**US Army Corps
of Engineers®**
Philadelphia District

DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT

RESPONSES TO EXHIBITS/TRANSCRIPT SUBMITTED IN DNREC'S LETTER DATED DECEMBER 21, 2001 TO CORPS OF ENGINEERS

EXHIBIT #64

ELIZABETH MURPHY, DRPA

Comments noted. No response required.

EXHIBIT #65

ROBERT CONTE

Comments noted. No response required.

EXHIBIT #66

SPIROS MANTZANIOS, MOTIVA ENTERPRISES

Comment. Good evening. My name is Spires Mantzavinos, External Affairs Manager for Motiva Enterprises' Delaware City Refinery. I would like to make some brief comments.

At the public workshop held on June 6, I commented that preliminary results from a study commissioned by the Delaware City Refinery indicated that dredging the Delaware River to 45 feet would cause an increase in the deposition of silt at the Refinery's docks, cooling water intake channel and spur channel areas. Thus, causing an increase in the frequency and the amount that refinery has to dredge on an ongoing basis and significantly increase the refinery's costs.

Since that workshop, Motiva conducted additional research in order to confirm the results of that preliminary study and attempt to quantify the increase in silt deposits. The findings of that additional research were confirmed and the study anticipates that siltation at the refinery could increase by a factor of 1.5 to 2.0.

Motiva respectfully submits a copy of this study for the record.

Based on this data, we cannot support the dredging because we anticipate an adverse economic impact to the refinery. Motiva looks forward to continue working with the Corps of Engineers in order to find an appropriate solution so that the Delaware City Refinery is not damaged as a result of this project. Thank you.

Response. Based on review of the attached report that was submitted for the record the following is the Corps response.

We continue to assert that the CoastWatch report, and in particular its conclusions, are flawed and inadequate to support statements regarding impacts of the proposed Delaware Deepening project on sedimentation at Motiva.

The following paragraph summarizes the logic used by CoastWatch to conclude that the proposed Delaware Deepening will cause shoaling rate increases by a factor of 1.5 to 2.0.

CoastWatch Report, section 5.1: (copied verbatim)

"As based upon previous COE modeling studies (Kim and Johnson, 1998), the effect of the proposed channel deepening showed the greatest salinity differences within the vicinity of Motiva plant. A simulation that was conducted as based upon flows for November 1995 showed increases in bottom salinities upwards of 1 to 3 ppt. These changes could have dramatic effects of increasing collision efficiency and resultant siltation by a factor of 1.5 to 2.0."

There is no "November 1995" simulation anywhere in the cited report. We did not simulate November 1995 flows at any time in the WES model investigation.
Perhaps the author of the report mistook "November 1965" (as shown on several figures as well as in their respective captions) for "November 1995. There is a simulation of the drought of record for the Delaware River Basin – covering the period from July through November 1965 - presented in the WES report. By definition, the "drought of record" is a very rare event - whether it is less or more frequent than a 100-year event, it is, nonetheless, a very infrequent occurrence. This model simulation computed salinity time series at a number of locations for the existing geometry of the Delaware estuary and for the geometry modified to reflect the channel deepened to 45 feet. The difference between the two model runs thus represents the predicted change in salinity due to channel deepening.

In fact, there are about four days each in the October and November 1965 simulation results during which the bottom salinity difference due to deepening is in the range of 1 to 3 ppt. However, the monthly mean salinity difference in October is less than 0.5 ppt, and approximately 0.5 ppt in November 1965, at the location selected by CoastWatch (RM 54, Reedy Island Jetty.). CoastWatch has apparently extracted about eight days of predicted salinity change data – from a 5-month simulation of the most extreme drought on record for the Delaware Basin – and interpreted this salinity change as representative of the long-term impact of the deepening project at Motiva's facility. This is patently incorrect.

Further, CoastWatch then used their assumed salinity change of "1 to 3 ppt" and applied it to a set of laboratory experiments (referenced to "Gibbs, 1983") to predict the impact of the increased salinity on shoaling at Motiva. As the Corps of Engineers stated previously (30 November 2001) in comments to Motiva on this approach:

"Given the complex nature of flows, sediment transport, and the salinity regime of the Delaware estuary in the vicinity of the Motiva facility, it appears highly unrealistic to us to predict a significant increase in sedimentation solely by extrapolating results of a single laboratory experiment that examined only one of many parameters relevant to estuarine sedimentation processes. There is no scientific basis presented in the

CoastWatch report that indicates how it was determined that salinity changes alone control sedimentation at Motiva."

The CoastWatch assumptions regarding the role of salinity on shoaling rate are contradicted by more than five decades of shoaling and dredging experience of the Philadelphia District in the Delaware Estuary.

- The major shoaling areas of the Delaware River Main Channel are located in the Marcus Hook, Deepwater, and New Castle Ranges. Together these three ranges account for about 85% of the annual volume of maintenance dredging in the Delaware River, Philadelphia to the Sea project. These ranges extend over a distance of about 20 miles (Marcus Hook shoal ~ RM 80; New Castle shoal ~ RM 60), and experience a large variation in salinity, both between sites at any given time, and over any given period with varying fresh water inflows. The Delaware Estuary salt line is typically located downstream of the shoal in the Marcus Hook Range, but upstream of both the Deepwater and New Castle shoal areas. The centroid of the New Castle Range shoal is about one mile east of the centroid of the Motiva channel shoal.
- Corps of Engineers hydrographic surveys and dredging records show that shoaling in the three Delaware River Main Channel ranges is essentially independent of antecedent hydrologic conditions. This is not the same as stating that there is "zero" contribution from salinity/flocculation effects at these sites. However, if there is a salinity effect on shoaling, it appears to be negligible. Shoaling at these sites is almost certainly dominated by other factors, such as the underlying tidal flow characteristics, adjacent estuary bottom geometry and sediment type. It appears likely that the shoaling situation at Motiva is similarly controlled by tidal flow characteristics and adjacent bottom geometry and sediment distribution.
- In effect, the logic used in the CoastWatch analysis of salinity implies that salinity is the only factor influencing shoaling in the Delaware River. It ignores the larger impacts of other factors, such as the underlying tidal flow distribution, adjacent estuary bottom geometry and sediment type. It is likely that the background, natural salinity variability in the vicinity of Motiva's channel is so large, and the salinity changes attributed to deepening so small, that the deepening project will have no practical impact on shoaling at Motiva's facilities.

In April 2001, the Corps of Engineers provided CoastWatch with 35 years of USGS conductivity data from Reedy Island. CoastWatch was apparently unaware of the existence of this data set. The conductivity data can be converted into a reasonable approximation of salinity, and as such, show a long-term variability at Reedy Island that ranges from 0 ppt (essentially fresh water) to as much as 13 to 15 ppt. The Motiva facilities are located several miles upstream of the Reedy Island gage site, and are therefore expected to have somewhat lower absolute salinity than is observed at Reedy Island, but the salinity range at Reedy Island is presumably typical of the range at Motiva. The 35-year time series was analyzed to create a representation of salinity at Reedy Island for an "average" 1 January to 31 December period. (See attached figure, which displays the raw "mean daily salinity" for 1965 - 2001 at Reedy Island in red, and the "average" salinity in blue.) In the "average" year, salinity is lowest in the first week of April, at about 1 ppt, and highest about the middle of October, at about 7 ppt. Obviously, any given day of any given year can differ significantly from the long-term average, due principally to changes in rainfall over the Delaware watershed.

In summary, we find the CoastWatch report and its conclusions seriously flawed. CoastWatch has misinterpreted model-predicted salinity changes from eight days of the drought of record as representative of typical salinity conditions at Motiva. They then selectively apply this change to results from a single laboratory experiment from 1983 to conclude that the Delaware Deepening project will cause dredging increases at Motiva by a factor of 1.5 to 2.0.

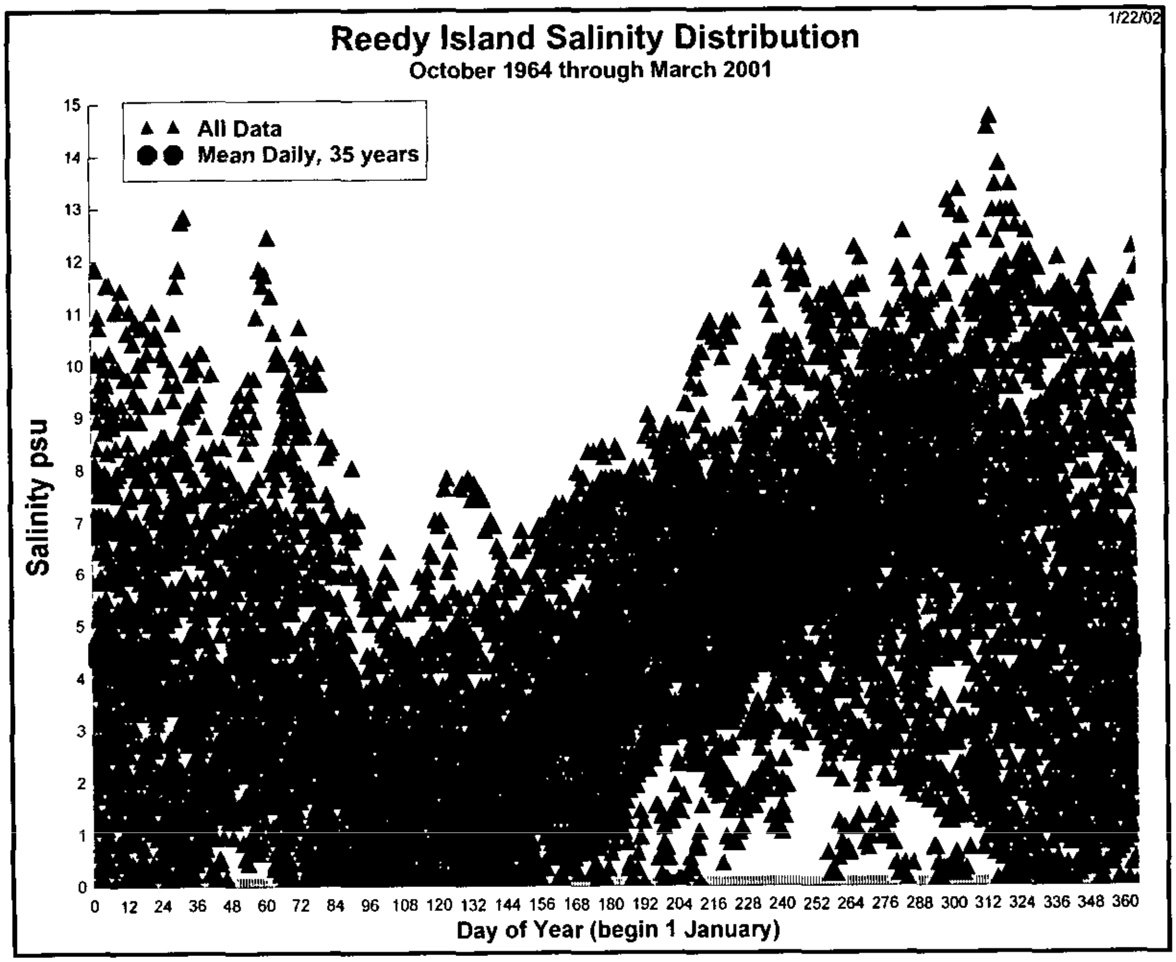

EXHIBIT #67

JANE NOGAKI, NEW JERSEY ENVIRONMENTAL FOUNDATION

Comment. The New Jersey Environmental Federation has gone on record against this project when funding proposals for it began moving through the NJ State Legislature in 1999. After examining the proposal, we determined it would be detrimental to the quality of surface and groundwater in New Jersey, threatened the Potomac Raritan Aquifer that underlies the river, threatens the declining blue crab and recovering oyster populations in the estuary, while providing highly speculative economic benefit to the area. The Corps justifies this project by claiming that 80% of the benefits accrue to six oil facilities, but only one is on record saying they support and may take advantage of the project, and one actively opposes it (Motiva in Delaware).

Response. An analysis of potential impacts of the project on drinking water aquifers and groundwater is presented in the July 1997 SEIS **(EXHIBIT 4)** in Sections 5.10 and 7.0, respectively. At the request of the Corps, the U.S. Geological Survey was tasked to make an assessment or investigate impacts of the dredging project on the drinking water aquifers. The concerns generally focused on three areas of concern.

- (1) Dredging breaches confining unit
- (2) Saltwater in river encroachment onto well-recharge areas
- (3) Disposal areas effecting nearby wells

To address the above concerns the U.S. Geological Survey (USGS) subsequently performed three separate studies. The USGS issued three separate reports as listed below.

1. Evaluation of Ground-Water Flow from Dredged Material Disposal Sites in Gloucester and Salem Counties, New Jersey (USGS, 1995).

2. Hydrogeologic Conditions Adjacent to the Delaware River, Gloucester, Salem and Cumberland Counties, New Jersey (USGS, 1996).

3. Selected Hydrogeologic and Chloride-Concentration Data for the Northern and Central Coastal Area of New Castle County, Delaware (USGS, 1998).*

* *Note draft report was prepared in 1996.*

A letter dated 23 January 1996 was then issued by the USGS, which summarized their findings and referenced these reports. The USGS investigation or analysis of the above concerns reached the following findings:

In summary, the concerns about increasing the potential for saltwater from the river to infiltrate into the adjacent aquifers, either as a result of dredging through a confining unit or as a result of the upstream movement of saltwater in the deepened channel can be *set aside. No significant confining units will be breached and the saltwater will not significantly move upstream to increase the threat of saltwater intrusion.*

The concern that fluids leaching from the dredged-material disposal areas could infiltrate to the aquifer with recharge can also be set aside.

Since the completion of that study and in cooperation with NJDEP and DNREC, the Corps has installed monitoring wells at all Federally owned CDFs that are or will be used for placement of dredged material from the maintenance of the existing 40-foot Delaware River Main Channel as well as from the deepening project in the States of New Jersey and Delaware. Also, groundwater-monitoring wells will be installed at the new upland disposal sites that will be developed for the deepening project. Groundwater monitoring plans have been developed for all of the Federally owned Main Channel Dredge Disposal Areas. The groundwater-monitoring program for the NJ sites has been approved by the NJDEP. The groundwater-monitoring program for Reedy Point North and Reedy Point South disposal areas (both located in the State of Delaware) has been submitted to DNREC for their approval.

Concerning impacts to blue crab and oyster populations, please refer to the general responses. Motiva is not one of the six benefiting refinery facilities.

Comment. Dangerous toxins such as antimony, arsenic, copper, lead, mercury, zinc and PCB's lurk in the river sediments. Digging them up, then disposing of them on the shores threatens drinking water and the recovering river ecosystem. Already there are fish consumption advisories for mercury and PCB's for river fish, re-suspending toxins in the sediment only endangers our fish populations further?

Response. The Corps has conducted extensive testing to investigate potential impacts associated with sediment contamination. These tests have included chemical analysis of channel sediments to determine actual contaminant concentrations, and biological testing to evaluate toxicity concerns. Analysis of channel sediments has indicated that contaminants that are present, primarily heavy metals, are at concentrations considered low to medium. The results of state-of-the-art PCB analyses indicated that PCBs, which are ubiquitous in modern society, are one to three orders of magnitude lower in the navigation channel than in shallows outside the project area, and below levels of concern. It is likely that this is the result of regular dredging maintenance, which precludes contaminants from building up over time.

The Corps also evaluated toxicity of bottom sediments by directly exposing aquatic organisms to the sediment. Water column, or suspended solid particulate phase bioassays were run to evaluate water quality concerns associated with the release of contaminants from sediment into dredging or placement site water. Whole sediment, or benthic bioassays were run to evaluate impacts to bottom dwelling organisms that would reside in sediments placed in an aquatic environment. These tests, which are commonly used to evaluate the quality of dredged material, were developed and approved by the U.S. Environmental Protection Agency.

A variety of aquatic organisms were used in the bioassays including larval shrimp approximately four days old, fathead minnows hatched the previous day, and American oyster embryos approximately two-hours after fertilization. These young organisms are very fragile and sensitive to contaminants in their environment. Following established protocols, these organisms were exposed to samples of bottom sediment for a prescribed period of time to evaluate any differences in mortality between Delaware River channel sediment and clean laboratory sediment. All organisms (100%) survived the numerous bioassays that were run, which is a strong indication that channel sediments are not toxic to aquatic organisms.

Lastly, bioaccumulation tests were run with channel sediment from Delaware Bay to evaluate the potential uptake of contaminants by aquatic organisms at aquatic placement sites. This test allows aquatic organisms to live in the sediment for approximately one month, and then analyzes the animal tissues to evaluate any accumulation of contaminants. Tests were run with the hard-shelled clam and a marine worm. Overall, there was no evidence that contaminants accumulated in animals exposed to Delaware Bay sediment at greater concentrations than animals exposed to clean laboratory sediment. All tissues were representative of what one would expect of animals living in a clean environment.

State and Federal resource agencies have reviewed the Corps' sediment quality data. The States of Delaware, New Jersey and Pennsylvania have approved the deepening project by finding it consistent with their respective coastal zone management programs. The U.S. Environmental Protection Agency stated: "EPA continues to believe that there will be no adverse impacts associated with the disposal of sediments generated by the project." The U.S. Fish and Wildlife Service stated: "Results of chemical analyses provided within the biological assessment indicated that contaminant loads in the sediments tested are low."

Despite the positive results of the tests conducted to date, the Corps intends to monitor water quality during construction. This monitoring will insure that dredging and disposal activities associated with the deepening project do not adversely impact the aquatic resources of the Delaware River and Bay. The Corps has been working with the States of New Jersey and Delaware, and the Delaware River Basin Commission (DRBC), to develop an acceptable protocol for this type of monitoring. To date, the Killcohook, Oldmans, Pedricktown North and Pedricktown South CDFs have been monitored. Reports on the monitoring studies conducted at the Killcohook and Pedricktown North CDFs have been provided as part of the public record. The reports provide details on how CDFs would be monitored.

The Corps has also conducted modeling efforts to simulate the quality of water discharged from the Reedy Point South CDF during disposal operations, and contaminant concentrations in the water column resulting from dredging activity. These studies have also been included as part of the public record. Both the modeling results and the field monitoring studies indicate that dredging and dredged material disposal operations do not significantly impact water quality.

Comment. According to the University of Delaware's Sea Grant program report ("Sedimentary Impact of Dredging the Delaware Estuary: Geochemical Impacts and Natural Radionucleide Tracers") there are significant concerns about toxins leaching through the dredge spoils stored at confined disposal sites to contaminate drinking water aquifers below. That is why groups like the NJ Sierra Club, Delaware Riverkeeper, NJ Environmental Federation, other members of the Alliance to Dump the Delaware Deepening oppose the deepening project.

Response. The United States Geological Survey conducted studies of the Federally owned dredged material disposal areas used for the Delaware River Main Channel. In particular, a report entitled Evaluation of Ground-Water Flow from Dredged Material Disposal Sites in Gloucester and Salem Counties, New Jersey (USGS, 1995) **(EXHIBIT 19)** was published which studied this concern. A letter dated 23 January1996 was then issued by the USGS, which summarized and referenced this and other relevant USGS reports.

The USGS concluded that *the concern that fluids leaching from the dredged-material disposal areas could infiltrate to the aquifer with recharge water can also be set aside.* The USACE agrees with this conclusion, however, to ensure the safety of the main aquifers underlying the disposal areas, the USACE has completed installation of monitoring wells at *every* Federally-owned Main Channel dredged material disposal area. The groundwater-monitoring program for the NJ sites has been approved by the NJDEP. The groundwater-monitoring program for Reedy Point North and Reedy Point South disposal areas (both located in the State of Delaware) has been submitted to DNREC for their approval.

EXHIBIT #68

DENISE OLBERT, NATIONAL WILDLIFE FEDERATION

Comment. Questions surrounding the overall viability of this project are relevant to your decision on this permit. That is because, in an effort to find affordable disposal sites for the dredge material, the Corps has been almost continually making significant changes to this project over time --changes that are obscuring the project's environmental impacts. In fact, changes to the project have outpaced required documentation under the National Environmental Policy Act (NEPA), rendering the Corps' most recent *Supplemental Environmental Impact Statement* (SEIS 1997) inadequate. Since that last SEIS, the Corps has decided to dispose of millions of cubic yards of main channel sand at Broadkill, Port Mahon, and Rehoboth/Dewey beaches and Kelly Island. The 1997 SEIS makes no mention of plans to renourish any of these sites except Kelly Island.

Therefore, we believe that the environmental impacts of plans to dispose of both the amount and type of sand coming from the Main Channel on these beach sites has not been adequately identified or studied; and we urge DNREC to require more information from the Corps before making any decision on this permit.

Response. Appropriate supplemental NEPA documentation associated with the individual beach nourishment projects will be prepared to evaluate placement of main channel sand on selected beaches.

Comment. NWF is concerned that the spawning habitat of the Delaware Bay's fragile horseshoe crab population could be placed at risk by plans to dispose of main channel sand at Kelly Island, Port Mahon, and Broadkill Beach. Since 1990, the population of horseshoe crabs in the Delaware River estuary has declined by a shocking 90%. A vital and sustainable population of horseshoe crabs is critical to the health of migratory bird populations, important for medical research, and important to the livelihoods of those who harvest them. Yet biologists admit that our knowledge of the stock, habitat needs and life cycles of horseshoe crabs is very tenuous. Acknowledging the importance of horseshoe crabs and how little we know about them, the Atlantic States Marine Fisheries Commission has purposefully adopted a conservative, risk-averse coastwide management strategy for the crabs. This should tell us that any human activities that might threaten horseshoe crabs themselves or their habitat ought to be looked at very closely.

Response. Refer to the general responses on "horseshoe crabs".

Comment. In a letter to the Corps dated November 14, 2001, which we are submitting into the hearing record today, the U.S. Fish and Wildlife Service (FWS) noted several concerns related to horseshoe crabs. First, they noted that the Corps' recent report "Preconstruction *Horseshoe Crab Egg Density Monitoring and Habitat Availability at Kelly Island, Port Mahon, and Broadkill Beach Study Areas, Delaware,* " showed that the beaches chosen for dredge disposal "provide important spawning habitat for horseshoe crabs and that spawning effort is extensive at Kelly Island and Port Mahon." The "high" numbers of spawning horseshoe crabs at these sites prompted the FWS to recommend that the Corps comply with the Atlantic States Marine Fisheries Commission's *Interstate Fishery Management Plan for Horseshoe Crabs,* which restricts beach renourishment in spawning areas between 15April --30 August. We support this recommendation as vital to protecting horseshoe crabs in Delaware Bay. The Fish and Wildlife Service also noted that, depending upon weather conditions, horseshoe crabs may spawn at different beaches year to year, making more than one year of data important for verifying actual spawning habits of horseshoe crabs on specific beaches.

Response. Refer to the general response on " horseshoe crabs". Also, Corps response to the U.S. Fish and Wildlife Service letter dated November 14, 2001 is attached.

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
WANAMAKER BUILDING, 100 PENN SQUARE EAST
PHILADELPHIA, PENNSYLVANIA 19107-3390

REPLY TO
ATTENTION OF
CENAP-PL-E

Subject: Review of Draft Horseshoe Crab Egg Density and Habitat Availability Report-Delaware River Main Channel Deepening Project

Mr. Clifford Day, Supervisor
U. S. Department of Interior
Fish and Wildlife Service
New Jersey Field Office
927 N. Main Street, Building D
Pleasantville, New Jersey 08232

JAN 28 2002

Dear Mr. Day:

I am writing to address the concerns that you raised in your November 14, 2001 letter to John Brady, of our Environmental Resources Branch about placing dredged material on Delaware Bay shore areas. These concerns resulted from your review of our September 15, 2001 draft report: *Preconstruction Horseshoe Crab Egg Density Monitoring and Habitat Availability at Kelly Island, Port Mahon, and Broadkill Beach Study Areas, Delaware.*

I believe it is important that you understand the history of work in this area before addressing your specific concerns. As part of the Delaware River Main Channel Deepening Project, the Corps prepared a Supplemental Environmental Impact Statement (July 1997) outlining a plan to use Delaware Bay sand for wetland restoration at both Kelly Island, Delaware and Egg Island Point, New Jersey. In addition, material would be stockpiled off the bay coast near Broadkill Beach and Slaughter Beach for future beach nourishment.

Because of concerns raised by your agency and others about the potential impacts of stockpiling sand, the Corps proposed depositing the sand directly on Delaware beaches, a suggestion made by your agency. Our decision was sent by letter to the U.S. Fish and Wildlife Service on May 7, 1998 and was announced at a subsequent public hearing on May 10, 1998 in Dover, Delaware. On July 14, 2000, the Delaware Department of Natural Resources and Environmental Control (DNREC) submitted a list of beaches it felt would benefit from nourishment with Delaware Bay sand from the Delaware River shipping channel. This list included Broadkill Beach and Port Mahon on the bay and Rehoboth Beach/Dewey Beach on the Atlantic coast. Nourishment for each of these beaches is also being pursued under separate Corps' authorities resulting in three individual federal projects, each of which has previously prepared National Environmental Policy Act (NEPA) documents that were coordinated with your Annapolis Field Office. These NEPA documents will be supplemented or revised for beach

nourishment areas when DNREC and the Corps decide which beaches are best suited for nourishment, thereby meeting the NEPA requirements for these actions.

A monitoring/management plan was developed for the Kelly Island wetland restoration project in close coordination with DNREC and the appropriate federal agencies, including U.S. Fish and Wildlife Service Bombay Hook National Wildlife Refuge Office. One of the plan's goals is to create more spawning habitat for horseshoe crabs. As a result, the Corps' Philadelphia District initiated the horseshoe crab egg density and habitat availability study for Kelly Island, Port Mahon and Broadkill Beach. There is a two-fold purpose for the study. The first is to establish pre-construction conditions at the three locations, which will be compared to post-construction horseshoe crab use. The second is to gather information to determine if construction can take place during the environmental window (April 15-August 31) established by the Atlantic States Marine Fisheries Commission's Interstate Fishery Management Plan for Horseshoe Crab (1998). Next year, we plan to collect additional spawning horseshoe crab data at Kelly Island, Broadkill Beach and Port Mahon.

In 2001, the Corps has also collected data on juvenile horseshoe crabs at these three locations and at Kitts Hummock, a known productive spawning area recommended as a control by DNREC. We have also gathered data for spawning adults at Kelly Island and Port Mahon. When these studies are completed, we will send them to you for review.

Turning to the draft September 2001 report, it was found that only 40.8 percent of Kelly Island and 26.9 percent of Port Mahon provide suitable spawning habitat. Much of the shoreline at Kelly Island is underlain with peat and is unsuitable for spawning. The existing spawning habitat at Kelly Island is very dynamic due to the continuing erosion, with sand and peat areas changing each year. In addition, since 1997, the southern most sandy area near the tip of Kelly Island has eroded about 650 feet northward, eliminating possible spawning habitat. At Port Mahon, the shoreline is lined with riprap causing a high annual mortality rate for spawning horseshoe crabs. Restoration at these two locations is expected to greatly enhance spawning habitat. Shorebirds are also being monitored at Kelly Island, Port Mahon, Broadkill Beach, and Prime Hook Beach (a control site) and will continue after project construction to determine the degree of success in providing shorebird habitat. Additional parameters such as sediment movement, water quality, and aquatic resources are being monitored to determine the degree of success for the Kelly Island wetland restoration.

We believe it would be productive for our respective technical staffs to meet in the near future to discuss the project and your concerns. Further, we believe it would be appropriate for the U.S. Fish and Wildlife Service to wait until discussions have taken place and next year's data collection is finished before making a final decision on whether construction can be performed within the horseshoe crab environmental window.

If you have questions or concerns, please call John Brady at 215-656-6554.

Sincerely,

Robert L. Callegari
Chief, Planning Division

Copy Furnished:
U.S. Fish and Wildlife Service, Annapolis Office
U.S. Fish and Wildlife Service Bombay Hook, National Wildlife Refuge
DNREC, Cooksey, Love, Carter, Moyer

Comment. Perhaps most importantly, the FWS noted that additional NEPA documentation is necessary in order for the agency to make a determination on proposals to place the dredge materials at Kelly Island, and Port Mahon and Broadkill Beach. The agency cites serious concerns about the effects of pumping sand onto beaches where juvenile horseshoe crabs dwell for 1-2 years after they hatch. Biologists believe that smothering even one generation of juvenile horseshoe crabs could further threaten the sustainable population.

Response. NEPA documents will be supplemented or revised for beach nourishment areas when DNREC and the Corps decide which beach areas are best suited for nourishment, thereby meeting the NEPA requirements for these activities.

Comment. The Corps was asked to study implications of the channel dredging on female blue crabs, which have been found to overwinter along the Delaware River channel. The Federation is concerned with the accuracy of the Corps' *Delaware Bay Winter Crab Survey* commissioned to Versar, Inc., which was designed to estimate blue crab populations in areas that might be affected by the dredge. The report did not provide all the necessary scientific information needed for state and federal resource managers to make a determination about the risk to blue crabs. Missing are crucial details such as the locations of the samples, and age profiles. It is unclear what the breakdown of the blue crab population is between adults and juveniles. Large differences between the conclusions drawn by the Corps' study and a study done by Helser last year calls into question the accuracy of the Corps' estimate. DNREC also requested information about habitat for related species, and the study failed to provide that data. Finally, the study was timed just after commercial dredging took place, which could diminish the density, and this factor was not discussed or considered in the report. Clearly, more accurate study must be demonstrated before the Corps or DNREC can make a scientific determination on whether the project will adversely impact female blue crabs.

Response. Refer to the general response on " blue crabs".

Comment. Another concern about the Corp's environmental conclusions is the fleeting attention that has been given to the presence of Sabellaria Vulgaris at some of the project sites. These sand-building worms construct colonies of sand reefs, and meet the criteria of Essential Fish Habitat under the federal Magnuson Stevens Act. The "reefs" provide habitat for a number of minute species that are key parts of the aquatic food chain. They also offer hiding places and feeding opportunities for a variety of fish of interest to sportsmen. Fisherman who enjoy the presence of abundant fish around these reefs might find that their sportfishing opportunities would significantly diminish if these reefs were not there. In 1997, the Corps recognized this problem and agreed not to stockpile sand at Broadkill and Slaughter beaches where the sand-builders had been found. But now the Corps wants to dump sand on some of those same reefs. The Corps only recently agreed to do a mitigation study on the Sabellaria after a Delaware citizen protested. While that study agreed that sand disposal would bury and smother the reef colonies, the only mitigation options offered were to attempt to reconstruct the reefs following sand dumping or to try to pickup and move the reefs. However, these methods have never been tested and there is no back up plan for failure. The insufficiency of the Corps' environmental studies is also illustrated by their failure to identify the presence of Sabellara Bulgaris at Port Mahon. During an observational walk at Port Mahon just last month, NWF found Sabellena Vulgaris in the proposed project area. None of the Corps' NEPA documentation mentions the presence of these reefs at Port Mahon.

Response. Refer to the general response on "*Sabellaria vulgaris*".

Comment. The amount of sand to be dumped at each beach disposal site is another factor that continues to change, further complicating efforts to understand environmental impacts. The Corps' Permit Application suggested that Port Mahon, Kelly Island, Broadkill, and Rehoboth/Dewey would all receive the same amounts of sand from the Delaware Deepening project as was originally planned for them in their individual beach renourishment plans. However, according to recent correspondence from the Corps of Engineers, the plan now is to eliminate one site (Broadkill or Rehoboth/Dewey) and to increase the proposed dumping amounts at each of the remaining beaches. This is because the Corps now believes there will not be enough dredge material from the channel deepening to fill all four sites." The Corps now plans to place more sand than is needed at Port Mahon, Kelly Island and either Rehoboth/Dewey or Broadkill, increasing the likliehood of environmental damage. Why overfill three sites and eliminate a fourth? One reason may be cost. The other may be the smaller grain size of the Main Channel sand. More sand of this smaller grain size will be needed to accomplish the same result as renourishing the beach with local sand, which has a matching grain size. This begs the question: Are we renourishing beaches for the benefit of Delaware, or to better serve the Deepening project? If the purpose is to protect Delaware's coastline and natural resources, wouldn't Delaware be better served if it got the *optimal* amount and type of sand, and not the sand that happens to be dredged from the River bottom? The environmental impacts of building these beaches up beyond their original sand levels are not clear. And of course, no one knows whether this sand that is now coming from the Delaware River Main Channel will erode, or otherwise perform, similar to the sand from local sources as originally planned.

Response. Since the State of Delaware has not made a final decision on the sand placement sites, Port Mahon, Broadkill, and Dewey/Rehoboth (being studied by the Corps as separate projects) were included in the Corps permit application. Depending on the selected areas, each will receive the amount of material originally planned for (except Port Mahon) in their original beach renourishment plans. It may also be necessary to place slightly more material at a particular site to accommodate the overall plan. The amount of the increase will be within the anticipated advanced nourishment needs of the project and will not significantly change the scope or footprint of any individual project. These sites will not be overfilled. Grain size at all sites is appropriate for placement as beachfill. Beneficial use of dredged material in Delaware is a direct benefit to the state. It should be understood that material slated for the Delaware beaches could be placed in needed areas of the New Jersey Bay coast as an alternative. The amount and type of material being dredged from the main channel is appropriate for the designated beaches. The beaches are not being built beyond their original limits. In fact much more sand at

Kelly, Port Mahon and Broadkill Beaches would be required to restore the eroded shoreline to it's pre-eroded coastline at the turn of the century.

Comment. Finally, the public benefit of the choice to build a beach at the Port Mahon site has been seriously questioned by the President's Office of Management and Budget. In a January 2001 letter, the Office of Management and Budget (OMB), part of the Executive Office of the President, called into deep question the cost-effectiveness of the Port Mahon project. We make this document available for the record in this proceeding. OMB notes that Port Mahon is located in the most highly erosive part of the Delaware Bay and that the proposed "beach" would have to be reconstructed, on average, every seven years. The letter states that the Corps has not demonstrated that Port Mahon would represent an "efficient, productive way to target Federal and local dollars for ecosystem restoration." OMB'S review is critically important in light of the enormous cost of this project (approximately $20 million over the next 50 years). Their conclusion that Port Mahon would not be cost-effective due to the high erosion rates means that this project is unlikely to receive budget support for the many renourishments that would be necessary in the future.

OMB also questions the environmental benefits of the Corps' proposal to "build" habitat at Port Mahon. The letter states that "building a beach at Port Mahon would "hardly 'restore' the area" and that "a natural beach would not survive for long except as isolated and shifting small pockets of sand. " NWF is concerned about how the shifting and eroding of this newly-built "beach" would impact horseshoe crab spawning; and how the repeated reconstruction of the beach every seven years will affect juvenile horseshoe crabs who, as we mentioned before, live in the sand for 1-2 years before moving to deeper waters. The cycles of construction necessary for this eroding project could smother a class of horseshoe crabs every seven years.

Response. Responses to the January 2001 letter are attached.

Honorable Mitchell E. Daniels, Jr.
Director
Office of Management and Budget
Washington, D.C. 20503-0008

Dear Mr. Daniels:

In response to your letter dated January 18, 2001, I am submitting for your review a Corps of Engineers memorandum detailing the findings of their review of your concerns related to the Port Mahon, Delaware ecosystem restoration project. While your office recognized the importance of restoring the Delaware Bay ecosystem, you questioned the array of alternatives considered and the justification and overall advisability of ecosystem restoration at this location. As outlined in the Corps memorandum, both the study authority and non-Federal sponsor together focused the feasibility analyses geographically on Port Mahon area and technically on the development of a multi-objective project to protect State Road 89 and wetlands behind it. Further, the Corps did consider alternatives (permanent evacuation and relocation of State Road 89) that would allow natural erosion processes to continue. Neither of these alternatives were considered in detail since they would not meet the overall study objectives of shoreline erosion and habitat protection and restoration and were cost prohibitive. Finally, the Corps again consulted with the U.S. Fish and Wildlife Service as requested and a letter dated May 11, 2001 that documents their continued support for the project.

Please advise this office based on the additional information provided whether my recommendations to support the authorization and implement the project are consistent with Administration policy.

Sincerely,

Mike Parker
Assistant Secretary of the Army
(Civil Works)

DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

CECW-PM

AUG 3 2001

MEMORANDUM FOR THE ASSISTANT SECRETARY OF THE ARMY (CIVIL WORKS)

SUBJECT: Port Mahon, Delaware

1. PURPOSE: In response to your 13 March 2001 memorandum, the U.S. Army Corps of Engineers has reviewed the concerns raised by the Office of Management and Budget (OMB) in their 18 January 2001 letter related to the subject project. The findings of the Corps review and my recommendation are summarized below.

2. DISCUSSION:

a. The Delaware Bay Coastline – Delaware & New Jersey, Port Mahon Delaware Interim Feasibility Study, Final Feasibility Report and Environmental Assessment determined that shoreline erosion and shoreline development have significantly reduced the spawning suitability of the Port Mahon area for the horseshoe crab. Although there is no sandy beach present at Port Mahon at this time, horseshoe crabs continue to attempt to nest in the roadbed with limited success and significant mortality. The prime spawning beaches are between Maurice River and the Cape May Canal in New Jersey and the sandy beaches between Bowers Beach and Lewes in Delaware. Port Mahon is just north of Bowers Beach. Port Mahon's location in the bay relative to salinity and hydraulic conditions make it suitable habitat for horseshoe crabs. The beach fill will protect existing wetlands as well as the wetlands to be restored as a component of the Port Mahon project. All of these features are expected to benefit migratory shorebird species.

b. The proposed ecosystem restoration project consists of three elements designed to restore the ecosystem at Port Mahon. The first element consists of restoration of 19.2 acres of horseshoe crab habitat through the placement of 306,000 cubic yards (cy) of sand for approximately 4,900 feet along the shoreline and the construction of a 1200-foot revetment at the southern end of the proposed project to tie into the existing revetment from the termination of the beachfill to provide stability. The second element will involve raising State Road 89 for a distance of 7,500 feet to protect 59.1 acres of wetlands from excessive and damaging overwash. The third element in the recommended plan is the restoration of 21.4 acres of degraded marsh west of State Road 89. The proposed ecosystem restoration and protection project will provide 193 average annual high value habitat units. In addition to ecosystem restoration and protection and the associated non-monetary environmental quality benefits, the project will produce incidental national economic development (NED) benefits. These estimated NED benefits amount to an average annual total of $140,000, and consists of reduction of infrastructure damages and avoidance of fuel delivery by more costly alternative means. A monitoring program to document project performance compared to design predictions will be conducted as a cost-shared engineering and design activity during the continuing construction for periodic nourishment. A 5-year monitoring and adaptive management

plan to evaluate success and provide for potential minor project modifications to improve overall project performance is also included in the recommended project.

c. Section 101 (a)(12) of the Water Resources Development Act (WRDA) of 1999 authorized project construction at a total cost of $7,644,000, with an estimated Federal cost of $4,969,000 and an estimated non-Federal cost of $2,675,000 and at an estimated average annual cost of $234,000 for periodic nourishment over the 50-year life of the project, with an estimated annual Federal cost of $152,000 and an estimated annual non-Federal cost of $82,000.

d. OMB raised two concerns in their 18 January 2001 letter. The first concern relates to the array of alternatives considered in the feasibility study. The second concern relates to the justification and overall advisability of ecosystem restoration at Port Mahon. A response to each of these concerns is provided in the following paragraphs.

e. OMB requested that a broader array of alternatives for addressing the horseshoe crabs and migratory birds of Delaware Bay be evaluated, in consultation with the U.S. Fish and Wildlife Service, to determine whether the significant public investment required to sustain a man-made beach is justified at Port Mahon. The sponsor of the feasibility investigation, the State of Delaware, requested a study to evaluate the advisability of ecosystem restoration at Port Mahon, not the Delaware Bay and as a result, a comprehensive plan of action for the Delaware Bay did not result from the feasibility investigations. Ecosystem restoration was the primary objective of the feasibility analysis, although clearly the sponsor is interested in the project's secondary benefits of providing protection to State Road 89 and the pipeline that delivers jet fuel to Dover Air Force Base. As requested, the U.S. Fish and Wildlife Service reviewed the concerns raised by OMB and documented their position in a letter dated 11 May 2001 (enclosed). As outlined in this letter, the U.S. Fish and Wildlife Service believes the Port Mahon site "offers substantial potential for habitat improvement". In addition, the U.S. Fish and Wildlife Service acknowledged the study authority and the non-Federal sponsor together focused the feasibility analyses geographically on the Port Mahon area and technically on the development of a multi-objective project to protect State Road 89 and wetlands behind it.

f. OMB also suggested that the removal of some or all of the existing hard structures from the Port Mahon shoreline to allow for the natural erosion of the rural road and wetlands should be considered for implementation, since it believes that the proposed action would not restore the designated area. The alternatives considered for the Port Mahon area included two alternatives (permanent evacuation and relocation of State Road 89) that would allow natural erosion processes to continue to damage habitat and existing infrastructure. Neither of these alternatives was considered in detail since they did not meet the overall study objectives of shoreline erosion and habitat protection and restoration and were considered cost prohibitive. Specifically, permanent evacuation of the area was expected to have high social and economic costs and would not prevent the loss of habitat. Relocation of State Road 89 would involve extensive wetland destruction and costly mitigation measures while providing no habitat protection, and as a result, the plan was eliminated from further consideration. Furthermore, jet fuel is delivered to Dover Air

Force Base via an underground pipeline on the landward side of the road that will continue to require protection from shoreline erosion, negating the effects of relocating State Road 89. This pipeline is critical to normal operations at Dover Air Force Base and readiness for National Security. Without the pipeline, jet fuel would have to be delivered via truck in a large number of trips, increasing the risk of spills that would cause significant environmental damages.

g. The proposed project at Port Mahon will restore historic horseshoe crab habitat and associated wetlands and protect these habitats from further loss and degradation. While the proposed project will not be a "natural" beach, since it will need to be replenished every seven years, it will be much more than "isolated shifting pockets of sand". The restored beach will remain a functioning beach, usable annually by spawning horseshoe crabs and the thousands of migratory birds that need to feed on horseshoe crab eggs, for the life of the project. The selected plan provides the optimum ecosystem restoration and environmental quality benefits at Port Mahon and is incrementally the least-cost alternative in terms of habitat units per total present worth project costs.

3. RECOMMENDATION: In view of the above, and since this project was formulated for shoreline erosion and habitat protection and restoration purposes, I recommend this project be resubmitted to OMB for clearance.

FOR THE COMMANDER:

Encl

for
ROBERT H. GRIFFIN
Brigadier General, USA
Director of Civil Works

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401

May 11, 2001

Lt. Colonel Timothy Brown
District Engineer
U.S. Army Corps of Engineers
100 Penn Square East
Philadelphia, PA 19107-3390

Attn: Steve Allen

Re: Port Mahon Feasibility Study

Dear Colonel Brown:

This responds to your office's request for our comments on the letter dated January 18, 2001, from Mr. Wesley Warren of the Office of Management and Budget to your office relating to the Port Mahon Feasibility Study. Mr. Warren's letter questions the environmental justification for the project and suggests that a wider array of alternatives for addressing the needs of horseshoe crabs and shorebirds should have been evaluated to provide assurance that the benefits of maintaining a beach at this particular location are worth the cost. This approach overlooks the fact that the Port Mahon project was not formulated simply to address the habitat needs of horseshoe crabs and shorebirds, but also for protection of infrastructure (road and jet fuel pipeline) and water dependent recreational and commercial facilities (e.g., boat launching ramp, docks, and fishing pier). In addition, the project will also benefit a wide variety of public fish and wildlife resources by preventing erosion of the marsh and by improving the water quality of Delaware Bay due to the reduction in the input of fine sediments.

While no formal study was conducted to evaluate potential projects specifically for horseshoe crabs in Delaware Bay, it certainly appears that the Port Mahon site offers substantial potential for habitat improvement. This site lies within the shoreline region between the Mispillion River and Kelly Island where the greatest number of horseshoe crabs come ashore to spawn. Unfortunately, the Port Mahon shoreline is largely unsuitable for spawning due to limited beach habitat and the presence of bulkheads and riprap. This problem creates a significant opportunity for habitat improvement. While the alternative of simply removing the bulkhead and riprap and allowing the natural erosion process to proceed would reduce the mortality of adult crabs, the effective increase in the spawning success would be limited because sand for beach habitat is

naturally scarce. The project would supply the sand needed to improve spawning as well as achieving other benefits mentioned above.

We share the concern about the relatively high amount of replenishment that will be necessary to maintain the beach at this location. Substantive spawning beaches do not naturally occur much north of Pickering Beach which is located approximately 2.7 miles down the bay from Port Mahon. The current lack of sand at Port Mahon is likely to have been exacerbated by the bulkhead, but beach habitat under natural conditions would probably be limited to small pocket areas. Fortunately, the maintenance cost will be reduced since the material would come from the ongoing maintenance dredging of the Delaware main navigation channel. However, there are significant uncertainties involved in estimating erosion rates 50 years into the future. In addition, the demands for sand for use at other shoreline locations may be substantially greater than they are at this time. In view of this, a project based on a 25-year life, as is currently common for projects of this type, may have been more appropriate.

We cannot rule out the possibility that beach replenishment for horseshoe crab spawning habitat could be more cost effectively accomplished at other locations where the erosion rate may be lower. However, the study authorization was specific for Port Mahon and the nonfederal sponsor was especially interested in a multiple objective project that included reducing the threat to the road as well as to the wetlands behind the road. Furthermore, it does not appear that such a high standard (i.e., a demonstration of the highest benefits and cost effectiveness of any site in the Delaware Bay region) would normally be required to justify a project. For example, if the issue was evaluating beach replenishment for a human community, it would not be necessary to show that the site had the highest benefit-cost ratio of any site in Delaware Bay.

Thank you for the opportunity to comment. If there are any questions, please contact George Ruddy at (410) 573-4528.

Sincerely,

Beth McGee

for John P. Wolflin
Supervisor
Chesapeake Bay Field Office

Comment. Quite simply, the Corps has not adequately demonstrated that deepening the Delaware River and disposing of the sediments on Delaware Bay beaches will not harm the state's aquatic resources. Yet, the Corps wants DNREC to issue this permit in spite of a "hold harmless" clause so that Delaware citizens will have to pay for any environmental damages that result. Questions about cost-efficiency and the environmental impacts also indicate that the Corps has not yet identified adequate and appropriate disposal sites. We believe DNREC cannot fulfill its responsibilities under the standard set forth in the subaqueous lands law by approving the Corps application. We therefore urge DNREC to deny the permit.

Response. If an environmental problem arises during dredging, the Corps and the project sponsor, the Delaware River Port Authority, will be responsible for any environmental remediation costs that occur during dredging of the Delaware River Main Ship Channel. This responsibility will be detailed in the Project Cooperation Agreement to be signed by the Corps and DRPA. Further, as the applicant for the DNREC permit, the Corps is legally and financially accountable for any remediation that falls within the permit parameters. Contrary to statements made at the December 4 and 5 2001 public hearings, the state will not incur any financial burden if the dredging causes an environmental problem.

EXHIBIT #69

CORAILE PRYDE

Comment.

Monitoring effluent from dredge spoils storage sites:

I am concerned that drainage from dredge spoils sites might harm nearby aquifers or land areas or degrade the quality of the river water downstream to the sites. The Corps said at the previous workshop that they would "monitor" the storage sites. Please give the details on this:

What will be monitored? Loss of contaminants from the spoils site? Appearance of higher levels of contaminants downstream from the site? Other?
What materials might be tested for---pesticides, PCB'S, mercury, antimony, arsenic, cadmium, chromium, zinc, other?
While many of the heavy metals maybe present in relatively insoluble states in the material buried beneath the river, this could change as the dredge spoils are exposed to air and to microbial action, and they might be transformed into more soluble compounds. How will such changes be taken into account in the test program?
On what basis will a decision be made on whether or not to test for a given contaminant?
How often will the tests be done?
Is there a written document describing "best practices" on such testing?
What dredge spoils sites are currently being tested?
What contaminants are tested for at each site?

What is the current annual cost of testing each of these sites?
How will the results from monitoring be made available to the public?

Response. Water discharged from confined disposal facilities (CDFs) would be monitored during construction of the Delaware River Main Channel Deepening Project. The Corps has been working with the States of New Jersey and Delaware, and the Delaware River Basin Commission (DRBC), to develop an acceptable protocol for this type of monitoring. To date, the Killcohook, Oldmans, Pedricktown North and Pedricktown South CDFs have been monitored. Reports on the monitoring studies conducted at the Killcohook and Pedricktown North CDFs have been provided as part of the public record **(EXHIBIT 40 Binder 3).** The reports provide details on how CDFs would be monitored. A scope of work for water quality monitoring at the Reedy Point South CDF has also been submitted for the public record **(EXHIBIT 9).** Any changes to the plan would be made in consultation with the States of New Jersey and Delaware and the DRBC.

The United States Geological Survey conducted studies of the federally owned dredge disposal areas used for the Delaware River Main Channel. In particular, a report entitled Evaluation of Ground-Water Flow from Dredged Material Disposal Sites in Gloucester and Salem Counties, New Jersey (USGS, 1995) **(EXHIBIT 19)** was published which studied this concern. A letter dated 23 January 1996 was then issued by the USGS, which summarized and referenced this and other relevant USGS reports.

The USGS concluded that *the concern that fluids leaching from the dredged-material disposal areas could infiltrate to the aquifer with recharge water can also be set aside.* The USACE agrees with this conclusion, however, to ensure the safety of the main aquifers underlying the disposal areas, the USACE has completed installation of monitoring wells at *every* Federally-owned Main Channel dredge disposal area. The groundwater-monitoring program for the NJ sites has been approved by the NJDEP. The groundwater-monitoring program for Reedy Point North and Reedy Point South disposal areas (both located in the State of Delaware) has been submitted to DNREC for their approval.

Comment.

Sediment Contaminants:

The workshop handouts on "Sediment Quality Testing" and "ERL/ERM Sediment Guidelines "raise many questions. First, are the data referred to in the two papers identical (from the same set of test points)? If not, what are the differences?

The most important part of any analytical study is determining how and where samples Should be taken. Making the right decisions depends on understanding what the data need to demonstrate and what pitfalls are presented by the different choices that might be made. To make valid predictions about what concentrations of contaminants will be present in different regions of the river, we need to understand how the levels of different

types of contaminants (e.g. heavy metals vs. organics) have been affected by their history:
Where did they enter the river?
Have they been largely removed from the main channel by the combined scouring of repeated dredging and river current?
What are the concentrations in regions near the main channel, as opposed to within the channel at a given point in the river's length?
How do concentrations of various contaminants vary as a distance downstream from the mouths of side channels and old industrial sites.
Answering these questions requires understanding how the selections of sampling sites and approaches might affect the results. Some things that need to be considered are:
What was the depth of the samples –how far below the current river" bottom" did the samples extend?
Were any samples examined in such a way that contaminant levels were reported as a function of depth below river bottom?
Were contaminants studied as a function of depth in shoals?

Were any of the data points obtained from "averaging" the results from two or more samples?
Were any data points obtained from physically mixing any of the samples before testing?
Were any tests done on individual samples?
What rationale was used in determining what samples (or results) should be combined?

In addition to answering these questions directly, please give detailed references to where the test descriptions and data analyzed appear in the material sent to DNREC for the permit application.

An analytical study that carefully addresses the type of questions posed here could provide a reliable way to determine if there are any areas in which the dredge spoils would have contaminant levels exceeding acceptable limits. It is possible that some safer storage facilities could be found for them, although it might involve shipping them a considerable distance. Without this kind of analysis of how sampling was carried out, the results reported to us are essentially meaningless in determining if the deepening and widening of the main channel can be carried out safely.

Response. The "ERL/ERM Sediment Guidelines" handout only addressed heavy metals. That data set was the same as the bulk sediment analysis heavy metal data set discussed in the "Sediment Quality Testing" handout. The "Sediment Quality Testing" handout also discussed organic contaminants that were tested from the same samples as the heavy metal data set, a separate high resolution PCB data set, and a separate biological effects based testing data set.

The bulk sediment analysis data set discussed in both handouts included 153 individual samples. Those samples were collected from 86 sediment cores that were collected in the navigation channel and in channel bends that were proposed to be widened. The location of the sediment cores can be found on Plates 5 and 6 of the Corps' July 1997 **(EXHIBIT 4)** Delaware River Main Channel Deepening Project Supplemental Environmental Impact Statement. The samples were collected in three rounds of testing. Sample locations for the first round of testing were selected by the U.S. Environmental Protection Agency. Sample locations for the later rounds were selected to provide more thorough coverage of the project area. Within the navigation channel, cores were five to seven feet deep to reach the depth of excavation for the deepening project. Within the shallower channel bends, we attempted to collect 20-foot cores, but it was not always possible to drill 20 feet deep. Sample locations varied within individual cores. Individual cores were evaluated for sediment stratification, and individual strata of at least six inches in length were sampled. In some cores that had no sediment stratification, samples were collected from the top half and bottom half of the core. None of the 153 data points were derived by averaging two separate samples. Uniform amounts of material were collected over the length of the observed sediment strata. This material was physically mixed and subsampled to provide the necessary material to run the chemical tests.

There is not sufficient information to identify where individual contaminants entered the river. It is likely that lower observed concentrations in the navigation channel relative to nearby non-navigation areas is the result of maintenance dredging to prevent material from accumulating. Data has been collected within areas that would be dredged as part of the Delaware River Main Channel Deepening project. We do not have data on areas outside of the project.

EXHIBIT #70

JIM STEFFENS, DELAWARE CHAPTER OF THE SIERRA CLUB

Comment. Accompanying these comments is a copy of a letter from the Office of Management and Budget to the Assistant Secretary of the Army, Joseph W. Westphal, dated 18 January 2001. This letter criticizes the plan for Port Mahon, stating that Port Mahon "is situated at a point of maximum shoreline erosion compared to other location of the Delaware Bay," that there exists no appreciable beach to restore, and that the proposed beach would have to be reconstructed on average once every seven years, or seven times during the life of the project. The letter says, "The Corps has not demonstrated that [this project] would represent an efficient, productive way to target Federal and local dollars for ecosystem restoration ." The Corps used for its assessments aerial photographs of Port Mahon taken in 1988. This assessment is completely out of date. No wetlands currently exist between the road and the water, and the metal bulkheads placed there sometime in the past are largely collapsed and stand in water even at low tide.

Response. Responses to the 18 January 2001 letter are attached.

Honorable Mitchell E. Daniels, Jr.
Director
Office of Management and Budget
Washington, D.C. 20503-0008

Dear Mr. Daniels:

In response to your letter dated January 18, 2001, I am submitting for your review a Corps of Engineers memorandum detailing the findings of their review of your concerns related to the Port Mahon, Delaware ecosystem restoration project. While your office recognized the importance of restoring the Delaware Bay ecosystem, you questioned the array of alternatives considered and the justification and overall advisability of ecosystem restoration at this location. As outlined in the Corps memorandum, both the study authority and non-Federal sponsor together focused the feasibility analyses geographically on Port Mahon area and technically on the development of a multi-objective project to protect State Road 89 and wetlands behind it. Further, the Corps did consider alternatives (permanent evacuation and relocation of State Road 89) that would allow natural erosion processes to continue. Neither of these alternatives were considered in detail since they would not meet the overall study objectives of shoreline erosion and habitat protection and restoration and were cost prohibitive. Finally, the Corps again consulted with the U.S. Fish and Wildlife Service as requested and a letter dated May 11, 2001 that documents their continued support for the project.

Please advise this office based on the additional information provided whether my recommendations to support the authorization and implement the project are consistent with Administration policy.

Sincerely,

Mike Parker
Assistant Secretary of the Army
(Civil Works)

DEPARTMENT OF DEFENSE UNITED STATES OF AMERICA

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

CECW-PM

AUG 3 2001

MEMORANDUM FOR THE ASSISTANT SECRETARY OF THE ARMY (CIVIL WORKS)

SUBJECT: Port Mahon, Delaware

1. PURPOSE: In response to your 13 March 2001 memorandum, the U.S. Army Corps of Engineers has reviewed the concerns raised by the Office of Management and Budget (OMB) in their 18 January 2001 letter related to the subject project. The findings of the Corps review and my recommendation are summarized below.

2. DISCUSSION:

a. The Delaware Bay Coastline – Delaware & New Jersey, Port Mahon Delaware Interim Feasibility Study, Final Feasibility Report and Environmental Assessment determined that shoreline erosion and shoreline development have significantly reduced the spawning suitability of the Port Mahon area for the horseshoe crab. Although there is no sandy beach present at Port Mahon at this time, horseshoe crabs continue to attempt to nest in the roadbed with limited success and significant mortality. The prime spawning beaches are between Maurice River and the Cape May Canal in New Jersey and the sandy beaches between Bowers Beach and Lewes in Delaware. Port Mahon is just north of Bowers Beach. Port Mahon's location in the bay relative to salinity and hydraulic conditions make it suitable habitat for horseshoe crabs. The beach fill will protect existing wetlands as well as the wetlands to be restored as a component of the Port Mahon project. All of these features are expected to benefit migratory shorebird species.

b. The proposed ecosystem restoration project consists of three elements designed to restore the ecosystem at Port Mahon. The first element consists of restoration of 19.2 acres of horseshoe crab habitat through the placement of 306,000 cubic yards (cy) of sand for approximately 4,900 feet along the shoreline and the construction of a 1200-foot revetment at the southern end of the proposed project to tie into the existing revetment from the termination of the beachfill to provide stability. The second element will involve raising State Road 89 for a distance of 7,500 feet to protect 59.1 acres of wetlands from excessive and damaging overwash. The third element in the recommended plan is the restoration of 21.4 acres of degraded marsh west of State Road 89. The proposed ecosystem restoration and protection project will provide 193 average annual high value habitat units. In addition to ecosystem restoration and protection and the associated non-monetary environmental quality benefits, the project will produce incidental national economic development (NED) benefits. These estimated NED benefits amount to an average annual total of $140,000, and consists of reduction of infrastructure damages and avoidance of fuel delivery by more costly alternative means. A monitoring program to document project performance compared to design predictions will be conducted as a cost-shared engineering and design activity during the continuing construction for periodic nourishment. A 5-year monitoring and adaptive management

plan to evaluate success and provide for potential minor project modifications to improve overall project performance is also included in the recommended project.

c. Section 101 (a)(12) of the Water Resources Development Act (WRDA) of 1999 authorized project construction at a total cost of $7,644,000, with an estimated Federal cost of $4,969,000 and an estimated non-Federal cost of $2,675,000 and at an estimated average annual cost of $234,000 for periodic nourishment over the 50-year life of the project, with an estimated annual Federal cost of $152,000 and an estimated annual non-Federal cost of $82,000.

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e. OMB requested that a broader array of alternatives for addressing the horseshoe crabs and migratory birds of Delaware Bay be evaluated, in consultation with the U.S. Fish and Wildlife Service, to determine whether the significant public investment required to sustain a man-made beach is justified at Port Mahon. The sponsor of the feasibility investigation, the State of Delaware, requested a study to evaluate the advisability of ecosystem restoration at Port Mahon, not the Delaware Bay and as a result, a comprehensive plan of action for the Delaware Bay did not result from the feasibility investigations. Ecosystem restoration was the primary objective of the feasibility analysis, although clearly the sponsor is interested in the project's secondary benefits of providing protection to State Road 89 and the pipeline that delivers jet fuel to Dover Air Force Base. As requested, the U.S. Fish and Wildlife Service reviewed the concerns raised by OMB and documented their position in a letter dated 11 May 2001 (enclosed). As outlined in this letter, the U.S. Fish and Wildlife Service believes the Port Mahon site "offers substantial potential for habitat improvement". In addition, the U.S. Fish and Wildlife Service acknowledged the study authority and the non-Federal sponsor together focused the feasibility analyses geographically on the Port Mahon area and technically on the development of a multi-objective project to protect State Road 89 and wetlands behind it.

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3. RECOMMENDATION: In view of the above, and since this project was formulated for shoreline erosion and habitat protection and restoration purposes, I recommend this project be resubmitted to OMB for clearance.

FOR THE COMMANDER:

Encl

for ROBERT H. GRIFFIN
Brigadier General, USA
Director of Civil Works

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401

May 11, 2001

Lt. Colonel Timothy Brown
District Engineer
U.S. Army Corps of Engineers
100 Penn Square East
Philadelphia, PA 19107-3390

Attn: Steve Allen

Re: Port Mahon Feasibility Study

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While no formal study was conducted to evaluate potential projects specifically for horseshoe crabs in Delaware Bay, it certainly appears that the Port Mahon site offers substantial potential for habitat improvement. This site lies within the shoreline region between the Mispillion River and Kelly Island where the greatest number of horseshoe crabs come ashore to spawn. Unfortunately, the Port Mahon shoreline is largely unsuitable for spawning due to limited beach habitat and the presence of bulkheads and riprap. This problem creates a significant opportunity for habitat improvement. While the alternative of simply removing the bulkhead and riprap and allowing the natural erosion process to proceed would reduce the mortality of adult crabs, the effective increase in the spawning success would be limited because sand for beach habitat is

naturally scarce. The project would supply the sand needed to improve spawning as well as achieving other benefits mentioned above.

We share the concern about the relatively high amount of replenishment that will be necessary to maintain the beach at this location. Substantive spawning beaches do not naturally occur much north of Pickering Beach which is located approximately 2.7 miles down the bay from Port Mahon. The current lack of sand at Port Mahon is likely to have been exacerbated by the bulkhead, but beach habitat under natural conditions would probably be limited to small pocket areas. Fortunately, the maintenance cost will be reduced since the material would come from the ongoing maintenance dredging of the Delaware main navigation channel. However, there are significant uncertainties involved in estimating erosion rates 50 years into the future. In addition, the demands for sand for use at other shoreline locations may be substantially greater than they are at this time. In view of this, a project based on a 25-year life, as is currently common for projects of this type, may have been more appropriate.

We cannot rule out the possibility that beach replenishment for horseshoe crab spawning habitat could be more cost effectively accomplished at other locations where the erosion rate may be lower. However, the study authorization was specific for Port Mahon and the nonfederal sponsor was especially interested in a multiple objective project that included reducing the threat to the road as well as to the wetlands behind the road. Furthermore, it does not appear that such a high standard (i.e., a demonstration of the highest benefits and cost effectiveness of any site in the Delaware Bay region) would normally be required to justify a project. For example, if the issue was evaluating beach replenishment for a human community, it would not be necessary to show that the site had the highest benefit-cost ratio of any site in Delaware Bay.

Thank you for the opportunity to comment. If there are any questions, please contact George Ruddy at (410) 573-4528.

Sincerely,

Beth McGee

for John P. Wolflin
Supervisor
Chesapeake Bay Field Office

There are presently wetlands at Port Mahon, specifically as a result of the failed bulkhead. The beachfill project as designed will not cover these wetlands. The renourishment cycle for Port Mahon is well within normal limits. Many Corps beach nourishment projects require filling every year. An erosion model was applied at Kelly Island and Port Mahon and determined that this site is appropriate for wetland and beach restoration with appropriate renourishment. Without the projects at Port Mahon and Kelly Island, severe erosion and lost of valuable habitat will continue indefinitely.

Comment. I am also enclosing a copy of a letter from the U.S. Fish and Wildlife Service to Mr. John Brady of the Corps dated 14 November 2001, stating that the Fish and Wildlife Service has only just become aware that Port Mahon and Broadkill Beach are targeted as dredge disposal sites. The letter presents data on unusually large numbers of horseshoe crab eggs found at Kelly Island and Port Mahon and lesser numbers at Broadkill Beach. The letter requests that the Corps comply with a timing restriction between 15 April and 31 August, during which no beach replenishment will be conducted. Furthermore, U.S. Fish and Wildlife is requiring that further data be supplied under NEPA guidelines. In simple language, this letter is stating that Kelly Island and Port Mahon beaches are already well utilized as spawning grounds by horseshoe crabs, and that Corps beach construction activities at these sites are likely only to have deleterious effects on horseshoe crab reproduction.

Response. Refer to the general response for "horseshoe crab impacts from sand placement". Also, refer to the attached Corps response to the 14 November 2001 U.S. Fish and Wildlife Service letter.

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
WANAMAKER BUILDING, 100 PENN SQUARE EAST
PHILADELPHIA, PENNSYLVANIA 19107-3390

REPLY TO
ATTENTION OF
CENAP-PL-E

Subject: Review of Draft Horseshoe Crab Egg Density and Habitat Availability Report-Delaware River Main Channel Deepening Project

Mr. Clifford Day, Supervisor
U. S. Department of Interior
Fish and Wildlife Service
New Jersey Field Office
927 N. Main Street, Building D
Pleasantville, New Jersey 08232

JAN 28 2002

Dear Mr. Day:

I am writing to address the concerns that you raised in your November 14, 2001 letter to John Brady, of our Environmental Resources Branch about placing dredged material on Delaware Bay shore areas. These concerns resulted from your review of our September 15, 2001 draft report: *Preconstruction Horseshoe Crab Egg Density Monitoring and Habitat Availability at Kelly Island, Port Mahon, and Broadkill Beach Study Areas, Delaware.*

I believe it is important that you understand the history of work in this area before addressing your specific concerns. As part of the Delaware River Main Channel Deepening Project, the Corps prepared a Supplemental Environmental Impact Statement (July 1997) outlining a plan to use Delaware Bay sand for wetland restoration at both Kelly Island, Delaware and Egg Island Point, New Jersey. In addition, material would be stockpiled off the bay coast near Broadkill Beach and Slaughter Beach for future beach nourishment.

Because of concerns raised by your agency and others about the potential impacts of stockpiling sand, the Corps proposed depositing the sand directly on Delaware beaches, a suggestion made by your agency. Our decision was sent by letter to the U.S. Fish and Wildlife Service on May 7, 1998 and was announced at a subsequent public hearing on May 10, 1998 in Dover, Delaware. On July 14, 2000, the Delaware Department of Natural Resources and Environmental Control (DNREC) submitted a list of beaches it felt would benefit from nourishment with Delaware Bay sand from the Delaware River shipping channel. This list included Broadkill Beach and Port Mahon on the bay and Rehoboth Beach/Dewey Beach on the Atlantic coast. Nourishment for each of these beaches is also being pursued under separate Corps' authorities resulting in three individual federal projects, each of which has previously prepared National Environmental Policy Act (NEPA) documents that were coordinated with your Annapolis Field Office. These NEPA documents will be supplemented or revised for beach

nourishment areas when DNREC and the Corps decide which beaches are best suited for nourishment, thereby meeting the NEPA requirements for these actions.

A monitoring/management plan was developed for the Kelly Island wetland restoration project in close coordination with DNREC and the appropriate federal agencies, including U.S. Fish and Wildlife Service Bombay Hook National Wildlife Refuge Office. One of the plan's goals is to create more spawning habitat for horseshoe crabs. As a result, the Corps' Philadelphia District initiated the horseshoe crab egg density and habitat availability study for Kelly Island, Port Mahon and Broadkill Beach. There is a two-fold purpose for the study. The first is to establish pre-construction conditions at the three locations, which will be compared to post-construction horseshoe crab use. The second is to gather information to determine if construction can take place during the environmental window (April 15-August 31) established by the Atlantic States Marine Fisheries Commission's Interstate Fishery Management Plan for Horseshoe Crab (1998). Next year, we plan to collect additional spawning horseshoe crab data at Kelly Island, Broadkill Beach and Port Mahon.

In 2001, the Corps has also collected data on juvenile horseshoe crabs at these three locations and at Kitts Hummock, a known productive spawning area recommended as a control by DNREC. We have also gathered data for spawning adults at Kelly Island and Port Mahon. When these studies are completed, we will send them to you for review.

Turning to the draft September 2001 report, it was found that only 40.8 percent of Kelly Island and 26.9 percent of Port Mahon provide suitable spawning habitat. Much of the shoreline at Kelly Island is underlain with peat and is unsuitable for spawning. The existing spawning habitat at Kelly Island is very dynamic due to the continuing erosion, with sand and peat areas changing each year. In addition, since 1997, the southern most sandy area near the tip of Kelly Island has eroded about 650 feet northward, eliminating possible spawning habitat. At Port Mahon, the shoreline is lined with riprap causing a high annual mortality rate for spawning horseshoe crabs. Restoration at these two locations is expected to greatly enhance spawning habitat. Shorebirds are also being monitored at Kelly Island, Port Mahon, Broadkill Beach, and Prime Hook Beach (a control site) and will continue after project construction to determine the degree of success in providing shorebird habitat. Additional parameters such as sediment movement, water quality, and aquatic resources are being monitored to determine the degree of success for the Kelly Island wetland restoration.

We believe it would be productive for our respective technical staffs to meet in the near future to discuss the project and your concerns. Further, we believe it would be appropriate for the U.S. Fish and Wildlife Service to wait until discussions have taken place and next year's data collection is finished before making a final decision on whether construction can be performed within the horseshoe crab environmental window.

If you have questions or concerns, please call John Brady at 215-656-6554.

Sincerely,

Robert L. Callegari
Chief, Planning Division

Copy Furnished:
U.S. Fish and Wildlife Service, Annapolis Office
U.S. Fish and Wildlife Service Bombay Hook, National Wildlife Refuge
DNREC, Cooksey, Love, Carter, Moyer

Comment. I am also enclosing copies of photographs taken by Capt. Robert Martin (U.S. Navy, retired) of the beaches at Port Mahon and Broadkill, demonstrating the presence of colonies and reefs of the tube-forming worm, Sahellaria vulgaris, at these sites. I myself collected samples of Sabellaria colonies at a location halfway between the fishing and fuel supply piers at Port Mahon on Friday, 30 November 2001. The Corps fails to mention the presence of *Sabellaria* in any of the EIS, SEIS or Subaqueous Lands Act permit application documents. Additional photographs demonstrate that these sites represent a shallow water community, consisting of crabs and amphipods in addition to colonial worms.

Response. Refer to the general response for "*Sabellaria vulgaris* Impacts from Sand Placement". A study on *Sabellaria* at Broadkill Beach (Miller, 2002) was completed in January 2002 and is included with these responses. As pointed out in our response to the U.S. Fish and Wildlife Service letter of 14 November 2001, NEPA documents will be supplemented or revised for beach nourishment areas when DNREC and the Corps decide which beaches are best suited for nourishment, thereby meeting the NEPA requirements for these actions.

Comment. While at Port Mahon on 30 November I talked with a waterman who was transferring his day's harvest of 26 bushels of oysters from his boat to his pickup truck. This single harvest represents $700 in gross income. The effects of the dredging project on oyster beds in the vicinity of Kelly Island and Port Mahon are only mentioned in passing in the documents provided in the application.

Response. Refer to the general response for "oyster impacts". A study on pre-construction oyster, water quality, and sediment monitoring was completed in December 2001. The entire report is being submitted on a CD ROM.

Comment. I have long been concerned about the toxicity of the dredge spoils, due to their known content of heavy metals—including lead, cadmium, arsenic and mercury-as well as PCB'S polycyclic aromatic hydrocarbons, and DDT and its metabolites. Although the Corps has repeatedly claimed that they have tested these residues exhaustively, it is my contention that the chronic toxicity of dredge material from the main channel has been inadequately evaluated. I am enclosing a copy of a study coordinated by the National Oceanic and Atmospheric Administration, in which chronic toxicity tests of Delaware River sediments on marine organisms were conducted using methods not employed by the Corps. The sediments were indeed toxic, and the levels of toxicity correlated most strongly with the levels of heavy metals in the sediments. These chronic toxicity protocols were subsequently adopted by the EPA this past summer and will be henceforth required for the evaluation of all dredge sediments. Although the NOAA study did not examine any samples from the main channel of the Delaware River, the study begs the question of what hazard is to be found in main channel sludge. This is particularly important given the location of the Kelly Island wetlands in the flyway of internationally important migratory birds, and more specifically in proximity to Bombay Hook National Wildlife Refuge.

Response. Bulk sediment analyses of Delaware Bay channel sediments were conducted to determine the total concentration of contaminants within the sediments. Chemical parameters included heavy metals, pesticides, PCBs, PAHs, and a variety of volatile and semi-volatile organics. To evaluate potential impacts to fish and wildlife resources, bulk sediment data were compared to ERL/ERM sediment guidelines. These guidelines provide an estimate of the potential for sediment contaminants to adversely effect aquatic resources. Through a comprehensive review of available data on sediment effects, researchers established two guideline values. These two values are referred to as effects range-low (ERL) and effects range-median (ERM). The researchers stated: "The two guideline values, ERL and ERM, delineate three concentration ranges for a particular chemical. The concentrations below the ERL value represent a minimal-effects range; a range intended to estimate conditions in which effects would be rarely observed. Concentrations equal to and above the ERL, but below the ERM, represent a possible-effects range within which effects would occasionally occur. Finally, the concentrations equivalent to and above the ERM value represent a probable-effects range within which effects would frequently occur." (Long et al. 1995).

Bulk sediment analyses of Delaware Bay sediments only detected heavy metals, extremely low concentrations of PCBs and di-n-butyl phthalate. The ERL guideline for PCBs is 22.7 parts per billion. The highest detected concentration of PCBs in Delaware Bay channel sediment samples was 0.02 parts per billion. There is no guideline for di-n-butyl phthalate, however, the State of New Jersey has developed a standard of 5,700 parts per million as a maximum concentration for clean residential areas. The maximum concentration of di-n-butyl phthalate in Delaware Bay channel sediment samples was 0.88 parts per million. Phthalates are used in manufacturing plastic products. It is likely that detection of di-n-butyl phthalate is not from sediment contamination, but the result of laboratory contamination as the sediments come in contact with plastics from the time samples are collected through the laboratory analysis. Table 1 compares the heavy metal data to ERL/ERM sediment guidelines. The actual bulk sediment concentrations have been previously provided to the Delaware DNREC. All heavy metal concentrations detected in Delaware Bay sediments were below the ERL levels except one sample concentration of nickel (sample concentration of 21.4 mg/kg, ERL concentration of 20.9 mg/kg) and two sample concentrations of cadmium (sample concentrations of 1.22 and 2.8 mg/kg, ERL concentration of 1.2 mg/kg). These samples were collected from locations known to contain fine grain material; this material would not be placed on beaches. All concentrations of heavy metals detected in areas to be dredged for beach nourishment were below ERL levels. Based on these results, there is no reason to believe that placement of Delaware Bay sand on Delaware beaches would impact aquatic resources from a contamination perspective.

Table 1. Comparison of Delaware Bay Main Channel Sediment Data to ERL/ERM Sediment Guidelines

	ERL Value	ERM Value	% Samp. < ERL	% Samp. > ERL & < ERM	% Samp. > ERM
Antimony	2	25	69.6	30.4 *	0.0
Arsenic	8.2	70	100.0	0.0	0.0
Beryllium	NC	NC	NC	NC	NC
Cadmium	1.2	9.6	91.3	8.7	0.0
Chromium	81	370	100.0	0.0	0.0
Copper	34	270	100.0	0.0	0.0
Lead	46.7	218	100.0	0.0	0.0
Mercury	0.15	0.71	100.0	0.0	0.0
Nickel	20.9	51.6	95.7	4.3	0.0
Selenium	NC	NC	NC	NC	NC
Silver	1	3.7	100.0	0.0	0.0
Thallium	NC	NC	NC	NC	NC
Zinc	150	410	100.0	0.0	0.0

ERL/ERM guidelines are in mg/kg.

NC - Parameter has no established ERL/ERM guidelines.

Non-detections were included in the analysis at half the detection limit.

* - Antimony was not detected in any of the Delaware Bay samples. These samples were non-detections with high detection limits.

Long, E.R., D.A. MacDonald, S.L. Smith, and F.C. Calder. 1995. Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments.
Environmental Management 19(1):81-97.

To further evaluate sediment quality, water column and whole sediment bioassays were run to directly evaluate the impacts of sediment contaminants on living organisms. Bioassays provide information on the toxicity of individual contaminants, and also to indicate possible interactive effects of multiple contaminants. For Delaware Bay sediment samples, early life stages of the sheepshead minnow, the American oyster, a mysid shrimp, an infaunal amphipod, a burrowing polychaete and a bivalve mollusc were tested. In multiple tests with numerous individuals of each species, no toxicity (as defined by mortality) was observed.

As a final sediment quality check, bioaccumulation tests were run to evaluate the potential for organisms to accumulate contaminants from the channel sediment into body tissues, which could then be magnified up through the food web. For these tests, a bivalve mollusc and a burrowing polychaete were used. The organisms were allowed to live in the channel sediments for a 28-day test period, and then the soft body tissues were chemically analyzed. Control organisms living in completely clean sediment were also run for comparison. No pesticides, PCBs or PAHs were detected in any of the tissue samples. Some heavy metals were detected, however, these metals were also detected in the control organisms, and all tissue concentrations were within range of acceptable background tissue levels.

Overall, these test results indicate that dredging channel sand from Delaware Bay, and using the sand for beach nourishment, would not have an adverse effect on aquatic resources of the bay. There is no evidence of any potential contaminant problems. Wildlife resources that would be in contact with the beach sand or forage for food at the water line would also be unaffected. There are no concerns with regard to toxicity or bioaccumulation of contaminants through a food web with sand of this quality.

With regard to the draft NOAA study (10/26/00), the following information should be noted. In Delaware Bay (strata 11-14), all sampling sites (39-61) except site 57 had no contaminant concentrations above an ERL level. Site 57 is located in Maurice River Cove near the New Jersey shoreline, far removed from the navigation channel. With regard to toxicity testing in Delaware Bay, there was no toxicity observed in Delaware Bay sites (strata 11-14) for the sea urchin fertilization toxicity test or the human reporter gene system (Cytochrome P450) response test. In addition, amphipod mortality observed from Delaware Bay sites was not statistically significant from controls. While there appeared to be some toxicity observed with the Microtox ® test, the report is not clear on the significance of this information. Delaware Bay sites closest to the navigation channel (sites 47, 49 and 52) were among the lowest relative to response levels. Overall, the report does not raise concerns relative to the use of Delaware Bay material for habitat creation.

Comment. Based on the above issues, I make the following recommendations concerning the deepening project:

- The Corps' application should be denied, since the construction of a beach at Port Mahon, at the most erodable point of the Delaware shoreline will not result in the formation of a stable, permanent beach, will cost considerable and unnecessary amounts of money to maintain, and contributes nothing to the construction of meaningful wetland habitat. Neither will the barrier beach at Kelly Island protect this site from continuous and extensive erosion. However, should the project go forward in spite of these concerns, it should be contingent upon independent evaluation of main channel dredge spoils for their suitability as beach replenishment material, as well as upon an absolute ban on economic loading as a means of reducing the level of fine sediment in the dredge spoils within Delaware waters.

Response. The beach at Port Mahon will protect existing wetlands both behind the failed bulkhead, and beyond Port Mahon road. The project at Kelly Island creates approximately 60 acres of new intertidal wetland while protecting thousands of additional acres of wetlands. In addition it provides over 1 mile of horseshoe crab habitat along the shoreline. The site will specifically protect the existing shoreline against continued rapid erosion, which since 1993 has retreated an average of over 300 feet along the mile stretch and in some areas over 500 feet. Economic loading is not presently included in the plan to deepen the Delaware River. The obvious location for the use of economic loading is where the materials to be dredged are comprised of a minimum of 90% sand. The vast majority of materials in the Delaware Bay portion of the shipping channel are comprised of material appropriate for economic loading. The use of economic loading would result in substantial cost savings for the project and the State of Delaware with negligible impact to the environment.

It is correct that Kelly Island and Port Mahon are the location of the highest erosion rate documented for the Bay and ocean shorelines of Delaware. It is also correct that the project "will not result in the formation of a stable, permanent beach." No location in Delaware or elsewhere enjoys the benefit of a "stable, permanent beach," so this is perhaps not a fair criterion by which to judge the potential for the project to improve the situation at Kelly Island. The facts are:

- Delaware has a finite (and diminishing) supply of wetlands;
- Kelly Island wetlands have eroded over at least the past 100 years at a rate higher than at any other location in Delaware – as much as 50 feet of retreat per year;
- If no action is taken at Kelly Island, there is every reason to believe that the rate of wetland loss over the past century will continue for the foreseeable future, further depleting Delaware's limited supply of this natural resource;
- The proposed Kelly Island project will stop further loss of wetlands at this location, and restore some of the acreage lost to natural causes.

The Kelly Island wetland restoration will restore about 60 acres of tidal wetlands. This project is described in Section 3.3.3 and 3.3.4 of the SEIS (1997). A summary description of the project was submitted as part of the permit application as well as the "Kelly Island - Restoration Project Design Package" and "Kelly Island-Wetland Restoration: Goals and Objective Table, dated 1 November 2000" **(EXHIBIT 1).** This table is attached.

Comment.

- The Corps' application should be denied, since it will pose significant harm to the horseshoe crab populations of Delaware Bay, which are already in serious decline. Even with the prohibition of beach replenishment from 15 April to 31 August as proposed by the U.S. Fish and Wildlife Service, the beach building activities of the Corps will have a significant impact on the juvenile crabs that are well documented to occupy the shallow areas along the shore, and will bury the Sabellaria communities which occupy this environment.

Response. Refer to the general responses for "horseshoe crab impacts from sand placement" and "*Sabellaria vulgaris* impacts from sand placement".

Comment.

- The Corps' application should be denied, since it fails to consider the effects of the project on oyster beds within the river in the vicinity of Kelly Island, an economic asset to our state. The Corps' proposal to "monitor" the oyster beds during the dredging operation is completely inadequate. How will they monitor the beds? What baseline do they have to judge if the beds are harmed? What actions will they take if harm is observed? And who will monitor the monitors?

Response. Refer to the general responses for "monitoring" and "oyster impacts". Pre-construction baseline information was collected in 2000/2001 and will continue in 2002.

Comment.

- The Corps' application should be denied, since there is a significant risk posed by the toxicity of the dredge spoils to be placed in Delaware's wetlands. However, should the project go forward in spite of these concerns, it should only be considered following extensive testing of the dredge spoils under EPA guidelines for chronic toxicity prior to their deposition on Delaware lands.

Response. Refer to previous detailed response.

Delaware River Main Channel Deepening Project

Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
Jse dredged material to create and stablish 60-acre tidal wetland that rovides habitat for native species horseshoe crab, shorebirds, fish, *Spartina*, waterfowl) and prevents continued erosion of Kelly Island vithout significant adverse impacts o contiguous habitats.	Prevent deleterious effects to adjacent shellfish (oyster) populations and habitat.	No significant increase in anaerobic (smothered) conditions of shellfish beds when compared to pre-project conditions in the same locations.	Using sediment profiling camera with plan view attached, develop reference photographs of existing oysters so that reasonable color comparisons can be made in the future. Reference photos of anaerobic sediments will be obtained from existing imagery files. Photos will be taken quarterly during preconstruction and construction and for three years following construction. Transects will be set up between Kelly Island and the nearest oyster areas as well as control transects both north and south of Kelly Island.	1. Validate cause of anaerobic conditions to determine if project related. 2. Investigate restoration technology and methods. 3. Restore oyster habitat.
		No transport of placed sand from project onto nearby oyster beds or leases.	Sediment grab sampling of bay bottom between project and oyster beds (Drum Bed, Silver Bed, and Pleasanton's Rock) once during preconstruction, and quarterly for one year after construction when the need for future sampling will be reevaluated. In addition, grab samples will be taken between the project and the nearest oyster beds after major storms, which is defined as either (1) a tide based storm where post-storm surveys shall be obtained when water levels at Lewes and/or Port Mahon equal or exceed +7.5 ft above MLLW during a storm event, regardless of whether there are erosion impacts detected/observed at the Kelly Island berm; or (2) Observation-based, where post storm surveys shall be obtained if there is apparent scarping or shoreline retreat of the Kelly Island berm, even if tide gage measurements at Lewes and Port Mahon fail to equal or exceed +7.5 ft MLLW. Samples taken after construction will be compared to samples taken prior to project construction. This assumes that the sand from the project will be (Continued on next page)	1. Alternatives will be developed to divert sediment transport away from oyster grounds. 2. Construct diversions. 3. If diversions are not successful, investigate restoration technology and methods. 4. Restore oyster habitat.

Delaware River Main Channel Deepening Project

Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
			distinctly different from the pre-project bay bottom and will therefore be traceable. Within one year before construction, side scan sonar or a similar imaging technology will be used to characterize the bay bottom between Kelly Island and the nearest oyster areas.This will be repeated one year after construction..Transects will be set up between Kelly Island and the nearest oyster areas as well as control transects both north and south of Kelly Island.	
		No significant increase in suspended solids from fine grained material contained by the berm. A significant increase would be more than 25% above the yearly preconstruction mean.	Install a turbidity measuring instrument. Data will be gathered for one year prior to the construction of Kelly Island, during construction, and for three years after construction. In addition quarterly inspections will be done to inspect the berm for breaches.	Repair berm. Restore oyster habitat.
	Silt retained for periods between maintenance of the offshore sand dike and other features.	Shoreline retreat rate of less than 14 ft per year on average over 10-year period after construction. Additionally, equilibration of dike slope in first year should not result in shoreline recession of greater than 30 ft. (WES design criteria).	Annual cross-sectional surveys of offshore dike from landward edge of crest of dike to offshore toe of slope. Annual aerial photographs at 1:2400 scale.	Replenish cross-section of dike with sand if deemed necessary by the Corps and DNREC. Evaluate reasons for accelerated erosion. Mitigate with appropriate volume of sand to restore berm to expected condition.
	Contain silty dredged material.	Sufficient capacity in site to contain 200,000 cubic yards of fine sediments mixed with an additional 500,000 cubic yards of sandy sediments.	Observation of placement operation to be sure that placement of sand over silts reasonably mixes in the site. Water quality standards in the discharge from the site should not exceed those specified prior to dredging. During disposal of dredged material into the wetland restoration area, water quality will be monitored at the discharge pipes with an automatic sampler. Emphasis will be on monitoring total suspended solids.	If water quality standards are not met, dredging operation will be modified to bring discharges within limits by methods such as increasing the ponding period, or decreasing the discharge rate.

Delaware River Main Channel Deepening Project
Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
	Average annual sediment transport rate away from structure should not exceed 35,000 cubic yards.	Annual topographic and bathymetric surveys of offshore sand dike show change in dike volume not exceeding 35,000 cubic yards per year. (Some sediment will move on and offshore but can be accounted for in the volume calculations. Interest here is sand lost from the project to the north or south.)	Annual cross-sectional surveys of offshore dike from landward edge of crest of dike to offshore toe of slope. Annual aerial photographs at 1:2400 scale.	Assess cause and determine appropriate action .
	Created marshes similar to native low marshes on 40 acres (including hummocks).	Similar to adjacent reference marsh located on northern third of Bombay Hook tidal marsh.	1 year after tidal exchange established, survey area to assess natural plant recruitment using random or systematic 1-m plot methods used by the National Wildlife Refuge to be sure desired plants are present.	Assess cause and determine appropriate action.
			3 years after tidal exchange established, within +/- 3% species composition similarity with reference marsh or a desirable species composition as determined by the Corps, DNREC, and Federal Resource Agencies. In the creation of the vegetated low marsh, flexibility will be used when evaluating if the marsh is a success. Although the standard of having the vegetation within +/- 3% of the reference marsh will be used as a guideline, the Corps, DNREC and the Federal resource agencies will determine if the marsh is a "success" after vegetation has become established.	Consider modification of topography, eradication of undesirable species, planting of desired species, modification of water flow characteristics, and protection against geese and other animals eating the plants.
	Establish 50 ft width of beach grass on crest of berm/dike.	75% survival after 1 year from planting.	Field surveys for survival of planted stems yearly for three years.	More plantings of beach grass.

Delaware River Main Channel Deepening Project

Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
	Optimize habitat for use by summer and winter flounder juveniles. Although the objective of maximizing summer and winter flounder habitat will focus on these species, an attempt will be made to create a diverse aquatic community that is similar to that which exists in the adjacent reference tidal marsh waterways.	Establish at least 1000 linear feet of tidal channel at least 0.1 m deep at mean low water (NMFS, 1999) within 1 year after tidal exchange is established. The width of the channel will be determined to maximize tidal exchange without causing erosion to the sides of the channels.	Yearly air photos. Seining in new and reference channels of created marsh and adjacent tidal marsh waterways in late spring one year after tidal flow is established to determine if species are present.	Assess cause and determine appropriate action such as modification of topography and modification of water flow characteristics.
	Maximize habitat for horseshoe crabs.	At mean high water line: 1. Depth of sand is at least 16 inches. 2. Sand has 2 to 6 % moisture at 3.7 in. below the surface. 3. Beach slope is 5 to 9 %. 4. Grain size is between 0.5 and 1.0 mm at 3.7 inches below the surface.	Measure variables as described in Brady and Schrading (1996) every 500 feet along the berm face, biweekly between 1 May and 1 July, for three years after construction. Measure density of horseshoe crabs eggs at same locations following protocol that is being developed by the Atlantic States Marine Fisheries Commission.	1. Adding sand to berm. 2. Grade berm.
	Insignificant horseshoe crab mortality due to design of project. For example, in or around structures, or in the marsh (if they were to migrate over the sand dike).	Less than 10 % of crabs trapped in structures or on landward side of berm.	Yearly visual observation and counts of crabs during spawning season. Comparisons will be made between the project and other natural areas where mortality occurs.	Sand fence at edge of vegetated top of berm.

Delaware River Main Channel Deepening Project
Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
	On beachface, maximize feeding habitat for sanderlings, red knots, turnstones.	Since the main food for these species in Delaware Bay is horseshoe crab eggs, if horseshoe crab habitat is maximized, feeding habitat for these species will be as well.		
	In marsh, maximize habitat on a minimum of 20 acres for migratory shorebirds such as dowitchers, dunlin, semiplamated sandpiper, etc.	Less than 25% vegetative cover (Manomet, 1999) with 75% in a combination of mud flats and shallow water less than 12 cm at mean low water (Harrington, Undated).	Yearly air photos. Observations and counts of species using area during spring and fall migrations (could be incorporated into the aerial census being done by NJ and DE).	Assess cause of failure and determine appropriate action such as modification of topography and modification of water flow characteristics.
	Limit invasion of *Phragmites* Create marshes similar to native low marshes (including hummocks).	Less than 1% populated by *Phragmites* in monotypic stands in the marsh, as well as the berm and back dike.	Yearly air photos. Ground surveys.	Control of *Phragmites* using methods such as spot treatment of herbicides or water level manipulation.

