Executive Summary

Final Programmatic Environmental Impact Statement for
Oyster Restoration in Chesapeake Bay
Including the Use of a Native and/or Nonnative Oyster

Responsible Agency: U.S. Army Corps of Engineers, Norfolk District

ABSTRACT: The Norfolk District of the U.S. Army Corps of Engineers, the Maryland Department of Natural Resources, and the Virginia Marine Resources Commission have completed a Final Programmatic Environmental Impact Statement (PEIS) that presents information regarding a variety of strategies for attempting to restore the population of oysters throughout Chesapeake Bay. The proposed action that prompted the preparation of this PEIS was to introduce a nonnative species, the Suminoe oyster, and continue efforts to restore the native Eastern oyster. The Suminoe oyster is a native of the China Sea that has environmental requirements and tolerances similar to those of the Eastern oyster but is resistant to diseases that have adversely affected the Eastern oyster. Seven individual reasonable alternatives that would involve one or more oyster species individually or together were evaluated during the study. In addition, Alternative 8 proposed three combinations of the individual alternatives. As part of the NEPA process, the public was invited to comment on the Draft PEIS between October 17, 2008, and December 15, 2008 (60 days). Written and oral comments received during the public comment period were considered in revising the Draft PEIS and selecting a preferred alternative. This Final PEIS describes the direct and indirect effects of the proposed action and alternatives on ecological, environmental, and human issues identified during the public interest review at the outset of the PEIS process. Factors relevant to the proposed action and alternatives included the oyster population in the Bay, selected other components of the ecosystem of Chesapeake Bay, water quality, threatened and endangered species, essential fish habitat, social factors, economics, aesthetics and recreation, historic and archaeological resources, wetlands, sanctuaries and refuges, environmental justice, air quality, public safety and fouling, commercial navigation, and potentially affected resources outside Chesapeake Bay. After considering all available information and the input of all stakeholders, the lead agencies have concluded that Alternative 8a, a combination of alternatives that involves only the native Eastern oyster, is the preferred approach for restoring the Chesapeake Bay oyster population.

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E.1 PROJECT OVERVIEW

This Final Programmatic Environmental Impact Statement (PEIS) was developed by the U.S. Army Corps of Engineers (USACE), Norfolk District, and its non-Federal sponsors, the Maryland Department of Natural Resources (DNR), and the Virginia Marine Resources Commission (VMRC) (known collectively as the lead agencies), in accordance with the requirements of the National Environmental Policy Act of 1969 (NEPA; 42 USC 4321-4347), 40 CFR Parts 1500-1508, and 33 CFR Parts 230 and 325. This document assesses a range of options for restoring oysters to Chesapeake Bay and evaluates the potential environmental consequences of those options. The need for an environmental impact statement was triggered by the proposed action, which was to introduce the nonnative Suminoe oyster to Chesapeake Bay while continuing efforts to restore the native oyster. A programmatic evaluation (i.e., a PEIS) was determined to be appropriate in this instance because subsequent NEPA analyses and documents may have to be prepared in tiers as more site-specific plans for implementing a preferred alternative are defined. A PEIS is especially valuable when considering actions that encompass a large geographic scale or that constitute complex programs, both of which would be characteristics of a joint State and Federal effort to restore the size and functions of the oyster population throughout Chesapeake Bay. The information and assessments presented in this PEIS are the outcome of the joint effort of Federal and State agencies and private organizations working coherently and consistently toward a common restoration goal. The scope of this Final PEIS is to evaluate the potential consequences of the proposed action and each alternative for all relevant elements of the environment in as much detail as is possible, given uncertainties about implementation. To facilitate the evaluation, representative implementation plans were created for the proposed action and each alternative to provide a basis for analyzing the potential adverse effects and benefits that might result from implementing those actions. The plans were designed to be reasonably realistic; however, they are not recommendations or specific proposals, but only representations of the kinds of actions that might be taken to implement each of the broad programmatic alternatives. The analyses for this Final PEIS were based on the best information available. The uncertainties associated with the use of limited or questionable data are described, and the role those uncertainties played in the lead agencies' selection of a preferred alternative is explained.

E.2 PURPOSE AND NEED

The Eastern oyster *(Crassostrea virginica*) was once so abundant in Chesapeake Bay that it inspired the Algonquin to name the bay *Chesepiook*, meaning "great shellfish bay." The abundant oyster was a keystone species that provided a variety of ecological services within the Bay's ecosystem. It was a primary component of the Bay's filtration system and provided rich habitat for many other species (Newell 1988). Oysters filter water to feed on small plankton, removing sediment and other particles from the water column, clearing the water, and increasing light penetration in the process. Improved water clarity promotes the growth of underwater grasses, which benefit blue crabs and many other aquatic organisms. Oyster reefs also provide a unique kind of habitat for fish and other species in the Bay. In addition to its ecological functions, the Eastern oyster was as an important food resource for Native Americans and early European settlers, and the Bay's oyster fishery developed into a large export industry during the

1800s. The Chesapeake oyster fishery became the largest in the world during the 1880s (NRC 2004). Towns such as Crisfield on Maryland's Eastern Shore were established and prospered solely on the basis of the abundance of oysters in local waters. The oyster became widely recognized as an important cultural symbol of the Chesapeake Bay region.

