fisheries landings, DMF trawls, bathymetric surveys, and other geologic investigations relating to the ecology of each potential borrow site satisfying exclusionary criteria suggest the sites are quite similar; therefore, site-specific studies are not appropriate. The Proponent also discussed borrow site alternatives with fishermen and incorporated their input into the exclusionary analysis.

DMF 14. Relative comparisons of habitat "value" based on comparison of fishing activity (commercial and recreational) between areas of Nantucket Sound fail to acknowledge activity at the proposed mining site and appears to be as much a function of sea conditions at the site as the occurrence or relative abundance of desired species.

The analysis of potential borrow sites must rely on all available information, including commercial and recreational fishing activity. Fishing activity is positively correlated with the availability of target species such as striped bass and bluefish. Given the public interest in protecting these important species, it would be irresponsible not to include this information in the evaluation of borrow site alternatives. Consultations with fishermen have provided important supplementary information consistent with survey results which confirms that the Borrow Site is not highly-utilized for fishing. The Proponent has collected an abundance of site-specific data at the Borrow Site by performing benthic and ichthyoplankton surveys and otter trawl, mid-water trawl, and rod-and-reel sampling.

DMF 15. In a similar vein, the proposed mining area may serve as refuge from harvest for finfish due to regular inclement conditions and may in fact provide greater ecological services than other areas. Such comparisons cannot be made without additional data.

See responses to DMF 5, 12, and 14.

DMF 16. If there is currently no evidence of shore birds nesting on the beach along much of proposed fill area, what certainty is there that birds will use the area following construction?

The primary factor restricting Piping Plover and Least Tern use in most of the Project area is the narrow beach width. These shorebirds typically nest on the northern and southern margins of the Project where the beach is wider and provides nesting areas sheltered from storm waves. By widening the beach, the proposed nourishment Project will expand shorebird habitat and provide foraging opportunities similar to those within the historic nesting areas. Piping Plovers and Least Terns are known to nest where sandy dredged material has been deposited, and state experts from the Natural Heritage and Endangered Species Program have concurred these shorebirds are likely to use the nourished beach. As a result of all of this information, the Proponent is confident that the nourished beach will be used by shorebirds.

DMF 17. If shore birds colonize the area, will the extended beach become productive habitat, or merely a "breeding sink" that will rapidly peak and decrease in use? Should this occur, or if multiple breeding seasons are not supported due to loss of beach sand, the expected natural resource benefits would not be achieved and cannot be said to offset marine habitat impacts.

While loss of beach sand will occur, a significant portion of the nourished beach will remain until renourishment, thus continuously providing shorebird habitat. The nourished beach is composed of two parts: (1) a “design beach,” which provides protection during a major (50-year) storm; and (2) “advanced nourishment,” which is sacrificial and will erode over time. The advanced nourishment will be seaward of the design beach and is intended to protect and maintain the design fill during the intervals between renourishment events. Post-construction monitoring will enable the Proponent to schedule renourishment to occur after the advanced nourishment fill has eroded but before significant losses to the design beach. Therefore, maintaining the design beach will provide a significantly wider beach that can continuously serve as habitat. Based on these characteristics, shorebirds are likely to sustain their use of the habitat rather than experience a peak and subsequent decrease.

Furthermore, it is essential to acknowledge that even the best nesting habitat naturally changes over time. Eastern Nantucket is an extremely dynamic environment where habitat is lost and gained annually, and sometimes even monthly. While sand may erode from one location, sediment transport may result in better conditions elsewhere along the coastline where previous conditions were unsuitable for shorebirds. Overall, with the Project there should be a net benefit to nesting habitat for plovers and terns along the entire coastline. Finally, the Proponent’s extensive monitoring will occur on a regular basis to assess shorebird use.

DMF 18. Estimation of the functional loss of important habitat areas as minimal in comparison to the extent of such sediment types within greater Nantucket Sound is not credible, as the NOI does not provide any quantitative analysis or comparison of biological productivity of these sediment types over the same range. The assumption that all such sediments provide the same habitat value is not correct.