Comment.

- The Corps' application should be denied, since it fails to establish who will oversee, carry out and bear financial responsibility for beach maintenance at Port Mahon and Kelly Island. The Corps may not be required to include the maintenance costs of these beaches in the overall costs of the project. However, since the project will create new and recurring expenses for beach maintenance, these costs need to be considered in the overall benefit-cost analysis. American taxpayers in general and Delaware taxpayers specifically should know what long-term financial commitments are involved.

Response. Concerning the Kelly Island Project, the Corps will periodically make inspections to make sure that the project is functioning as designed. Also, the Corps plans to perform maintenance such as restoring of sand material. For the Port Mahon, once the project is constructed, periodic nourishment and maintenance would be part of the authorized Port Mahon Project.

Comment.

- The Corps' application should be denied, since it fails to elaborate responsibility to any party should there be environmental harm. Recently federal funding for replenishment of Delaware's recreational beaches foundered on the issue of liability. However, any liability due to a beach "nourishment" project is inconsequential compared to a project of this magnitude, where toxic dredge spoils are involved, where novel, untried beach stabilization technologies are to be attempted, and where multiple threats to Delaware's environment are possible, some of which have not even been evaluated. The State of Delaware would itself be irresponsible if it were to "hold harmless" a federal entity that has so poorly estimated the impacts of its proposed project, and which has not begun to consider the eventuality of environmental harm. The Delaware public has a right to know what party bears financial responsibility for the mitigation of any environmental damage.

Response. If an environmental problem arises during dredging, the Corps and the project sponsor, the Delaware River Port Authority, will be responsible for any environmental remediation costs that occur during dredging of the Delaware River Main Ship Channel. This responsibility will be detailed in the Project Cooperation Agreement to be signed by the Corps and DRPA. Further, as the applicant for the DNREC permit, the Corps is legally and financially accountable for any remediation that falls within the permit parameters.

EXHIBIT #71

RUSSEL W. PETERSON

Comment. The prime objective of the dredging is to allow much larger oil tankers to come up the Delaware through the confines of a narrow channel and oncoming ship traffic. Although the proposed project contends that 80 percent of dredging will accrue to the six oil companies currently operating refineries along the Delaware, none has shown any significant interest in the project. Motiva, the only one operating in Delaware, has publicly opposed the project.

Response. The design vessel will be the same with the deepened Delaware River channel as for the current channel. Larger tankers are not expected nor analyzed in the Corps' benefit-cost evaluation due to the channel deepening. Also, crude oil benefits will accrue for six refinery locations only. A seventh refinery location, Motiva, has not been included in the assessment of navigation transportation cost savings benefits.

Comment. If it is desirable for the shipment of some products other than oil to have a port in the Mid Atlantic region with a channel deeper than the Delaware River's current 40 feet; why shouldn't the neighboring Port of Baltimore, with its existing 50 foot channel, be used?

Response. Navigation transportation cost savings are based on the tonnage moving through the Delaware River port system now and expected to continue to do so in the future (with and without the channel deepening). The Corps analysis does not claim that any tonnage will be induced to or from the port strictly because of the channel deepening.

EXHIBIT #72

LORRAINE M. FLEMING DELAWARE NATURE SOCIETY

Comment. The blue crab is Delaware's most valuable fishery. In 2000 the commercial harvest of more than 100,000 bushels (1 00,765 bu.) was valued at more than $5 million ($5,061,933). Mature female crabs, the critical breeding stock, are known to overwinter by hibernating in the sediments in the deeper sections of the lower Bay, possibly in or near the navigational channel. An attempt to answer the question of whether winter dredging associated with the deepening project would cause significant female crab mortality was addressed by a recent Versar study conducted in February 2001 (Volstad and Kelley 2001). The study concluded that planned "deepening during winter will have negligible impact . . . .because only a small area with relatively low density of crabs will be affected." I have reviewed the report and assert that this conclusion, based on spotty sampling during one season and unwarranted extrapolations, borders on being scientifically capricious. I have heard that an additional season's sampling is planned by the Corps. This gives me no comfort.

I have also reviewed the Division of Fish and Wildlife's 2001 stock assessments of Delaware Bay blue crab (Helser and Khan 2001). Stocks are currently average to a little below average compared with stock averages since 1979. Noting that the stock is fully exploited, the report recommends: ".. targeting of female crabs in the fishery,, particularly when they are concentrated, should be discouraged."

Response. Refer to the general response for "impacts on over-wintering female blue crabs".

Comment. Each spring hundreds of birders and other ecotourists flock to Delaware Bay beaches to view the spectacle of hundreds of thousands of shorebirds, stopping over en route from South and Central America to the Arctic. Economic benefits to Delaware--a large portion of the estimated $64+ million spent annually on wildlife-watching. The birds' arrival in this area of recognized international importance is timed to coincide with horseshoe crab spawning that results in the availability of millions of eggs--fuel for the famished and depleted birds. [I submit an exhibit for the record: a copy of an essay by Howard P. Brokaw, "Spring Shorebirds on Delaware Bay," published in *Birds of Delaware* (Hess, West, Barnhill, and Fleming 2000)]. Clearly the proposed placement of dredged material as beach replenishment at any sites frequented by crabs and birds, especially Port Mahon, would mean drastic interference with shorebird staging activities; but the Corps' proposed "window" of closure (April 15-August 31) only addresses part of the concerns. Juvenile crabs stay near the shore in sandflat areas for the first two years of their lives, so sand placement at any time of year could easily obliterate two generations.

Response. Refer to the general response for "migratory shorebirds impacts".

Comment. The planned restoration of Port Mahon is of particular concern. Undesirable as the habitat "appears" now it seems to function well for the crab-shorebird connection and remains the geographic zenith of activity. The Port Mahon and other Bay beach replenishment proposals can only be viewed as a large scale experiment, one we believe is not worth the risk!

We are dismayed that the Corps has not put forward a convincing proposal for quickly identifying any unforeseen adverse effects upon critical living resources. Promises and plans for monitoring programs are unacceptably vague. Before, during, and after monitoring should be routine procedural elements of any major Corps project. Without careful monitoring, environmental damage can accumulate to unacceptable levels before anyone is alerted, and the time and resources needed to remediate the damage can increase exponentially. Such damage can directly and significantly diminish the livelihood and quality of life of Delaware citizens in both direct and indirect ways, and can result in direct economic hardship for important portions of our state's commercial activities.

Response. Refer to the general response for "monitoring".

EXHIBIT #73

RICHARD A. FLEMING DELAWARE NATURE SOCIETY

1. COMMENT PUBLIC RECORD, RAF SUBMISSION PAGES 204-270

Statement. Reference: "Global Trends in Container, Breakbulk and Tanker Shipping, Vessel Size and Their Impact on Channel Deepening", April 4, 1996: a discussion sponsored by the Port of Philadelphia and Camden. Participants were national experts in global trend, ocean shipping trends, ocean terminal design " the purpose for the meeting was to provide factual information on global trends in the shipping industry and how these trends are/will impact channel depths in the future". The document contains much pertinent material. The final page lists four main conclusions, including:

- "The present channel depth (for the Delaware River) makes Wilmington fully competitive in the North/South containership trades".
- "Delaware has nothing to gain from a deeper Delaware River main channel...Nor is it wise for Delaware to enhance Philadelphia's prospect of becoming a 'mini' super port".
- "In addition, it surely makes little sense to possibly strengthen competing Delaware River refineries in Pennsylvania and New Jersey by using Delaware's public funds to support the deeper main channel project".
- Land area on the Delaware River can be developed to sustain a larger amount of niche cargoes in these trades which will not need a deeper main channel. Public funds should be directed to developing these niches".

In other words, the report of a panel of distinguished experts, brought together by the Port of Philadelphia and Camden to discuss shipping trends as they impacted a potential Delaware River deepening project, includes conclusions that Delaware has nothing to gain from the proposed project, has much to lose, and that it makes little sense to support the project with Delaware's public funds.

Response. The four conclusions stated above are not from the referenced report "Global Trends in Container, Breakbulk and Tanker Shipping, Vessel Size and Their Impact on Channel Deepening." The source of these statements is unknown to DRPA. DRPA has never seen those statements before, does not know their origin and disputes their conclusions. The 1996 session was a discussion only. It elicited many points of view but did not attempt to reach "conclusions." That is stated repeatedly through the notes of the report.

To the contrary, the final page of the notes of the 1996 discussion contains statements such as:

- "Based on the data presented, the EPA believes that there will be no adverse impacts associated with the disposal of sediments generated by the project."
- The Delaware River's 40-foot channel is the shallowest channel among our major rival ports. The ports of New York, Baltimore and Norfolk have 42-to-55-foot channels. This means that larger ships carrying more cargo can potentially call these ports."
- "Among the current users of the terminals, scrap exports would benefit from the deeper channel. There is also the potential for larger vessels carrying steel products."
- "However, the current trend in shipbuilding is for larger vessels with more draft. Containerships of 5,000-6,000 TEU's, and potentially larger, are under construction that require depths deeper than 40 feet."

Finally, the management of the Port of Wilmington does not agree with the statements represented as "conclusions" and has refuted those statements.

2. LEGAL CLARIFICATION

Question S3. Is Mr. Callegari – or anyone in the Corps – authorized to commit the Delaware River Port Authority to anything?

Response. No.

Question S5. Who is responsible to monitor for, identify, analyze and correct unforeseen environmental damage – and fund the work? What are the limits of responsibility of the Corps and the DRPA?

Response. During project construction, the Corps or Corps contractor will be responsible for monitoring and identification of a problem. Responsibility for project costs are set forth in the Project Cooperation Agreement (PCA) entered into by the Corps and the Delaware River Port Authority. All CERCLA remediation costs are the responsibility of DRPA. Any other remediation costs would be subject to cost/sharing between the Corps and DRPA.

The Corps is unaware of any limitations on its responsibilities or the responsibilities of DRPA as set forth in the PCA other than the limitations that may be subsequently placed upon the Corps by the United States Congress.

3. ENVIRONMENTAL DAMAGE - MONITORING

Question S6. The application and supporting documents cite a variety of monitoring commitments. Who will do the monitoring and reporting? What reports will be issued? What will be their frequency? Will members of DNREC and the public be allowed full participation in the design and execution of the monitoring and reporting process?

Response. All monitoring efforts will be contracted to environmental consulting groups with appropriate levels of expertise in the various areas of environmental science. The consultants will be required to prepare individual reports for each monitoring effort to document results. In some cases (i. e, oyster monitoring) monitoring will be conducted on an annual basis. In other cases (i.e., CDF monitoring) the frequency of monitoring will depend on the construction schedule. Scopes of work for all monitoring that fulfills a commitment to the State of Delaware DNREC will be coordinated with the State of Delaware DNREC prior to contracting the work. All reports for these efforts will be coordinated with the Delaware DNREC and will also be available to the public.

4. QUANTITY OF DREDGED MATERIAL

Question S7. What will be the total cubic yardage of all removed material (including that removed by those benefiting from the project, e.g. refineries, and including also 50 years of maintenance dredge spoils? Where will it be deposited (itemize by site and quantity)? When will the chosen deposition sites be full? When will new sites (in addition to the three new sites to be provided by DRPA) be needed, where will they be needed and what is the status of their identification and/or acquisition? Has permission been received from property owners for deposition of spoils on Delaware beaches?

Response. The current initial quantity of dredged material to be removed from the deepened federal channel is approximately 26.3 million cubic yards. In addition annual maintenance of about 1.1 million cubic yards will be realized. The current total cubic yards to be removed from the project (initial plus 50 years of maintenance) would amount to 81.3 million cubic yards. For the initial dredging, the disposal plan is shown in a table below. Approximately 840,000 cubic yards will be removed from the benefiting terminals. The material from the benefiting terminals will be placed at a privately owned active upland confined disposal facility. Once the beach placement areas are identified, the Project Cooperation Agreement is signed; coordination with the property owners for acquisition of lands or rights of way will be undertaken by the project sponsor, Delaware River Port Authority.

Delaware River Main Channel Deepening Project
Initial Dredging/Disposal Plan

Reach	Delaware River Station	Quantity Cubic Yards	MATERIAL	Disposal Area
A-A	Beckett St. Terminal	954,000	sand	National Park
	19+700 to 28+137	208,600	sand	"
	28+137 to 32+756	417,922	silt	"
	Total Reach A-A	**1,580,522**		
A	32+756 to 43+814	280,600	silt	Raccoon Island
	Horseshoe-Eagle Bend STA 42+000	772,232	sandy silt	"
	43+814 to 60+000	266,108	sand	"
	60+100 to 70+400	546,500	silt	"
	70+400 to 90+000	550,000	sand	"
	Mifflin-Bilingsport Bend Sta. 72+000	690,545	sandy silt	"
	Bilingport-Tinicum Bend Sta. 80+000	107,676	silt	"
	Total reach A	**3,213,661**		
B	90+000 to 117+000	1,242,400	sand	15D
	Tinicum-Eddyston Bend Sta. 98+150	279,435	sand	"
	Eddy-Chester Bend Sta.104+000	9,695	silt	"
	118+000 to 124+000	581,413	silt	"
	Marcus Hook Anchorage 124 to end	1,626,123	silt	Pedricktown North
	124+000 to 137+000	1,626,123	silt	15G
	137+000 to 145+160	694,200	silt & sand	Pedricktown South
	Mhook-Bellevue Bend Sta.141+000	157,112	silt	"
	145+160 to 176+000	462,000	silt	"
	Bellevue-Cherryls Bend Sta.158+000	169,380	Silt	"
	Total Reach B	**6,847,881**		(ROCK to Ft Mifflin 70,000 Cubic Yards
C	182+000 to 206+201& Cherry-Deepwater Bend 186	1,028,000	Silt	Killcohook
	206+201 to 225+000 & Bulkhead Bar	875,000	sand	Killcohook
	225+000 to 242+514 & New Castle-Reedy Bend	1,506,000	Silt	"
	Total Reach C	**3,409,000**		
D	249+000 to 270+000	844,000	sand	Reedy Point South
	includes Reedy-Baker Bend Sta.264+000			"
	270+000 to 300+000	1,727,000	silt	Artificial Island
	300+000 to 325+000	1,348,700	fine sand	"
	includes Baker-Liston Bend Sta.275+000			"
	Total Reach D	**3,919,700**		
E	Sta. 350+000 to 360+000	597,000	sand	Kelly Island
	Sta.360+000 to 381+000	245,000	sandy silt	
	Sta. 381+000 to 433+000	1,642,000	sand	"
	Sta. 433+000 to 467+000	2,600,000	sand	Egg Island
	Sta. 467+000 to 486+000	1,254,200	sand	Delaware Beaches
	Sta. 496+000 to 512+000	990,000	sand	Delaware Beaches
	Total Reach E	**7,328,200**		
	Total	**26,298,964** **SAY 26,300,000CY**		

The maintenance dredging quantities will be placed in the disposal area that is prepared to handle material at the time of the contract. By reach the following areas will be utilized in a rotating fashion that allows for optimum use.

Reach A& AA	National Park, Raccoon Island.
Reach B	Pedricktown North and South, Oldmans, 15D, 15G.
Reach C	Killcohook, Penns Neck.
Reach D	Artificial Island
Reach E	Buoy 10 and required maintenance of beneficial use sites.

There is adequate capacity for the initial dredging and 50 years of maintenance in the disposal areas mentioned above. No additional disposal sites are required over the 50-year project life.

5. DREDGING TECHNIQUES

Question S8. Will bucket dredging, "economic loading" or "thin layering" techniques be allowed anywhere in Delaware waters? If so – where when, under what restrictions and will new DNREC approvals be required...or will approval be considered granted if the current application is approved?

Response. There is no prohibitive window for bucket dredging below the Delaware Memorial Bridge therefore a contractor may decide to utilize bucket dredging in some areas or for entire projects if it is deemed economically beneficial. As currently planned, the project would not include thin layering or economic loading of barges or hopper dredges. Economic loading has never been considered in the riverine portion of the project. However, in Delaware Bay, where sand would be dredged and used for beach nourishment, there would be a cost savings with economic loading of hopper dredges. The Corps will consider the benefit of using economic loading when a final determination has been made with the State of Delaware regarding which beaches will be nourished. The benefit of economic loading increases as the distance between the dredging site and placement site increases. In 1998, a field study was conducted with the hopper dredge McFarland. Monitoring was conducted at two sites, one of predominately coarse-grained material, and the other of predominately fine-grained material. As the hopper was filled to an economic load, monitoring quantified the degree of suspended solids and contaminant release generated by overflow, and the dispersion of the overflow plume. Potential impact to oyster beds through increased sedimentation was evaluated with a sediment profiling camera system. Photographs of the bottom, sediment-water interface were taken before and after overflow, and analyzed to measure any recent sedimentation. A report of this investigation was provided for the public record. The States of Delaware and New Jersey would have to approve economic loading relative to compliance with their section 401 water quality certification programs and coastal zone management programs.

Question S9. Is it true that in Reach E only hydraulic dredges will be used when pumping sand to wetlands for restoration and to beaches for nourishment?

Response. It is anticipated that hydraulic hopper and pipeline dredges will be used to construct the beneficial use sites in the Delaware Bay. Bucket dredging with barges is an acceptable alternative if economically viable and practical considering time restraints for the dredging contracts.

6. MAINTENANCE RESPONSIBILTY

Question S10. What will be the Corps' long term responsibility regarding maintenance of Kelly Island and Pea Patch Island?

Response. Concerning the Kelly Island Project, the Corps will periodically make inspections to make sure that the project is functioning as designed. Also, the Corps plans to perform maintenance such as restoring of sand material. For Pea Patch Island, any maintenance will be performed as part of our regular maintenance program as part of the existing Philadelphia to Sea (Delaware River 40-foot) Federal project.

7. SAFETY

Statement. Safety issues are related to environmental concerns. The project originally was design to deepen the current 40 main channel to 45 feet – with two foot allowable overdredge- but the overdredge allowance more recently was reduced to one foot. Costs were reduced but project benefits apparently not reduced. It appears undeniably true that since the depth of the newly dredged channel will be less than the original project plan, the draft of ships actually using the deepened channel will also be less than assumed in the current benefit-cost analysis... and therefore the benefit-to-cost assessment is inaccurate.

Question S11. Why will this reduction in planned dredging not reduce – in actual practice – the maximum operating draft of ships actually traversing the deepened channel – and why were benefits not recalculated?

Response. Overdredging is a cost consideration during construction, not a benefit consideration. Vessel operating practice for underkeel clearance will be the same with the proposed deepened channel depth as for the current channel depth. Below is a discussion of overdepth versus vessel operating practice.

OVERDEPTH (COST)

Overdepth, or more precisely, "allowable overdepth," is an increment that defines the depth tolerance for dredging contracts. That is, although the dredging contractor must provide the "required depth" everywhere within the dredging limits, removal of material between the required depth and the allowable overdepth is at the option of the contractor. The provision of an overdepth during dredging assures that the required depth is achieved. The required depth represents the full-authorized project dimensions for channel depth and width. In the existing Delaware River navigation project, the authorized depth of 40 feet Mean Low Low Water (MLLW) is the required depth of dredging, with the allowable overdepth usually specified as 41 feet MLLW. Maintenance dredging in the proposed project deepening to 45 feet MLLW will have the practice of the existing project and utilize 1 foot of allowable overdepth. A required overdepth of 1 foot and an additional allowable overdepth of .5 feet are included. Since this is a new project, one foot of overdepth is required to ensure that the required depth is achieved. This provides insurance that future maintenance dredging will not be required to excavate virgin materials.

VESSEL OPERATING PRACTICE (BENEFIT)

The proposed deepening of the 40-foot project to 45 feet will not lead to a change in safe vessel operating practice. Presently, The Pilots' Association for the Bay and River Delaware uses 3 feet as the minimum underkeel clearance with use of tidal range for vessel transits. Although the project depth will increase by 5 feet, to 45 feet, the present operating practice of the Pilots with regard to underkeel clearance will not change.

CONCLUSION

The practice of allowable overdepth is a feature of the Corps of Engineers dredging program, and is applicable to both new work and operation and maintenance dredging. This practice has evolved to assure that authorized project dimensions of depth and width are provided in full, meeting the needs of the navigation community and the commitment of the Federal government with regard to navigation. At the same time, allowable overdepth provides the dredging contractor a reasonable "construction tolerance," and proportional compensation, in achieving required project dimensions. However, allowable overdepth is not directly related to or included in the calculation of navigation benefits. Because it is an optional feature of dredging practice, there is neither the assurance nor requirement that it will be provided during dredging. Navigation benefits are based on the assumption that full authorized project dimensions are constructed and maintained, whether for the existing 40-foot channel, or for the proposed 45-foot channel and existing operating practice employed by the Pilots, as described above. ***The use of allowable overdepth in new work and maintenance dredging has no direct bearing on benefits.***

8. TOTAL PROJECT COSTS

Question S12. Assuming project mid-point in 2005, what will be the total project cost, benefits and benefit-to-cost ratio in year 2005 dollars?

Response. In the economic analysis, in accordance with the Corps regulation ER 1105-2-100, the price level was held constant at the price level at the time of the analysis. Inflation is not a factor in Corps' planning studies. However, for budgetary purposes Corps inflates project cost to the mid-point of construction.

9. ALTERNATIVE SITE FOR DISPOSAL OF BAY SAND MATERIAL

Question S14. What is the Corps' alternative site for disposal of the 3,151,000 cubic yards of sand now designated for Delaware beaches...and what would be the Corps disposal costs for the beach site versus the alternative?

Response. Presently there is no planned alternative to the Delaware beaches, although there are numerous sites on the New Jersey Bay coast that require sand.

10. OTHER FEDERAL PROJECTS

Question S15. Is it correct that the following projects are or can be "stand alone", independent of the main channel deepening project, and that they can go forward regardless of whether or not the main channel deepening project proceeds: Kelly Island maintenance, Broadkill Beach replenishment, Port Mahan protection, Broadkill/Dewey Beach replenishment?

Response. With the **exception of Kelly Island**, the other projects can go forward regardless of whether or not the main channel deepening project proceeds.

11. ENVRIONMENAL REMEDIATION/DAMAGE

Question. Why should Delaware be 100% responsible for rectifying - and funding-all needed environmental remediation required as a result of unforeseen project damage?

Response. If an environmental problem arises during dredging, the Corps and the project sponsor, the Delaware River Port Authority, will be responsible for any environmental remediation costs that occur during dredging of the Delaware River Main Ship Channel. This responsibility will be detailed in the Project Cooperation Agreement to be signed by the Corps and DRPA. Further, as the applicant for the DNREC permit, the Corps is legally and financially accountable for any remediation that falls within the permit parameters.

Question. Will current monitoring plans alert us to long term, low level environmental damage?

Response. With regard to contaminant issues, chemical analysis of channel sediments, biological testing of channel sediments, monitoring of CDFs during active disposal operations, modeling of potential contaminant pathways that could be a potential source of impact, and consultation with Federal and State experts have led to the conclusion that deepening the Delaware River main navigation channel and placement of material in CDFs and at beneficial use sites in Delaware Bay would not have any adverse impacts on natural resources.

Most of the resources are being monitored before the project begins. Our current plan is to monitor during construction (where appropriate) and after construction.

Monitoring plans in Delaware have been developed in coordination with DNREC and Federal resource agencies as well as species experts, where appropriate. DNREC has participated in oyster monitoring near Kelly Island. Many of the monitoring studies are being done by experts recommended by DNREC such as Dr. Richard Weber for spawning horseshoe crabs and Dr. Brian Harrington for shorebirds. Dr. Douglas Miller from the University of Delaware is an acknowledged expert on *Sabellaria*. Dr. Eric Powell of the Haskins Shellfish Research Laboratory is participating in bay wide oyster monitoring studies. Many of the studies are being done by Versar, Inc., a nationally known environmental consulting firm who has a history of working in the Delaware Bay. It seems prudent that scientists and agency experts to design and execute complicated monitoring studies; however, all of our studies are made available to the public and are posted on our web site.

12. MONITORING

Question. Will monitoring be sufficiently independent of project management?

Response. All monitoring efforts will be contracted to environmental consulting groups with appropriate levels of expertise in the various areas of environmental science. The consultants will be required to prepare individual reports for each monitoring effort to document results. All reports for these efforts will be coordinated with the Delaware DNREC and will also be available to the public.

13. PROJECT COSTS

Question. What are true project costs, calculated in 2005 dollars – the mid-point of the project?

Response. Refer to the response to question S12.

14. BENEFITS TO STATE OF DELAWARE

Question. What is the basis for Corps claims of $74 million in benefits to Delaware?

Response. The $74 million is the cost of transporting and placement of dredged material from the deepened Delaware River Main Channel to the State of Delaware Beaches and construction of the Kelly Island Wetland Creation Project.

15. UPLAND SPOIL SITES

Question. Have all the required upland spoils sites been acquired and are they not prepared to receive spoils?

Response. The project sponsor, the Delaware River Port Authority will initiate the acquisition of upland disposal sites once the Project Cooperation Agreement is signed.

16. SAFETY

Question. We do not understand why the reduction in allowable overdredging does not result in a reduction in draft of ships traversing the channel.

Response. Refer to the response to question S11.

17. ENVIROMENTAL WINDOWS

Question. We would like to see a better compact tabular presentation of all restrictions on dredging technology and "windows (prohibited regions/times of year).

Response. An environmental windows table is attached.

18. PRECISE DEFENTION OF CERTAIN TERMINOLGOY

Comment. Certain terminology needs more precise definition. Certain critical elements of Corps commitment are not specified for example "clean sand", "best management practices" and "minimal effects of blasting on fish".

Response. The term "clean sand" can be defined in two ways. Concerns raised with regard to the deepening project mostly relate to the level of contaminants in the sand. The sand would not be considered clean if there were high levels of contaminants. Bulk sediment testing of this sand indicates that contaminant concentrations are low and that there are no concerns related to human health or protection of environmental resources. From a contaminant perspective the sand is clean. Typically, with beach nourishment projects, the concerns are more directed to the grain size of the material. If there is a high percentage of material that is finer grained than what is considered sand size then there is the concern that the resulting beach will look muddy or dirty. The material would not be considered clean from an aesthetic perspective. Delaware Bay channel sand that would be used for beach nourishment is greater than 90 percent sand and will provide an aesthetically pleasing, clean beach.

A discussion of the term "best management practices" for dredging can be found on page 51 of the document titled: *The Delaware Statewide Dredging Policy Framework* dated February 2001.

US Army Corps
of Engineers®
Philadelphia District

DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT

ENVIRONMENTAL WINDOWS IN DELAWARE

DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT ENVIRONMENTAL WINDOWS IN DELAWARE

RESOURCE	ACTIVITY	EXISTING ENVIRONMENTAL WINDOWS	PROPOSED CHANGES TO WINDOWS*
Fish	Rock Blasting Overboard Disposal in All Areas	15 March-30 Nov. (Delaware Memorial Bridge to Betsy Ross Bridge)	None
Anadromous Fish	Bucker Dredging	16 March to 31 May above River Mile 62 (Pea Patch Island)	None
Shortnose Sturgeon	Hydraulic Dredging in Non-Federal Channels	15 April-21 June (Delaware Memorial Bridge to Kinkora Range)	None
Shortnose Sturgeon	Bucket Dredging in All Areas	15 March-31 May (Delaware Memorial Bridge to Kinkora Range)	None
Atlantic Sturgeon	Hopper Dredging in All Areas	Monitors required from 1 May and 1 October between Bombay Hook, DE and the PA/DE boundary	None
Sea Turtles	Hopper Dredging in All Areas	1 June-30 November (Delaware Bay to Delaware Memorial Bridge; Sea Turtle Monitors Required)	None
Pea Patch Island Wading Bird Colony	Dredging within 2600 ft of Colony	1 April-31 August	None
Shorebirds and Horseshoe Crabs	Construction of Kelly Island Wetland Restoration andBeach Nourishment	15 April to 31 August (Area of concern is on the beach)	See discussion below.
Sandbar Shark	Beach Nourishment at Broadkill Beach	1 May to 15 Sept. (Area of concern is in the water just offshore)	See discussion below.
Winter Flounder	Dredging and Sand Placement below River Mile 35.	1 January to 31 May	See discussion below.
Over-wintering female blue crabs	Channel Dredging in Bay below RM 32.	1 December to 31 March	See discussion below.

ANY CHANGES TO THE EXISTING ESTABLISHED ENVIRONMENTAL WINDOWS WOULD FOLLOW THE FOLLOWING PROTOCOL:

CORPS OF ENGINEERS PROCEDURES FOR REQUESTING CHANGES IN CLOSED ENVIRONMENTAL WINDOWS

- **PLANNED CHANGES**

  These changes would be requested where we believe that data indicates that work could be performed within the environmental window without significantly impacting species of concern. For the Delaware River Main Channel Deepening Project data is being gathered by the Corps for species such as the horseshoe crab, shorebirds, and blue crab that may indicate that work can be done within the environmental windows because of small numbers of animals within the work areas. This data will be coordinated with appropriate State and Federal agency personnel, including species experts, and submitted to the appropriate State offices (such as DNREC Coastal Zone or Wetlands) and/or Federal resource agency office (such as USFWS or NMFS) with the request for working within the windows. A meeting may be useful to discuss the issues.

  Another possibility is to modify construction techniques to eliminate potential impacts to the species in question. This is being considered for the winter flounder and sandbar shark where coordination is proceeding with the National Marine Fisheries Service as part of an Essential Fish Habitat Evaluation.

- **UNPLANNED CHANGES**

  This would occur when an unplanned event occurs such as an adverse weather condition that has delayed project construction. This would usually involve working in the window for a relatively short period of time. Coordination would be done with the appropriate State/Federal agency to determine if this work could be done without significantly impacting the species in question.

Shorebirds and Horseshoe Crabs

A monitoring/management plan was developed for the Kelly Island wetland restoration project and has been closely coordinated with DNREC and Federal resource agencies, including personnel from the Bombay Hook National Wildlife Refuge. Kelly Island has been eroding for many years. See the attached diagram that shows the 2001 shoreline superimposed on a 1926 photo. In 1926 the percent of sandy beach in the reach of shoreline that will be restored by the wetland restoration was 100%; in 2001 the amount of potential horseshoe crab spawning habitat in 49.9%. The project would restore this to 100%.

One of the goals of the monitoring/management plan for Kelly Island that was developed by this interagency group was to create spawning habitat for horseshoe crabs. The horseshoe crab egg density and habitat availability study was done at the three areas in Delaware Bay in Delaware where we propose to place dredged material: Kelly Island, Port Mahon, and Broadkill Beach. One of the goals of this study was to establish pre-construction conditions at these areas to be compared to post-construction horseshoe crab use. Another reason that this information was needed was to see if work could be done within the environmental window (15 April to 31 August) established by the Atlantic States Marine Fisheries Commission's *Interstate Fishery Management Plan for Horseshoe Crab* (1998).

This is especially critical for Kelly Island wetland restoration that will take over a year to construct. There is a concern that if construction is not completed in a continuous manner, the structure may be compromised. We plan to gather additional data on spawning horseshoe crabs at Kelly Island in 2002, as well as at Broadkill Beach and Port Mahon. We have also gathered data on juvenile horseshoe crabs for these three areas, as well as Kitts Hummock (a known productive spawning area recommended by DNREC as a control), as well as data for spawning adults at Kelly Island and Port Mahon. After we have completed these studies, we are planning to meet with DNREC , the National Marine Fisheries Service, the U.S. Fish and Wildlife Service and other appropriate experts to discuss population levels and construction techniques that may be able to avoid or minimize impacts to horseshoe crabs. It is noted that only 49.9 % of Kelly Island and 26.9 % of Port Mahon was found to be suitable spawning habitat in 2001. Restoration efforts at Kelly Island and Port Mahon are expected to greatly enhance the spawning habitat. Much of the shoreline at Kelly Island is under lain with peat and unsuitable for spawning. The shoreline at Port Mahon is lined with rock rip rap that results in the mortality of many spawning horseshoe crabs each year.

Sandbar Shark

The habitat along the lower Delaware Bay coast in Delaware has been designated as "Habitat Areas of Particular Concern" by the NMFS. Pratt (1999) believes that there will be a great potential to impact shark pups and their food source of benthic organisms in the nursery areas along the Delaware Bay Coast, especially offshore from Broadkill Beach to Slaughter Beach, if sand is deposited near the beach (in areas 1 – 4 m deep) in the nursery season. Potential impacts may include but not be limited to: changing the habitat characteristics, depth, profile, odor, turbidity and fauna of the area. Loss of forage would also occur. Prey species, principally crabs and fish of many species, may be disrupted directly by the presence of physical activity in the area and indirectly by the covering of vulnerable food web organisms with sand. A "closed" window from 1 May to 15 September was recommended by the National Marine Fisheries Service (Gorski, 2000) to prevent potential impacts to newborn and juvenile sharks such as suffocation. After this time period, the young sharks have reached a larger size where they would be more able to avoid the sand placement operations.

On 7 November 2000 representatives from the Corps and the NMFS held a teleconference to explore methods to place sand on Broadkill Beach during the Spring/Summer without significantly impacting the sandbar sharks puping (females giving birth to live-born young) and the nursery area that is located offshore in shallow waters. It was agreed that sand placement can be performed during the period from 1 May to 15 September using the following conservation measures:

a. A sand dike, 200 to 300 feet in length, will be constructed above mean high water (MHW) to contain dredged material that is pumped landward of it. The dike will be constructed using existing sand on the beach. The dike will be long enough that most dredged material will drop out on the beach and not return to the bay. As material is deposited the dike may be repositioned seaward to contain the required filling above MHW for that section of Beach. The slurry will still be controlled by the dike along the shoreline. No dredged material will be hydraulically placed below MHW during the restricted period. The dike will be extended down the beach as the area behind the dike is filled and the dredged pipe is lengthened. The dredged material that has been deposited will be built into dunes. It is expected that little of this material will be re-deposited by wave action during the spring/summer window period since weather is generally mild, except for possible hurricanes. After September 15, some dredged material will be graded into the bay to widen the beach.
b. The dredged pipe will be placed on pontoons for a minimum of 1000 feet, beginning at approximately elevation –4.7 NGVD, extending offshore to avoid disrupting along shore traveling by the young sandbar sharks. This distance will be determined by the National Marine Fisheries Service. The remainder of the pipeline extending to the beach, and back to the dredge, can rest on the bottom.

References:

Gorski, Stanley W., 2000, Letter to John T. Brady dated February 10, 2000, National Marine Fisheries Service, Highlands, NJ.

Pratt, Harold "Wes", 1999, Letter to John T. Brady dated October 4, 1999, National Marine Fisheries Service, Narragansett, RI.

Winter Flounder

The winter flounder in Delaware Bay are part of the Mid-Atlantic population that migrate inshore in the fall and early winter and spawn in late winter and early spring. In Delaware Bay, spawning takes place January, February and March, with early life stages being present in April and May (Riportella, 2001). Trawl surveys by the Delaware Department of Natural Resources and Environmental Control indicate that they are not abundant and that they occur in the lower portion of Delaware Bay where there are higher salinity levels (Michels, 2000). Generally the concern for winter flounder extends from the mouth of Delaware Bay to River Mile 35.

Deepening the Navigation Channel has the potential to impact winter flounder if they were present; however, it is unlikely that the navigation channel has any significant use by this species.

The Deepening Project has the potential to impact eggs during the dredging of the channel and during the placement of the dredged material. It is likely that dredging will have a minimal impact on eggs of this species for the following reasons. First, most eggs have been found in shallow water, less than 5 meters. The navigation channel is presently 40 feet (12.2 meters) or greater and will be deepened to 45 feet (13.7 meters). Although eggs have been found in the 45 feet deep navigation channel of New York Harbor, the adjacent, shallow areas had greater densities, indicating that the more shallow water areas are preferred spawning habitat (Gallo, 2001). Another reason that winter flounder are likely to prefer areas adjacent to the navigation channel is that the deep draft vessels currently using the channel are creating more turbid conditions in the channel with their prop-wash that is likely to adversely impact spawning.

Since the larvae are non-dispersive, they are believed to occur in the same areas as the eggs, i.e. in shallow water. Because of the reasons listed above for eggs, it is unlikely that the navigation channel would provide preferred habitat for larvae.

Any juveniles or adults that use the channel could be adversely impacted by dredging, either by entrainment or increased turbidity. However, because of the channel's use by deep draft vessels and the resulting turbidity and prop wash, it is unlikely that the navigation channel has significant use from these life stages of winter flounder.

The placement of dredged material along the shallow shorelines of New Jersey and Delaware at the wetland restorations at Egg Island Point and Kelly Island and the beach restoration at Broadkill Beach and Port Mahon in Delaware Bay and Dewey-Rehoboth beaches along the Delaware Atlantic coast are more likely to have adverse impacts on spawning adults and early life stages (larvae and juveniles) than channel dredging. However, the impacts are not expected to be significant for the following reasons. First, as stated above, data from New Jersey and Delaware indicate that winter flounder populations currently using Delaware Bay are smaller than those further north in the range and become less abundant moving from northern New Jersey to southern New Jersey. In addition, the wetland restorations at Egg Island Point and Kelly Island will create tidal guts in the wetlands with abundant invertebrate fauna that will be beneficial to early life stages of winter flounder that will compensate for any temporary, minimal impacts that would occur from the construction of the two wetland restorations (Goodger, 2001). It is also noted that the construction of these structures is a one-time event except for occasional maintenance that can be done outside the winter flounder window.

Winter Flounder References:

Gallo, Jenine, Email to John Brady, New York District, Corps of Engineers, April 10, 2001.

Goodger, Personal Communication, National Marine Fisheries Service, Oxford, MD, April 20, 2001.

Michels, Stewart. Personal Communication, DNREC. December 13, 2000.

Riportella, Anita, 2001. Personal Communication, National Marine Fisheries Service, Highlands, New Jersey.

Over-Wintering Female Blue Crabs

A study titled *Delaware River Main Channel Deepening Project Delaware Bay Winter Crab Survey – 2000/2001* was completed in October 2001 and submitted to DNREC. This report covers the first year of pre-construction monitoring. Pre-construction monitoring will continue until construction begins and subsequent reports will be provided when available.

The study indicates that about 0.1 percent (about 70,000 crabs) of the crabs hibernating in lower Delaware Bay would be impacted. Although this loss should not impact the Delaware Bay blue crab population, the Philadelphia District will continue to coordinate with DNREC to explore methods to minimize this impact.

Concerning best management practices for Kelly Island, the Corps has developed a number of "goals/objectives " in coordination with DNREC and the Federal resource agencies to achieve the goals and objectives of the wetland restoration at Kelly Island. Specific physical and biological parameters will be measured prior to and after construction to determine if these goals and objectives can be met. If these goals and objectives are not met, appropriate actions will be undertaken. See Kelly Island Wetland Restoration Project goals and objectives table, dated November 2000, that is attached to the general response for "monitoring".

Minimal effects of blasting on fish: The NMFS has determined a shortnose sturgeon "take" limit for blasting associated with this project. The excerpt below is taken from their Biological Opinion (BO) **(EXHIBIT 22):**

"NMFS anticipates that the Deepening Project rock blasting conducted from December 1 to March 15 may result in the observed take of two (2) shortnose sturgeon from injury or mortality. A portion of the rock blasting project involves setting sink gillnets around the blast area to prevent shortnose sturgeon from entering the blasting zone. The aforementioned observed take of 2 shortnose sturgeon will be inclusive of any shortnose sturgeon injured or killed as a result of the gillnetting effort. However, a large amount of non-lethal incidental take (from harass, trap, capture, or collect) may result from the gillnetting effort and it is very difficult to predict how many sturgeon will be captured in these gillnets. The assignment of a number is highly speculative and in instances such as these, the NMFS designates the expected level of take from harass, trap, capture, or collect for the rock blasting project as unquantifiable.

It is difficult to ascertain future take of shortnose sturgeon as there has not been a previous blasting project conducted in this area. However, the NMFS believes that this level of incidental take is reasonable given the (1) previous level of take in the upper Delaware River dredging activities; (2) the distribution and abundance of adult shortnose sturgeon in the immediate project area; (3) the lack of information and hypotheses on juvenile distribution in the lower Delaware River; (4) the proposed measures to reduce the impact of blasting on fish; and (5) the time of year proposed for the project. Consultation must be reinitiated if the take level is exceeded."

In the accompanying biological opinion, the NMFS determined that this level of anticipated take is not likely to result in jeopardy to the species.

In addition, the following measures that are outlined in the Biological Opinion will be done to reduce impacts of fish in general:

- Surveillance for schools of fish will be conducted by vessels with sonar fish finders (with a LCD display screen) for a period of 20 minutes before each blast. The surveillance zone will be approximately circular with a radius of about 500 feet extending outward from each blast set. If fish schools are detected, blasting will be delayed until they leave.

- Two scare charges shall be used at each blast. The scare charges shall be detonated in close proximity to each blast. Each individual scare charge shall not exceed a TNT-equivalent weight of 0.1 lb. The detonation of the first scare charge will be at 45 seconds prior to the blast, with the second scare charge detonated 30 seconds prior to the blast. It is necessary to employ the scare charges and conduct the surveillance surveys before each blast, as some fish have been found to recolonize the blast zone soon after a detonation.
- All blast holes will be stemmed to suppress the upward escape of blast pressure from the hole. The minimum stemming shall be 2 feet thick. Stemming shall be placed in the blast hole in a zone encompassed by competent rock. Measures shall be taken to prevent bridging of explosive materials and stemming within the hole. Stemming shall be clean, angular to subangular, hard stone chips without fines having an approximate diameter of 1/2-inch to 3/8-inch. A barrier shall be placed between the stemming and explosive product, if necessary, to prevent the stemming from setting into the explosive product.
- Blast pressures will be monitored and upper limits will be imposed on each series of 5 blasts.
- Average peak pressure shall not exceed 70 pounds per square inch (psi) at a distance of 140 feet.
- Maximum peak pressure shall not exceed 120 psi at a distance of 140 feet.
- Pressure will be monitored for each blast only at a distance of 140 feet.

19. FEDERAL COASTAL ZONE CONSISTENCY DETERMINATION

Request B1. Please provide a copy of the Consistency Determination made by each of the states of Pennsylvania, New Jersey and Delaware.

Response. A copy of the Coastal Zone Consistency Determination from each of the states is attached.

State of New Jersey

Christine Todd Whitman
Governor

Department of Environmental Protection
Land Use Regulation Program
P. O. Box 439, Trenton, NJ 08625
Fax #: (609) 292-8115

Robert C. Shinn, Jr.
Commissioner

AUG 29 1997

Robert l. Callegari
Chief, Planning Division
U.S. Army Corps of Engineers, Philadelphia District
100 Penn Square East
Philadelphia, Pennsylvania 19107-3390

RE: Federal Consistency for Delaware Main Channel Deepening
FC File Number: 0000-90-0005.3

Dear Mr. Callegari:

The New Jersey Department of Environmental Protection, Land Use Regulation Program, acting under Section 307 of the Federal Coastal Zone Management Act (P.L. 92-583) as amended, given the understandings set forth in the Memorandum of Understanding between the New Jersey Department of Environmental Protection and the U.S. Army Corps of Engineers dated August 29, 1997, certifies that the above referenced project is consistent with the approved New Jersey Coastal Zone Management Program. Specifically the U.S. Army Corps of Engineers, Philadelphia District proposes a project consisting of modifying the depth of the existing channel from 40 to 45 feet at mean low water, with an allowable dredging overdepth of one foot. The modified channel would follow the existing channel alignment from Delaware Bay to Philadelphia Harbor and Beckett Street Terminal, Camden, New Jersey, with no change to channel widths. The plan also includes channel bend widenings, as well as partial deepening of Marcus Hook Anchorage to 45 feet. In addition, 229000 cubic yards of rock would be removed from the channel in the vicinity of Marcus Hook, Pennsylvania. Approximately 33 million cubic yards of material would be dredged for the initial project. Annual maintenance dredging would be approximately 6,007,000 cubic yards. In the riverine portion of the project area, dredged material would be placed in nine active, Federal upland confined disposal facilities and four new upland confined disposal facilities identified as 17G, 15D, 15G and Raccoon Island. The Delaware Bay dredged material from the initial project construction would be used for habitat development at Egg Island Point, New Jersey and Kelly Island, Delaware, and for stockpiling of sand for later beach nourishment work at Slaughter and Broadkill beaches in Delaware.

Pursuant to 15CFR 930.44, the Program reserves the right to object and request remedial action if this proposal is conducted in a manner, or is having an effect on, the coastal zone which is substantially different than originally proposed.

Thank you for your continued attention to and cooperation with New Jersey's Coastal Management Program.

Sincerely,

Richard H. Kropp
Director

ACKNOWLEDGEMENT BETWEEN

NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION

AND

U.S. ARMY CORPS OF ENGINEERS, PHILADELPHIA DISTRICT

PURPOSE

The purpose of this memorandum is to set forth the acknowledgements between the New Jersey Department of Environmental Protection and the U.S. Army Corps of Engineers, Philadelphia District regarding the following dredging and dredged material disposal issues:

A. NJDEP Water Quality Certification 0800-90-0001.4 for the maintenance of the Delaware River Philadelphia to Sea 40-foot Federal Navigation project, and

B. NJDEP Coastal Zone Consistency Determination 0000-90-0005.3 for construction and maintenance of the Delaware River 45-foot Federal Navigation Project.

This memorandum provides the framework to accomplish the following:

1. Implement management and monitoring for surface dewatering discharges from existing confined upland disposal facilities for the maintenance dredging of the existing Federal Navigation Project, Delaware River Philadelphia to the Sea 40-foot Project, and additional confined upland disposal facilities for the construction and maintenance dredging of the Delaware River Main Channel 45-foot Deepening Project.

2. Implement management and monitoring for ground water discharges from existing confined upland disposal facilities for the maintenance dredging of the existing Federal Navigation Project, Delaware River Philadelphia to the Sea 40-foot Project, and additional disposal facilities for the construction and maintenance dredging of the Delaware River Main Channel 45-foot Deepening Project.

3. Provide public fishing access to the Delaware River at the Raccoon Island confined upland disposal facility.

4. Confirm and further evaluate the effects of potential salinity changes on oyster populations due to the deepening project.

5. Develop and implement a monitoring plan to assess the long term effectiveness of the habitat development project at Egg Island Point and any effects of the habitat development project to the oyster beds proximate to this site.

6. Develop sediment sampling and testing protocols to be implemented throughout the life of the Delaware River Main Channel 45' Deepening Project.

PROJECT AREA

The project area is located within the Delaware River and Bay and the borders of the Commonwealth of Pennsylvania, and the States of New Jersey and Delaware. It extends over 100 river miles of the Delaware River and Bay, from Philadelphia, Pennsylvania to the mouth of the Delaware Bay.

OVERVIEW

The Philadelphia District of the U.S. Army Corps of Engineers (Corps) and the New Jersey Department of Environmental Protection (DEP) will form a working group to develop appropriate coordinated sediment sampling and testing programs, surface water discharge monitoring plans and ground water protection program plans which will be implemented in conjunction with the maintenance dredging of the existing 40-foot Federal Navigation project, and the construction and maintenance dredging of the 45-foot Main Channel Deepening project. These plans will consider the results of previously collected Delaware River sediment quality data, the location of dredging within the Delaware River, and the technical design of the confined upland disposal facility to be used for each reach of the channel. Sampling, testing and monitoring plans will be implemented at the appropriate time based on the timing of the dredging activities for both the maintenance dredging of the existing project and the construction and maintenance dredging of the deepening project.

SEDIMENT SAMPLING AND TESTING

Previously collected sediment quality data will be used to identify contaminants of concern, which will then be the focus of additional sediment tests. The level and frequency of sampling and type of testing will be determined by the working group. This testing will include bulk sediment chemistry analysis. Sampling plans will consider the location of dredging within the Delaware River. More extensive sampling may be required in industrialized portions of the river (i.e. between Philadelphia, Pennsylvania and Wilmington, Delaware) than in less developed areas such as the lower portion of the river and Delaware Bay. Sampling may also be reduced over time in areas provided that a data base is established to document that the sediments are adequately characterized and not contaminated at levels of concern.

In areas which are determined by the working group to be sufficiently characterized, if contaminants have not been detected, or contaminants have been detected at levels below concern, additional evaluation will not be required at this time. However, the full spectrum of contaminants will require periodic testing over the life of the project, to insure that sediment conditions have not changed.

Based on an evaluation of the previously collected data and any additional sediment testing, modifications to the design and method of operation of the confined upland disposal facilities will be evaluated by the working group and implemented by the Corps as needed to protect human health and wildlife. Management of the CDFs may include institutional controls, sequencing of disposal, or other techniques. The Corps shall coordinate the development and implementation of final closure plans for each confined upland disposal facility with the DEP when the facilities are no longer to receive dredged material.

SURFACE WATER MANAGEMENT AND MONITORING

Previously collected data will be used to identify contaminants of concern, which will then be the focus of additional water quality tests. The level and frequency of sampling and type of testing will be determined by the working group. This testing will include modified elutriate testing of sediment and monitoring of effluent discharged from the confined upland disposal facilities. Sampling and monitoring plans will consider the location of dredging within the Delaware River. More extensive sampling may be required in industrialized portions of the river (i.e. between Philadelphia, Pennsylvania and Wilmington, Delaware) than in less developed areas such as the lower portion of the river and Delaware Bay. Sampling and monitoring may also be reduced over time in areas provided that a database is established to document that surface water quality is not impacted.

In areas that are determined by the working group to be sufficiently characterized, if contaminants have not been detected, or contaminants have been detected at levels below concern, additional evaluation will not be required at this time. However, the full spectrum of contaminants will require periodic testing over the life of the project, to insure that sediment conditions have not changed.

Based on an evaluation of the previously collected data and any additional water quality testing/monitoring, modifications to the design and method of operation of the confined upland disposal facilities will be evaluated by the working group and implemented by the Corps as needed to protect water quality. Modifications to improve the quality of dewatering effluent discharged from the sites will primarily be directed to increasing the residence time on a site, which would allow additional settling of suspended sediment prior to the discharge.

GROUND WATER MONITORING

In consideration of previous geotechnical and hydrogeologic investigations contracted through or conducted by the Corps, NJDEP has agreed to allow the use of the following confined upland disposal facilities (CDF) for disposal and containment of sediments from the subject dredging operations: National Park, Oldmans No.1, Pedricktown North, Pedricktown South, 17G, Raccoon Island, 15D, 15G, Penns Neck, Killcohook Nos. 1, 2 and 3 and Artificial Island.

This acknowledgement is based upon the development of ground water protection program (GWPP) plans that will be developed by Corps in coordination with DEP for all of the CDFs listed above with the exception of the facility at Artificial Island. The GWPP plans will be developed in accordance with DEP guidelines and include any or all of the following components:

1. A ground water classification for each impacted aquifer in the area of each CDF pursuant to the New Jersey Ground Water Quality Standards, N.J.A.C. 7:9-6. This is a primary component of each GWPP and the results of each classification will dictate the need for pursuing the measures outlined in 2, 3 and 4 below. Where a CDF is located within an area with ground water classifications of III-A or III-B, DEP may waive the need for pursuing the requirements in 2, 3 and 4 below provided that the existing use of the ground water within the area is not impaired as a result of the operation of the subject CDF.

2. A ground water monitoring well system, consisting of monitoring wells located in each aquifer that may be impacted by the discharge and capable of producing uncompromised samples of ground water quality both upgradient and downgradient of the subject CDF. The number of ground water monitoring wells shall be adequate to characterize and intercept any contaminant plume emanating from the subject CDF.

3. A ground water sampling program for each ground water monitoring well system comprised of a list of ground water analytes, a sample collection schedule, sample preservation and shipment procedures, analytical procedures and chain of custody control. The sampling program shall be developed in consideration of the quality of the sediments dedicated to each CDF, the frequency of use of each site and onsite hydrogeologic conditions.

4. The ground water quality data generated from each ground water sampling program shall be subjected to appropriate statistical analysis in order to determine whether the discharge from any CDF is resulting in a contravention of the ground water quality standards.

FISHING ACCESS

When the Raccoon Island CDF is modified to eliminate the existing road which crosses the site, a perimeter road shall be constructed and maintained by the Corps to facilitate periodic maintenance and subsequent dike raisings for the Raccoon Island CDF. This road should be used to provide direct access to the Delaware River for fishing and boating activities. Any proposed plans for these activities will be coordinated with the Corps, the project sponsor, and DEP.

OYSTERS AND RELATED ISSUES

The Corps is relying on the conclusions of Rutgers University oyster researcher Dr. Eric Powell, a nationally recognized expert on oyster ecology, that the range of salinity changes predicted by the hydrodynamic model discussed in the Final SEIS would pose no adverse impact on the oyster resource in the Delaware River and Bay. Documentation of these conclusions, or those of another expert in the field of oyster ecology, shall be provided to the Department prior to beginning the main channel deepening project. The Corps in cooperation with NJDEP, will develop and implement, a monitoring plan to ensure that the long term impacts of any potential salinity change due to the deepening of the navigation channel have been accurately assessed with respect to the oyster population in the Delaware River and Bay.

HABITAT DEVELOPMENT

Prior to the construction of the habitat development project at the Egg Island Point site, the Corps shall provide the DEP with data validating that the material to be used will be at least 90% sand, based on each individual vibracore. The Corps will develop and implement a monitoring plan to assess the long-term effectiveness of the habitat development project and any impacts to oysters beds proximate to the site.

COORDINATION

The NJDEP Dredging Task Force Committee will be the primary vehicle for future coordination efforts. The Corps and NJDEP will form a working group to develop appropriate coordination of sediment sampling and testing, surface water discharge and ground water monitoring plans. The cost of any additional testing or monitoring will be considered by the working group, as it is recognized that funding constraints will limit the amount of data that can be collected in a given fiscal year. The Corps and the DEP will meet at a minimum of once every 5 years to evaluate

The Corps and the DEP will meet at a minimum of once every 5 years to evaluate the effectiveness of this document, review the management of the confined upland disposal facilities and evaluate the data generated in accordance with the document.

Robert C. Shinn, Jr.
Commissioner, New Jersey Department
of Environmental Protection

8/27/97
Date

Robert B. Keyser
Lieutenant Colonel, Corps of Engineers
Philadelphia District Engineer

29 Aug 97
Date

STATE OF NEW JERSEY
DEPARTMENT OF ENVIRONMENTAL PROTECTION
(See Issuing Division below)

PERMIT*

The New Jersey Department of Environmental Protection grants this permit in accordance with your application, attachments accompanying same application, and applicable laws and regulations. This permit is also subject to the further conditions and stipulations enumerated in the supporting documents which are agreed to by the permittee upon acceptance of the permit.

Permit No. 0800-90-0001.4		Application No. 0800-90-0001.4
Issuance Date August 29, 1997	Effective Date August 29, 1997	Expiration Date August 29, 2002
Name and Address of Applicant US Army Corps of Engineers 100 Penn Square East Wanamaker Building Philadelphia, PA 19107-3390	Name and Address of Owner Same as Owner	Name and Address of Operator Same As Owner
Location of Activity/Facility *(Street Address)* Phila to Sea Lot ______ Block ______	Issuing Division Land Use Regulation Program	Statute(s) NJSA 58:10-1 to 13
Type of Permit `Water Quality Certificate`		Maximum Approved Capacity, if applicable

This permit grants permission to: Place and dewater dredge material at the following upland confined disposal facilities in conjunction with the maintenance dredging of the Federal Navigation Project in the Delaware River, Philadelphia to the sea. The sites are as follows:

220 Oldmans No. 1 Disposal Areas, Oldmans Township, Salem County

154 acre National Park Disposal Area, National Park, Gloucester County

397 acre Penns Neck Disposal Area, Pennsville, Salem County

3800 acre Artificial Island Disposal Area, Lower Alloways Creek, Salem County

1430 acre Killcohook Disposal Area, Lower Penns Neck, Salem County

1270 acre Pedricktown North and South Disposal Areas, Oldmans Township, Salem County

The material proposed for removal and disposal under this Water Quality Certificate is from the Delaware River and is represented on plans in 15 sheets, prepared by the Army Corps of Engineers, generally entitled "Delaware River Philadelphia to the Sea Examination" and dated with no revisions as follows: sheet 1-undated, sheet 2-January 10, 1995, sheet 3-12 February 1995, sheet 4-13 February 1995, sheet 5-16 February 1995, sheet 6-26 July 1995, sheet 7and 8- 22 August 1995, sheet 9-27 July 1995, sheet 10- 1 August 1995, sheet 11- 2 August 1995, sheet 12- 21 August 1995, sheet 13- 15 August 1995, sheet 14- 16 August 1995 and sheet 15- 17 August 1995.

Prepared By: ____________________
Kevin J. Broderick
Project Manager

Revised Date

Approved by the Department of Environmental Protection
Name (Print or Type) ____________________ Title ____________________
Signature ____________________ Date ____________________

* *The word permit means "approval, certification, registration, etc."* (General Conditions are on the Reverse Side)

DEP-007 (1/95)

This Water Quality Certificate supersedes Water Quality Certificate 0800-90-0001.3, dated May 30, 1997. The proposed activity as described above, will comply with the applicable provisions of Section 301, 302, 303, 306 and 307 of the Clean Water Act and will be conducted in a manner that will not violate applicable Surface and Groundwater Standards of the State of New Jersey, given the understandings set forth in the Acknowledgement between the New Jersey Department of Environmental Protection and the U.S. Army Corps of Engineers dated August 29, 1997 and provided the following conditions are met:

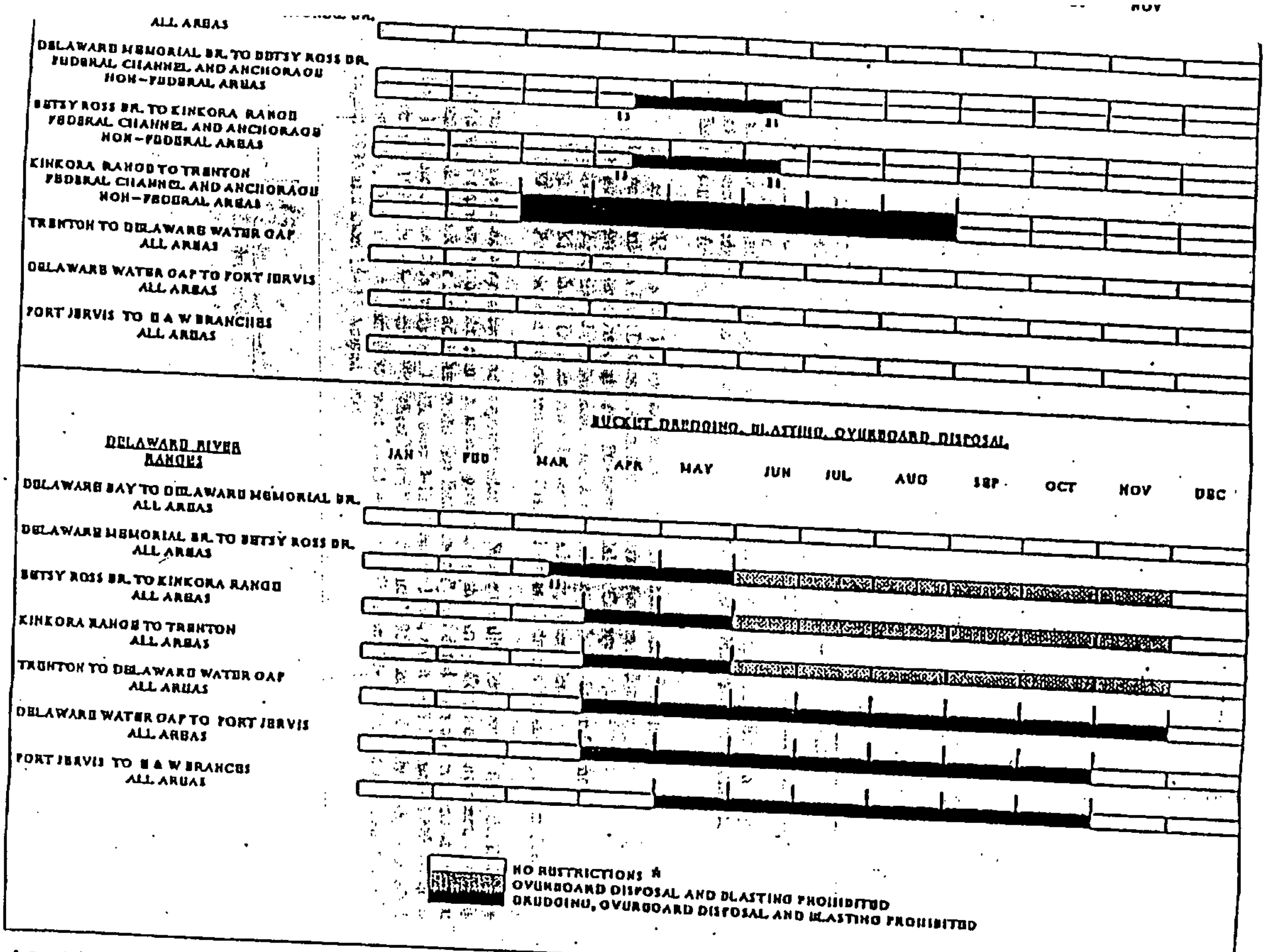
1. This Water Quality Certificate is issued subject to the timing restrictions developed by the Delaware River Fisheries Cooperative and attached to this permit as exhibit A.

2. The foregoing applies only and exclusively to the effect the proposed work would have on water quality as defined in the regulation establishing certain classification to be assigned to the waters of this State and standards of quality to be maintained in waters so classified. The certification does not apply to broader ecological, biological or environmental effects which may result from the project, nor does this certification evaluate the degree of public interest the project may generate.

8/29/97
Date

Richard Kropp, Director
Land Use Regulation Program

Exhibit "A"



* Dredging Permit Applications for these areas are subject to review, and restrictions may be implemented on a case-by-case basis

Pennsylvania Department of Environmental Protection

Rachel Carson State Office Building
P.O. Box 2063
Harrisburg, PA 17105-2063

February 4, 1997

Policy Office

Mr. Robert L. Callegari
Chief, Planning Division
Philadelphia District, Corps of Engineers
Department of the Army
Wanamaker Building, 100 Penn Square East
Philadelphia, PA 19107-3390

Dear Mr. Callegari:

The Pennsylvania Department of Environmental Protection (DEP) has reviewed the draft supplemental environmental impact statement (SEIS) regarding the Delaware Main Channel Deepening Project. We have the following comments:

The Department's main concern regarding this project has been the potential for increase in magnitude and upstream migration of salinity that could result, and the possibility of a significant impact on Philadelphia's water supply, the Potomac-Raritan-Magothy aquifer, as well as increased problems to industrial users in Pennsylvania.

Sections of the SEIS that address these concerns include Chapter 5 and Sections 7.1 and 7.2. In order to develop the information of Chapter 5, the Corps has utilized a three-dimensional hydrodynamic model to predict changes in Delaware River and Estuary salinity under various flow scenarios. These scenarios were coordinated with the various water resources agencies of the Delaware River Basin.

The SEIS concludes that "deepening of the Delaware River navigation channel will have a negligible effect on the recharge characteristics of the aquifer" and that "although the proposed channel deepening is predicted by the salinity model to increase [river mile] 98 chlorinity with a recurrence of the drought of record, the resulting 30-day average chlorinity will still be below the present standard of 180 ppm." Moreover, the SEIS points out "Philadelphia's intake at the Samuel Baxter Treatment Plant at river mile 110 is well upstream of [river mile] 98 where the chlorinity standard is set."

In recent discussion with the Delaware River Basin Commission (DRBC) Operations Staff, who have independently modeled salinity changes resulting from the proposed channel deepening using a different model, DEP determined that some discrepancies still exist between modeling results from the DRBC's and Philadelphia District's salinity models. These discrepancies should be resolved. However, it does not appear that the conclusions of the SEIS would be invalidated by minor adjustments in salinity intrusion findings.

Therefore, this Department concurs with your final determination that the proposed Delaware River Main Channel Deepening Project is consistent with Pennsylvania's Coastal Zone Management Program.

If you have any questions, please feel free to contact William A. Gast, Chief of the Division of Water Use Planning, DEP's Bureau of Watershed Conservation at (717) 772-4048.

We appreciate the opportunity to comment on this proposal.

Sincerely,

B. Sexton

Barbara A. Sexton
Director, Policy Office

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENTAL CONTROL
DIVISION OF SOIL AND WATER CONSERVATION
89 KINGS HIGHWAY
P.O. BOX 1401
DOVER, DELAWARE 19903

OFFICE OF THE
DIRECTOR

TELEPHONE: (302) 739 - 3451

May 1, 1997

Robert L. Callegari
Chief, Planning Division
Philadelphia District
U. S. Army Corps of Engineers
100 Penn Square East
Philadelphia, Pennsylvania 19107-3390

RE: ***Consistency Certification***
Delaware River Main Channel Deepening Project

Dear Mr. Callegari:

The Delaware Coastal Management Program (DCMP) has received and reviewed your consistency determination for the above referenced project. Pursuant to National Oceanic & Atmospheric Administration regulations (15 CFR 930), the DCMP concurs with your consistency determination for the deepening of the Delaware River Federal navigation channel from a depth of 40 feet to 45 feet. The DCMP certifies this project consistent with its program policies after review of the 1997 Draft Environmental Impact Statement, post-informational studies, and conditions agreed to by the Corps of Engineers in their April 30, 1997 letter. Our concurrence will be based upon the restrictions and/or conditions placed on any and all permits issued to you for this project.

This consistency certification in no way guarantees that the State of Delaware will contribute funding to the non-federal sponsorship of this project. Due to the large scale of this project, the DCMP requests that the Corps of Engineers hold an informational public meeting for the citizens of the State of Delaware so that they may be aware of this project and understand its scope.

The DCMP would like to thank the Corps for their coordination and cooperation in the review of this project and we look forward to working with you in the future. If you have any questions regarding this determination please contact me at (302) 739-3451.

Sincerely,

Sarah W. Cooksey

Sarah W. Cooksey, Administrator
Delaware Coastal Management Program

SWC/jll
cc: Secretary Christophe A.G. Tulou, DNREC

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DEPARTMENT OF DEFENSE
UNITED STATES OF AMERICA

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
WANAMAKER BUILDING, 100 PENN SQUARE EAST
PHILADELPHIA, PENNSYLVANIA 19107-3391

REPLY TO
ATTENTION OF

Planning Division

30 APR 1997

Sarah W. Cooksey
Delaware Coastal Management Program
89 Kings Highway
P.O. Box 1401
Dover, Delaware 19903

Dear Ms. Cooksey:

Pursuant to the Delaware Coastal Management Program's (DCMP's) federal consistency certification of the Delaware River and Bay Main Channel Deepening Project, the Philadelphia District of the Army Corps of Engineers agrees to the following:

1. To use "best management practices" during construction of the Kelly Island wetland restoration to minimize the chances of additional turbidity in Delaware Bay as a result of fine-grained material that could possibly escape from this site.

2. To include the latest design of the Kelly Island wetland restoration, dated March 1997, and the subsequent maintenance of this site after construction.

3. To assist the State of Delaware in addressing the ongoing erosion problem at Pea Patch Island.

4. To investigate the feasibility of using blasted rock from the channel deepening in the Marcus Hook region for erosion control/shoreline stabilization and habitat enhancement projects.

5. To restrict dredging for either the initial construction or subsequent maintenance of the 45 foot channel within close proximity so that no disturbance occurs to the wading bird colony at Pea Patch Island between 1 April and 30 August.

6. To coordinate with the State of Delaware Department of Natural Resources and Environmental Control during the preparation of Plans and Specifications to attempt to identify specific areas within the area to be dredged that are used by this species for spawning if there is a continuing concern for Atlantic Sturgeon.

7. To address during the Plans and Specifications phase the impacts to benthic resources from the placement of sand stockpiles underwater, specifically at site MS-19 and evaluate the possibility of placing such sand material on the shore for replenishment, protection, and wildlife habitat.

The Army Corps of Engineers understands that the DCMP's federal consistency certification of the Delaware River and Bay Main Channel Deepening project does not in any way guarantee that the State of Delaware will participate in funding the non-federal sponsorship of this project. The Corps looks forward to the federal consistency certification of this project by the Delaware Coastal Management Program based upon the agreements outlined above.

Sincerely,

Robert L. Callegari
Chief, Planning Division

Clarification B2. Reference: letter, Callegari to Cooksey, 30 April 1997. Please clarify the first six Corps commitments made in the cited letter.

Response. Comment noted. No response required.

Request B21. Please provide a copy of the "best management practices" that the Corps agrees to use.

Response. A discussion of the term "best management practices" can be found on page 51 of the document titled: *The Delaware Statewide Dredging Policy Framework* dated February 2001. The project as proposed in the current DNREC permit application would include the following BMPs: hydraulic dredging where applicable; no barge overflow; appropriate seasonal dredging windows; selection of channel sand for beach nourishment to insure an appropriate distance between the borrow area and the beach; visual inspection of material placed on beaches; adherence to special conditions contained in the permit; and employment of dredging inspectors.

Question B22. What is the date of the latest Kelly Island wetlands restoration design? Please provide a copy of the Corps' agreement to provide maintenance after construction.

Response. The design of Kelly Island was completed in December 2000. Details of the design features will be completed in the plans and specifications phase. The effort will be undertaken prior to the actual construction, scheduled in Fiscal Years 2004/2005. As stated at the 6 June 2001 public workshop, the Corps will perform regular inspection and maintenance.

Question B23. What written commitments has the Corps made as a result of its agreement to assist the State of Delaware in addressing the ongoing erosion problem at Pea Patch Island?

Response. The Corps has awarded two contracts, which have rebuilt the historic seawall that protects the southeastern portion (the section effected by erosion) of the island.

Question B24. What were the results of the Corps's study of feasibility of using blasted rock for erosion control and other environmentally protective projects?

Response. The blasted rock will be placed at an existing Federally owned confined upland disposal facility at Fort Mifflin, Pennsylvania. The determination of beneficial re-use of the rock will be made at the completion of the rock removal contract.

Question B25. What formal commitments have been made by the Corps regarding identification of Atlantic Sturgeon spawning areas?

Response. The Corps of Engineers has made no formal commitments to specifically identify spawning areas, but is willing to continue to work with DNREC to minimize the probability of adverse impacts to Atlantic sturgeon. The Corps has agreed to monitor for

Atlantic sturgeon between 1 May and 1 October for hopper dredging between Bombay Hook, Delaware and the Commonwealth of Pennsylvania and State of Delaware boundary as requested by DNREC. The protocol would be the same as that described for sea turtles. Typical scope of work that would be part of a dredging project to monitor sea turtles is attached to the general responses for "shortnose and Atlantic sturgeon concerns".

20. SPOILS DEPOSITION SITES

Question B3. If Delaware elects to separately contract to replenish sand on its own beaches, where will the Corps place dredges spoils from Reach E? Are the alternative sites ready to receive spoils now? If not, what must be done before spoils can be placed on these sites? What would be the added cost to the project of the preferred alternative?

Response. The State is not contemplating replenishing their beaches under separate contracts. The state of Delaware had previously provided the Corps with a list of alternative beaches along the entire bay coast. If the State chooses to pursue the cost shared alternative federal study route at some location, then the dredged material from the channel can be placed at other sites, including alternate New Jersey sites as previously mentioned in response to question S14.

21. PROJECT COSTS AND BENEFITS – YEAR 2005

Question B4. Assume that the project begins in year 2002 and continues for the next four to six years. What then will be the total project cost, and the average annual benefits expressed in year 2004 dollars...the anticipated mid-point on construction?

Response. Refer to the response to question S12.

22. FIFTY YEAR SPOILS DISPOSAL NEEDS

Question B5. What is the total cubic yardage of spoils (rock, sand, silt, etc.) to be removed from the river including the Main Channel Deepening Project, dredging required by refineries and others in order for them to achieve project benefits, 50 years of maintenance dredging and any other spoils generated as a result of the project?

Response. Refer to response to question S7.

Question B6. What sites currently are available to receive the 50 years of construction and maintenance spoils and when will each site be filled? (Corps documents state that this is a project requirement.)

Response. In the Corps permit application; the fact sheet presents the disposal plan to receive the 50 years of dredged material. The upland sites include existing Federally owned CDFs, National Park, Pedricktown North and South, Oldmans, Penns Neck, Killcohook, Reedy Point South, and Artificial Island and acquisition of new sites by the project sponsor, identified as Raccoon Island, Site 15G and 15 D. The combination of sites is adequate to provide over 50-years of upland disposal capacity for the project.

Question B7. What new sites have the DRPA provided, what is their ultimate capacity, are they fully prepared and certified to receive spoils today... and, if not, what is the status of site preparation?

Response. The status of acquiring the potential sites depends upon the signing of the PCA. As indicated in our previous response to DNREC, letter dated 31 July 2001 Enclosure 2, Item 1, *"prior to the signing of the Project Cooperation Agreement the sponsor is not required to acquire disposal sites. When the PCA is signed, the sponsor will initiate acquisition of lands for development of the required disposal sites for the project*

Question B8. Over the period through 2051 will any new Delaware disposal sites be needed in order to provide a place for dredged material?

Response. No additional Delaware sites will be required to accommodate material associated with the Delaware River Main Channel Deepening Project.

23. EGG ISLAND POINT

Question B10. Who owns the site? What is its remaining capacity? When is it expected to be full? Will it receive spoils from construction, maintenance or both? From what specific river locations will it receive construction spoils?

Response. The Egg Island Point area is owned by the State of New Jersey. The site is not an upland confined disposal facility. Using sand material from the deepened channel, a wetland restoration and protection project will be created at Egg Island Point.

24. PROJECT COSTS

Question B11. What will be the total project cost calculated in mid-2005 dollars, and what will be the total dollar responsibility of DRPA?

Response. Refer to the response to question S12.

25. BEACH PLACEMENT OF SAND

Question C1. Does DNREC anticipate that sand will be placed on any property not owned by the State of Delaware? The answer appears to be "Yes", based on the entry under item #11 of the Basic Application Form.). If so, who are the property owners?

<u>**Response**</u>. The selection of final beach placement sites has not been finalized and, the Project Cooperation Agreement has not been signed. As a result, real estate actions have not been pursued.

<u>**Question C2**</u>. Please provide a copy of the easement language expected to be used in the "temporary easements" acquitted for placement of sand on privately owned or state owned property. Who in Delaware state government will review the document for adequacy regarding protection of state interests and obligations? Has this review been completed? If so, please provide written confirmation.

<u>**Response.**</u> Refer to response to question C1.

26. UPLAND SITES FOR DISPOSAL OF DREDGED SPOILS

<u>**Statement.**</u> The application states that there will be three upland disposal sites: Raccoon Island, 15D, and 15G; site 17G is no longer available. Earlier literature states that the DRPA is responsible for acquisition and site preparation. We would like to understand the status of upland site acquisition and preparation for spoils deposition.

<u>**Response.**</u> The status of acquiring the potential sites depends upon the signing of the PCA. As indicated in our previous response to DNREC, letter dated 31 July 2001 Enclosure 2, Item 1, *"prior to the signing of the Project Cooperation Agreement the sponsor is not required to acquire disposal sites. When the PCA is signed, the sponsor will initiate acquisition of lands for development of the required disposal sites for the project*

<u>**Question C3.**</u> Is this still the plan?

<u>**Response.**</u> Yes.

<u>**Question C4**</u>. Does DRPA have to provide any upland sites for the project in addition to the three named and, if so, have the sites been identified?

<u>**Response**</u>. No.

<u>**Question C5.**</u> Has the DRPA completed legal acquisition of the three cited upland sites? If not, what is the current status of their acquisition efforts?

<u>**Response**</u>. No. Acquisition of cited upland sites will commence when the Project Cooperation Agreement is executed.

<u>**Question C6.**</u> Since 17G is no longer available, will DRPA replace it? If so, what is the status of new site acquisition?

<u>**Response.**</u> No. The material that was designated to be placed at 17G will be disposed at Raccoon Island. This site has adequate capacity to handle the dredged material that was

slated to be placed at 17G. Also, due to reduction of initial dredging quantities, the remaining sites have adequate disposal capacity for 50 years.

Question C7. How will effluent from CDFs be monitored so that any developing environmental problems can be detected early and corrective steps taken? What is the status of preliminary monitoring work or preparations for monitoring, at each site?

Response. The quality of effluent discharged from the Reedy Point South Confined Disposal Facility (CDF) would be monitored during dredged material disposal operations. Monitoring would follow similar procedures as those used to conduct the *Pedricktown Confined Disposal Facility Contaminant Loading and Water Quality Analysis* (October 2000) and *Killcohook Confined Disposal Facility Water Quality Analysis* (February 2001) studies **(EXHIBIT 40 Binder 3)**. Reports documenting these efforts have been previously provided to the Delaware Department of Natural Resources and Environmental Control. In addition, subsequent to disposal operations, surface sediment samples will be collected from the CDF and analyzed for total contaminant concentrations. The data will be evaluated using U.S. Environmental Protection Agency ecological risk assessment methodology. Scopes of Work for both of these efforts were submitted as part of the Delaware River Main Channel Deepening Project permit application **(EXHIBIT 9)**.

27. REACH E DREDGE SPOILS DISPOSAL

Question C8. Is it correct that all Reach E spoils from the deepening project will go either to wetlands/island restoration or beach nourishment? Will any go to upland spoils sites? Will any go to Reedy Point?

Response. Yes. No. Material will be placed in upland site at Reedy Point.

Question C9. Excluding drifting sediment, what spoils from locations other than Reach E will end up in Delaware? Please list regions of the river and quantities therefrom

Response. Approximately 900,000 cubic yards of dredged material from Reach D will be placed in the existing Federally-owned Reedy Point South CDF.

28. UPLAND SITES AS ALTERNATIVES TO BEACH PLACMENT

Question C10. Please list all disposal sites from which aqueous discharge will flow into Delaware waters.

Response. The existing Federally owned CDFs, Killcohook, Artificial Island, Reedy Point South, Pedricktown North and South will discharge flow into Delaware waters.

Question C11. In the event that some spoils now designated for beach nourishment or wetlands restoration for whatever reason need instead to be placed in upland sites, what upland disposal sites are available and closest to Delaware beaches?

Response. Artificial Island, NJ.

Question C12. Who owns each of these upland sites now?

Response. Federal Government

Question C13. The "Fact Sheet" page 6 states that "All disposal preparation work will be done prior to initial dredging." Is preparation of the required three new upland disposal sites and access roads now complete, and if not what remains to be done and what is the timetable for completion?

Response. Once the PCA is executed, and the project sponsor acquires the necessary lands for the development of the three upland disposal facilities, identified as Raccoon Island, 15D and 15G, the details of the access roads and other features will be finalized. The design of the new dikes has been completed in the preconstruction phase. Sites will be developed to receive dredged material for each dredging contract.

Question C14. Have plans been submitted to DNREC defining protocols for operations and monitoring of CDF's in Delaware or an other sites where effluent from dredged spoils may discharge directly into Delaware waters?

Response.

- **Effluent Discharge**

The quality of effluent discharged from the Reedy Point South Confined Disposal Facility (CDF) would be monitored during dredged material disposal operations. Monitoring would follow similar procedures as those used to conduct the *Pedricktown Confined Disposal Facility Contaminant Loading and Water Quality Analysis* (October 2000) and *Killcohook Confined Disposal Facility Water Quality Analysis* (February 2001) studies. **(EXHIBIT 4, Binder 3)** Reports documenting these efforts have been previously provided to the Delaware Department of Natural Resources and Environmental Control. In addition, subsequent to disposal operations, surface sediment samples will be collected from the CDF and analyzed for total contaminant concentrations. The data will be evaluated using U.S. Environmental Protection Agency ecological risk assessment methodology. Scopes of Work for both of these efforts were submitted as part of the Delaware River Main Channel Deepening Project permit application **(EXHIBIT 9).**

- **Groundwater Monitoring**

The USACE in conjunction with the New Jersey Department of Environmental Protection (NJDEP) has developed a groundwater-monitoring program for federally owned confined upland disposal facilities (CDFs). The CDFs , which are to be continually used for the Delaware River Main Channel Deepening project, are all located in New Jersey and now have monitoring wells. These monitoring wells along with the groundwater-monitoring program are designed to ensure that our confined disposal areas (CDFs) are not adversely impacting the drinking water aquifers.

This comprehensive groundwater-monitoring plan has been approved by the NJDEP and sampling is scheduled to begin in Spring 2002. The monitoring plan is intended to establish a baseline for all of the CDF's. After 2 years of monitoring all of the federally owned Main Channel CDF's, the plan calls for a final report on each of the CDF's, which will recommend a custom-monitoring plan tailored to each CDF. Once the site-specific CDF plans have been approved by the NJDEP, the site-specific CDF groundwater monitoring plans will then be implemented.

The USACE has also installed monitoring wells at the two sites in Delaware (Reedy Point North and Reedy Point South). A separate groundwater-monitoring plan (very similar to the NJDEP approved plan) has been sent to DNREC and we are awaiting their approval. Once DNREC approves the plan we intend on implementing groundwater monitoring at Reedy Point North and Reedy Point South.

29. DEFINITION OF "CLEAN SAND"

Question C15. Please provide a copy of the technical specification for "clean sand

RESPONSE. From an engineering standpoint, material is typically classified as clean sand when it contains less than 10% fine-grained materials. We are not aware of a technical specification for "clean sand". The term "clean sand" can be defined in two ways. Concerns raised with regard to the deepening project mostly relate to the level of contaminants in the sand. The sand would not be considered clean if there were high levels of contaminants. Bulk sediment testing of this sand indicates that contaminant concentrations are low and that there are no concerns related to human health or protection of environmental resources. From a contaminant perspective the sand is clean. Typically, with beach nourishment projects, the concerns are more directed to the grain size of the material. If there is a high percentage of material that is finer grained than what is considered sand size, then there is the concern that the resulting beach will look muddy or dirty. The material would not be considered clean from an aesthetic perspective. Delaware Bay channel sand that would be used for beach nourishment is greater than 90 percent sand and will provide an aesthetically pleasing, clean beach.

30. TOTAL PROJECT SPOILS

Question C16. Please explain the basis for the 18.98 figure.

Response. The 18.98 million was the estimated amount to be dredged from State of Delaware waters. This figure has been recently revised to 17.7 million cubic yards.

30. BUOY 10-DISPOSAL OF PROJECT SPOILS

Question D1. Is the plan to place all subsequent maintenance dredge spoils only at the Buoy 10 location? If not, what is the plan?

Response. Maintenance material from Delaware Bay will be placed at Buoy 10 unless required for maintenance of other projects.

Question D2. Is there any reason why some or all spoils from channel deepening cannot be deposited at the Buoy 10 site? If so, what is it?

Response. The buoy 10 site is only permitted to receive dredged material from maintenance dredging of the Delaware Bay portion of the Delaware River channel.

Question D3. Conversely, is there any reason why some or all spoils from maintenance dredging cannot be deposited on Delaware beaches?

Response. The cost of beach placement far exceeds that of placement at Buoy 10. This is due to pipeline and booster pumps required to deliver the dredged material. In addition, the process of beach placement is considerably slower than bottom dumping, thus elevating costs.

31. DREDGING CONTRACTORS

Question E1. What dredging companies has the Corps used for construction and maintenance projects on the Delaware River over the past 20 years, and approximately what were the sizes of the major projects they worked on? Please illustrate size in terms of quantity of spoils dredged and cost of the contracts.

Response. This office has readily available records dating back to 1990; this response is based on that information. The dredging firms working on the Delaware River maintenance projects over that time period are, Weeks Marine (formerly American Dredging in this area), Norfolk Dredging Company and Great Lakes Dredging Company (including North Atlantic Trailing Company (NATCO)), with the majority of contracts going to Weeks and Norfolk. The unit price contracts, issued during that time, required removal of approximately 4 million cubic yards of material in 1990, 1991 and 1992 (each year) and approximately 2.5 million cubic yards of material from 1993 to 2001 (each year). All of these contracts were completed with the use of hydraulic pipeline dredges. In addition to the pipeline contracts, in 1993 there was a lease of plant contract issued to Weeks Marine for $2 million, which utilized a mechanical (bucket) dredge. Another lease of plant contract was awarded to NATCO for a hopper dredge for $2 million.

32. DREDGING TECHNOLOGIES

Question. Please provide written copies of the "best management practices" (which the Corps states will be followed in their dredging and Kelly Island wetland restoration operations).

Response. A discussion of the term "best management practices" can be found on page 51 of the document titled: *The Delaware Statewide Dredging Policy Framework* dated February 2001. The dredging as proposed in the current DNREC permit application would include the following BMPs: hydraulic dredging where applicable; no barge overflow; appropriate seasonal dredging windows; selection of channel sand for beach nourishment to insure an appropriate distance between the borrow area and the beach; visual inspection of material placed on beaches; adherence to special conditions contained in the permit; and employment of dredging inspectors. These practices will be employed at the Kelly Island Wetland Restoration Project. Also, refer to goals and objectives table for Kelly Island Wetland Restoration Project, dated November 2000.

Question E3. Please document Corps commitments that the following techniques will not be used in Delaware waters or, if they will, please explain any limitations on their use:

> "bucket dredging"
> "economic loading" – better described as dredging with overflow of liquid with low solids content from barges
> "thin layering" – spoils disposal by deposition of thin layers (up to several inches in depth) on river bottoms

Response. There is no prohibitive window for bucket dredging below the Delaware Memorial Bridge therefore a contractor may decide to utilize bucket dredging in some areas or for entire projects if it is deemed economically beneficial. As currently planned, the project would not include thin layering or economic loading of barges or hopper dredges. Economic loading has never been considered in the riverine portion of the project. However, in Delaware Bay, where sand would be dredged and used for beach nourishment, there would be a cost savings with economic loading of hopper dredges. The Corps will consider the benefit of using economic loading when a final determination has been made with the State of Delaware regarding which beaches will be nourished. The benefit of economic loading increases as the distance between the dredging site and placement site increases. In 1998, a field study was conducted with the hopper dredge McFarland. Monitoring was conducted at two sites, one of predominately coarse-grained material, and the other of predominately fine-grained material. As the hopper was filled to an economic load, monitoring quantified the degree of suspended solids and contaminant release generated by overflow, and the dispersion of the overflow plume. Potential impact to oyster beds through increased sedimentation was evaluated with a sediment profiling camera system. Photographs of the bottom, sediment-water interface were taken before and after overflow, and analyzed to measure any recent sedimentation. A report of this investigation was provided for the public record. The States of Delaware and New Jersey would have to approve economic loading relative to compliance with their section 401 water quality certification programs and coastal zone management programs.

Question E4. Will disposal of spoils be allowed in any Delaware waters – including the Delaware River or its tributaries, the Delaware Bay, offshore or any other Delaware water bodies?

Response. Placement of dredged material will be performed as outlined in the permit from the State of Delaware and as previously answered in this document. No unauthorized disposal of dredged material will occur as part of this project.

Question E5. Is it true that in Reach E only hydraulic dredges will be used to pump sand to wetlands for restoration and to beaches for nourishment?

Response. Refer to response to question S9.

33. DREDGING WINDOWS

Question E6. Will you please provide in a single summary document a summary of prohibited time periods for various kinds of dredging?

Response. Please refer to the attached environmental windows table. Additional information is located in the general responses for "environmental windows".

34. BLASTING ISSUES-EFECTS ON MARINE LIFE.

Statement. Previous Corps correspondence states that "Monitoring of impacts to fish from blasting will also be conducted to verify that impacts are minimal'.

Question F1. Please provide a copy of the monitoring plan and define what is meant by "minimal".

Response. A scope of work will be developed to include all of the conservation measures, including monitoring, that are listed in the Biological Opinion **(EXHIBIT 22)** from the NMFS. Also, please refer to the answer for the previous question 18 on "Precise definition of certain terminology".

35. PEA PATCH ISLAND ISSUES

Statement. A Corps commitment, as expressed in item 5 of the 30 April 1997 letter, Callegari to Cooksey reads: "To restrict dredging for ***either the initial construction or subsequent maintenance of the 45 foot*** channel within close proximity so that no disturbance occurs to the wading bird colony at Pea Patch island between 1 April and 30 August."

Question G1. Does the Corps agree that the italicized section should be changed to read "...both the initial construction and the subsequent maintenance..."?

Response. Yes.

Question G2. (a) What does "within close proximity" mean? (b) Is the commitment to not dredge during this period, or to dredge in such a way that no disturbance occurs? (c) Who is the judge of whether or not disturbance occurs?

Response.

- **(a) and (b).** Please refer to the attached environmental windows table located in the general responses for "environmental windows". As shown, dredging is prohibited within 2,600 feet of the heron colony during this time period.

- **(c)** The rational for using a minimum distance of 2,600 feet is described in Section 10.4.3.6 of the Corps SEIS (July 1997) **(EXHIBIT 4).** It is the minimum distance that dredging has been done from the heron colony and no apparent negative consequences were known to occur. This window has been coordinated with DNREC and Federal resource agencies.

36. MONITORING

Question H3. Please identify those portions of reports which give benchmarking data on contaminants present now at Buoy 10, on Delaware beaches and other Delaware sites designated to receive dredge spoils.

Response. We are not aware of any reports that provide the requested information.

Question H4. What Delaware standards and sampling protocols will the Corps use to assess contamination in soil, water and in effluent from spoils sites?

Response.

- **Effluent Discharge**

The quality of effluent discharged from the Reedy Point South Confined Disposal Facility (CDF) would be monitored during dredged material disposal operations. Monitoring would follow similar procedures as those used to conduct the *Pedricktown Confined Disposal Facility Contaminant Loading and Water Quality Analysis* (October 2000) and *Killcohook Confined Disposal Facility Water Quality Analysis* (February 2001) studies **(EXHIBIT 40, Binder 3).** Reports documenting these efforts have been previously provided to the Delaware Department of Natural Resources and Environmental Control. In addition, subsequent to disposal operations, surface sediment samples will be collected from the CDF and analyzed for total contaminant concentrations. The data will be evaluated using U.S. Environmental Protection Agency ecological risk assessment methodology. Scopes of Work for both of these efforts were submitted as part of the Delaware River Main Channel Deepening Project permit application **(EXHIBIT 9).**

- **Groundwater Monitoring**

The USACE in conjunction with the New Jersey Department of Environmental Protection (NJDEP) has developed a groundwater-monitoring program for federally owned confined upland disposal facilities (CDFs). The CDFs, which are to be continually used for the Main Channel Deepening project, are all located in New Jersey and now have monitoring wells. These monitoring wells along with the groundwater-monitoring program are designed to ensure that our confined disposal areas (CDFs) are not adversely impacting the drinking water aquifers.