Commercial landings of oysters in Chesapeake Bay declined steadily during the late 19th and early 20th centuries, and harvest yields were reduced by half in the 50 years between the late 1880s and about 1930. Major factors believed to have contributed to that decline include intense fishing pressure, mechanical destruction of habitat, siltation of optimal substrate, and overfishing. One hundred years of increasingly intensive and mechanized fishing contributed to leveling the profile of the oyster bars in Chesapeake Bay (Rothschild et al. 1994). Declining water quality also contributed to reducing the oyster population. Clearing of forests and development of land within the Bay's watershed caused increased agricultural runoff, sedimentation, nutrient input, and environmental pollution that killed oysters or created conditions that were less favorable for them (Kemp et al. 2005; Boynton et al. 1995)

During the mid-20th century, oyster harvests remained comparatively stable for several decades (through the late 1970s) before beginning another steep decline that continues to the present. The Bay's oyster population is now estimated to be less than 1% of its size during the 1800s (Newell 1988). The more recent decline in the population has been attributed primarily to the introduction of two foreign diseases to which the Eastern oyster initially had no resistance. The diseases Dermo and MSX are harmless to humans but usually are fatal to Eastern oysters. These diseases have been particularly detrimental to the oyster fishery because they kill many oysters before they reach market size. The high rate of mortality caused by these diseases not only decreases the number of oysters available for harvest, but also reduces the number of large, highly reproductive oysters that are left to propagate the species. Overall, oyster populations in the Bay are now strongly controlled by disease pressure (Ford and Tripp 1996) as well as the continuing loss of hard bottom and oyster shell that are essential for their successful reproduction. Harvest, various kinds of degradation of oyster habitat, poor water quality, and complex interactions among these factors are also are affecting oysters negatively (Hargis 1994; NRC 2004).

Although some localized successes in restoring oysters have been documented as a result of more recent restoration activities, traditional management, repletion, and restoration programs do not appear to have reversed the overall, Bay-wide decline in the oyster population. Given that oyster diseases appear to be a major factor inhibiting recovery, the States began investigating the possibility of introducing a nonnative oyster that is resistant to disease. The Suminoe oyster (*Crassotera ariakensis*), a native of the China Sea, was found to have environmental requirements similar to those of the Eastern oyster and to be resistant to MSX and Dermo. In various studies conducted in the Bay, the Suminoe oyster exhibited greater survival rates and grew faster than the native Eastern oyster. Those studies suggested that the Suminoe oyster has the potential to improve the oyster fishery and water quality in Chesapeake Bay, which encouraged greater interest in the possibility of introducing the species.

Planned and unplanned introductions of nonnative species often have had negative effects on the ecosystems that receive them; furthermore, the introduction of a naturally reproducing

nonnative species into an open aquatic environment is almost certainly irreversible. To assess the risks involved with introducing the Suminoe oyster into the Bay, the Chesapeake Bay Commission, the Chesapeake Bay Foundation, the U.S. Environmental Protection Agency, and the U.S. Senate Committee on Appropriations asked the National Research Council (NRC) of the National Academy of Sciences to describe the state of knowledge about the Suminoe oyster and begin assessing the risks involved with introducing the species in Chesapeake Bay. That study (NRC 2004) identified gaps in the state of knowledge about the Suminoe oyster and recommended research needed to support an adequate risk assessment. Beginning in 2004, Maryland, Virginia, the Potomac River Fisheries Commission, and the National Oceanic and Atmospheric Administration funded extensive research on the Suminoe oyster, much of it focused on risk questions identified in the NRC's report. This Final PEIS incorporates the findings of those studies that are available to date.

USACE, VMRC, and DNR all have been conducting programs to restore the native oyster in Chesapeake Bay for many years. The concept of introducing a nonnative species to achieve the oyster restoration objective for the Bay is very controversial and deviates significantly from all prior restoration efforts. For these reasons, the agencies concluded that it would be appropriate to prepare a PEIS evaluating the proposed introduction and alternatives that might also be feasible means of reaching the restoration objective. The restoration objective encompasses both ecological and economic goals; therefore, alternatives involving aquaculture are included among the range of actions considered in this PEIS.