The Project area constitutes a tiny fraction of the Nantucket Shoals ecosystem, which extends for more than 25 miles off the southeast coast of Nantucket and covers an area larger than one million acres. Mobile fish species pursue prey and utilize the Project area as one portion of a much larger habitat range, and migratory species that occur seasonally on the shoals are not specifically dependent upon the Project area. Habitat

impacted by the Project is not exclusive to any particular species, comparable habitat areas are available nearby, and fish populations that utilize the shoals are not expected to be significantly impacted by the Project.

Although Project dredging may temporarily reduce available prey within the dredge footprint itself, the Borrow Site does not contain unique characteristics to suggest that prey could not be located nearby while the dredge footprint recovers. Moreover, Project dredging will not result in a conversion of habitat type at the Borrow Site; the post-excavation substrate will remain sandy and will resemble the existing substrate's composition. Minerals Management Service studies suggest that habitat recovery occurs within one to three years of dredging and that post-recovery composition of the benthic community mirrors its pre-excavation condition when habitat characteristics of an excavated area are retained.

DMF 19. The NOI contains no information on the frequency or projected volume of future mining activities in this area and no evaluation of fisheries habitat impacts.

The Proponent's application addresses initial Project nourishment and the first renourishment event; potential nearshore and Borrow Site impacts have been assessed and described in detail. As proposed, the Project's renourishment interval is approximately five years (depending on meteorological conditions), although it is common for renourishment intervals to lengthen over subsequent cycles; the Proponent is also considering a reduced initial Project scope which would have a shorter renourishment interval but would allow monitoring results to demonstrate the lack of impacts.

Renourishment efforts will not generate nearshore impacts in excess of those created by initial Project construction since no renourishment material will extend beyond the equilibrium footprint. Similar to the initial Project dredging, impacts from excavating renourishment material will be temporary and characterized by relatively rapid benthic recolonization. Furthermore, it is important to note that renourishment events will involve significantly less fill than initial Project construction, since the design beach will remain in place; assuming adequate maintenance of the design fill, renourishment will only re-construct the advanced nourishment portion of the Project design. As a result, renourishment will require a shorter construction period than the initial Project, thus lessening the disruptions to the local community and fishermen.

DMF 20. The NOI provides virtually no information on the ultimate fate of the fill material and associated habitat loss.

The littoral system will naturally transport nourishment material north and south of the Project area. Adjacent shorelines will accrete naturally as a result of the nourishment, with the beach at Sesachacha Pond widening by approximately 40 feet. Typically, the magnitude of shoreline change will decrease with increasing distance from the nourishment area. Extensive computer modeling results indicate that sediment transport from the Project area will not detrimentally impact wave transformation or current flow.

Detailed sub-marine video photography, sidescan sonar imagery, and diver surveys show that cobble habitat is most dense in the area offshore from Sankaty Head Lighthouse, with decreasing density to the north and south. Survey data also indicate

that the highest densities of cobble (greater than 50%) are located a minimum of 800 feet offshore. The majority of this dense cobble is located 1,600-3,500 feet offshore, which is well outside of the Project's equilibrium profile. Survey results show that approximately 31.4 acres of actual cobble will be partially buried by the equilibrium footprint at its maximum extent; this area represents approximately 10.6% of the total 295-acre equilibrium footprint. Cobble survey results, including graphical depictions of the impact area, are being submitted to the Commission under separate cover. No habitat loss is expected outside the Project area, and the Proponent is committed to mitigating for unavoidable, permanent habitat impacts within the Project area to ensure no net loss to habitat functions or values. Refinement of the mitigation plan is proceeding through the regulatory process.

DMF 21. Monitoring plans must include evaluation of the changed cycle of burial and exposure that will impact the cobble habitat within the context of benthic recolonization and functional return. This is of particular concern given the long (six to ten years) recovery time documented for cobble habitat.