This comprehensive groundwater-monitoring plan has been approved by the NJDEP and sampling is scheduled to begin in Spring 2002. The monitoring plan is intended to establish a baseline for all of the CDF's. After 2 years of monitoring all of the federally owned Main Channel CDF's, the plan calls for a final report on each of the CDF's, which will recommend a custom-monitoring plan tailored to each CDF. Once the site-specific CDF plans have been approved by the NJDEP, the site-specific CDF groundwater monitoring plans will then be implemented.

The USACE has also installed monitoring wells at the two sites in Delaware (Reedy Point North and Reedy Point South). A separate groundwater-monitoring plan (very similar to the NJDEP approved plan) has been sent to DNREC and we are awaiting their approval. Once DNREC approves the plan we intend on implementing groundwater monitoring at Reedy Point North and Reedy Point South.

Question H5. Please document Corps responsibilities regarding environmental monitoring of beach disposal sites.

Response. Please refer to the response to concern "c" under the general response for "monitoring".

Question H6. If leachate composition exceeds Delaware standards, who is responsible to conduct remedial action? Who is responsible to fund the effort?

Response. If an environmental problem arises during dredging, the Corps and the project sponsor, the Delaware River Port Authority, will be responsible for any environmental remediation costs that occur during dredging of the Delaware River Main Ship Channel. This responsibility will be detailed in the Project Cooperation Agreement to be signed by the Corps and DRPA. Further, as the applicant for the DNREC permit, the Corps is legally and financially accountable for any remediation that falls within the permit parameters.

Question H7. Please document Corps commitments to perform long term sampling and analysis in order to determine the concentration of key toxins which may be resuspended by dredging of the main channel, berthing areas and spur channels.

Response. No spur channels would be dredged as part of the Delaware River Main Channel Deepening Project. Deepening of berthing areas would require separate Federal and State permits. Monitoring requirements for work within berthing areas would be determined through the individual permitting processes. Only a portion of one berthing area is within Delaware State waters. A scope of work for monitoring water quality at the point of dredging was included with the permit application **(EXHIBIT 9).** This monitoring would occur during the dredging operation.

Question H8. Please document Corps commitments to determine downstream environmental effects of dredging-induced silting.

Response. Dredging causes the re-suspension of a fraction of the bottom sediment being removed. The magnitude of the re-suspension depends on a number of factors, including dredging method, in situ sediment characteristics, physical environmental conditions at the site during dredging, etc. Re-suspension of bottom sediment is a process that occurs naturally in all tidally dominated estuaries with significant quantities of available fine-grained sediment, including the Delaware Estuary. The natural estuarial processes of re-suspension, transport, and deposition occur continuously with rates that vary over a large range depending on the stage of the tide, depth of water, and wave conditions (which increase during storms.) In this regard, sediment re-suspension from dredging is no different from natural sediment re-suspension that is intrinsic to the Delaware Estuary, and will cause no impacts that differ from what occurs naturally.

Question H9. Please document Corps commitments to monitor environmental effects in sensitive areas during and after the deepening project. These areas include oyster beds and Kelly island.

Response. Please refer to the response to concern "d" under general response for "monitoring".

Question H10. Please document Corps responsibilities for long term (50 year) environmental monitoring of the Pea Patch Island site.

Response. We do not plan to conduct long term environmental monitoring.

37. DREDGE OPERATION

The permit application grants permission to authorized DNREC representatives to "enter upon the premises during working hours".

Question H12. Does this mean that DNREC representatives can board operating dredges? What type of permission must be obtained before boarding, and from whom?

Response. A safety briefing must be given to all those that intend to board a dredge, under contract to the Corps. All safety equipment, life jacket, hardhat and safety shoes would be required and the Corps would accompany visitors on-site inspector. The permission is usually given through contacting the Corps project manager. These requirements would be in addition to any boarding requirements enforced by the contractor.

38. KELLY ISLAND

Funding and Authorization. We understand that this is a stand-alone wetlands restoration project whose congressional authorization and federal funding is separate from the main channel deepening project.

Question I1. Is this correct? If so, has the project been authorized? What is the status of funding?

Response. Kelly Island Wetland Restoration Wetland Project is exclusively part of the Delaware River Main Channel Deepening Project. No separate authorization or funding exists for this project.

Question I2. Is it true that the Corps of Engineers will be responsible for maintenance of the structure for the 50 year life of the project?

Response. The Corps will periodically make inspections to make sure that the project is functioning as designed. Also, the Corps plans to perform periodic inspection and maintenance such as restoring of sand material.

38. BROADKILL BEACH

Funding and Authorization. We understand that this is a stand-alone project whose congressional authorization and federal funding is separate from the main channel deepening project.

Question I3. Is this correct? Has the project been authorized? What is the status of funding? Will the Broadkill Beach project continue even if the main channel deepening project is delayed or suspended?

Response. Yes. The project has been authorized for construction and plans and specifications have been completed. Construction funds have been requested. If funding is provided, the Broadkill Beach Project will continue.

Question I4. Is it true that the Corps of Engineers will have no responsibility for maintenance of the beach once construction is complete?

Response. Once the project is constructed periodic nourishment and maintenance would be performed as part of the authorized Broadkill Beach Project.

Question I5. What have you determined to be the total cubic yards needed for beach replenishment, and the cost per cubic yard of moving the required sand from the main channel to its final location on the beach? Please split out mobilization/demobilization costs as a separate line item.

Response. The estimated quantity of material to be placed at Broadkill Beach is shown in the table for the response to question S7. The current cost of moving the material to the beach is approximately $10.00-$13.00 per cubic yard. Mobilization of a dredge will range from $300,000 to $1,000,0000.

Question I6. In addition to the cost of getting sand from the source to the beach, there are other costs including acquisition of easements, surveys, appraisals, plantings, fencing, project management, etc. All appear also to be part of the MCD project. Will Delaware have to incur any of these additional costs, or are all paid for out of MCD funding?

Response. If the project is constructed as part of the MCD, the cost of getting sand material for the initial project would be funded as part of the MCD project, as well as the acquisition of easements, surveys, appraisals and project management. Costs for dune grass, and fencing would be part of the authorized Broadkill Beach Project.

39. REHOBOTH/DEWEY BEACH

Funding and Authorization. We understand that this also is a stand-alone project whose congressional authorization and federal funding is separate from the main channel deepening project.

Question I7. Is this correct? Has the project been authorized? What is the status of funding? Will the Rehoboth/Dewey Beach project continue even if the main channel deepening project is delayed or suspended?

Response. Yes. The project has been authorized for construction and plans and specifications have been completed. Construction funds have been requested. If funding is provided, the Rehoboth/Dewey Beach project will continue.

Question I8. Is it true that the Corps of Engineers will have no responsibility for maintenance of the beach once construction is complete?

Response. Once the project is constructed periodic nourishment and maintenance would be performed as part of the authorized Rehoboth/Dewey Beach Project.

Question I9. What have you determined to be the total number of cubic yards and the cost per cubic yard of moving the required cubic yards of sand from the main channel to its final location on the beach? Please split out mobilization/demobilization costs as a separate line item.

Response. The estimated quantity of material to be placed at Dewey- Rehoboth Beach is shown in the table for the response to question S7. The current cost of moving the material to the beach is approximately $15.00-$18.00 per cubic yard. Mobilization of a dredge will range from $300,000 to $1,000,000.

Question I10. In addition to the cost of getting sand from the source to the beach, there are other costs including acquisition of easements, surveys, appraisals, plantings, fencing, project management, etc. All appear also to be part of the MCD project. Will Delaware have to incur any of these additional costs, or are all paid for out of MCD funding?

Response. If the project is constructed as part of the MCD, the cost of getting sand material for the initial project would be funded as part of the MCD project, as well as the acquisition of easements, surveys, appraisals and project management. Costs for the dune grass and fencing, will be part of the authorized Rehoboth/Dewey Beach Project.

40. PORT MAHON

Funding and Authorization .We understand that this also is a stand-alone project whose congressional authorization and federal funding is separate from the main channel deepening project.

Question I11. Is this correct? Has the project been authorized? What is the status of funding? Will the project continue even if the main channel deepening project is delayed or suspended?

Response. Yes. The project has been authorized for construction. At this point, no further efforts are being undertaken due to lack of federal funding.

Question I12. What will be the responsibility of the Corps of Engineers once construction is complete?

Response. Once the project is constructed, periodic nourishment and maintenance would be part of the authorized Port Mahon Project.

Question I13. What have you determined to be the total number of cubic yards and the cost per cubic yard of moving the required 306,000 cubic yards of sand from the main channel to its final location? Please split out mobilization/demobilization costs as a separate line item.

Response. The estimated quantity of material to be placed at Port Mahon is approximately 300,000 cubic yards. The current cost of moving the material to the beach is approximately $10.00-$13.00 per cubic yard. Mobilization of a dredge will range from $300,000 to $1,000,0000

Question I14. In addition to the cost of getting sand from the source to the beach, there are other costs including acquisition of easements, surveys, appraisals, plantings, fencing, project management, etc. All appear also to be part of the MCD project. Will Delaware have to incur any of these additional costs, or are all paid for out of MCD funding?

Response. If the project is constructed as part of the MCD, the cost of getting sand material for the initial project would be funded as part of the MCD project, as well as the acquisition of easements, surveys, appraisals and project management.

41. KILLCOHOOK

Question I15. Will any portion of Delaware lands at Killcohook be affected directly or indirectly by the project and, if so, what will be those effects?

Response. Killcohook is currently an active Federally owned CDF operated by the Corps. Cells 2 and 3 are mainly in the State of Delaware.

Summary. Because of the importance and the cost of beach replenishment, it will be helpful to have one page summary of quantity and cost data for all beaches designated to receive sand.

Question I16. Please summarize (in tabular form for ready comparison) for each beach (1) the total quantity of sand to be placed on the beach, (2) mobilization/demobilization costs and (3) all other costs directly attributable to sand replenishment on the beach. What would be the total Delaware share for each beach if not done as part of the main channel deepening project?

Response. The quantities to be placed on the Delaware Beaches are shown in the table provided in response to question S7. Mobilization of a dredge for each project will range between $300,000 and $1,000,000. The cost per cubic yard for Broadkill, Rehoboth/Dewey and Port Mahon is stated in response to questions I5, I9, and I3, respectively. If the projects (Broadkill, Port Mahon) are constructed as part of the Delaware River Main Channel Deepening Project there would be no cost to the State of Delaware for initial sand placement however, if these projects are constructed independently from the Delaware River Main Channel Deepening Project, the State of Delaware share for each project for initial construction is 35%. Kelly Island is exclusively associated with the Delaware River Main Channel Deepening Project. Regarding, the Rehoboth/Dewey Project, there would be no cost savings to State of Delaware for initial sand placement if it was constructed as part of the Delaware River Main Channel Deepening Project. If other sites are selected for sand placement as part of the Delaware River Main Channel Deepening Project along the Delaware Bay there would be no cost to the State of Delaware for initial construction.

42. ACCIDENT ISSUES

Safety and Accident Concerns. Accidents offer the greatest opportunity for environmental damage of the river and important nearby ecological regions. We need to better understand the opportunity for accidents, how remediation efforts will be organized and who will be responsible to determine, direct and fund remediation efforts.

Question J1. Why does reduction in overdepth dredging not increase safety concerns?

Response. Overdepth, or more precisely, "allowable overdepth," is an increment that defines the depth tolerance for dredging contracts. That is, although the dredging contractor must provide the "required depth" everywhere within the dredging limits, removal of material between the required depth and the allowable overdepth is at the option of the contractor. The provision of an overdepth during dredging assures that the required depth is achieved. The required depth represents the full-authorized project dimensions for channel depth and width. In the existing Delaware River navigation project, the authorized depth of 40 feet Mean Low Low Water (MLLW) is the required depth of dredging, with the allowable overdepth usually specified as 41 feet MLLW. Maintenance dredging in the proposed project deepening to 45 feet MLLW will have the practice of the existing project and utilize 1 foot of allowable overdepth. A required overdepth of 1 foot and an additional allowable overdepth of .5 feet are included. Since this is a new project, one foot of overdepth is required to ensure that the required depth is achieved. This provides insurance that future maintenance dredging will not be required to excavate virgin materials. The proposed deepening of the 40-foot project to 45 feet will not lead to a change in safe vessel operating practice. Presently, The Pilots' Association for the Bay and River Delaware uses 3 feet as the minimum underkeel clearance for vessel transits. Although the project depth will increase by 5 feet, to 45 feet, the present operating practice of the Pilots with regard to underkeel clearance will not change.

Question J2. Who is responsible now to manage oil spill cleanup in the Delaware and Delaware/New Jersey sections of the river? Who pays?

Response. The U.S. Coast Guard would manage an oil spill cleanup in the Delaware River. Figure 21-1 of the Corps July 1997 SEIS **(EXHIBIT 4)** shows the "Unified Command System Organization" of the USCG to respond to oil spills. A member of this organization would be appointed as the Federal "On Scene Coordinator" and work with representatives of the Delaware Emergency Management Agency, DNREC, the New Jersey Emergency Management Agency, and the NJDEP, depending on the location of the accident. Each vessel navigating in the Delaware River/Bay and each processing facility of hazardous materials is required to have a "spill response plan" in place.

The entity that would pay for the cleanup, including the cost of the participating government agencies, is called the "Responsible Party". This is generally the owner of the commodity that is spilled, such as oil. The owner is likely to litigate if it appears that the accident was the fault of another party, to attempt to recover their costs.

Question J3. To give us an idea of actual minimum vessel bottom clearances in practice, please provide the following data for the month of March 2001 (March selected arbitrarily as an example):

- *the geographical location of that month's shallowest main channel location according to the Groundwater Modeling System.*

Response. The Groundwater Modeling System is not used to determine the geographical location of any month's shallowest main channel location. Determination of depth in the channel is accomplished with hydrographic surveying. Hydrographic survey data (depth, vessel position, and tide) are processed to create digital files and images using AutoCAD software. Hydrographic surveys of the nearly 100 miles of navigation channel from Philadelphia to naturally deep water at the mouth of Delaware Bay are performed on a year-round basis, with more frequent surveys obtained in areas with higher shoaling rates. Given the extent of the channel that constitutes the Philadelphia-to-the-Sea project and the limited area that can be surveyed in any one-month period, we do not have a "snapshot" of depths for the entire channel for the month of March 2001. As an example of our hydrographic survey program, we surveyed eleven discrete sections of this project in the three-month period from 1 January to 31 March 2001. Together, these surveys covered 189,000 lineal feet of channel, or about 37% of the total project length.

The Philadelphia District also periodically prepares a summary document referred to as a "Channel Statement" that lists the shallowest measured depth, by quarter-channel segment, in each of 24 discrete ranges of this project. These ranges vary in length from as little as 0.42 miles to as much as 12.42 miles. The most recent Philadelphia-to-Sea channel statement, dated 1 September 1999, is copied below for your information. It should be noted that actual vessel bottom clearance is dependent not only on the draft of the vessel and channel depth, but also on the stage of the tide at the time of vessel transit.

DEPARTMENT OF THE ARMY
Philadelphia District, Corps of Engineers
Wanamaker Building-100 Penn Square East
Philadelphia, Pennsylvania 19107-3390

CENAP-OP-TS

1 September 1999

DELAWARE RIVER-Pennsylvania, New Jersey, Delaware
Ship Channel from the Sea (Buoy No.9) to Allegheny
Avenue, Philadelphia, Pennsylvania

Minimum Depth in each 1/4
width of Channel, entering
from Seaward.

Ranges	Date of Survey	DIMENSIONS			Left Outside Quarter	MID-CHANNEL		Right Outside Quarter
		Width Feet	Length Miles (Naut)	Depth Feet	Feet	Left Inside Quarter Feet	Right Inside Quarter Feet	Feet
Brandywine-from Buoy No.9*	7 Jun 99	1000	10.94	40	35.9	38.3	40.0	38.6
Miah Maull	9 Jun 99	1000	7.02	40	40.1	42.4	42.4	40.4
Cross Ledge	18 May 99	1000	3.39	40	40.1	42.4	42.4	40.4
Liston-Below Ship John Light	10 May 99	1000	5.57	40	40.6	40.6	41.3	39.0
Liston-Above Ship John Light	5 May 99	1000-800	12.42	40	40.2	40.3	40.5	39.6
Baker	25 Mar 99	800	1.65	40	44.1	44.3	42.1	38.2
Reedy Island	24 Mar 99	800	4.28	40	38.1	39.5	40.0	36.6
New Castle	5 Aug 99	800	4.34	40	34.3	38.3	41.7	37.2
Bulkhead Bar	5 May 99	1600	0.56	40	43.7	45.1	42.5	35.4
Deepwater Point	11 Aug 99	800	3.76	40	37.9	41.7	42.2	37.7
Cherry Island	19 Feb 99	800	4.33	40	41.4	41.7	41.6	40.4
Bellevue	19 Apr 99	800	3.05	40	37.5	42.2	42.4	41.6
Marcus Hook	3 Aug 99	800	4.25	40	31.9	35.2	37.9	40.7
Chester	25 Mar 99	800	1.82	40	38.6	40.6	40.6	39.8
Eddystone	16 Jul 98	800	1.08	40	40.4	40.9	42.8	41.5
Tinicum	2 Mar 99	800	3.03	40	37.7	39.9	39.6	38.3
Billingsport	23 Feb 99	800	1.15	40	40.0	41.1	42.1	36.4
Mifflin	20 Oct 98	800	2.83	40	39.0	39.9	41.2	40.3
Eagle Point (Naval Base)	6 May 99	800	1.74	40	41.0	41.5	41.5	41.8
Horseshoe Bend	6 May 99	800-500	0.80	40	38.6	44.6	44.5	43.2
East Horseshoe and Reach M	7 May 99	500-400	1.17	40	38.5	41.0	43.7	45.5
Reach M to Benjamin Franklin Bridge	28 Jul 99	400	2.95	40	19.9	30.1	40.4	38.5
Benjamin Franklin Bridge to Cambria Street	10 Dec 98	400	2.00	40	40.2	42.0	40.6	41.1
Cambria Street to Allegheny Avenue	15 Dec 98	400	0.42	40	39.8	39.8	40.5	39.4
			FEET			DIMENSIONS		
						60%	80%	100%
Camden Waterfront	10 Nov 98	1600	4,500	40		38.7	38.7	38.7
ANCHORAGES								
Marcus Hook	24 Mar 99	2300	13,650	40		38.0	33.5	15.6
Mantua Creek	20 Oct 98	1400	11,600	37		37 1	35.9	34.5
Gloucester	30 Oct 98	550	3,500	30		39.2	35.4	34.5
Port Richmond	15 Dec 98	750	3,400	37		31.9	30.6	25.2

Note: The information shown on this channel statement represents the results of surveys made on the dates indicated and can only be considered as indicating the general conditions existing at that time. All depths refer to Mean Low Water. Drawings showing the depths in channel are available to the public. Requests for such drawings, including the locality desired, should be made to the District Engineer.

* The debris in the vicinity of Wreck Buoy#9 has recently been re-surveyed using sweep, side scan, and magnetometer techniques.

Roy E. Denmark Jr.
ROY E DENMARK JR
Chief, Operations Division

- the actual maximum draft of each tanker, as loaded (including squat), that traversed the main channel that month.

Response. The Maritime Exchange would be an appropriate data source for operating drafts of vessels.

- the minimum bottom clearance for each ship.

Response. Presently, the Pilots' Association for the Bay and River Delaware use three feet as the minimum clearance between the vessel bottom and the channel bottom. This operating practice will remain the same in the future with the deepened channel.

- the actual number of barrels of petroleum lightered that month.

Response. The Delaware Petroleum Council would be an appropriate source to obtain this information.

43. PROJECT ECONOMIC ISSUES

Question K1. To allow better understanding of effects on costs and benefits, please provide data on overall dredging costs ($/cubic yard) in the lower Delaware River ($15/yd3?), separating specifying the amount ($5/yd3?) for the dredging operation itself and for site acquisition, preparation and maintenance ($10/yd3?).

Response. The cost per cubic yard of dredged material was provided in response to question I16. The cost to grade and move material around on the beaches or restoration sites will range between $1.00 and $3.00 per cubic yard.

44. EFFECT ON LIGHTERING VOLUME

Question K2. What did the Corps assume to be the number of barrels lightered per year (before and after the project) and the annual cost of lightering in dollars per barrel (also before and after the project). What was the source of the information?

Response. The last year of lightering data in the Corps' Limited Reevaluation Report dated February 1998 was 1992. Total lightering for the six benefiting facilities was 78 million barrels. The deepened channel to 45 feet is estimated to reduce lightering requirements by 42%. The cost of lightering per barrel was provided by the lightering company and is proprietary.

45. EFFECT ON COSTS

Question K3. What was the resulting reduction in cubic yards of spoils to be removed from the channel?

Response. The amount of cubic yards of dredged material to be removed initially is 26,300,000. The reduction of yardage independently will reduce the cost of the dredging, however individual unit costs may rise. There are numerous factors that contribute to the cost of dredging including bank thickness, material type, density, pumping distance, and the size of the dredge. The amount of reduction in cost from overdepth reduction varies from area to area. In practice, Corps will require 1 foot of overdepth for the dredging with an additional of .5 foot of allowable overdpth. The overdepth quantities are included in the total quantity.

Question K4. Is it correct to assume that the reduction on allowable overdraft dredging, and the consequent increase in maintenance dredging, increases overall "project + maintenance costs" by on the order of a billion dollars? If not, please provide what the Corps believes to be a more correct number-together with the detailed analysis upon which your conclusion rests.

Response. It is incorrect to assume that reduction of "allowable overdraft" (overdepth) dredging will result in increased maintenance dredging. It is therefore also incorrect to assume that reducing allowable overdepth will increase "project + maintenance costs" by on the order of a billion dollars. The proposed use of .5 foot allowable overdepth combined with 1 foot of required overdepth for project construction and maintenance will have no impact on the long-term costs associated with this project.

A 1-foot required combined with a .5 foot of allowable overdepth rather than two-foot increment for allowable overdepth dredging is possible primarily because of improved technology compared to what existed 10 or more years ago. Electronic vessel positioning (GPS), heave-pitch-roll monitoring, and real-time tide data permit more accurate placement of the cutterhead of a hydraulic dredge, or the suction head of a hopper dredge.

Question K5. Did the Corps perform a side-by-side assessment of the overall costs versus benefits-construction plus maintenance – of a project based on the Corps' standard two foot overdepth dredging versus one based on their recent decision to save on construction costs by going to one foot overdraft dredging (and accepting an attendant increase in maintenance costs)? If so, please provide the economic comparison. If not, please explain why this should not be required prior to project approval.

Response. The choice to decrease the paid overdepth of the project is consistent with present industry practice across the country. When the feasibility report was being developed, many areas were using two-foot overdepths. Utilization of two-foot overdepth at this time would be considered fiscally irresponsible and unjustified from an engineering perspective.

Question K6. What construction cost reduction was achieved by the allowable overdredge reduction from two to one foot?

Response. The Corps did not perform this type of analysis. As a result, a cost comparison is not available nor is performing this analysis justified. Also, refer to response to question K3.

Question K7. What maintenance cost increase occurs because of the approximately 1000 cubic yards per year increase in maintenance dredging?

Response. There are numerous factors that contribute to the cost of dredging including bank thickness, material type, density, pumping distance, and the size of the dredge. It is impractical and unrealistic to assign a cost to a 1,000 cubic yard increase in dredged material.

45. EFFECT ON BENEFITS

Question K8. Were benefits reduced when allowable overdepth dredging was reduced? If not, why not?

Response. No. This is a construction consideration, not a benefit consideration, and has no impact on vessel operating practices. The purpose of paid over-depth is to ensure that the dredging contractor is fairly paid for material removal to the required depth. Dredging and surveying techniques have improved in the last 10 years, allowing better control of material removal and measurement. Benefits are calculated applying the design project depth.

Question K9. What is the basis for assuming that ships in practice actually will risk proceeding upriver with an extra five feet of draft?

Response. Many vessels are making full use of the current channel and, if capable based on design characteristics, will also make use of the cost efficiencies provided by the deepened channel.

Spoils Disposal in Pennsylvania Mines. We understand that disposal of spoils in Pennsylvania mines is being considered.

Question. Is this true? If this is to be done must environmental effects be considered as part of the overall project EIS? Can such disposal be done without an EIS?

Response. There are no plans for taking dredged material for mine reclamation as part of this project.

46. DELAWARE ECOMOMIC ISSUES

"This sand (for the beaches) will come at a reduced cost to taxpayers. Rather than the state spending approximately $70 million to dredge sand from the bay and offshore, Delaware can acquire the same material from the channel deepening project at a cost of only $7 million."

Question L1. Does the Corps agree that you were the source of the information reported by Mr. Rochford?

Response. Corps only provided estimated costs for taking sand material to Delaware Beaches and Kelly Island Wetland Restoration Project.

Question L2. Regardless of the source, does the Corps agree that Mr. Rochford is correct in his statement or-if not- how would the Corps correct the statement to make it accurate?

Response. The following information is provided.

- Approximately $30 million in project funds will be spent at Kelly Island to restore 60 acres of tidal wetlands, protect approximately 5,000 feet of eroding tidal wetlands, and increase horseshoe crab spawning habitat
- Approximately $44 million in project funds will be spent to restore state-selected Atlantic Coast and Delaware Bay beaches.

Question L3. Please provide a detailed financial analysis of the cost of removing the three million cubic yards of sand from the main channel and placing it on Delaware beaches. This should include only the actual incremental costs of dredging and beach disposal (including mobilization/demobilization costs), and omit all other non task-specific cost elements including site acquisition, project supervision, navigation aid costs, etc.

Response. Refer to the previous response to question I16.

Fact Sheet Claims. The facts Sheet (pp.9-10) accompanying the permit application makes a number of claims regarding economic benefits to Delaware (not included in project justification), but there is not supporting information or references to how the information might be obtained for review by the public.

Question L4. Please add to the permit application appropriate references and supporting information so that interested parties can follow-up, obtain copies of relevant documents if interested and make an independent judgment on the claims of economic benefits to Delaware. Specifically direct the reader to the source of the economic, jobs, wages and tax claims in the Fact Sheet attached to the Delaware permit application.

Response. The description and backup for the regional input-output model was provided to Mr. Fleming by the Corps by fax in April 2001 in response to his request. As part of this submission we are including the backup on CD ROM.

Question L5. What was the effect of the reduced overdredging on benefits to Delaware (jobs, taxes, etc.)?

Response. None. Overdredging is a construction consideration and has no impact on benefits. The input-output model considered the potential impact of total construction costs to the region.

Maintenance Dredging. Project benefits are mostly dredging costs, and so it would seem that direct benefits to Delaware mostly would be via charges by Delaware dredging firms. Therefore it would be helpful to know what Delaware firms have been used by the Corps historically, and what proportion of total maintenance dredging contracts they have received.

Question L6. What has been the total cost of maintenance dredging since 1990, how much of this has been paid to firms physically located in Delaware. What are the names of those firms, and what is the name and address of a contact in Delaware?

Response. To the best of our knowledge, there are no dredging companies, with the large type of equipment needed for maintenance dredging, located in the State of Delaware. However there are many companies which provide services (such as, fuel, food and water delivery, tugs boats and operators, etc.).

Question L7. Does the Corps claim that 300/1600 or about 20% of the jobs will be to Delawareans that live, work and buy their supplies and services in our state? If not, what exactly is the claim?

Response. The input-output regional model, applied by a Corps contractor, was an expansion of the State of Delaware model. The model is generalized, and apportioned the impact of construction to the tri-state area, including the State of Delaware.

Question L8. Please provide a list and brief job description (i.e. dredge operator, surveyor, laborer, secretary, etc.) for each of the 300 jobs which will accrue to Delaware according to the project.

Response. As stated in the response to L7 above, the output of the model is generalized and does not predict specific jobs.

Econometric Model. The permit application states that Delaware benefits were determined using a nationally linked input-output model of the region developed by the University of Delaware. This econometric study, which is the basis for the claimed benefits, is not included in the application. We need to better understand the specifics of both the input and the output data in order to understand the results. Econometric models suffer from a variety of errors. Typically errors arise when default input in these models is not kept up to date. The University of Delaware model, when used in the late 1980s and early 1990s was updated quarterly.

Question L9. When was the most recent complete update of the input data in the model?

Response. 1996.

Question L10. Please provide copies of the following information related to the input-output economic model referred to in the Fact Sheet: (1) any Request for Proposals or other description of the study desired by the Corps; (2) the signed contract for the study,

(3) all input data supplied by the Corps; (4) copies of any interim reports plus the final report. Also please show where in the final report is to be found the benefits to Delaware cited in the Fact Sheet – or the basis for determining the benefits if they are not taken directly from the report.

Response. Refer to response to L4.

Question L11. Has the Corps assessed probable economic losses to Delaware resulting from reduced lightering or any other project result and, if yes, can you provide a copy of the analysis?

Response. No, the Corps has not conducted this type of analysis. A reduction in lightering costs is a savings to the national economic development account.

PUBLIC RECORD RAF SUBMISSION PAGES 1-6 J. Sharpe testimony

Question M2. Please respond to Mr. Sharpe's comments that "If one examines transportation casualties, the vast majority of oil spilled in the Delaware estuary is from large tankers in the river near port, no significant spillage from barges."

Response. Reduction in vessel casualties and oil spills are not quantified in the benefit analysis, but the channel improvement is expected to make vessel operations safer in the Delaware River port system. The deeper channel will allow the same tanker fleet to have to lighter less crude oil at Big Stone Beach Anchorage before coming upriver. This will result in a reduction in potential spillage during lightering operations and also a reduction in the number of lightering barges that will need to navigate upriver to the refineries.

As far as the activities for each of the spills on the USCG database, they do not go into detail about the activities that were taking place when a spill occurs. A majority of the spills are small non-commercial boaters that spill a few gallons. Most spills on the list that involve larger vessels are probably attributed to some kind of transfer operations to a facility or to a barge of some kind. Also, a vast majority of the spills that occurred at Big Stone Anchorage were attributed to some form of lightering (Silva, 2001).

Reference:

Silva, K, US Coast Guard, Email to Laura Csoboth, US Army Corps of Engineers, June 22, 2001.

Question M3. Please respond to Mr. Sharpe's comments that "The mud deeper that 40 feet has been hiding down there for decades and may contain some nasty toxics that have been kept out of the system because of burial and being under what were previously anoxic bottom waters (water without oxygen)...To suddenly expose these 'older' (buried) sediments to oxygenated bottom water will have effects that are difficult to predict...There is the potential of remobilizing ancient toxic materials in the system that had been sequestered, in the past. I have not seen adequate consideration of this problem."

Response. The Corps has conducted extensive testing to investigate potential impacts associated with sediment contamination. These tests have included chemical analysis of channel sediments to determine actual contaminant concentrations, and biological testing to evaluate toxicity concerns. Analysis of channel sediments has indicated that contaminants that are present, primarily heavy metals, are at concentrations considered low to medium. The results of state-of-the-art PCB analyses indicated that PCBs, which are ubiquitous in modern society, are one to three orders of magnitude lower in the navigation channel than in shallows outside the project area, and below levels of concern. It is likely that this is the result of regular dredging maintenance, which precludes contaminants from building up over time.

The Corps also evaluated toxicity of bottom sediments by directly exposing aquatic organisms to the sediment. Water column, or suspended solid particulate phase bioassays were run to evaluate water quality concerns associated with the release of contaminants from sediment into dredging or placement site water. Whole sediment, or benthic bioassays were run to evaluate impacts to bottom dwelling organisms that would reside in sediments placed in an aquatic environment. These tests, which are commonly used to evaluate the quality of dredged material, were developed and approved by the U.S. Environmental Protection Agency.

A variety of aquatic organisms were used in the bioassays including larval shrimp approximately four days old, fathead minnows hatched the previous day, and American oyster embryos approximately two-hours after fertilization. These young organisms are very fragile and sensitive to contaminants in their environment. Following established protocols, these organisms were exposed to samples of bottom sediment for a prescribed period of time to evaluate any differences in mortality between Delaware River channel sediment and clean laboratory sediment. All organisms (100%) survived the numerous bioassays that were run, which is a strong indication that channel sediments are not toxic to aquatic organisms.

Lastly, bioaccumulation tests were run with channel sediment from Delaware Bay to evaluate the potential uptake of contaminants by aquatic organisms at aquatic placement sites. This test allows aquatic organisms to live in the sediment for approximately one month, and then analyzes the animal tissues to evaluate any accumulation of contaminants. Tests were run with the hard-shelled clam and a marine worm. Overall, there was no evidence that contaminants accumulated in animals exposed to Delaware Bay sediment at greater concentrations than animals exposed to clean laboratory sediment. All tissues were representative of what one would expect of animals living in a clean environment.

State and Federal resource agencies have reviewed the Corps' sediment quality data. The States of Delaware, New Jersey and Pennsylvania have approved the deepening project by finding it consistent with their respective coastal zone management programs. The

U.S. Environmental Protection Agency stated: "EPA continues to believe that there will be no adverse impacts associated with the disposal of sediments generated by the project." The U.S. Fish and Wildlife Service stated: "Results of chemical analyses provided within the biological assessment indicated that contaminant loads in the sediments tested are low."

Despite the positive results of the tests conducted to date, the Corps intends to monitor water quality during construction. This monitoring will insure that dredging and disposal activities associated with the deepening project do not adversely impact the aquatic resources of the Delaware River and Bay. The Corps has been working with the States of New Jersey and Delaware, and the Delaware River Basin Commission (DRBC), to develop an acceptable protocol for this type of monitoring. To date, the Killcohook, Oldmans, Pedricktown North and Pedricktown South CDFs have been monitored. Reports on the monitoring studies conducted at the Killcohook and Pedricktown North CDFs have been provided as part of the public record. The reports provide details on how CDFs would be monitored.

The Corps has also conducted modeling efforts to simulate the quality of water discharged from the Reedy Point South CDF during disposal operations, and contaminant concentrations in the water column resulting from dredging activity. These studies have also been included as part of the public record. Both the modeling results and the field monitoring studies indicate that dredging and dredged material disposal operations do not significantly impact water quality.

PUBLIC RECORD, RAF SUBMISSION PAGES 86-89; Record of Public Hearing (paraphrased)

__Question M4.__ Would the Corps see some value in some kind of a monitoring committee that involves stakeholders...a committee charged with issuing periodic reports at some reasonable interval in environmental effects both of construction and later maintenance dredging? (transcript pages 57-58).

__Response.__ All monitoring efforts will be contracted to environmental consulting groups with appropriate levels of expertise in the various areas of environmental science. The consultants will be required to prepare individual reports for each monitoring effort to document results. Scopes of work for all monitoring that fulfills a commitment to the Delaware DNREC will be coordinated with the Delaware DNREC prior to contracting the work. All reports for these efforts will be coordinated with the Delaware DNREC and will also be available to the public.

__Question M5__. Please provide a detailed analysis of the two major elements of the cost of picking sand up and taking it from the channel in Reach E and placing it, for example on Broadkill Beach (transcript pages 89 – 90).

Response. The quantities to be placed on the Delaware Beaches are shown in the table provided in response to question S7. Mobilization of a dredge for each project will range between $300,000 and $1,000,000. The cost per cubic yard for Broadkill, Rehoboth-Dewey and Port Mahon is stated in response to questions I5, I9, and I13 respectively (range $10.00-18.00 per cubic yard).

Question M6. Please provide written documentation outlining Corps responsibility to fix unexpected problems that might develop as a result of the project.

Response. If an environmental problem arises during dredging, the Corps and the project sponsor, the Delaware River Port Authority, will be responsible for any environmental remediation costs that occur during dredging of the Delaware River Main Ship Channel. This responsibility will be detailed in the Project Cooperation Agreement to be signed by the Corps and DRPA. Further, as the applicant for the DNREC permit, the Corps is legally and financially accountable for any remediation that falls within the permit parameters.

PUBLIC RECORD, RAF SUBMISSION PAGES 90; Mac Artor testimony at the Public Workshop;

Question M7. It appears that the sponsor, the Delaware River Port Authority, has no project responsibilities other than providing their portion of the non-Federal part of project funding and sites adequate to accept all project spoils. Is this correct? If not, what additional responsibilities does DRPA have?

Response. Besides providing project funding and provision of sites to accept dredged material from initial deepening as well as subsequent maintenance of the 45-foot channel, the sponsor would be responsible for various actions as discussed in responses to question M8 below.

Question M8. Who decides whether or not remediation is required, and exactly what type and degree of remediation is appropriate?

Response. Any decision as to need, type and degree of hazardous substance remediation covered by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) will be made by the U.S. Environmental Protection Agency in conjunction with the State where the remediation is taking place. Any other environmental remediation will be decided upon by the Corps unless such remediation is a requirement of any valid State permit or water quality certification in which case the State will decide upon the need, type and degree of remediation required.

Question M9. Who is legally responsible to perform and/or pay for needed remediation work?

Response. Responsibility for project costs are set forth in the Project Cooperation Agreement (PCA) entered into by the Corps and the Delaware River Port Authority. All

CERCLA remediation costs are the responsibility of DRPA. Any other remediation costs would be subject to cost-sharing between the Corps and DRPA.

Question M10. What are the limits of responsibility of the Corps, the sponsor (Delaware River Port Authority and the State of Delaware?

Response. The Corps is unaware of any limitations on its responsibilities or the responsibilities of DRPA as set forth in the PCA other than the limitations that may be subsequently placed upon the Corps by the United States Congress. The limitations on the State of Delaware's Department of Natural Resources and Environmental Control as a regulatory agency are those placed upon it by the State Legislature.

Question M11. Is there precedent for liability, or non-liability, on the part of the sponsor, in this case the Delaware River Port Authority?

Response. Both the Federal Government and DRPA are included within the definition of the term "person" as set forth in section 101(21) of CERCLA and are therefore subject to any hazardous substance remediation required under CERCLA. Liability for any state permit or water quality certification violation would be placed upon the Corps as the permit holder.

Question M12. As a civilian employee, does Delaware agree that Mr. Callegari is authorized to commit the Corps to the agreements specified in the permit application?

Response. State of Delaware is to prepare response.

Question M13. Is Mr. Callegari- or anyone in the Corps –authorized to commit the Delaware River Port Authority to anything?

Response. No.

PUBLIC RECORD, RAF SUBMSSION PAGE 95

Question M14. Please explain why $300 million in regional benefits should be credited to the project even though $100 million of that is money recycled from within the region. Also how much of the $32 million comes from Delawareans?

Response. Regional benefits were not used in the calculation of benefits and costs for the project to determine economic justification. The $32 million is the national economic development account navigation transportation savings benefits for crude oil imports.

Question M15. Please explain how the loss $32 million in lightering cost reduction affects Delaware.

Response. Reduction in the cost of lightering or $32 million in benefits for crude oil is a savings to the national economic development account (i.e., benefiting all states, including Delaware) from the more efficient movement of this cargo through the transportation system.

PUBLIC RECORD, RAF SUBMSSION PAGE 95; H. Subramanian testimony at the Public Workshop;

Question M16. Please provide a written explanation of "best management practices" for dredging.

Response. A written explanation of the term "best management practices" for dredging can be found on page 51 of the document titled: *The Delaware Statewide Dredging Policy Framework* dated February 2001.

Question M17. Please provide specifications for "clean sand".

Response. We are not aware of a technical specification for "clean sand". The term "clean sand" can be defined in two ways. Concerns raised with regard to the deepening project mostly relate to the level of contaminants in the sand. The sand would not be considered clean if there were high levels of contaminants. Bulk sediment testing of this sand indicates that contaminant concentrations are low and that there are no concerns related to human health or protection of environmental resources. From a contaminant perspective the sand is clean. Typically, with beach nourishment projects, the concerns are more directed to the grain size of the material. If there is a high percentage of material that is finer grained than what is considered sand size, then there is the concern that the resulting beach will look muddy or dirty. The material would not be considered clean from an aesthetic perspective. Delaware Bay channel sand that would be used for beach nourishment is greater than 90 percent sand and will provide an aesthetically pleasing, clean beach.

PUBLIC RECORD, RAF SUBMSSION PAGE 95; R. Fleming testimony at the Public Workshop;

Question M18. Where can spoils be put if for whatever reason some cannot be placed on Delaware beaches of any of the other planned Delaware sites?

Response. The state of Delaware had previously provided the Corps with a list of alternative beaches along the entire bay coast. If the State chooses to pursue the cost shared alternative federal study route at some location, then the dredged material from the channel can be placed at other sites, including alternate New Jersey sites as previously mentioned in response to question S14. There is no preferred alternative.

Question M19. I'd like to know the average cost per cubic yard to dredge and dispose of material from Reach E onto Delaware beaches...and also the cost farther north where the sand goes to upland disposal sites. For each case please break down the costs into two categories: the cost of the dredging operation itself, and the cost of acquiring, preparing, distributing, and maintaining the sites.

Response. The quantities to be placed on the Delaware beaches are shown in the table provided in response to question S7. Mobilization of a dredge for each project will range between $300,000 and $1,000,000. The cost per cubic yard for Broadkill, Rehoboth-Dewey and Port Mahon is stated in response to questions I5, I9, and I13, respectively (range $10.00 to18.00 per cubic yard) the average cost of disposal at upland sites ranges from $1.00 to $10.00 per cubic yard depending on many factors.

Question M20. Would the Corps agree to a monitoring committee of stakeholders, charged with issuing periodic reports on environmental effects of construction and later maintenance dredging? Stakeholders might include, for example, members of DNREC, Delaware environmental groups and the Delaware public?

Response. All monitoring efforts will be contracted to environmental consulting groups with appropriate levels of expertise in the various areas of environmental science. The consultants will be required to prepare individual reports for each monitoring effort to document results. Scopes of work for all monitoring that fulfills a commitment to the Delaware DNREC will be coordinated with the Delaware DNREC prior to contracting the work. All reports for these efforts will be coordinated with the Delaware DNREC and will also be available to the public

PUBLIC RECORD, RAF SUBMSSION PAGE 95; D. Obert testimony at the Public Workshop;

Question M21. Please provide backup for the claim of $70 million in (Delaware) benefits for $7 million in contribution.

Response. Refer to the previous response.

PUBLIC RECORD, RAF SUBMSSION PAGES 95-96; RAF questions (pages 96-99)

Question M22. Please provide me with a copy of the detailed calculations from which the Corps' $32 million annual refinery benefits were calculated. See attachment for explanation.

Response. Ms. Molly Murray of the Wilmington News-Journal made a similar request to the Corps last year. A copy of a table sent by the Corps to Ms. Murray to explain the calculation of crude oil benefits is shown below.

AVERAGE ANNUAL BENEFITS FOR LIGHTERING SAVINGS TO EXISTING LARGER TANKER FLEET

	Corps *6 oil refinery Motiva not included*	**Global** *7oil refinery Including. Motiva*	**Maritrans** 7 oil facilities including. Motiva
Total barrels	250,000,000	365,000,000	365,000,000
% Oil lightered	.31	.35	.29
Barrels lightered	78,000,000	127,750,000	105,850,000
Barrels no longer lightered (5-foot deeper channel)	32,760,000	51,100,000	42,340,000
Barrels X 40-cents*	$13,100,000	$20,440,000	$16,936,000
Subtract Motiva	-	$3,000,000 (estimate)	$3,000,000 (estimate)
Net Category Annual Benefits	$13,100,000	$17,440,000	$13,936,000

*In the case of the Corps information, we are only using 40-cents to be consistent with the other two columns.

The price that the Corps actually used is proprietary information and, as requested by Maritrans---not releasable.

PUBLIC RECORD, RAF SUBMSSION PAGES 101; RAF questions (page 101)

Question M23. Do you agree with Mr. Rochford's statement as quoted in the above paragraph?

Response. Economic justification for the proposed project applied only navigation transportation savings to the national economic development account. Port facilities in the state of Delaware (such as the Port of Wilmington and Motiva) are not expected to benefit due to the current depths of their access channels. The estimate of indirect benefits from construction applied a generalized input-output model framework. These potential benefits were not included in the analysis to determine project justification (navigation transportation savings to the national account were the only basis used for benefits for project justification, not state, local, or company-specific impacts).
Refer to Mr. Sprague statement at the public hearing concerning benefits to Port of Wilmington. Also, refer to response to L2.

Question M24. If not, what would you suggest as a more correct statement of economic benefits to Delaware?

Response. Concerns benefits to Delaware, as the Port of Wilmington pointed out during the June 6, 2001 public workshop and December 4, 2001 public hearing, the project will make the port more competitive in the world market and will enhance its ability for economic growth if facilities are shifted directly onto the Delaware River with access to the 45-foot channel. In addition, consider these benefits:

- Approximately $30 million in project funds will be spent at Kelly Island to restore 60 acres of tidal wetlands, protect approximately 5,000 feet of eroding tidal wetlands, and increase horseshoe crab spawning habitat
- Approximately $44 million in project funds will be spent to restore state-selected Atlantic Coast and Delaware Bay beaches.
- During construction, Delaware may accrue indirect economic benefits associated with 300 jobs and millions of dollars in wages, state revenues, and state and local tax receipts.

Question M25. Whichever economic benefit you feel is most appropriate to describe value to Delaware, please provide a detailed explanation and a line-item derivation of the preferred value.

Response. Economic justification for the proposed project applied only navigation transportation savings to the national economic development account. Port facilities in the state of Delaware (such as the Port of Wilmington and Motiva) are not expected to benefit due to the current depths of their access channels. The estimate of indirect benefits from construction applied a generalized input-output model framework. These potential benefits were not included in the analysis to determine project justification (navigation transportation savings to the national account were the only basis used for benefits for project justification, not state, local, or company-specific impacts).

Indirect benefits for construction are derived from a generalized input-output model; the level of detail requested for specific jobs is not available from the model. The reduction in lightering costs for crude oil shipments is a savings to the national economic development account.

PUBLIC RECORD, RAF SUBMSSION PAGES 124-142; RAF (pages 124-142)

Question M25. In order to better understand the Delaware benefits as claimed in the permit application, some additional information is needed. Please see the nine questions on RAF Submission page 126.

Response. Indirect benefits for construction are derived from a generalized input-output model; the level of detail requested for specific jobs is not available from the model. The reduction in lightering costs for crude oil shipments is a savings to the national economic development account.

Question M26. In order to better understand possible hazards related to polychlorinated biphenyls released by the dredging operation, some additional information is needed. Please see the five questions on RAF Submission page 129.

Question 1. What are currently allowable concentrations of PCBs in the river?

Response. The most restrictive PCB criteria for the Delaware River are human health criteria (0.0448 ng/L for freshwater and 0.0079 ng/L for marine waters).

Question 2. What are allowable releases from sediments dispersed in the river from dredge operation?

Response. The amount of PCBs potentially released during main channel deepening dredging operations was estimated as a screening exercise to determine the potential for exceeding Delaware River human health criteria. These calculations can be found in the document titled: *PCB Mobilization During Dredging Operations and Sequestration by Upland Confined Disposal Facilities* (December 2001), which has been provided for the public record. During the dredging process itself, between 0.07 and 0.23 kg of total PCBs could be released to the water column, using environmentally conservative or worst-case estimates of physical and chemical processes, which may occur during dredging. The dissolved fraction of PCBs, which might be released during dredging, is estimated to be between 0.036 and 0.117 kg, again using worst-case assumptions. In the most contaminated reach of the estuary, this dissolved fraction could result in water column concentrations that are between 13 and 43% of the PCB human health criteria using these worst-case assumptions.

Question 3. What are allowable PCB flows into the river from upland confined disposal facilities?

Response. In coordination with the DRBC and the States of New Jersey and Delaware, discharges from CDFs have been evaluated relative to criteria established for protection of aquatic life in the Delaware River estuary. Freshwater objectives for PCBs are: acute 1000 ng/L and chronic 14 ng/L. Marine objectives for PCBs are: acute 5000 ng/L and chronic 30 ng/L. Based on the short-term nature of disposal operations the acute criteria are considered most applicable. The document titled: *PCB Mobilization During Dredging Operations and Sequestration by Upland Confined Disposal Facilities* (December 2001) also addresses release of PCBs from CDFs. PCBs have also been monitored in discharges from CDFs during disposal operations. Reports of these investigations (*Pedricktown Confined Disposal Facility Contaminant Loading and Water Quality Analysis* dated October 2000 and *Killcohook Confined Disposal Facility Water Quality Analysis* dated February 2001) have been provided for the public record **(EXHIBIT 40, Binder 3).** Analyses have demonstrated that 99.9 percent of the PCBs entering a CDF are retained and not discharged back to the river. Using mass balance type calculations, discharges from the Killcohook CDF had less than a one percent affect on ambient Delaware River PCB concentrations. The discharge met the acute criterion for protection of aquatic life at all times; the chronic criterion was met in all but one sample. For the Pedricktown study, both acute and chronic criteria were met at all times.

Question 4. How are allowable concentrations affected by and different…

- In the vicinity of the dredging operation and also farther downstream beyond the "mixing zone"?

- For aquatic plant life and for fish (because of concerns regarding bio-accumulation)...and for drinking water?

Response. A report titled *Near-Field Water Quality Modeling of Dredging Operations in the Delaware River* (December 2001) has been provided for the public record. The model selected for this evaluation is the DREDGE model, developed by the USACE for near-field (i.e., within a 200-foot mixing zone) evaluation of dredging operations. DREDGE was developed to assist in making a-priori assessments of environmental impacts from proposed dredging operations. DREDGE estimates the mass rate at which bottom sediments become suspended into the water column as the result of hydraulic and mechanical dredging operations and the resulting suspended sediment concentrations. These are combined with information about site conditions to simulate the size and extent of the resulting suspended sediment plume. DREDGE also estimates particulate and dissolved contaminant concentrations in the water column based upon sediment contaminant concentrations and equilibrium partitioning theory. The results of the DREDGE model indicate the following, using environmentally conservative assumptions. Neither dissolved metals nor total dissolved PCBs released during cutterhead hydraulic dredging or bucket dredging would exceed DRBC acute or chronic water quality criteria outside of the mixing zone, using the model. Given the conservative nature of these predictions, actual contaminant concentrations are expected to be considerably lower than predicted. The water quality criteria are established for protection of aquatic life in the Delaware River estuary, so bioaccumulation would not be a concern. Refer to questions 1 and 2 for concerns relater to human health (i.e. drinking water).

Question 5. Should actual PCB releases from dredging and from CDFs be monitored and, of so, how?

Response. Scopes of work for monitoring water quality during operation of the Reedy Point South CDF and at the point of dredging have been provided for the record **(EXHIBIT 9).**

PUBLIC RECORD, RAF SUBMSSION PAGES 196-200

Question M28. For the years 1990 through the present, how many total incoming barrels of oil were transported upriver by tanker, and of this how many barrels were lightered? (RAF Submission page 199 – 200)

Response. The last available year of data in the last approved Corps study report was 1992. For the six benefiting facilities in 1992, 250 million barrels of crude oil were imported into the Delaware River port system, and of this total, 78 million barrels were lightered.

PUBLIC RECORD, RAF SUBMSSION PAGES 201-202

Question M29. Please note the cost data for Delaware beach nourishment projects over the period 1988 – 1997 (Faucett Report3). This gives about $6/cubic yard as the cost of nourishing Delaware beaches. Is this an accurate figure...and did the federal government pick up about 65% of this cost?

Response. We are not aware how this figure was determined.

EXHIBIT #74

DENNIS ROCHFORD, MARITIME EXCHANGE FOR DELAWARE RIVER & BAY

Comments noted. No response required.

EXHIBIT #75

JIM BRYANT

Response. Refer to response in **EXHIBIT 102.**

EXHIBIT #76

EILLEN M. BUTLER, DELAWARE NATURE SOCIETY

Comment.

Living Resource Concerns

Horseshoe Crabs

Delaware Bay has been recognized as the epicenter for horseshoe crab spawning activity along the Atlantic coast. Last year a 1,500 square mile area outside the mouth of the Delaware Bay was designated a no-take zone for horseshoe crabs in recognition for the important role they play in maintaining shorebird populations. Horseshoe crabs bury eggs in the Bay sands only for them to be extracted like a pirate's treasure by exhausted and emaciated shorebirds as they migrate north to their spring breeding grounds in the Arctic. The deepening project proposes to provide horseshoe crab habitat using spoils from the project. Concerns remain, however, over grain size, sand placement and potential contamination, the slope of the sand is critically important for female crabs to begin to bury their eggs. If the slope is constructed improperly, the beach will not be utilized for spawning purposes. Additionally, the Society is concerned that the size of the main channel sand suggested for beach replenishment/habitat purposes is too small and will erode at a high rate. According to the Corps only "clean" sand will be used. Previously, we requested that the Corps provide a definition for "clean" sand. This was not done. In their first one or two years of life, juvenile horseshoe crabs can be found using shallow subtidal areas adjacent to Kelly Island, Port Mahon, and Broadkill Beach – the same areas identified for beach replenishment. Concerns over impacts to juvenile crabs remain for if even a few millimeters of sand has the potential to smother juvenile crabs in these areas, an entire generation of crabs could be lost with Delaware realizing the impacts for years to come. Delaware, along with New Jersey and Maryland, have taken a conservative risk-averse approach. to managing horseshoe crab populations in the Bay. Commercial fishermen have drastically reduced their harvests. For the state to permit activities that will likely reduce horseshoe crab populations to further this project is irresponsible, and could potentially be considered a takings by commercial fishermen.

Response. Refer to the general response for "horseshoe crab impacts from sand placement." The term "clean sand" can be defined in two ways. Concerns raised with regard to the deepening project mostly relate to the level of contaminants in the sand. The sand would not be considered clean if there were high levels of contaminants. Bulk sediment testing of this sand indicates that contaminant concentrations are low and that there are no concerns related to human health or protection of environmental resources. From a contaminant perspective the sand is clean. Typically, with beach nourishment projects, the concerns are more directed to the grain size of the material. If there is a high percentage of material that is finer grained than what is considered sand size, then there is the concern that the resulting beach will look muddy or dirty. The material would not be considered clean from an aesthetic perspective. Delaware Bay channel sand that would be used for beach nourishment is greater than 90 percent sand and will provide an aesthetically pleasing, clean beach.

Comment.

Sandbar Sharks

Sandbar sharks use the Delaware Estuary for nursery habitat. Considered over exploited by the North Atlantic shark fishing industry, they comprise up to 80% of the U.S. commercial harvest of large coastal sharks. Currently there is a dearth of information surrounding their reproductive biology and nursery grounds. However: it is known that juvenile sharks are most vulnerable to human activity. With limited data on the sandbar shark's lifecycle, a conservative approach to managing stocks is appropriate. A recent study survey conducted by the National Oceanic and Atmospheric Administration and the National Marine Fisheries Service indicate that sharks are primarily distributed in shallow near shore waters and can move in groups of a few dozen or hundreds. Again, the potential for severe impact to this fishery is real. All such concerns thus far identified beg the question "Where is the Army Corps' contingency plan if one or each fishery is severely depressed?"

Response. Refer to the general response for "concerns for sandbar sharks".

Comment.

Dredging Windows

The Society questions the Corps ability/desire to adhere to appropriate dredging windows. There is disparity between dredging windows identified by DNREC and the proposed dredging windows provided by the Corps. Which windows will prevail? Additionally, how will DNREC enforce these windows and when requested, how will DNREC process variance requests from permit requirements? It is imperative that DNREC establish a formal, definitive procedure for any variance request that should include public disclosure and comment prior to DNREC's response to the request. The Society further suggests the Secretary of DNREC be the only entity to authorize such variance requests.

Response. Refer to the general response for "environmental windows".

Comment.

Federal Agency Response

Federal Agency Concerns Revealed

Correspondence dated January 18,2001 from the Office of Management and Budget to the Army Corps indicated that beach replenishment activities proposed for Port Mahon does not justify the costs to do so. In fact, due to the highly erosive nature of Port Mahon, the Office of Management and Budget state that "the project hardly would 'restore' the area." Further, "Both the ecological importance and the cost-effectiveness of establishing and maintaining a beach at this particular, vulnerable site are far from clear." The agency even suggests that "alternatives considered also should include the option of removing some or all of the existing hard structures from the present Port Mahon shoreline, which would allow the rural road and the wetlands behind it to erode naturally." The U.S. Fish and Wildlife Service also provided a letter to the Army Corps dated November 14, 2001 regarding egg density monitoring at Kelly Island, Port Mahon, and Broadkill Beach. In the letter the Service stated that it only recently became aware of the Corps plans to use Port Mahon and Broadkill Beach as dredge material disposal sites. The Service reminded the Corps that any proposal to use dredge spoils at Port Mahon and Broadkill Beach would require an environmental assessment, or further, an environmental impact study, both required by the federal National Environmental Policy Act.

Response. Please refer to responses to January 18, 2001 Office of Management and Budget letter and to November 14, 2001 U.S. Fish and Wildlife Service letter. Both letters are attached.

Honorable Mitchell E. Daniels, Jr.
Director
Office of Management and Budget
Washington, D.C. 20503-0008

Dear Mr. Daniels:

In response to your letter dated January 18, 2001, I am submitting for your review a Corps of Engineers memorandum detailing the findings of their review of your concerns related to the Port Mahon, Delaware ecosystem restoration project. While your office recognized the importance of restoring the Delaware Bay ecosystem, you questioned the array of alternatives considered and the justification and overall advisability of ecosystem restoration at this location. As outlined in the Corps memorandum, both the study authority and non-Federal sponsor together focused the feasibility analyses geographically on Port Mahon area and technically on the development of a multi-objective project to protect State Road 89 and wetlands behind it. Further, the Corps did consider alternatives (permanent evacuation and relocation of State Road 89) that would allow natural erosion processes to continue. Neither of these alternatives were considered in detail since they would not meet the overall study objectives of shoreline erosion and habitat protection and restoration and were cost prohibitive. Finally, the Corps again consulted with the U.S. Fish and Wildlife Service as requested and a letter dated May 11, 2001 that documents their continued support for the project.

Please advise this office based on the additional information provided whether my recommendations to support the authorization and implement the project are consistent with Administration policy.

Sincerely,

Mike Parker
Assistant Secretary of the Army
(Civil Works)

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

CECW-PM

AUG 3 2001

MEMORANDUM FOR THE ASSISTANT SECRETARY OF THE ARMY (CIVIL WORKS)

SUBJECT: Port Mahon, Delaware

1. PURPOSE: In response to your 13 March 2001 memorandum, the U.S. Army Corps of Engineers has reviewed the concerns raised by the Office of Management and Budget (OMB) in their 18 January 2001 letter related to the subject project. The findings of the Corps review and my recommendation are summarized below.

2. DISCUSSION:

a. The Delaware Bay Coastline – Delaware & New Jersey, Port Mahon Delaware Interim Feasibility Study, Final Feasibility Report and Environmental Assessment determined that shoreline erosion and shoreline development have significantly reduced the spawning suitability of the Port Mahon area for the horseshoe crab. Although there is no sandy beach present at Port Mahon at this time, horseshoe crabs continue to attempt to nest in the roadbed with limited success and significant mortality. The prime spawning beaches are between Maurice River and the Cape May Canal in New Jersey and the sandy beaches between Bowers Beach and Lewes in Delaware. Port Mahon is just north of Bowers Beach. Port Mahon's location in the bay relative to salinity and hydraulic conditions make it suitable habitat for horseshoe crabs. The beach fill will protect existing wetlands as well as the wetlands to be restored as a component of the Port Mahon project. All of these features are expected to benefit migratory shorebird species.

b. The proposed ecosystem restoration project consists of three elements designed to restore the ecosystem at Port Mahon. The first element consists of restoration of 19.2 acres of horseshoe crab habitat through the placement of 306,000 cubic yards (cy) of sand for approximately 4,900 feet along the shoreline and the construction of a 1200-foot revetment at the southern end of the proposed project to tie into the existing revetment from the termination of the beachfill to provide stability. The second element will involve raising State Road 89 for a distance of 7,500 feet to protect 59.1 acres of wetlands from excessive and damaging overwash. The third element in the recommended plan is the restoration of 21.4 acres of degraded marsh west of State Road 89. The proposed ecosystem restoration and protection project will provide 193 average annual high value habitat units. In addition to ecosystem restoration and protection and the associated non-monetary environmental quality benefits, the project will produce incidental national economic development (NED) benefits. These estimated NED benefits amount to an average annual total of $140,000, and consists of reduction of infrastructure damages and avoidance of fuel delivery by more costly alternative means. A monitoring program to document project performance compared to design predictions will be conducted as a cost-shared engineering and design activity during the continuing construction for periodic nourishment. A 5-year monitoring and adaptive management

plan to evaluate success and provide for potential minor project modifications to improve overall project performance is also included in the recommended project.

c. Section 101 (a)(12) of the Water Resources Development Act (WRDA) of 1999 authorized project construction at a total cost of $7,644,000, with an estimated Federal cost of $4,969,000 and an estimated non-Federal cost of $2,675,000 and at an estimated average annual cost of $234,000 for periodic nourishment over the 50-year life of the project, with an estimated annual Federal cost of $152,000 and an estimated annual non-Federal cost of $82,000.

d. OMB raised two concerns in their 18 January 2001 letter. The first concern relates to the array of alternatives considered in the feasibility study. The second concern relates to the justification and overall advisability of ecosystem restoration at Port Mahon. A response to each of these concerns is provided in the following paragraphs.

e. OMB requested that a broader array of alternatives for addressing the horseshoe crabs and migratory birds of Delaware Bay be evaluated, in consultation with the U.S. Fish and Wildlife Service, to determine whether the significant public investment required to sustain a man-made beach is justified at Port Mahon. The sponsor of the feasibility investigation, the State of Delaware, requested a study to evaluate the advisability of ecosystem restoration at Port Mahon, not the Delaware Bay and as a result, a comprehensive plan of action for the Delaware Bay did not result from the feasibility investigations. Ecosystem restoration was the primary objective of the feasibility analysis, although clearly the sponsor is interested in the project's secondary benefits of providing protection to State Road 89 and the pipeline that delivers jet fuel to Dover Air Force Base. As requested, the U.S. Fish and Wildlife Service reviewed the concerns raised by OMB and documented their position in a letter dated 11 May 2001 (enclosed). As outlined in this letter, the U.S. Fish and Wildlife Service believes the Port Mahon site "offers substantial potential for habitat improvement". In addition, the U.S. Fish and Wildlife Service acknowledged the study authority and the non-Federal sponsor together focused the feasibility analyses geographically on the Port Mahon area and technically on the development of a multi-objective project to protect State Road 89 and wetlands behind it.

f. OMB also suggested that the removal of some or all of the existing hard structures from the Port Mahon shoreline to allow for the natural erosion of the rural road and wetlands should be considered for implementation, since it believes that the proposed action would not restore the designated area. The alternatives considered for the Port Mahon area included two alternatives (permanent evacuation and relocation of State Road 89) that would allow natural erosion processes to continue to damage habitat and existing infrastructure. Neither of these alternatives was considered in detail since they did not meet the overall study objectives of shoreline erosion and habitat protection and restoration and were considered cost prohibitive. Specifically, permanent evacuation of the area was expected to have high social and economic costs and would not prevent the loss of habitat. Relocation of State Road 89 would involve extensive wetland destruction and costly mitigation measures while providing no habitat protection, and as a result, the plan was eliminated from further consideration. Furthermore, jet fuel is delivered to Dover Air

Force Base via an underground pipeline on the landward side of the road that will continue to require protection from shoreline erosion, negating the effects of relocating State Road 89. This pipeline is critical to normal operations at Dover Air Force Base and readiness for National Security. Without the pipeline, jet fuel would have to be delivered via truck in a large number of trips, increasing the risk of spills that would cause significant environmental damages.

g. The proposed project at Port Mahon will restore historic horseshoe crab habitat and associated wetlands and protect these habitats from further loss and degradation. While the proposed project will not be a "natural" beach, since it will need to be replenished every seven years, it will be much more than "isolated shifting pockets of sand". The restored beach will remain a functioning beach, usable annually by spawning horseshoe crabs and the thousands of migratory birds that need to feed on horseshoe crab eggs, for the life of the project. The selected plan provides the optimum ecosystem restoration and environmental quality benefits at Port Mahon and is incrementally the least-cost alternative in terms of habitat units per total present worth project costs.

3. RECOMMENDATION: In view of the above, and since this project was formulated for shoreline erosion and habitat protection and restoration purposes, I recommend this project be resubmitted to OMB for clearance.

FOR THE COMMANDER:

Encl

for
ROBERT H. GRIFFIN
Brigadier General, USA
Director of Civil Works

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401

May 11, 2001

Lt. Colonel Timothy Brown
District Engineer
U.S. Army Corps of Engineers
100 Penn Square East
Philadelphia, PA 19107-3390

Attn: Steve Allen

Re: Port Mahon Feasibility Study

Dear Colonel Brown:

This responds to your office's request for our comments on the letter dated January 18, 2001, from Mr. Wesley Warren of the Office of Management and Budget to your office relating to the Port Mahon Feasibility Study. Mr. Warren's letter questions the environmental justification for the project and suggests that a wider array of alternatives for addressing the needs of horseshoe crabs and shorebirds should have been evaluated to provide assurance that the benefits of maintaining a beach at this particular location are worth the cost. This approach overlooks the fact that the Port Mahon project was not formulated simply to address the habitat needs of horseshoe crabs and shorebirds, but also for protection of infrastructure (road and jet fuel pipeline) and water dependent recreational and commercial facilities (e.g., boat launching ramp, docks, and fishing pier). In addition, the project will also benefit a wide variety of public fish and wildlife resources by preventing erosion of the marsh and by improving the water quality of Delaware Bay due to the reduction in the input of fine sediments.

While no formal study was conducted to evaluate potential projects specifically for horseshoe crabs in Delaware Bay, it certainly appears that the Port Mahon site offers substantial potential for habitat improvement. This site lies within the shoreline region between the Mispillion River and Kelly Island where the greatest number of horseshoe crabs come ashore to spawn. Unfortunately, the Port Mahon shoreline is largely unsuitable for spawning due to limited beach habitat and the presence of bulkheads and riprap. This problem creates a significant opportunity for habitat improvement. While the alternative of simply removing the bulkhead and riprap and allowing the natural erosion process to proceed would reduce the mortality of adult crabs, the effective increase in the spawning success would be limited because sand for beach habitat is

naturally scarce. The project would supply the sand needed to improve spawning as well as achieving other benefits mentioned above.

We share the concern about the relatively high amount of replenishment that will be necessary to maintain the beach at this location. Substantive spawning beaches do not naturally occur much north of Pickering Beach which is located approximately 2.7 miles down the bay from Port Mahon. The current lack of sand at Port Mahon is likely to have been exacerbated by the bulkhead, but beach habitat under natural conditions would probably be limited to small pocket areas. Fortunately, the maintenance cost will be reduced since the material would come from the ongoing maintenance dredging of the Delaware main navigation channel. However, there are significant uncertainties involved in estimating erosion rates 50 years into the future. In addition, the demands for sand for use at other shoreline locations may be substantially greater than they are at this time. In view of this, a project based on a 25-year life, as is currently common for projects of this type, may have been more appropriate.

We cannot rule out the possibility that beach replenishment for horseshoe crab spawning habitat could be more cost effectively accomplished at other locations where the erosion rate may be lower. However, the study authorization was specific for Port Mahon and the nonfederal sponsor was especially interested in a multiple objective project that included reducing the threat to the road as well as to the wetlands behind the road. Furthermore, it does not appear that such a high standard (i.e., a demonstration of the highest benefits and cost effectiveness of any site in the Delaware Bay region) would normally be required to justify a project. For example, if the issue was evaluating beach replenishment for a human community, it would not be necessary to show that the site had the highest benefit-cost ratio of any site in Delaware Bay.

Thank you for the opportunity to comment. If there are any questions, please contact George Ruddy at (410) 573-4528.

Sincerely,

Beth McGee

for John P. Wolflin
Supervisor
Chesapeake Bay Field Office

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
WANAMAKER BUILDING, 100 PENN SQUARE EAST
PHILADELPHIA, PENNSYLVANIA 19107-3390

REPLY TO
ATTENTION OF
CENAP-PL-E

Subject: Review of Draft Horseshoe Crab Egg Density and Habitat Availability Report-Delaware River Main Channel Deepening Project

Mr. Clifford Day, Supervisor
U. S. Department of Interior
Fish and Wildlife Service
New Jersey Field Office
927 N. Main Street, Building D
Pleasantville, New Jersey 08232

JAN 28 2002

Dear Mr. Day:

I am writing to address the concerns that you raised in your November 14, 2001 letter to John Brady, of our Environmental Resources Branch about placing dredged material on Delaware Bay shore areas. These concerns resulted from your review of our September 15, 2001 draft report: *Preconstruction Horseshoe Crab Egg Density Monitoring and Habitat Availability at Kelly Island, Port Mahon, and Broadkill Beach Study Areas, Delaware.*

I believe it is important that you understand the history of work in this area before addressing your specific concerns. As part of the Delaware River Main Channel Deepening Project, the Corps prepared a Supplemental Environmental Impact Statement (July 1997) outlining a plan to use Delaware Bay sand for wetland restoration at both Kelly Island, Delaware and Egg Island Point, New Jersey. In addition, material would be stockpiled off the bay coast near Broadkill Beach and Slaughter Beach for future beach nourishment.

Because of concerns raised by your agency and others about the potential impacts of stockpiling sand, the Corps proposed depositing the sand directly on Delaware beaches, a suggestion made by your agency. Our decision was sent by letter to the U.S. Fish and Wildlife Service on May 7, 1998 and was announced at a subsequent public hearing on May 10, 1998 in Dover, Delaware. On July 14, 2000, the Delaware Department of Natural Resources and Environmental Control (DNREC) submitted a list of beaches it felt would benefit from nourishment with Delaware Bay sand from the Delaware River shipping channel. This list included Broadkill Beach and Port Mahon on the bay and Rehoboth Beach/Dewey Beach on the Atlantic coast. Nourishment for each of these beaches is also being pursued under separate Corps' authorities resulting in three individual federal projects, each of which has previously prepared National Environmental Policy Act (NEPA) documents that were coordinated with your Annapolis Field Office. These NEPA documents will be supplemented or revised for beach

nourishment areas when DNREC and the Corps decide which beaches are best suited for nourishment, thereby meeting the NEPA requirements for these actions.

A monitoring/management plan was developed for the Kelly Island wetland restoration project in close coordination with DNREC and the appropriate federal agencies, including U.S. Fish and Wildlife Service Bombay Hook National Wildlife Refuge Office. One of the plan's goals is to create more spawning habitat for horseshoe crabs. As a result, the Corps' Philadelphia District initiated the horseshoe crab egg density and habitat availability study for Kelly Island, Port Mahon and Broadkill Beach. There is a two-fold purpose for the study. The first is to establish pre-construction conditions at the three locations, which will be compared to post-construction horseshoe crab use. The second is to gather information to determine if construction can take place during the environmental window (April 15-August 31) established by the Atlantic States Marine Fisheries Commission's Interstate Fishery Management Plan for Horseshoe Crab (1998). Next year, we plan to collect additional spawning horseshoe crab data at Kelly Island, Broadkill Beach and Port Mahon.

In 2001, the Corps has also collected data on juvenile horseshoe crabs at these three locations and at Kitts Hummock, a known productive spawning area recommended as a control by DNREC. We have also gathered data for spawning adults at Kelly Island and Port Mahon. When these studies are completed, we will send them to you for review.

Turning to the draft September 2001 report, it was found that only 40.8 percent of Kelly Island and 26.9 percent of Port Mahon provide suitable spawning habitat. Much of the shoreline at Kelly Island is underlain with peat and is unsuitable for spawning. The existing spawning habitat at Kelly Island is very dynamic due to the continuing erosion, with sand and peat areas changing each year. In addition, since 1997, the southern most sandy area near the tip of Kelly Island has eroded about 650 feet northward, eliminating possible spawning habitat. At Port Mahon, the shoreline is lined with riprap causing a high annual mortality rate for spawning horseshoe crabs. Restoration at these two locations is expected to greatly enhance spawning habitat. Shorebirds are also being monitored at Kelly Island, Port Mahon, Broadkill Beach, and Prime Hook Beach (a control site) and will continue after project construction to determine the degree of success in providing shorebird habitat. Additional parameters such as sediment movement, water quality, and aquatic resources are being monitored to determine the degree of success for the Kelly Island wetland restoration.

We believe it would be productive for our respective technical staffs to meet in the near future to discuss the project and your concerns. Further, we believe it would be appropriate for the U.S. Fish and Wildlife Service to wait until discussions have taken place and next year's data collection is finished before making a final decision on whether construction can be performed within the horseshoe crab environmental window.

If you have questions or concerns, please call John Brady at 215-656-6554.

Sincerely,

Robert L. Callegari
Chief, Planning Division

Copy Furnished:
U.S. Fish and Wildlife Service, Annapolis Office
U.S. Fish and Wildlife Service Bombay Hook, National Wildlife Refuge
DNREC, Cooksey, Love, Carter, Moyer

EXHIBIT #77

MAYA K. van ROSSUM DELAWARE RIVERKEEPER

Comment. *The permit application, supporting materials, and subsequent response* documents submitted by the Army Corps of Engineers claim that the rock blasting which would be associated with the deepening project, as well as the dredging that will take place, will not jeopardize the continued existence of the Delaware River population of shortnose sturgeon. The Corps has utterly failed to prove this claim.

Quite to the contrary, the documents, quotes and expert opinion offered by the Corps and already on the public record tend to demonstrate that at worst the Corps will have serious impacts on the juvenile population of Delaware River shortnose sturgeon, and at best that they have no scientific study to determine whether or not they will have an impact.

Whether or not the Delaware River's shortnose sturgeon population will be significantly harmed by this project primarily hinges on where the juveniles are located in the River during the critical period of blasting.

The fact of the matter is the Corps doesn't know, and the experts don't know, no on knows, where the juveniles in the Delaware River are located during the year including during the critical period of blasting.

Contrary to what the Corps would have you believe, all the experts agree, including the experts from the Corps and the National Marine Fisheries Service (NMFS) - there are no studies that demonstrate where the Delaware River's juvenile shortnose sturgeon are located.

"As mentioned previously, the distribution and abundance of juvenile shortnose sturgeon in the Delaware River has not even been documented or studied" (NMFS Biological Opinion, Delaware River Main Channel Blasting Project, 2/2/01).

"However, due to a lack of data, the exact status of juvenile shortnose sturgeon in the Delaware River has yet to be determined."(NMFS *Biological Opinion, Delaware River Main Channel Blasting Project, 2/2/01.)*

"In the Delaware River, the location of the juvenile shortnose sturgeon is not known . . ." (Army Corps, *Biological Assessment: Effects of Rock Blasting the Shortnose Sturgeon, May 2000.)*

"Little is known about the movements of larvae and young-of-year shortnose sturgeon in the Delaware River and nursery habitat has not been identified." (Amy Corps, *Biological Assessment: Effects of Rock Blasting the Shortnose Sturgeon, May 2000.)*

"*To* date, no one has resolved, or even touched upon, the temporal and spatial occurrence aspects of shortnose sturgeon young (young-of-the-year and older juveniles) in the Delaware Estuary." *(Letter, John C. O'Herron, II to John Brady Army Corps of Engineers Philadelphia District, February 15, 1997, regarding the Draft Supplement Environmental Impact Statement.)*

So, the reality is that we don't know where the juveniles are located, the Army Corps doesn't know where the juveniles are located.

And, what little information we do have suggests that the juvenile population of shortnose sturgeon may very well be in the vicinity of the proposed blasting which would have profound impacts on those individuals present as well as the population as a whole.

The proposed blasting consists of 18 acres near Marcus Hook, PA, extending from river mile 76.4 to river mile 84.6.

According to the experts, shortnose sturgeon tend to aggregate in numbers ranging from a few to thousands.

According to expert opinions based on the location of juveniles in other river systems, it is likely that the juveniles in the Delaware River are generally located on the fresh side of the oligohaline/freshwater interface which occurs in the area between Wilmington, Delaware and Marcus Hook, Pennsylvania.

As a result, according to the experts, in the Delaware River, juveniles are likely to range from Artificial Island (river mile 54) to the Schuylkill River (river mile 92). Corps, NMFS and other experts reference this fact.

The proposed blasting which would take place from river mile 76.4 to river mile 64.6 is well within the area where juvenile shortnose sturgeon are likely to range.

With this kind of information in hand, John O'Herron, one of the leading experts on the Delaware River population of shortnose sturgeon makes clear "... no assumption can be made that shortnose sturgeon will not be present during blasting operations at Marcus Hook." (Letter John C. O'Herron II to John *Brady* Army Corps Of *Engineers Philadelphia District, February 15, 1997, regarding the Draft Supplement Environmental Impact Statement)*

NMFS has gone on the record stating: "Therefore, shortnose sturgeon maybe present in the action area and may be either directly or indirectly affected by blasting operations." (NMFS Biological Opinion, Delaware River Main Channel Blasting Project, 2/2/01).

And NMFS has also stated that "Shortnose sturgeon in the action area may be adversely affected by the Delaware River Main Channel Blasting Project. However, the degree of the impact depends on the number of individuals in the action area." *(NMFS*

Biological Opinion, Delaware River Main Channel Blasting Project, 22/01) Remember, the shortnose sturgeon are believed to aggregate in large numbers so that impact could likely be very high.

According to NMFS"... the extinction of a single shortnose sturgeon population risks permanent loss of unique genetic information that is critical to the survival and recovery of the species .. . ." *(NMFS Biological Opinion, Delaware River Main Channel Blasting Project, 2/201)*

According to leading experts, the protection of the juvenile life stage is critical to the survival of the population. (Letter *John C. O'Herron,II to John Brady Army Corps of Engineers Philadelphia District, February 15, 1997, regarding the Draft Supplement* Environmental Impact *Statement.)*

Also according to NMFS, ".. the current Delaware River DPS of shortnose sturgeon is not considered to be at a sustainable level ." *(NMFS Biological/Opinion, Delaware River Main Channel Blasting Project, 2/2/O1)*

The Delaware River population of shortnose sturgeon are important and in peril. We cannot afford to speculate, guess or rely upon opinions. The studies need to be done to tell us where the juveniles are located and whether or not the blasting will impact them.

We are not seeking to assert here that we know, with a certainty, that the proposed blasting or deepening will impact the shortnose sturgeon population, but we are asserting that the Corps, and even NMFS, have utterly failed to demonstrate that there will not be significant impacts that jeopardize the Delaware River's shortnose sturgeon population.

The record clearly demonstrates that the proposed blasting operations might in fact have significant and serious impacts on juvenile sturgeon and thus have serious ramifications for the population as a whole. At the very least, the record clearly demonstrates that more research is needed to draw a final conclusion on this issue.

Response. Refer to the general response for "shortnose and Atlantic sturgeon concerns".

Comment. We continue to have concerns that many aspects of the proposed project, such as the proposed spoil disposal plans and biological window's, have not been subjected to required NEPA review or public scrutiny.

Response. Appropriate supplemental NEPA documentation associated with the individual beach nourishment projects will be prepared to evaluate placement of main channel sand on selected beaches.

Comment. We continue to have questions about the Corps' potential use of economic loading as part of this project. They have not yet closed the door on use of this approach and yet expect Delaware to make a final permit decision absent a commitment one way or the other on this issue.

Response. As currently planned, the project would not include economic loading of barges or hopper dredges. Economic loading has never been considered in the riverine portion of the project. However, in Delaware Bay, where sand would be dredged and used for beach nourishment, there would be a cost savings with economic loading of hopper dredges. The Corps will consider the benefit of using economic loading when a final determination has been made with the State of Delaware regarding which beaches will be nourished. The benefit of economic loading increases as the distance between the dredging site and placement site increases. In 1998, a field study was conducted with the hopper dredge McFarland. Monitoring was conducted at two sites, one of predominately coarse-grained material, and the other of predominately fine-grained material. As the hopper was filled to an economic load, monitoring quantified the degree of suspended solids and contaminant release generated by overflow, and the dispersion of the overflow plume. Potential impact to oyster beds through increased sedimentation was evaluated with a sediment profiling camera system. Photographs of the bottom, sediment-water interface were taken before and after overflow, and analyzed to measure any recent sedimentation. A report of this investigation was provided for the public record. The States of Delaware and New Jersey would have to approve economic loading relative to compliance with their section 401 water quality certification programs and coastal zone management programs.

LETTER DATED DECEMBER 4, 2001 – MAYA van ROSSUM, DELAWARE RIVER KEEPER

Comment. The Corps has failed to demonstrate that the proposed blasting will not jeopardize the federally endangered shortnose sturgeon that live in the Delaware River.

Response. Refer to the general response for "shortnose and Atlantic sturgeon concerns".

Comment. NMFS conditions for protection of shortnose sturgeon are not enough ....

Response. Refer to the general response for "shortnose and Atlantic sturgeon concerns".

Comment. The record reflects that the proposed blasting could have serious impacts on the Delaware River's population of shortnose sturgeon, and that at the very least the Corps has not been able to demonstrate that they will not have a significant adverse impact. Therefore the requested permit must be denied.

Response. Refer to the general response for "shortnose and Atlantic sturgeon concerns".

Comment. We question the continued focus and investment on the proposed Kelly Island mitigation.

Response. The Kelly Island Wetland Restoration Project is not a mitigation project. This area was selected for beneficial use of dredged material to arrest the ongoing erosion in coordination with the State of Delaware. The main purpose of the project is as follows: to restore intertidal wetlands using dredged sediment from the deepening of the Delaware River navigation channel, stem erosion of the Kelly Island shoreline estimated at 20 feet per year, provide extensive sandy beach for spawning horseshoe crabs, and provide continued protection to the entrance of the Mahon River. As described in the permit application (Appendix M under Kelly Island Wetland Restoration), approximately 1.4 acres of tidal wetlands will be filled in Delaware with the Main Channel Deepening Project. Dredged material from the deepening project will be used to create approximately 60 acres of new inter tidal wetland while protecting thousands of additional acres of wetlands. In addition it provides over 1 mile of horseshoe crab habitat along the shoreline. The site will specifically protect the existing shoreline against continued rapid erosion, which since 1993 has retreated an average of over 300 feet along the mile stretch and in some areas over 500 feet.

Comment. The Corps continues to avoid the issue of economic loading - this issue must be decided conclusively before a permit can be granted.

Response. As currently planned, the project would not include economic loading of barges or hopper dredges. Economic loading has never been considered in the riverine portion of the project. However, in Delaware Bay, where sand would be dredged and used for beach nourishment, there would be a cost savings with economic loading of hopper dredges. The Corps will consider the benefit of using economic loading when a final determination has been made with the State of Delaware regarding which beaches will be nourished. The benefit of economic loading increases as the distance between the dredging site and placement site increases. In 1998, a field study was conducted with the hopper dredge McFarland. Monitoring was conducted at two sites, one of predominately coarse-grained material, and the other of predominately fine-grained material. As the hopper was filled to an economic load, monitoring quantified the degree of suspended solids and contaminant release generated by overflow, and the dispersion of the overflow plume. Potential impact to oyster beds through increased sedimentation was evaluated with a sediment profiling camera system. Photographs of the bottom, sediment-water interface were taken before and after overflow, and analyzed to measure any recent sedimentation. A report of this investigation was provided for the public record. The States of Delaware and New Jersey would have to approve economic loading relative to compliance with their section 401 water quality certification programs and coastal zone management programs

Comment. Potential toxic impacts of new proposed confined disposal facilities (CDFs) continues to be a concern.

Dr. Thomas Fikslin with the Delaware River Basin Commission (DRBC) analyzed data from two existing dredge spoils disposal facilities -- Money Island and Fort Mifflin. According to his findings, these sites are significant source of toxic pollution to the Delaware River. Among the toxics discharged to the River during the de-watering process are Cadmium, Lead, Copper, Zinc and total suspended solids. In some instances, the discharge concentration exceeds the DRBC's acute and/or chronic criteria, although the DRBC criteria are for dissolved metal. According to Dr. Fikslin the two disposal facilities are the eighth largest discharger to the estuary and in the case of lead discharge more lead than all 78 point source dischargers to the estuary combined. *(Presentation November 4,1998 before the DRBC's Toxics Advisory* Committee.)

Dr. Fikslin also found that the CDFs are a source of DDE to the River, and a potential source of PCBs that have been documented in the sediments of the estuary. According to Dr. Fikslin: his preliminary evaluation "indicates that CDFs have the potential to impact aquatic life through acute and chronic toxicity, and human health through the bioaccumulation of organic compounds such as PCBs and DDX." *(Presentation November 4,1998 before the DRBC'S Toxics Advisory Committee.)*

The Corps has responded with data from other Corps CDFs demonstrating that much lower concentrations of toxins are discharged during dewatering from these facilities and that in fact most toxins remain on site. Despite this Corps response concerns remain.

Response. At a 1998 meeting Dr. Thomas Fikslin of the Delaware River Basin Commission expressed concerns about the effluent water discharged from confined dredged material disposal facilities and potential impacts to aquatic life in the Delaware River. Dr. Fikslin reviewed a limited data set for two confined disposal facilities (CDFs) that are much smaller and thus function much differently from the sites that are used for the Delaware River Philadelphia to the Sea navigation project. The data reviewed by Dr. Fikslin was developed to meet conditions of Pennsylvania Water Quality Certifications for operating these sites. The data were developed in a manner that is not directly comparable to Delaware River water quality standards for dissolved metals. The data represented total concentrations of metals in effluent samples, which include both the dissolved and particulate fractions.

Dr. Fikslin concluded: "This preliminary evaluation indicates that CDFs have the potential to impact aquatic life...More data is needed on the quality, quantity and duration of the overflow from CDFs." He has been involved in recent Corps studies that monitored water quality at CDFs used for maintenance dredging of the Delaware River Philadelphia to the Sea project. These more comprehensive studies employed the correct procedures to make the comparison to Delaware River water quality criteria for dissolved metals. Reports of the studies conducted for the Pedricktown North and Killcohook CDFs have been provided for the public record **(EXHIBIT 40 Binder 3).**

The study results indicated that discharges from these CDFs during maintenance dredging operations did not substantially alter water quality or present environmental risks to Delaware River biota. Comparison to water quality criteria indicated that chemical concentrations in the discharge rarely exceeded acute criteria during the operation, suggesting that potential risks are low. Analytes that exceeded water quality criteria were primarily inorganic chemicals that were also present in background samples at levels similar to those in the weir discharge and in the river at the point of discharge. Estimations of inputs to the disposal sites relative to the loadings or outputs from the weir indicated that the CDFs are over 95% efficient at trapping inorganic constituents found in the channel sediments. For PCBs the CDFs are over 99% efficient. Mass balance calculations for the Killcohook CDF suggested that approximately 14.5 kg of PCBs were pumped into the site and only 0.01 kg were released back into the river through the weir. Estimates of the changes in heavy metal concentrations that the CDF discharges may have caused during the dredging using TMDL type calculation techniques indicated that no increases in ambient concentrations were caused by the operations.

Dr. Fikslin also indicated that the two CDFs he reviewed could be the eighth largest discharger to the estuary, and in the case of lead, may discharge more lead than all 78 point source dischargers to the estuary combined. CDFs are not used on a continuous basis throughout the year, and do not continuously discharge water. Of the two sites reviewed by Dr. Fikslin, one is used an average of approximately 45 days a year and the other is used an average of approximately 45 days every two years. As an example, approximately one million cubic yards of dredged material was placed in the Pedricktown North CDF during one monitoring event. During that operation the site discharged water to the Delaware River for 28 days. An estimated 0.39 Kg of lead were discharged to the Delaware River during that time, which averages about 0.014 Kg of lead per day. At the November 1998 presentation, Dr. Fikslin provided data showing that the 78 wastewater dischargers to the Delaware River discharge greater than 50 Kg of lead each day. Based on the infrequent use of CDFs, and the results of recent monitoring studies, Dr. Fikslin's conclusions are considered unsubstantiated.

Comment. First, the Corps is unable to demonstrate that proposed CDFs will be constructed and placed so as to avoid toxic discharges, or potential concerns to drinking water supplies from leaching of toxins (a concern expressed by the University of Delaware's Sea Grant Program in their December 1998 White Paper) because they have yet to demonstrate where these new CDFs will in fact be located. The Corps has made some projections on location but is unable to confirm them because the DRPA has not yet acquired the land for disposal purposes. And in fact some parcels, projected as locations for needed CDFs have already been removed from possibility because of purchases and actions by local governments. And, even for projected sites, the Corps has not provided details on the CDF operations in order to address concerns of toxic discharges. Details on the location, operation, size, and potential impacts must be provided for the locations where the new CDFs will actually be located before Delaware gives the requested permit. It is very possible that the proposed NJ sites are not secured for this project and so new sites need to be identified and secured - this could open the door for new site locations in New Jersey or Delaware.

Response. As part of the Corps permit application, Corps has identified the names and location of sites that will be utilized for initial construction of the project as well as the

50-year maintenance. Potential sites will be secured by the project sponsor, when the Project Cooperation Agreement is signed. Also, refer to responses on toxic concerns.

Comment. In addition, we are unaware of any response by the Army Corps to a June 8, 1999 letter from the US Fish and Wildlife Service *(Letter from Clifford G. Day, Supervisor, USF&W NJ Field Office to Robert L.* Callegari, Army Corps *of Engineers, June 8, 1999)* expressing concerns about "wildlife exposure to hazardous sediments placed in CDFs". The USF&W requested additional information and stated that dependent upon the information received they may recommend alternative CDF management strategies to minimize the potential exposure of trust resources.

Response. The complete Delaware River bulk sediment data set was provided to Mr. Day with a letter dated 29 June 1999. No further comments were received relative to sediment contaminants.

Comment. An Updated EIS is Necessary Before this Project Moves Forward.

"The Council on Environmental Quality regulations impose a duty on all federal agencies to prepare supplements to either draft or final [EISs] if there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts" South Trenton Residents Against 29 v. FHA, {76 F.3d 658,664 (3d Cir. 1999)

The proposed Delaware Deepening project has changed dramatically since the last supplemental EIS was issued in 1997. Therefore, we believe the law, good decision making, and common sense dictate that a new EIS, or at least a supplemental EIS, is necessary before any further decisions can be made on this project.