The following statements of need and purpose for action to restore oysters in Chesapeake Bay were developed through public-scoping meetings held in 2004:

> ***A need exists to restore the ecological role of oysters in the Bay and the economic benefits of a commercial fishery through native oyster restoration and/or an ecologically compatible nonnative oyster species that would restore these lost functions.***
>
> ***The purpose of this proposal is to establish an oyster population that reaches a level of abundance in Chesapeake Bay that would support sustainable harvests comparable to harvest levels during the period 1920–1970.***

Analyses conducted for this PEIS revealed a significant contradiction inherent in the statement of purpose for oyster restoration between the goals of restoring the ecological services of an abundant wild stock of oysters and restoring the economic contributions of the oyster fishery when the proposed action or alternatives are considered individually as potential means of reaching those goals. Several stakeholders who commented on the Draft PEIS recommended restating the purpose to establish two distinct goals, one economic and one ecological, and re-evaluating the proposed action and all alternatives (or additional alternatives) for their potentials to achieve each of those separate goals. Given the limited data and information available, however, the analyses of the broad, general actions described in this programmatic EIS provide considerable insight concerning how a wide range of possible actions might contribute to achieving economic and ecological objectives; consequently, restating the purpose and restructuring the analyses was deemed to be unnecessary. In lieu of redefining the goals of

restoration individually, the lead agencies defined combinations of alternatives that provided a viable means of resolving the contradiction inherent in the statement of purpose.

E.3 ASSESSMENT OF ENVIRONMENTAL CONSEQUENCES

Management programs and scientific studies devoted to the Eastern oyster have been diverse, but most were conducted for purposes very different than addressing the kinds of issues evaluated in this PEIS. Basic characteristics such as the size of the Bay-wide oyster population, the percentage of oysters that are harvested each year, and the rate of growth of oyster populations at different locations in the Bay and in different years have been only poorly defined. Despite their limitations, the data and results from those programs and studies were the only resources available and served as the primary basis for the assessments of the Eastern oyster presented here. The uncertainties that result from data limitations are acknowledged in those assessments. In response to interest in introducing the Suminoe oyster into Chesapeake Bay, State and Federal agencies funded an extensive research program to investigate the species. All available information from those studies, whether completed and peer-reviewed or continuing and documented only in progress reports, was used to assess the potential effects of the proposed action and alternatives that involve the Suminoe oyster. The assessments take into account the uncertainties associated with the use of preliminary or incomplete findings. Analyses and conclusions based on all these data were subjected to a rigorous peer-review process throughout the development of this Final PEIS. Sequential peer reviews contributed to identifying limitations of the analytical tools and findings. The peer reviews established scientifically acceptable boundaries concerning how the results should be employed in the PEIS, and the assessment of environmental consequences presented in this section recognizes those boundaries.

A major objective of the analysis of the proposed action and the alternatives was to assess the extent to which each might contribute to attaining the goal established in the statement of purpose. The numeric benchmark value of that goal was estimated to be 12 billion market-size oysters, which could support an annual harvest of 1.4 billion market-size oysters (5 million bushels), if all the harvest was from wild stock. No data are available that could be used to estimate the number of oysters smaller than market size that would be required to maintain a population of 12 billion market-size oysters; therefore, a restoration goal for the entire oyster population could not be quantified. As a point of reference, the baseline 2004 Bay-wide population of market-size Eastern oysters was estimated to be 809 million. Substantial aquaculture production would reduce the size of the wild stock required to attain the total harvest goal of 5 million bushels; consequently, the development of a large aquaculture industry capable of producing 5 million bushels a year would obviate the need for any wild stock. A fully restored wild stock would be essential, however, to restore the ecological services that oysters provide to the Bay and satisfy the statement of need for action. The analyses presented in Section 4.1 illustrate a potential contradiction inherent in the statement of purpose between the goals of restoring the ecological services of an abundant wild stock of oysters and restoring the economic contributions of the oyster fishery when the proposed action and alternatives are considered individually as potential means of reaching those goals. The combinations of alternatives developed by the lead agencies when the Draft PEIS was nearing completion, all of which include aquaculture of one or both species of oysters (E.4.9), provide a possible approach for resolving that contradiction.

The stated purpose of the actions evaluated in this PEIS is to increase the abundance of oysters in the Bay to match a historical reference population; therefore, the assessment of each alternative begins with an evaluation of the alternative's potential for attaining the numeric benchmark estimate of that historical reference population. Next, effects on other components of the ecosystem and water quality of Chesapeake Bay are addressed. Additional sections address the potential consequences of each alternative for rare, threatened, and endangered species; essential fish habitat; and all other elements of the affected environment, including topics such as recreation, aesthetics, economics, and socioeconomics. Data and information used in the analyses had a wide range of quality and reliability; therefore, the level of uncertainty associated with all projections and assessments is substantial. Uncertainty can result from unpredictable, large natural variability in some factor of known importance to a predicted outcome as well as from lack of knowledge about other factors that also might influence an outcome. The sources of uncertainty are identified, to the extent possible, in this Final PEIS, and the consequences of the uncertainty are described.

The Draft PEIS did not specify a preferred alternative from among the proposed action and alternatives because the lead agencies desired to receive input from all interested stakeholders and to consider it in selecting the appropriate course of future action to restore oysters. The preferred alternative presented in this Final PEIS reflects the scientific findings presented here as well as the extensive and comprehensive information and comments received from organizations and individuals who reviewed the Draft PEIS.