Post-construction monitoring will document burial and re-exposure associated with the cycles of nourishment, equilibration, and erosion. The Proponent will employ a multi-level monitoring approach along pre-established transects which will consist of sidescan sonar, videography, and quadrant sampling. Monitoring will occur annually along approximately six transects similar to those completed pre-construction. Resulting data will identify approximate boundaries of the seasonal nearshore scour zone and thus quantify the areas of cobble habitat that are permanently buried, buried and partially re-exposed, and buried and fully re-exposed. This information will confirm the adequacy of Project mitigation and inform the impact assessment for future stages of renourishment. The Project's design is engineered with a projected 5-year renourishment cycle (see Section 6.5 of the NOI Application); the Proponent is also considering a reduced initial Project scope which would have a shorter renourishment interval but would allow monitoring results to demonstrate the lack of impacts.

DMF 22. Discussions of significant impacts cannot be limited to population-level effects, particularly when one looks at the resolution of available data. At that scale, there would have to be a near complete failure of some species or group of species in order for it to be detected.

Impacts are most effectively and appropriately assessed by evaluating a species' use of habitat in the Project area in light of potential Project-related impacts to that particular habitat and in the context of similar habitat nearby. Habitat loss is associated with a loss of ecological productivity for a wide range of organisms. A comprehensive impact assessment must consider long-term impacts from habitat loss as well as potential direct impacts from construction activities (e.g., entrainment).

The Project-specific impact analysis shows that habitat impacts to existing sandy bottom at the Borrow Site and along the nearshore will be short-term, with recolonization and recovery in 1-3 years. In certain areas of localized nearshore cobble habitat, burial under nourishment fill will produce some unavoidable, permanent impacts in the form of conversion to sandy habitat; the Proponent will mitigate for these impacts by deploying habitat mitigation strategies. While resource surveys, scientific analyses, and modeling

results all support the predicted extent of impacts and mitigation, post-construction monitoring will quantify actual impacts to ensure that mitigation efforts are adequate and satisfactory. Because long-term Project success depends on future renourishment, ongoing monitoring will confirm the continuing adequacy of the mitigation and evaluate potential additional compensation through subsequent permitting, if necessary.

The Project's limited and unavoidable direct impacts to individual fish will be associated with entrainment in the dredge. Any such impacts, however, will be temporally constrained to the construction season and will potentially affect only a tiny fraction of the standing crop for species found in the Nantucket Shoals.

DMF 23. Techniques such as installation of geotextile tubes or construction of a seawall would have far fewer effects on marine resources, while the proposed beach fill and offshore mining would cause direct and spatially broad impacts to these species and habitats.

Federal, state and local environmental regulations strongly favor soft solutions such as beach nourishment over traditional hard structures (e.g., seawalls, groins, breakwaters, etc.) since "soft" alternatives do not inhibit natural sediment transport. Hard structures, on the other hand, alter natural coastal processes and induce habitat conversion. While beach nourishment is a shoreline management strategy that requires monitoring and maintenance, mainly in the form of renourishment, in this case the strategy allows for an appropriate balance between Project performance, natural resource protection and enhancement, and support for public access and recreation.

More specifically, the Wetlands Protection Act regulations favor beach nourishment over hard structures such as geotextile tubes and seawalls because structures alter natural coastal processes and the ecological benefits that sediment transport provides to coastal wetlands. While beach nourishment will have some unavoidable, permanent impacts to cobble habitat, in accordance with the Act the Proponent will mitigate for such impacts by creating new hard structure habitat nearby. The mitigation will ensure that the Project causes no net loss in habitat functions or values, and will be accompanied by post-construction monitoring to assess the mitigation's adequacy and success.

DMF 24. The proponents are proposing to work at a time of year likely to maximize impacts to marine fisheries resources and harvest at the mining and fill sites.

In proposing a construction schedule from June into the beginning of November, the Project will adhere to appropriate time-of-year (TOY) restrictions to minimize potential impacts to sensitive biological resources. Wave and weather data indicate that dangerous operating conditions are frequent during the late fall and winter months, negating construction during that season. Therefore, initiating construction early in the summer is necessary to complete the Project in a single season.