For example:

The Corps continues to consider a variety of options for disposal of spoils including dumping, various beneficial reuse alternatives, and beach disposal of spoils at Port Mahon, Broadkill, Rehobeth and/ Dewey beaches. A final plan still is not in place. And many of the new options now under consideration have never been subjected to the NEPA process.

Delaware raised significant and justified concerns regarding potential impacts on the ecologically and economically important blue crab populations in the River and as a result is requiring a biological window regarding allowable periods of dredging. The potential impacts to blue crab need NEPA review.

New concerns issued by the US Fish and Wildlife Service about potential impacts to the ecologically and economically important horseshoe crabs that live in the River and are already experiencing a decline in their numbers, have been raised. Among the concerns raised is a belief that the Corps has failed to fulfill the requirements of NEPA as it pertains to potential impacts to horseshoe crabs.

As far as we are aware, the letter from EPA Region II asserting that the Corps has failed to fulfill the requirements of NEPA on both economic and environmental grounds remains outstanding: ".,,. there may be a need for additional environmental analyses for certain issues not fully covered in the prior EIS documentation. For example, impacts related to the dredging of the private facilities discussed above and several port facilities owned or operated by local sponsors, and potential impacts associated with the development of new sites for dredged material disposal were not fully evaluated in the original EIS. Accordingly, these activities will have to be evaluated under NEPA." (Letter *from Robert W. Hargrove, Chief Strategic Planning and Multi-Media Programs Branch, EPA Region II to Robert Callageri, Army Corps of Engineem, June 30, 1999.)*

Economic loading is still an option for this project. If there is the possibility that economic loading (which has economic, water quality, and other environmental ramifications) will become part of this project, thorough NEPA analysis including opportunity for public input needs to be conducted.

While the Corps has identified areas where the new needed CDFs could be located, there is no reason to believe that these sites will actually be acquired and utilized for this purpose. Proposed CDF sites have already been removed from the realm of possibility by local governments who have purchased them for open space and other community purposes. The fact is that the Corps has not provided NEPA type analysis regarding the new, proposed CDFs that will necessarily be part of this project (either those that they have already identified or those that they may have to identify anew in the future). The Corps has made a number of assertions about the environmental ramifications of the presently proposed sites but has never provided the detail necessary to assess those assertions and has certainly never subjected their CDF proposals to thorough NEPA review.

The Corps has failed to include the impacts or costs of biological windows that are being necessarily placed on this project. Many of these biological windows are only now under construction. The result is that they have not been fully considered/included in the NEPA analysis conducted for this project (neither economically or environmentally).

These issues have not been the subject of full and fair NEPA review. We believe that before Delaware provides any permits to this project, it needs to ensure that the requirements of NEPA have been fulfilled.

Response Appropriate supplemental NEPA documentation associated with the individual beach nourishment projects will be prepared to evaluate placement of main channel sand on selected beaches. With regard to CDFs, the current disposal plan would use a combination of the sites discussed in the Corps 1997 Supplemental Environmental Impact Statement. Development of timing restrictions for dredging activities does not change the project that has been proposed. Timing restrictions will be used to appropriately sequence construction contracts to build the project. While these restrictions will insure that potential impacts are avoided, they do not change what will be built or how the physical construction will be conducted. Also, refer to the general responses on blue crabs, horseshoe crabs, environmental windows, to Corps response to U.S. Fish and Wildlife Service letter dated 14 November 2001 and previous responses on economic loading.

EXHIBIT #78

LAWRENCE J. DELPINO JR.

Comments noted. No response required.

EXHIBIT #79

MARION C. STEWART CIVIC LEAGUE FOR NEW CASTLE COUNTY

Comment. A point which has recently been raised is: Who will be fiscally responsible for any environmental damage that may occur? In other contracts, the Corps of Engineers has been very careful to insist on "hold harmless" clauses exempting it from responsibility. Would the State of Delaware or individual citizens be left holding the bag if damage occurs?

Response. If an environmental problem arises during dredging, the Corps and the project sponsor, the Delaware River Port Authority, will be responsible for any environmental remediation costs that occur during dredging of the Delaware River Main Ship Channel. This responsibility will be detailed in the Project Cooperation Agreement to be signed by the Corps and DRPA. Further, as the applicant for the DNREC permit, the Corps is legally and financially accountable for any remediation that falls within the permit parameters.

EXHIBIT #80

LEAH ROEDEL, DELAWARE RIVER AND BAY SHORELINE COUNCIL

Comment. We wish to raise three critical issues. First is protection of the environment. The Delaware River and Bay provide critical habitat for oysters, blue crabs, clams, fish, birds and wildlife. These resources are treasured by the general public, and provide economic resources. Hazards include:

- Resuspension of toxic substances.
- Increased turbidity of water.
- Smothering of oyster beds by moving sand.
- Disturbing of marine spawning beds.
- Destruction of critical wetlands and aquifers.

Response. The Corps has conducted extensive testing to investigate potential impacts associated with sediment contamination. These tests have included chemical analysis of channel sediments to determine actual contaminant concentrations, and biological testing to evaluate toxicity concerns. Analysis of channel sediments has indicated that contaminants that are present, primarily heavy metals, are at concentrations considered low to medium. The results of state-of-the-art PCB analyses indicated that PCBs, which are ubiquitous in modern society, are one to three orders of magnitude lower in the navigation channel than in shallows outside the project area, and below levels of concern. It is likely that this is the result of regular dredging maintenance, which precludes contaminants from building up over time.

The Corps also evaluated toxicity of bottom sediments by directly exposing aquatic organisms to the sediment. Water column, or suspended solid particulate phase bioassays were run to evaluate water quality concerns associated with the release of contaminants from sediment into dredging or placement site water. Whole sediment, or benthic bioassays were run to evaluate impacts to bottom dwelling organisms that would reside in sediments placed in an aquatic environment. These tests, which are commonly used to evaluate the quality of dredged material, were developed and approved by the U.S. Environmental Protection Agency.

A variety of aquatic organisms were used in the bioassays including larval shrimp approximately four days old, fathead minnows hatched the previous day, and American oyster embryos approximately two-hours after fertilization. These young organisms are very fragile and sensitive to contaminants in their environment. Following established protocols, these organisms were exposed to samples of bottom sediment for a prescribed period of time to evaluate any differences in mortality between Delaware River channel sediment and clean laboratory sediment. All organisms (100%) survived the numerous bioassays that were run, which is a strong indication that channel sediments are not toxic to aquatic organisms.

Lastly, bioaccumulation tests were run with channel sediment from Delaware Bay to evaluate the potential uptake of contaminants by aquatic organisms at aquatic placement sites. This test allows aquatic organisms to live in the sediment for approximately one month, and then analyzes the animal tissues to evaluate any accumulation of contaminants. Tests were run with the hard-shelled clam and a marine worm. Overall, there was no evidence that contaminants accumulated in animals exposed to Delaware Bay sediment at greater concentrations than animals exposed to clean laboratory sediment. All tissues were representative of what one would expect of animals living in a clean environment.

State and Federal resource agencies have reviewed the Corps' sediment quality data. The States of Delaware, New Jersey and Pennsylvania have approved the deepening project by finding it consistent with their respective coastal zone management programs. The U.S. Environmental Protection Agency stated: "EPA continues to believe that there will be no adverse impacts associated with the disposal of sediments generated by the project." The U.S. Fish and Wildlife Service stated: "Results of chemical analyses provided within the biological assessment indicated that contaminant loads in the sediments tested are low."

Despite the positive results of the tests conducted to date, the Corps intends to monitor water quality during construction. This monitoring will insure that dredging and disposal activities associated with the deepening project do not adversely impact the aquatic resources of the Delaware River and Bay. The Corps has been working with the States of New Jersey and Delaware, and the Delaware River Basin Commission (DRBC), to develop an acceptable protocol for this type of monitoring. To date, the Killcohook, Oldmans, Pedricktown North and Pedricktown South CDFs have been monitored. Reports on the monitoring studies conducted at the Killcohook and Pedricktown North CDFs have been provided as part of the public record. The reports provide details on how CDFs would be monitored.

The Corps has also conducted modeling efforts to simulate the quality of water discharged from the Reedy Point South CDF during disposal operations, and contaminant concentrations in the water column resulting from dredging activity. These studies have also been included as part of the public record. Both the modeling results and the field monitoring studies indicate that dredging and dredged material disposal operations do not significantly impact water quality.

Also, refer to the general responses for "oyster impacts", "*Sabellaria vulgaris* impacts from sand placement" and "concerns for sandbar sharks".

As described in the permit application (Appendix M under Kelly Island Wetland Restoration), approximately 1.4 acres of tidal wetlands will be filled in Delaware with the Main Channel Deepening Project. However, approximately 60 acres of tidal wetlands will be restored through the restoration of Kelly Island Wetland Restoration Project.

An analysis of potential impacts of the project on drinking water aquifers and groundwater is presented in the Corps July 1997 SEIS **(EXHIBIT 4)** in Sections 5.10 and 7.0, respectively. At the request of the Corps, the U.S. Geological Survey was tasked to make an assessment or investigate impacts of the dredging project on the drinking water aquifers. The concerns generally focused on three areas of concern.

- (1) Dredging breaches confining unit
- (2) Saltwater in river encroachment onto well-recharge areas
- (3) Disposal areas effecting nearby wells

To address the above concerns the U.S. Geological Survey (USGS) subsequently performed three separate studies. The USGS issued three separate reports as listed below.

1. Evaluation of Ground-Water Flow from Dredged Material Disposal Sites in Gloucester and Salem Counties, New Jersey (USGS, 1995).

2. Hydrogeologic Conditions Adjacent to the Delaware River, Gloucester, Salem and Cumberland Counties, New Jersey (USGS, 1996).

3. Selected Hydrogeologic and Chloride-Concentration Data for the Northern and Central Coastal Area of New Castle County, Delaware (USGS, 1998).*

* *Note draft report was prepared in 1996.*

A letter dated 23 January 1996 was then issued by the USGS, which summarized their findings and referenced these reports. USGS investigation or analysis of the above concerns reached the following findings:

In summary, the concerns about increasing the potential for saltwater from the river to infiltrate into the adjacent aquifers, either as a result of dredging through a confining unit or as a result of the upstream movement of saltwater in the deepened channel can be set aside. No significant confining units will be breached and the saltwater will not significantly move upstream to increase the threat of saltwater intrusion.

The concern that fluids leaching from the dredged-material disposal areas could infiltrate to the aquifer with recharge can also be set aside.

Since the completion of that study and in cooperation with NJDEP and DNREC, the Corps has installed monitoring wells at all Federally owned CDFs that are or will be used for placement of dredged material from the maintenance of the existing 40-foot Delaware River Main Channel as well as from the deepening project in the States of New Jersey and Delaware. Also, groundwater-monitoring wells will be installed at the new upland disposal sites that will be developed for the deepening project. Groundwater monitoring plans have been developed for all of the Federally owned Main Channel Dredge Disposal Areas. The groundwater-monitoring program for the NJ sites has been approved by the NJDEP. The groundwater-monitoring program for Reedy Point North and Reedy Point South disposal areas (both located in the State of Delaware) has been submitted to DNREC for their approval.

Comment. There are new cargo ship designs for river shipping, for example, the "Fast Ships, Inc. " of Philadelphia. Another example is the Sunoco large flat ships which ride high on the water and can carry 2.3 million barrels of oil in one trip. None of the regional oil companies have plans to deepen their side channels to connect with the deeper main channel. In fact, Motiva in Delaware now opposes the project for economic reasons,

Response. Container vessels of post-Panamax size will accrue navigation transportation cost saving benefits from the channel deepening. The mentioned Sunoco ships using the current channel will still need to lighter at Big Stone Beach Anchorage because of their sailing drafts. The six benefiting oil facilities are expected to deepen their berths to take advantage of the deepened Delaware River channel. Motiva, a seventh oil facility, has not been included in the benefit analysis.

EXHIBIT #82

BERNARD DEMPSEY

Comment. Delaware will receive virtually no benefits. The Port of Wilmington does not need it. Delaware's sole refinery opposes it as does its fisherman and recreational interests.

Response. For the State of Delaware, potential indirect benefits will result from project construction, and sand placement at State of Delaware beaches including Kelly Island. No benefits are claimed for either the Port of Wilmington or Motiva in the economic analysis of the national economic development account to determine project justification. Refer to Mr. Sprague's comments at the public hearing regarding Port of Wilmington benefits.

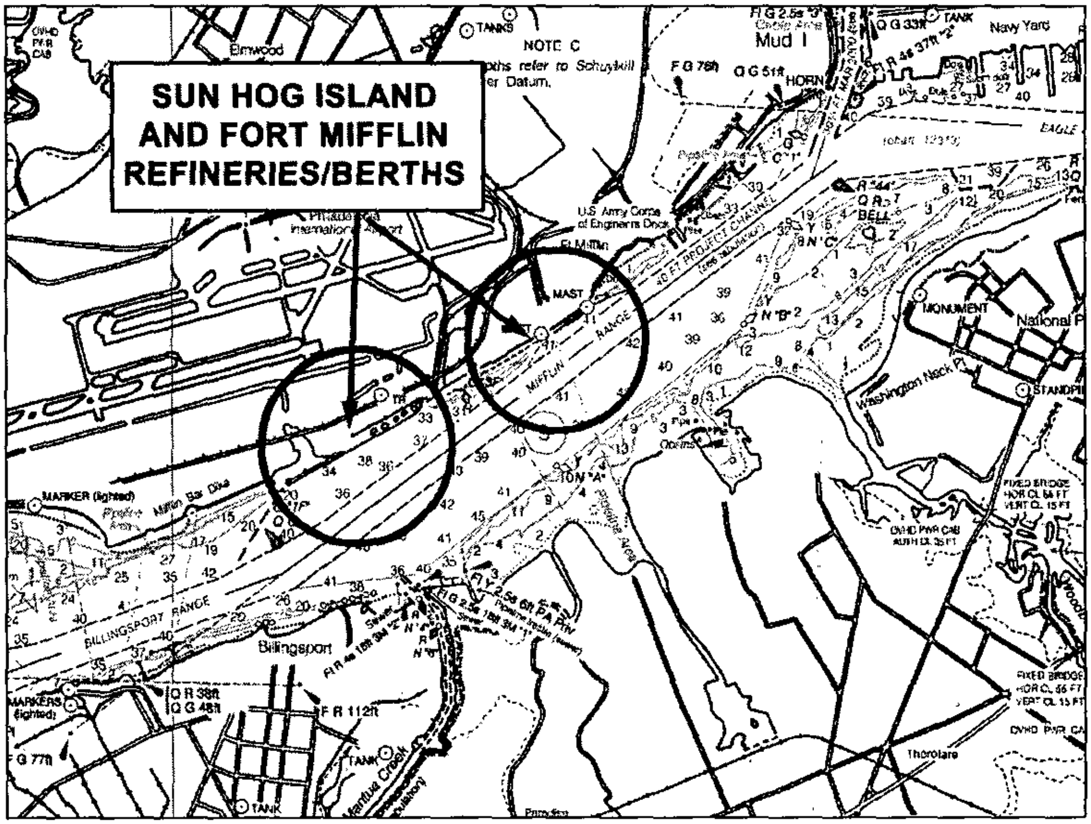
EXHIBIT #83

JONATHAN H. SHARP

Comment. One of the most disturbing inadequate studies is on contaminants in the sediments. The AD Little study contracted by the Delaware Estuary Program, federal studies done by the US Environmental Protection Agency and the National Oceanic and Atmospheric Administration, and studies done through DRBC and the states show high levels of contaminants in the sediments of the upper estuary. When confronted with this discrepancy to the Corps assessment, a reply was that the Corps study focused on the channel sediments and the AD Little study addressed the shoal areas that would not be dredged in channel deepening. I have heard no explanation of how it will be possible to dredge out to the channel from ports without going through the shoals other than: "that is outside the scope of this project".

Response. The private berths that would be deepened to take advantage of the 45-foot project all currently exist in the Delaware River. These berths currently extend from the shoreline of the river out to the Federal navigation channel. There are no shoals separating the berths from the federal channel.

The AD Little and NOAA sediment sampling and analysis programs did not sample specifically in the Corps' navigation channel. Most of their samples were obtained from areas outside the main channel that will not be dredged. The facilities that will benefit from the channel deepening are principally the oil refineries and their offloading infrastructure. All of the benefiting oil facilities utilize marginal piers and berths that are immediately adjacent to the navigation channel. See the figure below that illustrates the location of a typical oil facility berths relative to the navigation channel.



Comment. I have not seen adequate concern about the impact of the dredging activity itself. It is not possible to dredge this estuary without stirring up considerable sediment material that will be carried in the tidal currents and not be removed with the dredge spoils. The majority of the suspended sediment concentrations and mobility of the suspended sediments in the estuary today are due to tidal currents. The dredging activity will greatly increase this phenomenon and the suspended sediments resulting from the dredging will not be from the same surfacial layers that are resuspended naturally.

Response. A report titled *Near-Field Water Quality Modeling of Dredging Operations in the Delaware River* has been provided for the public record. The model selected for this evaluation is the DREDGE model, developed by the USACE for near-field (i.e., within a 200-foot mixing zone) evaluation of dredging operations. DREDGE was developed to assist in making a-priori assessments of environmental impacts from proposed dredging operations. DREDGE estimates the mass rate at which bottom sediments become suspended into the water column as the result of hydraulic and mechanical dredging operations and the resulting suspended sediment concentrations. These are combined with information about site conditions to simulate the size and extent of the resulting suspended sediment plume. DREDGE also estimates particulate and dissolved contaminant concentrations in the water column based upon sediment contaminant concentrations and equilibrium partitioning theory.

The results of the DREDGE model indicate the following, using environmentally conservative assumptions. Neither dissolved metals nor total dissolved PCBs released during cutterhead hydraulic dredging would exceed acute or chronic water quality criteria outside of the mixing zone, using the model. Even using a more conservative estimation approach, none of the metals would exceed water quality criteria at the edge of a 60-meter mixing zone except mercury and then only within 0.1 meters of the bottom. Given the conservative nature of these predictions, actual contaminant concentrations are expected to be considerably lower than predicted. None of the dissolved metal or total PCB concentrations predicted to be released to the water column as a result of bucket dredging were above the DRBC acute or chronic water quality criteria, even using the maximum sediment metal concentration measured in the area to be dredged. Even with a more conservative metals partitioning estimation approach, no metals with measurable sediment concentrations would exceed chronic or acute water quality criteria

Comment. I do not think that the assessment of the potential salt encroachment resulting form the dredging is accurate. The three-dimensional model used by the Corps is not accurate and early meetings with the Corps showed no inclination of using local input to refined the model.

Response. The Corps made a very significant investment of time, money, and inter-agency coordination to develop an appropriate 3D model that included the Delaware and Chesapeake estuaries. The coordination process was conducted with open invitation to any and all interested participants, including the University of Delaware. Periodic meetings were held to solicit comments on the scope, model development, scenarios to be modeled and to review results. Representatives from University from Delaware were invited but declined to attend these meetings. The WES 3D model applied to the Delaware and Chesapeake estuaries, and specifically to assess impacts of deepening the channel is widely regarded in the national and international modeling community as "state-of-art" and appropriate for the intended purposes.

Comment. I think that the unanswered questions of dredge spoils disposal are unacceptable. The current maintenance dredging produces very large volumes of spoils for which disposal sites are rapidly being filled. The deepening project and maintenance of the 45 foot channel will create much more spoils. I have seen the question of disposal sites constantly put off but have yet to see evidence that there is an environmentally acceptable solution. A few years ago, the proposal for disposal in the lower bay of some the dredge spoils was challenged because the site was a valuable fishing area. It was appalling to hear Corps representatives state that they had studied the location and were not aware of the biological value of the site.

Response. A dredged material disposal plan was developed by Corps and coordinated with the Federal and State resource agencies. This plan is documented in the Corps 1997 July SEIS.

EXHIBIT #84

PAT TODD, LEAGUE OF WOMEN VOTERS OF DELAWARE

Comment. We wonder how the Corps can substantiate claims of $74 million in benefits for Delaware. Motiva says they will receive no benefits. In fact, if the other oil refineries were to deepen their side channels, Motiva would be financially injured and has stated, it is against the deepening. The Wilmington Port thrives on the fact that it is a feeder or niche port; the Port has stated at state bond hearings that it has no plans to deepen its side channel to connect with a deeper main channel. Would the State benefit from dredging jobs? Maybe a few would be available, but the Corps must ask for national bids for the dredging so the work force would probably come from out-of-state and also, these would be only temporary jobs. Is the sand which is included as economic benefits for Port Mahon and Broadkill Beach and the erosion project for Kelly Island such a good deal for Delaware? Can the State afford the future maintenance costs for these projects?

Response. Concerns benefits to Delaware, as the Port of Wilmington pointed out during the June 6, 2001 public workshop and December 4, 2001 public hearing, the project will make the port more competitive in the world market and will enhance its ability for economic growth if facilities are shifted directly onto the Delaware River with access to the 45-foot channel. In addition, consider these benefits:

- Approximately $30 million in project funds will be spent at Kelly Island to restore 60 acres of tidal wetlands, protect approximately 5,000 feet of eroding tidal wetlands, and increase horseshoe crab spawning habitat
- Approximately $44 million in project funds will be spent to restore state-selected Atlantic Coast and Delaware Bay beaches.
- During construction, Delaware may accrue indirect economic benefits associated with 300 jobs and millions of dollars in wages, state revenues, and state and local tax receipts.

No benefits are claimed for Motiva . Also, no benefits are claimed for the Port of Wilmington because the Christina River access channel is shallower than the current 40-foot depth of the Delaware River main channel. A generalized input-output model has predicted 300 jobs for the state of Delaware to accrue from project construction. These potential indirect benefits for the state of Delaware are not included in the analysis to determine project justification (which considered impacts only to the national economic development account).

Comment. The League only sees economic costs to the State if this project goes ahead: the State of Delaware's share in the project, $10 million; the additional cost of maintenance dredging; the possible liability costs because the Corps is not assuming any liability for environmental damage; the possible cost of losing fishing industry revenues. This is occurring at a time when our State is strapped for funds.

Response. The financing plan that was developed by DRPA for the deepening project includes $7.5 million from State of Delaware not $10 million. If an environmental problem arises during dredging, the Corps and the project sponsor, the Delaware River Port Authority, will be responsible for any environmental remediation costs that occur during dredging of the Delaware River Main Ship Channel. This responsibility will be detailed in the Project Cooperation Agreement to be signed by the Corps and DRPA. Further, as the applicant for the DNREC permit, the Corps is legally and financially accountable for any remediation that falls within the permit parameters.

Comment. The League has a real concern for possible environmental damage. What will be the effect of resuspended toxic sediments during and after the dredging; the effect on the blue crab and recovering oyster populations; the other bottom dwelling creatures' habitat? What will be the effect of reintroducing dangerous toxins such as PCBs, pesticides, heavy metals on the wildlife such as the birds at Pea Patch Island, fish from the Delaware that are eaten by humans and other animals? What will be the effect on migratory species such as the horseshoe crabs and shore birds? The effect of blasting in the Claymont area on the fish population? The Corps says all this will be monitored. How long will it be monitored because these are not short-term effects? Will the monitoring be by an independent group? And at what expense?

Response. The Corps has conducted extensive testing to investigate potential impacts associated with sediment contamination. These tests have included chemical analysis of channel sediments to determine actual contaminant concentrations, and biological testing to evaluate toxicity concerns. Analysis of channel sediments has indicated that contaminants that are present, primarily heavy metals, are at concentrations considered low to medium. The results of state-of-the-art PCB analyses indicated that PCBs, which are ubiquitous in modern society, are one to three orders of magnitude lower in the navigation channel than in shallows outside the project area, and below levels of concern. It is likely that this is the result of regular dredging maintenance, which precludes contaminants from building up over time.

The Corps also evaluated toxicity of bottom sediments by directly exposing aquatic organisms to the sediment. Water column, or suspended solid particulate phase bioassays were run to evaluate water quality concerns associated with the release of contaminants from sediment into dredging or placement site water. Whole sediment, or benthic bioassays were run to evaluate impacts to bottom dwelling organisms that would reside in sediments placed in an aquatic environment. These tests, which are commonly used to evaluate the quality of dredged material, were developed and approved by the U.S. Environmental Protection Agency.

A variety of aquatic organisms were used in the bioassays including larval shrimp approximately four days old, fathead minnows hatched the previous day, and American oyster embryos approximately two-hours after fertilization. These young organisms are very fragile and sensitive to contaminants in their environment. Following established protocols, these organisms were exposed to samples of bottom sediment for a prescribed period of time to evaluate any differences in mortality between Delaware River channel sediment and clean laboratory sediment. All organisms (100%) survived the numerous bioassays that were run, which is a strong indication that channel sediments are not toxic to aquatic organisms.

Lastly, bioaccumulation tests were run with channel sediment from Delaware Bay to evaluate the potential uptake of contaminants by aquatic organisms at aquatic placement sites. This test allows aquatic organisms to live in the sediment for approximately one month, and then analyzes the animal tissues to evaluate any accumulation of contaminants. Tests were run with the hard-shelled clam and a marine worm. Overall, there was no evidence that contaminants accumulated in animals exposed to Delaware Bay sediment at greater concentrations than animals exposed to clean laboratory sediment. All tissues were representative of what one would expect of animals living in a clean environment.

State and Federal resource agencies have reviewed the Corps' sediment quality data. The States of Delaware, New Jersey and Pennsylvania have approved the deepening project by finding it consistent with their respective coastal zone management programs. The U.S. Environmental Protection Agency stated: "EPA continues to believe that there will be no adverse impacts associated with the disposal of sediments generated by the project." The U.S. Fish and Wildlife Service stated: "Results of chemical analyses provided within the biological assessment indicated that contaminant loads in the sediments tested are low."

Despite the positive results of the tests conducted to date, the Corps intends to monitor water quality during construction. This monitoring will insure that dredging and disposal activities associated with the deepening project do not adversely impact the aquatic resources of the Delaware River and Bay. The Corps has been working with the States of New Jersey and Delaware, and the Delaware River Basin Commission (DRBC), to develop an acceptable protocol for this type of monitoring. To date, the Killcohook, Oldmans, Pedricktown North and Pedricktown South CDFs have been monitored. Reports on the monitoring studies conducted at the Killcohook and Pedricktown North CDFs have been provided as part of the public record. The reports provide details on how CDFs would be monitored.

The Corps has also conducted modeling efforts to simulate the quality of water discharged from the Reedy Point South CDF during disposal operations, and contaminant concentrations in the water column resulting from dredging activity. These studies have also been included as part of the public record. Both the modeling results and the field monitoring studies indicate that dredging and dredged material disposal operations do not significantly impact water quality.

Refer to the general responses for "impacts on over-wintering female blue crabs", "oyster impacts", "horseshoe crab impacts from sand placement", "migratory shorebird impacts", "shortnose and Atlantic sturgeon concerns", and "monitoring".

EXHIBIT #85

JEFF STEIN, TAXPAYERS FOR COMMON SENSE

Comment. The Corps presents the project as having positive economic impacts for the State of Delaware. However economic impacts are not the same as net economic benefits and a finding of a project having economic impacts upon a state's economy is not the same as a project being cost-justified to the state. The Corps' estimate does not compare the with project condition to the without project scenario. Without such a comparison there is no way to determine if there is a net benefit to the State of Delaware of investing $10 million of state's taxpayer funds into this project as opposed to investing the same funds into some other jobs generating program. A useful and commissioned by the Delaware River Basin Commission found that there would be a 10.5% increased chance of oil spills if the Delaware River main channel is deepened to 45-feet.

Response. The Corps' benefit analysis compared navigation transportation costs to the national economic development account for both the 40-foot without project condition and the 45-foot with project condition. Benefits specific to a state such as Delaware were not a factor in the analysis used to determine project justification.

Comment. **Port of Wilmington:** The Corps cites the possibility of the Port of Wilmington, deepening its berths on the Christian River or relocating some cargo facilities to the Delaware River as opportunities for additional economic impact for the State of Delaware. However, there is no indication that the Port of Wilmington is planning to do this. In fact, the Port of Wilmington still has failed to deepen its berths on the Christina River from the current 35-foot depth and thus is not taking full advantage of the existing 40-foot Delaware River main channel. Also, the example the Corps gives of the Port of Wilmington constructing a new roll-on-roll-off facility the Delaware River is not pertinent in that roll-on-roll-off cargo, such as automobiles, is generally not transported on ships with drafts deeper than 40 feet.

Response. No benefits are claimed to the national economic development account for the Port of Wilmington. Refer to Mr. Sprague's testimony at the 4 December 2001 public hearing regarding potential benefits to Port of Wilmington.

Comment. Not only is this there a lack of justification for the State Delaware to invest $10 million into this federal deepening project, but the overall project also lacks economic justification from the federal taxpayer perspective.

Response. Economic justification to the National Economic Development account was determined in the Corps1992 Feasibility study phase and reaffirmed in the Corps Limited Reevaluation Report dated February 1998.

Comment. 80% of the project's benefits are based upon projections of large increases in crude oil imports and the ability of oil companies to transport that oil more efficiently in more fully loader oil tankers. However, since 1992 when the last Corps economic studies were completed, there is a clear trend of declining crude oil imports to the Delaware River. The Bush Administration and Congress' efforts to reduce U.S. dependence on foreign oil imports, and particularly imports from the Middle East following the events of September 11, put the Corps' 1992 projections in even more doubt. Furthermore, none of the six oil facilities the Corps has identified as project beneficiaries have made a firm, public commitment to deepen their berths.

Response. Comment noted on Taxpayers For Common Sense expectation for future of U.S. demand for oil. However, the U.S. Department of Energy in its December 2000 report projected that U.S. petroleum imports per day will increase by approximately 60% from the year 1999 to the year 2020. Also, the Corps does not require a legally binding written commitment from potential beneficiaries to deepen their berths.

EXHIBIT #86

JACK GALLOWAY, JOINT EXECUTIVE COMMITTEE FOR THE IMPROVEMENT & DEVELOPMENT OF THE PHILADELPHIA PORT AREA

Comments noted. No response required.

EXHIBIT #87

E. J. HUTCHINSON LETTER DATED DECEMBER 4, 2001

Comment. My primary concerns are:

1. The effect that deepening of the channel will have on salinity gradients in aquifers supplying potable water in Delaware.

2. Contamination of ground water by the dredge spoils.

3. What agency will guarantee our potable water quality if this deepening project goes forward?

Response. The Corps 3D numerical hydrodynamic/salinity modeling investigation for the Delaware estuary indicated that under certain hydrologic conditions, and at certain locations, there will be small but finite increases in salinity. These estimated salinity increases are negligibly small compared to the magnitude of natural salinity variability that occurs at most locations between Philadelphia and the sea. The natural salinity variability is principally dependent on antecedent hydrologic conditions (i.e., how much it rained in areas tributary to the estuary.) Other important natural factors that influence the distribution of salinity include normal astronomical tide forcing, coastal storms that "pump" additional seawater into the Delaware estuary, and the speed, direction, and duration of wind over the estuary surface.

Concerning the potential of fluids leaching from the dredged-material disposal area to infiltrate the underlying aquifers thereby causing contamination of the aquifers the following efforts were conducted.

The United States Geological Survey conducted studies of the Federally owned dredged material disposal areas used for the Delaware River Main Channel. In particular, a report entitled Evaluation of Ground-Water Flow from Dredged Material Disposal Sites in Gloucester and Salem Counties, New Jersey (USGS, 1995) was published which studied this concern. A letter dated 23 January1996 was then issued by the USGS, which summarized and referenced this and other relevant USGS reports.

The USGS concluded that *the concern that fluids leaching from the dredged-material disposal areas could infiltrate to the aquifer with recharge water can also be set aside.*

The USACE agrees with this conclusion, however, to ensure the safety of the main aquifers underlying the disposal areas, the USACE has completed installation of monitoring wells at *every* Federally-owned Main Channel dredged disposal area. The groundwater-monitoring program for the NJ sites has been approved by the NJDEP. The groundwater-monitoring program for Reedy Point North and Reedy Point South disposal areas (both located in the State of Delaware) has been submitted to DNREC for their approval.

Based on the above studies, it was concluded that there would be no detectable impact on the quality of water in Delaware aquifers resulting from the proposed Delaware River Main Channel deepening Project.

EXHIBIT #88

HOWARD NYGOOD

Comment. FROM THE NEWS-JOURNAL 5/20/98 :
The dredging project would cost Delaware taxpayers several million dollars and return no benefits to the state but would cost over a hundred employees in the lightening service. This service has an exemplary record of efficiency. Benefits would go to ports upriver in Pennsylvania which, along with Wilmington, have not committed themselves to deepening their ports or berths.

Response. Justification for this federal project is based on the benefits to the National Economic Development account. Benefits specific to the region, state, or an individual company are not a factor in the analysis for project justification. Also, the Corps does not require a legally binding written commitment from potential beneficiaries to deepen their berths.

Comment. FROM THE NEWS-JOURNAL 6/28/99:
The larger the ships the less maneuverability and thus the greater chance of collision or running aground and spilling oil to contaminate the entire Bay. This is especially pertinent when navigating upriver where there is rock unlike the lower Bay(former Governor Russell W. Peterson).

Response. The design vessel will be the same with the deepened Delaware River channel as with the current channel. Larger tankers are not expected nor analyzed in the Corps' benefit-cost evaluation due to the channel deepening.

Comment. FROM THE NEWS-JOURNAL 7/1-/2000:
Dredging the shipping channel would undoubtedly release toxins in a benthic area violating "Magnusson-Stevens" regulations. The release of toxins would have deadly effects on marine life and adversely impact the recreational fisheries in the state, which bring many millions of dollars to state coffers annually. In a study of possible effects of dredging in the Chesapeake Bay, the Corps of Engineers was found to have given false reports re the safety of dredging up toxins and had to reverse their findings.

Response. The Corps has conducted extensive testing to investigate potential impacts associated with sediment contamination. These tests have included chemical analysis of channel sediments to determine actual contaminant concentrations, and biological testing to evaluate toxicity concerns. Analysis of channel sediments has indicated that contaminants that are present, primarily heavy metals, are at concentrations considered low to medium. The results of state-of-the-art PCB analyses indicated that PCBs, which are ubiquitous in modern society, are one to three orders of magnitude lower in the navigation channel than in shallows outside the project area, and below levels of concern. It is likely that this is the result of regular dredging maintenance, which precludes contaminants from building up over time.

The Corps also evaluated toxicity of bottom sediments by directly exposing aquatic organisms to the sediment. Water column, or suspended solid particulate phase bioassays were run to evaluate water quality concerns associated with the release of contaminants from sediment into dredging or placement site water. Whole sediment, or benthic bioassays were run to evaluate impacts to bottom dwelling organisms that would reside in sediments placed in an aquatic environment. These tests, which are commonly used to evaluate the quality of dredged material, were developed and approved by the U.S. Environmental Protection Agency.

A variety of aquatic organisms were used in the bioassays including larval shrimp approximately four days old, fathead minnows hatched the previous day, and American oyster embryos approximately two-hours after fertilization. These young organisms are very fragile and sensitive to contaminants in their environment. Following established protocols, these organisms were exposed to samples of bottom sediment for a prescribed period of time to evaluate any differences in mortality between Delaware River channel sediment and clean laboratory sediment. All organisms (100%) survived the numerous bioassays that were run, which is a strong indication that channel sediments are not toxic to aquatic organisms.

Lastly, bioaccumulation tests were run with channel sediment from Delaware Bay to evaluate the potential uptake of contaminants by aquatic organisms at aquatic placement sites. This test allows aquatic organisms to live in the sediment for approximately one month, and then analyzes the animal tissues to evaluate any accumulation of contaminants. Tests were run with the hard-shelled clam and a marine worm. Overall, there was no evidence that contaminants accumulated in animals exposed to Delaware Bay sediment at greater concentrations than animals exposed to clean laboratory sediment. All tissues were representative of what one would expect of animals living in a clean environment.

State and Federal resource agencies have reviewed the Corps' sediment quality data. The States of Delaware, New Jersey and Pennsylvania have approved the deepening project by finding it consistent with their respective coastal zone management programs. The U.S. Environmental Protection Agency stated: "EPA continues to believe that there will be no adverse impacts associated with the disposal of sediments generated by the project." The U.S. Fish and Wildlife Service stated: "Results of chemical analyses provided within the biological assessment indicated that contaminant loads in the sediments tested are low."

Despite the positive results of the tests conducted to date, the Corps intends to monitor water quality during construction. This monitoring will insure that dredging and disposal activities associated with the deepening project do not adversely impact the aquatic resources of the Delaware River and Bay. The Corps has been working with the States of New Jersey and Delaware, and the Delaware River Basin Commission (DRBC), develop an acceptable protocol for this type of monitoring. To date, the Killcohook, Oldmans, Pedricktown North and Pedricktown South CDFs have been monitored. Reports on the monitoring studies conducted at the Killcohook and Pedricktown North CDFs have been provided as part of the public record. The reports provide details on how CDFs would be monitored.

The Corps has also conducted modeling efforts to simulate the quality of water discharged from the Reedy Point South CDF during disposal operations, and contaminant concentrations in the water column resulting from dredging activity. These studies have also been included as part of the public record. Both the modeling results and the field monitoring studies indicate that dredging and dredged material disposal operations do not significantly impact water quality.

EXHIBIT #89

DAVID R. KEIFER

Comment. I recall a concern over possible saline intrusion into the aquifers as a result of dredging that I cannot find discussed in the application.

Response. The Corps 3D numerical hydrodynamic/salinity modeling investigation for the Delaware estuary indicated that under certain hydrologic conditions, and at certain locations, there will be small but finite increases in salinity. These estimated salinity increases are negligibly small compared to the magnitude of natural salinity variability that occurs at most locations between Philadelphia and the sea. The natural salinity variability is principally dependent on antecedent hydrologic conditions (i.e., how much it rained in areas tributary to the estuary.) Other important natural factors that influence the distribution of salinity include normal astronomical tide forcing, coastal storms that "pump" additional seawater into the Delaware estuary, and the speed, direction, and duration of wind over the estuary surface. As a result, there will be no detectable impact on the quality of water in Delaware aquifers resulting from the proposed Delaware River Main Channel Deepening Project.

Comment. I can also find no discussion of possible impacts of the blasting in the Marcus Hook area on the area under the old Sun Oil refinery in southeastern Pennsylvania and northeastern Delaware that was once used for gas storage.

Response. The impact of blasting on the Sun Oil Refinery is negligible. The location, distance and magnitude of blasting in the Delaware River Channel do not warrant concern for this facility. Monitoring of vibration with respect to facilities along the shoreline is part of the contract to remove the rock. All acceptable limits for vibration will be maintained throughout the rock removal contract. Any damage to existing structures, although none is anticipated, will be the responsibility of the blasting contractor, and all necessary repairs will be performed at his expense.

Comment. Dredged material from the main channel of the Delaware does not make a wetland; it makes an area covered with dredged material. Natural processes over a great deal of time make a wetland.

Response. Wetlands have been successfully built using dredged material in the Chesapeake Bay. *Spartina alternifora* began to colonize the new wetland in the first growing season. Similar results are expected at Kelly Island since *Spartina* grows in adjacent wetlands and will provide a seed source.

Comment. That assumes that the dredged material is subject to becoming a wetland over time. I find it very hard to believe that the material from the main channel of the Delaware River can be anything useful. Humans have been using the River for navigation since the inhabitants of the Island Field Site walked this earth, if not before. I read what the consultants reports said about sediment composition but what if they are wrong or missed something? It boggles the mind to think of what may have fallen off or leaked out of all of those vessels over all of those years. To take the risk of spreading it around Kelly Island, Port Mahon, and Broadkill Beach to possibly help some businesses in and around Philadelphia is asking way too much.

Response. Bulk sediment analyses of Delaware Bay channel sediments were conducted to determine the total concentration of contaminants within the sediments. Chemical parameters included heavy metals, pesticides, PCBs, PAHs, and a variety of volatile and semi-volatile organics. To evaluate potential impacts to fish and wildlife resources, bulk sediment data were compared to ERL/ERM sediment guidelines. These guidelines provide an estimate of the potential for sediment contaminants to adversely effect aquatic resources. Through a comprehensive review of available data on sediment effects, researchers established two guideline values. These two values are referred to as effects range-low (ERL) and effects range-median (ERM). The researchers stated: "The two guideline values, ERL and ERM, delineate three concentration ranges for a particular chemical. The concentrations below the ERL value represent a minimal-effects range; a range intended to estimate conditions in which effects would be rarely observed. Concentrations equal to and above the ERL, but below the ERM, represent a possible-effects range within which effects would occasionally occur. Finally, the concentrations equivalent to and above the ERM value represent a probable-effects range within which effects would frequently occur." (Long et al. 1995).

Bulk sediment analyses of Delaware Bay sediments only detected heavy metals, extremely low concentrations of PCBs and di-n-butyl phthalate. The ERL guideline for PCBs is 22.7 parts per billion. The highest detected concentration of PCBs in Delaware Bay channel sediment samples was 0.02 parts per billion. There is no guideline for di-n-butyl phthalate, however, the State of New Jersey has developed a standard of 5,700 parts per million as a maximum concentration for clean residential areas. The maximum concentration of di-n-butyl phthalate in Delaware Bay channel sediment samples was 0.88 parts per million. Phthalates are used in manufacturing plastic products. It is likely that detection of di-n-butyl phthalate is not from sediment contamination, but the result of laboratory contamination as the sediments come in contact with plastics from the time samples are collected through the laboratory analysis. Table 1 compares the heavy metal data to ERL/ERM sediment guidelines. The actual bulk sediment concentrations have been previously provided to the Delaware DNREC. All heavy metal concentrations detected in Delaware Bay sediments were below the ERL levels except one sample concentration of nickel (sample concentration of 21.4 mg/kg, ERL concentration of 20.9 mg/kg) and two sample concentrations of cadmium (sample concentrations of 1.22 and 2.8 mg/kg, ERL concentration of 1.2 mg/kg). These samples were collected from locations known to contain fine grain material; this material would not be placed on beaches. All concentrations of heavy metals detected in areas to be dredged for beach nourishment were below ERL levels. Based on these results, there is no reason to believe

Table 1. Comparison of Delaware Bay Main Channel Sediment Data to ERL/ERM Sediment Guidelines

	ERL Value	ERM Value	% Samp. < ERL	% Samp. > ERL & < ERM	% Samp. > ERM
Antimony	2	25	69.6	30.4 *	0.0
Arsenic	8.2	70	100.0	0.0	0.0
Beryllium	NC	NC	NC	NC	NC
Cadmium	1.2	9.6	91.3	8.7	0.0
Chromium	81	370	100.0	0.0	0.0
Copper	34	270	100.0	0.0	0.0
Lead	46.7	218	100.0	0.0	0.0
Mercury	0.15	0.71	100.0	0.0	0.0
Nickel	20.9	51.6	95.7	4.3	0.0
Selenium	NC	NC	NC	NC	NC
Silver	1	3.7	100.0	0.0	0.0
Thallium	NC	NC	NC	NC	NC
Zinc	150	410	100.0	0.0	0.0

ERL/ERM guidelines are in mg/kg.

NC - Parameter has no established ERL/ERM guidelines.

Non-detections were included in the analysis at half the detection limit.

* - Antimony was not detected in any of the Delaware Bay samples. These samples were non-detections with high detection limits.

Long, E.R., D.A. MacDonald, S.L. Smith, and F.C. Calder. 1995. Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments.
Environmental Management 19(1):81-97.

that placement of Delaware Bay sand on Delaware beaches would impact aquatic resources from a contamination perspective.

To further evaluate sediment quality, water column and whole sediment bioassays were run to directly evaluate the impacts of sediment contaminants on living organisms. Bioassays provide information on the toxicity of individual contaminants, and also to indicate possible interactive effects of multiple contaminants. For Delaware Bay sediment samples, early life stages of the sheepshead minnow, the American oyster, a mysid shrimp, an infaunal amphipod, a burrowing polychaete and a bivalve mollusc were tested. In multiple tests with numerous individuals of each species, no toxicity (as defined by mortality) was observed.

As a final sediment quality check, bioaccumulation tests were run to evaluate the potential for organisms to accumulate contaminants from the channel sediment into body tissues, which could then be magnified up through the food web. For these tests, a bivalve mollusc and a burrowing polychaete were used. The organisms were allowed to live in the channel sediments for a 28-day test period, and then the soft body tissues were chemically analyzed. Control organisms living in completely clean sediment were also run for comparison. No pesticides, PCBs or PAHs were detected in any of the tissue samples. Some heavy metals were detected, however, these metals were also detected in the control organisms, and all tissue concentrations were within range of acceptable background tissue levels.

Overall, these test results indicate that dredging channel sand from Delaware Bay, and using the sand for beach nourishment, would not have an adverse effect on aquatic resources of the bay. There is no evidence of any potential contaminant problems. Wildlife resources that would be in contact with the beach sand or forage for food at the water line would also be unaffected. There are no concerns with regard to toxicity or bioaccumulation of contaminants through a food web with sand of this quality.

Comment. There will be an increase in maintenance-dredged material of 1,119,000 cy/yr. Where will that go and for how many years? The document indicates that the Corps is running out of space at existing disposal sites for dredging at current maintenance levels. So they must find more sites to maintain business as usual as well as getting yet more sites to place yet more dredged material. Rest assured that if the deepening project is approved and implemented, it would not be abandoned in the maintenance stage for lack of disposal sites.

Response. There is adequate capacity at the existing Corps upland confined disposal facilities in combination with added capacity of the proposed sites to be acquired by the project sponsor to accommodate the initial dredging quantity plus 50 years of maintenance dredging. Also, refer to response to question S7 **in EXHIBIT 73.**

Comment. In the 70's this was supposedly needed because tankers were getting bigger and bigger. The project was stopped. For their own reasons that had nothing to do with this project the shipping industry decided that tankers had gotten big enough. Now it is because container ships will be getting bigger.

Response. The 1970's study by the Corps concerned the potential for a deepwater port for tankers in the lower Delaware Bay, not the deepening of the Delaware River main navigation channel. The benefit analysis for the current study anticipated no change in the size of tankers with the channel deepening, just more efficient usage. Container vessels are shifting to larger, more efficient sizes in the post-Panamax size class. These container vessels are smaller than the tankers currently serving the Delaware River port system.

Comment. The horseshoe crabs have been around forever and will do just fine unless man does them in. The last thing they need is the help of the Corps of Engineers.

Response. Refer to the general response for "horseshoe crab impacts from sand placement."

EXHIBIT #90

STEVE CALLANEN, DELAWARE CHAPTER OF THE SIERRA CLUB

Comments noted. No response required.

EXHIBIT #91

DON P. AINSWORTH

Comment. From 1990 to 2000 US domestic waterborne freight traffic was down approximately five percent both inbound and outbound. During that same period waterborne traffic in the Mid Atlantic region covering the port markets of New . York/New Jersey, Philadelphia (including Delaware) and Baltimore was down 19 percent on the inbound side and 9.5 percent on the outbound side. Philadelphia was down 36 percent inbound and 18.5 percent outbound. New York/New Jersey was down 11.9 percent inbound, while Baltimore experienced little to no change. On the outbound side New York/New Jersey was down 2.3 percent and Baltimore down 13 percent. Clearly Philadelphia's domestic water traffic is shrinking faster that the country's, its region and the two major ports north and south of it. Most likely the same picture exists for international water traffic as well. Is the purpose of this proposed project to correct or ameliorate the erosion of Philadelphia's absolute and relative market shares of waterborne traffic?

Response. The same is not true for international waterborne commerce. Using Bureau of the Census trade statistics for the period 1990 to 2000, total international waterborne commerce handled by port in the Northeast (including New York/New Jersey, the Delaware River Port, and Baltimore) increased from 153.1 million tons to 169.1 million tons. That is a growth of 10.4 percent. General cargo tonnage handled by the Northeast posts during this period increased by 13 million tons or 60 percent. In this area – which contributes to most of the port-related jobs – the Delaware River Port increased by 4.1 million tons or by 92.9 percent. When compared to general cargo handled by competing ports, the market share for the Delaware River Port increased from 19.7 percent to 23.7 percent.

Every port on the U.S. East Coast either is deepening its shipping channel or has already done so. Other ports around the world have also created modern shipping channels to accommodate larger, deeper draft, vessels, and to remain competitive. Ships are getting larger, requiring deeper draft channels. These ships carry larger loads without increasing operating costs, thus reducing the landed cost of commodities and making them more competitive in the marketplace. If the Delaware River Port cannot accommodate these needs, the cargo will shift to ports that can. That will cost our region thousands of high-paying jobs and could increase the cost of doing business for local companies as well as increase the cost of commodities on store shelves.

Comment. What are the draft requirements of the next generation of vessels serving the major east coast ports? When are they expected to arrive on the scene? Will their future presence require further dredging in order to maintain economic competitiveness of the local area ports?

Response. Attached are tables which summarize the profiles of the vessels currently in use and of vessels now on order.

Crude Oil Tankers. Tankers drawing a maximum of 55-feet of water when they arrive at Delaware Bay will continue to dominate the trade. They will enter Delaware Bay at 55-foot draft and lighter to the maximum depth the shipping channel will allow, then proceed up the river to the refinery. If the U.S. Army Corps of Engineers does not modernize the Delaware River shipping channel, enormous quantities of crude oil will continue to be lightered in the environmentally sensitive Delaware Bay. If the Corps creates a modern shipping channel, lightering operations and their inherent risks will be greatly reduced. Examples of new tanker vessels include those introduced by Sun Oil.

Break Bulk Carriers (Steel and Slab Type Cargoes). As shown on the attached table, vessels of 50,000-to-79,999-dwt size, with drafts of 40.7-to- 43.3-feet currently account for about 20 percent of the world's bulk fleet. However, they account for 45 percent of the new bulk vessels on order. This size vessel is increasingly being used to transport steel slabs and steel products and bulk cargoes such as gypsum, ore and cement. Because they can carry larger loads, they can take advantage of economies of scale. With a

WORLD TANKER FLEET IN PROFILE

As of January 1, 2001

SIZE GROUP BY DWT	AVERAGE SIZE/DIMENSIONS/SPEED				IN FLEET			ON ORDER		
	LENGTH	BEAM	DRAFT	SPEED	VESSELS	DWT(M)	Avg DWT	VESSELS	DWT (M)	Avg DWT
10,000 - 19,999	469	70	28	14	585	8,762,578	14,979	30	484,000	16,133
20,000 - 29,999	568	83	34	15	405	10,968,700	27,083	19	456,700	24,037
30,000 - 44,999	594	96	37	15	708	26,781,900	37,828	120	4,631,769	38,598
45,000 - 59,999	650	106	40	15	249	12,811,712	51,453	27	1,258,000	46,593
60,000 - 79,999	758	113	42	15	217	15,056,602	69,385	13	904,464	69,574
80,000 - 119,999	794	136	46	15	529	50,844,339	96,114	68	7,157,377	105,256
120,000 - 199,999	892	149	54	15	283	40,908,615	144,553	64	10,073,214	157,394
200,000 - 319,000	1083	186	69	15	401	111,903,936	279,062	86	25,833,840	300,393
320,000 and Over	1221	215	76	15	41	16,789,734	409,506	3	1,320,000	440,000
TOTALS	**705**	**115**	**43**	**15**	**3,418**	**294,828,116**	**86,257**	**430**	**52,119,364**	**121,208**

Source: Clarkson Research Studies, *The Tanker Register 2001*

WORLD BULK CARRIER FLEET IN PROFILE AS OF JANUARY 1, 2001

SIZE GROUP BY DWT	AVERAGE SIZE/DIMENSIONS/SPEED					IN SERVICE			ON ORDER		
	SIZE DWT	LENGTH	BEAM	DRAFT	SPEED	SHIPS	DWT	Avg DWT	SHIPS	DWT	Avg DWT
Handy Size (10,000-34,999 dwt)											
10,000 - 19,999	16,118	479	71	29.2	14.3	634	10,131,724	15,981	16	233,260	14,579
20,000 - 24,999	23,148	538	79	32.2	14.5	555	12,895,229	23,235	14	310,900	22,207
25,000 - 29,999	27,560	574	82	33.1	14.5	800	22,138,371	27,673	54	1,507,100	27,909
Handymax (35,000-49,999 dwt)											
30,000 - 39,999	35,901	614	91	35.8	14.6	891	32,067,704	35,991	39	1,323,189	33,928
40,000 - 49,999	44,361	627	101	37.4	14.5	863	38,646,179	44,781	118	5,741,477	48,657
Panamax (50,000-79,999 dwt)											
50,000 - 59,999	55,163	705	105	40.7	15.0	122	6,692,939	54,860	71	3,704,600	52,177
60,000 - 79,999	68,554	745	106	43.3	14.5	934	65,015,077	69,609	172	12,787,764	74,347
Cape Size (80,000 dwt and over)											
80,000 - 99,000	87,063	807	127	44.0	14.5	42	3,728,590	88,776	11	100,600	9,145
100,000 - 149,999	138,447	886	140	55.4	14.4	226	32,070,516	141,905	0	0	0
150,000 & OVER	176,475	955	151	57.7	14.1	251	44,045,294	175,479	50	8,603,394	172,068
TOTALS	47,499	637	95	37.7	14.5	5,318	267,431,623	50,288	545	34,312,284	62,958

modern shipping channel, terminals on the Delaware River will be able to accommodate this size vessel.

Containerships. Mega Containerships of 3,000-to-7,000-teu's, are now being used in the Far East trade lanes, requiring 40-to-55-foot draft. Larger containerships of 7,200-to-9,800-teus are under construction, scheduled for delivery in 2003 and 2004. As these mega containerships are placed into the Far East trade lanes, the fourth generation post-Panamax containerships (3,000-to-5,000-teus, requiring 40-to-45-foot draft) will be repositioned. They will likely serve those U.S. East Coast ports that provide a modern shipping channel, efficient port terminals and access to inland transportation systems.

There are no plans to deepen the Delaware River Main Channel deeper than 45-feet. However, with a modern 45-foot channel, the Delaware River Port could accommodate the 60,000-dwt breakbulk and bulk cargo vessels and the post Panamax containerships.

WORLD CELLULAR CONTAINERSHIP FLEET IN PROFILE

As of April 1, 2001

CLASS (TEU Range)	AVERAGE SIZE/DIMENSIONS/SPEED						IN SERVICE			ON ORDER		
	SIZE (TEUs)	LENGTH (Feet)	BEAM (Feet)	DRAFT (Feet)	DEADWT	SPEED (KNOTS)	SHIPS	TEUs	Avg. TEUs	SHIPS	TEUs	Avg. TEUs
Feeder (100-499)	306	347.5	56.1	20.0	5,377	14.0	463	141,796	306	2	662	331
Feedermax (500-999)	706	451.8	70.5	25.9	11,049	16.5	536	378,320	706	56	42,790	764
Handy (1,000-1,999)	1,416	580.4	87.3	32.2	21,795	18.6	849	1,202,080	1,416	104	144,370	1,388
Sub-Panamax (2,000-2,999)	2,475	722.8	103.0	38.1	36,850	20.7	400	989,926	2,475	111	275,202	2,479
Panamax (3,000 & Over)	3,758	885.9	105.6	40.7	51,981	22.8	365	1,371,787	3,758	117	467,834	3,999
Post-Panamax (4,000 & Over)	5,548	952.8	131.2	44.3	71,171	24.5	146	810,040	5,548	124	748,426	6,036
TOTALS	**1,774**	**590.6**	**84.6**	**31.2**	**24,835**	**18.6**	**2,759**	**4,893,949**	**1,774**	**514**	**1,679,284**	**3,267**

Table 1. WORLD LINER FLEET AS OF APRIL 1, 2001

Vessel Type	Vessels	Deadwt Tons (millions)	TEU Cap'y (000s)
Container	2,739	70	4,811
Multi-Purpose	2,045	20.7	878
Ro/Ro	1,032	8.4	376
General Cargo Tramp	641	5.1	112
General Cargo Liner	522	9.5	33
Total Liner Fleet	**6,979**	**113.7**	**6,210**

Source: Clarkson Research Studies, The Containership Register 2001, pp. ix, x.

EXHIBIT #92

DAVID S. CHAPMAN, UNIVERSITY OF DELAWARE SEA GRANT, MARINE ADVISORY SERVICE

Comment noted. No response required.

EXHIBIT #93

MICHAEL RICHARDS

Comment. Another very strong issue was made by James G. Bryant of the Community Environmental Legal Defense Fund (Delaware Chapter) who spoke about the numerous health issues that would come into play should the dredging take place, the high rates of cancer that already exist in this State, the fact that he has diabetes which was caused by environmental conditions here in Delaware, and other issues. He spoke as a scientist who is knowledgeable about the PCB's and had his facts in order- all based on standard scientific testing. The Army Corp of Engineers kept using the phrase that certain contaminants were within acceptable levels, but seemed to have NO real research findings attached to those statements, as opposed to the ones presented by Mr. Bryant.

Response. After review of Mr. Bryant's testimony from the public transcript, and from two letters addressed to Lt. General Robert B. Flowers (13 November 2001 and 18 December 2001), we are unable to find any scientific fact or research findings to substantiate his statements. Conversely, Corps findings have been documented in numerous scientific reports that have been made part of the public record.

Comment. A third presenter made another very strong point, one I was not aware of, and that is that the technology is now moving for oil tankers to not draw as much water - and referred to a vessel that Sunoco has - and that they are not going inland, i.e. up rivers so much, but docking along the coast line to deliver their loads. This was very interesting - and I would like more information on this. Certainly as was pointed out in former Governor Peterson's letter, the larger the vessel the less maneuverability it has -and already we have these super huge vessels that are monstrous - and how much longer will we have oil anyhow? We need to be working towards alternate sources of energy as these fossil fuels are so quickly being used up. We have just returned from a 3 month trip to Europe - and I was impressed at all the number of windmills to power electricity we saw in Scotland, England, Denmark and Germany.

Response. New Sunoco chartered tankers have comparable sailing drafts to large tankers already in the fleet. These tankers first lighter at Big Stone Beach Anchorage and then navigate upriver to unload the remaining crude oil at the refinery dock.

EXHIBIT #94

W. FREDERICK LAHVIS MEDICAL CONSULTANT, STATE OF DELAWARE, DEPARTMENT OF HEALTH AND SOCIAL SERVICES

Comment. My primary concern is of contamination that does not penetrate to aquifer depth but which seeps directly into the river and bays. No containment system has to date proved 100% effective and according to a recent study by NOAA (National Oceanic and Atmospheric Agency) Delaware River sediments contain several significant contaminants including PCBs, dioxin and heavy metals. Dioxin is considered to be one of the most potent carcinogens known to man. Placing dredge material along the river shore, to me, is incomprehensible. Delaware already has one of the highest rates of cancer in the country so why place us at additional risk?

Response. Bulk sediment analyses of Delaware Bay channel sediments were conducted to determine the total concentration of contaminants within the sediments. Chemical parameters included heavy metals, pesticides, PCBs, PAHs, and a variety of volatile and semi-volatile organics. To evaluate potential impacts to fish and wildlife resources, bulk sediment data were compared to ERL/ERM sediment guidelines. These guidelines provide an estimate of the potential for sediment contaminants to adversely effect aquatic resources. Through a comprehensive review of available data on sediment effects, researchers established two guideline values. These two values are referred to as effects range-low (ERL) and effects range-median (ERM). The researchers stated: "The two guideline values, ERL and ERM, delineate three concentration ranges for a particular chemical. The concentrations below the ERL value represent a minimal-effects range; a range intended to estimate conditions in which effects would be rarely observed. Concentrations equal to and above the ERL, but below the ERM, represent a possible-effects range within which effects would occasionally occur. Finally, the concentrations equivalent to and above the ERM value represent a probable-effects range within which effects would frequently occur." (Long et al. 1995).

Bulk sediment analyses of Delaware Bay sediments only detected heavy metals, extremely low concentrations of PCBs and di-n-butyl phthalate. The ERL guideline for PCBs is 22.7 parts per billion. The highest detected concentration of PCBs in Delaware Bay channel sediment samples was 0.02 parts per billion. There is no guideline for di-n-butyl phthalate, however, the State of New Jersey has developed a standard of 5,700 parts per million as a maximum concentration for clean residential areas. The maximum concentration of di-n-butyl phthalate in Delaware Bay channel sediment samples was 0.88 parts per million. Phthalates are used in manufacturing plastic products. It is likely that detection of di-n-butyl phthalate is not from sediment contamination, but the result of laboratory contamination as the sediments come in contact with plastics from the time samples are collected through the laboratory analysis. Table 1 compares the heavy metal data to ERL/ERM sediment guidelines. The actual bulk sediment concentrations have been previously provided to the Delaware DNREC. All heavy metal concentrations detected in Delaware Bay sediments were below the ERL levels except one sample concentration of nickel (sample concentration of 21.4 mg/kg, ERL concentration of 20.9

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Beryllium	NC	NC	NC	NC	NC
Cadmium	1.2	9.6	91.3	8.7	0.0
Chromium	81	370	100.0	0.0	0.0
Copper	34	270	100.0	0.0	0.0
Lead	46.7	218	100.0	0.0	0.0
Mercury	0.15	0.71	100.0	0.0	0.0
Nickel	20.9	51.6	95.7	4.3	0.0
Selenium	NC	NC	NC	NC	NC
Silver	1	3.7	100.0	0.0	0.0
Thallium	NC	NC	NC	NC	NC
Zinc	150	410	100.0	0.0	0.0

ERL/ERM guidelines are in mg/kg.

NC - Parameter has no established ERL/ERM guidelines.

Non-detections were included in the analysis at half the detection limit.

* - Antimony was not detected in any of the Delaware Bay samples. These samples were non-detections with high detection limits.

Long, E.R., D.A. MacDonald, S.L. Smith, and F.C. Calder. 1995. Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments.
Environmental Management 19(1):81-97.

concentration of nickel (sample concentration of 21.4 mg/kg, ERL concentration of 20.9 mg/kg) and two sample concentrations of cadmium (sample concentrations of 1.22 and 2.8 mg/kg, ERL concentration of 1.2 mg/kg). These samples were collected from locations known to contain fine grain material; this material would not be placed on beaches. All concentrations of heavy metals detected in areas to be dredged for beach nourishment were below ERL levels. Based on these results, there is no reason to believe that placement of Delaware Bay sand on Delaware beaches would impact aquatic resources from a contamination perspective.

To further evaluate sediment quality, water column and whole sediment bioassays were run to directly evaluate the impacts of sediment contaminants on living organisms. Bioassays provide information on the toxicity of individual contaminants, and also to indicate possible interactive effects of multiple contaminants. For Delaware Bay sediment samples, early life stages of the sheepshead minnow, the American oyster, a mysid shrimp, an infaunal amphipod, a burrowing polychaete and a bivalve mollusc were tested. In multiple tests with numerous individuals of each species, no toxicity (as defined by mortality) was observed.

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As a final sediment quality check, bioaccumulation tests were run to evaluate the potential for organisms to accumulate contaminants from the channel sediment into body tissues, which could then be magnified up through the food web. For these tests, a bivalve mollusc and a burrowing polychaete were used. The organisms were allowed to live in the channel sediments for a 28-day test period, and then the soft body tissues were chemically analyzed. Control organisms living in completely clean sediment were also run for comparison. No pesticides, PCBs or PAHs were detected in any of the tissue samples. Some heavy metals were detected, however, these metals were also detected in the control organisms, and all tissue concentrations were within range of acceptable background tissue levels.

Overall, these test results indicate that dredging channel sand from Delaware Bay, and using the sand for beach nourishment, would not have an adverse effect on aquatic resources of the bay. There is no evidence of any potential contaminant problems. Wildlife resources that would be in contact with the beach sand or forage for food at the water line would also be unaffected. There are no concerns with regard to toxicity or bioaccumulation of contaminants through a food web with sand of this quality.

State and Federal resource agencies have reviewed the Corps' sediment quality data. The States of Delaware, New Jersey and Pennsylvania have approved the deepening project by finding it consistent with their respective coastal zone management programs. The U.S. Environmental Protection Agency stated: "EPA continues to believe that there will be no adverse impacts associated with the disposal of sediments generated by the project." The U.S. Fish and Wildlife Service stated: "Results of chemical analyses provided within the biological assessment indicated that contaminant loads in the sediments tested are low."

Despite the positive results of the tests conducted to date, the Corps intends to monitor water quality during construction. This monitoring will insure that dredging and disposal activities associated with the deepening project do not adversely impact the aquatic resources of the Delaware River and Bay. The Corps has been working with the States of New Jersey and Delaware, and the Delaware River Basin Commission (DRBC), to develop an acceptable protocol for monitoring the effluent discharged from CDFs to the river during disposal operations. To date, the Killcohook, Oldmans, Pedricktown North and Pedricktown South CDFs have been monitored. Reports on the monitoring studies conducted at the Killcohook and Pedricktown North CDFs have been provided as part of the public record. The reports provide details on how CDFs would be monitored and analysis of past results.

The Reedy Point South CDF is the only site to be used in Delaware. The Corps has also conducted modeling efforts to simulate the quality of water discharged from the Reedy Point South CDF during disposal operations, and contaminant concentrations in the water column resulting from dredging activity. These studies have also been included as part of the public record. Both the modeling results and the field monitoring studies indicate that dredging and dredged material disposal operations do not significantly impact water quality.

Concerning the potential of fluids leaching from the dredged-material disposal area to infiltrate the underlying aquifers thereby causing contamination of the aquifers the following efforts were conducted.

The United States Geological Survey conducted studies of the Federally owned dredged material disposal areas used for the Delaware River Main Channel. In particular, a report entitled Evaluation of Ground-Water Flow from Dredged Material Disposal Sites in Gloucester and Salem Counties, New Jersey (USGS, 1995) was published which studied this concern. A letter dated 23 January1996 was then issued by the USGS which summarized and referenced this and other relevant USGS reports.

The USGS concluded that *the concern that fluids leaching from the dredged-material disposal areas could infiltrate to the aquifer with recharge water can also be set aside.*

The USACE agrees with this conclusion, however, to ensure the safety of the main aquifers underlying the disposal areas, the USACE has completed installation of monitoring wells at *every* Federally-owned Main Channel dredged disposal area. The groundwater monitoring program for the NJ sites has been approved by the NJDEP. The groundwater-monitoring program for Reedy Point North and Reedy Point South disposal areas (both located in the State of Delaware) has been submitted to DNREC for their approval.

EXHIBIT #95

SYLVIA LAHIS

Comment. I believe that the dumping of toxic substances from the dredging of the Delaware River by the Army Corps of Engineers does not fit in with these plans.

Response. The Corps has conducted extensive testing to investigate potential impacts associated with sediment contamination. These tests have included chemical analysis of channel sediments to determine actual contaminant concentrations, and biological testing to evaluate toxicity concerns. Analysis of channel sediments has indicated that contaminants that are present, primarily heavy metals, are at concentrations considered low to medium. The results of state-of-the-art PCB analyses indicated that PCBs, which are ubiquitous in modern society, are one to three orders of magnitude lower in the navigation channel than in shallows outside the project area, and below levels of concern. It is likely that this is the result of regular dredging maintenance, which precludes contaminants from building up over time.

The Corps also evaluated toxicity of bottom sediments by directly exposing aquatic organisms to the sediment. Water column, or suspended solid particulate phase bioassays were run to evaluate water quality concerns associated with the release of contaminants from sediment into dredging or placement site water. Whole sediment, or benthic bioassays were run to evaluate impacts to bottom dwelling organisms that would reside in sediments placed in an aquatic environment. These tests, which are commonly used to evaluate the quality of dredged material, were developed and approved by the U.S. Environmental Protection Agency.

A variety of aquatic organisms were used in the bioassays including larval shrimp approximately four days old, fathead minnows hatched the previous day, and American oyster embryos approximately two-hours after fertilization. These young organisms are very fragile and sensitive to contaminants in their environment. Following established protocols, these organisms were exposed to samples of bottom sediment for a prescribed period of time to evaluate any differences in mortality between Delaware River channel sediment and clean laboratory sediment. All organisms (100%) survived the numerous bioassays that were run, which is a strong indication that channel sediments are not toxic to aquatic organisms.

Lastly, bioaccumulation tests were run with channel sediment from Delaware Bay to evaluate the potential uptake of contaminants by aquatic organisms at aquatic placement sites. This test allows aquatic organisms to live in the sediment for approximately one month, and then analyzes the animal tissues to evaluate any accumulation of contaminants. Tests were run with the hard-shelled clam and a marine worm. Overall, there was no evidence that contaminants accumulated in animals exposed to Delaware Bay sediment at greater concentrations than animals exposed to clean laboratory sediment. All tissues were representative of what one would expect of animals living in a clean environment.

State and Federal resource agencies have reviewed the Corps' sediment quality data. The States of Delaware, New Jersey and Pennsylvania have approved the deepening project by finding it consistent with their respective coastal zone management programs. The U.S. Environmental Protection Agency stated: "EPA continues to believe that there will be no adverse impacts associated with the disposal of sediments generated by the project." The U.S. Fish and Wildlife Service stated: "Results of chemical analyses provided within the biological assessment indicated that contaminant loads in the sediments tested are low."

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The Corps has also conducted modeling efforts to simulate the quality of water discharged from the Reedy Point South CDF during disposal operations, and contaminant concentrations in the water column resulting from dredging activity. These studies have also been included as part of the public record. Both the modeling results and the field monitoring studies indicate that dredging and dredged material disposal operations do not significantly impact water quality.

Comment. First of all the Army Corps is known to have a dismal track record. They have created environmental problems in the Mississippi River Valley and in the Everglades that caused taxpayers millions of dollars to reverse. Whoever wants substantial proof of what the Corps' dredging can do, she or he can take a trip to Kelly Island near the Little Creek Wildlife refuge. Will this area go the way of Killcohook?

Response. Wetlands have been successfully built using dredged material in the Chesapeake Bay. *Spartina alternifora* began to colonize the new wetland in the first growing season. Similar results are expected at Kelly Island since *Spartina* grows in adjacent wetlands and will provide a seed source. Killcohook is a dredged disposal and was not planned to be a wetland.

Comment. At one of the Mayor's Advisory Council meetings, Mayor Baker told us that Wilmington is fortunate to have so many beautiful waterways surrounding it. When shown a map of the city, I noticed precious waterfront land that could be used for housing or for a public park. I was told that it would be impossible to build there because the Army Corps has been dumping toxic dredge there for years The area is contaminated. Why doesn't DNREC test the areas where dumping has already occurred to look for contaminates? It appears that the Corps thinks of this state as a dumping ground. Once they are finished, we will hardly be able to call Delaware a liveable place.

Response. The Corps does operate two confined disposal facilities, which are used to maintain the navigation channel to the State-owned Port of Wilmington. These sites are permitted by the Delaware Department of Natural Resources and Environmental Control. We are not aware of any toxic contaminant issues associated with these sites.

EXHIBIT #96

NORMAN, BARTHLESON, PRESIDENT, CAPE SHORES HOMEOWNERS ASSOCIATION

Comment. Our Homeowners have requested in the past to be designated a "beneficial use site" and we again request the designation. The benefits derived including economic well being and good beaches far outweigh any potential negative effects.

Comment noted. No response required.

EXHIBIT #97

IRA WAYNE SPENCER, INTERNATIONAL LONGHSHOREMAN'S ASSOCIATION

Comments noted. No response required.

EXHIBIT# 98

COASTWATCH ENGINEERING AND PLANING OF BALTIMORE MARYLAND

Response. This exhibit contains Corps response to Motiva's letter dated 27 November 2001. No response is required.

EXHIBIT# 99

MAYA K. van ROSSUM LETTER DATED DECEMBER 7, 2001

Comment. The Corps claimed that the study done by A.D. Little which demonstrated high levels of toxins in Delaware Estuary sediments did not have any areas overlapping with the Corps sampled areas. The enclosed report states "The disagreement between USACE and Arthur D. Little (ADL) on the heavy metals and pesticides concentrations of the Delaware River sediments are of the order of 800% to 2800%,, for similar parts of the river -- ADL values being higher than USACE values." (emphasis added)

Response. The difference in contaminant concentrations between the Arthur D. Little study and Corps studies for similar parts of the river was highlighted in the Corps 1997 Supplemental Environmental Impact Statement. However, the Arthur D. Little study collected sediment samples from shoal areas while the Corps collected samples from the navigation channel. The referenced December 1998 report prepared by researchers from the University of Delaware does not provide any new data or actual analyses to suggest that the deepening project would result in contaminant problems. The researchers based their conclusions on existing studies that were not conducted within the navigation channel, or at locations where dredged material would be placed. They do acknowledge that "the data collected by the USACE is recognized to be the most extensive, in most cases, their numbers of heavy metal and pesticide concentrations of the sediment are on the lower side compared with other published and non-published results." However, they criticize the data by simply stating "the conclusions appear doubtful." No facts or direct evidence are provided to support this position, although they do indicate that other reports were more elaborate.

Comment. The enclosed report also discusses the need for additional research regarding potential impacts to drinking water aquifers.

Response. An analysis of potential impacts of the project on drinking water aquifers and groundwater is presented in the July 1997 SEIS **(EXHIBT 4)** in Sections 5.10 and 7.0 respectively. At the request of the Corps, the U.S. Geological Survey was tasked to make an assessment or investigate impacts of the dredging project on the drinking water aquifers. The concerns generally focused on three areas of concern.

- (1) Dredging breaches confining unit
- (2) Saltwater in river encroachment onto well-recharge areas
- (3) Disposal areas effecting nearby wells

To address the above concerns the U.S. Geological Survey (USGS) subsequently performed three separate studies. The USGS issued three separate reports as listed below.

1. Evaluation of Ground-Water Flow from Dredged Material Disposal Sites in Gloucester and Salem Counties, New Jersey (USGS, 1995).

2. Hydrogeologic Conditions Adjacent to the Delaware River, Gloucester, Salem and Cumberland Counties, New Jersey (USGS, 1996).

3. Selected Hydrogeologic and Chloride-Concentration Data for the Northern and Central Coastal Area of New Castle County, Delaware (USGS, 1998).*

** Note draft report was prepared in 1996.*

A letter dated 23 January1996 was then issued by the USGS, which summarized their findings and referenced these reports. USGS investigation or analysis of the above concerns reached the following findings:

In summary, the concerns about increasing the potential for saltwater from the river to infiltrate into the adjacent aquifers, either as a result of dredging through a confining unit or as a result of the upstream movement of saltwater in the deepened channel can be set aside. No significant confining units will be breached and the saltwater will not significantly move upstream to increase the threat of saltwater intrusion.

The concern that fluids leaching from the dredged-material disposal areas could infiltrate to the aquifer with recharge can also be set aside.

Since the completion of that study and in cooperation with NJDEP and DNREC, the Corps has installed monitoring wells at all Federally owned CDFs that are or will be used for placement of dredged material from the maintenance of the existing 40-foot Delaware River Main Channel as well as from the deepening project in the States of New Jersey and Delaware. Also, groundwater-monitoring wells will be installed at the new upland disposal sites that will be developed for the deepening project. Groundwater monitoring plans have been submitted to NJDEP and DNREC for their approval. Upon approval, the Corps will commence the groundwater monitoring.

Note Corps has provided responses to MAYA K. van ROSSUM LETTER DATED June 5, 2001 as part of the June 6, 2001 public workshop (EXHIBIT 40)

EXHIBIT# 100

JIM STEFFENS DELAWARE CHAPTER OF THE SIERRA CLUB

Comment. My comments pertain to certain aspects of the project, particularly the possibility that deepening the channel may cause greater encroachment of saltwater further up the river. This is of concern, since higher levels of salt may cause the oyster beds in the river to become more susceptible to disease. These beds are only now recovering from previous disease episodes.

The Corps claim that they have modeled the effects of deepening the channel, and that they foresee insignificant increases in salinity. However, in his comments at the hearing on 4 December 2001, Colonel Brown made reference to the report generated by a consultant to the Motiva refinery, who examined the effects of the deepening project Motiva's side channels. Colonel Brown implied that the increased sedimentation predicted was, in the opinion of the Motiva consultant, the result of increased salinity.

Although I have not yet seen the Motiva consultant's report nor been able to compare his estimate of increased salinity with that estimated by the Corps, I am concerned that there may be a discrepancy between these two estimates, especially since the Corps has never presented modeling data detrimental to its case, and since I see no reason why the Motiva consultant would have a reason to be biased against the channel deepening (all parties agree that the deepening offers no direct benefit to Motiva).

Response. The consultant to Motiva, CoastWatch, did not perform salinity modeling, nor did they develop any estimates of increased salinity related to the proposed channel deepening. CoastWatch incorrectly quoted and applied values of Corps-predicted salinity change that they then used in their analysis. CoastWatch then concluded that the small salinity changes predicted by the Corps of Engineers model for some locations under certain conditions would lead to increased shoaling at Motiva's facility by a factor of 1.5 to 2. We continue to assert that the documentation provided by CoastWatch is superficial, fundamentally in error, and does not support the conclusions that are asserted. Also, refer to Corps response in **EXHIBIT 66.**

Comment. I should also point out that salinity driven increases in sedimentation may then also be a factor for the Port of Wilmington as well, particularly as the port plans to move operations directly on the Delaware River shoreline. The additional costs of any additional dredging must be considered in the benefit-cost analysis for the State of Delaware, in addition to the loss of revenue to state watermen if the oyster beds are affected.

Response. The Corps of Engineers conducted a sedimentation investigation for Wilmington Harbor between 1998 and 2001. The effort included collection of appropriate prototype data (tide, salinity, suspended sediment and currents) as well as development of a state-of-the-art numerical 3D circulation and sedimentation model. The purpose of this effort was to determine if structural modifications could be made to the present configuration of the port that would lead to cost-effective reductions on the project's shoaling rate. The study indicated that tidal circulation patterns within Wilmington Harbor, combined with proximity to the high ambient suspended sediment concentrations in the adjacent Delaware River, are responsible for the shoaling problem. There was no correlation found between Wilmington Harbor salinity variations and subsequent rate of shoaling.

EXHIBIT# 101

LESLIE G. SAVAGE DELAWARE AUDUBON SOCIETY

Comment. We ask the question how much water will be pulled down from the Delaware River Water Basin in order to accommodate the project's needs? What will be the impact to existing wells and water supplies to the communities to our north and to the northern parts of New Castle county that rely on recharges from these northern sources for drinking water supplies(for example, the Brandywine River)? Much of the region is currently seeing drought conditions and experience drought conditions regularly during the summer months.

Response. Any volume of sediment removed from the bottom of the navigation channel is immediately replaced by adjacent estuarine water. The volume rate of this sediment removal is so low as to be completely negligible when viewed against the volume of estuary water available to replace it. A typical hydraulic dredge working in the Delaware might remove on the order of 20,000 cubic yards of sediment in 24 hours. That equates to a volumetric sediment removal rate of about 6 cubic feet per second (cfs). For perspective, consider that the long-term average flow rate of fresh water at Trenton is about 12,000 cfs, or that tidal forcing at the mouth of the estuary can lead to flow rates on the order of 4,000,000 cfs at the time of peak flood or ebb. The notion that dredging sediment from the estuary bottom will "drain" fresh water from the non-tidal portion of the river, or from other places within the watershed, is scientifically unsound.

In regard to the question on impacts to "water supply" and aquifer recharge, it should be noted that the proposed channel deepening will create no new breaches in aquifers that provide water supply to communities of facilities adjacent to the Delaware estuary

It is our understanding that DNREC is currently studying groundwater in New Castle County and that a new comprehensive groundwater model is being constructed. The current problem of over pumping in States of Delaware and New Jersey will not be effected by the proposed deepening project.

Comment. It has long been our assertion that the Cost/Benefit Ratio calculated by the Army Corp of Engineers is skewed unrealistically in favor of the project. The Corp's calculations for the project indicate that 80% of the projected benefits of the project will be accrued by the six oil refinery locations in the northernmost portion of the project area (Marcus Hook, PA and north). They assert that much of this savings will come about simply by eliminating the need for two lightering operations per shipment of oil. With the need for only one, the oil companies will reduce "operating costs". They claim that the region will see the benefits of these reduced costs through more jobs available at the refineries and the reduced costs will be passed along to the consumer at the pump. Since many of those refinery locations are operating at capacity or close to capacity at current, the prospect of additional jobs is questionable and offset by the loss of jobs in the lightering industry. Historically, most oil companies do not pass these kinds of savings on to the consumers in the region but use these to enhance their profitability to their shareholders.

Response. In accordance with the Corps regulation, ER 1105-2-100, navigation National Economic Development account (NED) benefits accrue from the reduction in transportation costs and the resultant increase in the relative value of the output of goods and services. The NED benefit analysis does not assess the potential impact on jobs or a reduction in costs to consumers. Specific savings on a regional, state, local, or company-specific basis are not evaluated in a Corps economic analysis to determine project justification.

Comment. Today, there exists credible research and evidence that global warming is real and is a result of our consumption of fossil fuels, such as oil. It is also clear that to provide long term energy without irreparable damage to our earth's ecosystems, we must develop cleaner burning, sustainable energy sources and reduce our dependence on fossil fuels. With these environmental concerns in mind, along with the realization that less dependence on foreign oil would enhance our national security, we foresee a future with far less need for oil importation and refining. We ask the question, "Is it wise to invest much of the taxpayer's money in a project that offers a limited lifetime benefit, since 80% of the project benefits would be realized by precisely the kinds of companies which we will need less of in the future?"

Response. Comment noted on Delaware Audubon Society expectation for future of U.S. demand for oil. However, the U.S. Department of Energy in its December 2000 report projected that U.S petroleum imports per day will increase by approximately 60% from the year 1999 to the year 2020.

Comment. The lack of clear liability for any unforeseen environmental damages that may evolve over time due to the project is the greatest concern Delaware Audubon sees for the state. The Army Corp has a "hold harmless "clause built into all their contracts. The local sponsor is the Delaware River Port Authority. They are the ones who we said to have initiated the project. If this is the case, they should be the ones making the application for the subaqueous lands permit and thus assuming the liability for damages related to the project construction and lifetime. To date, they have not even signed the local sponsor agreement and the Army Corp is making application to the State of Delaware when they clearly stated they have no financial liability for remediation of problems for the lifetime of this project. With this unclear commitment to liability, the State of Delaware would most likely be forced to assume liability for remediation of long-term environmental damage. The State of Delaware must not be left in a position of being held liable for damages for this project. The cost of remediation of such damages could make the $10 million that the state would chip in for the cost of this project look like pocket change. Delaware Audubon asks "Does the State of Delaware have that kind of money available to remedy all possible environmental consequences posed by this project should we be left holding the "liability bag''?"

Response. If an environmental problem arises during dredging, the Corps and the project sponsor, the Delaware River Port Authority, will be responsible for any environmental remediation costs that occur during dredging of the Delaware River Main Ship Channel. This responsibility will be detailed in the Project Cooperation Agreement to be signed by the Corps and DRPA. Further, as the applicant for the DNREC permit, the Corps is legally and financially accountable for any remediation that falls within the permit parameters.

Comment. Delaware Audubon questions the overall benefit to the State of Delaware. The State of Delaware is experiencing a tighter budget than we have in a number of years. The Army Corp of Engineers has put forth a number of figures to project the financial benefit to Delaware, if their deepening project were to occur. We would like to see the data they used to arrive at these dollar projections. What does not appear to be built into their financial forecast is the cost to our already established income sources on which the project might have a negative impact. For example, during horseshoe crab spawning season the state plays host to tourists from all over the world who come to observe the annual northerly trek of migratory birds. Birding is one of the most popular nature related recreational activities and generates a great deal of money both for local businesses and governments but for the state as well. Should the already stressed horseshoe crab population suffer further declines due to Corp activities, the migratory birds suffer and this has a negative impact on tourism dollars taken in.

Response. The Kelly Island Wetland Restoration and sand placement at Port Mahon and Broadkill Beach are expected to benefit spawning horseshoe crabs and the shorebirds that feed on their eggs. Also, refer to the general responses for "horseshoe crab impacts from sand placement" and "migratory shorebird impacts." The potential for increased tourism from the improved birding activities exists as a result of the proposed wetland restoration and sand placements.

Comment. The Army Corp tells us that one of the benefits to the state is the use of sand for beach replenishment. Delaware has an ongoing need for beach replenishment by virtue of being a coastal state. Dredging the Delaware River Main Channel and beach replenishment are two separate issues. Why should Delaware give the Corp a permit to tear up 108 miles of the Delaware River, much of it containing substantial levels of toxins, heavy metals and PCB's to get a small portion of that sand placed on our beaches for replenishment? If this is such a great deal for Delaware, why do we have to pay our $10 million share of the project to allow the Corp to dump our sand on our beach, instead of in a confined disposal site? The Corp is required to pay for disposal of dredged materials as part of the project costs.

Response. In the Delaware Bay portion of the project, dredged material from the deepened channel primarily consists of sand. Based on coordination, with Federal and State resource agencies, it was concluded that this sand should be used for beneficial uses such as beach nourishment/replenishment. Also, refer to responses on PCB's.

Comment. Ironically, the projects 80% beneficiaries are those 6 oil refinery locations in Pennsylvania while the one oil refinery in Delaware, Motiva located in Delaware City, would see no benefit from the deeper channel and actually be harmed. Because of the refinery's location on the Delaware they are unable to dock a deeper draft ship. They are unable to deepen their berths due to the substantial silting at their location Motiva has officially, on the record stated they are against this deepening since they believe that the increased main channel depth would actually increase their need to maintenance dredge their existing berths due to increased silting over the already heavy amount. What benefit is there to the State of Delaware in granting a permit that helps lower operating costs to oil refineries that operate in direct competition with Motiva while increasing operating costs to Motiva?

Response. We do not concur that the Delaware River Channel Deepening project will increase Motiva's operating costs. Please refer to our detailed responses in **EXHIBIT 66.**

Comment. Port of Wilmington

Delaware Audubon is thrilled to know that the Port of Wilmington is currently fiscally sound and highly profitable. The new, world-class refrigeration units are not only a source of great pride but represent a highly profitable niche market in fresh produce which the Port of Wilmington has come to be known for.

Dennis Rochford adamantly states that the businesses along the Delaware River will not be second to the Port of New York City. Delaware Audubon disputes this argument as illogical. Irregardless of depth how could any port, including the Port of Wilmington which lies close to 100 miles upriver, be in direct competition with a port which is located directly on the Atlantic Ocean? Delaware Audubon instead believes that the Port of Wilmington has the perfect opportunity to become a regional port needed to move goods initially brought into the Port of New York bound for Delaware and surrounding areas. The transportation of goods by ship from New York to our region has to be at least as cost effective as train or truck. With this kind of thinking, the Port of Wilmington could guarantee they will continue to be profitable. Has the Port of Wilmington taken steps to develop this type of business venture? We strongly feel that there are many opportunities that the Port of Wilmington could explore to provide long-term job security and profitability, just as they have done thus far, without requiring a deeper main channel. We note there are new ships being designed to carry larger quantities of oil in rivers where a shallower draft is necessary. With this kind of forward thinking, it is possible that more ships that carry other cargos will be designed for the shallower draft as well. The Port of Wilmington must explore the whole range of business opportunities available.

Response. Comment noted. The Port of Wilmington is not included in the Corps' benefit analysis.

Comment.

Horseshoe Crabs

The Delaware Bay is the epicenter of spawning activity for the Atlantic Coast Horseshoe Crab population. Hundreds of thousands of migratory shorebirds each spring depend on abundant supplies of horseshoe crab eggs on which to refuel as they make their way north from their wintering grounds in South America to their breeding grounds in the Artic. The American Bird Conservancy has listed the Delaware Bay as one of 100 globally important birding areas.

Horseshoe crabs are also commercially fished as bait for the conch and eel fishing industries. The blue blood of the horseshoe crab provides a critical element in medical research. The Atlantic States Marine Fisheries Commission places such importance on the horseshoe crab that they opt for risk-averse policies.

The value of this amazing prehistoric creature is clear. What is unclear is why the horseshoe crab population as a whole is stressed and declining. Much more research is needed. It is important for us to have the time to understand what factors are forcing the population downward before we proceed with any project that has the potential to magnify the stresses responsible for their decline in the first place.

Response. Refer to the general response for "horseshoe crab impacts from sand placement".

Comment.

Hot Spots and Analyses

Delaware Audubon disagrees with the U.S. Army Corp of Engineers that their bulk sediment tests clearly show no large toxic contaminations that prevent the deepening. Even their averaged sediment test results showed excessive levels of a number of heavy metals, one pesticide and two PCBs. These test results were from the main channel and bend areas to be widened. These results do not show data from the shallower sides of the Delaware River, since this is not part of the original project area. However, the levels of toxins and contaminates from these shallower areas are pertinent to the life time of the project and tend to be higher than those found in the main channel. Sediment from the sides will "drift" overtime to the deeper main channel. The necessary maintenance dredging will then reintroduce these contaminates over time back into the water and food chain. In addition, these will then be placed in the confined disposal facilities (CDF's) creating the possibility they could leech into groundwater or surrounding wells, not to mention the impact to crops and wildlife in the CDF area.

Response. The Corps has conducted extensive testing to investigate potential impacts associated with sediment contamination. These tests have included chemical analysis of channel sediments to determine actual contaminant concentrations, and biological testing to evaluate toxicity concerns. Analysis of channel sediments has indicated that contaminants that are present, primarily heavy metals, are at concentrations considered low to medium. The results of state-of-the-art PCB analyses indicated that PCBs, which are ubiquitous in modern society, are one to three orders of magnitude lower in the navigation channel than in shallows outside the project area, and below levels of concern. It is likely that this is the result of regular dredging maintenance, which precludes contaminants from building up over time.

The Corps also evaluated toxicity of bottom sediments by directly exposing aquatic organisms to the sediment. Water column, or suspended solid particulate phase bioassays were run to evaluate water quality concerns associated with the release of contaminants from sediment into dredging or placement site water. Whole sediment, or benthic bioassays were run to evaluate impacts to bottom dwelling organisms that would reside in sediments placed in an aquatic environment. These tests, which are commonly used to evaluate the quality of dredged material, were developed and approved by the U.S. Environmental Protection Agency.

A variety of aquatic organisms were used in the bioassays including larval shrimp approximately four days old, fathead minnows hatched the previous day, and American oyster embryos approximately two-hours after fertilization. These young organisms are very fragile and sensitive to contaminants in their environment. Following established protocols, these organisms were exposed to samples of bottom sediment for a prescribed period of time to evaluate any differences in mortality between Delaware River channel sediment and clean laboratory sediment. All organisms (100%) survived the numerous bioassays that were run, which is a strong indication that channel sediments are not toxic to aquatic organisms.