E.4 PROPOSED ACTION AND ALTERNATIVES

E.4.1 Proposed Action

The State of Maryland and Commonwealth of Virginia proposed to introduce the Suminoe oyster (*C. ariakensis*) into the tidal waters of Maryland and Virginia for the purpose of establishing a naturalized, reproducing, and self-sustaining population of this oyster species. Diploid Suminoe oysters would be propagated from existing third or later generations of the Oregon stock of the species, in accordance with the International Council for the Exploration of the Sea's (ICES) *Code of Practices on the Introductions and Transfers of Marine Organisms 1994* (ICES 1995). Deployment of diploid Suminoe oysters from hatcheries was proposed to occur first on State-designated sanctuaries separate from native oyster restoration projects, where harvesting would be prohibited permanently, and then on harvest reserves and special management areas, where selective harvesting would be allowed. Suminoe spat would be placed on existing bars that do not require habitat rehabilitation. The States further proposed to continue efforts with the USACE to restore the native Eastern oyster throughout the Chesapeake Bay by using the best available restoration strategies and stock assessment techniques, including maintaining and expanding the existing network of sanctuaries and harvest reserves, enhancing the brood stock, and supplementing natural recruitment with hatchery-produced spat.

The lead agencies developed a representative plan for introducing the Suminoe oyster that is described in detail in Section 4.1.1. Current restoration programs for the Eastern oyster that would continue as part of this action are described in detail in Section 4.1.2.

E.4.2 Alternative 1: No Action

This alternative consists of continuing Maryland's present oyster restoration and repletion programs, and Virginia's oyster restoration program under current program and resource management policies and available funding using the best available restoration strategies and stock-assessment techniques. The details of the activities assumed under this alternative are presented in Section 4.1.2.

E.4.3 Alternative 2: Enhance Efforts to Restore the Native Oyster

This alternative consists of expanding, improving, and accelerating Maryland's oyster restoration and repletion programs, and Virginia's oyster restoration program in collaboration with Federal and private partners. This work would include, but would not be limited to, an assessment of cultch limitations and long-term solutions for this problem and the development, production, and deployment of large quantities of disease-resistant strain(s) of the Eastern oyster to enhance the brood stock.

Details of the enhanced restoration activities assumed under this alternative are presented in Section 4.1.3. This alternative includes roughly doubling the number of acres of habitat to be rehabilitated over a 10-year period and increasing the number of seed oysters to be planted by a factor of 4.5 over 10 years. Initial evaluations lead to the conclusion that using disease-resistant stains of the native oyster developed in hatcheries to restore wild oyster populations is inadvisable; consequently, that element of the alternative was not considered in further analysis for the PEIS. Numerous stakeholders who commented on the Draft PEIS suggested an approach known as “revolving brood stock” hatchery production in which wild oysters taken from areas in which disease resistance appears to be developing are used as brood stock in the hatchery. The brood stock would be replaced each year with new brood stock from those locations. Analyses for Alternative 2 assume the use of offspring of the brood stock of wild Eastern oysters spawned in hatcheries each year in Maryland and Virginia. Under Alternative 2, most spat would be planted on sanctuary bars.

E.4.4 Alternative 3: Harvest Moratorium

This alternative consists of implementing a temporary moratorium on harvesting native oysters and a compensation (buy-out) program for the oyster industries in Maryland and Virginia or a program that offers displaced oystermen on-water work in a restoration program.

For the purposes of analysis, the moratorium was assumed to be in place throughout a 10-year period used to establish milestones for comparing the actions evaluated in this PEIS. Current restoration programs, as described for Alternative 1, were assumed to continue under this alternative. The cost of a compensation program would be limited to no more than the estimated benefits that participants in the fishery would have realized over the 10-year assessment period (about $10.5 million). In response to a substantial number of stakeholders’ comments on Alternative 3, the lead agencies revisited their concept for this alternative when it was included in the combinations of alternatives (Alternative 8) to represent substantially revised management programs rather than a complete moratorium on the harvest of wild oysters.

E.4.5 Alternative 4: Cultivate Eastern Oysters

This alternative consists of establishing or expanding State-assisted, managed, or regulated aquaculture operations in Maryland and Virginia using the native oyster species.

An economic demand model was used to define the largest oyster aquaculture industry that would be economically viable in the Bay (about 2.6 million bushels). For the purposes of comparing the economics of the alternatives, the maximum industry was assumed to develop over time and to be achieved at the end of 10 years. The maximum industry was assumed to exist throughout that period for evaluating all other elements of the affected environment to illustrate the greatest possible contrast in potential effects among the alternatives.

E.4.6 Alternative 5: Cultivate Nonnative Oysters

This alternative consists of establishing State-assisted, managed, or regulated aquaculture operations in Maryland and Virginia using suitable triploid, nonnative oyster species.

Based on a review of studies of nonnative species considered for use in Chesapeake Bay, the Suminoe oyster was determined to be the only species that has environmental tolerances suited to the Bay, is economically viable, and for which substantial data were available for use in analysis. Analyses for this alternative, therefore, considered only the use of triploid Suminoe oysters. The same maximum, economically viable industry estimated for Alternative 4 (2.6 million bushels) was assumed for this alternative. Biosecure hatchery facilities would be required. This assumption provided the greatest possible contrast in potential effects among the alternatives.