TOY restrictions are implemented to avoid adversely affecting species' reproductive success, particularly for populations affected by overharvesting (e.g., winter flounder and cod) or other stresses such as degraded spawning habitat (e.g., anadromous fish). All marine waters off New England are designated as Essential Fish Habitat (EFH) for fish species and life stages. As presented in the NOI, the Borrow Site and nourishment area

are designated as EFH for a variety of commercially-important species including winter flounder, for which the population has declined dramatically. Data from the ichthyoplankton study performed as part of the Proponent's Fisheries Sampling Plan supports this EFH designation. Accordingly, the Proponent will adhere to a TOY restriction between February and the end of May, during which no Project dredging will occur within the Borrow Site. This restriction will protect winter flounder spawning.

The Proponent's surveys have confirmed that the Project area is not a critical lobster migration corridor. However, lobsters that do occur in the Project area are mobile during the warmer months and capable of avoiding construction activities; during the colder months, lobsters often hibernate within the sand. If regulatory constraints forced the Project's construction schedule into these colder months, lobsters could be subjected to mortality as a result of entrainment in the dredge. The proposed construction schedule, which extends from June into the beginning of November, minimizes the likelihood of any impacts to local lobster populations.

DMF 25. Calculation of the value of lost habitat, ecological services, or access using the NRDA or other procedures is limited by the quantity and quality of data to make the assessment. As such, estimates of loss associated with this project are likely undervalued.

In its comment letter on the DEIR, NMFS requested that the alternatives analysis assess the potential temporary and permanent costs of habitat impacts at the Borrow Site and nourishment area. Subsequent conversations with NMFS staff revealed a preference for a methodological approach resembling the Natural Resources Damages Assessment (NRDA); regulatory agencies have utilized NRDA when an entity has damaged the environment with an oil spill or other contaminant release that has resulted in a loss of habitat functions and values. In such cases, the impact from contamination is absolute and damage can be quantified. There is no precedent for applying NRDA to a typical USACE permit application.

Nonetheless, the Proponent attempted to respond to NMFS' comment and prepared a full accounting of habitat costs of the sand mining and nourishment. That estimate included, most importantly, the cost of a robust mitigation and monitoring program to insure against any net loss in habitat functions and values. The Proponent believes the resulting NRDA-type assessment was appropriate given the amount of information typically required when applying for and obtaining a USACE permit. Furthermore, due to the Project's predominantly short-term impacts, the simplified approach using known assumptions provides a more accurate result. Complex formulas of function and value loss developed by regulatory agencies for oil and other contaminant releases are not appropriate for a beach nourishment project.

DMF 26. The NOI fails to quantify the extent and magnitude of impacts to cobble habitat at the fill site. As such, the proposed artificial reef construction cannot be expected to address loss of cobble habitat functions and values, nor does it consider loss or alteration of these ecological services at the proposed mining site. Considerably more effort will be required to identify appropriate compensatory mitigation, both type and value, for the potential impacts of this project.

Estimated percent cobble coverage was preliminarily based on data from sidescan sonar surveys and subsequent diver surveys using video cameras performed along six shore-perpendicular transects. More recently, in September 2007, the Proponent conducted an extensive video survey of the nourishment area by collecting video along 123 shore-parallel transects approximately 200-300 feet long. Real-time, high-precision GPS data were directly incorporated into the video feed to accurately record positional information within each video frame.

To analyze the data, Project scientists randomly sub-sampled five still images from each of the 123 video transects. Scientists then assessed the habitat type, marine ecology, and percent cobble coverage within each of the 615 images. Based on the photographic analysis, cobble habitat 400-600 feet offshore is very sporadic, with densities of 0-10% cover consisting of small cobbles. From 600-800 feet offshore, cobble coverage increases to densities of 10-25% along portions of the Project shoreline. Dense cobble (i.e., areas where coverage exceeds 40%) is located more than 800 feet offshore; in this portion of the equilibrium footprint, fill thickness is not expected to exceed 10-12 inches. Dense cobble coverage extends at least to the seaward boundary of the photographic survey (i.e., 4,000-4,500 feet offshore). The average density of cobble coverage within the equilibrium footprint is 9.4%; a maximum cobble density of 57% occurs at the seaward extent of the equilibrium toe approximately 4,800 feet north of the Project's southern terminus.