Lastly, bioaccumulation tests were run with channel sediment from Delaware Bay to evaluate the potential uptake of contaminants by aquatic organisms at aquatic placement sites. This test allows aquatic organisms to live in the sediment for approximately one month, and then analyzes the animal tissues to evaluate any accumulation of contaminants. Tests were run with the hard-shelled clam and a marine worm. Overall, there was no evidence that contaminants accumulated in animals exposed to Delaware Bay sediment at greater concentrations than animals exposed to clean laboratory sediment. All tissues were representative of what one would expect of animals living in a clean environment.

State and Federal resource agencies have reviewed the Corps' sediment quality data. The States of Delaware, New Jersey and Pennsylvania have approved the deepening project by finding it consistent with their respective coastal zone management programs. The U.S. Environmental Protection Agency stated: "EPA continues to believe that there will be no adverse impacts associated with the disposal of sediments generated by the project." The U.S. Fish and Wildlife Service stated: "Results of chemical analyses provided within the biological assessment indicated that contaminant loads in the sediments tested are low."

Despite the positive results of the tests conducted to date, the Corps intends to monitor water quality during construction. This monitoring will insure that dredging and disposal activities associated with the deepening project do not adversely impact the aquatic resources of the Delaware River and Bay. The Corps has been working with the States of New Jersey and Delaware, and the Delaware River Basin Commission (DRBC), to develop an acceptable protocol for this type of monitoring. To date, the Killcohook, Oldmans, Pedricktown North and Pedricktown South CDFs have been monitored. Reports on the monitoring studies conducted at the Killcohook and Pedricktown North CDFs have been provided as part of the public record. The reports provide details on how CDFs would be monitored.

The Corps has also conducted modeling efforts to simulate the quality of water discharged from the Reedy Point South CDF during disposal operations, and contaminant concentrations in the water column resulting from dredging activity. These studies have also been included as part of the public record. Both the modeling results and the field monitoring studies indicate that dredging and dredged material disposal operations do not significantly impact water quality.

With regard to contaminants outside of the navigation channel "drifting" over time to the deeper main channel, it is not anticipated that future conditions will be significantly different from current conditions.

Concerns about "*contaminates over time…could leech* ***(leach)*** *into groundwater or surrounding wells*." Studies have been conducted regarding leaching of contaminants from disposal areas into aquifers.

In particular, a United States Geological Survey report entitled Evaluation of Ground-Water Flow from Dredged Material Disposal Sites in Gloucester and Salem Counties, New Jersey (USGS, 1995) was published which studied this concern. A letter dated 23 January 1996 was then issued by the USGS, which summarized and referenced this and other relevant USGS reports.

The USGS concluded that "*the concern that fluids leaching from the dredged-material disposal areas could infiltrate to the aquifer with recharge water can also be set aside.*"

The USACE agrees with this conclusion, however, to ensure the safety of the main aquifers underlying the disposal areas, the USACE has completed installation of monitoring wells at *every* Federally-owned Main Channel dredged material disposal area. The groundwater-monitoring program for the NJ sites has been approved by the NJDEP. The groundwater-monitoring program for Reedy Point North and Reedy Point South disposal areas (both located in the State of Delaware) has been submitted to DNREC for their approval.

Comment. A number of years ago, a public health advisory was issued asking everyone to not eat fish caught in the Delaware River north of the C&D Canal due to dangerously high levels of PCB contamination. PCB's are known carcinogens and that public health advisory is still in effect today. Delaware Audubon finds it hard to swallow that there is no toxic contamination in the same river locations where there is a public health advisory against eating fish caught there.

Response. Because of PCB concerns in the Delaware Estuary, the Corps conducted a bulk sediment investigation using state-of-the-art, high-resolution techniques for detecting PCB congeners. Sediment cores were collected at 15 channel sites throughout the estuary and divided into surface and sub-surface samples. Samples were assayed for 80 separate PCB congeners. The concentrations of all PCB congeners were summed to determine the total PCB distribution at surface and sub-surface collection sites. The high-resolution PCB tests demonstrated that PCB concentrations in the navigation channel were low and within an acceptable range, based on New Jersey and Delaware guidelines. Study results indicated that concentrations of PCBs in the channel were 1 to 3 orders of magnitude lower than concentrations in shoal sampling locations of a previous study.

EXHIBIT #102

JIM BRYANT

Comment. As a Follow up to my letter 11-13-01,to you entered into the record for hearing 12-05-01 as this letter will be also, dredging of the Delaware should not even be considered until the US-EPA stops the source of the toxic pollutants flowing into the river. Many of the questions in the hearing of 12-05-01 were concerning the question of liability for an environmental catastrophe. You may rest assured that if anyone distributes this sand and dredging spoils onto the beaches, wet lands or in stockpiles there will be astronomical health and environmental problems far exceeding those of Times, Beach, Missouri, Great Lakes and Love Canal NY because it is the same type of pollutant.

Irrespective of national and international data relating to major health concerns; including cancer, overshadowed by the events of 9-11, Secretary DiPasquale of DNREC (Secretary's Order No. 2001-A0042) permitted the continued release of the toxic environmental contaminants on the general population including thousands of children in approximately eights schools. Both diabetes and cancer are rampant in the area The report presented by Mr. Ali Mirzalkalili DNREC is a terroristic set to purposefully contaminate the food supply.

Response. There is no evidence to support the contention that the Delaware River main channel-deepening project would adversely effect Delaware River natural resources or human health through release of sediment contaminants. The Corps has conducted extensive testing to investigate potential impacts associated with sediment contamination. These tests have included chemical analysis of channel sediments to determine actual contaminant concentrations, and biological testing to evaluate toxicity concerns. Analysis of channel sediments has indicated that contaminants that are present, primarily heavy metals, are at concentrations considered low to medium.

With regard to toxicity concerns, several different species of aquatic organisms were exposed to channel sediments, using procedures approved by the U.S. Environmental Protection Agency. The tests, which are commonly used to evaluate the quality of dredged material, resulted in complete survival of all individuals. These results strongly indicated that channel sediments are not toxic. Other tests were run to evaluate the potential for contaminants to accumulate in the tissues of organisms that would live in the sediment placed for beneficial uses in Delaware Bay. All tissues analyzed from these tests were representative of what one would expect from organisms living in a clean environment.

Other State and Federal resource agencies have also reviewed the Corps' sediment quality data. The States of Delaware, New Jersey and Pennsylvania have approved the deepening project by finding it consistent with their respective coastal zone management programs. The U.S. Environmental Protection Agency stated: "EPA continues to believe that there will be no adverse impacts associated with the disposal of sediments generated by the project." The U.S. Fish and Wildlife Service stated: "Results of chemical analyses provided within the biological assessment indicated that contaminant loads in the sediments tested are low."

EXHIBIT #103

ANDEREW LORENZ

Comment noted no response needed.

EXHIBIT #104

ROBERT D. CUNNINGHAM, Jr.

Comment.

I. TOXINS

The Army Corps of Engineers has conducted extensive testing of river bottom samples for the presence of toxins. I request that the following information be released and be made readily available for inspection:

1. List the substances tested for, the mean values of the concentrations obtained, and the range of values found, for the samples obtained by the Corps, and any samples obtained by private industry around any side channel or berthing area that would anticipated to be dredged by either the Army Corps or by the private sector.

2. It might be anticipated that some compounds are found in high concentrations in river bottom samples obtained upstream, or closer to the river bank, than concentrations of the same compounds found in the lower reaches of the river~ or the shipping channel itself. Please describe any such variation, specifying the compounds involved.

3. The Army Corps of Engineers have routinely replenished sand along Rehobeth Beach in Delaware, with samples of the sand analyzed before replenishment. Please list the compounds tested for, the mean concentrations, and ranges obtained for the sample of material obtained preceding the most recent beach replenish in Rehobeth or other nearby resort beach area.

4. Permissible values for toxic compounds have been set by the Environmental Protection Agency. These guidelines have been recently revised. Please describe the recent revision in permissible levels and testing procedures, and list the current ranges of acceptable concentrations.

5. At the recent public hearing on the Delaware River deepening project, someone introduced a study regarding toxicity due to chronic exposure. Please describe this study. Using the range of values obtained from river bottom core sample testing, does this study indicate a hazard to aquatic life from the current concentrations of compounds present in the river bottom?

Response.

1. A complete discussion of the sediment quality analyses conducted for both the main navigation channel and private berthing areas is provided in the Corps July 1997 Supplemental Environmental Impact Statement, which has been made part of the public record **(EXHIBIT 4).**

2. Contaminant concentration differences were found between the up-river and bay portions of the project, and between shoal areas of the river and the navigation channel. This information is provided in the Corps 1997 Supplemental Environmental Impact Statement.

3. The Corps has not nourished any beaches along the Atlantic coast of Delaware except at Indian River Inlet. Past beach nourishment projects have been conducted by the State of Delaware. The Corps does have Federally authorized projects to nourish some beaches along the Atlantic coast of Delaware, but those projects have not been constructed.

4. The Corps is not aware of any Federal standards for permissible levels of contaminants in dredged material. Dredged material contaminant evaluations have been conducted using the U.S. Environmental Protection Agency/U.S. Army Corps of Engineers guidance document titled: *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual (Inland Testing Manual)* EPA-823-B-98-004, dated February 1998. As part of these evaluations the Corps has used sediment guidelines that are employed by the States of Delaware and New Jersey. This information is provided in the 1997 Supplemental Environmental Impact Statement.

5. This study was made part of the public record by Mr. Jim Steffens, Chair, Delaware Chapter of the Sierra Club. With regard to the draft NOAA study (10/26/00), the following information should be noted. In Delaware Bay (strata 11-14), all sampling sites (39-61) except site 57 had no contaminant concentrations above an ERL level. Site 57 is located in Maurice River Cove near the New Jersey shoreline, far removed from the navigation channel. With regard to toxicity testing in Delaware Bay, there was no toxicity observed in Delaware Bay sites (strata 11-14) for the sea urchin fertilization toxicity test or the human reporter gene system (Cytochrome P450) response test. In addition, amphipod mortality observed from Delaware Bay sites was not statistically significant from controls. While there appeared to be some toxicity observed with the Microtox ® test, the report is not clear on the significance of this information. Delaware Bay sites closest to the navigation channel (sites 47, 49 and 52) were among the lowest relative to response levels. Overall, the report does not raise concerns relative to the use of Delaware Bay material for habitat creation. In up-river locations there were sampling sites with contaminant concentrations that exceeded ERLs and occasionally ERMs. It is not possible to comment on actual contaminant concentrations because concentrations were not provided in the report. In addition, some sites did exhibit toxicity relative to at least one of the tests that were run. It is not clear from the report if any of the sampling sites were in the navigation channel. Also it should be noted that in this portion of the river dredged material would be removed from the aquatic environment and placed in confined disposal facilities on land

Comment.

II. BLUE CRABS AND OYSTERS

Routine maintenance dredging of the Delaware River shipping channel has been ongoing for decades. Have there been studies of the effect of this dredging on oyster and blue crab populations? If so, what did these studies show. At the public hearing, someone stated that there are new ongoing studies of these two species and the effect that the dredging project may have. I would like to obtain these studies when available.

Response. Refer to the general responses for "impacts on over-wintering female blue crabs" and "oyster impacts". These studies are available on the Philadelphia District Information Network at http://www.nap.usace.army.mil/cenap-pl/deldocs.htm

Comment.

III. SALT WATER INCURSION AT PRIME HOOK NATIONAL WILDLIFE REFUGE

At the public hearing, someone stated that because of beach erosion, saltwater incursion is now a problem at Prime Hook National Wildlife Refuge. If the dredging project does not occur, what plans are there for replenishment projects to protect Prime Hook from saltwater incursion?

Response. Prime Hook is not a Corps of Engineers project, so we have no knowledge of the referenced problem, and would have no responsibility or authority to address the problem, unless specifically requested to do so by Congress or another agency.

Comment.

IV. PEA PATCH ISLAND

Pea Patch Island, site of a heron rookery, is threatened with erosion. Does the Delaware River deepening project include plans to restore and stabilize erodable areas of Pea Patch Island? If the dredging project does not occur, is there an alternative project being planned to protect the island?

Response. The restorations of areas that have eroded on Pea Patch Island are being done under separate authorities, not the Delaware River Main Channel Deepening Project and have received permits from DNREC. Wetlands Permit WE-075/99 permitted construction of a 1,050 linear foot stone breakwater (South Breakwater) on the southeast shore of the island, and Wetlands Permit WE-278/00 permitted the construction of a 650 lineal foot stone breakwater (North Breakwater). Both of the breakwaters have been constructed. DNREC and the Corps are currently investigating additional erosion control at the northeast side of Pea Patch Island.

EXHIBIT #105

ED HAZZOURI, SUNOCO, INC.

Comments noted. No response required.

EXHIBIT #106

STEVE CALLANEN, SIERRA CLUB

Comment. How many and what percentage of the existing docking and ship loading/off-loading facilities in the ports of Wilmington, Philadelphia and Camden, NJ, are designed to accommodate "super size" vessels. How many and what percentage of the corporations using these ports have committed to increasing the size of their docking facilities and the depth of their berthing spur channels if the river is deepened to 45-feet?

Response. Post-panamax container vessels that will serve the port are merely one step from the panamax class, and are not "supersize" vessels. Also, the tanker fleet will not change with the channel deepening. The above vessels can be accommodated by the existing port facilities. Corps does not require a legally binding written commitment from potential beneficiaries to deepen their berths. Also, refer to response in **EXHIBIT 114**.

Comment. The Port of New York/New Jersey is limited by the amount of available open space surrounding its docks that is needed for the short term storage and sorting of shipping container (i.e., box) modules. The problem is so severe that consideration has been given to transporting all off-loaded shipping containers by rail to a distant rail-hub sorting location – perhaps somewhere in Pennsylvania. Do adequate open spaces, and railroad and trucking facilities exist around the ports of Wilmington, Philadelphia and Camden, NJ, to accommodate the increased physical volume of container modules that "super size" container ships could generate?

Response. Yes. The Delaware River port facilities for containers do not have the same capacity problems as described above for the Port of New York/New Jersey.

Comment. It is significant that practically all of the new "super size" container vessels that require a deeper Delaware River are owned by foreign shipping companies. Hence, U.S, taxpayers are being requested to substantially subsidize foreign commercial shipping operations. Is this equitable? The GAO and the Corps should be requested to determine the revenue, resulting from a deeper Delaware River that will go into the coffers of giant foreign corporations.

Response. The Corps regulation for the benefit analysis of deep-draft navigation studies, ER 1105-2-100, requires the calculation of navigation transportation cost savings to the national economic development account from the more efficient movement of commodities. Regional, state, local, or company-specific impacts are not included in the analysis.

Comment. In literature distributed at the 5 December hearing, the Corps stated ***"It is true that the Corps analysis does not count any national navigation benefits for the State of***

Delaware because it does not have directly benefiting facilities located on the Delaware River." *The Corps also* stated that *"During project construction, based on an input-output economic model of the tri-state region Delaware may accrue the following indirect economic benefits from construction of the project: 300 jobs, $31 million in wages, $60 million in total revenues into the state's economy,* $4 *million in state and local tax receipts."* Over what time period are these benefits spread? If these workers earn a total of $31 million in wages, how do they generate an additional $29 million over and above their salaries, to equate to $60 million in total revenues into the state's economy? The Corps should be requested to provide a detailed explanation of how Delaware's ***"indirect economic benefits"*** were derived, and the GAO should be requested to confirm the validity of these claimed *"indirect economic benefits."*

Response. A set of the narrative and backup data for the indirect economic benefits from construction is provided as part of this submission on CD ROM. Indirect benefits were not included in the determination of project justification.

Comment. The point of the above listed initiatives is that they conclusively demonstrate the Corps' continuing efforts to promote and implement the dredging of NY/NJ and Norfolk port channels deeper than 45-feet. In view of these project plans, the Philadelphia District Office of the Corps should be required to explain how the proposed deepening of the Delaware River to 45-feet will keep the Ports of Wilmington, Philadelphia and Camden, NJ, on a competitive par with these deeper East Coast ports. Do Corps plans possibly exist for future dredging of the Delaware River to depths greater than 45-feet.

Based on the rationale of attempting to make Delaware River ports "competitive" with neighboring Atlantic Coast ports, what is the point in deepening the Delaware River to "only" 45-feet if the Port of New York/New Jersey is to be increased to more than 50-feet?

Unfortunately, deepening the Delaware River will not decrease the 103-mile distance from the Atlantic Ocean to the ports of Philadelphia and Camden. Hence, these Delaware River ports can not be expected to achieve and maintain competitive equality with those in the New York/New Jersey and Norfolk areas by means of dredging. This 103-mile geographic handicap needs to be accepted and factored into the cost effectiveness of future regional port development and dredging plans.

Response. The economically justified deepening of the Delaware River channel to 45 feet was analyzed in terms of navigation transportation cost savings to the national economic development account for tonnage specifically moving through the port, not on a competitive basis with deepening plans for other ports. No plans to deepen the Delaware River beyond 45 feet are active presently nor expected in the future (which would first require Congressional study authorization and funding).

Comment. If the river is dredged to 45-feet, the Army Corps of Engineers will have to dispose of 29.3million cubic yards of dredge spoil, a volume equivalent to the cross-sectional shape of a football field extending for 3.1 miles. (NOTE: In literature distributed by the Corps at the 5 December hearing, the total dredge spoil volume was given as 29.3-million cubic yards-a reduction of 3.7-million cubic yards from the previously reported figure of 33-million cubic yards.) In addition to the need to initially dispose of this mammoth amount of dredge spoil, the **environmental and monetary cost of disposing of 1.1 million additional cubic yards per year of "maintenance" dredge spoil,** above the 5 million cubic yards currently dredged to maintain the 40-foot channel, should be determined. Will taxpayers be expected to fund these never ending escalating costs? Perpetual "maintenance dredging" costs in the out-years need to be accurately determined and identified up-front as a portion of the estimated total cost of this project.

The costs for disposal of dredged spoil are rapidly rising due to the increasing scarcity of disposal locations, and the increasing need for confined disposal of contaminated sediments. Unknown is the hidden cost of the cumulative environmental damage being caused by massive annual dredging.

Response. There is adequate capacity at the existing Corps upland confined disposal facilities in combination with added capacity of the proposed new sites to accommodate the initial dredging quantity plus 50 years of maintenance dredging. The Corps budget as provided by the executive Branch of the US Government includes continued maintenance of our country's navigable waterways.

Comment. The Corps states *that "Delaware Bay sand slated for placement on the beaches has undergone chemical and biological testing. The results show the sand to be clean material. . . and, in terms of appearance and texture, will be essentially the same as what is now on the beaches."* The Corps should be required to validate this claim by presenting grain size measurements taken from a suitable diverse number of sediment samples from the Delaware River dredge site and the Rehoboth/Dewey Beach area. The percentage of silt and clay in the Delaware River dredge site samples also should be provided.

Response. The Corps has performed extensive sampling and analysis of the material to be dredged. Based on those studies and findings, the material to be dredged for any of the Delaware Bay Beaches or Dewey-Rehoboth Beach is appropriate for placement as beach fill.

Comment. The Corps claims that *"approximately $34 million in project funds will be spent* to *place sand on Delaware Atlantic Coast and Bay beaches such* as *Broadkill Beach, Port Mahon or Rehoboth Beach/Dewey Beach."* The GAO should substantiate the true unbiased value of these purported "beneficial uses" to Delaware. The dollar amounts that it will cost the Corps to move dredge spoil to these beach locations is not equivalent to the value of the sand to Delaware. For example, it has been reported that the Corps proposes moving 1.44 million cubic yards of "primarily good quality" sandy spoil to Rehoboth Beach and Dewey Beach. It should be noted that a plentiful supply of extremely "clean" beach sand exists at the northern tip of Cape Henlopen, In a 4 January 2001 letter addressed to DNREC'S Mr. Robert D. Henry, Mr. Daniel L. Hussin, Vice

President, Great Lakes Dredge & Dock Company, stated that a hopper dredge could be loaded at the Cape Henlopen borrow site and sand could be bottom dumped in the littoral drift zone at Rehoboth Beach and Dewey Beach for a unit cost between $2.40 and $2.90 per cubic, with a mobilization/demobilization cost of $100,000-$200,000. At these estimated commercial prices, the maximum value of 1.44 million cubic yards of high quality beach sand is approximately $4.5 million (i.e.,(1.44 million c.y. x $2.90 per c.y.) + $300,000)), assuming that Delaware paid 100% of the cost. The existing federal cost-sharing program for beach replenishment would reduce Delaware's cost for this sand considerably.

Response. Refer to response to questions (38,39,40) on costs for beach placement in **EXHIBIT 73.**

Comment. Replenishment of eroded beaches at seashore parks does not qualify for federal funding because beach nourishment projects reportedly must be justified on the basis of preventing flood damage to private and public property. According to a 1995 Corps report federal policies ***"virtually limit shore protection projects to densely developed areas with high economic value."*** Assuming that this policy is still in effect, on what basis does the Corps justify spending $40 million in project funds to restore a wetland on Kelly Island? **If the Corps has discretionary authority over how it disposes of dredge spoil for wetland or beach replenishment purposes, Delaware should insist that dredge spoil sand from the Delaware River be placed on the badly eroding Atlantic ocean shoreline of Cape Henlopen State Park in the vicinity of the two historic World War II lookout towers that are now in the surf zone.** Delaware apparently cannot afford the cost of replenishing the ocean shoreline of Cape Henlopen State Park.

Response. As part of the Delaware River Main Channel Deepening Project, a disposal plan was developed and coordinated with the Federal and State resource agencies considering beneficial uses of sand material. The State of Delaware expressed interest in the restoration/protection of Kelly Island. As a result, this site was given consideration in the development and subsequent evaluation of a disposal plan. This disposal plan addressed beneficial use of dredged material considering environmental impacts and costs.

Comment. It has been reported in the newspapers that the Corps is offering beach replenishment dredge spoil to Delaware "free of charge." Something is wrong with this claim. Nothing is free. All costs, whether incurred by the federal government or the states, need to be accurately accounted for and included in the estimated cost of the proposed Delaware River deepening project.

Response. The cost of placing sand material to Delaware Beaches is included as a project cost for the Delaware River Main Channel Deepening Project. The Federal Government and the project sponsor (Delaware River Port Authority) will cost/share the cost for placing the sand material.

Comment. The Corps states that *"Approximately $40 million in project funds will be spent at Kelly Island* to *place* 2.4 *million cubic yards of dredged Delaware Bay sand to restore 60 acres of tidal wetlands and protect approximately 5,000 feet of eroding tidal wetland."*

Man-made wetlands often are of questionable value and have been shown to possess diminished ecological value when compared to natural wetlands. This is not surprising considering that it has taken thousands of years to create the unique soils that form the foundation of coastal Delaware wetlands. The monetary value the Corps assigns to man-made wetlands should be questioned.

Response. The project at Kelly Island creates approximately 60 acres of new intertidal wetlands while protecting thousands of additional acres of wetlands. In addition it provides over 1 mile of horseshoe crab habitat along the shoreline. The site will specifically protect the existing shoreline against continued rapid erosion, which since 1993 has retreated an average of over 300 feet along the mile stretch and in some areas over 500 feet. The Corps hasn't assigned any monetary value.

Comment. Dr. Delvin S. Fanning, Professor of Soil Science, University of Maryland, documents that practically nothing grows on dredged spoil from brackish water because the ***"soils that form on the dredged material are likely to be active acid sulfate soils."*** Copious amounts of lime must be added to these soils before much of anything will grow in them, except for invasive phragmites weeds. ("Coastal Acid Sulfate Soils," by D. S. Fanning and S. N. Burch, American Society of Agronomy, Crop Science Society of America, Soil Science Society of America pp. 921-937, copyright 2000.)

Response. The dredged material that will be used to restore the marsh at Kelly Island will be subject to tidal flow twice a day. Under these conditions, even if the material was potential acid sulfate soil, it would not become acidic because it would remain anaerobic (Fanning, D.S., University of Maryland, Personal Communication with John Brady, U.S. Army Corps of Engineers, January 15, 2002). Dredged material from brackish water has been used to build inter-tidal wetlands with *Spartina alteniflora* in the Chesapeake Bay.

Comment. The Corps should be required to estimate the total bio-mass and diversity of benthic organisms that will be killed by dredging 29.3-million cubic yards of sediment from the Delaware River, and to estimate the total bio-mass and diversity of benthic organisms that will be killed as a result of burial under the millions of cubic yards of dredge spoils to be dumped along shoreline beaches and wetlands.

Response. Refer to the general response for "impacts on benthic communities".

Comment. What will be the consequences to the environment and the Delaware tourist economy if the dredge spoil transported to these beaches contains excessive amounts of black silt and clay? Will the Corps assume all costs associated with repairing, or attempting to repair, environmental damage that could possibly result from this massive dredging project?

Response. Based on conducted Corps sampling and subsequent analysis, the material to be transported and placed to these beaches does not contain excessive amounts of silt and clay. The amount and type of material being dredged from the main channel is appropriate for the designated beaches.

Comment. What is the increased likelihood of collision or grounding accidents during the navigation of "super size" vessels in a 103-mile Delaware River channel whose width will not be increased? "Super size" vessels in motion possess considerably more inertia which limits their maneuverability - especially in tight quarters. What will be the maximum allowable speed of "super size" vessels in the Delaware River channel?

Response. The design vessel (crude oil tanker) will be the same with the deepened channel as the design vessel for the current channel depth, so there will not be any safety impacts.

EXHIBIT#107

ROBERT D. BESWICK, JR.

Comment. 3) It was stated that the Corps of Engineer's 1997 SEIS is not in compliance with current Federal Environmental requirements in that it does not address certain environmental concerns which have been identified since completion of the 1997 SEIS, such as disposal of the dredged material and other items.

Response. Appropriate supplemental NEPA documentation associated with the individual beach nourishment projects will be prepared to evaluate placement of main channel sand on selected beaches.

Comment. Motiva representative stated the proposed channel deepening would be harmful to their operations. A person addressing the City of Wilmington Port operations stated that the channel deepening would help the Wilmington Port but he gave no specific details on how that economic benefit could occur. His conclusion of economic benefit to Wilmington is highly suspect since there is no proposal to deepen the Wilmington Port to 45 feet and he did not address port capacity itself. I can't believe that Delaware is being asked to help finance this very questionable $311 million project.

Several of the speakers stated that there needs to be a comprehensive analysis of total Delaware River channel and all Delaware River Port operations to determine just what channel depth is needed to properly handle all ports using the Delaware River. Such a study should consider the channel depth required to support existing and/or financed port cargo handling, storage and transportation capacities. All port and river requirements should be coordinated and in balance rather than undertaking unsupported dredging needs. This should be done before Delaware makes its major decision on a potentially very environmentally damaging channel deepening which may not even be needed or justified.

Response. Please refer to response **(EXHIBIT 66)** to Motiva's concerns on impact of the deepening project. No project benefits are claimed for Motiva and Port of Wilmington.

Comment. 6) The Corps says the liability issue will be spelled out in an agreement being negotiated with DRPA but that agreement would only be finalized after the Corps obtained the Delaware permits to proceed with the dredging. The Corps previously indicated it is not assuming any financial responsibility or liability for damages resulting from their proposed project. This is a totally unreasonable position and one which should be unacceptable to the State of Delaware. The Corps has never been cooperative with the State of Delaware on this project as evidenced by initially ignoring the State's requirement for a dredging permit until receiving pressure from our Congressional delegation. They also have continually ignored all previously stated environmental and economic objections to this dredging proposal, regardless of the source of objection. The Corps made statements that they would monitor environmental affects during construction but did not indicate what they would do if a negative event occurred. I seriously question that they would stop the dredging regardless of what was happening to the environment. The Corps has adequately proven over the years that the State of Delaware must have every issue totally resolved to our satisfaction before giving them any approval to proceed.

Response. If an environmental problem arises during dredging, the Corps and the project sponsor, the Delaware River Port Authority, will be responsible for any environmental remediation costs that occur during dredging of the Delaware River Main Ship Channel. This responsibility will be detailed in the Project Cooperation Agreement to be signed by the Corps and DRPA. Further, as the applicant for the DNREC permit, the Corps is legally and financially accountable for any remediation that falls within the permit parameters.

EXHIBIT #108

PETER S. MARTIN DELAWARE WILDLANDS, INC.

Comment. The Main Channel Deepening and Delaware Ports: Wilmington and Delaware City/Motiva

Attachment 1 is a summary of information found in several Journal of Commerce articles, and in a report of a seminar sponsored by the Ports of Philadelphia and Camden. It is important to understand that the Port of Wilmington has developed its economic success as a "niche" port specializing in refrigerated cargo, such as fruit and meat, and as an automobile shipping and receiving port. The fruit and meats are mostly of Pacific origin and the main automobile contract has been with VW. Present and future shipbuilding and merchant shipping trends do not support the need for a deeper main channel. Indeed, port depths greater than 45 feet are the exception rather than the rule. Most of Wilmington's refrigerated cargo arrives from the Pacific and utilizes the Panama Canal, which is limited to vessels of less than 38 feet in draft. Present and future automobile carriers will have drafts of 30 feet or less. The operator of Delaware's only refinery/port has indicated that it does not support the Main Channel Deepening. Predicted shipping trends indicate that Delaware's Ports can and will have continued success with the current existing channel depths.

Response. No benefits are claimed for either the Port of Wilmington or Motiva in the economic analysis of the national economic development account to determine project justification. For the state of Delaware, potential indirect benefits will result from project construction and from sand placement at Delaware Beaches and Kelly Island.

Comment.

Kelly Island and Port Mahon

Combined sand losses from the Port Mahon and Kelly Island projects are estimated (by the ACOE) to average in excess of 56,000 cubic yards per year. This material will have a significant negative impact on the adjacent benthic communities, including oyster beds, and will probably increase deposits in the Mahon channel. Increased shoaling at the Port Mahon fuel pier is also highly probable. In both projects, the artificial horseshoe crab beaches of optimum slope would be short lived and unsustainable without continual sand replenishments.

Response. Refer to the general responses for "monitoring", "horseshoe crab impacts from sand placement", and "oyster impacts". The benthic communities that occupy the "footprint" where the Kelly Island project is proposed have gained that habitat over the past century (or more) as a direct result of natural erosion of Kelly Island wetlands.

Coordination with environmental agencies has suggested that it might be a better use of Delaware's natural resources, in particular its remaining wetland habitat, to protect and restore Kelly Island.

Sediment placed at Kelly Island will not adversely impact oyster resources in Delaware. Fine-grained sediments will be confined within and protected from release by the sand dike at the perimeter of the project. Sand that constitutes the material for dike construction will be subject primarily to transport in the alongshore direction, predominantly to the north. Our evaluation of potential offshore transport of sand from the dike to the oyster areas indicates a low probability of impacts. In addition, there is an oyster and sediment monitoring plan in place for Kelly Island that will indicate if sand is being transported toward the oyster areas well before adverse impacts could occur.
The combined action of waves and tides will reshape the sand placed to build the Kelly Island confinement dike into a "natural beach" configuration. As such, the slope that results in the intertidal zone will be conducive to horseshoe crab transit and spawning activity. It will certainly be a more suitable habitat for horseshoe crab spawning than the present eroding wetland scarp at Kelly Island or the stone revetment at Port Mahon.

Comment. In combination, these projects provide no sustainable horseshoe crab habitat, and pose significant environmental threats to adjacent benthic communities. There is no enhancement of biodiversity, but rather a threat to biodiversity.

Response. Refer to the general responses for "monitoring", "horseshoe crab impacts from sand placement", and "oyster impacts".

Comment. In summary, the ACOE permit should be denied for the following reasons:

- there is no demonstrated economic benefit for the State of Delaware
- the Kelly Island and Port Mahon projects have no ecological, environmental, or habitat benefits for the State of Delaware

Response. Concerns benefits to Delaware, as the Port of Wilmington pointed out during the June 6, 2001 public workshop and December 4, 2001 public hearing, the project will make the port more competitive in the world market and will enhance its ability for economic growth if facilities are shifted directly onto the Delaware River with access to the 45-foot channel. In addition, consider these benefits:

- Approximately $30 million in project funds will be spent at Kelly Island to restore 60 acres of tidal wetlands, protect approximately 5,000 feet of eroding tidal wetlands, and increase horseshoe crab spawning habitat
- Approximately $44 million in project funds will be spent to restore state-selected Atlantic Coast and Delaware Bay beaches.
- During construction, Delaware may accrue indirect economic benefits associated with 300 jobs and millions of dollars in wages, state revenues, and state and local tax receipts.

No benefits are claimed for either the Port of Wilmington or Motiva in the economic analysis of the national economic development account to determine project justification.

The access channels into both facilities are shallower than the current 40 foot depth of the Delaware River main channel and are expected to remain so in the future. For the state of Delaware, potential indirect benefits will result from project construction and from sand placement at Delaware Beaches including Kelly Island and Port Mahon.

A description of the Kelly Island wetland restoration is included in the permit application and is summarized here. This project has been coordinated with DNREC and Federal resource agencies and a plan has been developed to make sure that the environmental goals are achieved. Refer to the attached Kelly Island Wetland Restoration goals and objective table dated November 2000. The Kelly Island Project is a wetland restoration. The main purposes of the project are to restore intertidal wetlands using dredged sediment from the deepening of the Delaware River navigation channel, stem erosion of the Kelly Island shoreline, provide extensive sandy beach for spawning horseshoe crabs, and provide continued protection to the entrance of the Mahon River.

Restoring wetlands in this environmentally sensitive area has been a high priority for the State of Delaware. A plan has been developed with the assistance of the Federal and State resource agencies to restore 60 acres of intertidal habitat. The site will be constructed as an impoundment and remain as such until the sediments consolidate and vegetation becomes established. At that time, the State of Delaware will decide whether to open the site up to unregulated tidal inundation. The option to convert back to an impoundment will be maintained. Following construction, the site will be monitored to insure that the goals of the project are met and that no adverse impacts occur, particularly impacts to oyster beds.

The sand placement at Port Mahon is described in the SEIS (1997) **(EXHIBIT 3).** Placing sand at Port Mahon is expected to benefit horseshoe crabs. Refer to the general response for "horseshoe crab impacts from sand placement". Also refer to the general response for "monitoring".

EXHIBIT #109

JOHN C. DRAGONE, MARITRANS OPERATING COMPANY L.P.

Comment. The Corps continues to present material as fully founded and factual but when pressed for clarification and justification it continues to provide little if any reliable data to support its positions. The following are examples:

1. Including stand alone projects (Kelly Island & Port Mahon) in the cost benefit to the State of Delaware for the main channel project.
2. Stating that the project will bring 300 jobs to Delaware without providing data to support the claim. How long will they be employed? Will they be Delaware residents? What current businesses and residents will suffer as a result of the project?
3. Dismissing Motiva's concerns shortly before the hearing after waiting several months to respond to the issues they raised at the June 6th public meeting and not providing any analysis as to why at the public hearings.

Response. Kelly Island Wetland Restoration Project is not a sand alone project, as this project has not been authorized for construction by Congress. At this time, this project can only be constructed as part of the Delaware River Main Channel Deepening Project. Justification for the Delaware River Main Channel Deepening Project was based only on navigation transportation savings to the National Economic Development account. The narrative and backup data for the generalized regional input-output model are provided as part of this submission on CD ROM. For this analysis, employment involves the project construction period only.

Concerning coordination with Motiva, the following is a summary.

The Corps of Engineers did not "wait several months" to respond to the issues raised by Motiva at the June public meeting. The first meeting on Motiva's operation was held at Delaware City on 17 April 2001. The meeting was attended by three Motiva personnel, five from Motiva's contractor, CoastWatch, and one member of the Philadelphia technical staff. Neither Motiva nor CoastWatch provided any information at that time supporting the claim that the Delaware Deepening project would adversely impact Motiva's operations. The principal outcome of the meeting was a request by CoastWatch for the Corps of Engineers to provide additional information on Delaware estuary salinity conditions, the Delaware 3D salinity modeling effort, and information pertaining to a 3D numerical sediment transport study performed in 2000 – 2001 by the Corps of Engineers for Wilmington Harbor – Christina River.

On 18 April 2001, one day after the initial meeting, the Corps of Engineers provided the first of several transmittals of data and reports to CoastWatch. There was no response by CoastWatch to these data transmittals until 21 June 2001, when CoastWatch president Mr. John Klein called to request additional information. That information was provided to CoastWatch via email and mail on 25 June 2001. CoastWatch made additional requests for data and these data were sent on several dates, including 20 and 26 July 2001 and on 21 August 2001.

The first information provided by Motiva or CoastWatch to the Corps of Engineers was a letter report dated 27 November 2001. This report was received in our office on 28 November 2001, four working days prior to the 4 December Public hearing. The Corps of Engineers provided initial review comments to Motiva on 30 November 2001. In view of the fact that the CoastWatch report included only nine pages of text with a limited review period, the Corps characterized comments as "initial." We stand by our initial observation that the material provided to us is too abbreviated and superficial to lead to the conclusions promulgated by Motiva and CoastWatch.

In view of these facts, it is evident that the Corps of Engineers responded promptly and professionally to every request for information and technical assistance made by Motiva and by CoastWatch.

Comment. The Port of Wilmington states that its long-term health depends on the dredging project since it would allow them to expand. However, what credence can be placed in this statement when the Port never took advantage of the existing channel depth that presently allows for expansion. This position appears to follow the national trend of Port Authority's never to criticize a dredging project whether it benefits that particular port or not. You cannot base cost benefit analysis for the State on the assumption that the Port may expand and make huge capital expenditures in the future to accommodate unidentified customers and trades.

Response. The Port of Wilmington is not included in the estimate of navigation transportation cost savings benefits to the National Economic Development account applied to determine justification for the Delaware River Main Channel Deepening Project.

EXHIBIT #110

WILLIAM BURTON-VERSAR, INC

Corps report. No response required.

EXHIBIT #111

JAMES STUHLTRAGER, MID-ATLANTIC ENVIRONMENTAL LAW CENTER

Comment.

1. The MCD Endangers Biologically Productive Areas

Delaware must ensure that biologically productive areas are not be disturbed, Section 3.05(D) of the Regulations forbids the "[d]redging of biologically productive areas, such as nursery areas, shellfish beds, and submerged aquatic vegetation." The MCD will impact many of Delaware's most significant productive biological areas. Spoils from the dredge will adversely affect those beaches that are the horseshoe crabs' spawning areas, including Broadkill Beach, Kelly Island and Port Mahon. See Comments of Delaware Audubon Society; Comments of National Wildlife Federation. Dredging the lower Delaware Bay will disturb the subaqueous lands where blue crabs spend the winter. See Delaware Bay Winter Crab Survey. The National Marine Fisheries Service ("NMFS") has concluded that the MCD may have negative impacts on the sandbar shark. See. Comments of Delaware Nature Society. Moreover, the documents submitted by the Corps demonstrate that at worst, the MCD will have serious impacts on the juvenile population of shortnose sturgeon, and at best, that the Corps has not conducted enough scientific studies to determine the impact. See Comments of Delaware River-keeper Network. Furthermore, the MCD will result in the destruction of oyster beds and submerged vegetation. See Permit Application at Environmental Windows: Therefore, the Regulations give DNREC no choice but to deny dredging and related activities in Delaware's biologically productive areas.

Response. Refer to the general responses for "impacts on over-wintering female blue crabs", "oyster impacts", "concerns for sandbar sharks", and "shortnose and Atlantic sturgeon concerns".

Comment.

2. The MCD Will Result in Substantial Damage To The Environment.

Delaware must ensure that the environmental quality of the state's waters are improved. Section 3.05(A) of the Regulations requires that the MCD be designed to "[maintain or improve the environmental quality of the State's water resources, subaqueous lands and wetlands." The MCD is not designed to maintain or improve the quality of the environment in Delaware. To the contrary, the MCD recognizes that some measure of environmental harm will occur to Delaware's environment. This is very different from maintaining the State's subaqueous lands. Various species such as the shortnose sturgeon, the sandbar shark, the blue crab, the horseshoe crab, winter flounder, and oysters will ultimately be impacted adversely by the.MCD. Supra. The project will disturb contaminants and toxins that will be released into Delaware's water, making them "bioavailable''to benthic organisms to be ingested by these species. Through food-chain transfer, these contaminants will bioaccumulate in human food supplies. See Delaware Estuary Program Final Report on Distributions of Chemical Contaminants and Acute Toxicity in Delaware Estuary Sediment (June 4, 1994) ("DEP Report"). Therefore, because the MCD does not maintain or improve the environment, but will instead destroy biological resources and cause toxic contamination, the State must deny the permit.

Response. Refer to the general responses for "impacts on over-wintering female blue crabs", "oyster impacts", "concerns for sandbar sharks", concerns for winter flounder", "horseshoe crab impacts from sand placement" and "shortnose and Atlantic sturgeon Concerns".

The Corps has conducted extensive testing to investigate potential impacts associated with sediment contamination. These tests have included chemical analysis of channel sediments to determine actual contaminant concentrations, and biological testing to evaluate toxicity concerns. Analysis of channel sediments has indicated that contaminants that are present, primarily heavy metals, are at concentrations considered low to medium. The results of state-of-the-art PCB analyses indicated that PCBs, which are ubiquitous in modern society, are one to three orders of magnitude lower in the navigation channel than in shallows outside the project area, and below levels of concern. It is likely that this is the result of regular dredging maintenance, which precludes contaminants from building up over time.

The Corps evaluated toxicity of bottom sediments by directly exposing aquatic organisms to the sediment. Water column, or suspended solid particulate phase bioassays were run to evaluate water quality concerns associated with the release of contaminants from sediment into dredging or placement site water. Whole sediment, or benthic bioassays were run to evaluate impacts to bottom dwelling organisms that would reside in sediments placed in an aquatic environment. These tests, which are commonly used to evaluate the quality of dredged material, were developed and approved by the U.S. Environmental Protection Agency.

A variety of aquatic organisms were used in the bioassays including larval shrimp approximately four days old, fathead minnows hatched the previous day, and American oyster embryos approximately two-hours after fertilization. These young organisms are very fragile and sensitive to contaminants in their environment. Following established protocols, these organisms were exposed to samples of bottom sediment for a prescribed period of time to evaluate any differences in mortality between Delaware River channel sediment and clean laboratory sediment. All organisms (100%) survived the numerous bioassays that were run, which is a strong indication that channel sediments are not toxic to aquatic organisms.

Bioaccumulation tests were run with channel sediment from Delaware Bay to evaluate the potential uptake of contaminants by aquatic organisms at aquatic placement sites. This test allows aquatic organisms to live in the sediment for approximately one month, and then analyzes the animal tissues to evaluate any accumulation of contaminants. Tests were run with the hard-shelled clam and a marine worm. Overall, there was no evidence that contaminants accumulated in animals exposed to Delaware Bay sediment at greater concentrations than animals exposed to clean laboratory sediment. All tissues were representative of what one would expect of animals living in a clean environment.

State and Federal resource agencies have reviewed the Corps' sediment quality data. The States of Delaware, New Jersey and Pennsylvania have approved the deepening project by finding it consistent with their respective coastal zone management programs. The U.S. Environmental Protection Agency stated: "EPA continues to believe that there will be no adverse impacts associated with the disposal of sediments generated by the project." The U.S. Fish and Wildlife Service stated: "Results of chemical analyses provided within the biological assessment indicated that contaminant loads in the sediments tested are low."

<u>Comment.</u>

3. The Dredge Disposal Sites Will Have Suffer Severe Environmental Impacts

Delaware must ensure that subaqueous lands do not suffer any negative effects of dredge disposal. Sections 3.05(B)(1) and (B)(2) require DNREC to consider any environmental impacts at the dredging sites as well as any environmental effects of the disposal of dredged materials at and surrounding the disposal sites. As discussed above, the placement of dredge spoils from the MCD will have devastating environmental impacts. The quality of the material may not sufficient for beach replenishment. Placement will harm the spawning grounds of horseshoe crabs and sandbar sharks. <u>Supra.</u> Furthermore, the toxicity of the dredge spoils from toxic "hot spots" has never been fully addressed by the Corps. <u>See</u> Comments of Sierra Club (Delaware Chapter). Therefore, because the MCD will have severe negative environmental impacts at the disposal sites, the State must deny the permit.

Response. Refer to the general responses for "horseshoe crab impacts from sand placement" and "concerns for sandbar sharks".

The Corps has conducted extensive testing to investigate potential impacts associated with sediment contamination. These tests have included chemical analysis of channel sediments to determine actual contaminant concentrations, and biological testing to evaluate toxicity concerns. Analysis of channel sediments has indicated that contaminants that are present, primarily heavy metals, are at concentrations considered low to medium. The results of state-of-the-art PCB analyses indicated that PCBs, which are ubiquitous in modern society, are one to three orders of magnitude lower in the navigation channel than in shallows outside the project area, and below levels of concern. It is likely that this is the result of regular dredging maintenance, which precludes contaminants from building up over time.

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Comment.

4. Delaware's Water Quality Standards Will Be Violated.

Delaware must maintain its water quality, Section 3.01 (B)(l)(a) of the Regulations requires DNREC to consider the "impairment of water quality... which may reasonably be expected to cause violation of the State Surface Water Quality Standard." The MCD is reasonably expected to cause excursions of Delaware's water quality standards ("'WQSs"). For example, the MCD will resuspend toxic contaminants in the water column. See DEP Report; Comments of Sierra Club (Delaware Chapter). These resuspended toxics are likely to be at levels that exceed WQSs. Therefore, because the MCD is likely to cause excursions of WQSs, the State must deny the permit.

Response. Despite the positive results of the tests conducted to date, the Corps intends to monitor water quality during construction. This monitoring will insure that dredging and disposal activities associated with the deepening project do not adversely impact the aquatic resources of the Delaware River and Bay. The Corps has been working with the States of New Jersey and Delaware, and the Delaware River Basin Commission (DRBC), to develop an acceptable protocol for this type of monitoring. To date, the Killcohook, Oldmans, Pedricktown North and Pedricktown South CDFs have been monitored. Reports on the monitoring studies conducted at the Killcohook and Pedricktown North CDFs have been provided as part of the public record. The reports provide details on how CDFs would be monitored.

The Corps has also conducted modeling efforts to simulate the quality of water discharged from the Reedy Point South CDF during disposal operations, and contaminant concentrations in the water column resulting from dredging activity. These studies have also been included as part of the public record. Both the modeling results and the field monitoring studies indicate that dredging and dredged material disposal operations do not significantly impact water quality.

Comment.

5. The MCD Will Have Negative Effects On Shellfishing and Finfishing.

Delaware must ensure that its shellfish and finfish populations are not be impaired. Section 3.0 l(B)(l)(b) of the Regulations requires DNREC to consider any "effect on shellfishing, finfishing, or other recreational activities." As discussed above, the MCD will adversely effect the spawning grounds of numerous commercially or recreationally important species including: blue crabs, oysters, horseshoe crabs, summer flounder, and sandbar sharks. Supra. Therefore, because the MCD may impact the spawning grounds of these important species, which may ultimately lead to lower stocks, the State must deny the permit.

Response. Refer to the general response for "impacts on benthic communities".

The impacts to Federally managed fish are discussed in the "Essential Fish Habitat Evaluation" a draft of which was submitted with the permit application under "Channel Dredging" **(EXHIBIT 1).** A revised draft report of the "Essential Fish Habitat Evaluation" is attached in the general response for "benthic communities". The entire report is available on a CD ROM. Although some impacts are expected to occur to managed species, none are expected to have a significant impact. Also, refer to the general responses for "impacts on over-wintering female blue crabs", "oyster impacts", "concerns for sandbar sharks", concerns for winter flounder", "horseshoe crab impacts from sand placement" and "shortnose and Atlantic sturgeon concerns".

Comment.

6. Delaware's Hydrology Will Be Impaired.

Delaware must insure that surface and groundwater hydrology are not be altered in any way that would harm local interests. Section 3.01 (B)(1)(f) of the Regulations requires DNREC to consider the "extent to which the [MCD] may adversely impact natural surface and groundwater hydrology." The Motiva Refinery has already spoken out in opposition to the MCD because it will alter the current of the River and result in increased siltation, and associated dredging costs, at the refinery See. Molly Murray, Motiva Opposes Dredging, Wilmington News Journal, June 7, 2001 at B 1. As for groundwater, the aquifers that run beneath both the Bay and the River Bay will be adversely impacted by any dredging. See generally Comments of New Jersey Environmental Federation. Once these aquifers have been contaminated, there is no way to repair them. This may create a *public* health danger for which the Corps has already disavowed any responsibility. Supra. Therefore, because the MCD will have negative impact on both surface and groundwater hydrology, the State must deny the permit.

Response. Please refer to **EXHIBIT 66** for the Corps response on impacts to Motiva's refinery.

At the request of the Corps, the U.S. Geological Survey was tasked to make an assessment or investigate impacts of the dredging project on the drinking water aquifers. The concerns generally focused on several areas of concern including,

- (1) Dredging breaches confining unit
- (2) Saltwater in river encroachment onto well-recharge areas

To address the above concerns the U.S. Geological Survey (USGS) subsequently performed three separate studies. The USGS issued three separate reports as listed below.

1. Evaluation of Ground-Water Flow from Dredged Material Disposal Sites in Gloucester and Salem Counties, New Jersey (USGS, 1995)

2. Hydrogeologic Conditions Adjacent to the Delaware River, Gloucester, Salem and Cumberland Counties, New Jersey (USGS, 1996)

3. Selected Hydrogeologic and Chloride-Concentration Data for the Northern and Central Coastal Area of New Castle County, Delaware (USGS, 1998*).* *

* *Note draft report was prepared in 1996.*

A letter dated 23 January1996 was then issued by the USGS, which summarized their findings and referenced these reports. The USGS investigation or analysis of the above concerns reached the following findings:

In summary, the concerns about increasing the potential for saltwater from the river to infiltrate into the adjacent aquifers, either as a result of dredging through a confining unit or as a result of the upstream movement of saltwater in the deepened channel can be set aside. No significant confining units will be breached and the saltwater will not significantly move upstream to increase the threat of saltwater intrusion.

Since USGS studies indicate that no significant aquifers will be breached, adverse impacts from dredging can be set aside.

Comment.

7. The Present Environmental Condition Of The Delaware River And Bay Is Too Fragile To Risk Damage.

Delaware must ensure that the fragile environmental condition of the Delaware River and Bay is not placed in peril. Section 3.01(5)(3) requires DNREC to consider whether the MCD could have the potential to cause any adverse environmental impacts, taken in conjunction with the existing situation. The existing situation is that the Delaware River and Bay have been polluted by various industries for over a hundred years. See Comments of Delaware Nature Society. Due to pubic awareness, the water of the River and Bay has become cleaner which has allowed the Delaware Estuary to return as source of food, recreation and aesthetic enjoyment for the citizens of Delaware, as well as the citizens of other states Id. Conversely, the MCD project *will severely* disrupt this balance and adversely impact the Delaware River and Bay and anyone who depends on these waters for their livelihood or enjoyment. Therefore, the balance of equities compels the State deny the permit.

Response. Refer to responses for comments 3 and 4, above.

Economic Factors

Comment.

1. The Corps' Cost/Benefit Methodology is Flawed, And In Any Event Reveals No Real Economic Benefits.

Delaware must ensure that the benefits of the MCD outweigh its cost, Section 3.05(B)(3) of the Regulations requires DNREC to consider the proposed "economic and noneconomic benefits of the [MCD] compared to [its] costs, both direct and secondary." The economic benefits of the MCD are highly suspect. Presently, the MCD *is* under review by the General Accounting Office ("GAO"). See John Sullivan, Review of Delaware Dredging, N.Y. Times, April 15, 2001, at 14 NJ p. 5. The Environmental Groups believe that the GAO's report expected sometime next year, will conclude that the Corps has overstated the benefit of the MCD and has underestimated its costs. In addition, the Environmental Groups believe that GAO will find that the MCD does not meet minimum federal standards of national economic development. Therefore, we recommend that Delaware defer action on the permit application until the GAO study is released.

Assuming, arguendo, that Delaware chooses to proceed with the permit review, a cost/benefit analysis demonstrates that the MCD offers no benefit to Delaware. The Corps has not demonstrated any direct economic benefit to the State of Delaware. Instead the Corps' permit application implies that Delaware will receive an indirect benefit in the form of sand for beach replenishment. However, this supposed "benefit" to citizens of Delaware is not a result of the MCD. Instead, the beaches that the Corps' has proposed for beach replenishment through the MCD have already been approved as separate beach replenishment projects. See Comments of Richard A. Fleming (Delaware Nature Society); Comments of National Wildlife Federation. Yet, Delaware is being called on to issue a permit to receive a "benefit" that the State is slated to get regardless of the MCD. Thus, because there is no economic benefit in the MCD for Delaware, the State must deny the permit.

Response. Concerns benefits to Delaware, as the Port of Wilmington pointed out during the June 6, 2001 public workshop and December 4, 2001 public hearing, the project will make the port more competitive in the world market and will enhance its ability for economic growth if facilities are shifted directly onto the Delaware River with access to the 45-foot channel. In addition, consider these benefits:

- Approximately $30 million in project funds will be spent at Kelly Island to restore 60 acres of tidal wetlands, protect approximately 5,000 feet of eroding tidal wetlands, and increase horseshoe crab spawning habitat
- Approximately $44 million in project funds will be spent to restore state-selected Atlantic Coast and Delaware Bay beaches.

- During construction, Delaware may accrue indirect economic benefits associated with 300 jobs and millions of dollars in wages, state revenues, and state and local tax receipts.

The Kelly Island Wetland Project is not an approved replenishment project. At this time, it can only be constructed as part of the Delaware River Main Channel Deepening Project. The Corps benefit analysis for this deep draft navigation project, as required, followed guidance in the planning regulation, ER 1105-2-100. Navigation transportation cost savings benefit will accrue to the national economic development account.

Comment.

2. The MCD Will Have Negative Impacts On Important Commercial And Recreational Interests.

Delaware must ensure that commercial and recreational interests are not harmed. Section 3.01 (A) of the Regulations requires DNREC to consider the public interest in any activity that may affect the State's subaqueous lands. One such consideration is "the potential effect on the public with respect to commerce, . . . recreation, aesthetic enjoyment, [and] natural resources." Regulations at 3.01(A). The MCD will have devastating effects on commercial and recreational interests. As discussed above, the Corps proposes to place spoils of the MCD on beaches throughout the state. These spoils may not be of appropriate quality for beach replenishment. See. Comments of National Wildlife Federation; Comments of Richard A. Fleming (Delaware Nature Society); Comments of Sierra Club (Delaware Chapter). Dumping low quality sand on Delaware's beaches may result in tourists choosing other, more pristine beaches in the Mid-Atlantic area. Moreover, these spoils will adversely affect the breeding habitats of horseshoe crabs and will thus effect the aesthetic enjoyment of thousands of "birders" who annually visit Delaware's beaches. See Comments of Audubon Society. Therefore, because the MCD will have negative impacts on important commercial and recreational interests in Delaware, the State must deny the permit.

Response. Placement of sand on Delaware beaches is expected to have beneficial impact on horseshoe crabs and shorebirds. Refer to the general responses for "horseshoe crab impacts from sand placement" and "migratory shorebirds impacts".

Bulk sediment analyses of Delaware Bay channel sediments were conducted to determine the total concentration of contaminants within the sediments. Chemical parameters included heavy metals, pesticides, PCBs, PAHs, and a variety of volatile and semi-volatile organics. To evaluate potential impacts to fish and wildlife resources, bulk sediment data were compared to ERL/ERM sediment guidelines. These guidelines provide an estimate of the potential for sediment contaminants to adversely effect aquatic resources. Through a comprehensive review of available data on sediment effects, researchers established two guideline values. These two values are referred to as effects range-low (ERL) and effects range-median (ERM). The researchers stated: "The two guideline values, ERL and ERM, delineate three concentration ranges for a particular chemical. The concentrations below the ERL value represent a minimal-effects range; a range intended to estimate conditions in which effects would be rarely observed. Concentrations equal to and above the ERL, but below the ERM, represent a possible-effects range within which effects would occasionally occur. Finally, the concentrations equivalent to and above the ERM value represent a probable-effects range within which effects would frequently occur." (Long et al. 1995).

Bulk sediment analyses of Delaware Bay sediments only detected heavy metals, extremely low concentrations of PCBs and di-n-butyl phthalate. The ERL guideline for PCBs is 22.7 parts per billion. The highest detected concentration of PCBs in Delaware Bay channel sediment samples was 0.02 parts per billion. There is no guideline for di-n-butyl phthalate, however, the State of New Jersey has developed a standard of 5,700 parts per million as a maximum concentration for clean residential areas. The maximum concentration of di-n-butyl phthalate in Delaware Bay channel sediment samples was 0.88 parts per million. Phthalates are used in manufacturing plastic products. It is likely that detection of di-n-butyl phthalate is not from sediment contamination, but the result of laboratory contamination as the sediments come in contact with plastics from the time samples are collected through the laboratory analysis. Table 1 compares the heavy metal data to ERL/ERM sediment guidelines. The actual bulk sediment concentrations have been previously provided to the Delaware DNREC. All heavy metal concentrations detected in Delaware Bay sediments were below the ERL levels except one sample concentration of nickel (sample concentration of 21.4 mg/kg, ERL concentration of 20.9 mg/kg) and two sample concentrations of cadmium (sample concentrations of 1.22 and 2.8 mg/kg, ERL concentration of 1.2 mg/kg). These samples were collected from locations known to contain fine grain material; this material would not be placed on beaches. All concentrations of heavy metals detected in areas to be dredged for beach nourishment were below ERL levels. Based on these results, there is no reason to believe that placement of Delaware Bay sand on Delaware beaches would impact aquatic resources from a contamination perspective.

To further evaluate sediment quality, water column and whole sediment bioassays were run to directly evaluate the impacts of sediment contaminants on living organisms. Bioassays provide information on the toxicity of individual contaminants, and also to indicate possible interactive effects of multiple contaminants. For Delaware Bay sediment samples, early life stages of the sheepshead minnow, the American oyster, a mysid shrimp, an infaunal amphipod, a burrowing polychaete and a bivalve mollusc were tested. In multiple tests with numerous individuals of each species, no toxicity (as defined by mortality) was observed.

As a final sediment quality check, bioaccumulation tests were run to evaluate the potential for organisms to accumulate contaminants from the channel sediment into body tissues, which could then be magnified up through the food web. For these tests, a bivalve mollusc and a burrowing polychaete were used. The organisms were allowed to live in the channel sediments for a 28-day test period, and then the soft body tissues were chemically analyzed. Control organisms living in completely clean sediment were also run for comparison. No pesticides, PCBs or PAHs were detected in any of the tissue

Table 1. Comparison of Delaware Bay Main Channel Sediment Data to ERL/ERM Sediment Guidelines

	ERL Value	ERM Value	% Samp. < ERL	% Samp. > ERL & < ERM	% Samp. > ERM
Antimony	2	25	69.6	30.4 *	0.0
Arsenic	8.2	70	100.0	0.0	0.0
Beryllium	NC	NC	NC	NC	NC
Cadmium	1.2	9.6	91.3	8.7	0.0
Chromium	81	370	100.0	0.0	0.0
Copper	34	270	100.0	0.0	0.0
Lead	46.7	218	100.0	0.0	0.0
Mercury	0.15	0.71	100.0	0.0	0.0
Nickel	20.9	51.6	95.7	4.3	0.0
Selenium	NC	NC	NC	NC	NC
Silver	1	3.7	100.0	0.0	0.0
Thallium	NC	NC	NC	NC	NC
Zinc	150	410	100.0	0.0	0.0

ERL/ERM guidelines are in mg/kg.

NC - Parameter has no established ERL/ERM guidelines.

Non-detections were included in the analysis at half the detection limit.

* - Antimony was not detected in any of the Delaware Bay samples. These samples were non-detections with high detection limits.

Long, E.R., D.A. MacDonald, S.L. Smith, and F.C. Calder. 1995. Incidence of Adverse Biological Effects Within Ranges of Chemical Concentrations in Marine and Estuarine Sediments. Environmental Management 19(1):81-97.

samples. Some heavy metals were detected, however, these metals were also detected in the control organisms, and all tissue concentrations were within range of acceptable background tissue levels.

Overall, these test results indicate that dredging channel sand from Delaware Bay, and using the sand for beach nourishment, would not have an adverse effect on aquatic resources of the bay. There is no evidence of any potential contaminant problems. Wildlife resources that would be in contact with the beach sand or forage for food at the water line would also be unaffected. There are no concerns with regard to toxicity or bioaccumulation of contaminants through a food web with sand of this quality.

Comment.

3. The Primary Objective Of The MCD Is Already Being Achieved Through Other Means.

Delaware must consider whether new technologies obviate the need for the MCD. Section 3.01(A)(5) of the Regulations requires DNREC to consider "[t]he extent to which the [Corps'] primary objectives and purposes can be realized without the use of [subaqueous] lands." The stated purpose of the MCD is to reduce the lightering costs to refineries in Pennsylvania and New Jersey. See Permit Application at p. 2. Yet, the benefits of reduced lightering costs are already being realized through the use of new ships that carry more oil to Pennsylvania and New *Jersey's* refineries at the river's current depth of 40 feet. New fleet of fast ships makes dredging moot. Wilmington News Journal, September 5, 2001 at A11. Therefore, because the benefits of reduced lightering costs are already being achieved through the use of new ships, the use of Delaware's subaqueous lands are unnecessary. Thus, the State must deny the permit.

Response. New tankers being introduced into the fleet still need to lighter at Big Stone Beach Anchorage before moving upriver to the refineries. These tankers will achieve reduced transportation costs to the National Economic Development account with the deepened channel.

Comment.

4. The Corps Has Not Employed Any Mitigations to Offset Potential Future Public Losses.

Delaware must ensure that the Corps employs mitigation efforts for the MCD. Section $3.01(.4)(7) of the Regulations requires DNREC to evaluate "the extent to which the [Corps] can employ mitigation measures to offset any losses incurred by the [MCD]." The MCD does not *employ any* mitigation efforts to address future losses to the public. To the contrary, the Corps has disavowed any responsibility for future losses as a result of the MCD and has asked the State to agree to a "hold harmless" clause to insulate the Corps from any future liability. See. Comments of Delaware Audubon Society; Comments of Richard A. Fleming (Delaware Nature Society). Instead of mitigation, the

Corps has stated that it will "monitor" the environmental impacts of the MCD. Monitoring is not a "mitigating measure" that would offset any cost to Delaware to maintain or repair any area that is damaged by the MCD. Therefore, because the Corps has refused to employ mitigation measures and has stated it is not responsible for any future losses to the public, the State must deny the permit.

Response. The project has been designed to avoid impacts to environmental resources of the Delaware estuary. In Delaware Bay, placement of dredged material will benefit the State by restoring previously lost wetlands, nourishing eroding beaches, protecting sensitive habitats, improving horseshoe crab spawning habitat and migratory shorebird habitat. These actions do not require mitigation because the impacts of these actions are beneficial.

If an environmental problem arises during dredging, the Corps and the project sponsor, the Delaware River Port Authority, will be responsible for any environmental remediation costs that occur during dredging of the Delaware River Main Ship Channel. This responsibility will be detailed in the Project Cooperation Agreement to be signed by the Corps and DRPA. Further, as the applicant for the DNREC permit, the Corps is legally and financially accountable for any remediation that falls within the permit parameters.

Comment.

5. There Is No Benefit To The Public.

Delaware must ensure that the MCD provides a benefit to the State of Delaware. Section 3.01(A)(8) of the Regulations requires DNREC to consider the "extent to which the Delaware public at large will benefit from the MCD and the extent to which the public would suffer detriment." As discussed above, Delaware does not receive any real "benefit" from the MCD. The only "benefit" alleged by the Corps is that dredge spoils will be used for beach replenishment. However, this offer is not a legitimate benefit in that separate beach replenishment projects have already been approved for Delaware' s beaches and the quality of the spoils may not be sufficient for beach replenishment. Conversely, the detriments to Delaware are substantial. As discussed above, Delaware's citizens will pay at least $10 million for potentially low quality sand, the potential destruction of productive habitats, the potential loss of tourism, and the prospect of future expenditures on mitigation. Therefore, because the public does not receive any benefit from the MCD, but will instead suffer considerable detriment, the State must deny the permit.

Response. Concerns benefits to Delaware, as the Port of Wilmington pointed out during the June 6, 2001 public workshop and December 4, 2001 public hearing, the project will make the port more competitive in the world market and will enhance its ability for economic growth if facilities are shifted directly onto the Delaware River with access to the 45-foot channel. In addition, consider these benefits:

- Approximately $30 million in project funds will be spent at Kelly Island to restore 60 acres of tidal wetlands, protect approximately 5,000 feet of eroding tidal wetlands, and increase horseshoe crab spawning habitat
- Approximately $44 million in project funds will be spent to restore state-selected Atlantic Coast and Delaware Bay beaches.
- During construction, Delaware may accrue indirect economic benefits associated with 300 jobs and millions of dollars in wages, state revenues, and state and local tax receipts.

Justification for this federal project is based on benefits to the national economic development account. Benefits specific to the region, state, or an individual company are not a factor in the analysis for project justification.

EXHIBIT #112

JAMES R. MAY & MICHAEL E. CROWSON, WIDENER UNIVERSTIY

Comment.

Summary. We believe the Corps' application is not complete because it fails to evaluate the adverse effects of using Port Mahon and Broadkill Beach Disposal Areas as dredged spoils disposal sites. The State of Delaware must protect federal trust resources, including those found in submerged areas, like Horseshoe Crabs. Illinois C.R. Co.v. Illinois, 146 U,S. 387 (1892); see also, Ram*sar Convention* on *Wetlands of International Importance* (ratified by U. S., April 4, 1987) (listing Delaware Estuary as internationally significant resource due in part to Horseshoe Crabs). To evaluate the application, one must understand the environmental and economic impacts of disposing of the contaminated spoils from the main channel. But the Corps has not conducted an environmental assessment of disposing the spoils at the Port Mahon and Broadkill Beach Disposal Areas. Accordingly, we recommend DNREC request the Corps comply with the National Environmental Policy Act ("NEPA") and prepare a Supplemental Environmental Impact Statement ("SEIS") before the state completes its evaluation of the Dredge's environmental and economic impacts under Delaware law.

Why the SEIS is necessary. The Corps' regulations require it to "prepare supplements to either draft or final environmental impact statements if... there are significant new circumstances or information relevant to environmental concerns and bearing on the proposed action or its impacts." 33 C.F.R.$ 230. 13(b) (citing 40 C.F.R. $1502.09(c)(1)(i)). This has been interpreted to require an SEIS if "the proposed [activity] will have a significant impact on the environment *in a manner not previously evaluated and considered.* " *Id.* (emphasis added); see also, Marsh v. Oregon Natural Resources Council, 490 U.S.360, 373-74. The SEIS must evaluate "any substantial changes [that] have occurred or *new* information [that] has come to light, " South Trenton Residents Against 29 v. Federal Highway Administration, 176 F.3d 658, 663 (3rd Cir.1999). See e.g.., Portland Audubon Society v. Babbitt , 998 F.2d 705 (9th Cir. 1993) (new information on the impact of logging on the spotted owl gave rise to review in an

SEIS). The SEIS must take a "hard look' at the (1) environmental impacts, (2) unavoidable adverse environmental impacts, and (3) alternatives to disposing the spoils at the Port "Mahon and Broadkill Beach Study Areas. NEPA $ 102(2.)(C)(i)-[v); Citizens to Preserve Overton Park v. Volpe, 401 U.S. 402(1971].

Response. Appropriate supplemental NEPA documentation associated with the individual beach nourishment projects will be prepared to evaluate placement of main channel sand on selected beaches

Comment. The Corps has not evaluated and considered the environmental impacts of disposing of dredged spoils at the Port Mahon and Broadlkill Beach Disposal Areas. Port Mahon and Broadkill Beach provide important spawning habitat for the Horseshoe Crabs. Horseshoe Crabs spawn at different areas in different years depending on water conditions. The fact that the spawning areas change with each spawning season shows the need for protracted studies of impacts. The Corps conducted an EIS for the Dredge in September 1996 for Broadkill Beach and September 1997 for Port Mahon. These EISs, however, did not evaluate the adverse effects on the horseshoe crab. The "Essential Fish Habitat" evaluation in the Corps' application does not mention any long-term scientific studies concerning the impact on horseshoe crabs in the proposed areas, and in particular, the effects on juvenile Horseshoe Crabs in the sub-tidal shallows off of Port Mahon and Broadkill Beach. Plus, the Corps has not submitted any alternatives that may potentially minimize the adverse impacts on the Horseshoe Crab habitats in the proposed areas. All of these facts mandate" an SEIS from the Corps.

Response. Refer to the general response for "horseshoe crab impacts from sand placement".

Comment. Other federal agencies believe the Corps should prepare an SEIS and evaluate these impacts. A United States Fish and Wildlife Service ("Service") letter to The Corps, dated November 14, 2001, expresses reservations concerning the Corps' beach nourishment activities in these areas within the restricted times stated by the Corps. 1The letter describes concerns regarding any adverse impacts that the use of the spoils will have on juvenile crabs and shorebirds that inhabit these beaches. The Service says that the pre-construction horseshoe crab egg density monitoring report is not equivalent to conducting a study under NEPA. Thus, it concludes, "the Service assumes that a formal proposal to nourish the subject beaches as part of the . . . Project will be addressed in a forthcoming NEPA document'"2

1 Letter from Clifford G. Day. USFWS, to John Brady, USACE dated November 14, 2001

2 Id. Other federal agencies have also voiced their concerns regarding the dredge. A letter to the Assistant Secretary of the Army (Civil Works) from the Office of the Management Budget ("OMB'"), dated January 18,2001 questions the financial viability of maintaining Port Mahon. That letter calls for Service "to evaluate a much broader array of alternatives for addressing the needs of the horseshoe crabs and migratory birds "to substantiate any funds being allocated for subsequently maintaining the habitat. Letter from Wesley p.Warren OMB to Joseph W. Westphal, Asst. Sec. Of the Army, dated January 18, 2001

Response. Refer to the general responses for "horseshoe crab impacts from sand placement" and "migratory shorebird impacts". Also, refer to Corps letter dated January 28, 2002 responding to November 14, 2001 letter from U S Fish and Wildlife Service.

Comment. The inadequately assessed impacts on the Horseshoe Crab of depositing dredged spoils at Port Mahon and Broadkill Beach manifest "new circumstances or information [that have] a significant impact on the environment in a manner not previously evaluated and considered." Thus,an SEIS is necessary for this evaluation.

Response. Appropriate supplemental NEPA documentation associated with the individual beach nourishment projects will be prepared to evaluate placement of main channel sand on selected beaches

EXHIBIT #113

BEVERLY V. BAXTER, THE COMMITTEE OF 100

Comment noted. No response required.

EXHIBIT #114

CORAILE PRYDE

Question 1.

Elizabeth Murphy, representing the Delaware River Port Authority, gave testimony at the December 6 hearing that was clearly misleading. She indicated that the Port of Philadelphia was responding to items listed in the 1996 report "Global Trends in Ocean Shipping and Vessel Size" that was based on testimony from a group of consultants hired by the Ports of
Philadelphia and Camden to examine the feasibility of Philadelphia's becoming a "super port" serving the new category of "post-Panama container ships".
The report made it quite clear that there would only be one, or at most, two, east coast ports that would function as superports and get business from the larger ships. It also made it clear that the port(s) chosen would have to meet all, not just some, of the requirements listed on pp. 9-10 of the summary of presentations.

Response. Ms. Murphy never said the Delaware River Port Complex (which for purposes of these responses includes the ports of Wilmington, Philadelphia and Camden and are collectively referred to in these responses as "the Delaware River Port") aspired to become a "super port." In fact, DRPA concurs with Coralie Pryde's conclusions that it is unlikely the Delaware River Port will ever become a "super port."

Such a "super port" would be capable of handling the fifth generation mega containerships, with capacity to carry 5,500-to-10,000 teus. These vessels will need channel depths of 45-feet to 55-feet, and perhaps even deeper.

With that as background, please note the following:

1. Containerized cargo is only one of three cargo types. The Delaware River Port competes for containerized cargo and would be able to handle more container traffic if it had a modern shipping channel. However, limiting the discussion only to containers ignores the other two cargo types that would benefit from a modern shipping channel.

Those are:

Breakbulk cargoes such as steel products and slabs, paper and lumber, and scrap metal, and;

Bulk cargoes such as iron ore, cement, petroleum and fertilizer.

Exporters and importers of these commodities need to use the deeper-draft vessels that are now in use and are becoming industry standards. That need is based on the economics of transportation: the more cargo a vessel can carry the more competitive it becomes and the lower the landed-cost of the commodity it carries. If the Delaware River Port does not provide a modern shipping channel, competition will economic forces will demand the shift of cargo to port cities that can meet modern standards. Two reports quantify the potential economic benefits to the Delaware River Port from the use of larger vessels for bulk and breakbulk cargoes. The reports, which are part of the hearing record are: "Economic Benefits of a 45 Foot Delaware River Channel" by Martin Associates and "Port of Wilmington, Delaware, Economic Benefits of a 45-Foot Delaware River Channel " by Martin Associates.

2. For containerized cargo, the so-called "fourth generation post-Panamax containerships" are now in service on major world trade routes. These vessels, which have capacities of 3,500-to-5,500- teus, require shipping channels with drafts of 40 to 45 feet. Without a modern, 45-foot channel, the Delaware River Port could not service this size vessel. This would negate the dockside and transportation investments the states of Delaware, Pennsylvania and New Jersey have made to accommodate containerized cargo and the marketing efforts the port has extended to bring these vessels to the Delaware River.

3. As the mega containerships are introduced into service on the longer Far East trade routes, the fourth generation "post-Panamax" vessels will service shorter trade routes, such as Delaware River Port to Europe and the Mediterranean, and Delaware River Port to Central and South America. The Port of New York is scheduled to have 50-feet of draft by 2009 and is likely to attract one or more of the mega containership services. This will likely have a significant impact within the Port of New York/New Jersey causing

operators of the 3,500 to 5,000 teu vessels to consider alternative ports to service their vessels. Those alternative ports must offer a modern shipping channel and the ability to serve the New York market, as well as other East Coast and Midwest locations. The Delaware River Port will be ideally positioned to compete for one or more of these shipping lines, if it has a modern shipping channel capable of handling post-Panamax ships.

4. The questioner asks if a Delaware River marine terminal has all the facilities needed to handle more containerized cargo. Yes, Philadelphia has a container terminal that can provide the list of services and facilities listed in the reports, on Pages 9 and 10. The Packer Marine Terminal, which would benefit from the channel modernization program, is a container terminal that meets the criteria listed. The marginal berth is 3,100-feet long. The Commonwealth of Pennsylvania has appropriated $10 million for the purchase of two new post-Panamax container cranes, which are scheduled to be available in 2003. The terminal has 106 acres, with an additional 50 acres adjacent to the terminal. Packer Avenue has on-terminal rail service and is located adjacent to two intermodal rail terminals, AmeriPort and CSX. The ILA services the Packer Avenue Marine Terminal, giving it the same union and work rules as other East Coast container terminals. In addition, Philadelphia is the third largest consumer market in the U.S.

5. The Port of Wilmington, which is realigning its terminal configuration, is building berths on the Delaware River. These new berths will be close to the main channel and would benefit from the channel modernization program. Given a 45-foot channel, Wilmington will have the option of developing port property along the Delaware River into a container terminal capable of handling post-Panamax vessels.

Comment.

The following criteria were
listed under Port Related Factors]
Berts of 900-1,000 feet in length
34 Post Panamax Cranes available for each berth
40-50 acres of backland
Rail on terminal
Dedicated terminals
Flexible, reliable labor 24 hour availability
Competitive rail and truck services
All [items?] in costs must make sense compared to other options
Medium to large local markets
2)Which do they meet now? How were changes accomplished?

Response. Philadelphia's Packer Marine container terminal, located south of the Walt Whitman Bridge, will meet the requirements listed in the report for a post-Panamax container terminal. In fact, the terminal is a load-center container port for the P&O Australian/New Zealand service, which has notified port operators that the containerships it is building will need 42-to-45-foot of draft.

- Marginal berth of 3,100 linear feet.

- The Commonwealth of Pennsylvania has appropriated $10 million in funding for the purchase of two new post-Panamax cranes, which will be operational in 2003.

- Packer Avenue is 106 acres, with an additional 50 acres adjacent to the terminal.

- Packer Avenue has on-terminal rail service provided by the shared assets railroad Conrail, which give CSX, NS and CP access to the terminal. In addition, the terminal is adjacent to the AmeriPort and CSX intermodal rail facilities. In close proximately, NS is constructing a new intermodal rail facility

- The terminal is currently a multipurpose facility, handling break bulk cargoes in addition to containers. It can be readily converted into a dedicated container terminal.

- ILA labor and work rules apply, the same labor and work rules that apply at all container terminals on the U.S. East Coast.

- Serving the terminal are three class-I railroads, plus local and national motor carriers. The Commonwealth of Pennsylvania provided funding to lower railbeds and raise power lines. This improvement created double-stack container rail service to and from the port and across the state.

- The Philadelphia region is the third largest consumer market in the U.S.

Comment.

3)Which other requirements can be met within the next five years?

Response. Once the two post-Panamax container cranes are operational in 2003, the Packer Marine Terminal meets the criteria listed. The Port of Wilmington is in an early phase of port development on the Delaware River.

Comment.

4)What would be the cost of meeting those requirements?

Response. The Commonwealth has provided $10 million to fund the acquisition of the two post-Panamax container cranes.

Comment.

5) Specifically how will the need for increased dredging (and the cost of maintaining more dredge disposal sites) affect the costs Philadelphia will incur in becoming a superport compared to other options in which the port is either directly on or very near the ocean?

Response. The Delaware River Port has no plans or intention to become a super-container port. That would require deepening the channel beyond 45-feet, and no such plan exists. However, providing a modern shipping channel with a 45-foot depth will enable the port to remain competitive. With a modern shipping channel, the Delaware River Port will be able to accommodate larger breakbulk vessels, which are now in service, and the third and fourth generation containerships.

Comment.

Under Vessel Related [Factors]
1) How can the single deep lane in the Delaware safely accommodate two-way traffic to and from the port involving large numbers of wide, deep-draft vessel?.

Response. The channel accommodates two-way traffic currently and will continue to do so in the future. Post-panamax vessels benefiting from the project will not have sailing drafts that exceed 45 feet. Navigation transportation cost savings are based on the tonnage moving through the Delaware River port system now and expected to continue to do so in the future (with and without the channel deepening).

Comment.

2) How can they serve post-Panamax vessels that are more than 45 feet deep when the deepening will result in a maximum depth of 45 feet?

Response. Given the 45-foot channel, the Delaware River Port will be limited to accommodating fourth generation post-Panamax containerships with maximum draft, plus under-keel safety clearance, of up to 45-feet. Referring to graphics in the subject report, see figure 23, post-Panamax containerships begin with the fourth generation design, capable of carrying 4,000-to-5, 000+ teus. Fifth generation containerships are in service with capacity of 5,000-to-7, 000-teu's. Containerships now in construction will have capacity to carrying 7,200-to-9, 800 teus. These larger vessels will operate between mega container load centers. The Delaware River Port will never become a mega container load center, but that should not be interpreted to mean that the port is not viable. Many international airports cannot handle the Concorde, but that does not mean they are not viable airports and should be phased out so that only mega airports remain.

Post-Panamax containership range in draft from 42 feet to 55+ feet. Referring to the subject report, Figures 30 and 31, the characteristics for several post-Panamax containerships are provided, with depths ranging from 41-feet-to-46-feet:

APL Vessel,	4,830 TEU	41.0-Ft Draft, + Clearance
APL Vessel	5,430 TEU	46.0-Ft Draft, + Clearance
MOL Vessel	4,748 TEU	42.6-Ft Draft, + Clearance

With a 45-foot main channel, the Delaware River Port will be able to accommodate fourth generation, post-Panamax, containerships. No plans exist for the Delaware River Port to become a load center for the post-Panamax mega containerships

Comment.

3) How does Philadelphia plan to become competitive with ports directly opening to the Atlantic when ships will need to spend more than half a day in total traveling slowly up and down the Delaware to reach the port? In particular, how can they possibly be competitive in attracting east/west ocean traffic when the river travel time is spent going north and south?

Response. The Port of the Delaware River will remain competitive in the future for the same reasons it has successfully competed with ocean-side ports for the past 300 years. To international shipping companies, the question is not "how far is the port from the ocean?" If that were the case, ports would not exist along the Mississippi River or the Great Lakes. Rather, the relevant questions is: "what is the cost to get my commodity to my customer?" The answer to that question depends on several factors including:

- Number of days the ship spends in transit.
- Adequacy of the shipping channel so ships do not have to unload portions of their cargo before proceeding to dock.
- Waiting time to dock.
- Skill and speed of dockworkers and the necessary equipment to load and unload quickly.
- Location and adequacy of dockside storage.
- Availability of landside transportation.
- Congestion on the waterway, on the dock and during landside transportation.
- Proximity of the port to the customers' location.

On all of these issues, except the first, the Delaware River Port is competitive. Being centrally located, some shipping lines trade off transit time up the Delaware River for shorter, more congested inland transportation. Most of the container services that now call at the Delaware River Port are primarily North/South carriers. The port's marketing efforts are focused on the North/South trade lanes, including Central and South America, Australia/New Zealand and Southeast Asia. Total transit time to Philadelphia is about the same as going to the Port of New York. That makes the Delaware River Port competitive in the North/ South trade lanes. Good examples are the Australian and New Zealand ocean carriers, P&O and Columbus Lines, which have made the Delaware River Port their primary port on the North Atlantic range. P&O has informed port officials that they are building new containerships that will require 42-foot draft. The port's new container cranes that are being purchased are to service these vessels.

In addition, local port operators handle ships quickly, commodities move to landside storage or directly to railroad cars or trucks, and since many customers live close to the metropolitan area, final delivery is efficient. These advantages have gained the Delaware River Port increasing market share when compared with other East Coast ports. A modern shipping channel would remove another obstacle to competitiveness, however the lack of a modern shipping channel would render the port's other advantages moot.

Thus the port's geographic location, in relation to major U.S. markets, and the supporting transportation infrastructure are important factors in port selection. The Delaware River Port serves the mid-Atlantic, mid-West and Canadian markets effectively by rail and motor carriers. Total door-to-door logistics cost and transit time influence shipments routing. The Delaware River Port, being further inland and less congested, easily services major inland markets.

Three Class I railroads serve the Delaware River Port terminals, offering double-stack service. Also, the port is adjacent to the interstate highway network. All of these factors help offset the costs and time incurred coming up the river. Time, costs and service tradeoffs, which the carriers must evaluate, make the port competitive.

Comment.

Question 2
About three years ago, Manny Stamatakis said that DRPA had hired consultants to study thoroughly the economic costs and benefits to Philadelphia of deepening the main channel of the Delaware River. The firm of Gahagan and Bryant was apparently chosen to carry out this study. Inquiries to this firm about receiving copies of the study's conclusions have been met with the statement that, "The results are not available because they have never been officially released."
1) Why has DRPA not insisted on receiving a final report on this study? Surely no competent consulting firm would be unable to complete such a report in three years.

Response. The request for information should have been made to DRPA, not to the consultant. Gahagan and Bryant are DRPA's engineering consultants for the project. They have completed studies that deal with engineering issues. None of this work addresses "the economic costs and benefits to Philadelphia of deepening the main channel of the Delaware River." Two reports completed by the consulting firm of Martin Associates, which address economic costs and benefits to the Ports of Philadelphia and Wilmington, have been made part of the Public Hearing record. The reports are entitled:

- Economic Benefits of a 45-Foot Delaware River Channel

- Port of Wilmington, Delaware-Economic Benefits of a 45-Foot Delaware River Channel

Comment.

2) How much has DRPA paid the firm for their work on this study?

Response. We do not know which study Coralie Pryde is referring to.

Comment.

3) Exactly where did the money come from to pay for this study. Did
any of it come directly orindirectly from transit tolls?

Response. The State of New Jersey, Commonwealth of Pennsylvania and the U.S. Congress have given DRPA three major missions to fulfill. They are: regional transportation, port enhancement and regional economic development. The same bistate compact that gave DRPA those responsibilities also mandates that DRPA must be self-sufficient, that is operating without tax support. The majority of DRPA's revenue, therefore, comes from transportation sources including bridge tolls and transit fares.

However, some further explanation is appropriate. DRPA views an active port complex as a positive economic factor, not a drain on resources. Trucks are the reason. The Delaware River Port generates a huge volume of truck traffic, and these trucks are constantly crossing DRPA bridges. For example, during the winter fruit season an estimated 1,500 trucks per week move cargo out of local port terminals. Commodities like steel, lumber, paper and bulk commodities also generate significant truck movements. Overall, trucks account for 5 percent of the traffic on DRPA's four bridges but they generate 24 percent of DRPA's total bridge revenue.

EXHIBIT #115

DAVID R. CONRAD, NATIONAL WILDLIFE FEDERATION

Comment. Deposition of Dredged Material. Substantial issues are surfacing and continue to be unresolved over plans for disposal of MCD sand on Delaware shorelines. The Corps has recognized, for instance, that the required NEPA documentation has not been completed for various key aspects of dredged material disposal, and basic plans for disposal continue to remain in a state of flux. As the National Wildlife Federation and other organizations testified at the December 4th hearing, Kelly Island, Port Mahon, and Broadkill beach have been identified as important horseshoe crab spawning habitats, which must receive the protection of environmental dredging windows. The U. S. Fish and Wildlife Service and DNREC biologists, in addition, are recommending studies for multi-year data on horseshoe crab spawning on Delaware and New Jersey shores in order to identify appropriate measures for protection of habitat, They are also concerned about potential of the Corps proposed sand deposition to kill one to two year-classes of juvenile horseshoe crabs at these sites during each renourishment period. In the case of the Corps proposal to essentially create a new beach area at Port Mahon, the Corps has already admitted that due to the extremely high erosion character of this shoreline, renourishment will be required every 7 years. On January 18th of this year, the White House Office of Management and Budget said of the Port Mahon proposal:

".. we believe that **the Corps has not demonstrated that it would represent an efficient productive way to target Federal and local dollars for ecosystem restoration.**

"Because Port Mahon is situated at a point of maximum shoreline erosion compared to other locations on the shores of Delaware Bay, the Corps would have to reconstruct the proposed beach, on average, every seven years. The project hardly would 'restore' the area. Tidal marshes and mudflats dominate the surrounding area. **A natural beach would not survive here for long except as isolated and shifting small pockets of sand. Both ecological importance and the cost-effectiveness of establishing and maintaining a beach at this particular, vulnerable site are far from clear.**

"In our opinion, the Corps and the U.S. Fish and Wildlife Service would need to evaluate a much broader array of alternatives for addressing the needs of the horseshoe crabs and migratory birds of Delaware Bay to determine whether the significant public investment required to sustain a man-made beach is justified at this location. This effort could, and perhaps ultimately should lead to a comprehensive plan of action for the Bay. We believe that the alternatives considered also should include the option of removing some or all of the existing hard structures from the present Port Mahon shoreline, which would allow the rural road and the wetlands behind it to erode naturally. . .." (from Letter dated January 18,2001 to Honorable Joseph W. Westfall, Assistant Secretary of the Army (Civil Works) from Honorable Wesley P. Warren. Associate Director of the Office of Management and Budget for Natural Resources, Energy and Science) (emphasis added).

The Office of Management and Budget is the arm of the federal Executive Branch that is charged by Presidential Executive Order 12322 to conduct the independent review of all Corps water resource projects and to make findings and recommendations on whether the project has been properly planned and whether it will be forwarded to Congress with support from the Executive Branch and the President. In this instance, the Port Mahon project was determined unworthy and returned to the Department of the Army, The Port Mahon proposal (as part of the MCD) fails to meet basic environmental and economic criteria. DNREC should reject the permit.

Response. Refer to the general response for "horseshoe crab impacts from sand placement". Appropriate supplemental NEPA documentation associated with the individual beach nourishment projects will be prepared to evaluate placement of main channel sand on selected beaches. Also, refer to responses to the January 18, 2001.

Honorable Mitchell E. Daniels, Jr.
Director
Office of Management and Budget
Washington, D.C. 20503-0008

Dear Mr. Daniels:

In response to your letter dated January 18, 2001, I am submitting for your review a Corps of Engineers memorandum detailing the findings of their review of your concerns related to the Port Mahon, Delaware ecosystem restoration project. While your office recognized the importance of restoring the Delaware Bay ecosystem, you questioned the array of alternatives considered and the justification and overall advisability of ecosystem restoration at this location. As outlined in the Corps memorandum, both the study authority and non-Federal sponsor together focused the feasibility analyses geographically on Port Mahon area and technically on the development of a multi-objective project to protect State Road 89 and wetlands behind it. Further, the Corps did consider alternatives (permanent evacuation and relocation of State Road 89) that would allow natural erosion processes to continue. Neither of these alternatives were considered in detail since they would not meet the overall study objectives of shoreline erosion and habitat protection and restoration and were cost prohibitive. Finally, the Corps again consulted with the U.S. Fish and Wildlife Service as requested and a letter dated May 11, 2001 that documents their continued support for the project.

Please advise this office based on the additional information provided whether my recommendations to support the authorization and implement the project are consistent with Administration policy.

Sincerely,

Mike Parker
Assistant Secretary of the Army
(Civil Works)

DEPARTMENT OF THE ARMY
U.S. Army Corps of Engineers
WASHINGTON, D.C. 20314-1000

REPLY TO
ATTENTION OF:

CECW-PM

AUG 3 2001

MEMORANDUM FOR THE ASSISTANT SECRETARY OF THE ARMY (CIVIL WORKS)

SUBJECT: Port Mahon, Delaware

1. PURPOSE: In response to your 13 March 2001 memorandum, the U.S. Army Corps of Engineers has reviewed the concerns raised by the Office of Management and Budget (OMB) in their 18 January 2001 letter related to the subject project. The findings of the Corps review and my recommendation are summarized below.