One important aspect of the assessment of this alternative that differs from the assessment of Alternative 4 is the estimate of the probability that a large-scale aquaculture operation using triploid Suminoe oysters could result in an unintended introduction of a reproducing population of the species.

E.4.7 Alternative 6: Introduce Another Nonnative Oyster Species

This alternative consists of introducing and propagating in the State-sponsored, managed, or regulated oyster restoration programs in Maryland and Virginia, a disease-resistant oyster species other than the Suminoe oyster, or an alternative strain of the Suminoe oyster from waters outside the U.S. in accordance with the *ICES Code of Practices on the Introductions and Transfers of Marine Organisms 1994* (ICES 1995).

Based on a review of studies of nonnative species considered for use in Chesapeake Bay, the Suminoe oyster and the Pacific oyster were determined to be the only species that have environmental tolerances suited to the Bay and that might be economically viable. Very little information about how the Pacific oyster might respond to conditions in Chesapeake Bay was available, which precluded a detailed analysis of the consequences of using that species for this alternative. At least two strains of the Suminoe oyster in addition to the Oregon stock specified in the proposed action are maintained in hatcheries in the Bay region. No comparative studies or

field trials using those other strains have been conducted to date; consequently, no basis exists for assessing whether another strain would be more or less suitable than the Oregon stock for meeting the goals of the PEIS. Insufficient information is available for assessing the outcome of this alternative and comparing it to the outcomes of the other alternatives, and it was eliminated from detailed analysis in the PEIS

E.4.8 Alternative 7: Introduce the Suminoe Oyster and Discontinue Efforts to Restore the Eastern Oyster

This alternative would involve attempting to establish a naturalized, reproducing, and self-sustaining population of the Suminoe oyster in the tidal waters of Maryland and Virginia, but discontinuing efforts to restore the Eastern oyster.

Biologically, this alternative is similar to the proposed action, except that any benefits (or costs) of current restoration activities for the Eastern oyster would not be realized. Effects on other components of the affected environment were considered to be similar to those for the proposed action, except for the economic consequences. Initial analysis suggested little economic difference between this alternative and the proposed action; therefore, this alternative also was eliminated from detailed analysis in the PEIS.

E.4.9 Alternative 8: Combination of Alternatives

The lead agencies defined three combinations of oyster restoration activities near the completion of analyses of the proposed action and other alternatives for the Draft PEIS. These combinations of alternatives effectively address the inherent contradiction between economic and ecological restoration in the statement of purpose for action. In considering the potential benefits and risks of each of these combinations, the lead agencies recognized that financial and physical constraints (e.g., the capacity of existing oyster hatcheries, shell resources) might require some activities included as part of a combination to be implemented on smaller scales than were considered in evaluating the individual alternatives and the proposed action. The combinations of alternatives evaluated include

- **Combination 8a – Eastern oysters only**
  - Alternative 2: Enhance efforts to restore Eastern oysters
  - Alternative 3: Impose a temporary harvest moratorium and a compensation program for the oyster industries
  - Alternative 4: Cultivate Eastern oysters

- **Combination 8b – Eastern oysters and triploid Suminoe oysters**
  - Alternative 2: Enhance efforts to restore Eastern oysters
  - Alternative 3: Impose a temporary harvest moratorium and a compensation program for the oyster industries
  - Alternative 4: Cultivate Eastern oysters
  - Alternative 5: Cultivate triploid Suminoe oysters

- **Combination 8c – Eastern oysters and diploid and triploid Suminoe oysters**

Proposed Action:	Introduce diploid Suminoe oysters and continue Eastern oyster restoration
Alternative 2:	Enhance efforts to restore Eastern oysters
Alternative 3:	Impose a temporary harvest moratorium and a compensation program for the oyster industries
Alternative 4:	Cultivate Eastern oysters
Alternative 5:	Cultivate triploid Suminoe oysters

E.5 COMPARISON OF THE ALTERNATIVES

A matrix of decision criteria that listed all of the ecological, environmental, social, and economic factors to be considered in selecting the most appropriate means of restoring oysters in Chesapeake Bay was established at the initiation of this PEIS. Tables 2-3 and 2-4 in Section 2.0 provide summaries of effects of the proposed action and each of the alternatives on each individual decision criterion. Outcomes generally were defined only qualitatively. The lead agencies created the three combinations of alternatives as the Draft PEIS was nearing completion because results of analyses at that point suggested that none of the individual alternatives were likely to attain the oyster restoration goal established in the statement of purpose. In addition, the combinations resolved the inherent conflict between ecological and economic objectives that had become apparent during the analysis. As a consequence, the lead agencies' further deliberations to select a preferred alternative focused solely on the three combinations of alternatives. Some of the key findings for each of the three combinations of alternatives are as follows:

Alternative 8a (Eastern oyster only) – This combination poses no ecological risks associated with introducing a nonnative species into Chesapeake Bay. Traditional restoration and management programs appear to be unlikely to produce a substantial increase in the Bay-wide population of Eastern oysters, even if the magnitude of those efforts is increased significantly. Recent programs using non-traditional methods (e.g., creating elevated reefs, revolving brood stock hatchery operations to increase the rate of development of disease resistance, large-scale restoration in target tributaries) have produced results that suggest the possibility of significantly enhancing the population. Restrictions on harvest may contribute to an enhanced rate of development of disease resistance in the native oyster, although they may adversely affect watermen. Continuing loss of hard-bottom substrate in the Bay may be the greatest obstacle to enhancing the Bay-wide oyster population. Aquaculture, particularly with triploid native oysters, may contribute to increasing the economic value of the oyster fishery in the Bay.