The proposed mitigation plan, which is still undergoing refinement, will create an area of hard bottom habitat to mitigate for the approximately 30 acres of cobble bottom that video survey results have determined will be impacted as a result of burial under either initial Project nourishment or equilibration of the nourished profile. The 30-acre impact calculation is conservative (i.e., it may over-estimate the actual impact area), and some of this cobble burial will be temporary. The area's dynamic conditions dictate a cycle of coverage and re-exposure: after the beach equilibrates (i.e., reaches its most seaward extent), the toe will begin eroding landward, thus re-exposing some of the buried cobble.

The Proponent has refined the design and location of cobble habitat mitigation based on a detailed impact analysis. The goal of the mitigation design is to re-establish cobble and hard bottom habitat in areas containing monotypical sand similar to the sandy benthic habitat the nourishment fill will create; the Proponent is confident that the proposed design will accomplish this objective. As a result of the mitigation, there will be no net loss in habitat functions or values in the nourishment area. Since the Project will not convert habitat type at the Borrow Site, there will be no loss of ecological services in that area (see response to DMF 18); therefore, mitigation is not necessary. The details of the mitigation plan, including the mitigation-to-impact ratio, are being refined through the regulatory process.

DMF 27. Considerable effort will be required to perform appropriate site-selection, permitting, and monitoring tasks associated with creation of an artificial reef. To date, no work has been performed to identify viable sites or characterize impacts to fisheries resources and habitat that may result from reef construction.

In response to feedback obtained at a multi-agency consultation meeting, the Proponent is performing a detailed alternatives analysis for potential mitigation sites. Site selection will consider proximity to existing cobble to promote rapid colonization of the mitigation

area, positioning within the sediment transport system to ensure that the mitigation area will not be covered by sand transported from the nourished beach, and site-specific characteristics of the sandy habitat to ensure that cobble mitigation replaces habitat that is similar to the sandy habitat created by nourishment. Site-specific videography of potential mitigation sites is crucial for identifying a sandy site suitable for placement of the hard structure mitigation material; video surveys will also ensure that rocky and vegetated bottoms are not impacted. The outcome of this analysis will be a preferred mitigation plan that is the best alternative and ensures no net loss in habitat functions or values.

The Project's mitigation elements are currently being evaluated, designed, and revised based on public review and comment during the relevant regulatory reviews and permitting, including MEPA, USACE 10/404, 401 Water Quality Certification, and MA Wetlands Protection Act. Cobble habitat mitigation will require approval pursuant to M.G.L. Chapter 91, and the Proponent will submit a separate application to DEP for the appropriate license or permit once the design is finalized. A monitoring program will quantify the adequacy and success of the mitigation's replication of lost functions and values through the creation of new structural habitat.

DMF 28. Other than availability, use of concrete railroad ties provides no real value in terms of replacement of the habitat being lost.

The current mitigation design, which is still undergoing refinement, includes a combination of natural rock, reef balls, and perhaps supplemental railroad ties to provide greater structural diversity than would occur with a single material type. When piled together, the ties provide habitat that is more complex than structure created with piled stones alone. Stone will replace the low-relief cobble structure buried under nourishment material. Diverse habitat will result from this superior design. The Proponent is in favor of implementing a pilot mitigation effort to demonstrate the efficacy of the overall mitigation proposal.