2. DISCUSSION:

a. The Delaware Bay Coastline – Delaware & New Jersey, Port Mahon Delaware Interim Feasibility Study, Final Feasibility Report and Environmental Assessment determined that shoreline erosion and shoreline development have significantly reduced the spawning suitability of the Port Mahon area for the horseshoe crab. Although there is no sandy beach present at Port Mahon at this time, horseshoe crabs continue to attempt to nest in the roadbed with limited success and significant mortality. The prime spawning beaches are between Maurice River and the Cape May Canal in New Jersey and the sandy beaches between Bowers Beach and Lewes in Delaware. Port Mahon is just north of Bowers Beach. Port Mahon's location in the bay relative to salinity and hydraulic conditions make it suitable habitat for horseshoe crabs. The beach fill will protect existing wetlands as well as the wetlands to be restored as a component of the Port Mahon project. All of these features are expected to benefit migratory shorebird species.

b. The proposed ecosystem restoration project consists of three elements designed to restore the ecosystem at Port Mahon. The first element consists of restoration of 19.2 acres of horseshoe crab habitat through the placement of 306,000 cubic yards (cy) of sand for approximately 4,900 feet along the shoreline and the construction of a 1200-foot revetment at the southern end of the proposed project to tie into the existing revetment from the termination of the beachfill to provide stability. The second element will involve raising State Road 89 for a distance of 7,500 feet to protect 59.1 acres of wetlands from excessive and damaging overwash. The third element in the recommended plan is the restoration of 21.4 acres of degraded marsh west of State Road 89. The proposed ecosystem restoration and protection project will provide 193 average annual high value habitat units. In addition to ecosystem restoration and protection and the associated non-monetary environmental quality benefits, the project will produce incidental national economic development (NED) benefits. These estimated NED benefits amount to an average annual total of $140,000, and consists of reduction of infrastructure damages and avoidance of fuel delivery by more costly alternative means. A monitoring program to document project performance compared to design predictions will be conducted as a cost-shared engineering and design activity during the continuing construction for periodic nourishment. A 5-year monitoring and adaptive management

plan to evaluate success and provide for potential minor project modifications to improve overall project performance is also included in the recommended project.

c. Section 101 (a)(12) of the Water Resources Development Act (WRDA) of 1999 authorized project construction at a total cost of $7,644,000, with an estimated Federal cost of $4,969,000 and an estimated non-Federal cost of $2,675,000 and at an estimated average annual cost of $234,000 for periodic nourishment over the 50-year life of the project, with an estimated annual Federal cost of $152,000 and an estimated annual non-Federal cost of $82,000.

d. OMB raised two concerns in their 18 January 2001 letter. The first concern relates to the array of alternatives considered in the feasibility study. The second concern relates to the justification and overall advisability of ecosystem restoration at Port Mahon. A response to each of these concerns is provided in the following paragraphs.

e. OMB requested that a broader array of alternatives for addressing the horseshoe crabs and migratory birds of Delaware Bay be evaluated, in consultation with the U.S. Fish and Wildlife Service, to determine whether the significant public investment required to sustain a man-made beach is justified at Port Mahon. The sponsor of the feasibility investigation, the State of Delaware, requested a study to evaluate the advisability of ecosystem restoration at Port Mahon, not the Delaware Bay and as a result, a comprehensive plan of action for the Delaware Bay did not result from the feasibility investigations. Ecosystem restoration was the primary objective of the feasibility analysis, although clearly the sponsor is interested in the project's secondary benefits of providing protection to State Road 89 and the pipeline that delivers jet fuel to Dover Air Force Base. As requested, the U.S. Fish and Wildlife Service reviewed the concerns raised by OMB and documented their position in a letter dated 11 May 2001 (enclosed). As outlined in this letter, the U.S. Fish and Wildlife Service believes the Port Mahon site "offers substantial potential for habitat improvement". In addition, the U.S. Fish and Wildlife Service acknowledged the study authority and the non-Federal sponsor together focused the feasibility analyses geographically on the Port Mahon area and technically on the development of a multi-objective project to protect State Road 89 and wetlands behind it.

f. OMB also suggested that the removal of some or all of the existing hard structures from the Port Mahon shoreline to allow for the natural erosion of the rural road and wetlands should be considered for implementation, since it believes that the proposed action would not restore the designated area. The alternatives considered for the Port Mahon area included two alternatives (permanent evacuation and relocation of State Road 89) that would allow natural erosion processes to continue to damage habitat and existing infrastructure. Neither of these alternatives was considered in detail since they did not meet the overall study objectives of shoreline erosion and habitat protection and restoration and were considered cost prohibitive. Specifically, permanent evacuation of the area was expected to have high social and economic costs and would not prevent the loss of habitat. Relocation of State Road 89 would involve extensive wetland destruction and costly mitigation measures while providing no habitat protection, and as a result, the plan was eliminated from further consideration. Furthermore, jet fuel is delivered to Dover Air

Force Base via an underground pipeline on the landward side of the road that will continue to require protection from shoreline erosion, negating the effects of relocating State Road 89. This pipeline is critical to normal operations at Dover Air Force Base and readiness for National Security. Without the pipeline, jet fuel would have to be delivered via truck in a large number of trips, increasing the risk of spills that would cause significant environmental damages.

g. The proposed project at Port Mahon will restore historic horseshoe crab habitat and associated wetlands and protect these habitats from further loss and degradation. While the proposed project will not be a "natural" beach, since it will need to be replenished every seven years, it will be much more than "isolated shifting pockets of sand". The restored beach will remain a functioning beach, usable annually by spawning horseshoe crabs and the thousands of migratory birds that need to feed on horseshoe crab eggs, for the life of the project. The selected plan provides the optimum ecosystem restoration and environmental quality benefits at Port Mahon and is incrementally the least-cost alternative in terms of habitat units per total present worth project costs.

3. RECOMMENDATION: In view of the above, and since this project was formulated for shoreline erosion and habitat protection and restoration purposes, I recommend this project be resubmitted to OMB for clearance.

FOR THE COMMANDER:

Encl

for
ROBERT H. GRIFFIN
Brigadier General, USA
Director of Civil Works

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401

May 11, 2001

Lt. Colonel Timothy Brown
District Engineer
U.S. Army Corps of Engineers
100 Penn Square East
Philadelphia, PA 19107-3390

Attn: Steve Allen

Re: Port Mahon Feasibility Study

Dear Colonel Brown:

This responds to your office's request for our comments on the letter dated January 18, 2001, from Mr. Wesley Warren of the Office of Management and Budget to your office relating to the Port Mahon Feasibility Study. Mr. Warren's letter questions the environmental justification for the project and suggests that a wider array of alternatives for addressing the needs of horseshoe crabs and shorebirds should have been evaluated to provide assurance that the benefits of maintaining a beach at this particular location are worth the cost. This approach overlooks the fact that the Port Mahon project was not formulated simply to address the habitat needs of horseshoe crabs and shorebirds, but also for protection of infrastructure (road and jet fuel pipeline) and water dependent recreational and commercial facilities (e.g., boat launching ramp, docks, and fishing pier). In addition, the project will also benefit a wide variety of public fish and wildlife resources by preventing erosion of the marsh and by improving the water quality of Delaware Bay due to the reduction in the input of fine sediments.

While no formal study was conducted to evaluate potential projects specifically for horseshoe crabs in Delaware Bay, it certainly appears that the Port Mahon site offers substantial potential for habitat improvement. This site lies within the shoreline region between the Mispillion River and Kelly Island where the greatest number of horseshoe crabs come ashore to spawn. Unfortunately, the Port Mahon shoreline is largely unsuitable for spawning due to limited beach habitat and the presence of bulkheads and riprap. This problem creates a significant opportunity for habitat improvement. While the alternative of simply removing the bulkhead and riprap and allowing the natural erosion process to proceed would reduce the mortality of adult crabs, the effective increase in the spawning success would be limited because sand for beach habitat is

naturally scarce. The project would supply the sand needed to improve spawning as well as achieving other benefits mentioned above.

We share the concern about the relatively high amount of replenishment that will be necessary to maintain the beach at this location. Substantive spawning beaches do not naturally occur much north of Pickering Beach which is located approximately 2.7 miles down the bay from Port Mahon. The current lack of sand at Port Mahon is likely to have been exacerbated by the bulkhead, but beach habitat under natural conditions would probably be limited to small pocket areas. Fortunately, the maintenance cost will be reduced since the material would come from the ongoing maintenance dredging of the Delaware main navigation channel. However, there are significant uncertainties involved in estimating erosion rates 50 years into the future. In addition, the demands for sand for use at other shoreline locations may be substantially greater than they are at this time. In view of this, a project based on a 25-year life, as is currently common for projects of this type, may have been more appropriate.

We cannot rule out the possibility that beach replenishment for horseshoe crab spawning habitat could be more cost effectively accomplished at other locations where the erosion rate may be lower. However, the study authorization was specific for Port Mahon and the nonfederal sponsor was especially interested in a multiple objective project that included reducing the threat to the road as well as to the wetlands behind the road. Furthermore, it does not appear that such a high standard (i.e., a demonstration of the highest benefits and cost effectiveness of any site in the Delaware Bay region) would normally be required to justify a project. For example, if the issue was evaluating beach replenishment for a human community, it would not be necessary to show that the site had the highest benefit-cost ratio of any site in Delaware Bay.

Thank you for the opportunity to comment. If there are any questions, please contact George Ruddy at (410) 573-4528.

Sincerely,

Beth McGee

for John P. Wolflin
Supervisor
Chesapeake Bay Field Office

Comment. We are further concerned that the Corps has failed to identify and make recommendations to avoid or mitigate potential damage to *sabellaria vugaris* reef areas (and associated fish habitat) that may be caused by sand deposition at Port Mahon. The Corps has not identified the costs of such mitigation to the taxpayers, and, has failed to prepare the necessary Supplemental Environmental Impact Statement that is required by NEPA for the Delaware beach sand deposition from the MCD proposal. DNREC should reject this permit for failure to provide this information.

Response. Refer to the general response for "*Sabellaria vulgaris* impacts from sand placement". Appropriate supplemental NEPA documentation associated with the individual beach nourishment projects will be prepared to evaluate placement of main channel sand on selected beaches.

Comment. Dredging Windows. The Corps has not clarified the MCD dredging and placement schedule around appropriate seasonal environmental windows to minimize impact on marine habitat. We urge DNREC to seek the following information to meeting the requirements of this proceeding: 1) identification of the current status of all environmental windows for both dredging and disposal activities, 2) identification of exactly where geographically and during what periods (and displayed graphically within the Delaware Bay region) these windows will apply to protect individual species and multiple species, where applicable 3) identification of environmental window issues and study requests /needs that remain outstanding or unresolved, and 4) identification and full clarification of the effects of these window requirements on the economic costs of the project and identification of any required revision of dredging schedules that may be necessary to implement each feature and to complete the project.

Response. Refer to the general response for "environmental windows". The dredging windows may have an effect on the cost of constructing projects in the Delaware Bay. The following is a summary of projects and their associated issues with regard to windows.

- **Kelly Island.** In order to construct Kelly Island, complete relief for one season from the horseshoe crab and winter flounder windows is required. No relief is required from blue crab, sandbar shark or other windows. The increase in cost to observe these windows is prohibitive to constructing the project, since any interrupted construction activity has a high degree of risk associated with total failure of the project.

- **Port Mahon.** The horseshoe crab window can be observed if relief is given from the blue crab and winter flounder windows or vice versa. (i.e. blue crab and winter flounder can be observed with relief from the horseshoe crab window). No other windows impact Port Mahon construction.

- **Broadkill Beach.** The sandbar shark window can be mitigated by construction revisions as detailed in response to 6 above. The additional cost is considered to be project inclusive. The anticipated dredging time for Broadkill Beach is between 10-12 months so observation of the horseshoe crab, blue crab and winter flounder windows in any combination will increase the cost to construct Broadkill Beach. An additional dredge or multiple barges will be required. Quantification of the cost increase is impossible due to the various combinations of windows and construction methods.

- **Egg Island Point.** Relief from the horseshoe crab, blue crab, and winter flounder windows is required to construct the project. The increase in cost to observe these windows is prohibitive to constructing the project, since any interrupted construction activity has a high degree of risk associated with total failure of the project

Comment.

Economic Impacts. The economics of the project remain in serious question and the MCD has not been justified as being in the public interest. The Corps suggests that "based on an input-output economic model of the tri-state region Delaware may accrue the following indirect economic impacts from construction of the project: 300 jobs, $31 million in wages, $60 million in total revenues filtered into the state's economy, $4 million in state and local tax receipts and $9 million in federal tax receipts." Lacking a thorough review of this economic model and its basic assumptions, and without confidence of even the validity and consistency of whatever was the source of this information, on its face we must question whether such assertions can provide any basis for DNREC's review of this project's merits. For instance, the statement does not quantify job and revenue losses from reduced lightering activities that are at the heart of the project's current economic justification by the Corps.

We are concerned that: 1) the current project justification contains outdated information (due at least in part to the age of the underlying studies) that may be critical to DNREC and federal government decision making, 2) some navigation benefit claims may be substantially overstated, and 3) the costs of activities such as disposal of dredged material may be considerably greater and may carry greater environmental costs to Delaware and the nation than have currently identified. Eighty percent of the benefits of the project are based upon providing reduced lightening costs to six Delaware River-based oil refineries. Questions have been raised about the legitimacy of these benefit claims, whether the refineries will indeed make the investments necessary to utilize the deepened channel, whether the costs have been accurately reflected to date (given uncertainties over schedules, disposal capacity, etc.).

Response. Justification for the federal project is based on benefits to the National Economic Development (NED) account. The last (NED) analysis was the Corps Limited Reevaluation Report completed in February 1998. Benefits specific to the region, an individual state, or an individual company, are not a factor in the analysis for project justification. Indirect benefits for construction to the state of Delaware were derived from a generalized input-output model and were not used to determine project justification.

The reduction in lightering costs is a savings to the national economic development account. This savings is one part of the $32 million in benefits estimated for crude oil imports. Commodity growth, deeper loading of smaller tankers, and reduced tanker operating costs are other parts of the total crude oil benefits.

EXHIBIT #116

MAYA K. van ROSSUM RIVERKEEPER

Comment. I was at the DRBC offices this morning. On the wall they had a December 18, 2001 map of the Delaware Estuary indicating the current location of the salt line in the Delaware Estuary. According to this document the salt line is now at River Mile 85 and the normal mid-month value for December is River Mile74. Clearly, the range of the salt line during this portion of the year does include, depending on weather conditions, this portion of the River. Recall that the likely (but as of yet unconfirmed) location of juvenile shortnose sturgeon in the Delaware River is linked with the location of this salt line. And recall that the proposed blasting associated with this project is river mile 76.4 to river mile 84.6. This information confirms our concerns, and the concerns expressed by NMFS, the Corps and other experts, that the juvenile shortnose sturgeon may very well be aggregating in and around the proposed blasting area during the proposed period of blasting, thereby endangering the River's population of shortnose sturgeon.

Response. Refer to the general response for "shortnose and Atlantic sturgeon concerns".

EXHIBIT #117

ROBERT V. MARTIN

Comment.

Costs:

The ACOE, The Maritime Exchange, and the Delaware River Port Authority (the non-federal sponsor) state that the cost of this project will be $311,000,000. To get a proper perspective, the basic cost of this project used a pricing year of 1991 for the 1992 EIS. The pricing year for this project has not changed.

According to the U.S. Bureau of Labor and Statistics Inflation Calculator the year 1991 price level of $311,000,0000 translates to $405,076,000 in the year 2001. This is a factor of 1.3025. The cost of the project is apportioned l/3rd to the non-federal sponsor and 2/3rd to the federal sponsor according to ACOE information. (*see note 1. end of letter)

Disallowing any increased amounts due to inflation, note the following discrepancies and misleading information, even though unintentional:
The ACOE states benefits to the State of Delaware will be a $30,000,000 Project at Kelly Island and a $44,000,000 Beach Replenishment Project for beaches at Port Mahon, Broadkill Beach and/or Rehoboth-Dewey Beach. The DRPA and The Maritime Exchange mistakenly cite $74,000,000 or $70,000,000 targeted for beach replenishment sand. The ACOE figures are what it will cost the ACOE to implement these projects. The ACOE cost does not necessarily translate to a dollar benefit to the State of Delaware.

Response. Comment noted.

Comment.

REPLENISHMENT COSTS AT DELAWARE BEACHES

Port Mahon is not a beach it is subaqueous land as you will note in the attached photographs taken November, 2001. Please see comments related to Port Mahon in a subsequent paragraph. For the purpose of comparing beach replenishment costs, Port Mahon will be considered a beach.

According to the ACOE sand costs for Delaware Bay Beaches (Port Mahon and Broadkill Beach) will range from $8 to $10 per cubic yard for beach placement and $1.50 to $2. for handling on the beach. For the purpose of comparison I will use a combined total of $11 per cy for bay beaches. Atlantic Ocean Beaches , Rehoboth and Dewey sand placement costs have not been finalized. I was informed in a previous communication with ACOE Engineering that it would cost $15 per cy just to transport sand from Reach E to Rehoboth Beach and that beach handling would be additional. For the purpose of this comparison I will use$15 per cy yard for beach placement and $2 per cy for handling or scaping on the beach for a total of $17 per cy for ocean beaches.

Port Mahon	Cost to ACOE 306,000cy@$11 =	$ 3,366,000
Broadkill Beach	Cost to ACOE 1,305,000cy@ $11=	$14,355,000.
Rehoboth/Dewey	Cost to ACOE 1,437,272 Cy@$17=	$24,433,624
	Total Cost to ACOE	$42,154,624

The above figures are a low approximation of costs and are about $2 million short of the ACOE prediction of $44,000,000 beach replenishment costs. This replenishment cost is a one time cost and is for an initial deposition only. The ACOE does not include any additional or maintenance replenishment in the Deepening Project.

Total initial costs for the State of Delaware as per the 50 year Environmental Impact Statements for each of these 'beach' projects using the same amount of replenishment material follows (all amounts are published EIS amounts):

Port Mahon (includes geotextile tubes, road Elevation sand, etc.)	State Cost 35% $2,619,050	1997 price year
Broadkill Beach (includes berm dunes, Fencing, etc)	State Cost 35%40 $2,943,150	1995 price year
Rehoboth/Dewey (includes berm dunes, Fencing, etc)	State Cost 35% $3,189,900	1995 price year
Total Initial State costs for all three Beach projects	**$8,752,100**	

This total State cost is a far cry from the ACOE's published am't of $44,000,000, and the Maritime Exchange statement of $70,000,000 for beach replenishment. A letter was sent to the Governor of Delaware in September citing the Maritime Exchange misinformation and misleading statements.

The ACOE uses their cost as the beneficial dollar amount for the State of Delaware. A real stretch for a benefit. There is no reason for the State of Delaware to donate $10,000,000 to the Deepening Project for replenishment sand and then also pay out additional for the State's own projects as well. I fail to grasp the Channel Deepening Project as a dollar beneficial replenishment plan for the State of Delaware.

The only real beaches in the Corps's Deepening Project are Broadkill, Rehoboth/Dewey. The combined total cost for both of these beach 50Year Replenishment Projects, including initial replenishment with all requirements and all replenishment for the entire 50 Years follows:

Broadkill	(This is the State cost of35%)	$12,925,150
Rehoboth/Dewey	(This is the State cost of 35%)	$23,562,700
Total State of Delaware obligation **50 Years**		**$36,487,850**

Believe that the Deepening Project's beach replenishment plan is an "economic windfall" as stated by the Maritime Exchange and you will believe that horseshoe crabs fly in formation with the birds to the bay shores at migration time.

Delaware beach residents should rest assured that they are better off relying on the largesse of the State of Delaware for beach replenishment as opposed to this one shot deal from the ACOE and the DRPA Deepening project which at best is dubious and outrageously expensive.

Remember that these are all tax dollars and these dollars come out of both the left and right pockets.

Response. The analysis as presented by Mr. Martin is a reasonable budgetary approximation of costs. If Broadkill, and Port Mahon are constructed as part of the Delaware River Main Channel Deepening Project there would be no cost to the State of Delaware for initial placement of sand material however, if these projects are constructed independently from the Delaware River Main Channel Deepening Project, the State of Delaware share for each project for initial construction is 35% as displayed above. Regarding, the Rehoboth/Dewey Project, there would no cost savings to State of Delaware for initial sand placement if it was constructed as part of the Delaware River Main Channel Deepening Project. If other sites are selected for sand placement as part of the Delaware River Main Channel Deepening Project along the Delaware Bay there would be no cost to the State of Delaware for initial sand placement.

Comment.

Biodiversity and the *Sabellaria Vularis*

I have tried over a period of years to convince the ACOE and later DNREC that ***Sabellaria Reefs*** known locally as "coral beds" existed in the subaqueous shores of Delaware off of Slaughter and Broadkill Beaches and outward into the bay. It wasn't until the June 6, 2001 ACOE sponsored public workshop on the Delaware Permit held at the Delaware State University, Dover, DE that the existence of these reefs was acknowledged by Mr. John Brady after he viewed my photos taken at Broadkill and Slaughter Beaches. Mr. Brady was sufficiently impressed so that he employed a scientist from the U of D Marine College , Lewes, DE to so attest.

The reefs provide a habitat for a number of minute specie which in turn attract a variety of pelagics which in turn attract a variety of human specie (shore fishermen, commercial fishermen off-shore sports-fishermen). A large reef off of Broadkill Beach is identified as a 'coral bed (improperly of course, but long term usage makes the identifier acceptable) on local navigation charts. This "coral bed' has attracted a number of trophy black drum which of course, have attracted a large number of trophy hunter fishermen. Not incidently, a now closed restaurant in the town of Little Creek, DE, 11/2miles from Port Mahon was called "The Coral Reef".
A healthy reef equals a healthy bay.

The Sabellaria Vularis larvae can be found all over the bay during the reproductive period (Curtis). You would believe that the reefs also are found all over the bay, and indeed they are not. I suggest that those who make such generalizations go out and find a few reefs. I would sure like to know as these reefs are good "hook-hang-up" spots. ***Sabellaria*** do not require large rocks. I have a specimen on a small oyster shell as well as one on a 1" piece of gravel. ***Sabellaria*** occur only in specialized areas and cannot be found by "bottom grabs" as some are wont to do.

Many minute organisms such as amphipods and the white fingered crab are found in these reefs and contribute to the vast bio-diversity of this area. The amphipods (1 to 2 mm in length) and the crab (2mm to 19 mm) are fully mature. They become part of a food chain which is rather important to the survival of the benthic community. (Please see attached photo copies of these specie)

Mr. Brady contracted Mr. D. Miller (see report which is part of the ACOE Application) of the U. D, Marine College at Lewes, DE, to visit Broadkill Beach. The Miller report was not particularily significant although it did verify the existence of ***Sabellaria Vulgaris*** and their reefs at Broadkill which completely supported my photographic proof The report was mainly a repeat of descriptions and comments made by investigators of ***sabellaria,*** including Dr. H. Wells (1970). Dr. Wells stated. that sabellaria reefs are found in two locations on the East Coast due to a specialized environment. These he identified as the Delaware Bay, and Rodanthe, N.C.. He stated that these are areas where reef building habitat of the specie is well developed and that this specie is an isolated one from other sand tube builder worm families. Dr. Wells also stated (1970," Reefs in Delaware Bay") that these reefs offer a degree of protection from waves on sandy beaches where they occur. The reefs stabilize sediments and provide shelter for other organisms. Multer/Milliman 1967,and Kirtley/Tanner, 1968, stated that reefs are of considerable import to the evolution of coastlines. I have observed that dragging and dredging activities over 50 years has degraded the area near Delaware shores. These reefs do not recover if they are covered. They die! Wells also affirmed that past reefs attract larvae and additional reef structures are superimposed.

Miller's report suggested mitigation alternatives for the *Sabellaria* reefs. I am most surprised that such a suggestion could be made.

The word 'mitigation' is usually a legal or political term and is not a scientific one. You can do one of three things with the sabellaria reefs. You can leave them alone, you can protect them or cover them and smother them. If DNREC or the ACOE pursue 'mitigation' there may be legal ramifications and restrictions. Before any such activity is pursued or attempted I believe that an in-depth study will be of interest to NOAA, EPA, NMFS, and others. In addition, the Magnusen-Stevens Act must be addressed. The report does support my thesis, "cover and you will smother".

In addition to the ***Sabellaria Vulgaris*** reefs at Broadkill and Slaughter Beaches, there are large colonies, beds, and at least one large reef located at Port Mahon. The large reef at Port Mahon is of such strength and hardness that it will support trespass, although I do not recommend it. There is a large colonization located between the fishing pier and the fuel station at Port Mahon.

Specimens were obtained from all three locations. Photographs were also taken. See attached photos.

Please note the attachment describing Biodiversity by K. Hill of the Smithsonian Marine Station at Fort Pierce, Florida. Hill states that" The factors which threaten biodiversity in estuaries and in the ocean are generally the same as those which affect biodiversity in terrestrial systems; overpopulation, physical alteration of habitat areas alien species introduction and changes in atmospheric composition".

An all day session "Biodiversity Symposium: Protecting Delaware's Living Resources" was held in Dover on February 20, 2001. The main thrust of the session was directed towards terrestrial concerns. Governor Ruth Ann Minner spoke at this session. The symposium was sponsored by the State of Delaware, Industry, and Environmental Organizations of Delaware. It might be well for the state to sponsor such a program directed towards marine biodiversity. That kind of attention could shed considerable light on proposals as now being made by the ACOE. The lack of understanding of the marine ecology of our state is appalling. There doesn't seem to be even an elementary understanding of the immense and far reaching impact of shore projects as proposed by the ACOE. These projects are not <u>all</u> beneficial, **always.**

<u>Response</u>. Refer to the general response for "*Sabellaria vulgaris* impacts from sand placement".

<u>Comment.</u>

<u>Kelly Island</u>

Kelly Island is not really an island. It is an extended marsh which has been eroding for years and years. The ACOE in the 50 year EIS for Port Mahon state that "re-building" a "wetlands" at Kelly Island, constructing or not constructing a confined disposal facility (CDF), will not have any beneficial or adverse affect on Port Mahon. It should be noted that the weather and sea conditions of this area can be very severe and threatening. The ACOE by its own admission is so concerned that it plans to continuously monitor the structure, the fill, and the "beach" placement of sand so as to be sure that the mouth of the Mahon River will remain navigable. It is expected that transport of sand from the 'beach' will be at the rate of 35,000 cy per year. This is a' wait and see' project from all appearances. There is nothing to rehabilitate. To fill a 60 acre diked area with silt and sand, plant it (phragmite will be a strong competition) and call it a marsh restoration is a stretch. Obviously the ACOE does not expect the 'beach sand' to hold as a series of composition groins 750 feet apart will be placed to retard erosion of the newly constructed beach. Where this eroding 35,000 cy of sand per year will go is anybody's guess. There will not be any natural input of sand at Kelly or Port Mahon as there is none available. Maintenance will require constant replenishment, I suggest, more frequently than the ACOE expects. Nor-easters could wipe this beach out in a matter of a very few days. I believe that local watermen know this and very few have any engineering background.

There is no way the 'beach' can be maintained without constant refurbishing. The source of this replenishment, if it is to be provided by regular maintenance dredging of the river channel, may not be sufficient or timely. 2,400,000 cy of silt/sand for Kelly as for Egg Island Point, N.J. A minimum of 4.8 million cubic yards for marsh 'reconstruction' or bulkheading. The ACOE states in its application for a permit that the Kelly Island 'beach' will be graded by bulldozer. That's going to be very interesting to watch as the only way equipment of that type can get to the proposed dike area will be via transport similar to an LST. If retardation of the erosion were the only objective at Kelly Island, I wonder that the alternative of rip-rap bulk-heading for the fill mile, as proposed for the smaller end of the dike, be just as effective.

The $30,000,000 cost of the Kelly Island project is the ACOE'S cost to build a CDF and does not translate to a $30,000,000 return for the State of Delaware which has no plans whatsoever to build a dike at Kelly.

Response. Beneficial use of dredged material in restoring eroding shorelines at Kelly Island and Port Mahon should help restore/preserve biodiversity in Delaware Bay. As noted in the general response for "*Sabellaria vulgaris* impacts from sand placement", impacted *Sabellaria* habitat will be restored.

In response to a letter dated September 11, 1997 from Captain Martin in the Port Mahon EIS (1997) **(EXHIBIT 3)**, it was stated:

"The Feasibility study has determined that the proposed use of Kelly Island as a beneficial use of dredged materials site for the Delaware River Main Channel Deepening Project would have no impact on the shoreline at Port Mahon. The Mahon River Channel provides access to commercial and recreational facilities along the Mahon River. The Corps does not anticipate that beachfill would have any adverse effects on the navigational channel."

The potential impacts to the Mahon River from sand migrating from Kelly Island are discussed in Section 9.3.1.3 of the SEIS (1997) **(EXHIBIT 4):**

"Mahon River Navigation Channel Impacts From Kelly Island. The amount of sand that may be transported into the Mahon River navigation channel is very difficult to estimate. The net transport is expected to be 35,000 yd^3/yr to the north. Tidal currents and waves out of the north will tend to move some material south, but the volume is uncertain. Further, sand that does move south may not enter the navigation channel. Therefore, the channel will be surveyed annually to determine whether shoaling in the channel is a problem. Channel maintenance will be planned for every three years. However, annual surveys (at least for the first 5 years) will indicate whether this is a reasonable estimate for maintenance.

If dredging is required due to sand accumulation, the sandy material removed from the channel could be placed on the offshore sand dike to postpone its maintenance requirements (as discussed above)."

The primary purpose of Kelly Island is to benificially utilize dredged material from the deepening project which would otherwise be disposed of in a confined disposal area or overboard site. The project at Kelly Island also creates approximately 60 acres of new intertidal wetland while protecting thousands of additional acres of wetlands. In addition it provides over 1 mile of horseshoe crab habitat along the shoreline. The site will specifically protect the existing shoreline against continued rapid erosion, which since 1993 has retreated an average of over 300 feet along the mile stretch and in some areas over 500 feet. The prediction that 35,000 CY of sand will leave the site each year is based on a beach without groins. The addition of the groins will limit the predicted losses and may actually result in an accretion of sand in some areas. Periodic maintenance will assure that the shoreline in this area remains stable. The amount of maintenance material over the long term should not exceed the predicted yearly losses. Transportation of heavy equipment is feasible through the use of barges, cranes, ramps, temporary dock facilities and, yes, LST's. The construction of a riprap revetment or bulkhead would certainly work effectively in this area however it is not considered environmentally friendly to horseshoe crabs or other species. In addition it would not satisfy the primary purpose of the project, beneficial use of dredged material.

Comment.

Port Mahon

The area of Port Mahon projected for sand deposition is located along Delaware Road #89.

The ACOE states that they do not plan to fill in the area between the deteriorating sheet metal bulkhead and the road as they consider this area wetlands. An examination of the attached photographs will show otherwise. The amount of vegetation in this area is so sparse that it can hardly be recognized. The photos were taken from the fishing pier November, 2001. You will note that the high tidal water is up against the rip-rap bulkhead protecting the road. Hardly a wetland. This is subaqueous land without further explanation.

The ACOE'S application states that the 'beach which you will note is non-existent in the accompanying photos and is barely an exposed mud flat at low tide, will be filled with sand 240 feet channel-ward from the high-water line, which you will note from photos is at the road rip-rap. The fishing pier extends approximately 250 feet from shore as does the fueling pier just to the north.

The extravagance of beach-fill will overwhelm the area. Any recreational fishing dependent on the fishing pier will be seriously curtailed. The benthic community as well as the ***sabellaria*** colonies, beds and reefs (see accompanying photos) will be inarguably smothered with no chance of recovery. This is a **<u>one time</u>** exercise, dump the dredged sand and run.

The New Hampshire based fuel company, owners of the fuel pier, have complained in the past of shoaling and minimal depths for their fuel barges and tugs. The transfer of fuel can be difficult at times. Fuel transfer, I understand, is done only at high tide to minimize the danger of collision with the pier, or grounding. I fail to see any input from either the Dover Air Force Base or the fuel company related to the possibility of increased shoaling, or insufficient water in which to conduct the fuel transfer exercise. The ACOE expects a transport of 35,000 cy of sand from the proposed diked and groined 'beach' at Kelly Island. I'm sure that that the 306,000 cy of sand proposed for Port Mahon, which is adjacent to Kelly Island, will drift with tide and wave action at least to the degree of drift at Kelly.

The Port Mahon part of the deepening project is not particularily beneficial as Port Mahon is already a target for dredgings from the regular maintenance dredging of the present 40 foot channel. I do not see any advantage to be gained in a one shot deal

.
Road #89 is very difficult to keep passable (check with DELDOT). If the State of Delaware were serious about reconstructing the road by elevating it 2 feet above its present height it could do it for far less than the ACOE'S $10 per cy cost of placing and handling of 306,000 cy of sand ($10. X 306,000= $3,600,000). That amount is the cost to the ACOE and as with other projects related to the channel deepening, this cost does not translate to a $ benefit for the State of Delaware.

The application for the utilization of Port Maholn as a sand deposition site for all of the above reasons is faulted. It appears not to address aqueous lands properly as well as threatening the bio-diverse habitat of the benthic community, especially the ***sabellaria vulgaris*** reefs which will have no chance of recovery.

Response. The impacts to wetlands from construction of a beach at Port Mahon are described in Section 6.5 of the Port Mahon EIS (1997) **(EXHIBIT 3):**

"This alternative involves the construction of a 100 ft wide beach berm (above mhw) in conjunction with raising Road 89. The total area of initial beach\berm would cover approximately 26.2 acres (approx. 7 acres of berm and 19.2 acres of beach slope). In addition to providing much needed beach habitat on the bay side, the beach berm would serve as a "soft" sacrificial revetment to protect approximately 70.9 acres of tidal marsh habitat west of Road 89, and approximately 1.7 acres of tidal marsh within the bulkhead area from erosion. Emergent marsh areas protected from erosion are presented in Figure EA-16, which exhibits acreages lost if no action is taken. The high marsh areas consisting of Spartina patens and Distichlis spicata, and low marsh areas consisting of Spartina alterniflora would receive the most protection.

This alternative would involve the conversion of 2.5 acres of intertidal rocky/debris habitat and 2.4 acres of mudflat, and 21.5 acres of shallow subtidal habitat into sandy beach habitat. Some losses (approx. 0.5 acres) of the existing bulkhead-tidal marsh are expected due to overwash of sand resulting from wave run-up during storms, however, the beach would prevent further loss of the bulkhead tidal marsh area (approximately 1.7 acres) to erosion. The beachface would also preclude direct tidal connection from the Delaware Bay in the bulkhead marsh."

It is acknowledged that wetlands adjacent to the shoreline at Port Mahon have eroded since 1997, but as of last year (2001), about one half of the 1997 acreage is left. In any case, we concur that tidal wetlands as well as subtidal areas are also "subaqueous" lands.

Also, refer to the general response for "impacts on benthic communities".

The impacts to the State fishing pier from construction of a beach at Port Mahon are described in Section 6.1.2 of the Port Mahon EIS (1997) **(EXHIBIT 3):**

"The beach restoration alternative would provide improved access to the facilities at Port Mahon, thereby benefitting recreation activities. This would benefit bird watching activities, use of the State boat ramp, and access to the State fishing pier. However, deep water would be inaccessable to fisherman for approximately 200 feet of the landward end of the fishing pier, which would result in approximately 2/3 of the fishing pier to be inaccessable to fishable water along Delaware Bay. This estimate may vary between nourishment cycles (every 7 years) as erosion would reclaim some of the deeper water prior to nourishment."

Also, refer to the general response for "*Sabellaria vulgaris* Impacts from Sand Placement".

Less than 2 acres of wetlands exist behind the failed steel bulkead. Certainly, if the area contained no wetlands, it would be simpler to construct. The beach will be constructed at Port Mahon as protection for the eroding wetlands behind the steel bulkhead and primarily for the thousands of acres located behind RD 89. An additional benefit will be the protection of RD 89 from continued washout from storm and tidal inundation. Port Mahon is not a disposal site for dredged material from the current 40 foot channel project as stated by Mr. Martin. Mitigation for loss of (*Sabellaria)* habitat will be accomplished as recommended by Dr. Douglas Miller, University of Delaware, the recognized expert in the area.

Comment.

BROADKILL BEACH

The section of the application describing Broadkill Beach is confusing. The amount of sand scheduled for beach replenishment, 1,305,000 cy appears excessive. Broadkill Beach will be much better off with the Congress approved 50 year beach replenishment plan than a one time shot from the deepening project. The 50year project includes a replenishment every 5 years. The ACOE project is a one shot deal. Any replenishment at Broadkill must include a protection for the sabellaria reefs which exist. Please see the section on biodiversity

I recommend that the permit not be approved as written for Broadkill Beach. At an average cost of $11 per cy for placing sand on the beach and dozing it will cost the ACOE $14,566,000 to replenish Broadkill for 1,306,000 cy of sand. This figure which the ACOE translates as a $ benefit to the State of Delaware. Preposterous! The 50 year project. State initial cost for dune construct, fencing, grading, and all requirements will only be $2.9 million. “An economic windfall”? What kind of rationalization is that? Broadkill and Rehoboth/Dewey do much better depending on the largesse of the State of Delaware than depend on the tentative deepening project.

Response. Refer to the general responses for “*Sabellaria vulgaris* Impacts from Sand Placement” and “Impacts on Benthic Communities.

1,305,000 CY is the amount of sand proposed to be placed at Broadkill by the authorized Broadkill Beach Project. Slightly more sand will be placed at Broadkill Beach if it is utilized by the deepening project as a beneficial use site. The amount of sand will not significantly change the footprint of the proposed project over its +13,000 ft length. In fact, the additional sand will extend the time period required for periodic nourishment as stated in the 50 year project.

Compensation for loss of *Sabellaria* habitat will be accomplished as recommended by Dr. Douglas Miller, University of Delaware. Five rock reefs will be constructed at the location of the existing groins to recreate the 320 square meters of habitat. The cost of the project in either scenario is approximately equal, however the cost of the 50 year beach replenishment project is cost shared with Delaware while the main channel sand is delivered without cost sharing from Delaware.

Comment.

Rehoboth/Dewey Beach

Again, the ACOE translates their cost for beach replenishment at Rehoboth/Dewey to a $ benefit for Delaware. Nothing could be further from the truth! Transporting sand to Rehoboth/Dewey will cost approximately $15 per cy, handling on the beach between $1.50 and $2. Using$17 as the total cost of one cy times the proposed deposition of 1,540,000 cy the cost to the ACOE will be near $26,180,000. This is the amount which the ACOE declares as a benefit to Delaware.

The application is not clear whether or not it is following the same plan as the 50 year joint federal and state replenishment project. If it is, it is considerably more expensive. The EIS of the 50 year plan assigns Delaware 35% of that total cost which is $3,189,900. Considerably different from the $26 million the ACOE states is a $ benefit. The ACOE appears not to have any hesitation in declaring their cost as beneficial endowment.
The sand replenishment will be a one time deposition the timing of which may not be appropriate.

Response. Beneficial use of dredged material in restoring eroding shorelines at Kelly Island and Port Mahon should help restore/preserve biodiversity in Delaware Bay. As noted in the general response for "*Sabellaria vulgaris* impacts from sand placement", impacted *Sabellaria* habitat will be restored.

Comment.

Port of Wilmington

The Port of Wilmington is a thriving and growing niche port and will never be considered a mega port. It has a considerable reputation as a port for fruit and automobiles neither of which will ever require deep draft vessels. The Port is building even more refrigeration units and also has a permit request to build a RORO(roll-on- roll-off) pier located on the Delawre River. This will be one of the most modern piers of its type. There are no plans to deepen the 33 foot depth of the river location of this pier.

The Christiana River depth cannot accommodate deeper draft vessels and neither can the piers. There appears not to be any economic benefit to the Port of Wilmington. Please see the Zeien Report attachment. Also see

Attached CENAP re: Permit for Wilmington Delaware River pier.

Response. No navigation transportation cost savings benefits for the Port of Wilmington are claimed because of the shallow Christina River access channel. Refer to Mr. Sprague's testimony on 4 December 2001 public hearing on benefits to the Port of Wilmington.

Comment.

Litering.

There seems to be a considerable lack of understanding as to what litering is as related to traffic on the Delaware River. (see Zeien report). Even the ACOE states in the FEIS of the Deepening Project that oil companies have no intention of changing the size, draft or numbers of tankers sailing the Delaware River. Usually tankers enter the bay at 55' draft after being litered at sea or in the Bahamas. There will still be the same number of litering events. It is the event, not the quantity of oil litered or the amount transported up-river, which is the spill risk. The litering experience over the past several years have had negligible spillage, and none is forseen. The U.S. Coast Guard states that any notable oil spills have resulted from docking activities, collisions with piers, or grounding. If one is to think of larger ships, think of the maneuverability and the stopping capability of large ships. Delaware River Pilots are amongst the world's best and have an exemplary record of piloting the river. The only benefit of the deepening project would be to give the present traffic and pilot responsibility more room to react in emergencies. I'm sure pilots will welcome that aspect. But to give them larger ships with deeper drafts to maneuver will be no improvement or a less risk.

The danger of up-river grounding will be greater and the danger of a major oil spill will be greater with larger tankers than from litering. Remember the Valdez. They are still cleaning up from that spill. A similar spill event in the Delaware will be both an economic and environmental disaster. We will be de-oiling Canadian and Snow Geese for the next millennium.

Shore residents have more to fear from storms and the destruction of Delaware's living resources than they have from oil tankers and spillage from litering experiences. I repeat, there will be the **same number of litering events no matter the depth, 40' or 45", of the channel.**

Response. There will be the equivalent number of tankers using the deepened Delaware River channel, but less lightering at Big Stone Beach Anchorage will be required by the tanker fleet.

PUBLIC HEARING TRANSCRIPT 4-5 December 2001 DNREC's Public Hearing

Verbatim from transcript

Starting at PAGE 110

CLYDE ROBERTS

Comment.

MR. ROBERTS: My name is Clyde Roberts, and I come from Portland, Delaware, and I have been involved in commercial fishing, I suppose, most of my life, and I also run a charter boat for a while, and I am here tonight to tell you that I think that the dredging project is a bad idea and should not go on, and I will tell you one of the -- the main reason that north of the C&D Canal is the biggest spawning area in the State for many, many stocks of fish, the chad, the striper bass, and the sturgis.

Response. Impacts to finfish are described in Section 5.1.8 of the EIS (1992) **(EXHIBIT 7).** A number of measures will be used to minimize impacts to fish in the Delaware River north of the C&D Canal. For blasting, measures to reduce impacts on all fish are discussed in the Biological Opinion for shortnose sturgeon from the NMFS **(EXHIBIT 22).** Environmental windows, refer to attachment in general response for environmental windows, will help avoid and minimize impacts to many aquatic organisms.

Comment.

Now,the rivers north of the C&D Canal, this is probably where" 95 percent of all the spawning takes place. It already is "overloaded with PCBS. You are not allowed, or at least you are warned, the letter has been out that you should not eat more than two helpings of fish north of the C&D Canal.

Now, some of these scientific facts, so-called, we have heard, and I am not discounting -- I believe in science, but I don't believe in some of the figures that scientists throw around. Now, if north of the C&D Canal is already polluted with PCBS and it hasn't cleaned itself out since 1994, when they first started it, what's the problem?

Response. Because of PCB concerns in the Delaware Estuary, the Corps conducted a bulk sediment investigation using state-of-the-art, high-resolution techniques for detecting PCB congeners. Sediment cores were collected at 15 channel sites throughout the estuary and divided into surface and sub-surface samples. Samples were assayed for 80 separate PCB congeners. The concentrations of all PCB congeners were summed to determine the total PCB distribution at surface and sub-surface collection sites. The high-resolution PCB tests demonstrated that PCB concentrations in the navigation channel were low and within an acceptable range, based on New Jersey and Delaware guidelines. Study results indicated that concentrations of PCBs in the channel were 1 to 3 orders of magnitude lower than concentrations in shoal sampling locations of a previous study.

A review of PCB issues associated with the Delaware River Main Channel Deepening Project was submitted to the public record in a document titled: *PCB Mobilization During Dredging Operations and Sequestration by Upland Confined Disposal Facilities* (December 2001). Based on the studies that have been conducted it is concluded that dredging and dredged material disposal operations associated with the deepening project would not violate Delaware River water quality standards, and that overall the project would serve to remove PCBs from the aquatic environment. The project would not result in adverse affects to aquatic resources or human health.

Comment.

And some of them mention the shortnose sturgeon. Well, I am a sturgeon fisherman. We used to be before there was a moratorium put on them. There has been a moratorium put on the shortnose sturgeon for over 20 years. We "know, as the fish is getting in its proper habitat, and it's not subjected to too much credation and so forth, over fishing, that that fish will thrive. It will come back. The rockfish came back within five years, an abundant stock we had.

Now, the shortnose sturgeon hasn't been targeted for commercial fishery because it's got moratorium on it and it hasn't come back. And I believe that the reason is, basically, the habitat that they have to live in. It's, to me, it's the contamination that they are subjected to that they haven't come back. Now, I can't prove that. I don't have it -- but I believe you can come to that conclusion.

If it's not credation and if it's not over fishing and if they have the proper habitat, they would do their job. You provide the fishes proper habitat, they will take care of itself,, as long as you don't over fish it and have a great predator around.

The other thing, not only is it a spawning ground, plays a very important part in the State, but it's also a nursing area. This is where all these little fingers was in -- mostly even the blue claw crab, when they sampled the blue claw crab, they put a claw up in the river because all of the crabs that are spawning now make their way up, and they are about as big as your little finger, and I cannot see -- common sense will tell me that all this sediment that's been built up over the years and we are now going to start dredging five foot of water, 800 to 1,000 foot across, that they are not going to sir up contaminants. Now,I just don't believe that.

Response. Refer to the general response for "shortnose and Atlantic sturgeon concerns". And to the general response for "impacts on over-wintering female blue crabs".

ANTHONY TOLTA

Starting at PAGE 140

Comment.

MR. TOLTA: Anthony Tolta. I had someone earlier that called a bunch of environmentalists obstructionists. There is 26 people that have spoken opposing this project so far, and they talked about a number of different reasons. There is a lot of problems with this project, and that's what's all being brought out by this hearing, and why it should not go forward.

I was asked to come and just talk a little bit about horseshoe crabs since this is going to impact their beach nesting area. Horseshoe crabs are very important to the ecosystem. A lot of things eat their eggs, from migratory shorebirds to a lot of the fish that we catch and harvest commercially.

Their blood is very important to us also. When you go to the doctor and you get a shot, the medicine that was in that shot was tested with an extract from their blood to make sure it was safe for us. If there was something wrong with that medicine, you can actually develop toxic shock and die from them.

Very important biomedically. They are now doing AIDS and cancer research with them, and there is something in their blood which stops the growth of some cancer cells in the laboratory and the scientists are trying to isolate what that is, so this animal may be the cure for one of our most dreaded diseases.

We have seen a marked decline in the population of horseshoe crabs, from being over harvested, pollution plays a problem with it, loss of habitat. A lot of things impact the horseshoe crab and how it selects it his beach. It can be beach slope, segment

size, or the chemical composition of it. You are going to be changing the beach by adding new sediment" to it. The sediment may not agree with the horseshoe crabs. 'It may be too fine for their nesting. It -- so they may not nest on that beach or their eggs may not be successful in hatching.

Response. Refer to the general responses for "horseshoe crab impacts from sand placement".

Comment.

Chemical compositions, we have already heard a lot about the toxicities of the sediments here, and, so, that may affect the eggs and reduce the success of the hatching.

Response. The Corps evaluated toxicity of bottom sediments by directly exposing aquatic organisms to the sediment. Water column, or suspended solid particulate phase bioassays were run to evaluate water quality concerns associated with the release of contaminants from sediment into dredging or placement site water. Whole sediment, or benthic bioassays were run to evaluate impacts to bottom dwelling organisms that would reside in sediments placed in an aquatic environment. These tests, which are commonly used to evaluate the quality of dredged material, were developed and approved by the U.S. Environmental Protection Agency.

A variety of aquatic organisms were used in the bioassays including larval shrimp approximately four days old, fathead minnows hatched the previous day, and American oyster embryos approximately two-hours after fertilization. These young organisms are very fragile and sensitive to contaminants in their environment. Following established protocols, these organisms were exposed to samples of bottom sediment for a prescribed period of time to evaluate any differences in mortality between Delaware River channel sediment and clean laboratory sediment. All organisms (100%) survived the numerous bioassays that were run, which is a strong indication that channel sediments are not toxic to aquatic organisms.

Comment.

Chemicals can get incorporated into the eggs to get past into the food chain, again, one of the foods that we eat, and, also, migratory shore birds that come from South America, they stay here for about two weeks, doubling their body weight, eating on their eggs and they continue to the nesting ground in Canada. So, the impact can have global implications on some of these animals. So, horseshoe crabs are very important. They are just one species that's out there.

A lot of things that we have heard about --other problems. The toxins that we "talked about, PCBS, dioxins, they are very sticky to "beiner" sediments. These are the sediments that get suspended easily into the water column and stay suspended for a long period of

time and can travel with the currents on there, so you can actually impact a greater area from where you are just putting the sediments out there on it.

Response. Bioaccumulation tests were run with Delaware Bay channel sediment to evaluate the potential for organisms to accumulate contaminants from the channel sediment into body tissues, which could then be magnified up through the food web. For these tests, a bivalve mollusc and a burrowing polychaete were used. The organisms were allowed to live in the channel sediments for a 28-day test period, and then the soft body tissues were chemically analyzed. Control organisms living in completely clean sediment were also run for comparison. No pesticides, PCBs or PAHs were detected in any of the tissue samples. Some heavy metals were detected, however, these metals were also detected in the control organisms, and all tissue concentrations were within range of acceptable background tissue levels.

Overall, these test results indicate that dredging channel sand from Delaware Bay, and using the sand for beach nourishment, would not have an adverse effect on aquatic resources of the bay. There is no evidence of any potential contaminant problems. Wildlife resources that would be in contact with the beach sand or forage for food at the water line would also be unaffected. There are no concerns with regard to toxicity or bioaccumulation of contaminants through a food web with sand of this quality.

GENERAL RESPONSES

TO

COMMENTS /CONCERNS

BENTHICS
BLUE CRAB
HORSESHOE CRAB
MONITORING
OYSTERS
SABELLARIA VULGARIS
SANDBAR SHARK
MIGRATORY SHOREBIRDS
SHORTNOSE AND ATLANTIC STURGEON
ENVIRONMENTAL WINDOWS
WINTER FLOUNDER

BENTHICS

IMPACTS ON BENTHIC COMMUNITIES

NUMBER OF EXHIBIT: 106, 111

BACKGROUND

Impacts of dredging on benthic organisms are discussed in the Corps EIS (1992) in Section 5.1.7 **(EXHIBIT 7).**

Impacts to benthic communities due to wetland restoration at Kelly Island are discussed in Sections 8.0 and 9.1.3 of the SEIS (1997) **(EXHIBIT 4).**

THE FOLLOWING CONCERN WAS RAISED.

Concern.

- Dredging to deepen the channel and placement of dredged material on Delaware Bay shorelines will adversely impact benthic communities.

Response. Impacts of dredging on benthic organisms are discussed in the EIS (1992) in Section 5.1.7 **(EXHIBIT 7).** This section says that dredging can result in destruction of bottom habitat and loss of existing sessile benthic community; however, benthic organisms from adjacent areas begin to re-colonize disturbed areas soon after completion of dredging operations, although the new community is likely to be different from the original. The Philadelphia to the Sea navigation channel (Delaware River) is currently maintained to a depth of 40 feet mlw through periodic dredging of shoaling areas. Deepening of this channel to 45 feet mlw is not expected to significantly alter the substrate, amount of light penetration, long-term turbidity levels or water quality. While initial construction of the new channel would impact the benthic community in areas that are not now maintained through dredging, maintenance of the new channel is not expected to impact benthos significantly more than current disturbances.

Impacts to benthic communities due to wetland restoration at Kelly Island are discussed in Sections 8.0 and 9.1.3 of the SEIS (1997) **(EXHIBIT 4).** No significant differences were found between any of the beneficial use sites and background conditions in Delaware Bay that would preclude its use.

Approximately 60 acres of mostly sub-tidal habitat adjacent to Kelly Island will be restored to intertidal wetland habitat, consisting of mostly *Spartina alterniflora* (saltmarsh cordgrass). Prior to the severe erosion that is presently taking place, this area consisted of intertidal marsh. Nevertheless, the benthic community that exists will be replaced by an intertidal marsh community. The benthic communities adjacent to Kelly Island would be eliminated and the bottom would be changed from subtidal to intertidal wetland, averaging about +5 feet MLW. This site was among those having the poorest quality benthic communities. It was characterized by a considerably less diverse assemblage than the background benthic communities in Delaware Bay.

Impacts to benthic communities at Broadkill Beach are discussed in Section 5.3.1 of the EIS for that project **(EXHIBIT 5):**

The majority of the impacts of beachfill placement will be felt on organisms in the intertidal zone and nearshore zones. The nearshore and intertidal zones are more dynamic, and are characterized by great variations in various abiotic factors. Approximately 69 acres of aquatic habitat (below mean high water) will be impacted by beachfill placement. Fauna of the intertidal zone are highly mobile and respond to stress by displaying large diurnal, tidal, and seasonal fluctuations in population density (Reilly *et al.* 1983). Despite the resiliency of intertidal benthic fauna, the initial effect of beachfill deposition will be the smothering and mortality of existing benthic organisms within the shallow nearshore (littoral) zone. This will initially reduce species diversity and density. Burial of less mobile species such as amphipods and polychaetes would result in losses, however, densities and biomass of these organisms are relatively low on beaches. Beach nourishment may also temporarily inhibit the return of adult intertidal organisms from their nearshore-offshore overwintering refuges, cause reductions in organism densities on adjacent unnourished beaches, and inhibit pelagic larval recruitment. Parr *et al.*, 1978 notes that the nearshore community is highly resilient to this type of disturbance, however, the offshore community is more susceptible to damage by receiving high sediment loads from fines sorting out from a beachfill.

The ability of a nourished area to recover depends heavily on the grain size compatibilities of material pumped on the beach (Parr *et al.*, 1978). Reilley *et al.* (1983) conclude that nourishment initially destroys existing macrofauna, however, recovery is usally rapid after pumping operations cease. Recovery of the macrofaunal component may occur within one or two seasons if grain sizes are compatible with the natural beach sediments. However, the benthic community may be somewhat different from the original community. Hurme *et al.* (1988) caution, "macrofauna recover quickly because of short life cycles, high reproductive potential, and planktonic recruitment from unaffected areas. However, the recolonized community may differ considerably from the original community. Recolonization depends on the availability of larvae, suitable conditions for settlement, and mortality. Once established, it may be difficult for the original community species to displace the new colonizers." Benthic recovery on the beach/intertidal zone may become hampered by periodic nourishments. Based on the above-mentioned studies, the benthic community may take 1-2 years to recover. With a five year renourishment cycle, the benthic community may be in a higher than normal state of flux as a result of the periodic disturbances of renourishment. It is conceivable that the benthic community may attain a recovered state for a period of 3-4 years before being disturbed again by a renourishment cycle.

Impacts to benthic communities at Port Mahon are discussed in Section 6.6.1 of the EA (1997) for that project **(EXHIBIT 3):**

"Effects of Beachfill Placement on Benthos. The majority of the impacts of beachfill placement would be felt on organisms within the intertidal and nearshore subtidal zones of the Delaware Bay. Approximately 21.5 acres of aquatic habitat (below mean low water) would be impacted by beachfill placement. Approximately 2.4 acres of rocky intertidal habitat and 2.4 acres of mudflat would be affected by beachfill placement. The initial effect of beachfill deposition would be the smothering and mortality of existing benthic organisms within the shallow nearshore (littoral) zone, however, many benthic fauna (particularly siphonate suspension feeders and deep-dwelling fauna) are able to migrate vertically to pre-existing sediment depths (Maurer et al., 1978; Salia et al., 1972; Schafer, 1972; Shulenberger, 1970). Vertical migrations approaching 3-feet and more have been documented from a variety of fauna, demonstrating a large adaptive ability to recover from burial. Benthic fauna with limited abilities to migrate vertically would most likely perish after fill placement. Horizontal migration of benthic fauna from unimpacted areas and larval resettlement can bring about rapid recolonization of areas that have been disturbed by the emplacement of dredged materials (Ranasinghe, and Richkus, 1993; Van Dolah et al., 1984; Maurer et al., 1978; Oliver et al., 1977). This will initially reduce species diversity and number of animals, however, the deposition area is expected to recolonize rapidly. Initially, recolonization would be dominated by opportunistic species whose reproductive capacity is large, and whose environmental requirements are often flexible enough to allow them to occupy disturbed areas (Boesch and Rosenberg, 1981; McCall, 1977). This may be a moot point considering that the shoreline area is most likely to be currently inhabited by opportunistic species within the impact area (Collier et al. , 1980; USACE, 1997). Bioaccumulation evaluations that were conducted on channel sediments indicated that there was no real potential for bioaccumulation of contaminants in benthic organisms (USACE, 1997). Placement of beachfill would cover existing stone revetments and would provide a more favorable substrate for soft-bottom benthic species. This alternative would also significantly benefit spawning horseshoe crabs by providing an accessible gentle-sloped sandy beach."

In a comment letter in the Port Mahon EA (1997) **(EXHIBIT 3)** dated September 8,1997, the U.S. Fish and Wildlife Service stated:

"The aquatic habitat that would be replaced by the beach is considered to be of relatively low value. The benthic community is not well developed apparently due to the very soft bottom substrate. The extensive shoreline erosion in this region is continually increasing the amount of this type of aquatic habitat at the expense of vegetated wetlands."

However, on 28 January 2002 a reconnaissance of the Port Mahon shoreline found at least four locations of *Sabellaria vulgaris* colonies and two oyster reefs. Additional information will be gathered during 2002 to determine the extent of benthic communities at Port Mahon.

BLUE CRAB

IMPACTS ON OVER-WINTERING FEMALE BLUE CRABS

NUMBER OF EXHIBIT/COMMENTOR: 68,72, 80, 84, 104,111, Clyde Roberts

BACKGROUND

A study titled *Delaware River Main Channel Deepening Project Delaware Bay Winter Crab Survey – 2000/2001* (October 2001) was submitted to DNREC (**EXHIBIT 24).** This report covers the first year of pre-construction monitoring. Pre-construction monitoring will continue until construction begins and subsequent reports will be provided to DNREC when available.

A "threshold" based on a commonly used biological reference point was used to determine whether the removal of crabs by the channel deepening, in addition to the commercial fishing could result in overfishing of blue crab stock in Delaware Bay (See attached evaluation). The "threshold" exploitation rate to support a healthy stock size was estimated to be 54%. Overfishing would occur if the exploitation rate exceeds a threshold that would be expected to maintain a healthy stock while at the same time meeting management objectives based on economic evaluations. Based on the 2000/2001-winter dredge crab survey conducted by Versar, it was estimated that 70,038 crabs were hibernating in areas of the channel scheduled to be dredged during winter. As compared to the 1998-2000 average catch and number of crabs available to the fishery, the additional removal of these 70,038 crabs would increase the annual catch from 30.12 million to 30.19 million, and the exploitation rate would increase (due to the combined of fishing and dredging) by 0.1 percentage point to 50.12%. The total removal of crabs would still be below the 54% threshold, and thus the dredging in the channel would be expected to have minimal effect on the blue crab stock.

THE FOLLOWING CONCERNS HAVE BEEN RAISED:

Concern.

- **a.** Accuracy of study including locations of samples, age profiles (were the crabs juveniles or adults), difference in population estimate between the Corps study and the Helser study, habitat for related species, and that the study was done after harvest, so numbers would be lower.

Response. This comment appears to be based on our draft report **(EXHIBIT 23)** not the final report that was extensively reviewed by DNREC and NOAA fisheries biologists. The final report **(EXHIBIT 24)** contains more detail and has been provided to DNREC and is available for viewing on our web site at http://www.nap.usace.army.mil/cenap-pl/b8.pdf. The appendix of the final report contains all the station information (latitude and longitude) as well as a summary of other organisms that were collected in the dredges that can be used to characterize the habitat for related species. Also, the final report provides a breakdown of the size frequency distributions of three major carapace width sizes (<60 mm, 60-119 mm, and >120 mm; see Figure 11 in the final report) that can be used as surrogate to age (e.g. <60 mm being juveniles). No reliable method is currently available to estimate the age of blue crabs. The catches in the dredge survey were dominated by larger (>120 mm) adult crabs that are considered fully recruited to the fishery. Our estimate of 60.2 million fully recruited crabs in Delaware Bay was within the range of estimates for the 1979-1999 period reported by Helser (6-65 million), and does not significantly differ from the 2000 estimate of 44.5 million recruits (Desmond Kahn, DNREC pers. comm.). We also note that the historic standing stock estimates for the late summer of 2000 cannot be directly compared to the February 2001 estimate provided in the Versar report because the stock size is influenced by mortality and growth of an unknown portion of pre-recruits into the fully recruited size class.

The estimation of blue crab density in the navigation channel (and elsewhere) during winter cannot be based on trawl surveys because the crabs are not vulnerable to the trawl; they are generally inactive and burrow in the bottom sediment in concentrated small areas. Also, estimates for local regions, such as the navigation channel, cannot be based on catch per unit effort from the winter fishery because the catch reports for the Delaware Bay are not spatially referenced. For such reasons, it was decided to conduct a dredge survey. The sampling protocol for the winter crab survey followed standard fisheries sampling techniques and was modeled after methods that have been used in the winter surveys conducted in the Chesapeake Bay for over ten years. The study was conducted in a rigorous and scientifically accurate manner. The principal investigator for this project Dr. Jon Volstad is a fisheries biologist specializing in survey sampling methods. He helped design and validate the Chesapeake Bay winter crab survey and has published several articles on the Chesapeake survey results in peer reviewed scientific journals. The Chesapeake Bay survey has been thoroughly scrutinized by the scientific community and is the main tool being used by the resource agencies to manage the fisheries in Maryland and Virginia. The tows were standardized based on time and the beginning and ending coordinates for each sample was recorded using a Global Positioning System (GPS) with sub-meter accuracy. To insure that physical collections of blue crabs were conducted properly, a commercial crabbing boat and crew was hired to conduct the survey with fisheries scientists on-board to direct the sampling and collect the necessary data. All stations were selected using stratified random sampling techniques to increase the statistical power of the survey to determine population size differences between the channel and non-channel areas. Rigorous statistical testing was conducted on the data and a team of DNREC and NOAA fisheries scientists reviewed the report before finalizing the study. This study is being repeated for the winter 2002, and we have doubled the number of samples in the navigation channel from 60 to 120 to further investigate the use of the channel habitat by hibernating blue crabs. The results of the second year of testing should be available for review in the spring of 2002.

We were aware that our survey was conducted after most of the commercial harvest was completed (a similar time frame is sampled by the Chesapeake Bay program), and we discussed winter fishery landings in the report. We provided estimates of how many crabs may have been removed from Delaware Bay prior to our survey (about 3 million crabs) and we related that to our population estimate of 60 million crabs. A second year of sampling is being conducted this winter (2002) during the same time frame to evaluate yearly difference in crab distribution and abundance

Concern.

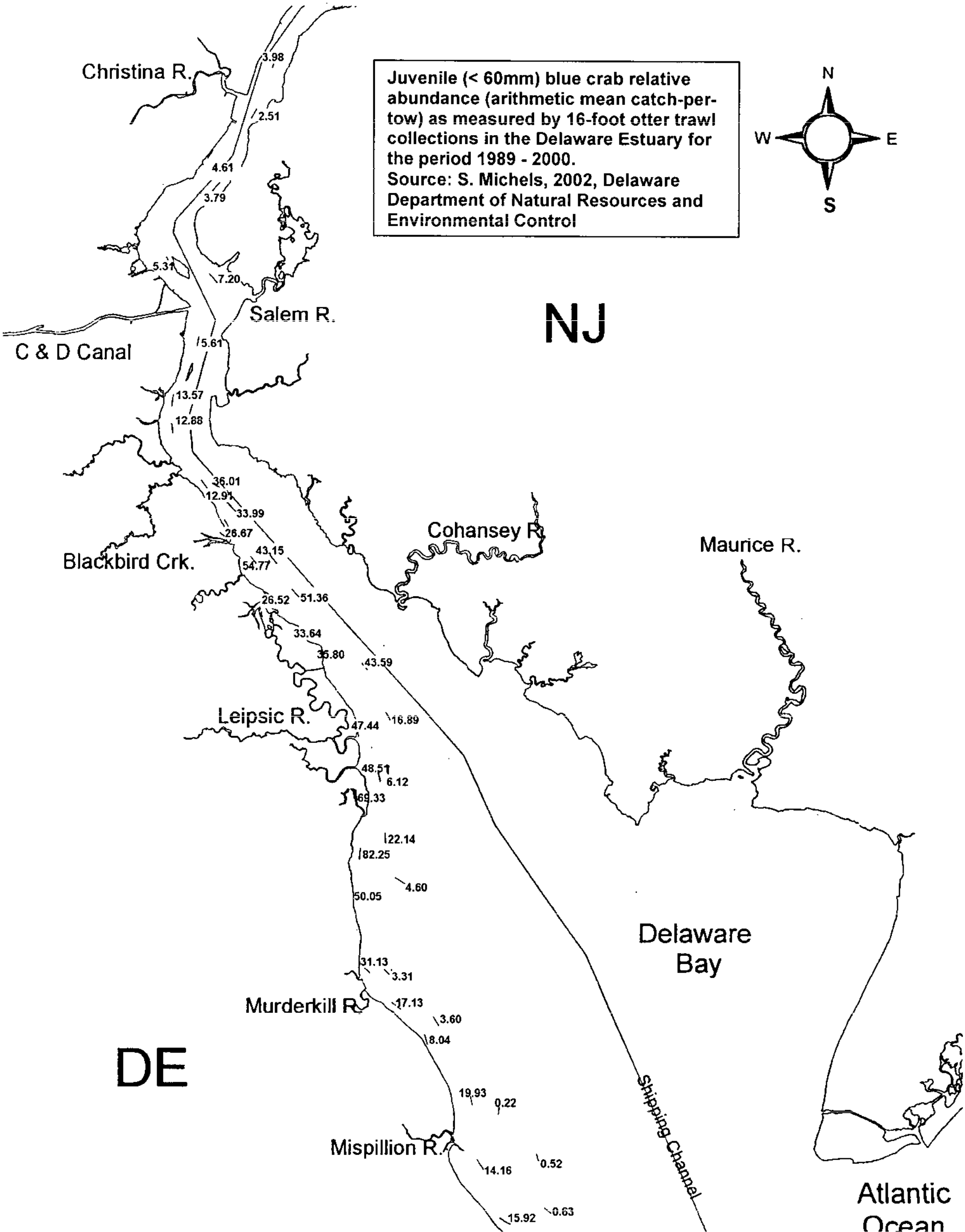
- **b.** Dredging above the C&D Canal, which is a nursery area for juvenile blue crabs will impact them by increased sedimentation and contaminants.

Response It is likely that nursery areas for juvenile blue crabs are in more shallow water areas, especially the tidal marshes that boarder each side of Delaware Bay (Epifanio, 1995) and not in the deeper water where the navigation channel is located. Attached is the juvenile blue crab results of the Delaware trawl sampling from 1989 to 2000 conducted from April through October (Michels, 2002) which indicates that juvenile blue crabs are more likely to be found south of the C&D Canal. However, the sampling also indicates that juveniles are found in deeper water up to about 18 ft mlw and the crabs are often associated with detritus concentrations. No sampling is done in the navigation channel (Michels, S. DNREC, Personal Communication, January 15, 2002). Studies have shown that increased sedimentation and contamination should not be significant and any effects should be localized.

Refrences:

Epifanio, C. E. 1995. *The Atlantic Blue Crab*, in Living Resources of the Delaware Estuary, Delaware Estuary Program.

Michels, Stewart. 2002. DNREC, Email to John Brady, U.S. Army Corps of Engineers, January 14, 2002.



Juvenile (< 60mm) blue crab relative abundance (arithmetic mean catch-per-tow) as measured by 16-foot otter trawl collections in the Delaware Estuary for the period 1989 - 2000.
Source: S. Michels, 2002, Delaware Department of Natural Resources and Environmental Control

Evaluation of potential impact of the Delaware Bay Navigation Channel Deepening Project on the blue crab stock.

We used a biological reference point as a guidance to whether the removal of crabs by the channel deepening in addition to the commercial fishing could result in overfishing of blue crab stock in Delaware Bay. Overfishing would occur if the exploitation rate exceeds a threshold that would be expected to maintain a healthy stock while at the same time meeting management objectives based on economic evaluations. We used a biological reference point of $F_{median}=1.3$ to determine the maximum fishing mortality for the Delaware blue crab, assuming a natural mortality for this stock at M = 0.8 (Anon. 1999; Helser and Kahn 2001). The commonly used reference point F_{median}, also referred to as F_{REP}, defines a fishing pattern that, on average, maintains a spawning stock that produces sufficient recruitment of crabs to replace the stock biomass lost due to mortality (Sissenwine and Shepherd 1987). An estimator of exploitation rate ***U*** of the Delaware Bay blue crab population is

$$U = \frac{C}{N}$$

where C is the total annual catch in numbers and N is number of crabs available to the fishery. Using Baranov's catch equation (Ricker, 1975):

$$U = \frac{F}{F+M}(1-e^{-(F+M)})$$

where F is instantaneous fishing mortality and M is natural mortality (assumed to be M=0.8; Helser and Kahn 2001), we estimated that the biological reference point of F_{median}=1.3 corresponds to an exploitation rate of U= 54%. The 1998-2000 mean fishing mortality rate (for fully recruited crabs) based on modified DeLury stock assessments is 1.14 (Helser and Kahn (2001), corresponding to an exploitation rate of U=50%. The 1998-2000 mean annual catch was 30.12 million crabs, and an estimated 60.24 million crabs were available to the fishery on average.

Based on the 2000/2001 winter dredge survey conducted by Versar, it was estimated that 70,038 crabs were hibernating in areas of the channel scheduled to be dredged. To evaluate the potential impact of the channel dredging on the blue crab stock size, we treated the mortality from dredging as an added component to the fishing mortality. Compared to the 1998-2000 average commercial catch and number of crabs available to the fishery, the removal of 70,038 crabs by dredging would increase the annual removal from 30.12 million to 30.19 million, comparable to a 0.1 percentage point increase in exploitation rate (from fishing and dredging mortality combined). The total removal of crabs would still be below the 54% threshold, and thus the dredging in the channel would be expected to have minimal effect on the blue crab stock. In fact, the removal of all crabs in the channel, estimated at 1.02 million, would result in an exploitation rate of 51.7% - still below the 54% threshold.

In the 2000/2001 winter dredge fishery, the reported landings indicate that 3.9 million crabs were caught, with an average catch per unit effort (CPUE) of 6,299 crabs per boat day. The 70,038 blue crabs hibernating in harms way in the channel represents the expected catches for a winter fishing effort of 11 boat days.

References:

Anon. 1999. 1999 Delaware Bay Blue Crab Fishery Management Plan. State of Delaware, Department of Natural Resources & Environmental Control, Delaware Division of Fish and Wildlife. In cooperation with The State of New Jersey, Division of Fish, Game & Wildlife.

Helser, T. E. and D.M. Kahn 2001. Stock assessment of Delaware Bay Blue Crab (*Callinectes sapidus*) for 2001. Report to DENREC.

Ricker, W.E. 1954. Stock and recruitment. J. Fish. Res. Board Can. 11: 559-623.

Ricker, W.E. 1975. Computation and Interpretation of Biological Statistics of Fish Populations. Bulletin of the Fisheries Research Board of Canada. 191.

Sissenwine, M.P. and J.G. Shepherd. 1987. An alternative perspective on recruitment overfishing and biological reference points. Can. J. Fish. Aquat. Sci. 44: 913-918.

HORSESHOE CRAB

HORSESHOE CRAB IMPACTS FROM SAND PLACEMENT

NUMBER OF EXHIBIT/COMMENTOR: 68, 70, 76, 101, 108, 111, 112, 115
Anthony Tolta

BACKGROUND

The construction of wetland restorations including Kelly Island will benefit spawning horseshoe crabs and shorebirds as stated in Section 9.1.5 of the Corps' July 1997 SEIS **(EXHIBIT 4)**:

"The construction of the wetland restorations will be phased to avoid and/or minimize impacts to fish and wildlife, especially to spawning horseshoe crabs and migrating and feeding shorebirds as described under Section 3.3.4.4. Reconstruction of wetlands at Kelly Island and Egg Island Point will greatly benefit most wildlife species. Although approximately 195 acres of aquatic habitat will be lost, this was formerly intertidal marsh before being destroyed by erosion. The loss of this aquatic habitat is not a significant impact."

ONGOING CORPS HORSESHOE CRAB STUDY

Currently an environmental window exists that prevents construction in the Delaware Bay portion of the project area (i.e. sand placement) from 15 April to 31 August to prevent impacts to spawning horseshoe crabs. This window follows the recommendations of the Atlantic States Marine Fisheries Commission's *Interstate Fishery Management Plan for Horseshoe Crab (1998).*

The proposed Kelly Island and Egg Island Point projects will be difficult to build if no construction is allowed during the 15 April to 31 August period.

The Delaware Department of Natural Resources and Environmental Control has stipulated that unless the Corps of Engineers can provide site specific information to indicate that 1) the Kelly Island site is not being used as a horseshoe crab nursery area or 2) that horseshoe crab spawning and egg incubation has ceased for the year, then the above window would be applied. Site specific information will be needed for confirmation of these conditions if sand placement is requested within the general 15 April to 31 August closure window.

As a result, during 2001 the Corps initiated a horseshoe crab study. The study *Preconstruction Horseshoe Crab Egg Density Monitoring And Habitat Availability At Kelly Island, Port Mahon, And Broadkill Beach Study Areas, Delaware* **(EXHIBIT 29)** estimated the amount of potential horseshoe crab spawning habitat that exists at each site; sampled horseshoe crab egg densities at these sites; and will compared those egg densities to egg densities on other horseshoe crab spawning areas examined along the Delaware Bay coast in Delaware during the same period. A revised draft report dated 31

December 2001 is attached. This report covers the first year of pre-construction monitoring. Pre-construction monitoring will continue until construction begins and subsequent reports will be provided to DNREC.

THE FOLLOWING CONCERNS HAVE BEEN RAISED:

Concern.

- **a.** Construction of Kelly Island Wetland Restoration and sand placement at Port Mahon will destroy existing habitat.

Response.

In a comment letter in the Port Mahon EA (1997) (Exhibit 3) dated September 8,1997, the U.S. Fish and Wildlife Service stated:

"The 5,200-foot long beach which is created and maintained by the project should be heavily utilized for spawning horseshoe crabs. Large numbers of horseshoe crabs routinely congregate in the Port Mahon area, but they currently find only very marginal spawning habitat."

The horseshoe crab egg density study done by Dr. Richard Weber in 2001 found that only 49.9 % of Kelly Island and 26.9 % of Port Mahon was suitable spawning habitat. Restoration efforts at Kelly Island and Port Mahon are expected to greatly enhance the spawning habitat. Much of the shoreline at Kelly Island is under lain with peat and unsuitable for spawning. The shoreline at Port Mahon is lined with rock rip-rap that results in the mortality of many spawning horseshoe crabs each year. The shoreline of Kelly Island has experienced severe erosion for many years. The long term erosion rate is about 20 feet per year. In 1926 the percent of sandy beach in the reach of shoreline that will be restored by the wetland restoration was 100%; in 2001 the amount of potential horseshoe crab spawning habitat is 49.9%. The project would restore this to 100%. Refer to the attached photo.

A monitoring/management plan (refer to the attached goals/objectives table dated November 2000) was developed for the Kelly Island wetland restoration project and has been closely coordinated with DNREC and Federal resource agencies, including personnel from the Bombay Hook National Wildlife Refuge. One of the goals was to maximize habitat for horseshoe crabs. The table explains how this goal is to be achieved including parameters that will be measured to determine if the goal is reached and measures that will be taken if the goal is not reached.

Concern.

- **b.** Working within the environmental window of 15 April to 30 August proposed by the Atlantic State Marine Fisheries Commission at Kelly Island, Port Mahon, and Broadkill Beach will adversely impact spawning.

Response.

The Corps of Engineers will not work within the window established by the Atlantic States Marine Fisheries Commission unless studies show and the State and Federal resource agencies agree that the work can be done without significantly impacting the horseshoe crabs.

Concern.

- **c.** There will be adverse impacts to hatchlings in the sand on the beaches even after August 30.

Response.

The number of hatchlings in the sand at Kelly Island, Port Mahon, and Broadkill Beaches is not known at this time. The Corps of Engineers intends to continue horseshoe crab studies in 2002 and will examine the beach areas for hatchlings in late September when their numbers are expected to be at a maximum.

Concern.

- **d.** There will be adverse impact to juveniles in the flats offshore that will be buried.

Response.

Little information exists about juvenile horseshoe crabs' use of the flats adjacent to spawning beaches. In 2001, the Corps of Engineers gathered data on juvenile horseshoe crabs for these three areas, as well as Kitts Hummock (a known productive spawning area recommended by DNREC as a control). Very few juveniles were found. See attached "Adult and Juvenile Horseshoe Crab Data –2001". We plan to repeat this study in 2002.

Concern.

- **e.** More than one year of data is needed to determine a beaches use for spawning.

Response.

In 2001 the Corps of Engineers conducted horseshoe crab studies at Kelly Island, Port Mahon, and Broadkill Beach for potential spawning habitat, egg density, numbers of spawning adults, and juveniles at adjacent sand/mud flat areas. These studies will be continued in 2002 with the addition of looking for hatchlings in the sand in the Fall.

Concern.

- **f.** The grain size of the sand placed on the beach will be too fine and will erode quickly.

Response.

The mean grain size of the dredged material that would be used on Delaware Bay beaches (Kelly Island, Port Mahon, and Broadkill Beach) is 0.41 mm, with a range of from 0.1 mm to 1.0 mm. This grain size would have a habitat suitability index (HSI) of about 0.7 (an optimal HSI is 1.0) (Brady, J. T. and Schrading, E, 1996. Habitat Suitability Index Models: Horseshoe Crab (Spawning Beaches) – Delaware Bay, New Jersey and Delaware). The horseshoe crab model is described in a planning aid report prepared by the U. S. Fish and Wildlife Service, dated March 21, 1997, and is included in Appendix A of the Port Mahon EA (1997) **(EXHIBIT 3).** The projected component index (CI) for horseshoe crabs (Sandy Beach Habitat) for both Kelly Island and Port Mahon is presented in the following table:

Suitability Index Variables	**Kelly Island**		**Port Mahon**	
	Value	**SI**	**Value**	**SI**
V1: Depth of sand over peat.	Greater than 16"	1.0	Greater than 16"	1.0
V2: % soil moisture content	3.6%	1.0	3.6%	1.0
V3: Beach slope (% grade)	5%	0.86	6.7%	1.0
V4: Mean grain size	0.41mm	0.67	0.41mm	0.67
*Component Index**	0.87		0.90	

*Component Index = $(V1 \times V2 \times V3 \times V4)^{1/4}$; A perfect score would be 1.0.

The grain size of sand on various Delaware Bay beaches in Delaware is shown in the attached table and figure (Weber, R. Email to John Brady, January 18, 2002) "Horseshoe Crab Spawning Beach Data: On each beach, the largest percentage of sediment was retained on the #40 sieve (0.845mm – 0.425mm). All beaches were similar in the amount of sediment that passed through the #40 sieve. All beaches except North Bowers (nourished in 1998) had appreciable amounts of larger sediments particles. On North Bowers, only 6.0% of all sediment was too coarse to pass through the #16 sieve, while other beaches had from 17.8% to 43.7% of all sediment too coarse to pass the #16 sieve. Most of the sediment at North Bowers is in the 1.13mm to 0.212mm size range. At this time, the importance of course sediment in Delaware Bay beaches is not known. However, the use of dredged material to restore beaches at Kelly Island and Port Mahon is expected to increase the amount and quality of the spawning area that is currently available".

Concern.

- **g.** The restored beaches at Kelly Island and Port Mahon will not be sustainable.

Response.

The sand berm at Kelly Island will be monitored and maintained when needed. No maintenance is planned for the beach at Port Mahon.

Draft Report

Preconstruction Horseshoe Crab Egg Density Monitoring and Habitat Availability at Kelly Island, Port Mahon, and Broadkill Beach Study Areas, Delaware

Richard G. Weber

31 December 2001

PRECONSTRUCTION HORSESHOE CRAB EGG DENSITY MONITORING AND HABITAT AVAILABILITY AT KELLY ISLAND, PORT MAHON, AND BROADKILL BEACH STUDY AREAS, DELAWARE

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31 December, 2001

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PRECONSTRUCTION HORSESHOE CRAB EGG DENSITY MONITORING AND HABITAT AVAILABILITY AT KELLY ISLAND, PORT MAHON, AND BROADKILL BEACH STUDY AREAS, DELAWARE

Richard G. Weber

Background

Several species of migratory shorebirds and resident laughing gulls feed extensively on eggs of the horseshoe crab, *Limulus polyphemus* L., during its spring spawning season (Botton 1984, Burger and Gochfeld 1991, Castro and Myers 1993). For some shorebird species migrating to their arctic nesting grounds, the stopover on Delaware Bay beaches to feed on *Limulus* eggs may represent the most critical part of their annual reproductive cycle (Castro and Myers 1993). Migrating shorebirds have been shown to make body weight gains of 40%, or more, during their two to three-week stopover on Delaware Bay beaches in May (Castro, et al. 1989).

In Delaware Bay, most *Limulus* spawning occurs from April through July, with May and June being the peak months of activity (Shuster and Botton 1985). Female *Limulus* spawn near the high tide line beneath the beach surface in "nests", where they produce one or more clusters of adhering eggs. Clusters are deposited below the feeding zone of shorebirds. However, many of these clusters become dissociated before the eggs hatch, and their constituent eggs are dispersed through beach sediments, toward the surface. A simple census, for egg clusters only, can underestimate actual egg numbers present on a beach (Weber 1998, 1999a, 2000). Several studies have sampled beaches to determine the populations of horseshoe crab eggs present in beach sediments. Researchers examining *Limulus* spawning behavior have taken a variety of approaches, however no standardized sampling method for determining densities of *Limulus* eggs dispersed in beach sediments has emerged from the literature. Such a method would facilitate a variety of comparisons that would be especially useful in making coastal and estuarine management decisions. Examples include: quantification of dispersed-egg population densities on beaches most heavily used by migrating shorebirds, comparisons of dispersed-egg populations in heavily used beaches with egg populations of less-used beaches, comparison of annual variations in spawning activity on a particular beach, and investigation of the effects of beach erosion or beach replenishment on *Limulus* spawning.

The Army Corps of Engineers is proposing to use dredged material from deepening the Delaware River Federal Navigation Channel for shoreline restoration projects at Kelly Island, Port Mahon, and Broadkill Beach, areas on the Delaware Bay known to attract shorebirds and spawning horseshoe crabs. These projects are expected to increase the amount and quality of horseshoe crab spawning habitat, significantly improving the habitat quality for both horseshoe crabs and shorebirds. In order to determine whether the completed shoreline restoration has benefited these species at the site, it is necessary to collect and analyze quantitative and qualitative baseline data on horseshoe crab egg density prior to construction.

Currently an environmental window exists that prevents construction (ie. sand placement) to take place from 15 April to 31 August to prevent impacts to spawning horseshoe crabs. This window follows the recommendations of the Atlantic States Marine Fisheries Commission's *Interstate Fishery Management Plan for Horseshoe Crab* (1998). These projects will be extremely difficult to build if no construction is done during this period. It may not be possible to complete the Kelly Island wetland restoration. The Delaware Department of Natural Resources and Environmental Control has stipulated that unless the Corps of Engineers can provide site specific information to indicate that 1) the site is not being used as a horseshoe crab nursery area or 2) that horseshoe crab spawning and egg incubation has ceased for the year, then the above window would be applied. Site specific information will be needed for confirmation of these conditions if sand placement is requested within the general 15 April to 31 August closure window. During 2001, this study will estimate the amount of potential horseshoe crab spawning habitat that exists at each site, will sample horseshoe crab egg densities at these sites, and compare those egg densities to egg densities on other horseshoe crab spawning areas examined on the Delaware Bay coast in Delaware during the same period.

Objectives Of This Study

This study was conducted on Kelly Island, Port Mahon (both in Kent County), and Broadkill (Sussex County) beaches, in Delaware during the summer of 2001. The study was designed to gather information about the seasonal distribution and relative abundance of horseshoe crab (*Limulus polyphemus* L.) eggs in these beaches, as they currently exist. The study also evaluated shorelines of these beaches so the amounts and locations of spawning habitats currently available on each could be estimated.

This report presents information about horseshoe crab egg densities gained during studies conducted on Kelly Island, Port Mahon, and Broadkill beaches (all in Kent County) during the summer of 2001. In it, I summarize my findings, discuss them in relation to the literature of horseshoe crab spawning, compare them to data collected in a parallel 2001 study on three other Delaware beaches (North Bowers, Kitts Hummock, and Pickering, all in Kent County), and further compare them to data collected during studies conducted on several other Delaware beaches during recent summers.

Materials And Methods

Descriptions of the study beaches **Kelly Island** is not actually an island, but rather a marshy peninsula lying between the Mahon River and Delaware Bay. The southern part of Kelly Island, near the mouth of the Mahon River, is the area where a restoration project is being considered. **Figure 1, Appendix A** is an aerial photograph of the study area, taken in 1997. This is the latest georeferenced photograph of this area currently available from the Delaware Department of Natural Resources. The shoreline runs more-or-less true north. At low tide, most of the shoreline consists of irregular, vertical peat "cliffs", ranging in height from ca. 0.5–1.3 meters above low water. The high ground consists of compacted mud and peat. There are few locations where the sandy areas of upper beach grade smoothly down to the low water line. The upper edge of the beach is separated from the background marsh by a variable wrack line, consisting mostly of coarse vegetable detritus, deposited during periods of storm flooding. Bayward from this storm wrack line, and running irregularly along beside it, is a discontinuous band of wave-deposited sand of varying depth, covering the mud and peat substrate. Depth of this band ranges from approximately 40 cm at the upper edge to 2 cm at the lower edge. The band ranges in width from 2.1 m (7') to 8.5 m (28'), and in all but a few narrow places, is discontinuous with the tide flats, being separated from the low water line by variable expanses of mud and peat substrate which are well above the low water line All egg clusters and eggs that I found on this beach were in this band of sand.

The two study transects sampled on Kelly Island during this study were "North", and "South", whose upper (high beach) ends were located at N39°12.679', W075°23.913' and N39°12.431', W075°23.849', respectively. Locations of these points are shown on **Figure 1, Appendix A.** Approximate distance between the two transects was 418 m (1,373'). These transects were selected, after a preseason site assessment, as being representative of the other sandy sections examined along that shoreline. Owing to an error in communication, both transects were located beyond the northern boundary of the proposed restoration project. This was not discovered until after samples had all been collected and processed. Location of the northern boundary of the restoration project is shown on **Figure 1, Appendix A.**

Port Mahon beach has a northeasterly-oriented Delaware Bay shoreline. **Figure 2, Appendix A** is an aerial photograph of the study area, taken in 1997. This is the latest georeferenced photograph of this area currently available from the Delaware Department of Natural Resources. A sand road closely parallels the shoreline. The southern midsection of the beach has several sections of vertical metal breakwater, which persist from early attempts to protect the roadway. Breakwater sections parallel the shoreline 1–2 m out past the low tide line. The road is separated from the water by a variable band of riprap which consists principally of boulders in the 30 – 120 cm (1' – 4') size range. The lower edge of the riprap runs variously up and down through the intertidal area. In some places the lower edge of the riprap reaches out nearly to the low tide line. In other cases the lower edge rises somewhat above the middle part of the intertidal area. At lunar tides, water rises completely over some sections of riprap, and wave action erodes the roadway. As a result, the road is subject to continual grading and repair, with additional sand being added several times each year. Sand from this erosion and subsequent replenishment migrates downslope through the riprap, to create the sections of sandy beach upon which the horseshoe crabs spawn.

On the bay side of the riprap, the beach contains varying amounts of smaller (≤ brick size) miscellaneous chunks of macadam, masonry rubble, etc., applied long ago in attempts to stabilize and maintain the road. This trash material, together with random layers of shell, is variably covered with sand. The color and size uniformity of the sand particles along the riprapped beach areas suggest that most sand present is the result of erosion from the material used to repair the road. Much of what appears to be sandy beach is actually shallow sand underlain by clay hardpan, dense layers of shell, or miscellaneous trash material, and is generally unsuitable for spawning. Female horseshoe crabs seldom spawn in situations where the sand is not at least deep enough to nearly cover their bodies, approximately 10 cm (4").

The two study transects sampled on Port Mahon during this study were "North", and "South", whose upper (high beach) ends were located at N39°11.114', W075°24.071' and N39°10.794', W075°24.297', respectively. Locations of these points are shown on **Figure 2, Appendix A.** Approximate distance between the two transects was 671 m (2,203'). These transects were used for this study because they have been sampled in similar studies each year since 1998. They were selected in 1998 because they had the deepest, most uniform layers of sandy sediment along the Port Mahon shoreline.

Broadkill Beach differs from the other beaches studied, being a wide, continuous band consisting almost entirely of clean sand and small (<2 cm) gravel. Sediment depths are greater than 30 cm in most sections. The beach is currently protected by a series of regularly-spaced breakwater structures extending from high on the beach, out into the water at right angles to the shoreline. Shoreward, the beach is backed by varying widths of sparsely vegetated dunes, and a dense residential area. **Figure 3, Appendix A** is an aerial photograph of the study area, taken in 1997. This is the latest georeferenced photograph of this area currently available from the Delaware Department of Natural Resources. This beach is the southernmost of the beaches studied and is approximately 42 km (26 miles) from Port Mahon.

The two study transects sampled on Broadkill beach during this study were "North", and "South", whose upper (high beach) ends were located at N38°49.961', W075°12.958' and N38°49.713', W075°12.692', respectively. Locations of these points are shown on **Figure 3, Appendix A.** Approximate distance between the two transects was 577 m (1,894'). These transect sites were selected after a preseason assessment of the entire beach frontage. They were visually representative of all frontage examined, and were reasonably close to public access points.