Alternative 8b (Eastern oyster and triploid Suminoe oysters) – The outcome of this alternative would be nearly the same as the outcome of Alternative 8a, with two major exceptions. The rapid growth rate and disease resistance of triploid Suminoe oysters suggests that cultivating the species could provide greater economic benefits than cultivating the native oyster and, thus, would offer the potential for greater enhancement of the oyster fishery in the Bay. Large-scale, long-term cultivation of triploid Suminoe oysters, however, is likely to result in an unintended introduction of a population of diploid, reproducing nonnative oysters into the

Bay. Such an introduction would be irreversible and would pose the risk of adverse ecological consequences that cannot be predicted at this time.

Alternative 8c (Eastern oyster and diploid and triploid Suminoe oysters) – This alternative offers the greatest potential for achieving the population goal established in the statement of purpose for the actions evaluated in this PEIS because of the Suminoe oyster's resistance to disease and rapid rate of growth; however, the introduction of a population of diploid, reproducing nonnative oysters would be irreversible and would pose the risk of adverse ecological consequences that cannot be predicted at this time. Furthermore, the likelihood of success of the proposed introduction and its ability to produce a large, self-sustaining population of Suminoe oysters throughout the Bay is uncertain. Continuing loss of hard-bottom substrate in the Bay would be a major obstacle to success. Studies of diploid Suminoe oysters in the laboratory and studies of confined triploid Suminoe oysters in the Bay suggest that the Suminoe oyster would provide ecological services similar to those provided by the native oyster; however, researchers cannot ascertain the degree to which the results of such studies can predict how diploid Suminoe oysters would interact with all of the components of the ecosystem of Chesapeake Bay in the natural environment. The Suminoe oyster is likely to compete with the native oyster, and the outcome of such competition could range from local extinction of either of the species to mixed-species reefs. The Suminoe oyster has a greater tendency to concentrate contaminants than the native oyster.

E.6 PUBLIC COMMENTS ON THE DRAFT PEIS

A 60-day public comment period (October 17 – December 15, 2008) followed publication of the Draft PEIS. During that period the lead agencies coordinated a series of public meetings – three each in Maryland and Virginia – to receive oral comments on the document. The Norfolk District received comments from 2,175 respondents in the form of letters, emails, and statements offered during the public meetings. A total of 92 individuals provided comments during one or more of the public meetings. The respondents consisted of a wide variety of concerned residents, business owners, representatives of watermen's associations, non-profit organizations, and State and Federal agencies. All comments received during the public comment period were considered, and copies of all comments received prior to the closing date of the comment period are included in Appendix J.

A total of 30 Federal, State, and local resource agencies, government commissions and committees, and one academic institution, the Virginia Institute for Marine Science (VIMS), submitted letters of comment on the Draft PEIS. Resource agencies representing states along the Atlantic seaboard that submitted comments included agencies in Florida, South Carolina, North Carolina, Virginia, Maryland, Delaware, New Jersey, New York, and Maine. The Scientific and Technical Advisory Committee (STAC) of EPA's Chesapeake Bay Program, which consists of appointed members selected from Federal and State agencies, universities, research institutions, and private industry, also submitted comments. A total of 32 nongovernmental organizations and 2,091 citizens submitted letters, postcards, emails, and oral comments concerning the Draft PEIS. Six representatives of businesses associated with the oyster industry also commented.

Approximately 95% of the individuals who commented expressed support for Alternative 8a or opposed the proposed action. Approximately 2.6% (56) supported Alternative 8c; 0.2% (4)

supported Alternative 8b; and 0.05% (1) endorsed the proposed action only. Approximately 2.4% (51) did not specify support for a particular alternative. Some individuals, including some seafood businesses and watermen, opposed the inclusion of a harvest moratorium as part of Alternatives 8b or 8c.

E.7 PREFERRED ALTERNATIVE

The Executive Committee, which comprised senior representatives of each of the lead agencies, carefully reviewed the summaries of projected outcomes and evaluated the benefits and risks associated with the proposed action and each of the alternatives for each of the decision criteria. Each of the lead agencies conducted its review from its own management perspective. The Norfolk District took the lead in developing consensus for a preferred alternative among the lead agencies through development and application of a decision-making framework and a series of meetings and conference calls. The Norfolk District selected the Analytical Hierarchy Process (AHP) and the Multi-Attribute Value Theory (MAVT) as the best means of organizing the diverse and complex universe of information that had to be considered in selecting a preferred alternative. Applying that decision-making process and accounting for science, public comments, observations, and professional judgment resulted in ranking the assessment category of Environment and Ecological as the highest priority, and the category of Social Effects as the lowest priority. Ecosystem effects were ranked the most important of the specific decision criteria, and visual and aesthetic effects were ranked the least important. Implementation of these decision-making tools resulted in ranking Alternative 8a highest in three of the four priority categories. Alternative 8b was ranked highest in the Economic category.