While the Proponent has considered the agency's comments during ongoing internal revisions, data from the best available scientific studies conclude that concrete and natural rock each provide similar substrate values for marine benthic communities. The following is a brief summary of recent scientific studies which assess the differences in biological colonization of materials in ocean waters:

- In a five-year direct comparison of quarry rock and concrete reefs in San Diego Bay, California, neither reef material influenced reef utilization. Comparisons between reef designs considered adult fish densities; over the five-year sampling period, adult fish densities increased from 16.37 per $100m^2$ to 43.19 per $100m^2$, but the increase was not significantly different between reef materials. Macrophytic algae quickly colonized both reef materials and remained healthy throughout the duration of the study (Pondella et al., 2006[4]).

[4] Pondella, D.J.; Allen, L..G.; Craig, M.T.; and Gintert, B. 2006. Evaluation of Eelgrass Mitigation and Fishery Enhancement Structures in San Diego Bay, California. Bulletin of Marine Science. 78(1) 115-131.

- In June 1998, 12 artificial reefs (four each of limestone quarry boulders, concrete-gravel aggregate, and concrete-tire aggregate) were deployed 200 meters offshore from Miami Beach, Florida in seven meters of water. From October 1998 through February 2001, divers recorded fish species abundance and length as well as spiny lobster abundance. After completing the study, there was no significant difference in total fish or spiny lobster abundance or fish biomass among the three reef types. Further analysis indicated no clustering of fish assemblages by reef type. Comparisons to pre-deployment fish counts showed increased fish abundance and richness in the local area (Walker et al., 2002[5]).
- In June 1998, settlement panels of wood, limestone, and concrete were installed in vertical and horizontal orientations in Sydney Harbor. After seven months, panels were removed and analyzed for species composition. Species composition was found to be dependent upon orientation as well as material type. Significant differences were detected in a comparison between wood and concrete or sandstone, but differences between sandstone and concrete were insignificant (Glasby, 2000[6]).
- A 60-month biological colonization study was recently completed in the temperate ocean waters off New Jersey. In June 1996, 30 experimental reefs were placed three nautical miles offshore from Barnegat Light; reef materials included rock, concrete, steel, and rubber. In October of each year, divers retrieved samples from each reef habitat for analyses. None of the differences in colonization were statistically significant, although colonization was greatest on concrete (followed by rock, rubber, and steel) in terms of total mean biomass. When comparing biomass broken down by taxa, the only statistically significant comparison involved rubber (Figley, 2003[7]).

DMF 29. Developing an artificial reef as mitigation for unrelated construction impacts in Nantucket Sound will require greater surety of success. We do, however, continue to encourage the applicants to consider the use of this technique as a form of shore protection and recognize that such deployments may also have positive habitat benefits if done properly.

Project alternatives involving submerged structures such as artificial reefs are inappropriate since they would not provide an adequate level of protection during storm surge events, when the elevation of the water's surface rises and creates greater clearance above the structure; this clearance allows more energy to pass over the submerged structure and impact the shoreline. A shore protection alternative employing a hard structure would also interfere with natural longshore sediment transport,

[5] Walker, B.K.; Henderson, B.; and Spieler, R.E. 2002. Fish assemblages associated with artificial reefs of concrete aggregates or quarry stone offshore Miami Beach, Florida, USA. Aquatic Living Resources. 15, 95-105.

[6] Glasby, T.M. 2000. Surface composition and orientation interact to affect subtidal epibiota. Journal of Experimental Marine Biology and Ecology. 248, 177-190.

[7] Figley, B. 2003. Marine Colonization of Experimental Reef Habitat in Temperate Ocean Waters of New Jersey. *Unpublished*.

potentially transmitting detrimental erosion impacts onto downdrift shorelines. Given this potential effect, DMF's suggestion would not satisfy state Wetlands Protection Act performance standards.

As previously stated (see the response to DMF 13), the alternatives analysis followed the USACE Highway Methodology and was thoroughly discussed with the USACE and resource agencies, including DMF. The Proponent presented a refined version of the analysis in the FEIR, which the Secretary of Environmental Affairs deemed acceptable. To request that the Proponent revisit the alternative analysis process is inappropriate.