Sampling procedures In Delaware Bay, *Limulus* spawning activity seems to be more intense during the full and new moon tides (Rudloe 1985). During the 2001 spawning season, full moon tides were on May 7; June 5; July 5, and new moon tides were on April 23, May 22; June 21. I sampled the beaches 2–4 days after each of these tides. It was not possible to sample all three beaches on a single day. Typically, the Kelly Island and Port Mahon samples were taken on one day, and Broadkill was sampled another day. For simplicity in this report, sample dates are listed as a single date (the day Kelly Island and Port Mahon were sampled), rather than two. Sample dates were April 26; May 10, 25; June 11, 25; July 9. On these dates, I sampled each beach along two transects which were at right angles to the waterline. Upper (high beach) transect endpoints were located by reference to permanent visual markers, and recorded as GPS readings, and the same section of beach was sampled on each date. (The exception to this sampling schedule is that I could not sample the Kelly Island N transect on 25 May because the boat sank at anchor while I was collecting the sample on S transect.) All transects were within the intertidal zone, where spawning activity is more concentrated (Botton, et al. 1994, Shuster and Botton 1985, Weber and Ostroff 1997, Williams 1986, Williams 1987).

On sample dates, I took 25 evenly-spaced core samples along each transect. Each transect spanned 83% of the distance from the nocturnal high tide wrack line down toward the foot of the beach, where the flat began. The nocturnal high tide wrack line was used as the upper end of transects because nocturnal tides around the new and full moons (when spawning is believed to be heaviest) are higher on the beach than diurnal high tides of the same period. I used 83% of the total distance from the nocturnal tide wrack line because a pilot study I did in 2000 (unpublished) showed that 100% of all egg clusters in each of four Delaware beaches were located in the upper 83% of the nocturnal-tide-wrack-line-to-flat span. In that study, 10 continuous trench transects, each running from nocturnal wrack line down to the tide flat, were made on each beach. Egg clusters present in every one-foot span of each trench were hand counted and recorded. The results showed clearly that the beaches studied had similar cluster distribution profiles. Cluster numbers were low near the wrack line, rose to maximum abundance near the upper mid beach, then decreased in numbers toward the lower end of the beach. No clusters were found in these beaches past the 83% point mentioned above.

Although intertidal beach spans varied at the points where transects were located, the 25 sample cores along each transect were kept evenly, thus proportionally, spaced across the sample distance by use of transect lines made from bungee cord. These lines were marked off into 25 equal units of distance. Bungee cord lines can be stretched to fit beaches of varying widths, and since the marks spread apart at the same ratio as the line is stretched, cores are always equally spaced across the span to be sampled.

Sample cores consisted of beach sediment cores, 5.7 cm (2.25") in diameter x 20 cm (8") deep. The 20 cm depth of the sample cores spans the reported range at which most egg clusters are placed during spawning (Hummon et al. 1976, Rudloe 1979, Weber 1998, Weber 1999a, Weber 2000). Surface area (cross section) of each core was 25.65 cm^2, giving a total cross-section of the 25 cores taken per transect of 641 cm^2. After each core was lifted, it was separated into two fractions: 0–5 cm and 5–20 cm depth. This was done by sliding a sheet metal divider through a transverse slit in the corer, located 5 cm from its top end. The divider was held in place until the lower, 5–20 cm, portion of the core had been dumped through a screen into the first sample bucket, then was removed so the 0–5 cm portion could be put through a screen into the second bucket. These core fractions are of interest because shorebirds forage in the surface sediments, while the clusters are deposited somewhat deeper. Knowledge of egg numbers present in the 0–5 cm part of a beach is therefore useful in estimating how many *Limulus* eggs are potentially available for shorebird use.

Core sample fractions from each transect were combined into the appropriate bucket as they were collected, and all of the sediment material collected was processed to extract the eggs. Upon collection, each fraction of the core sample was passed through a 13 mm (0.5") mesh screen into a collection bucket, to remove any large gravel or shells, and to reveal clumps of eggs. (When *Limulus* eggs are laid, they adhere together in tight clusters [Rudloe 1979], and they continue to adhere tightly to each other during the first weeks of development.) One, or more, tight aggregations of eggs that did not pass through the 13 mm mesh was recorded as a single cluster. Thus, a single 20 cm core could have up to two clusters: one each from the 0–5 cm and 5–20 cm fractions. After being recorded, clumps were broken apart to pass through the 13 mm screen, into the appropriate sample container, and their component eggs included in the final egg volume values. The 25 sample cores from a single transect (0–5 cm and 5–20 cm fractions, considered together) had a total volume of approximately 13.3 liters (3-1/2 gallons).

Extracting and quantifying eggs Samples were processed at the Delaware National

Estuarine Research Reserve Center, on Kitts Hummock Road, south of Dover, DE. The contents of each bucket were flushed through a series of screens with running water to separate eggs from most of the beach substrate material. Mesh size of the first screen was 6.4 mm (1/4"); of the second, 3.2 mm (1/8"). All eggs were captured on the third screen, of copper window screening (mesh size, 1 x 1.5 mm = 0.04" x 0.06"), which retained all eggs encountered, plus beach sediment particles in the same size range. Eggs were separated from the remaining sediment and most other materials retained on the third screen, by elutriation with running tap water as described previously (Weber 1998).

Residual peat particles and meiofauna were separated from *Limulus* eggs, embryos and trilobite larvae by hand picking. I then used a 10% (v/v) solution of $MgSO_4$ and tap water to separate smaller, greenish undeveloped eggs ("eggs") from the larger, visibly embryonated eggs ("embryos") by differential flotation. Viable "embryos" float, viable "eggs" sink, in this solution, giving a good separation. The separation is not absolute to the eye however, for some items that appear to be "eggs" float, while some apparent "embryos" sink. "Eggs" that float are not viable. Most hatchlings (trilobite larvae) swim, or float passively, in the $MgSO_4$ solution. All material that floated in the $MgSO_4$ solution was discarded, and only the viable eggs were quantified. It is not necessary to also quantify embryos and trilobite larvae, because the eggs take sufficient time to develop that they are present in the beach for at least two sample periods before they hatch. (See **Beach temperature**, below.)

As each sample is being separated from remaining sediments by the elutriation process, a few viable eggs are also rinsed out. All material coming out of the elutriation system was checked, and any viable eggs present were hand counted. When sample egg numbers were small, I made direct counts. When egg numbers were too great for direct counting to be efficient, I measured the extracted eggs volumetrically, using standard graduated cylinders. Volumes were measured by pouring the sample, with tap water, through a funnel into a graduated cylinder (25, 50, 100, 250 and 500 ml, as appropriate to sample size). The cylinder was then stoppered, inverted several times to distribute the sample evenly in the water column, set upright and allowed to settle. After settling, the cylinder was bumped against the benchtop several times to further consolidate the sample, then volume was read and recorded.

By counting measured volumes of eggs, some taken during each sampling period, I found there was an average of 178 eggs (n= 20 samples) per ml. Eggs used for these counts were taken from among those extracted from the core samples on each sample date. They were not selected from a single cluster, core, or transect. This correlates well with Shuster and Botton's (1985) report of 176 eggs/ml (n=9 samples from a single cluster). I used the average value 178 to calculate egg numbers from their respective volumes.

Results And Discussion

Beach temperature The time required for *Limulus* eggs to develop and hatch is controlled by ambient temperature. I measured beach temperatures within the transects on each date when core samples were taken. This was always near low tide, usually between 7 and 11 AM, so transects had been under the influence of air temperature and insolation for several hours prior to measurement. Readings were taken with digital probe thermometers at a depth of 20 cm, at the upper, middle, and lower end of each transect. On several transects, subsurface rock, shell, etc., required that some readings be taken at less than 20 cm, however, no readings were taken at less than 10 cm.

There was little variation in beach temperature within or between transects. On 26 April, during the first sampling, average temperature of the 3 beaches was 12.9°C (55.6°F). Average beach temperatures increased steadily through the sampling period to 23.0°C (73.8°F) on the last sample date (9 July). This is an average increase of ≈1.8°C (≈3.2°F) per week of the study period. In the laboratory, French (1979) found that *Limulus* eggs took more than 6 weeks to hatch at 15–17°C (59–63°F), and 3–4 weeks to hatch at 25°C (77°F). This suggests that eggs laid within the study transects both before sampling began, and during the course of this study, were present in the sand for sufficient time to be sampled at least twice.

Egg clusters and total egg population The summer's sampling yielded considerable information about egg populations on the sampled beaches. I found a combined total of 43 egg clusters on the Kelly Island and Port Mahon transects during the 2001 sampling period. No clusters were ever found on Broadkill Beach, although a few dispersed eggs were regularly recovered. The number of clusters found in any single transect on one sampling date ranged from 0 to 7 (for Port Mahon, south transect, on 11 June). For purpose of illustration, 7 clusters per transect would equate to 109.2 clusters per m^2. **Figure 4** shows the distribution of total egg clusters by sampling date. There were no clusters from any transect on the first sampling date, and only four clusters on the last sampling date, indicating that the sampling season spanned the period of heaviest spawning. Thus, data collected during this study should be representative of *Limulus* spawning on these transects during the 2001 spawning season.

Table 1 shows beaches and transects ranked by total numbers of egg clusters, and compares the 2001 season's cluster totals observed on the Port Mahon N and S transects to totals from previous years. No earlier data exists for Kelly Island because it has not been sampled previously. Cluster totals from previous years on Port Mahon are not directly comparable to the 2001 values, since the 2001 season sampling was done at right angles to the water line, and in previous years was done parallel with the water line. This change was made because the parallel sampling procedure used previously yielded eggs/m^2 values higher than were actually present over the whole intertidal spawning area. The 2000–1998 cluster totals are included to allow direct year-to-year comparisons during that period.

All clusters were in the 5–20 cm fractions of cores, except for one cluster found in the 0–5 cm fraction on Port Mahon N on 11 June. Of interest is the fact that in 2001 Port Mahon S had approximately twice as many clusters as Port Mahon N (**Table 1, Appendix B**). The previous year, both Port Mahon transects had nearly equal numbers of clusters, and in 1999, total clusters were highest on Port Mahon N. It is tempting to attribute the changes in egg cluster numbers observed on these transects, in each of these three seasons, to qualitative changes in the beach associated with erosion. However, that is not possible, in part because correlated sand depth and beach sediment studies have not been done on this beach.

The total number of eggs found in any single transect on one sampling date (0–5 cm and 5–20 cm fractions combined) ranged from 0, to 122,000 (Port Mahon N, 11 June). For purpose of illustration,122,000 eggs per transect would equate to 1,900,000 eggs per m^2. **Table 2 (Appendix B)** ranks the transects by total number of eggs collected during the 2001 season. For these beaches and transects, the ranking by total egg numbers is the same as the ranking by cluster totals, which is not always the case. Most eggs were in the 5–20 cm fractions of cores, but substantial numbers were also present in the 0–5 cm fractions. On Kelly Island and Port Mahon, eggs present in the 0–5 cm fractions ranged from 3% to 19% of total eggs collected (**Table 2**).

Broadkill beach, where no clusters were found, represents a curious case, since considerably more eggs were found in the 0–5 cm fractions than in the 5–20 cm fractions. The very high percentages of eggs found in the top 5 cm (N transect, 69%; S transect, 58%), and the very low total numbers of eggs found (**Table 2**), might suggest that many of the eggs found in the samples had washed down to this beach from more heavily used spawning beaches to the north. However, on the last sample date, I found an estimated hundred trilobite larvae in the 5–20 cm fractions from both transects. These, and the eggs found in the 5–20 cm fractions verify that some spawning did actually take place on these areas of Broadkill beach, since eggs will not become reburied into beach sediments after they have come up out of the sand. This fact was noted by Williams (1986), and is the basis of most methodologies used to separate *Limulus* eggs from beach sediment samples.

There are two components to the *Limulus* egg population in a beach: clusters as laid by spawning individuals, and the subsequently-dissociated eggs dispersed throughout beach sediments. Both these components must be sampled, and the resultant total egg volume quantified, to obtain the most accurate estimate of transect (and thus beach) egg load. Because dissociated eggs are present throughout the spawning season, a simple census for egg clusters only will seriously underestimate actual egg numbers present. Conversely, excluding egg clusters from total egg volume calculations would also underestimate egg numbers. In this study I enumerated clusters as they were found in the sample cores, using the 13 mm (0.5") screen. Then I replaced their component eggs into the samples so they would be included in the total egg population. Finally, I extracted all eggs from the entire quantity of material collected in the sample cores.

If it is assumed that clusters in this study contained the same number of eggs per cluster, 3,650, reported by Shuster and Botton (1985) for a study of Delaware Bay beaches, it is possible to estimate the fractions of eggs that were represented in clusters in this study. If the total number of clusters found on Kelly Island and Port Mahon during the 2001 sampling is multiplied by 3,650, and the resulting value is divided by the total eggs found on each beach, then only 23.1% (Port Mahon) and 40.6% (Kelly Island) of the eggs collected on these transects would have been contained in the clusters. Thus, dispersed eggs were substantially more abundant on these transects than the number of clusters would indicate. Moreover, these estimated percentages are likely to be high because complete clusters are seldom recovered with core sampling, and therefore the true percentages of eggs found in clusters during this study would be lower.

Kelly Island, Port Mahon and Broadkill beaches varied widely from each other in their transect total egg numbers for the sampling season. **Table 3, Appendix B** compares their season transect egg totals to season transect egg totals observed on Kitts Hummock, Pickering, and North Bowers beaches, which were also studied during 2001, in a parallel study. The Port Mahon transects had approximately twice as many total eggs as transects on the next most populous beach, Kitts Hummock (248,000). In turn, Kitts Hummock and Pickering (201,000) beach transects yielded more eggs than did those on Kelly Island. Pickering was approximately twice as productive as Kelly Island (104,000). North Bowers had approximately half as many eggs as Kelly Island (55,000). Broadkill beach had a season total from both transects of 431 eggs.

Evaluation of spawning habitat and 2001 beach egg loads *Limulus* eggs clusters and eggs are not distributed evenly across the intertidal area, but instead are more frequent at about mid span. The vertical sample transects used in this study passed through all intertidal areas where eggs were present. This has the effect of summing differing egg densities across the span sampled. In turn, this allows egg load data to be reduced to an average per-square-meter value which should be representative of any other square meter of spawning habitat in the immediate area. In this study, "spawning habitat" was defined as the area from the nocturnal high tide wrack line down toward the low water line, 83% of the distance to the beginning of the tide flat. Average-per-square-meter egg density values obtained from vertical transect sampling can be used to calculate estimates of beach egg load based on *length* of spawning habitat shoreline. The process is to multiply a transect's average eggs/m^2 value by the transect's length, then use the resulting value to multiply the meters of shoreline on that beach. As can be seen from data presented above, the full length of a beach may have a variable egg load. In fact, differences between total N and S transect egg loads are commonplace. For this reason, I used the average of the total eggs per transect in these calculations (0–5 cm and 5–20 cm fractions combined). In order from north to south, each of the study beaches is discussed below, with an estimate of its season total egg load. **Table 4, Appendix B** provides egg load estimates for each of the study beaches, which are discussed individually, below.

Kelly Island I walked 2,203 m (7,234') of frontage on this shoreline, to determine the amount of spawning habitat present. I began at the southern tip of Kelly Island, at the first section of sand with sufficient depth for spawning (N39°11.577', W075°23.781'), and continued northward along the storm wrack line to N39°12.872', W075°23.855. I used a GPS unit to record the lengths of sand stretches having sufficient depth for spawning. Center widths of these stretches were measured with a tape, so estimates of their surface areas could be also be calculated. There were 901 m (2,957') of spawning habitat along this 2,203 m (7,234') of bay frontage. This represents 40.8% of the length I examined. The combined area of these sections of spawning habitat was 0.39 hectare (0.96 acre). The 2001 estimated egg load for the 901 m spawning frontage of the 2,203 m examined, based on the calculations described above, is 3.2 x10^9 eggs **(Table 4, Appendix B).** Spawning frontage is shown in **Figure 1, Appendix A.**

Owing to the error mentioned earlier, the span of shoreline I examined extended from near the present south tip of Kelly Island to considerably north of the proposed restoration project. It was possible to calculate the percentage of spawning habitat that was within the limits of the proposed project. There were 933 m (3,062') of shoreline from the southern tip of Kelly Island to the northern limit of the proposed project. Within this span, there were 466 m (1,531') of spawning habitat. This represents 49.9% of the total span I examined. The combined area of the sections of spawning habitat within this span was 0.20 hectare (0.49 acre). The 2001 estimated egg load for the 466 m spawning frontage of this part of the shoreline, based on the calculations described above, is 0.83 x10^9 eggs (**Table 4, Appendix B**).

This is the first time Kelly Island has been evaluated as a *Limulus* spawning site. Judging from the evidence of a rapidly eroding shoreline—both on-site, from aerial photographs, and from the relevant USGS Quadrangle (1956)—the spawning habitat I evaluated in 2001 will very likely be altered before the next spawning season by erosion. Indeed, the impression gained from repeated sampling on the beach, and walking along the storm wrack line, is that this shoreline is not at all a constant or consistent spawning area. Some indication of recent changes along this shoreline can be obtained by simply noting the westward displacement of the sandy spawning areas I found in 2001 from the stretches of sand shown in the 1997 aerial photograph (**Figure 1, Appendix A**). The rate of erosion has been variable, as shown by the varying distances between lines indicating 2001 spawning habit, and the sandy stretches present in 1997.

It seems likely that some stretches of the Kelly Island shoreline with sand deep enough to be suitable for spawning in 2001 will still have enough sand next year. However, it is also likely that some stretches of shoreline suitable for spawning in 2001 will not be suitable next year. Further, some sections without any sand, or without a suitable depth of sand in 2001, could possibly have enough sand next year to support spawning. These are reasonable beliefs when the stretches of spawning habitat I found in 2001 are compared to the stretches of sand visible on the 1997 aerial photograph upon which they are plotted (**Figure 1, Appendix A**). Stretches of spawning habitat appear and disappear in response to continuing erosion of the shoreline. With reference to the 1997 photograph, in some places long stretches of sand present then are now gone. Other sandy spawning areas I found along those same sections of shoreline in 2001 are reduced in total length from stretches of sand visible in the photograph. Along some other sections of the shoreline, where no sand was visible in 1997, there was enough sand present in 2001 that spawning occurred.

Such comparisons must be made tentatively because the sandy stretches visible in the 1997 photograph were not checked to see how much spawning occurred on them. For Kelly Island, there is only the 2001 *Limulus* egg sampling and spawning habitat evaluation data, coupled with the understanding that spawning only occurs on sandy substrates. I have not observed *Limulus* to spawn in mud or peat substrates on any beach I have studied in Delaware. My experience in sampling Delaware beaches over the past four years is that they also do not spawn on beaches with only a shallow layer of sand (< 10 cm) over mud or peat. For this reason, stretches of sand shown in an aerial photograph do not necessarily indicate suitable spawning habitat.

Port Mahon I examined the entire 1,672 m (5,491') frontage of the beach at low tide, to determine the amount of spawning habitat present. I began at the southern end of the beach (N39°10.654' W075°24.491') where a culvert passes under the road, and continued northerly to N39°11.358', W075°23.909' at the bait store. I used a GPS unit to record the waterline lengths of sand stretches with sufficient depth for spawning. At the same time, center widths of these stretches were measured with a tape, so their approximate surface areas could be calculated. There were 450 m (1,478') of spawning habitat along the beach. This represents 26.9% of the total length of Port Mahon beach. The combined area of these lengths of habitat was 0.44 hectare (1.08 acre). The amount of spawning habitat on this beach has remained essentially the same since I examined it in 1999. At that time, total area of spawning habitat was 0.39 hectare (0.96 acre), and 28.5% of total beach length (Weber, 1999b). The 2001 estimated egg load for the 450 m spawning frontage of this beach, based on the calculations described above, is 22.3 x10^9 eggs **(Table 4, Appendix B).** Spawning frontage is shown in **Figure 2, Appendix A**.

Typically, Port Mahon transects have been among the top transects for total numbers of *Limulus* eggs. **Table 5, Appendix B** compares total egg numbers from the Port Mahon N and S transects over three years, during which period, season total egg numbers for the beach have ranged between 400,000 and 500,000, while per-transect season total values have been 174,000 or higher. The 2001 total egg values from Port Mahon transects S and N, 268,000 and 233,000 respectively, were considerably higher than from any other transect sampled in a parallel study of other Delaware beaches done that same season. The next highest 2001 egg total observed was from Kitts Hummock S (135,000 eggs). In 2000, total egg values from Port Mahon transects N and S were 174,000 and 229,000, respectively. These were less than the value observed on Ted Harvey S (312,000) that year. The 1999 Port Mahon transect totals were both higher than any others, with the next highest 1999 total being Ted Harvey S (140,000).

Comparing the *Limulus* egg data from Port Mahon beach with similar data collected on other beaches sampled in this, and earlier, studies is problematic. For example, the approximately mile-long frontage of Port Mahon contains a rather small percentage of shoreline where there is sufficient sand to allow spawning, and where coupled *Limulus* pairs come up to the water's edge. While other beaches generally provide a meter of spawning beach for each meter of shoreline, this is definitely not the case at Port Mahon. It seems probable that female *Limulus* in the waters along Port Mahon beach are forced to concentrate into the few areas where they can spawn. This seems unlikely to be the case on most other beaches where shoreline and suitable spawning habitat are essentially equal. While the N and S transects typically have high cluster and total egg counts, these may be high simply because individuals spread along the Port Mahon shoreline are forced to come to the same few locations suitable for spawning. This could account for the high cluster counts and total egg numbers observed there. However, this concentration effect is partly offset by the fact that *Limulus* are legally harvested from Port Mahon beach two days a week, during the spawning season.

Personal observations, and discussions with those harvesting, suggest that females coming onto the beach to spawn are the primary catch. These potential spawners are taken before they have a chance to lay eggs, since females full of eggs are more desirable as bait, their intended use. No data are available on the percentage of spawning females harvested from this beach each season, but the favored places to harvest are the few spawning areas, which include areas surrounding both the N and S transects. A further confounding factor for Port Mahon spawning areas is the fact that large numbers of *Limulus* adults, of both sexes, become accidentally wedged into interstices between rocks of the riprap shoreline erosion barrier. Some individuals are trapped during each spawning event. Many of these animals become so firmly wedged between rocks that they cannot get free. Gulls prey on the more accessible individuals; the others die of exposure or starvation.

Broadkill The area I evaluated began at N38°50.347', W075°13.493' and continued southward to N38°48.408', W075°11.397', at the boundary with Beach Plum Island Nature Reserve. Total frontage length, 4,723 m (15,506'), was determined by measurements taken from beach restoration project plans provided by USACE personnel. At 13 locations distributed along the frontage, I measured beach width from nocturnal tide wrack line down to the foot of the beach slope. Widths for Broadkill beach ranged from 11.9 m (39') to 16.1 m (53'), with an average width of 14.4 m (47'). Frontage length of the beach was multiplied by the average width value to estimate the amount of spawning habitat present. The full length of shoreline consisted of sandy sediments, which appeared suitable for *Limulus* spawning. The potential spawning habitat on the beach was 6.4 hectares (15.8 acres). The 2001 estimated egg load for the 4,723 m of spawning frontage on this beach, based on the calculations described above, is 0.25 x10^9 eggs **(Table 4, Appendix B).**

In terms of beach slope and sediment size distribution, the entire shoreline of Broadkill beach appears to be equally suitable for spawning. However, only low numbers of eggs were found there during this study. It is unclear why this is so, although I usually found the wave height, and corresponding surf, to be greater than found on more northerly Delaware beaches on the same day, and within an hour or two. This surf difference may be attributable to influence of ocean waves. On more northerly Delaware Bay beaches, *Limulus* spawning does not take place when onshore winds create waves over ca. 30 cm (12") (personal observation). Waves observed on Broadkill during sampling periods were frequently over 30 cm high, and on several occasions, were ca. 50 cm (20") high. Whatever the cause of the low egg numbers on Broadkill beach, the extremely low numbers indicate that it currently receives very little *Limulus* spawning.

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APPENDIX A

Figure 1 Aerial photograph of Kelly Island, taken in 1997, showing locations of 2001 study transects N and S. Linear frontage of spawning habitat is shown in yellow. The horizontal, white line marks the northern endpoint of the proposed restoration project.

APPENDIX A

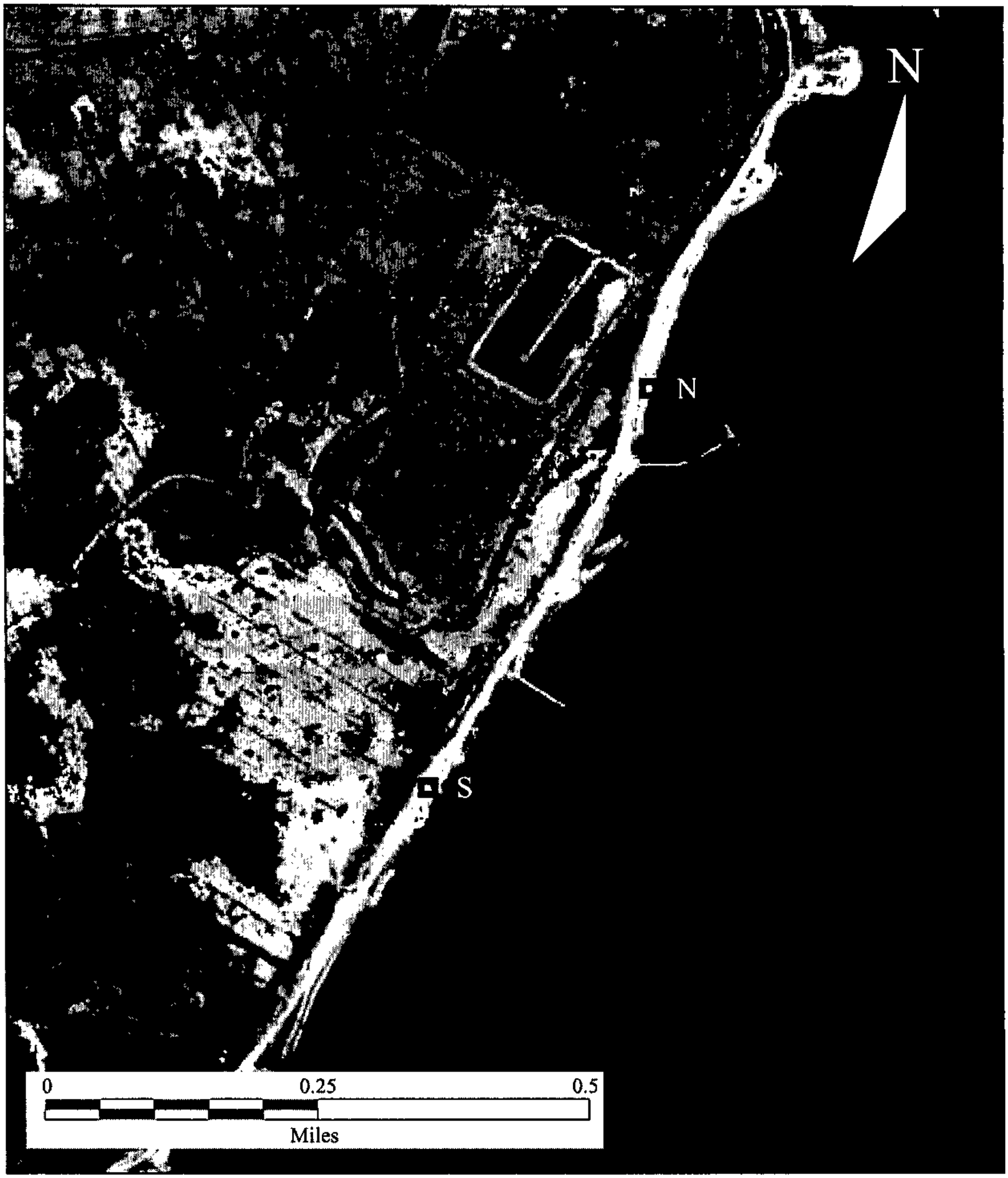


Figure 2 Aerial photograph of Port Mahon shoreline, taken in 1997, showing locations of 2001 study transects N and S. Linear frontage of spawning habitat is shown in yellow.

APPENDIX A

Figure 3 Aerial photograph of Broadkill beach, taken in 1997, showing locations of 2001 study transects N and S. The entire linear frontage of this beach is a continuous band of visually-similar spawning habitat.

APPENDIX A

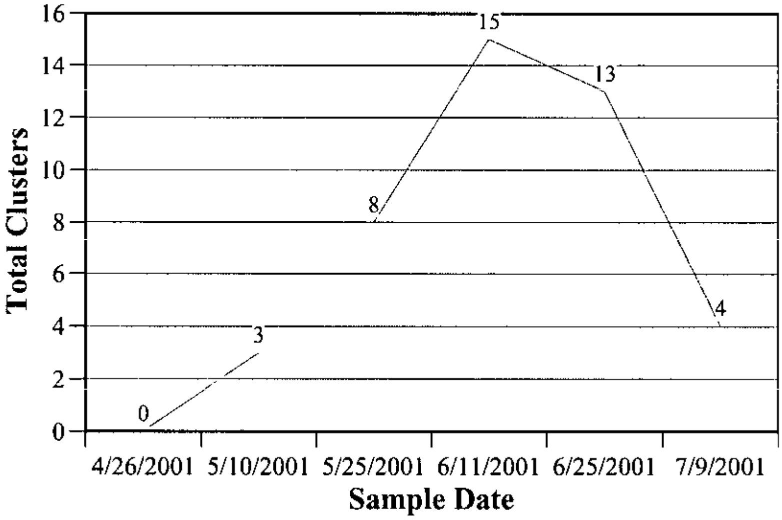


Figure 4 Distribution of the 43 egg clusters collected on Kelly Island and Port Mahon transects over the 2001 sampling period. No clusters were found on Broadkill beach. Values above dates are total clusters collected from all transects on that date

APPENDIX B

Table 1 Kelly Island and Port Mahon transects, ranked by total number of egg clusters found during the 2001 sampling period, with season cluster totals observed on Port Mahon during 2000 and 1999. The 2001 Port Mahon N and S transects are the same locations that were sampled in 2000 and 1999. Transect orientation was vertical in 2001, and horizontal in 2000 and 1999, so totals are not directly comparable. No clusters were found on Broadkill beach. The Kelly Island N total does not include a sample from 25 May, when only the S transect could be sampled, so the actual total would have been slightly higher.

	Total Clusters		
Beach & Transect	**2001**	**2000**	**1999**
Port Mahon, S	21	29	10
Port Mahon, N	11	25	27
Kelly island, N	8	—	—
Kelly island, S	4	—	—
Totals	44	54	37

Table 2 Kelly Island, Port Mahon, and Broadkill beach transects, ranked by total numbers of eggs found on transects in 2001. Values in the Total Eggs column are the sums of egg numbers extracted from all core samples taken in that transect during the season. Values in the 0–5 cm and 5–20 cm columns were obtained by various combinations of direct counts and volumetric extrapolations, so they have been truncated at the thousands level, except for Broadkill beach, where every egg was counted. The Kelly Island N total does not include a sample from 25 May, when only the S transect could be sampled, so the actual total would have been slightly higher.

Beach & Transect	Eggs, 0–5 cm	Eggs; 5–20 cm	Total Eggs	% in 0–5 cm
Port Mahon, S	18,000	250,000	268,000	7%
Port Mahon, N	44,000	189,000	233,000	19%
Kelly Island N	3,000	70,000	73,000	4%
Kelly Island S	1,000	30,000	31,000	3%
Broadkill S	223	102	325	69%
Broadkill N	61	45	106	58%

APPENDIX B

Table 3 Comparison of 2001 Kelly Island, Port Mahon, and Broadkill beach transect egg totals, to transect egg totals observed on Kitts Hummock, Pickering and North Bowers beaches during the same period. Values in the Total Eggs column are the sums of egg numbers extracted from all core samples collected from that transect during the season. Values in the 0–5 cm and 5–20 cm columns were obtained by various combinations of direct counts and volumetric extrapolations, so they have been truncated at the thousands level, except for Broadkill beach, where every egg was counted.

Beach	Eggs, 0–5 cm	Eggs; 5–20 cm	Total Eggs	% in 0–5 cm
Port Mahon	62,000	439,000	501,000	12%
Kitts Hummock	16,000	232,000	248,000	6%
Pickering	23,000	178,000	201,000	11%
Kelly Island	4,000	100,000	104,000	4%
North Bowers	2,000	53,000	55,000	4%
Broadkill S	284	147	431	66%

Table 4 Egg load estimates of Port Mahon, Kelly Island and Broadkill beaches, based on averages of beach N and S transect egg totals observed in 2001 (0–5 cm and 5–20 cm values combined). Spawnable Frontage is the combined length of all sections of spawnable shoreline frontage found on that beach in 2001. Egg Load Estimates were derived by multiplying Eggs /m^2 by Average Transect Length, then using the resulting value to multiply Spawnable Frontage. The Kelly Island N total does not include a sample from 25 May, when only the S transect could be sampled, so the actual egg total would have been slightly higher. The Kelly Island Project egg load estimate was calculated using Kelly Island values, for the shorter length of spawnable frontage within that section of shoreline.

Beach	Ave. Total Eggs per Transect	Eggs per sq. meter	Ave. Transect Length (m)	Spawnable Frontage (m)	Egg Load Estimate
Port Mahon	250,500	3,906,118	12.7	450	22.3×10^9
Kelly Island	52,000	810,851	4.4	901	3.2×10^9
Kelly Island Project	52,000	810,851	4.4	466	0.83×10^9
Broadkill	216	3,368	15.9	4,723	0.25×10^9

APPENDIX B

Table 5 Total numbers of eggs found on Port Mahon transects in 2001 together with numbers found the preceding two seasons (0–5 cm and 5–20 cm values combined). Note that totals listed here for 2000 and 1999 represent only the eggs found, and do not include embryo numbers, as was done in reports for those years. Values have been truncated at the thousands level.

	Total Egg Numbers		
Beach & Transect	**2001**	**2000**	***1999***
Port Mahon, S	268,000	229,000	234,000
Port Mahon, N	233,000	174,000	239,000
Totals	501,000	403,000	473,000

Delaware River Main Channel Deepening Project
Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
se dredged material to create and stablish 60-acre tidal wetland that rovides habitat for native species horseshoe crab, shorebirds, fish, *partina*, waterfowl) and prevents ontinued erosion of Kelly Island ithout significant adverse impacts o contiguous habitats.	Prevent deleterious effects to adjacent shellfish (oyster) populations and habitat.	No significant increase in anaerobic (smothered) conditions of shellfish beds when compared to pre-project conditions in the same locations.	Using sediment profiling camera with plan view attached, develop reference photographs of existing oysters so that reasonable color comparisons can be made in the future. Reference photos of anaerobic sediments will be obtained from existing imagery files. Photos will be taken quarterly during preconstruction and construction and for three years following construction. Transects will be set up between Kelly Island and the nearest oyster areas as well as control transects both north and south of Kelly Island.	1. Validate cause of anaerobic conditions to determine if project related. 2. Investigate restoration technology and methods. 3. Restore oyster habitat.
		No transport of placed sand from project onto nearby oyster beds or leases.	Sediment grab sampling of bay bottom between project and oyster beds (Drum Bed, Silver Bed, and Pleasanton's Rock) once during preconstruction, and quarterly for one year after construction when the need for future sampling will be reevaluated. In addition, grab samples will be taken between the project and the nearest oyster beds after major storms, which is defined as either (1) a tide based storm where post-storm surveys shall be obtained when water levels at Lewes and/or Port Mahon equal or exceed +7.5 ft above MLLW during a storm event, regardless of whether there are erosion impacts detected/observed at the Kelly Island berm; or (2) Observation-based, where post storm surveys shall be obtained if there is apparent scarping or shoreline retreat of the Kelly Island berm, even if tide gage measurements at Lewes and Port Mahon fail to equal or exceed +7.5 ft MLLW. Samples taken after construction will be compared to samples taken prior to project construction. This assumes that the sand from the project will be (Continued on next page)	1. Alternatives will be developed to divert sediment transport away from oyster grounds. 2. Construct diversions. 3. If diversions are not successful, investigate restoration technology and methods. 4. Restore oyster habitat.

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
			distinctly different from the pre-project bay bottom and will therefore be traceable. Within one year before construction, side scan sonar or a similar imaging technology will be used to characterize the bay bottom between Kelly Island and the nearest oyster areas.This will be repeated one year after construction..Transects will be set up between Kelly Island and the nearest oyster areas as well as control transects both north and south of Kelly Island.	
		No significant increase in suspended solids from fine grained material contained by the berm. A significant increase would be more than 25% above the yearly preconstruction mean.	Install a turbidity measuring instrument. Data will be gathered for one year prior to the construction of Kelly Island, during construction, and for three years after construction. In addition quarterly inspections will be done to inspect the berm for breaches.	Repair berm. Restore oyster habitat.
	Silt retained for periods between maintenance of the offshore sand dike and other features.	Shoreline retreat rate of less than 14 ft per year on average over 10-year period after construction. Additionally, equilibration of dike slope in first year should not result in shoreline recession of greater than 30 ft. (WES design criteria).	Annual cross-sectional surveys of offshore dike from landward edge of crest of dike to offshore toe of slope. Annual aerial photographs at 1:2400 scale.	Replenish cross-section of dike with sand if deemed necessary by the Corps and DNREC. Evaluate reasons for accelerated erosion. Mitigate with appropriate volume of sand to restore berm to expected condition.
	Contain silty dredged material.	Sufficient capacity in site to contain 200,000 cubic yards of fine sediments mixed with an additional 500,000 cubic yards of sandy sediments.	Observation of placement operation to be sure that placement of sand over silts reasonably mixes in the site. Water quality standards in the discharge from the site should not exceed those specified prior to dredging. During disposal of dredged material into the wetland restoration area, water quality will be monitored at the discharge pipes with an automatic sampler. Emphasis will be on monitoring total suspended solids.	If water quality standards are not met, dredging operation will be modified to bring discharges within limits by methods such as increasing the ponding period, or decreasing the discharge rate.

Delaware River Main Channel Deepening Project
Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
	Average annual sediment transport rate away from structure should not exceed 35,000 cubic yards.	Annual topographic and bathymetric surveys of offshore sand dike show change in dike volume not exceeding 35,000 cubic yards per year. (Some sediment will move on and offshore but can be accounted for in the volume calculations. Interest here is sand lost from the project to the north or south.)	Annual cross-sectional surveys of offshore dike from landward edge of crest of dike to offshore toe of slope. Annual aerial photographs at 1:2400 scale.	Assess cause and determine appropriate action .
	Created marshes similar to native low marshes on 40 acres (including hummocks).	Similar to adjacent reference marsh located on northern third of Bombay Hook tidal marsh.	1 year after tidal exchange established, survey area to assess natural plant recruitment using random or systematic 1-m plot methods used by the National Wildlife Refuge to be sure desired plants are present.	Assess cause and determine appropriate action.
			3 years after tidal exchange established, within +/- 3% species composition similarity with reference marsh or a desirable species composition as determined by the Corps, DNREC, and Federal Resource Agencies. In the creation of the vegetated low marsh, flexibility will be used when evaluating if the marsh is a success. Although the standard of having the vegetation within +/- 3% of the reference marsh will be used as a guideline, the Corps, DNREC and the Federal resource agencies will determine if the marsh is a "success" after vegetation has become established.	Consider modification of topography, eradication of undesirable species, planting of desired species, modification of water flow characteristics, and protection against geese and other animals eating the plants.
	Establish 50 ft width of beach grass on crest of berm/dike.	75% survival after 1 year from planting.	Field surveys for survival of planted stems yearly for three years.	More plantings of beach grass.

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
	Optimize habitat for use by summer and winter flounder juveniles. Although the objective of maximizing summer and winter flounder habitat will focus on these species, an attempt will be made to create a diverse aquatic community that is similar to that which exists in the adjacent reference tidal marsh waterways.	Establish at least 1000 linear feet of tidal channel at least 0.1 m deep at mean low water (NMFS, 1999) within 1 year after tidal exchange is established. The width of the channel will be determined to maximize tidal exchange without causing erosion to the sides of the channels.	Yearly air photos. Seining in new and reference channels of created marsh and adjacent tidal marsh waterways in late spring one year after tidal flow is established to determine if species are present.	Assess cause and determine appropriate action such as modification of topography and modification of water flow characteristics.
	Maximize habitat for horseshoe crabs.	At mean high water line: 1. Depth of sand is at least 16 inches. 2. Sand has 2 to 6 % moisture at 3.7 in. below the surface. 3. Beach slope is 5 to 9 %. 4. Grain size is between 0.5 and 1.0 mm at 3.7 inches below the surface.	Measure variables as described in Brady and Schrading (1996) every 500 feet along the berm face, biweekly between 1 May and 1 July, for three years after construction. Measure density of horseshoe crabs eggs at same locations following protocol that is being developed by the Atlantic States Marine Fisheries Commission.	1. Adding sand to berm. 2. Grade berm.
	Insignificant horseshoe crab mortality due to design of project. For example, in or around structures, or in the marsh (if they were to migrate over the sand dike).	Less than 10 % of crabs trapped in structures or on landward side of berm.	Yearly visual observation and counts of crabs during spawning season. Comparisons will be made between the project and other natural areas where mortality occurs.	Sand fence at edge of vegetated top of berm.

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
	On beachface, maximize feeding habitat for sanderlings, red knots, turnstones.	Since the main food for these species in Delaware Bay is horseshoe crab eggs, if horseshoe crab habitat is maximized, feeding habitat for these species will be as well.		
	In marsh, maximize habitat on a minimum of 20 acres for migratory shorebirds such as dowitchers, dunlin, semiplamated sandpiper, etc.	Less than 25% vegetative cover (Manomet, 1999) with 75% in a combination of mud flats and shallow water less than 12 cm at mean low water (Harrington, Undated).	Yearly air photos. Observations and counts of species using area during spring and fall migrations (could be incorporated into the aerial census being done by NJ and DE).	Assess cause of failure and determine appropriate action such as modification of topography and modification of water flow characteristics.
	Limit invasion of *Phragmites* Create marshes similar to native low marshes (including hummocks).	Less than 1% populated by *Phragmites* in monotypic stands in the marsh, as well as the berm and back dike.	Yearly air photos. Ground surveys.	Control of *Phragmites* using methods such as spot treatment of herbicides or water level manipulation.

ADULT AND JUVENILE HORSESHOE CRAB DATA

2001

Methods of Adult Horseshoe Crab Spawning Survey

Survey methods in the spring of 2001 for adult spawning horseshoe crabs followed those of instituted by the Delaware National Estuarine Research Reserve. Horseshoe crabs were counted along two transects (South and North) for each Delaware Bay beach. Transects were 50-m in length and followed the "crab-line" or limit of the beach where crabs are most intensely laying. Crabs were counted and identified as to sex 1-m above and below the "crab-line." Logistically, two surveyors worked each transect with one counting males and the other females each using a mechanical count recorders. The timing of each survey commenced at 20-minutes following the evening high tide for the new (22 May) or full moon (5 June).

Results of Adult Horseshoe Crab Spawning Survey

Spawning adult horseshoe crabs were more abundant at the Port Mahon Beach than at Kelly Island. At the peak spawning date, coinciding with the full moon of 5 June, there were roughly twice as many crabs along the Port Mahon beach. The reported count for this transect was initiated about a hour after the optimal start time. Counts along the Kelly Island shoreline were remarkably similar between the north and south transects at 618 and 600, respectively. The shoreline habitat of Kelly Island at the time of spawning was a mix of the higher salt marsh hummock with eroding cuts in between. Spawning crabs occupied positions in any suitable substrate where the females could dig in. Ratios of sexes were always very similar at about 2 to 3 males to each female. The spawning habitat of the Port Mahon beach was much more favorable with a wide swath of uninterrupted sandy beach. The area of the North Transect had many more obstructions in the lower intertidal zone and may account for the lower numbers at that beach. Port Mahon beach was also surveyed on an earlier date of lesser spawning activity that coincided with the new moon of 22 May. Counts from this survey were approximately half those of the full moon survey. At that time, a survey of the Kelly Island shoreline was precluded by severe thunderstorms in the area; Kelly Island is only reachable by boat.

Counts of horseshoe crabs at Kelly Island and Port Mahon during the 2001 spawning survey

		South Transect		**North Transect**	
Beach	**Date**	**Male**	**Female**	**Male**	**Female**
Kelly Island	22 May	Thunderstorm precluded beach survey			
Port Mahon		431	154	115	50
Kelly Island	5 June	400	200	399	219
Port Mahon		989	403	487*	161*

* Counts reported are from a second pass of the beach; on the initial pass, the mechanical counter for males malfunctioned. The count for females on the initial pass was 281.

Juvenile Horseshoe Crab Survey

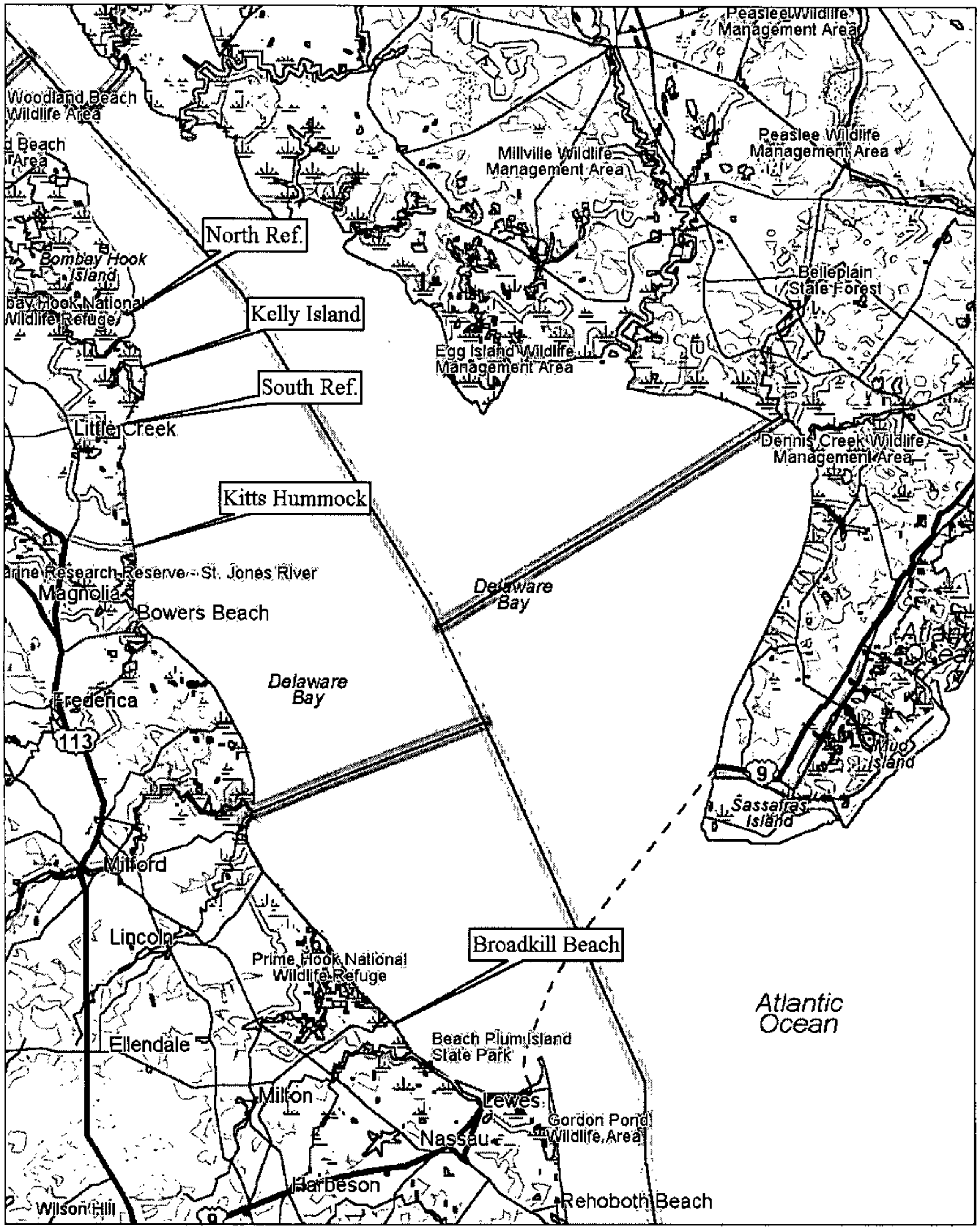
A juvenile horseshoe crab survey was conducted along Delaware Bay shoreline during September 2001. The survey was designed to characterize juvenile crab use of subtidal habitats adjacent to known spawning beaches. Beaches surveyed included Kelly Island, Kitts Hummock, Broadkill, and in addition adjacent reference areas located 0.5-miles north and south of Kelly Island. The south reference beach was near the Port Mahon spawning beach. Two transects were surveyed at each beach. Each transect constituted replicate tows (8 total) of a biological dredge at distances from the mean high tide line of 50, 100, 200, and 300-ft. The dredge was towed for a distance of 30-ft as measured by an incremental tag line. The biological dredge was constructed with a rectangular framed mouth of 10 x 18-in fitted with ¼-in mesh nylon bag. In operation, the heavy flat bar of the frame scraped along the bottom and dislodged epibenthic fauna into the collection bag. Following a tow, bottom material collected by the dredge was washed, sieved, and sorted; all juvenile horseshoe crabs were counted and measured for carapace width.

Results of Juvenile Horseshoe Crab Survey

Juvenile horseshoe crabs were collected at only one of the five beaches surveyed. A total of 11 crabs were collected at the south reference area approximately 0.5-miles downbay from Kelly Island. This area is also immediately downbay of the Port Mahon spawning beach. Crabs were collected in low numbers in each tow. The highest number was 3 from the second replicate tow at the 100-ft distance. Crabs were only collected at distances of 100 to 300-ft from the mean high water mark. Sizes of juvenile crabs measured as carapace width ranged from 6 to 14-mm.

Summary of juvenile horseshoe crab survey of Delaware Bay Beaches conducted during September, 2001

Beach	Transect	50-ft	100-ft	200-ft	300-ft	Total
Kelly Island	1	0/0	0/0	0/0	0/0	0
	2	0/0	0/0	0/0	0/0	0
Reference North	3	0/0	0/0	0/0	0/0	0
	4	0/0	0/0	0/0	0/0	0
Reference South	5	0/0	**0/1**	**1/0**	**2/0**	**4**
	6	0/0	**0/3**	**0/2**	**2/0**	**7**
Kitts Hummock	7	0/0	0/0	0/0	0/0	0
	8	0/0	0/0	0/0	0/0	0
Broadkill Beach	9	0/0	0/0	0/0	0/0	0
	10	0/0	0/0	0/0	0/0	0



3-D TopoQuads Copyright © 1999 DeLorme Yarmouth, ME 04096

1 mi Scale: 1 : 325,000 Detail: 8-3 Datum: WGS84

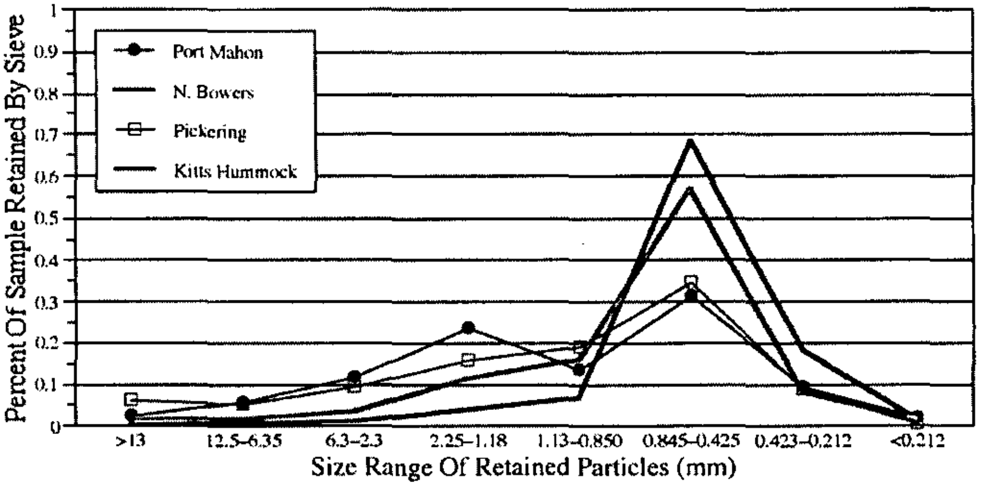
HORSESHOE CRAB SPAWNING BEACH DATA

Sediment Samples Taken In 2000

There were two samples each from Port Mahon and North Bowers, and three samples each from Pickering and Kitts Hummock. Samples were collected in June and August, 2000. Each sample consisted of five 5.7 cm (2.25") diameter by 20 cm (8") deep cores of sediment randomly collected along a 75' transect, parallel with the waterline and located at approximately the middle of the intertidal span. Total weights of dried sediment samples ranged from 2.700 kg to 3.960 kg (average = 3.461 kg, n = 10).

Sieve Size	Cumulative Percent Of Sediment Retained On Sieve				Approx. Particle Size (mm)
	Kitts	Pickering	Port Mahon	Bowers	
1/2"	1.5%	5.9%	2.5%	0.4%	>13
1/4"	3.2%	11.1%	8.3%	0.8%	12.5–6.35
#8	6.5%	20.4%	20.1%	2.0%	6.3–2.3
#16	17.8%	36.4%	43.7%	6.0%	2.25–1.18
#20	33.7%	55.5%	57.4%	12.5%	1.13–0.850
#40	90.6%	90.1%	88.8%	80.8%	0.845–0.425
#70	98.4%	99.2%	98.0%	98.7%	0.423–0.212
Pan	100.0%	100.0%	100.0%	100.0%	<0.212

On each beach, the largest percentage of sediment was retained on the #40 sieve. All beaches were similar in the amount of sediment that passed through the #40 sieve. All beaches except North Bowers had appreciable amounts of larger sediment particles. On Bowers, only 6.0% of all sediment was too coarse to pass through the #16 sieve, while other beaches had from 17.8%–43.7% of all sediment too coarse to pass the #16 sieve. As the chart below shows, most of the sediment on Bowers is in the 1.13 mm – 0.212 mm size range. The question is: How important is coarse sediment in Delaware Bay beaches to *Limulus* spawning?



Comparison Of Mahon, North Bowers, Pickering and Kitts Hummock Sediment Size Distributions At Mid Beach, 2000

Aggregate Size Distribution Summary: Percentage of sample retained on each sieve.

Kitts Hummock, 24 Aug '00

Sieve Size	Wrack Line	Mid Intertidal	Low Intertidal	Approx. Particle Size (mm)
1/2"	0.4%	1.5%	4.3%	>13
1/4"	0.6%	1.7%	2.6%	12.5–6.35
#8	1.4%	3.3%	5.2%	6.3–2.3
#16	4.8%	11.3%	13.3%	2.25–1.18
#20	12.0%	15.9%	21.7%	1.13–0.850
#40	71.6%	56.9%	43.3%	0.845–0.425
#70	7.4%	7.8%	7.5%	0.423–0.212
Pan	1.8%	1.6%	2.0%	<0.212
Totals	100.0%	100.0%	100.0%	

Port Mahon, 13 June '00

Sieve Size	Mid Intertidal	Approx. Particle Size (mm)
1/2"	2.5%	>13
1/4"	5.8%	12.5–6.35
#8	11.8%	6.3–2.3
#16	23.7%	2.25–1.18
#20	13.7%	1.13–0.850
#40	31.3%	0.845–0.425
#70	9.2%	0.423–0.212
Pan	2.0%	<0.212
Total	100.0%	

Pickering, 22 Aug '00

Sieve Size	Wrack Line	Mid Intertidal	Low Intertidal	Approx. Particle Size (mm)
1/2"	0.4%	5.9%	7.6%	>13
1/4"	0.6%	5.2%	3.8%	12.5–6.35
#8	1.4%	9.3%	6.7%	6.3–2.3
#16	7.1%	16.0%	14.0%	2.25–1.18
#20	15.5%	19.0%	17.4%	1.13–0.850
#40	62.8%	34.6%	42.1%	0.845–0.425
#70	11.4%	9.1%	7.5%	0.423–0.212
Pan	0.7%	0.8%	0.9%	<0.212
Totals	100.0%	100.0%	100.0%	

N. Bowers. 14 June '00

Sieve Size	Mid Intertidal	Approx. Particle Size (mm)
1/2"	0.4%	>13
1/4"	0.4%	12.5–6.35
#8	1.2%	6.3–2.3
#16	4.0%	2.25–1.18
#20	6.5%	1.13–0.850
#40	68.3%	0.845–0.425
#70	17.9%	0.423–0.212
Pan	1.3%	<0.212
Total	100.0%	

Sieve And Mesh Sizes

Sieve Size	Mesh Size, inches	Mesh Size, metric	Notes	Approx. Particle Size (mm)
1/2"	0.5"	13 mm		>13
1/4"	0.25"	6.3 mm		12.5–6.35
#8	0.0937"	2.36 mm	Tyler equivalent 8 mesh	6.3–2.3
#16	0.0469"	1.18 mm	Tyler equivalent 14 mesh	2.25–1.18
#20	0.0331"	0.850 mm	Tyler equivalent 20 mesh	1.13–0.850
#40	0.0165"	0.425 mm	Tyler equivalent 35 mesh	0.845–0.425
#70	0.0083"	0.212 mm	Tyler equivalent 65 mesh	0.423–0.212
Pan	---	---		<0.212

Richard G. Weber & Susan E. Love, 15 January 2002

The following information is extracted from my report to DNREC about the 2001 sampling season.

North Bowers cluster totals also varied considerably over the 2000–1998 period (**Table 1**) but that variability seems related to the beach replenishment done in spring of 1998. Replenishment work was stopped in mid-April, to accommodate *Limulus* spawning for the summer. The 1998 the North Bowers cluster total was the lowest of any beach sampled. However, in 1999, the cluster total was 3.8 times that observed in 1998. In 2000, the total clusters dropped to approximately half the 1999 value. The replenishment effort covered the beach with somewhat finer sand than had been present in 1997, and also made the slope less steep. One, or both of these factors may have adversely affected *Limulus* spawning on North Bowers. It will require additional study to determine how these factors affect *Limulus* spawning.

Table 1 Study beaches, ranked by total number of egg clusters found during the 2001 sampling period, with selected data from previous years. Cluster totals for Port Mahon and North Bowers from earlier years were collected from the same locations that were sampled in 2001. Transect orientation was vertical in 2001, and horizontal in all preceding years, so totals are not directly comparable. No clusters were found on Broadkill beach. The Kelly Island total does not include a sample from the N transect on 25 May, when only the S transect could be sampled, so the actual season total might have been slightly higher.

	Total Clusters			
Beach	**2001**	**2000**	**1999**	**1998**
Port Mahon	32	54	37	46
Re-Pickering	24	---	---	---
Kitts Hummock	16	---	---	---
Old Pickering	15	---	---	---
Kelly island	12	---	---	---
North Bowers	6	14	27	7
Broadkill	0	---	---	---
Total	105			

Further information can be gained about yearly variation in *Limulus* spawning patterns on individual beaches by comparing numbers of clusters found on individual transects over several years. **Table 2** shows yearly transect egg cluster totals for Port Mahon and North Bowers beaches. On Port Mahon, both the N and S transects had approximately equal total cluster counts in 2000. However, in the other years, the two transects differed widely in total clusters, and the same transect did not always have the highest total. It is tempting to attribute these yearly changes in egg cluster numbers to qualitative changes in the beach associated with storm erosion. However, that is not possible, in part because correlated sand depth and beach sediment studies have not been done on this beach.

Table 2 Port Mahon and North Bowers transects, ranked by total number of egg clusters found during the 2001 sampling period, with cluster totals observed in 2000, 1999, and 1998. The N and S transects on both beaches are the same locations that were sampled in all years. Transect orientation was vertical in 2001, and horizontal in previous years, so totals are not directly comparable.

	Total Clusters			
Beach & Transect	**2001**	**2000**	**1999**	**1998**
Port Mahon, S	21	29	10	30
Port Mahon, N	11	25	27	16
North Bowers, S	5	7	10	3
North Bowers, N	1	7	17	4

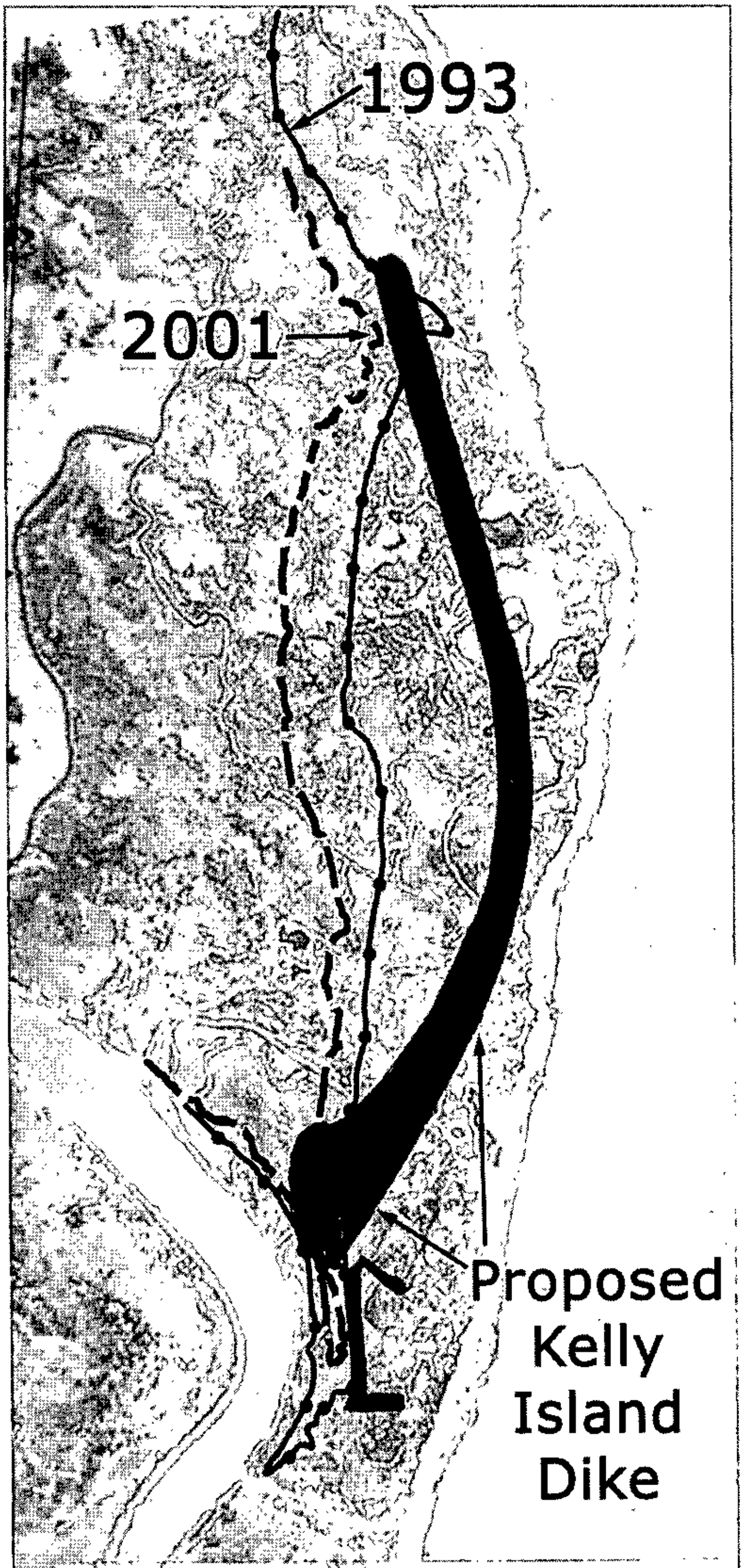
In 1999, cluster totals for both North Bowers transects increased from 1998 totals, with the N transect being somewhat more productive (**Table 2**). Numbers decreased in 2000, although totals were still approximately twice those observed in 1998. The 2001 totals are not directly comparable to totals from previous years because they were obtained from vertical transects, while horizontal transects were used in previous years. However, they do indicate that North Bowers S received considerably more spawning than the N transect in 2001.

Pickering Beach Data The replenishment begun on Pickering beach this spring could not be completed by the end of April, when work was stopped to allow *Limulus* to use the beach. This provided an unusual opportunity to compare spawning use of freshly treated and "old", untreated beach frontage. Both the original beach surface sampled last year ("Old Pickering") and the surface replenished in April of 2001 ("Re-Pickering") were used by spawning *Limulus*. This contrasts with North Bowers, where *Limulus* spawning decreased following the spring 1998 replenishment, rose somewhat in 1999, then declined.

Table 4 compares cluster and total egg data for the 4 transects sampled on Pickering beach. The Re-Pickering area had a total of 24 clusters, and 193,000 total eggs. The Old Pickering section had only 15 clusters, but had 201,000 total eggs. Thus, Re-Pickering had 1.6 times more clusters than Old Pickering, but a slightly lower total number of eggs. Most transects had essentially the same percentage of eggs in the 0–5 cm core fraction (7%—8%), but the percentage on Old Pickering S was almost twice that found on any other Pickering transect (14%). Viewed as old beach surface and replenished beach surface, these data suggest that the 2001 replenishment did not have any great effect on spawning along the two sections examined during this study.

Table 4 Comparison of total egg clusters and total eggs found on the 4 Pickering beach transects during the 2001 study, ranked by number of clusters. This table does not include data from April 26, when only the Old Pickering transects could be sampled. Values in the 0–5 cm and 5–20 cm columns were obtained by various combinations of direct counts and volumetric extrapolations, so they have been truncated at the thousands level.

Transect	Clusters	Eggs; 1-5 cm	Eggs; 5–20 cm	Total Eggs	% in 0–5 cm
Re-Pickering, N	14	7,000	95,000	102,000	7%
Re-Pickering, S	10	6,000	85,000	91,000	7%
Old Pickering, N	8	7,000	83,000	90,000	8%
Old Pickering, S	7	16,000	95,000	111,000	14%



Kelly Island Shorelines
1926 Aerial Photo

MONITORING

MONITORING

NUMBER OF EXHIBIT: 73, 84, 107

BACKGROUND

In the 1997 EIS **(EXHIBIT 4)**, the Corps has agreed to monitor many resources:

Section 9.3.1.3 of the Corps'1997 SEIS states that "*In light of the sensitivity of the oyster resources of the Kelly Island area certain contingency measures will be planned in the extremely unlikely event a breach occurs. These seed beds, existing under inherently low food supplies, do not have the reserves required to easily withstand increased turbidity levels that may result. Before the construction of the Kelly Island wetland restoration site, oyster populations will be measured to determine the status quo so that a comparison can be made in the unlikely event of a breach. Parameters to be measured include abundance, size (biomass) frequency, disease infection intensity, reproductive state, and recent mortality. If a breach occurs, the same parameters would be measured to determine the extent of impacts. If the impacts were significant, restoration of the bottom that was damaged by the release of silt would be done.*"

Specifically, Section 9.3.1.2 of the Corps' 1997 SEIS states that: "*The sand and geotextile tube dredged material containment facility at Kelly Island has been analyzed and designed to prevent the discharge of fine grained material into Delaware Bay. The design minimizes the risk to oyster resources due to catastrophic failure of the structure. Worst case scenarios have been utilized to model foundation and geotextile tube stability, settlement and bearing capacity, and erosional failure. Protection against scour is being provided by protective blankets. In addition, several other geotextile tube projects are being monitored to gain additional knowledge that will insure that this project will succeed. An operation and maintenance manual will be developed for this site, which will include a monitoring plan providing for periodic observation of the Kelly Island structure, especially during the critical late summer period.*"

Specifically, Section 3.3.4.1 of the Corps' 1997 SEIS states that: "*Both environmental and engineering monitoring at Kelly Island and Egg Island Point are important. Monitoring gives a physical and biological baseline from which to plan and design the projects. It provides documentation of events and project results, provides lessons learned to extrapolate to future similar projects, provides a success/failure track record, and gives needed information to determine if additional work or mid-course construction corrections are necessary (Landin 1992).*

During project construction, there is a need to closely monitor construction techniques, and to allow for field flexibility should the contractor encounter difficulties with tubes, discharge channels and weirs, sand berms, and temporary dikes. It is important to monitor effluent run-off from the Kelly Island CDF in order to meet Delaware state water quality standards. It may also be necessary to make during-construction corrections to *outfalls and filling rates, should any field problems be encountered. In addition, water quality will be monitored during construction and for 3-5 years following construction.*

Post-construction monitoring is the most detailed and involves a number of requirements:

a. Surveys of as-built elevations to be sure that +5 feet MLW is achieved after consolidation and settling of dredged material at Kelly Island and southeast Egg Island Point.

b. Geotextile tube observations to maintain their integrity and profile, with mid-course corrections such as patches of rips, re-tying of ports, and other maintenance built into the process at all three locations (especially critical at Kelly Island and southeast Egg Island Point).

c. Physical and engineering evaluation of structures, marsh and berm soils, weirs, CDF entrances and tidal exchange at Kelly Island, and breakwater tidal exchange at Egg Island Point at southeast and northwest locations.

d. Biological evaluation of marsh vegetation, marsh soils, fish and wildlife colonization, survival and reproduction of any planted areas, and general ecological health of the two sites.

e. Comparison of the new marsh sites to nearby marshes (e.g. Kelly Island could be compared to a healthy marsh in the Mahon River and an eroding marsh on either side of the project; and Egg Island Point could be compared to a healthy marsh near Maurice River and an eroding marsh northeast or southwest of the Egg Island Point site).

Subsequently, the Corps in coordination with DNREC and others has implemented studies to monitor a number of other significant resources including horseshoe crabs, shore birds, *Sabellaria,* wintering blue crabs, and a number of resources in relationship to the restoration of Kelly Island **(see "c" below).**

THE FOLLOWING CONCERNS HAVE BEEN RAISED:

Comment.

- **a.** Areas of concern need to be monitored before, during and after construction for six additional years. Environmental damage can take years to be evident. Current monitoring plans will not alert us to long-term, low-level damage.

Response.

Most of the resources that will be monitored will have at least 2 years of pre-construction monitoring before the project begins. Our current plan is to monitor during construction (where appropriate) and after construction for 3 years.

Comment.

- **b.** DNREC and the environmental community need to be involved in all aspects of monitoring (i.e. protocol, monitoring, and reporting process). Annual reports should be submitted to the Governor.

Response.

Monitoring plans in Delaware have been developed in coordination with DNREC and Federal resource agencies as well as species experts, where appropriate. DNREC has participated in oyster monitoring near Kelly Island. Many of the monitoring studies are being done by experts recommended by DNREC such as Dr. Richard Weber for spawning horseshoe crabs and Dr. Brian Harrington for shorebirds. Dr. Douglas Miller from the University of Delaware is an acknowledged expert on *Sabellaria*. Dr. Eric Powell of the Haskins Shellfish Research Laboratory is participating in bay wide oyster monitoring studies. Many of the studies are being done by Versar, Inc., a nationally known environmental consulting firm who have a history of working in the Delaware Bay. It seems prudent for scientists and agency experts to design and execute complicated monitoring studies; however, all of our studies are made available to the public.

Comment.

- **c.** What are the Corps' responsibilities regarding environmental monitoring of beach disposal sites?

Response.

A monitoring/management plan (See attached Kelly Island –Wetland Restoration Protection Goals Table) was developed for the Kelly Island wetland restoration project and has been closely coordinated with DNREC and Federal resource agencies, including personnel from the Bombay Hook National Wildlife Refuge. This plan calls for monitoring the following parameters:

Shellfish

Anaerobic Conditions (Sediment Profiling Camera)
Transport of Placed Sand (Grab Samples) Hydro Acoustic Survey
Suspended Solids (Turbidity Measuring Instrument)

Retain Silt in Offshore Dike

Shoreline Retreat (Annual Cross-Sectional Surveys)
Sufficient Capacity To Contain Material (Observation of Placement/Measure Discharge Water Quality)

Retain Sand in Offshore Dike

Determine Loss Of Sand (Topographic and Bathymetric Surveys; Cross-Sectional Surveys)

Create Low Marsh

Compare to Reference Marsh in Bombay Hook (Plant Surveys)

Establish Beach Grass on Crest of Dike

Measure Plant Survival (Field Surveys)

Habitat for Winter and Summer Flounder

Establish Tidal Channels (Air Photos and Fish Collections)

Habitat for Horseshoe Crabs

Measure Beach Variables and Crab Egg Densities, as well as Juveniles and Spawning Adults (Field Surveys)

Minimize Mortality for Spawning Horseshoe Crabs

Measure Mortality and Compare to "Natural" Areas (Field Surveys)

Maximize Feeding Habitat for Shorebirds on Beachface

Dependent on Horseshoe Crab Spawning Success (See above for Horseshoe Crabs)

Maximize Feeding Habitat for Shorebirds in Marsh

Dependent on Ratio of Cover Types (Air Photos and Counts of Target Species)

Limit Invasion of *Phragmites*

Less than 1% in Monotypic Stands (Air Photos and Ground Surveys)

The Corps of Engineers also plans to monitor horseshoe crabs (spawning, juveniles, and adults) and migratory shorebirds at Port Mahon, Broadkill Beach as well as a control beach recommended by DNREC. *Sabellaria* restored habitat will be monitored at Broadkill Beach and Port Mahon, if necessary.

Comment.

- **d.** What are the Corps commitments to monitor environmental effects in sensitive areas during and after construction, including oyster beds and Kelly Island?

Response.

Please see response for Kelly Island and other beaches in response to "c" above. A comprehensive plan to monitor oyster resources in Delaware Bay has begun. Pre-construction data was collected in 2000-2001 and will continue in 2002. Please refer to the general answer to comments on "oyster impacts" for more detailed information. A final report for oyster monitoring in 2000-2001 has been completed and submitted to DNREC and is available on our web site at: http://www.nap.usace.army.mil/cenap-pl/deldocs.htm#oysters.

Comment.

- e. How expensive will the monitoring be?

Response.

Pre-construction monitoring of biological resources is estimated to cost about $800,000 per year.

Delaware River Main Channel Deepening Project
Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
Use dredged material to create and establish 60-acre tidal wetland that provides habitat for native species (horseshoe crab, shorebirds, fish, *Spartina*, waterfowl) and prevents continued erosion of Kelly Island without significant adverse impacts to contiguous habitats.	Prevent deleterious effects to adjacent shellfish (oyster) populations and habitat.	No significant increase in anaerobic (smothered) conditions of shellfish beds when compared to pre-project conditions in the same locations.	Using sediment profiling camera with plan view attached, develop reference photographs of existing oysters so that reasonable color comparisons can be made in the future. Reference photos of anaerobic sediments will be obtained from existing imagery files. Photos will be taken quarterly during preconstruction and construction and for three years following construction. Transects will be set up between Kelly Island and the nearest oyster areas as well as control transects both north and south of Kelly Island.	1. Validate cause of anaerobic conditions to determine if project related. 2. Investigate restoration technology and methods. 3. Restore oyster habitat.
		No transport of placed sand from project onto nearby oyster beds or leases.	Sediment grab sampling of bay bottom between project and oyster beds (Drum Bed, Silver Bed, and Pleasanton's Rock) once during preconstruction, and quarterly for one year after construction when the need for future sampling will be reevaluated. In addition, grab samples will be taken between the project and the nearest oyster beds after major storms, which is defined as either (1) a tide based storm where post-storm surveys shall be obtained when water levels at Lewes and/or Port Mahon equal or exceed +7.5 ft above MLLW during a storm event, regardless of whether there are erosion impacts detected/observed at the Kelly Island berm; or (2) Observation-based, where post storm surveys shall be obtained if there is apparent scarping or shoreline retreat of the Kelly Island berm, even if tide gage measurements at Lewes and Port Mahon fail to equal or exceed +7.5 ft MLLW. Samples taken after construction will be compared to samples taken prior to project construction. This assumes that the sand from the project will be (Continued on next page)	1. Alternatives will be developed to divert sediment transport away from oyster grounds. 2. Construct diversions. 3. If diversions are not successful, investigate restoration technology and methods. 4. Restore oyster habitat.

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
			distinctly different from the pre-project bay bottom and will therefore be traceable. Within one year before construction, side scan sonar or a similar imaging technology will be used to characterize the bay bottom between Kelly Island and the nearest oyster areas.This will be repeated one year after construction..Transects will be set up between Kelly Island and the nearest oyster areas as well as control transects both north and south of Kelly Island.	
		No significant increase in suspended solids from fine grained material contained by the berm. A significant increase would be more than 25% above the yearly preconstruction mean.	Install a turbidity measuring instrument. Data will be gathered for one year prior to the construction of Kelly Island, during construction, and for three years after construction. In addition quarterly inspections will be done to inspect the berm for breaches.	Repair berm. Restore oyster habitat.
	Silt retained for periods between maintenance of the offshore sand dike and other features.	Shoreline retreat rate of less than 14 ft per year on average over 10-year period after construction. Additionally, equilibration of dike slope in first year should not result in shoreline recession of greater than 30 ft. (WES design criteria).	Annual cross-sectional surveys of offshore dike from landward edge of crest of dike to offshore toe of slope. Annual aerial photographs at 1:2400 scale.	Replenish cross-section of dike with sand if deemed necessary by the Corps and DNREC. Evaluate reasons for accelerated erosion. Mitigate with appropriate volume of sand to restore berm to expected condition.
	Contain silty dredged material.	Sufficient capacity in site to contain 200,000 cubic yards of fine sediments mixed with an additional 500,000 cubic yards of sandy sediments.	Observation of placement operation to be sure that placement of sand over silts reasonably mixes in the site. Water quality standards in the discharge from the site should not exceed those specified prior to dredging. During disposal of dredged material into the wetland restoration area, water quality will be monitored at the discharge pipes with an automatic sampler. Emphasis will be on monitoring total suspended solids.	If water quality standards are not met, dredging operation will be modified to bring discharges within limits by methods such as increasing the ponding period, or decreasing the discharge rate.

Delaware River Main Channel Deepening Project
Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
	Average annual sediment transport rate away from structure should not exceed 35,000 cubic yards.	Annual topographic and bathymetric surveys of offshore sand dike show change in dike volume not exceeding 35,000 cubic yards per year. (Some sediment will move on and offshore but can be accounted for in the volume calculations. Interest here is sand lost from the project to the north or south.)	Annual cross-sectional surveys of offshore dike from landward edge of crest of dike to offshore toe of slope. Annual aerial photographs at 1:2400 scale.	Assess cause and determine appropriate action .
	Created marshes similar to native low marshes on 40 acres (including hummocks).	Similar to adjacent reference marsh located on northern third of Bombay Hook tidal marsh.	1 year after tidal exchange established, survey area to assess natural plant recruitment using random or systematic 1-m plot methods used by the National Wildlife Refuge to be sure desired plants are present.	Assess cause and determine appropriate action.
			3 years after tidal exchange established, within +/- 3% species composition similarity with reference marsh or a desirable species composition as determined by the Corps, DNREC, and Federal Resource Agencies. In the creation of the vegetated low marsh, flexibility will be used when evaluating if the marsh is a success. Although the standard of having the vegetation within +/- 3% of the reference marsh will be used as a guideline, the Corps, DNREC and the Federal resource agencies will determine if the marsh is a "success" after vegetation has become established.	Consider modification of topography, eradication of undesirable species, planting of desired species, modification of water flow characteristics, and protection against geese and other animals eating the plants.
	Establish 50 ft width of beach grass on crest of berm/dike.	75% survival after 1 year from planting.	Field surveys for survival of planted stems yearly for three years.	More plantings of beach grass.

Delaware River Main Channel Deepening Project
Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
	Optimize habitat for use by summer and winter flounder juveniles. Although the objective of maximizing summer and winter flounder habitat will focus on these species, an attempt will be made to create a diverse aquatic community that is similar to that which exists in the adjacent reference tidal marsh waterways.	Establish at least 1000 linear feet of tidal channel at least 0.1 m deep at mean low water (NMFS, 1999) within 1 year after tidal exchange is established. The width of the channel will be determined to maximize tidal exchange without causing erosion to the sides of the channels.	Yearly air photos. Seining in new and reference channels of created marsh and adjacent tidal marsh waterways in late spring one year after tidal flow is established to determine if species are present.	Assess cause and determine appropriate action such as modification of topography and modification of water flow characteristics.
	Maximize habitat for horseshoe crabs.	At mean high water line: 1. Depth of sand is at least 16 inches. 2. Sand has 2 to 6 % moisture at 3.7 in. below the surface. 3. Beach slope is 5 to 9 %. 4. Grain size is between 0.5 and 1.0 mm at 3.7 inches below the surface.	Measure variables as described in Brady and Schrading (1996) every 500 feet along the berm face, biweekly between 1 May and 1 July, for three years after construction. Measure density of horseshoe crabs eggs at same locations following protocol that is being developed by the Atlantic States Marine Fisheries Commission.	1. Adding sand to berm. 2. Grade berm.
	Insignificant horseshoe crab mortality due to design of project. For example, in or around structures, or in the marsh (if they were to migrate over the sand dike).	Less than 10 % of crabs trapped in structures or on landward side of berm.	Yearly visual observation and counts of crabs during spawning season. Comparisons will be made between the project and other natural areas where mortality occurs.	Sand fence at edge of vegetated top of berm.

Delaware River Main Channel Deepening Project
Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
	On beachface, maximize feeding habitat for sanderlings, red knots, turnstones.	Since the main food for these species in Delaware Bay is horseshoe crab eggs, if horseshoe crab habitat is maximized, feeding habitat for these species will be as well.		
	In marsh, maximize habitat on a minimum of 20 acres for migratory shorebirds such as dowitchers, dunlin, semiplamated sandpiper, etc.	Less than 25% vegetative cover (Manomet, 1999) with 75% in a combination of mud flats and shallow water less than 12 cm at mean low water (Harrington, Undated).	Yearly air photos. Observations and counts of species using area during spring and fall migrations (could be incorporated into the aerial census being done by NJ and DE).	Assess cause of failure and determine appropriate action such as modification of topography and modification of water flow characteristics.
	Limit invasion of *Phragmites* Create marshes similar to native low marshes (including hummocks).	Less than 1% populated by *Phragmites* in monotypic stands in the marsh, as well as the berm and back dike.	Yearly air photos. Ground surveys.	Control of *Phragmites* using methods such as spot treatment of herbicides or water level manipulation.

OYSTERS

OYSTER IMPACTS

NUMBER OF EXHIBIT: 70, 80, 84,104,108,111

BACKGROUND

The Corps' July 1997 Supplemental Environmental Impact Statement (SEIS) **(EXHIBIT 4),** concludes that the deepening project is not expected to adversely impact oyster resources in Delaware Bay.

Section 9.3.1.3 of the Corps'1997 SEIS states that "*In light of the sensitivity of the oyster resources of the Kelly Island area certain contingency measures will be planned in the extremely unlikely event a breach occurs. These seed beds, existing under inherently low food supplies, do not have the reserves required to easily withstand increased turbidity levels that may result. Before the construction of the Kelly Island wetland restoration site, oyster populations will be measured to determine the status quo so that a comparison can be made in the unlikely event of a breach. Parameters to be measured include abundance, size (biomass) frequency, disease infection intensity, reproductive state, and recent mortality. If a breach occurs, the same parameters would be measured to determine the extent of impacts. If the impacts were significant, restoration of the bottom that was damaged by the release of silt would be done.*"

Although no significant impacts are anticipated, the Corps at the request of Federal and State resource agencies agreed to perform a monitoring study of the oyster populations in Delaware Bay. This effort, which calls for data collection over a period of one-year prior to construction, was initiated in April 2000 and completed in March 2001. Additional monitoring will be done in 2002 (pre-construction), during and after construction.

The results, from the first year of the data collection completed in March 2001, were documented in a report titled, *Oyster and Water Quality Monitoring Study for the Main Channel Deepening Project, Delaware Bay, New Jersey and Delaware (December 2001)* and has been submitted to DNREC. A table of contents and introduction is attached and the entire report is being submitted on CD ROM.

This study gathered pre-construction, base line data on the oyster populations and water quality parameters that would be compared to data to be collected during and after construction of the project. Pre-construction monitoring will continue until construction begins and subsequent reports will be provided to DNREC.

THE FOLLOWING CONCERNS HAVE BEEN RAISED:

Comment.

- **a. Concern for oyster beds near Kelly Island Wetland Restoration:**
    1. How will oysters be monitored?

Response.

A monitoring/management plan was developed for the Kelly Island wetland restoration project and has been closely coordinated with DNREC and Federal resource agencies. The "Kelly Island Wetland Restoration/Protection: Goals Table" was submitted as an attachment to the Corps permit application and is attached. One of the goals was to prevent deleterious effects to adjacent shellfish (oyster) populations and habitat.

To achieve this goal the following various parameters will be monitored. Using a sediment profiling camera, develop reference photographs of existing oysters so that reasonable color comparisons can be made in the future. Reference photos of anaerobic sediments will be obtained from existing imagery files. Photos will be taken quarterly during pre-construction and construction and for three years following construction. Transects will be set up between Kelly Island and the nearest oyster areas as well as control transects both north and south of Kelly Island. In addition, sediment grab sampling of bay bottom between project and oyster beds (Drum Bed, Silver Bed, and Pleasanton's Rock) will be done once during pre-construction, and quarterly for one year after construction, when the need for future sampling will be reevaluated. In addition, grab samples will be taken between the project and the nearest oyster beds after major storms, which is defined as either (1) a tide based storm where post-storm surveys shall be obtained when water levels at Lewes and/or Port Mahon equal or exceed +7.5 ft above MLLW during a storm event, regardless of whether there are erosion impacts detected/observed at the Kelly Island berm; or (2) observation-based, where post storm surveys shall be obtained if there is apparent scarping or shoreline retreat of the Kelly Island berm, even if tide gage measurements at Lewes and Port Mahon fail to equal or exceed +7.5 ft MLLW. Samples taken after construction will be compared to samples taken prior to project construction. This assumes that the sand from the project will be distinctly different from the pre-project bay bottom and will therefore be traceable. Within one year before construction, side scan sonar or a similar imaging technology will be used to characterize the bay bottom between Kelly Island and the nearest oyster areas. This will be repeated one year after construction. Transects will be set up between Kelly Island and the nearest oyster areas as well as control transects both north and south of Kelly Island. Pre-construction data was gathered in 2001 and will continue in 2002.

Comment.

2. What baseline will be used to see if beds are harmed?

Response

Please refer to previous response.

Comment.

3. What actions will be taken if harm is observed?

Response.

The goals and objectives table referred to in comment a-1, above lists the following actions that would be taken if the impact was a result of an increase in anaerobic (smothered) conditions of shellfish beds when compared to pre-project conditions in the same locations: (1) Validate cause of anaerobic conditions to determine if project related. (2) Investigate restoration technology and methods. (3) Restore oyster habitat.

If the impact is a result of transport of placed sand from the project onto nearby oyster beds or leased areas: (1) Alternatives will be developed to divert sediment transport away from oyster grounds. (2) Construct diversions. (3) If diversions are not successful, investigate restoration technology and methods. (4) Restore oyster habitat.

Comment.

4. Who will monitor the monitors?

Response.

All studies will be coordinated with State and Federal resource agencies.

Comment.

- **b.** Have there been past oyster studies to determine impacts of maintenance dredging?

Response.

Turbidity has been monitored during maintenance dredging near oyster beds only for an overflow trail of a hopper dredge. We don't operate past overflow during maintenance dredging.

Comment.

- **c.** Would like to have copies of ongoing studies.

Response.

Studies are available on the Philadelphia District Web Page:
http://www.nap.usace.army.mil/cenap-pl/deldocs.htm

PRE-CONSTRUCTION OYSTER, WATER QUALITY, AND SEDIMENT MONITORING STUDY FOR THE DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT

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Contract No. DCAW61-95-D-0011
Task Order No. 0086

Prepared Under the Supervision of

William H. Burton
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December 2001

FOREWORD

This report entitled *Pre-Construction Oyster and Water Quality Monitoring Study for the Main Channel Deepening Project, Delaware Bay, New Jersey and Delaware* was prepared by Versar, Inc., for Mr. John Brady, Environmental Resources Branch, U.S. Army Corps of Engineers, Philadelphia District, under Contract No. DACW61-95-D-0011, Delivery Order No. 0030. Dr. Eric Powel from Rutgers University's Haskin Shellfish Laboratory conducted the adult oyster monitoring for the project with the assistance of Meagan Cummings.

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APPENDICES

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LIST OF FIGURES

1.0 INTRODUCTION

The U.S. Army Corps of Engineers is planning to deepen the Delaware navigational channel from its current federally authorized depth of 40 feet MLW to 45 feet MLW between Philadelphia, PA and the Atlantic Ocean. Current plans call for the dredging to start late in the year 2001 or early 2002. As part of an on-going series of studies to characterize pre-construction conditions, the District conducted water quality and oyster bed monitoring in lower Delaware Bay during the 2000 and 2001 calendar year. Water quality monitoring was conducted to provide the physical/chemical data needed to help interpret oyster population health and to provide a means to verify hydrodynamic model predictions of potential salinity changes that may result after the channel is deepened. A three-dimensional hydrodynamic salinity model was developed to investigate whether the project will change the existing location of the salt line (the area of the river where saline ocean water and freshwater meet). The model suggested that a negligible movement of the salt line would result from the deepening. The findings from the salinity model indicated that the predicted range of salinity changes would pose no adverse impact on oyster resources. In consultation with the New Jersey Department of Environmental Protection, the Philadelphia District agreed to confirm and further evaluate the effects of potential salinity changes on oyster populations due to the deepening project and to implement a monitoring plan to assess any effects of the project to the oyster beds.

The purpose of this study is to examine the health and productivity of oyster populations on the natural seedbeds in the Delaware Bay prior to the deepening and to obtain pre-construction data on water quality. The data developed from this program will be used after the project is completed to determine if the deepening significantly impacted oyster populations in Delaware Bay.

This report provides a data summary of the pre-construction information generated from the first year of the monitoring program. Versar, Inc. Columbia, Maryland, conducted water quality monitoring and oyster spat production estimates. Rutgers University, Haskin Shellfish Research Laboratory in Bivalve, New Jersey, conducted the oyster population studies and assessed the pre-construction health and condition of the subject oyster beds. Dr. Robert Diaz, Ware Neck, VA, conducted the sediment profile camera reconnaissance study.