The Norfolk District acknowledged considerable uncertainty regarding the likelihood that Alternative 8a will result in establishing a sustainable, Bay-wide oyster population and the possibility that the Bay-wide population of Eastern oysters will continue to decline in the future; however, the District considered Alternative 8a to be a conservative choice because of the ecological uncertainties associated with implementing Alternative 8c and the strong opposition of most stakeholders to that alternative. The Norfolk District considered ecological uncertainties associated with Alternative 8b to be somewhat less than those associated with Alternative 8c, but those uncertainties could not be resolved with the data and information available for preparing the PEIS. The State of Maryland emphasized that not all strategies for native oyster restoration have yet been exhausted and that past native oyster restoration efforts were limited in scope (i.e., scale, lacked an ecological focus, and precluded a regional, large-scale response). Maryland favored a “zero-risk” policy regarding the Suminoe oyster based upon the precautionary principle, the potential for significant negative ecological consequences, and the irreversible nature of an introduction of the species, whether intended or unintended.

Based on the current state of the science and extensive public discourse, the lead agencies concluded that the use of nonnative oysters in Chesapeake Bay, its tidal tributaries, and the coastal bays and waters of Maryland and Virginia poses unacceptable ecological risks; therefore, it is prudent for USACE, the State of Maryland, and the Commonwealth of Virginia, and Potomac River Fisheries Commission to adopt a native-oyster-only preferred alternative for the

purposes of this PEIS.* The preferred alternative established by the lead agencies is Alternative 8a, with some modifications. The selection of Alternative 8a as the preferred alternative is consistent with the Chesapeake Bay Program's 1993 *Policy for the Introduction of Non-Indigenous Aquatic Species*, which requires jurisdictions in the Chesapeake Bay basin to oppose the first-time introduction of any non-indigenous aquatic species into the unconfined waters of Chesapeake Bay and its tributaries unless environmental and economic evaluations confirm that risks associated with the first-time introduction are acceptably low.

The modifications of the individual alternatives included in Preferred Alternative 8a are based on relevant findings of analyses conducted while preparing the PEIS as well as input from stakeholders delivered in written correspondence and oral presentations at public meetings. The modified elements of Preferred Alternative 8a include:

- ***Alternative 2 (Enhanced native oyster restoration)*** - Enhanced restoration activities to be implemented in the future may differ substantially from the traditional restoration programs previously conducted in both states. Although the kinds of future restoration activity may differ from those evaluated in some detail in the Draft PEIS, the level of activity will be substantially greater than past levels.

- ***Alternative 3 (Harvest Moratorium)*** – In lieu of a total moratorium, the lead agencies envision implementing more restrictive oyster harvesting management regimes (e.g., annual harvest quotas; closed and open harvesting areas) that would be biologically and economically sustainable, that would include accountability measures, and that would minimize the effects of harvest on the potential development of disease resistance.

- ***Alternative 4 (Expansion of native oyster aquaculture)*** - Both states may expand technical aquaculture support programs, particularly in the training of watermen who may be interested in transitioning from wild harvest to aquaculture. State expenditures to support aquaculture expansion may increase in the future and, thus, may be greater than those considered in this PEIS.

E.8 REQUIRED REGULATORY COMPLIANCE

All kinds of native oyster restoration activities that are likely to be considered in accordance with Preferred Alternative 8a will involve placing various kinds of substrate on the bottom of the Bay or manipulating the existing bottom substrate. In addition, large-scale programs may require on-shore development of some kind, such as building hatcheries or facilities for expanded aquaculture operations. Regulatory requirements will differ among projects depending on the scope, elements, magnitude, and location of each project. Statutes that might be applicable to the most diverse array of kinds of projects include

* Although the Executive Committee approved the phrase "for the purposes of this PEIS" as part of its joint statement identifying a preferred alternative, the members of the Committee acknowledge that none of the actions evaluated for this PEIS may be able to achieve the population goal defined in the statement of purpose for action (i.e., an oyster population that reaches a level of abundance in Chesapeake Bay that would support sustainable harvest comparable to harvest levels during the period 1920-1970).

- **NEPA of 1969**, as amended, 42 U.S.C. 432 et seq. - Federally funded projects must comply with NEPA. As noted in Section 1, subsequent to a PEIS, further NEPA analyses may be required in tiers (40 C.F.R. § 1508.28) upon definition of site-specific plans for implementing a preferred alternative. The findings of this PEIS will be used in subsequent NEPA analyses and decisions regarding site-specific plans for implementing the preferred alternative. The follow-on analyses are most likely to be presented in the form of relatively brief Environmental Assessments (EAs) and Findings of No Significant Impact (FONSIs).

- **Endangered Species Act of 1973**, as amended (Pub. L. 93-205; 16 U.S.C. 1532 et seq.) – requires an evaluation of the potential consequences of the program for Federally listed species within the project area and completion of Section 7 consultations with the FWS and NOAA's National Marine Fisheries Service (NMFS) as needed.

- **Magnuson-Stevens Fishery Conservation and Management Act**, as amended (Pub. L. 94-265; 16 U.S.C. 1801, et seq.) – requires evaluation of the potential consequences of the program for designated essential fish habitat for Federally managed species in the project area; NMFS reviews such evaluations.

- **National Historic Preservation Act of 1966**, as amended (Pub. L. 89-655; 16 U.S.C. 470. et seq.) – requires evaluation of the potential consequences of the program for historical and archeological resources in the project area; requires consultation with the appropriate State Historical Preservation Office(s) to ensure that cultural resources within the project area are identified and to obtain a formal opinion regarding potential loss or damage of important resources or to develop a Memorandum of Agreement about appropriate management or mitigation for any affected resources.

- **Fish and Wildlife Coordination Act of 1958**, as amended (Pub. L. 85-624; 16 U.S.C., 661 et seq.) – requires equal consideration for fish and wildlife resources in conjunction with water resources development programs and projects. It provides authority for the involvement of FWS and NMFS in evaluating potential effects on fish and wildlife and requires Federal agencies that construct, license, or permit water resource development projects to first consult with the FWS or NMFS, as appropriate, regarding the potential effects on fish and wildlife resources and measures to mitigate these effects.

- **Coastal Zone Management Act of 1972**, as amended (Pub. L. 92-583; 16 U.S.C. 1431, et seq.) – requires a Federal activity or program that may affect coastal areas to be consistent with applicable Coastal Zone Management (CZM) Plans and to receive a consistency determination from the applicable State CZM program(s) prior to taking action. According to legal precedent, states that have Federally approved CZM plans have the right to seek conditions on or prohibit the issuance of Federal permits and licenses that would affect those states (NRC 2004).

- **Clean Water Act of 1977**, as amended (Pub. L. 92-500; 33 U.S.C. 1251, et seq.) – Under Section 402, National Pollutant Discharge Elimination System permits could be required for stormwater discharges from, and sediment and erosion control at, construction sites (e.g., new hatcheries) or for other actions that might affect water quality (e.g., large-scale aquaculture operations). Depending on the nature of individual restoration projects, Maryland, Virginia, or both may have to apply to USACE for permits under Section 404 (a) or 404 (e), which regulate the discharge of dredged or fill material into waters of the United States. An Evaluation and Compliance Review of applications for such permits [per Section 404 (b)(1)] probably could be incorporated into NEPA documents prepared for individual restoration projects if they are to be Federally funded.

- **Clean Air Act,** as amended (42 U.S.C. 7401 et seq.) – NEPA documents prepared for individual projects would be submitted to the Regional Administrator of USEPA for review pursuant to Sections 176 and 309 of the Clean Air Act. Conformity would depend on the nature and scope of activities that would generate air emissions and the attainment status of the project location.

- **Rivers and Harbors Act, Section 10** – requires permits from USACE for any work in, over, or under navigable waters of the United States. The USACE may consider some individual projects to be exempt.

- **Estuarine Areas Act** (16 U.S.C. 1221 et seq.) – Coordination with Federal and State resource agencies during the preparation of any NEPA documents for individual restoration projects would signify compliance with this act.

- **Federal Water Project Recreation Act,** as amended (16 U.S.C. 4601-12 et seq.), **Wild and Scenic Rivers Act, as amended** (16 U.S.C. 1271 et seq.), **and Land and Water Conservation fund Act of 1965,** as amended (16 U.S.C. 4601-4 et seq.) - Coordination with the National Park Ser4vice (NPS) and the relevant State agencies during the preparation of any NEPA documents for individual restoration projects would signify compliance with these acts.

Several Executive Orders and Memoranda also may apply to some projects intended to implement Preferred Alternative 8a:

- **Executive Order 11988, Floodplain Management** (24 May 1977, as amended by Executive Order 12148, 20 July 1979), **Executive Order 11990, Protection of Wetlands** (24 May 1977) – On-shore development, such as for hatcheries or support infrastructure for aquaculture operations, could occur in the floodplain or in wetland areas. NEPA documents prepared for individual restoration projects would need to be circulated for public review to comply with the provisions of these orders.

- **Executive Order 12898, Environmental Justice in Minority Populations and Low-Income Populations** (11 February 1994) - NEPA documents prepared for individual restoration projects would need to be circulated for public review to comply.

- **Executive Memorandum, Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing NEPA** (11 August 1980) - On-shore development, such as for hatcheries or support infrastructure for aquaculture operations, could affect agricultural lands. NEPA documents prepared for individual restoration projects would need to be circulated for public review to comply.