Delaware River Main Channel Deepening Project

Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
se dredged material to create and stablish 60-acre tidal wetland that rovides habitat for native species horseshoe crab, shorebirds, fish, *partina*, waterfowl) and prevents ontinued erosion of Kelly Island vithout significant adverse impacts o contiguous habitats.	Prevent deleterious effects to adjacent shellfish (oyster) populations and habitat.	No significant increase in anaerobic (smothered) conditions of shellfish beds when compared to pre-project conditions in the same locations.	Using sediment profiling camera with plan view attached, develop reference photographs of existing oysters so that reasonable color comparisons can be made in the future. Reference photos of anaerobic sediments will be obtained from existing imagery files. Photos will be taken quarterly during preconstruction and construction and for three years following construction. Transects will be set up between Kelly Island and the nearest oyster areas as well as control transects both north and south of Kelly Island.	1. Validate cause of anaerobic conditions to determine if project related. 2. Investigate restoration technology and methods. 3. Restore oyster habitat.
		No transport of placed sand from project onto nearby oyster beds or leases.	Sediment grab sampling of bay bottom between project and oyster beds (Drum Bed, Silver Bed, and Pleasanton's Rock) once during preconstruction, and quarterly for one year after construction when the need for future sampling will be reevaluated. In addition, grab samples will be taken between the project and the nearest oyster beds after major storms, which is defined as either (1) a tide based storm where post-storm surveys shall be obtained when water levels at Lewes and/or Port Mahon equal or exceed +7.5 ft above MLLW during a storm event, regardless of whether there are erosion impacts detected/observed at the Kelly Island berm; or (2) Observation-based, where post storm surveys shall be obtained if there is apparent scarping or shoreline retreat of the Kelly Island berm, even if tide gage measurements at Lewes and Port Mahon fail to equal or exceed +7.5 ft MLLW. Samples taken after construction will be compared to samples taken prior to project construction. This assumes that the sand from the project will be (Continued on next page)	1. Alternatives will be developed to divert sediment transport away from oyster grounds. 2. Construct diversions. 3. If diversions are not successful, investigate restoration technology and methods. 4. Restore oyster habitat.

Delaware River Main Channel Deepening Project
Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
			distinctly different from the pre-project bay bottom and will therefore be traceable. Within one year before construction, side scan sonar or a similar imaging technology will be used to characterize the bay bottom between Kelly Island and the nearest oyster areas.This will be repeated one year after construction..Transects will be set up between Kelly Island and the nearest oyster areas as well as control transects both north and south of Kelly Island.	
		No significant increase in suspended solids from fine grained material contained by the berm. A significant increase would be more than 25% above the yearly preconstruction mean.	Install a turbidity measuring instrument. Data will be gathered for one year prior to the construction of Kelly Island, during construction, and for three years after construction. In addition quarterly inspections will be done to inspect the berm for breaches.	Repair berm. Restore oyster habitat.
	Silt retained for periods between maintenance of the offshore sand dike and other features.	Shoreline retreat rate of less than 14 ft per year on average over 10-year period after construction. Additionally, equilibration of dike slope in first year should not result in shoreline recession of greater than 30 ft. (WES design criteria).	Annual cross-sectional surveys of offshore dike from landward edge of crest of dike to offshore toe of slope. Annual aerial photographs at 1:2400 scale.	Replenish cross-section of dike with sand if deemed necessary by the Corps and DNREC. Evaluate reasons for accelerated erosion. Mitigate with appropriate volume of sand to restore berm to expected condition.
	Contain silty dredged material.	Sufficient capacity in site to contain 200,000 cubic yards of fine sediments mixed with an additional 500,000 cubic yards of sandy sediments.	Observation of placement operation to be sure that placement of sand over silts reasonably mixes in the site. Water quality standards in the discharge from the site should not exceed those specified prior to dredging. During disposal of dredged material into the wetland restoration area, water quality will be monitored at the discharge pipes with an automatic sampler. Emphasis will be on monitoring total suspended solids.	If water quality standards are not met, dredging operation will be modified to bring discharges within limits by methods such as increasing the ponding period, or decreasing the discharge rate.

Delaware River Main Channel Deepening Project

Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
	Average annual sediment transport rate away from structure should not exceed 35,000 cubic yards.	Annual topographic and bathymetric surveys of offshore sand dike show change in dike volume not exceeding 35,000 cubic yards per year. (Some sediment will move on and offshore but can be accounted for in the volume calculations. Interest here is sand lost from the project to the north or south.)	Annual cross-sectional surveys of offshore dike from landward edge of crest of dike to offshore toe of slope. Annual aerial photographs at 1:2400 scale.	Assess cause and determine appropriate action .
	Created marshes similar to native low marshes on 40 acres (including hummocks).	Similar to adjacent reference marsh located on northern third of Bombay Hook tidal marsh.	1 year after tidal exchange established, survey area to assess natural plant recruitment using random or systematic 1-m plot methods used by the National Wildlife Refuge to be sure desired plants are present.	Assess cause and determine appropriate action.
			3 years after tidal exchange established, within +/- 3% species composition similarity with reference marsh or a desirable species composition as determined by the Corps, DNREC, and Federal Resource Agencies. In the creation of the vegetated low marsh, flexibility will be used when evaluating if the marsh is a success. Although the standard of having the vegetation within +/- 3% of the reference marsh will be used as a guideline, the Corps, DNREC and the Federal resource agencies will determine if the marsh is a "success" after vegetation has become established.	Consider modification of topography, eradication of undesirable species, planting of desired species, modification of water flow characteristics, and protection against geese and other animals eating the plants.
	Establish 50 ft width of beach grass on crest of berm/dike.	75% survival after 1 year from planting.	Field surveys for survival of planted stems yearly for three years.	More plantings of beach grass.

Delaware River Main Channel Deepening Project

Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
	Optimize habitat for use by summer and winter flounder juveniles. Although the objective of maximizing summer and winter flounder habitat will focus on these species, an attempt will be made to create a diverse aquatic community that is similar to that which exists in the adjacent reference tidal marsh waterways.	Establish at least 1000 linear feet of tidal channel at least 0.1 m deep at mean low water (NMFS, 1999) within 1 year after tidal exchange is established. The width of the channel will be determined to maximize tidal exchange without causing erosion to the sides of the channels.	Yearly air photos. Seining in new and reference channels of created marsh and adjacent tidal marsh waterways in late spring one year after tidal flow is established to determine if species are present.	Assess cause and determine appropriate action such as modification of topography and modification of water flow characteristics.
	Maximize habitat for horseshoe crabs.	At mean high water line: 1. Depth of sand is at least 16 inches. 2. Sand has 2 to 6 % moisture at 3.7 in. below the surface. 3. Beach slope is 5 to 9 %. 4. Grain size is between 0.5 and 1.0 mm at 3.7 inches below the surface.	Measure variables as described in Brady and Schrading (1996) every 500 feet along the berm face, biweekly between 1 May and 1 July, for three years after construction. Measure density of horseshoe crabs eggs at same locations following protocol that is being developed by the Atlantic States Marine Fisheries Commission.	1. Adding sand to berm. 2. Grade berm.
	Insignificant horseshoe crab mortality due to design of project. For example, in or around structures, or in the marsh (if they were to migrate over the sand dike).	Less than 10 % of crabs trapped in structures or on landward side of berm.	Yearly visual observation and counts of crabs during spawning season. Comparisons will be made between the project and other natural areas where mortality occurs.	Sand fence at edge of vegetated top of berm.

Delaware River Main Channel Deepening Project
Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
	On beachface, maximize feeding habitat for sanderlings, red knots, turnstones.	Since the main food for these species in Delaware Bay is horseshoe crab eggs, if horseshoe crab habitat is maximized, feeding habitat for these species will be as well.		
	In marsh, maximize habitat on a minimum of 20 acres for migratory shorebirds such as dowitchers, dunlin, semiplamated sandpiper, etc.	Less than 25% vegetative cover (Manomet, 1999) with 75% in a combination of mud flats and shallow water less than 12 cm at mean low water (Harrington, Undated).	Yearly air photos. Observations and counts of species using area during spring and fall migrations (could be incorporated into the aerial census being done by NJ and DE).	Assess cause of failure and determine appropriate action such as modification of topography and modification of water flow characteristics.
	Limit invasion of *Phragmites* Create marshes similar to native low marshes (including hummocks).	Less than 1% populated by *Phragmites* in monotypic stands in the marsh, as well as the berm and back dike.	Yearly air photos. Ground surveys.	Control of *Phragmites* using methods such as spot treatment of herbicides or water level manipulation.

SABELLARIA VULGARIS

SABELLARIA VULGARIS IMPACTS FROM SAND PLACEMENT

NUMBER OF EXHIBIT: 68, 70, 115, 117

BACKGROUND

In response to information provided at the public workshop of June 6, 2001, the Corps initiated a study to determine the presence of *Sabellaria* at Broadkill Beach. ***PRE-CONSTRUCTION SABELLARIA VULGARIS BASELINE MONITORING AT BROADKILL BEACH SAND PLACEMENT SITE, SUSSEX COUNTY, DELAWARE*** (January 2002). This report is attached. Note a draft report was previously submitted (**EXHIBIT 28**). The report quantifies *Sabellaria* colonies found at Broadkill Beach in 2001 and lists possible ways to restore habitat lost as a result of sand placement. A similar study will be done in 2002 with an attempt to determine if sub-tidal colonies would be impacted.

THE FOLLOWING CONCERNS HAVE BEEN RAISED:

Comment.

- **a.** Sand placement will destroy *Sabellaria* reefs and the habitat that they provide for other aquatic species.

Response.

The Corps of Engineers is willing to replace *Sabellaria* habitat at Broadkill Beach using the least expensive method that is effective.

Comment.

- **b.** *Sabellaria* reefs meet criteria for Essential Fish Habitat (EFH) under the Magnuson Stevens Act.

Response.

Sabellaria reefs provide important habitat for aquatic species and are EFH for black sea bass (Goodger, T, NMFS. Personal Communication to John Brady, January 9, 2002). An EFH evaluation is currently being coordinated with the NMFS.

Comment.

- **c.** The options to replace habitat have never been tested and there is no backup plan if they fail.

Response.

The restoration suggestions in the 2001 study are based on and supported by reasonable inferences from (i) *Sabellaria* colony formation and persistence at nearby Cape Shores and Slaughter Beach, (ii) the location and substrata of colonies identified and mapped at Broadkill Beach, and (iii) species' population dynamics / recruitment information in the literature. Any restoration efforts will be monitored after construction to determine success.

Comment.

- **d**. Sabellaria have been found at Port Mahon as well as Broadkill Beach.

Response.

Sabellaria studies will continue in 2002, including an examination of sub-tidal areas. The studies will also include an evaluation of the Port Mahon area.

Comment.

- **e.** There is no mention of impacts to *Sabellaria* in the NEPA documents.

Response.

Appropriate supplemental NEPA documentation associated with the individual beach nourishment projects will be prepared to evaluate placement of main channel sand on selected beaches. Impacts to *Sabellaria* will be discussed in those documents.

Final Report

Pre-construction *Sabellaria vulgaris* Baseline Monitoring at Broadkill Beach Sand Placement Site, Sussex County, Delaware

Douglas C. Miller

January 2002

PRE-CONSTRUCTION *SABELLARIA VULGARIS* BASELINE MONITORING AT BROADKILL BEACH SAND PLACEMENT SITE, SUSSEX COUNTY, DELAWARE

FINAL REPORT

Contract Number: DACW61-01-P-0291

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Introduction

The sandbuilder worm or "reefworm," *Sabellaria vulgaris* Verrill 1873 is a tube-building, annelid polychaete worm common on the Mid-Atlantic coastline of the USA (Gosner 1978, Lippson and Lippson 1997, Pollock 1998). This species ranges from Cape Cod to Georgia, occurring from low in the intertidal zone to shallow subtidal in waters with salinity above 15 ‰ (parts per thousand) (Gosner 1978, Ruppert and Fox 1988). Their life cycle includes a planktonic larval stage (Curtis 1973, 1975), and the larvae settle gregariously on a wide variety of substrata, including rocks and cobbles, clamshells, oyster bars, horseshoe crab carapaces, other worm tubes and pilings (e.g., Hidu 1978, Karlson and Shenk 1983).

Sandbuilder worm tubes are built of sand grains cemented together into a hard encrustation or rock-like structure. For feeding and tube construction, the worms protrude their crown of tentacles from the tube openings. Worm tubes may be found singly or in small clusters attached to various substrata. In Delaware Bay, sandbuilder worms are also found in dense aggregations where the tubes grow in straight, parallel, spaghetti-like bundles that completely cover the substratum (e.g., Wells 1970). These bundles may extend 20 cm or more above the substratum and be firm enough to walk on, often forming worm reef. The surface of the reef is of brown, honeycomb-like tube openings, each representing an individual sandbuilder worm. Reef development appears to be a unique characteristic of Delaware Bay populations, although Wells (1970) describes masses on a shipwreck in North Carolina that closely resemble Delaware reefs in consistency, morphology and tidal elevation.

From their sizeable reef structure and outward appearance, these aggregations are sometime known locally as "corals." This term is taxonomically inaccurate as well as potentially misleading, and it will not be used in this report. Reef-forming corals are members of another phylum (the Phylum Cnidaria, Class Anthozoa, in part, known as hermatypic corals) and characteristic of warm, clear tropical waters (Lalli and Parsons 1997). Because of their particular habitat requirements, true reef corals are not found in the Mid-Atlantic region. However, at least one species of non-reef forming, true coral, *Astrangia danae*, is found in the region in subtidal habitats though it has little tolerance for brackish water and high turbidity (Gosner 1978). Again, because of differing habitat requirements, this star coral *A. danae* is not associated with the sandbuilder reefs.

The ecology of sandbuilder worms has been studied in the region, and in the Delaware Bay in particular, in a number of studies over the past 30 years, for example, Amos (1966), Wells (1970), Curtis (1973, 1975, 1978), and Pembroke (1976). These sandbuilder reefs form a habitat that is far more physically stable (termed "worm rocks" by Gosner 1978) and ecologically diverse than would otherwise be found on bare rock or sand substratum. Thus, their reef structure and associated invertebrates are likely to provide food for fish and therefore represent a productive nearshore marine habitat.

The Army Corps of Engineers is proposing to use dredge material from the deepening of the Delaware River Federal Navigation Channel for shoreline restoration at

Broadkill Beach (USACE 1997). This area has been known historically (e.g., Curtis 1975) and recently (R. Martin, personal communication 2000, D. Miller, personal observation 2000) to have sandbuilder worm reefs. Since shoreline restoration has the potential to bury and disrupt these reefs, it is necessary to determine the extent and location of present reefs as baseline data prior to construction activities.

Purpose / Objective of Study

The purpose of this study is to document the presence, extent and locations of *Sabellaria vulgaris* colonies at Broadkill Beach in summer, 2001, with respect to habitat type, tidal stage, and other environmental factors.

Methods

A survey of the sandbuilder worm colonies at the Broadkill Beach sand placement site was conducted on 20 - 21 July 2001. Within an hour of the afternoon low water, the beach was walked by the contractor and his associates in two segments: on 20 July, from the north end at California Avenue south to Route 16, and on 21 July, from the boundary of Beach Plum Island State Park north to Route 16. These dates were chosen to be near the lowest spring tides of the month and represent the best opportunity for the colonies to be observed and measured in the intertidal and nearshore subtidal zones along this beach. The following operational definitions were used: a colony is defined as an aggregation of worm tubes, usually small in size (< 1 m across) and somewhat isolated from other worm tubes. A reef is defined as a larger structure, a meter or more across, with 5 cm or more of vertical worm tube growth.

Where sandbuilder colonies or reefs were observed, their location was determined with a handheld GPS (Garmin model GPSMAP 76) and associated with nearby streets or landmarks. The dimensions of the colony or reef, along the shore and distance seaward from the beach-slope break, were determined with a measuring tape. Various digital photographs of the whole reef, as well as close-up sections, were made to document the reef shape and structure. An on-site determination of the overall condition of the reef was made as indicated by new tube growth (tubes with a "flare" or "porch," Wells 1970), tube erosion, over-settlement by mussels or tube worms, crab burrows, *et cetera*.

Reef observations and notes were recorded in the field on data sheets (see below and included in appendices) and additional observations were made on the study area shoreline, especially where rock, cobbles and gravel were present at the tidal level typically associated with sandbuilder reefs. At the *Sabellaria* reefs and other sites along Broadkill Beach, additional measurements were made to more fully characterize environmental conditions in the study area. These included: seawater temperature and salinity (handheld YSI model 30 meter), beach slope (inclinometer), and sediment grain size (standard dry sieving methods).

Results

Three large *Sabellaria* reefs were found on Broadkill Beach: two on the rock groins at Alabama and at Georgia Avenues (both north of Route 16, Fig. 1), and another on the Old Inlet Jetty (2.4 km south of Route 16 and 800 m north of the Beach Plum boundary, Fig 2). Table 1 summarizes the location, description and photo documentation of these three reefs. All *Sabellaria* documented in this survey were associated with large rocks comprising the groins and jetty, and none was found along the sand beaches or wooden groins.

Alabama and Georgia Avenue groin reefs

These two reefs are triangular in shape and occupy the bayward end of the rock groins (Figs. 4, 6, and 7) at the north end of the groin field north of Route 16. Near the bayward end of the reefs, sandbuilder worm tubes covered nearly all of the rock surface (Figs. 5 and 8) and extended farther out, beyond visibility in the wave swash. The worm tubes were colonized by macroalgae and mussels, and new tube growth was noted at the Alabama Avenue reef (Fig. 5).

Old Inlet Jetty reef

The reef observed at the Old Inlet Jetty is by far the largest on Broadkill Beach (Figs. 10 - 14). The jetty extends an estimated 65 m bayward, and the reef on both sides occurs along the full length of the jetty (Figs. 10, 11, and 14) from 2 - 5 m from the beach slope break. Coverage at the bay-end is essentially 100% by sandbuilder worm tubes. In places along the reef, there are dense settlements of mussels, and new tube growth (Fig. 12) was noted.

Sand beaches and wooden groins

No sandbuilder worm colonies or reefs were found on the sand beaches in the study area (e.g., Figs. 3 and 15). These beaches consisted of sand or small gravel at the beach slope break where it was expected to find sandbuilder colonies. Wooden groins north (Fig. 9) and south (Fig. 16) of Route 16 were examined and found to be colonized by barnacles, oysters and some tubicolous epifauna. No sandbuilder worm colonies were seen on these structures.

Within the study area, bay water salinity ranged from 25 – 28 ‰, and temperature ranged from 24 – 26.5 °C (Table 2). Beach sediments ranged from fine to coarse sands that were typically well sorted except at Alabama Avenue.

Discussion

Sandbuilder reefs at Broadkill Beach and nearby sites

At Broadkill Beach, there are three sandbuilder worm reefs within a 3 km length of the beach. Their total plan area is estimated to be approximately 320 m^2, and all colonies were on the rocks of artificial structures. The Old Inlet jetty reef has an estimated area more than twice that of the groin reefs combined. According to Wells (1970), it is apparently this reef that is depicted in the photograph in Amos (1966). No sandbuilder worm colonies were found on the sand beaches that comprise the remainder of the shoreline in the study area.

Since fall of 1999, the contractor has observed and photographed sandbuilder worm colonies and reefs on sand beaches north of the study site at Slaughter Beach as well as south at Cape Shores in Breakwater Harbor, near Lewes.

Sandbuilder intertidal reefs in the lower Delaware Bay have been documented by Amos (1966), Wells (1970), Curtis (1973, 1975, 1978), Pembroke (1976) and Woodard (1978), ranging from Woodland Beach (Maurer and Watling 1973, cited in Pembroke 1976) to South Bowers Beach to the Inner Breakwater Harbor at Lewes (Wells 1970). In particular, Wells (1970) lists both the inlet jetty and Broadkill Beach as sites of well-developed reef masses. Curtis (1973) used the jetty as a site in his field experiments and reports of live colonies at nearby Beach Plum Island and Primehook Beach. Curtis (1975) also notes that intertidal colonies at Broadkill Beach are associated with firm substratum. Woodard (1978) studied Old Inlet Jetty populations and provides a photograph in her Plate 1. While the species ranges from Cape Cod to Georgia (Gosner 1978), the formation of reef structures seems unique to Delaware Bay (with a single documented exception in North Carolina, Wells 1970). Both historical studies and personal observation by the contractor show that intertidal sandbuilder colonies and reefs extend along the shoreline north and south of the Broadkill Beach study area.

The vertical distribution of sandbuilder colonies with respect to the tides is described by both Wells (1970) and Curtis (1975). At Big Stone Beach, Delaware, Wells (1970, Fig. 3) shows beach colonies bayward of the slope break, ranging from 0.0 to 0.35 m above mean low water (MLW). Curtis (1975) related the vertical distribution to exposure times during extreme spring tides at the Mispillion jetty sandflat. Almost no live worms were found above exposures of 175 minutes, and most of the live colony was found in the 101 – 150 minute exposure zone.

Beach sand near the reefs and elsewhere ranged from fine to coarse in grain size (Table 2). Sandbuilder worms are epifaunal and require water flow and wave action to provide sand grains for tube building. Broadkill Beaches are fully exposed to the Delaware Bay to the northeast and provide sufficient resuspension of sand to allow tube growth. Rees (1976) reported that sandbuilder worms from Big Stone Beach used coarse and medium sand to build tubes and employ increasing grain sizes with time.

Sandbuilder worm habitat in lower Delaware Bay

The distribution of the intertidal colonies and reefs of sandbuilder worm at Broadkill Beach is limited to artificial rock. At other beaches previously studied by the contractor, sandbuilder worm reefs are found on the sand beach near the beach slope break where cobble-sized or larger (i.e., ≥6.4 cm across, Gray 1981, Table 2.1, p. 13) natural stone, bricks or other construction debris are present at the beach slope break.

Shoreline dynamics and sediment sources for the lower Delaware Bay are discussed by Maurmeyer (1978). The lack of cobble at Broadkill Beach could be due to a lack of natural or artificial source or that coarse material has been removed or buried. Burial could have been facilitated by the sand trapping action of the groins currently on the Broadkill Beach.

Subtidal sandbuilder worms populations are more widely distributed both in Delaware Bay (Pembroke 1976, Fig . 1) and throughout this geographic distribution (Wells 1970, Gosner 1978). Sandbuilder worms inhabit a variety of hard-bottom communities, including the Bay's oyster beds (e.g., Maurer and Watling 1973) as well as the serpulid reefs located nearby offshore (e.g., Haines 1978, Haines and Maurer 1980a,b)

Sandbuilder worm life history

The life history of the sandbuilder worm in the lower Delaware Bay was extensively studied by Curtis (1973, 1975, 1978) and Pembroke (1976). Wells (unpublished and cited in Curtis 1975) noted that each winter there was a nearly complete kill of the sandbuilder worm adults in the intertidal region. Settling plate studies have found that sandbuilder larvae begin to settle from the plankton in late May or early June. Curtis (1973) extended these studies and reports (e.g., Curtis 1978) that larvae occur in the plankton from mid-April through October and settle in late May through October, with peaks in early summer and later in autumn. Persistence of the larvae in the plankton suggests that spawning occurs repeatedly in the April to October breeding season. Subtidal adults appear to have much higher survival rates and thus are the main contributor of the spring larvae. The intertidal colonies are settled in the spring by larvae spawned mainly by subtidal adults.

Curtis (1973) proposed that lunar or tidal spawning phasing and positive phototaxis were required to retain larvae in the region of the adults' habitat. Such a mechanism could account for the high sandbuilder abundances, settlement and reef formation in the Delaware Bay as opposed to the rest of the species' range. However, Pembroke (1976) investigated phototactic and geotactic responses of sandbuilder larvae and concluded that a light-dependent vertical migration was not capable of retaining larvae within the Bay. Eckelbarger (1975) reported gregarious settlement of larvae in laboratory experiments. Woodard (1978) concluded that subtidal and low intertidal worms contribute most heavily to the breeding population in Delaware Bay.

Sandbuilder worms have a persistent and well-documented distribution within the Delaware Bay. Subtidal populations appear to be more widespread and seasonally stable. Intertidal populations are more limited by availability of stable substratum and determined by seasonal recruitment and winter mortality.

Potential impacts of shoreline restoration and possible restoration options

Shoreline restoration at Broadkill Beach is anticipated to extend sand 67 m (220 feet) from mean high water to a depth of up to 2 m of sand. This will bury the groins and most of the length of the Old Inlet Jetty. Given that sandbuilder worms are sessile and tube dwelling, burial with substantial depths of sand will smother the worms and kill the intertidal colonies and reefs.

Analysis of the literature and recent observations indicates that sandbuilder worm populations (intertidal, but especially subtidal) are persistent and nearby, north and south of, Broadkill Beach. The habitat at Broadkill Beach is suitable for reef formation and intertidal populations, though limited to artificial rock structures by lack of cobble-sized or larger substratum on the beach at the beach slope break.

Sandbuilder colony and reef restoration options should focus on providing sufficiently stable rock substratum during the late May – October settlement period accessible to planktonic larvae from source populations. Accordingly, potential strategies include:

- Placing suitable substratum, large rock in groins or jetties or cobble-sized gravel on sand beaches at the 0.0 MLW tidal level during the summer months following shoreline restoration,
- Removal of the current reef masses to new shoreline locations to reconstruct or re-seed reefs via enhanced larval settlement,
- Reestablishing reefs by emplacement of colonized rocks from an extensive source population, e.g. that at the Mispillion jetty (Curtis 1975).

The efficacy of such restoration measures could be assessed in terms of the overall number or area of reef habitat created as compared to that presently occurring at Broadkill Beach. Successful establishment of new intertidal reef should be apparent as settlement, and new tube growth should be visible within a few months. It would also be useful to know the exact location and distance to the nearest intertidal and subtidal populations. Transport of sand away from the shoreline restoration site has the potential to impact naturally occurring sandbuilder worms at nearby beaches as well as subtidal populations. While outside the project limits, these populations are those most likely to provide larvae for settlement on emplaced, bare substratum. If sandbuilder worms can successfully out compete barnacles and mussels for intertidal rock surface, then it may be feasible to emplace substratum prior to the larval settlement period.

Conclusions

In a July, 2001 survey of Broadkill Beach, sandbuilder worm colonies were found in reef-like masses at three locations: two on the rock groins at Alabama and at Georgia Avenues, and the largest on the Old Inlet Jetty south of Route 16 and north of the Beach Plum Island boundary. At each location, sandbuilder reefs were associated with large rocks comprising the groins and jetty. No colonies were found along the beach near the beach slope break, low in the intertidal zone where they presently occur at nearby beaches in the lower Delaware Bay. In comparison with other sites studied by the contractor, sand beaches at Broadkill Beach lack the stable, cobble-sized or larger substratum to which colonies attach at nearby beaches. All colonies at Broadkill Beach are associated with large rocks on artificial structures.

Sandbuilder worms have a life cycle with a planktonic larval stage that permits broad dispersal. Larval settlement occurs over extended periods in the summer and early fall and is often gregarious. Stable substratum, for example gravel and rock of sufficient size not to be overturned by wave action, placed near mean low water should provide favorable habitat for sandbuilder worm settlement and reef development.

Sandbuilder worms are epifaunal and require water flow and wave action to provide food particles, oxygen and sand grains for tube building. While they have some capability to withstand burial under thin layers of sand, shoreline restoration would be expected to bury the present reefs at Broadkill Beach resulting in a substantial loss of this habitat. This impact could be compensated by placing suitable substratum, large rock in groins or jetties or cobble-sized gravel on sand beaches at mean low water during the summer or early fall following shoreline restoration. Other possibilities include removing current reef masses to new shoreline locations to reconstruct or reseed from enhanced larval settlement on the restored reefs.

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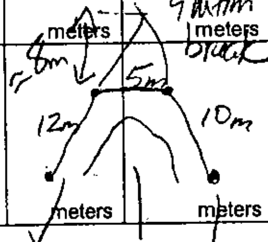
APPENDICES

Broadkill Data Sheet: Date 7/20 **/ Beach Segment** NORTH **/ Observers** Susannah Conrad Stephanie + Abigail Dorey **/ Start** 1300 **/ End** ____

Time	Colony #	Lat + Long	Along-shore	Seaward Extent	Shape	% Cover & Substratum	Condition	Additional Samples	Comments
13:51	# —	38° 50.438 75° 13.593 (4.6m)	— meters	— meters	photo # 1 ☐ rectangular ☐ triangular ☐ scattered ☐ isolated ☐ at edges	____% cover ☐ rock ☐ cobbles ☐ gravel ☐ sand ☐ mud	☐ mussels ☐ tubeworms ☐ crab holes ☐ new Sv growth ☐ new Sv settlement ☐ eroding tubes ☐ vacant tubes	voucher jar # sed sample bag or tube # beach slope 6 ° T 26.6 °C S 24.4 ‰	1st sand bar BN1
14:13	# —	38° 50.239 75° 13.304	— meters	— meters	photo # 2 ☐ rectangular ☐ triangular ☐ scattered ☐ isolated ☐ at edges	____% cover ☐ rock ☐ cobbles ☐ gravel ☐ sand ☐ mud	☐ mussels ☐ tubeworms ☐ crab holes ☐ new Sv growth ☐ new Sv settlement ☐ eroding tubes ☐ vacant tubes	voucher jar # sed sample bag or tube # beach slope 8 ° T 25.8 °C S 25.3 ‰	gravel sample G2
14:29	#	38° 49.997 75° 12.966 10.1	6.3 meters	5.0 9 m fm back meters	photo # 4-5 ☐ rectangular ☒ triangular ☐ scattered ☐ isolated ☐ at edges	50-100 % cover ☒ rock Spin ☐ cobbles ☐ gravel ☐ sand ☐ mud	☒ mussels + algae ☐ tubeworms ☐ crab holes ☒ new Sv growth ☐ new Sv settlement ☐ eroding tubes ☐ vacant tubes	voucher jar # sed sample bag or tube # beach slope 7 ° T 25.3 °C S 22.2 ‰	Sediment sample G3
14:42	#	38° 49.938 75° 12.911	 meters	meters	photo # (1) ☐ rectangular ☒ triangular ☐ scattered ☐ isolated ☐ at edges see sketch	edges only to 100 % cover ☒ rock Spin ☐ cobbles ☐ gravel ☐ sand ☐ mud	☒ mussels + algae ☐ tubeworms ☐ crab holes ☐ new Sv growth ☐ new Sv settlement ☐ eroding tubes ☐ vacant tubes	voucher jar # sed sample bag or tube # beach slope 6 ° T 25.2 °C S 25.2 ‰	G4 angelwing 10cm thick

around margin no SV 4m from slope back

Notes: ____

Sheet # ___ of ___ (form revised 20 July 2001)

Broadkill Data Sheet: Date 7/20 **/ Beach Segment** NORTH **/ Observers** ______ **/ Start** ______ **/ End** ≈1600

Time	Colony #	Lat + Long	Along-shore	Seaward Extent	Shape	% Cover & Substratum	Condition	Additional Samples	Comments
15:08	wood piling + # 8On	38° 49.876 75° 12.860 (4.8)	meters	meters	photo # ______ ☐ rectangular ☐ triangular ☐ scattered ☐ isolated ☐ at edges	______% cover ☐ rock ☐ cobbles ☐ gravel ☐ sand ☐ mud	☐ mussels ☐ tubeworms ☐ crab holes ☐ new Sv growth ☐ new Sv settlement ☐ eroding tubes ☐ vacant tubes	[✓ voucher jar # sed sample] bag or tube # beach slope 8 ° T 25.3 °C S 25.5 ‰	65
__:__	#	38° __.____ 75° __.____	meters	meters	photo # ______ ☐ rectangular ☐ triangular ☐ scattered ☐ isolated ☐ at edges	______% cover ☐ rock ☐ cobbles ☐ gravel ☐ sand ☐ mud	☐ mussels ☐ tubeworms ☐ crab holes ☐ new Sv growth ☐ new Sv settlement ☐ eroding tubes ☐ vacant tubes	voucher jar # sed sample bag or tube # beach slope ____ ° T ______ °C S ______ ‰	
__:__	#	38° __.____ 75° __.____	meters	meters	photo # ______ ☐ rectangular ☐ triangular ☐ scattered ☐ isolated ☐ at edges	______% cover ☐ rock ☐ cobbles ☐ gravel ☐ sand ☐ mud	☐ mussels ☐ tubeworms ☐ crab holes ☐ new Sv growth ☐ new Sv settlement ☐ eroding tubes ☐ vacant tubes	voucher jar # sed sample bag or tube # beach slope ____ ° T ______ °C S ______ ‰	
__:__	#	38° __.____ 75° __.____	meters	meters	photo # ______ ☐ rectangular ☐ triangular ☐ scattered ☐ isolated ☐ at edges	______% cover ☐ rock ☐ cobbles ☐ gravel ☐ sand ☐ mud	☐ mussels ☐ tubeworms ☐ crab holes ☐ new Sv growth ☐ new Sv settlement ☐ eroding tubes ☐ vacant tubes	voucher jar # sed sample bag or tube # beach slope ____ ° T ______ °C S ______ ‰	

Notes:

Sheet # 2 of 2 (form revised 20 July 2001)

Broadkill Data Sheet: Date 7/21/01 / Beach Segment South / Observers Stephanie Conrad [illegible] Abigail / Start 1400 / End 1615

Time	Colony #	Lat + Long	Along-shore	Seaward Extent	Shape	% Cover & Substratum	Condition	Additional Samples	Comments
11:14	Christine # transect	38° 48.04 75° 11.383	— meters	— meters	photo # 1 ☐ rectangular ☐ triangular ☐ scattered ☐ isolated ☐ at edges	___ % cover ☐ rock ☐ cobbles ☐ gravel ☐ sand ☐ mud	☐ mussels ☐ tubeworms ☐ crab holes ☐ new Sv growth ☐ new Sv settlement ☐ eroding tubes ☐ vacant tubes	voucher jar # sed sample bag or tube # beach slope 6 ° T 26.6 °C S 26.5 ‰	S1
14:31	#	38° 48.743 75° 11.668	3-4 meters	65 est 5m from edge in ~20 meters	photo # 2+ ☐ rectangular ☐ triangular ☐ scattered ☐ isolated ☐ at edges [illegible]	10-100 % cover at end ☒ rock ☐ cobbles ☐ gravel ☐ sand ☐ mud	☒ mussels -dense ☐ tubeworms ☐ crab holes grass ☒ new Sv growth ☐ new Sv settlement ☐ eroding tubes ☐ vacant tubes	voucher jar # sed sample bag or tube # beach slope 5 ° T 26.8 °C S 25.7 ‰	S2 mussel sample
15:18	#	38° 49.150 75° 12.070	— meters	— meters	photo # 3 ☐ rectangular ☐ triangular ☐ scattered ☐ isolated ☐ at edges	___ % cover ☐ rock ☐ cobbles ☐ gravel ☐ sand ☐ mud	☐ mussels ☐ tubeworms ☐ crab holes ☐ new Sv growth ☐ new Sv settlement ☐ eroding tubes ☐ vacant tubes	voucher jar # sed sample bag or tube # beach slope 5 ° T 28.0 °C S 26.4 ‰	S3
15:46	#	38° 49.646 75° 12.586	— meters	— meters	photo # ___ ☐ rectangular ☐ triangular ☐ scattered ☐ isolated ☐ at edges	___ % cover ☐ rock ☐ cobbles ☐ gravel ☐ sand ☐ mud	☐ mussels ☐ tubeworms ☐ crab holes ☐ new Sv growth ☐ new Sv settlement ☐ eroding tubes ☐ vacant tubes	voucher jar # sed sample bag or tube # beach slope 7 ° T 28.0 °C S 20.0 ‰	S4

Notes: ✓

Sheet # 1 of 2 (form revised 20 July 2001)

Broadkill Data Sheet: Date 7/21 **/ Beach Segment** ________ **/ Observers** ________ **/ Start** ________ **/ End** ________

Time	Colony #	Lat + Long	Along-shore	Seaward Extent	Shape	% Cover & Substratum	Condition	Additional Samples	Comments
15:54	#	38° 49.701 75° 12.659	— meters	— meters	photo # ____ ☐ rectangular ☐ triangular ☐ scattered ☐ isolated ☐ at edges	____% cover ☐ rock ☐ cobbles ☐ gravel ☐ sand ☐ mud	☐ mussels ☐ tubeworms ☐ crab holes ☐ new Sv growth ☐ new Sv settlement ☐ eroding tubes ☐ vacant tubes	voucher jar # sed sample bag or tube # beach slope ____° T ____°C S ____‰	S5
__:__	#	38° __.__ 75° __.__	meters	meters	photo # ____ ☐ rectangular ☐ triangular ☐ scattered ☐ isolated ☐ at edges	____% cover ☐ rock ☐ cobbles ☐ gravel ☐ sand ☐ mud	☐ mussels ☐ tubeworms ☐ crab holes ☐ new Sv growth ☐ new Sv settlement ☐ eroding tubes ☐ vacant tubes	voucher jar # sed sample bag or tube # beach slope ____° T ____°C S ____‰	
__:__	#	38° __.__ 75° __.__	meters	meters	photo # ____ ☐ rectangular ☐ triangular ☐ scattered ☐ isolated ☐ at edges	____% cover ☐ rock ☐ cobbles ☐ gravel ☐ sand ☐ mud	☐ mussels ☐ tubeworms ☐ crab holes ☐ new Sv growth ☐ new Sv settlement ☐ eroding tubes ☐ vacant tubes	voucher jar # sed sample bag or tube # beach slope ____° T ____°C S ____‰	
__:__	#	38° __.__ 75° __.__	meters	meters	photo # ____ ☐ rectangular ☐ triangular ☐ scattered ☐ isolated ☐ at edges	____% cover ☐ rock ☐ cobbles ☐ gravel ☐ sand ☐ mud	☐ mussels ☐ tubeworms ☐ crab holes ☐ new Sv growth ☐ new Sv settlement ☐ eroding tubes ☐ vacant tubes	voucher jar # sed sample bag or tube # beach slope ____° T ____°C S ____‰	

Notes:

Sheet # 2 of 2 (form revised 20 July 2001)

FIGURES

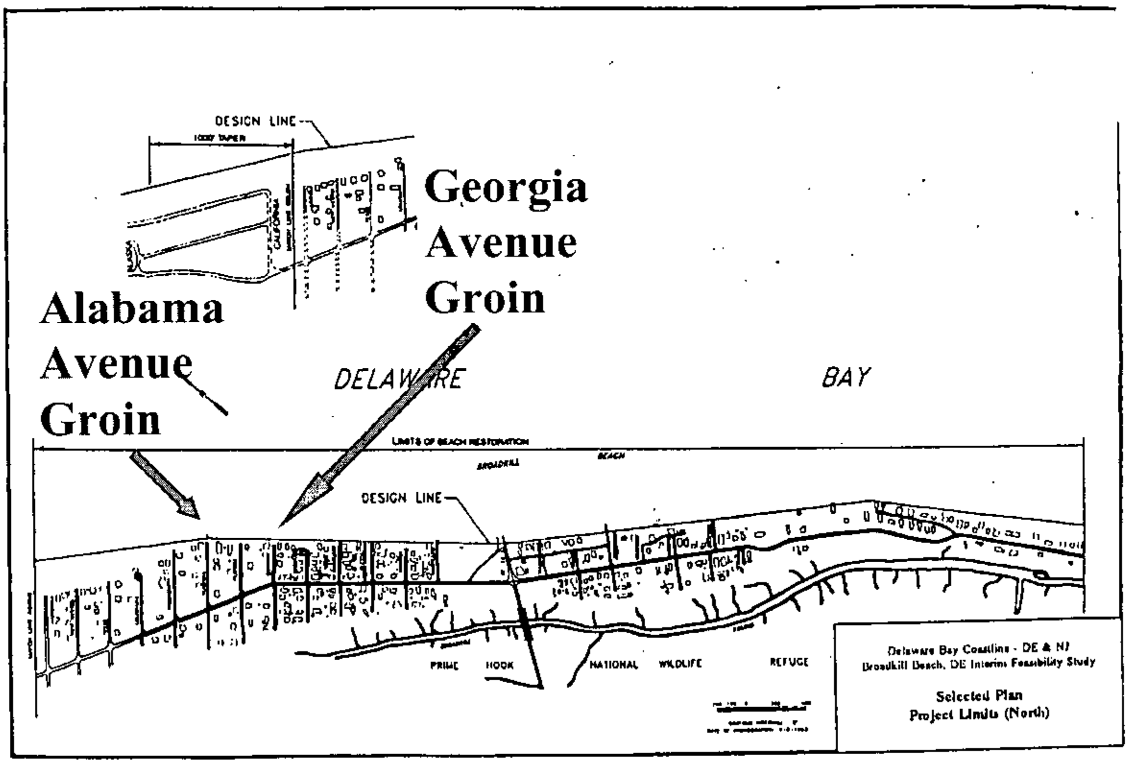


Figure 1. Location of Alabama and Georgia Avenue groin reefs.

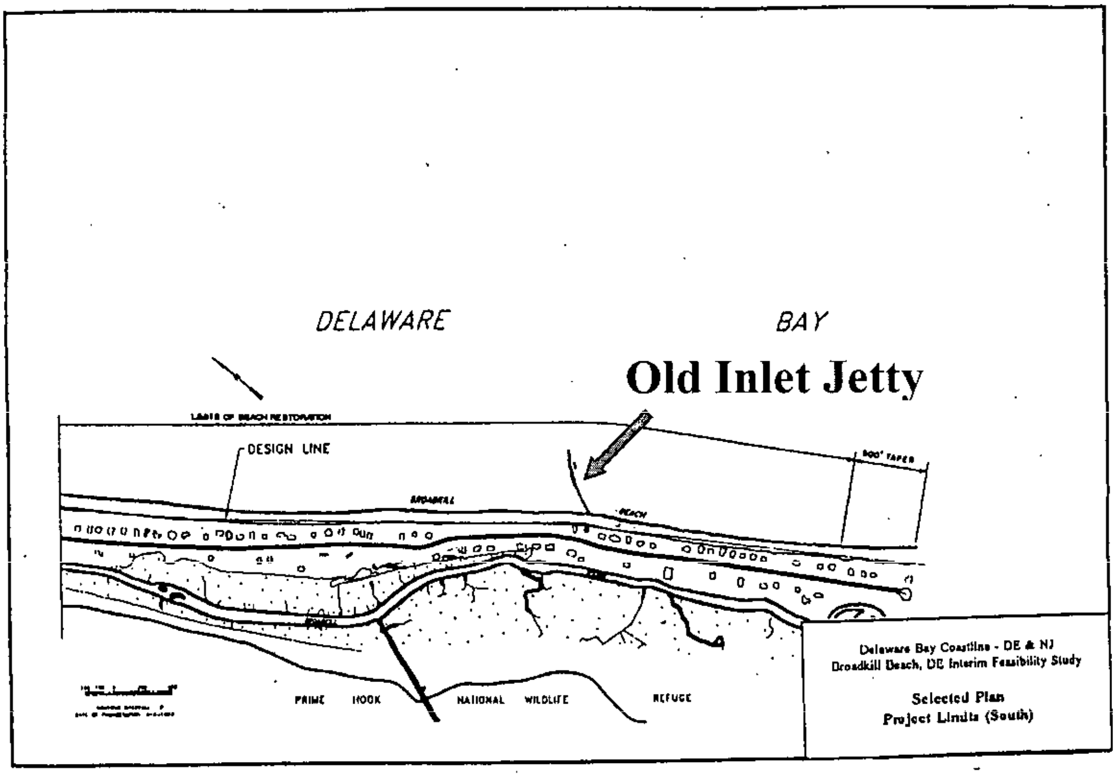


Figure 2. Location of Old Inlet Jetty reef.

Figure 3. Survey team for Broadkill Beach, 20 July 2001. Left to right: Stephanie Roberts (Howard U.), Abigail Bradley (U. Delaware), Susannah Karin (U. Delaware), Conrad Pilditch (U. Waikato). GPS Location: at north end of survey area, 38° 50.438′ N, 75° 13.593′ W.

Figure 4. Alabama Avenue groin, 20 July 2001, 38° 49.997′ N, 75° 12.996′ W. Wide photograph of the triangular reef at the bayward end of the rock groin.

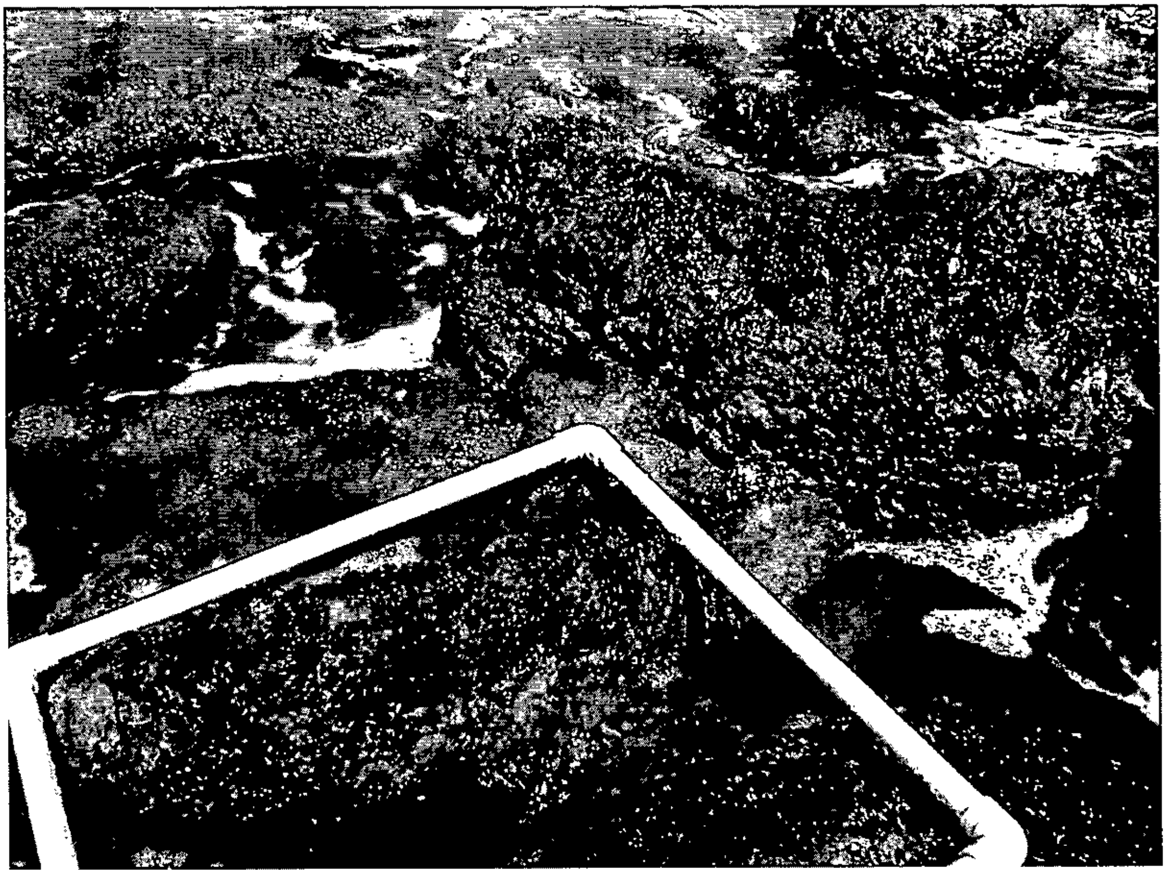


Figure 5. Alabama Avenue groin, 20 July 2001, 38° 49.997′ N, 75° 12.996′ W. Close photograph of rocks covered with sandbuilder worm colonies with 0.5 m x 0.5 m quadrat for scale. Note colonization by mussels and macroalgae.

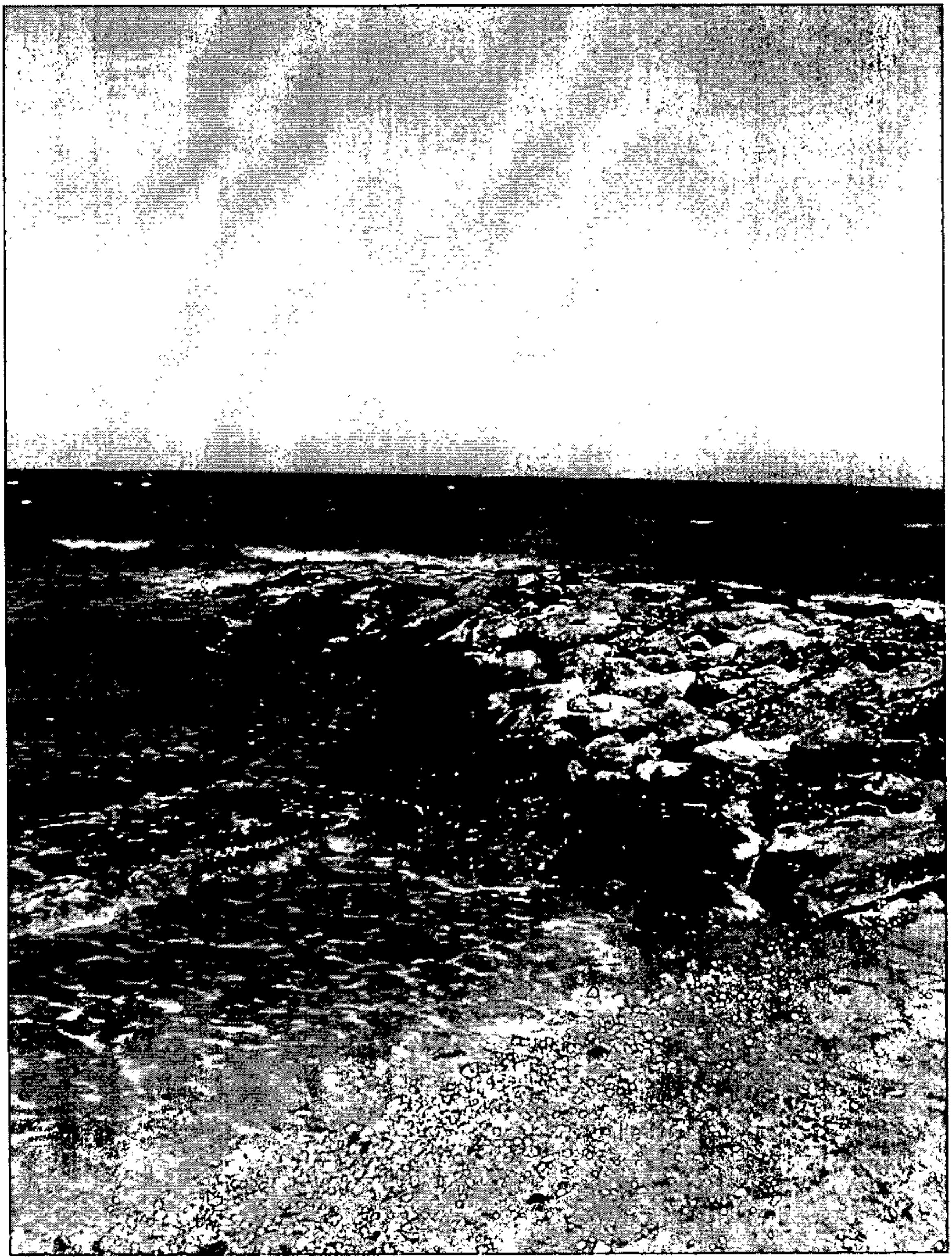


Figure 6. Georgia Avenue groin, 20 July 2001, 38° 49.938′ N, 75° 12.911′ W. Wide photograph of rocks covered with sandbuilder worm.

Figure 7. Georgia Avenue groin, 20 July 2001, 38° 49.938′ N, 75° 12.911′ W. Wide photograph of rocks covered with sandbuilder worm colonies with 0.5 m x 0.5 m quadrat for scale.

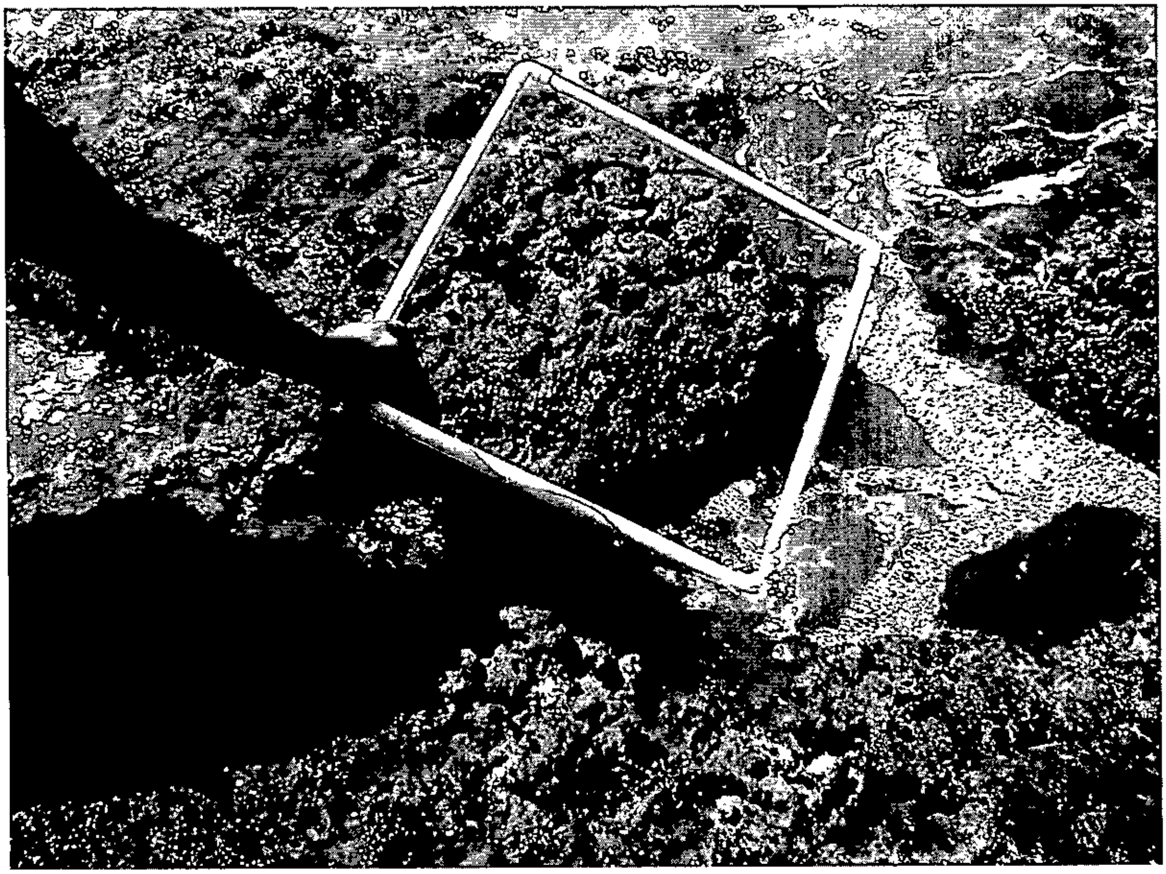


Figure 8. Georgia Avenue groin, 20 July 2001, 38° 49.938′ N, 75° 12.911′ W. Close photograph of rocks covered with sandbuilder worm colonies with 0.5 m x 0.5 m quadrat for scale.

Figure 9. Wooden groin, 20 July 2001, 38° 49.876′ N, 75° 12.860′ W. No sandbuilder worm colonies observed.

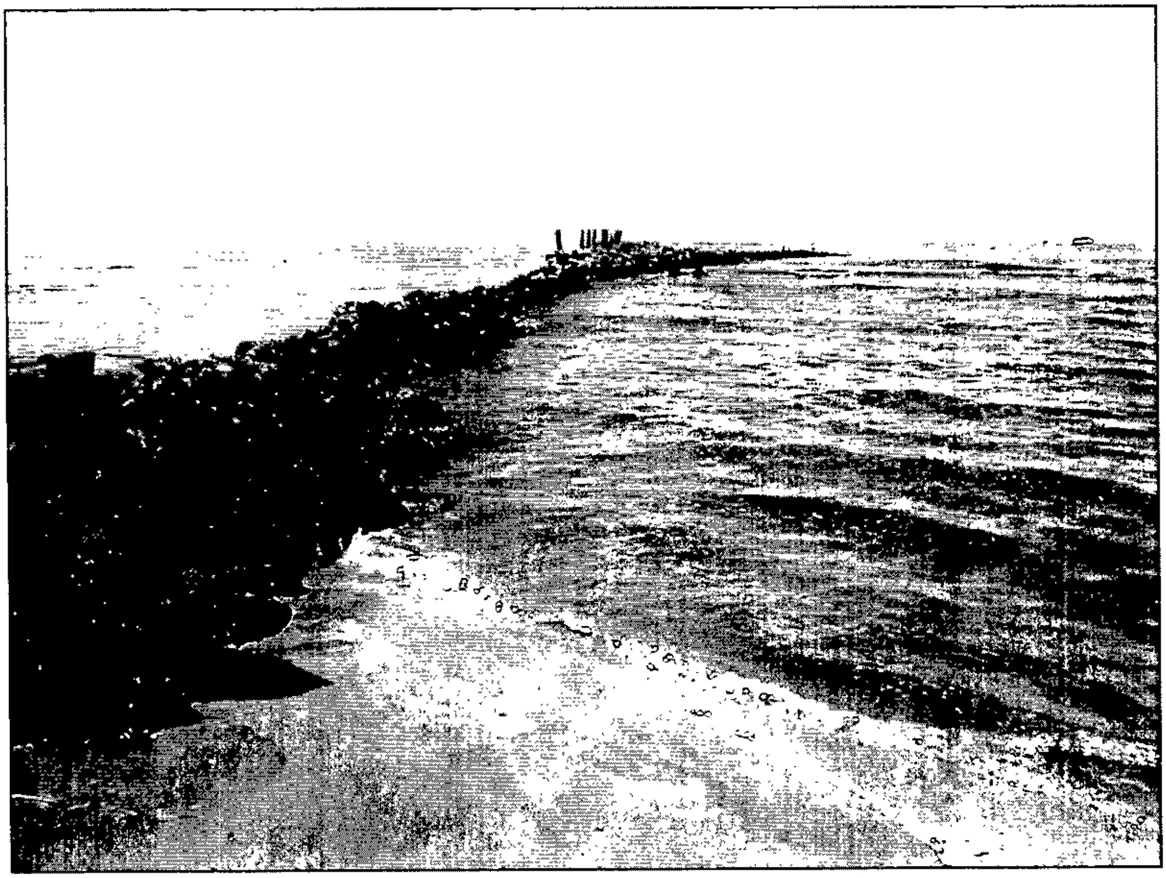


Figure 10. Old Inlet Jetty, 21 July 2001, 38° 48.743′ N, 75° 11.668′ W. Wide photograph showing full length of jetty.

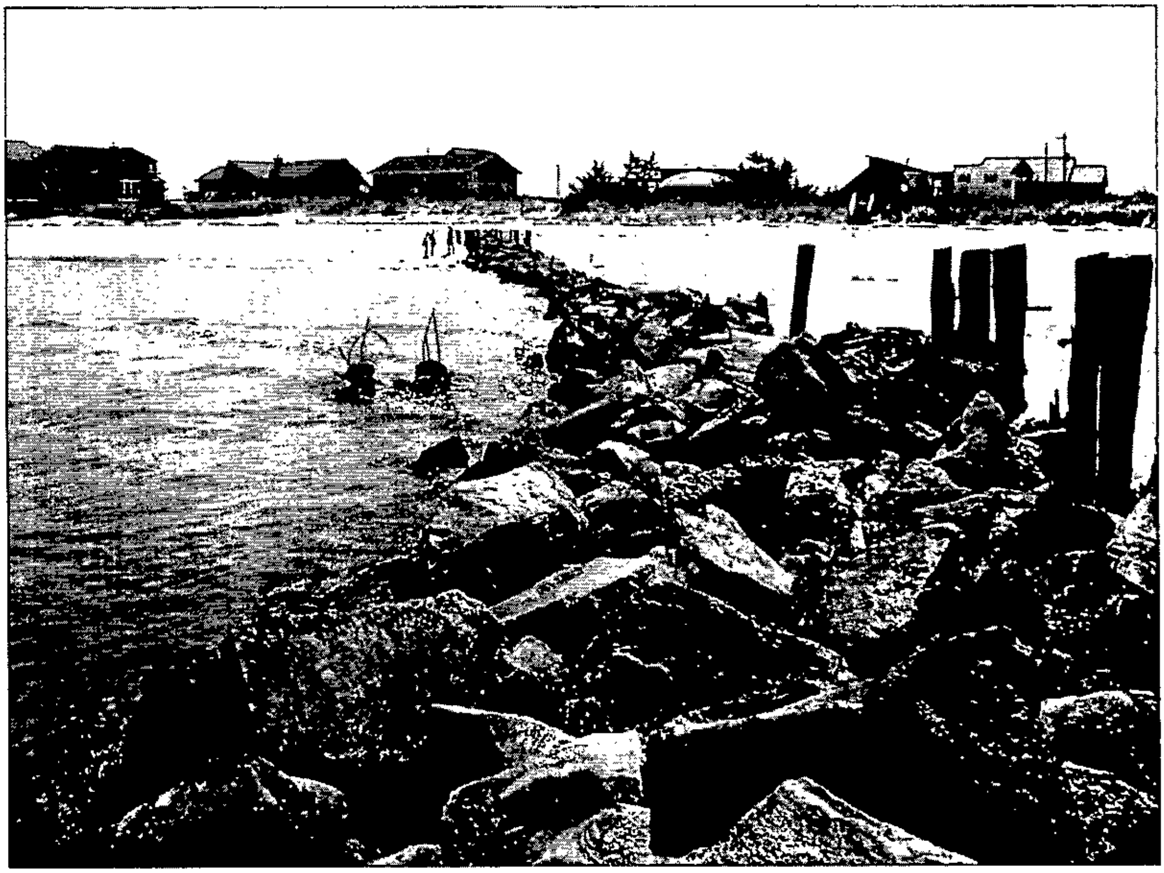


Figure 11. Old Inlet Jetty, 21 July 2001, 38° 48.743′ N, 75° 11.668′ W. Wide photograph from mid-jetty towards shore.

Figure 12. Old Inlet Jetty, 21 July 2001, 38° 48.743′ N, 75° 11.668′ W. Close photograph showing sandbuilder reef with mussels and new tube growth.

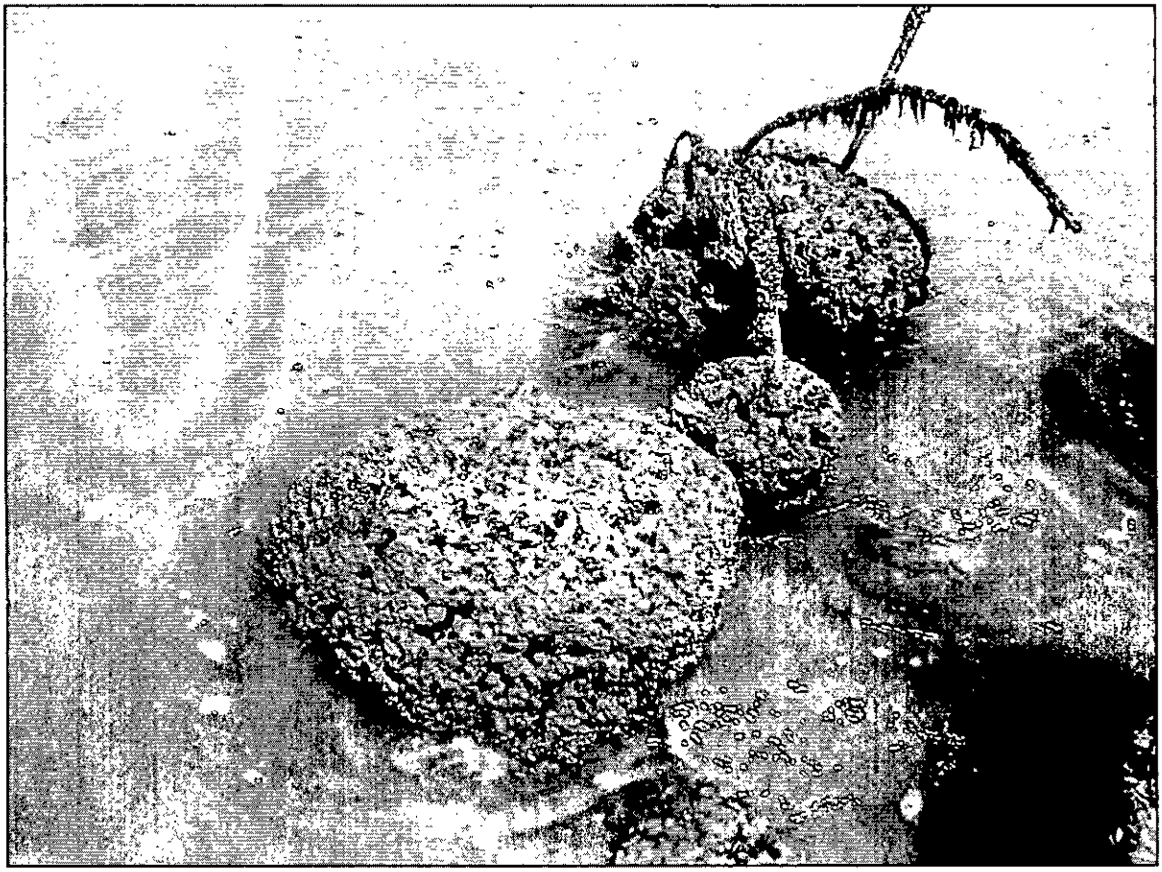


Figure 13. Old Inlet Jetty, 21 July 2001, 38° 48.743′ N, 75° 11.668′ W. Close photograph showing sandbuilder worm colonies completely covering rocks and other debris.

Figure 14. Old Inlet Jetty, 21 July 2001, 38° 48.743′ N, 75° 11.668′ W. Wide photograph from mid-jetty towards bay showing sandbuilder reef on flanks of jetty structure.

Figure 15. Sand beach, 21 July 2001, 38° 49.150′ N, 75° 12.070′ W. No sandbuilder worm colonies observed at beach slope break.

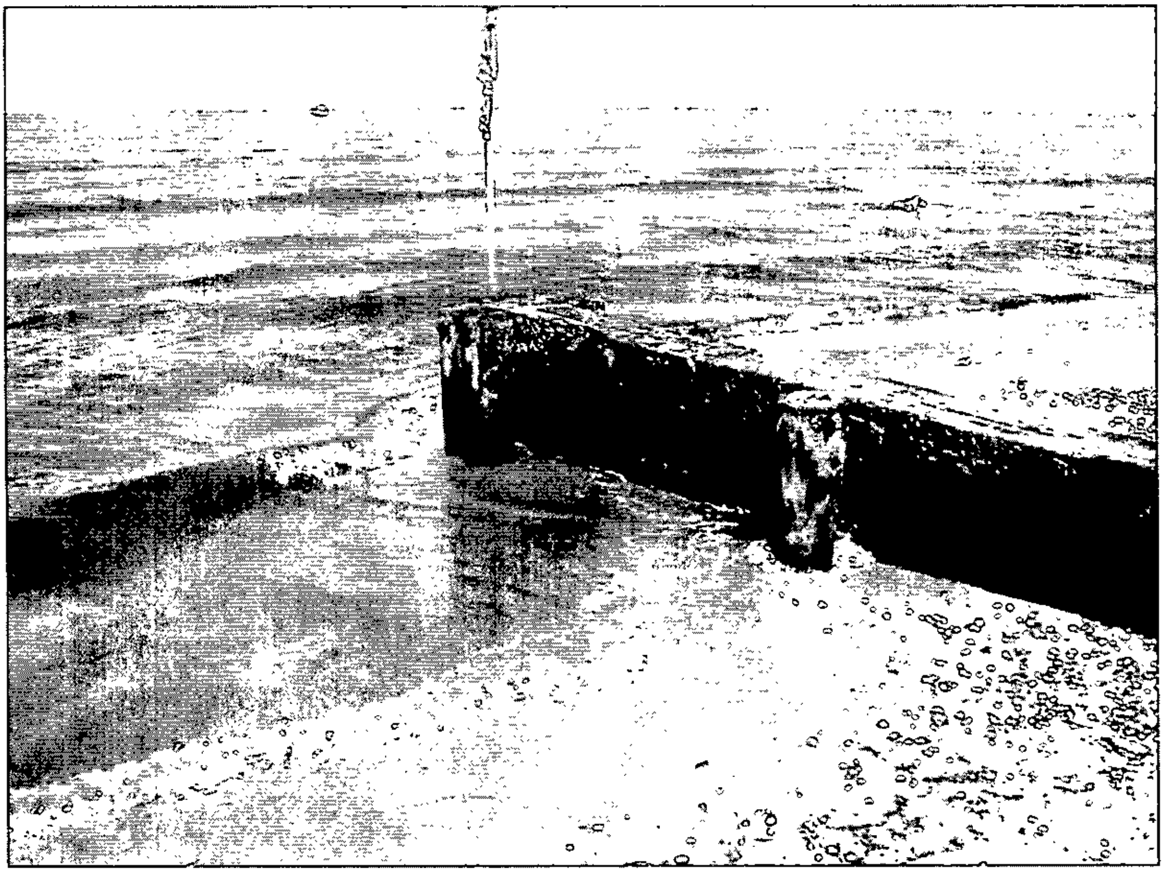


Figure 16. Wooden groin, 21 July 2001, 38° 49.646′ N, 75° 12.586′ W. No sandbuilder worm colonies observed.

TABLES

Table 1. Summary of locations and characterization of *Sabellaria* reefs at Broadkill Beach, surveyed 20-21 July 2001.

Sabellaria Reef	**GPS Location**	**Dimensions**	**Reef Description**	**Figure #s**
Alabama Avenue Groin	38° 49.997′ N 75° 12.966′ W	• Triangular reef at bayward end of groin • 6.3 m wide alongshore × 5 m visible bayward, starting 9 m from beach slope break • Plan area: 16 m^2	• Rock substratum, 50-100% covered • Reef settled with blue mussels and algae (sea lettuce and filamentous green) • New *Sabellaria* tube growth • Seawater: 25.3 °C, 22.2 ‰	• Location: Fig. 1 • Reef: Figs. 3, 4, 5
Georgia Avenue Groin	38° 49.938′ N 75° 12.911′ W	• Chevron-shaped reef at bayward end of groin • 5 m wide alongshore × 8 m visible bayward, plus band 27 m × 2 m wide, starting 4 m from beach slope break • Plan area: 74 m^2	• Rock substratum, edges of rocks to 100% covered • Reef settled with blue mussels and algae (sea lettuce and filamentous green), and false angel wing mollusc in burrows • Seawater: 25.5 °C, 25.2 ‰	• Location: Fig. 1 • Reef: Figs. 6, 7, 8
Old Inlet Jetty	38° 48.743′ N 75° 11.668′ W	• Long jetty • 3-4 m wide alongshore × 65 m (estimate) bayward, starting 2 – 5 m from beach slope break • Plan area: 228 m^2	• Coverage from 10% near beach to 100% at seaward end • Reef settled with mussels, porous, new tube growth • Seawater: 26.8 °C, 25.7 ‰	• Location: Fig. 2 • Reef: Figs. 10, 11, 12, 13, 14
Summary: three reefs in 3.0 km of beach		Of total area: 318 m^2	All on artificial rock	

Table 2. Summary of seawater temperature, salinity, beach slope and sediment grain size data Broadkill Beach, surveyed 20-21 July 2001.

Date, Local Time and Location	**GPS Latitude and Longitude**	**Seawater Temperature, °C**	**Salinity, ‰**	**Beach Slope, °**	**Sediment Median Grain Size and Sorting Coefficient**	**Comments**
20 July 13:51	38° 50.438′ N 75° 13.593′ W	26.6	24.4	6	582 μm coarse sand 0.21 ϕ sorting coefficient	Sandbar at north end Fig. 3
20 July 14:13	38° 50.239′ N 75° 13.304′ W	25.8	25.3	8	760 μm coarse sand 0.36 ϕ sorting coefficient	
20 July 14:29 Alabama Avenue	38° 49.997′ N 75° 12.966′ W	25.3	22.2	7	798 μm coarse sand 1.13 ϕ sorting coefficient	Sandbuilder reef Figs. 3-4
20 July 14:42 Georgia Avenue	38° 49.938′ N 75° 12.911′ W	25.2	25.2	6	648 μm coarse sand 0.63 ϕ sorting coefficient	Sandbuilder reef Figs. 6-8
20 July 15:08	38° 49.876′ N 75° 12.860′ W	25.3	25.5	8	225 μm fine sand 0.33 ϕ sorting coefficient	Wooden groin Fig. 9
21 July 14:14	38° 48.407′ N 75° 11.383′ W	26.6	26.5	6	196 μm fine sand 0.38 ϕ sorting coefficient	Student's transect site
21 July 14:31 Old Inlet Jetty	38° 48.743′ N 75° 11.668′ W	26.8	25.7	5	196 μm fine 0.24 ϕ sorting coefficient	Sandbuilder reef Figs. 10-14
21 July 15:18	38° 49.150′ N 75° 12.070′ W	28.0	26.4	5	900 μm coarse sand 0.11 ϕ sorting coefficient	Fig. 15
21 July 15:46	38° 49.646′ N 75° 12.586′ W	28.0	26.0	7	601 μm coarse sand 0.21 ϕ sorting coefficient	Fig.16
21 July 15: 54	38° 49.701′ N 75° 12.659′ W	Not determined	Not determined	Not determined	Not determined	Last wooden groin, no sandbuilder colonies
Summary	Ranges:	25.2 – 28.0 °C	22.2 – 26.5 ‰	5 – 8 °	Fine or coarse sands, well sorted to poorly sorted	

SANDBAR SHARKS

CONCERNS FOR SANDBAR SHARKS

NUMBER OF EXHIBIT: 76, 111

BACKGROUND

The habitat along the lower Delaware Bay coast in Delaware has been designated as "Habitat Areas of Particular Concern" by the NMFS. Coordination with NMFW through the Essential Fish Habitat Evaluation (EFH), as described below indicates that work can be done during environmental windows using modified construction techniques. A table of contents of a draft EFH evaluation dated November 2001 is attached. The entire report, including attachments is being submitted on CD ROM.

THE FOLLOWING CONCERNS HAVE BEEN RAISED:

Comment.

Sandbar sharks use the Delaware Estuary for nursery habitat. They congregate in shallow, near-shore waters and could be impacted by sand placement. The NMFS has concluded that the project may have negative impacts on this species.

Response.

The habitat along the lower Delaware Bay coast in Delaware has been designated as "Habitat Areas of Particular Concern" by the NMFS. Pratt (1999) believes that there will be a great potential to impact shark pups and their food source of benthic organisms in the nursery areas along the Delaware Bay Coast, especially offshore from Broadkill Beach to Slaughter Beach, if sand is deposited near the beach (in areas 1 – 4 m deep) in the nursery season. Potential impacts may include but not be limited to: changing the habitat characteristics, depth, profile, odor, turbidity and fauna of the area. Loss of forage would also occur. Prey species, principally crabs and fish of many species, may be disrupted directly by the presence of physical activity in the area and indirectly by the covering of vulnerable food web organisms with sand. A "closed" window from 1 May to 15 September was recommended by the National Marine Fisheries Service (Gorski, 2000) to prevent potential impacts to newborn and juvenile sharks such as suffocation. After this time period, the young sharks have reached a larger size where they would be more able to avoid the sand placement operations.

On 7 November 2000 representatives from the Corps and the NMFS held a teleconference to explore methods to place sand on Broadkill Beach during the Spring/Summer without significantly impacting the sandbar sharks puping (females giving birth to live-born young) and the nursery area that is located offshore in shallow waters. It was agreed that sand placement can be performed during the period from 1 May to 15 September using the following conservation measures:

a. A sand dike, 200 to 300 feet in length, will be constructed above mean high water (MHW) to contain dredged material that is pumped landward of it. The dike will be constructed using existing sand on the beach. The dike will be long enough that most dredged material will drop out on the beach and not return to the bay. As material is deposited the dike may be repositioned seaward to contain the required filling above MHW for that section of Beach. The slurry will still be controlled by the dike along the shoreline. No dredged material will be hydraulically placed below MHW during the restricted period. The dike will be extended down the beach as the area behind the dike is filled and the dredged pipe is lengthened. The dredged material that has been deposited will be built into dunes. It is expected that little of this material will be re-deposited by wave action during the spring/summer window period since weather is generally mild, except for possible hurricanes. After September 15, some dredged material will be graded into the bay to widen the beach. .

b. The dredged pipe will be placed on pontoons for a minimum of 1000 feet, beginning at approximately elevation –4.7 NGVD, extending offshore to avoid disrupting along shore traveling by the young sandbar sharks. This distance will be determined by the National Marine Fisheries Service. The remainder of the pipeline extending to the beach, and back to the dredge, can rest on the bottom.

References:

Gorski, Stanley W., 2000, Letter to John T. Brady dated February 10, 2000, National Marine Fisheries Service, Highlands, NJ.

Pratt, Harold "Wes", 1999, Letter to John T. Brady dated October 4, 1999, National Marine Fisheries Service, Narragansett, RI.

US Army Corps
of Engineers
Philadelphia District

DRAFT

DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT

ESSENTIAL FISH HABITAT EVALUATION

PREPARED BY:
PHILADELPHIA DISTRICT
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA 19107

NOVEMBER, 2001

Delaware River Main Channel Deepening Project
Essential Fish Habitat Evaluation

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Attachments

MIGRATORY SHOREBIRDS

MIGRATORY SHOREBIRDS IMPACTS

NUMBER OF EXHIBIT: 72, 80, 84

BACKGROUND

The construction of wetland restorations including Kelly Island will benefit spawning horseshoe crabs and shorebirds as stated in Section 9.1.5 of the Corps' July 1997 SEIS: **(EXHIBIT 4)** *"The construction of the wetland restorations will be phased to avoid and/or minimize impacts to fish and wildlife, especially to spawning horseshoe crabs and migrating and feeding shorebirds as described under Section 3.3.4.4. Reconstruction of wetlands at Kelly Island and Egg Island Point will greatly benefit most wildlife species. Although approximately 195 acres of aquatic habitat will be lost, this was formerly intertidal marsh before being destroyed by erosion. The loss of this aquatic habitat is not a significant impact."*

The Corps is proposing to use dredged material from deepening the Delaware River Federal Navigation Channel for shoreline restoration including a wetland restoration project at Kelly Island and sand placement at Port Mahon and Broadkill Beach. These areas are known to attract high numbers of shorebirds. In order to determine whether the completed wetland and shoreline restorations have benefited migratory shorebirds, it is necessary to collect and analyze quantitative and qualitative baseline data on shorebird use of the sites prior to construction. A draft report was completed in December 2001 and is attached and a final is due by March 2002. This report covers the first year of pre-construction monitoring. Pre-construction monitoring will continue until construction begins and subsequent reports will be provided to your office when available.

THE FOLLOWING CONCERNS HAVE BEEN RAISED:

Comment.

Delaware Bay is a major feeding and resting area for many species of migratory shorebirds. They feed on horseshoe crab eggs for a major food source. Impacting horseshoe crab spawning as well as impacting shorebird staging (especially at Port Mahon) would be detrimental to the shorebirds.

Response.

Please refer to the general response to "Horseshoe Crab Impacts from Sand Placement". As stated in this response, the Kelly Island wetland restoration project and sand placement at Port Mahon is expected to benefit horseshoe crabs by restoring spawning habitat. This will, in turn, benefit the migratory shorebirds that feed on the eggs. Studies done in 2001 indicate that Broadkill Beach is not a significant resource for either spawning horseshoe crabs or migratory shorebirds.

A monitoring/management plan was developed for the Kelly Island wetland restoration project and has been closely coordinated with DNREC and Federal resource agencies, including personnel from the Bombay Hook National Wildlife Refuge. Also, refer to the attached "goals table". Kelly Island has been eroding for many years. See the attached diagram that shows the 2001 shoreline superimposed on a 1926 photo. In 1926 the percent of sandy beach in the reach of shoreline that will be restored by the wetland restoration was 100%; in 2001 the amount of potential horseshoe crab spawning habitat is 49.9%. The project would restore this to 100%.

One of the goals of the monitoring/management plan for Kelly Island that was developed by this interagency group was to maximize feeding habitat for sanderlings, red knots, turnstones on the beach face. This would be done by creating spawning habitat for horseshoe crabs (See the general response to "Horseshoe Crab Impacts from Sand Placement"). Another goal (See "Goals Table" for Kelly Island attached) was to maximize habitat on a minimum of 20 acres for migratory shorebirds such as dowitchers, dunlin, semipalmated sandpiper, etc. in the marsh behind the sand berm.

The Corps is planning to monitor shorebird use at the Kelly Island restoration site and other sand placement areas in Delaware Bay for three years after construction. Pre-construction monitoring was done in 2001 (Harrington and McKeon, December, 2001). A draft report is attached. Pre-construction monitoring will continue in 2002.

Draft Report

Preconstruction Shorebird Monitoring at Kelly Island, Port Mahon and Broadkill Beach

Brian Harrington and Sea McKeon

December 2001

Delaware Bay Shorebird Studies, Spring 2001

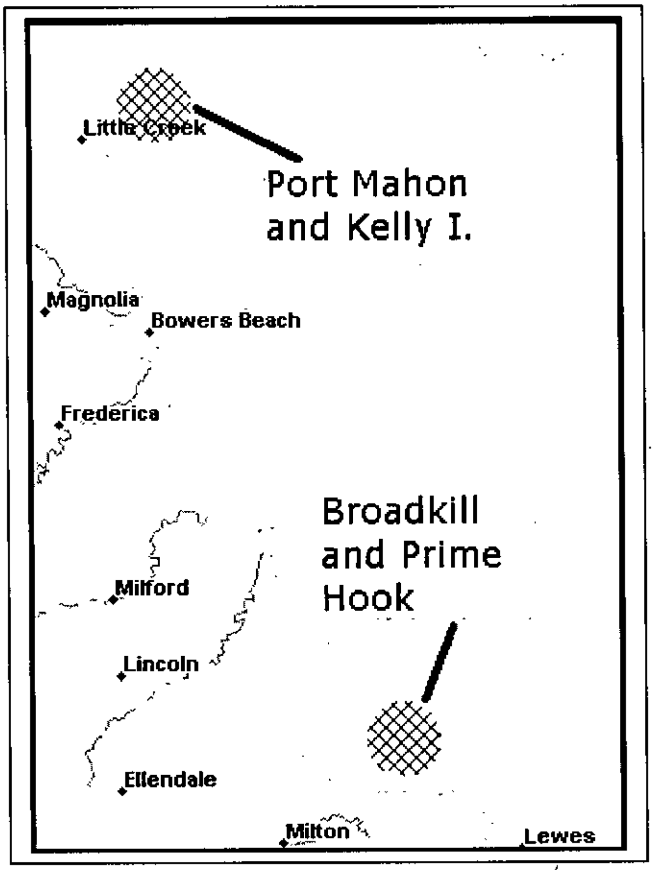
Prepared for the U.S. Army Corps of Engineers
By Brian A. Harrington and Sea McKeon
Manomet Center for Conservation Sciences
Manomet, MA 02345, December 2001

Exec. Summary

Introduction

Delaware Bay is recognized as one of the most critical stopovers worldwide for shorebirds migrating from their wintering grounds in Central and South America to their Arctic and Subarctic breeding grounds (WHSRN). Each spring shorebirds arrive by the hundreds of thousands on their staging grounds along the Delaware Bay to fuel up for the last leg of their northward journey. Their stopover coincides with the peak of horseshoe crab spawning. The millions of horseshoe crab eggs laid in the sand along bayshore beaches comprise an important food source for the migrants. Previous studies have called attention to apparent declines in the numbers of several shorebird species on their staging grounds (Howe et al. 1989, Clark et al. 1993, Harrington 1995) and point to the importance of habitat protection in the conservation of these species (Myers et al. 1987).

Figure 1. Location of study areas covered in this report.



The Army Corps of Engineers is proposing to use dredged material from deepening the Delaware River Federal Navigation Channel for shoreline restoration, including a restoration project at Kelly Island. Another project proposes sand placement at Broadkill beach.

Shoreline beaches on Delaware Bay are known to attract high numbers of shorebirds. In order to determine whether the shoreline restoration projects will benefit migratory shorebirds, it is necessary to collect and analyze quantitative and qualitative baseline data on shorebird use of the sites prior to construction. This report summarizes baseline work completed during May and June 2001. Principal emphasis was on documenting usage by shorebirds at the locations proposed for restoration, as well as at comparable abutting locations that are not slated for restoration. Rapid assessments also were made of common invertebrate animals in the same areas.

METHODS

A. Birds

Migratory shorebird surveys were conducted at four locations on the Delaware coast during May 2001 (Figure 1). Bird surveys were made with binoculars and a 20x telescope, and were conducted from vantage points that caused minimal disturbance to birds along the shoreline. Counting focused mostly on shoreline habitats, but flight-line counts of shorebirds moving between shoreline and nearby marshland habitats also were made near Port Mahon. Each shoreline section was divided into 25-31 subsections and marked. Counts were kept for each subsection. Species names, codes, and binomial names are shown in Appendix 4.

Knowing what tidal stage is best for counting shorebirds is important to designing sequel studies. Between two and eight shoreline surveys were made at each location each week. Shorebirds were counted at predicted mid-tide times (roughly half way between low and high tides) on each day that counts were made. A second count also was made either 3 hr before or 3 hr after the predicted mid-tide time, i.e. at approximately the time of predicted low or high tide. Correlation analysis was used to describe overall relationships between counts made at mid- versus low tide, and between counts made at mid- versus high tides. Analysis of Variance (SAS Institute 1999) was used to compare counts between the 4 study areas.

The methodology of the shoreline surveys closely followed that used by The Nature Conservancy and Manomet Center for Conservation Sciences for shorebird monitoring at Port Mahon in 1997 and 1999. The study areas (Appendix 1) are as follows:

1. Kelly Island (proposed for restoration): This area extends north along the shoreline from the mouth of the Mahon River for about 1.6 km to Deepwater Point.
2. Port Mahon: Surveyed as a future control site, the area is a 1 km stretch of shoreline just south of the mouth of the Mahon River where Port Mahon Road runs parallel to the Delaware Bay.
3. Broadkill Beach (proposed for restoration): The study area is a 4.4 km stretch of shoreline from Arizona Avenue south to the end of the paved road.
4. Prime Hook Beach: An equivalent area of habitat similar to Broadkill beach was surveyed as a future control site.

The study areas on Port Mahon and Broadkill beaches were divided into linear sections and marked. Similar linear segments were measured on

Kelly Island and Prime Hook Beach. Marker locations were also GPS-located for future reference (see Appendix 1).

To assess the levels of shorebird use of marshlands proximate to the study beaches, we counted birds moving between the marsh and the shore during peak migration weeks. These surveys were made near the north end of the Port Mahon study site for 10 minutes at dawn and/or dusk, times when shorebirds are expected to be moving to and from roosting sites.

B. Invertebrate animals.

At each of the 4 study locations (at the tideline in transect 1,10, 20, and 25), core samples were collected during visits to the study sites after May 15th. Samples were sorted with a standard 1 mm screen to identify macro-invertebrate taxa. Fifty-two samples were assessed. Cores were collected on site, screened in the field, and washed with salt water into suitable containers marked for date and location, refrigerated, and sorted within 36 hours.

Invertebrates were identified as follows:

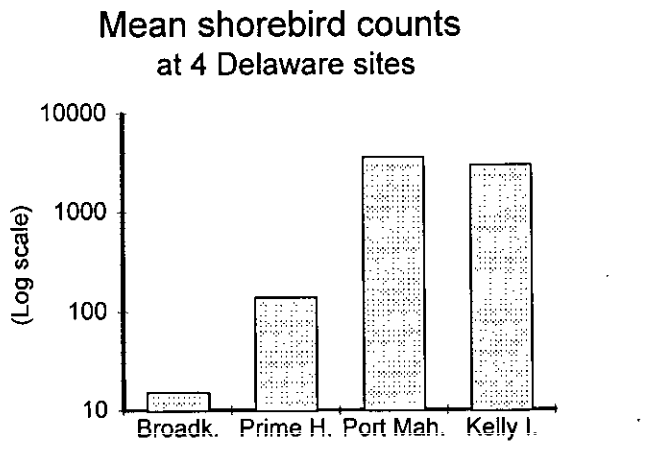
Gastropods and bivalves to genus (or better)
Amphipods and polychaete worms to family (or better)
Shrimps to genus (or better)
Crabs to genus (or better)
Insects and spiders to order (or better)
Scarce invertebrates (occurrence < 5% by head count) to class

Results

Part I. Bird studies.

A. Results, Overall shorebird counts

Figure 2. Mean counts of shorebirds at the four Delaware coastal study sites.

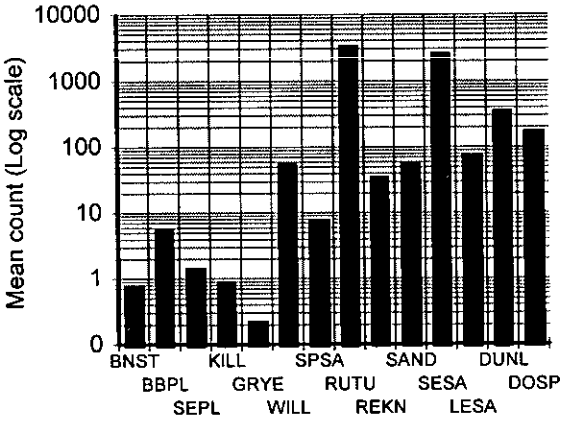


Counts of shorebirds were substantially and significantly ($P<0.001$) higher at the Port Mahon/Kelly Island pair of sites versus the Broadkill/Prime Hook pair of sites (Figure 2, note the log scale).

The overall numbers of shorebirds using the PAIRED study sites differed only slightly (and nonsignificantly) within the pair of locations near Port Mahon and within the pair near Prime Hook. Mean number of shorebirds counted at the Mahon pair was 3561 and 2965 versus 140 and 15 at the Prime Hook/Broadkill pair.

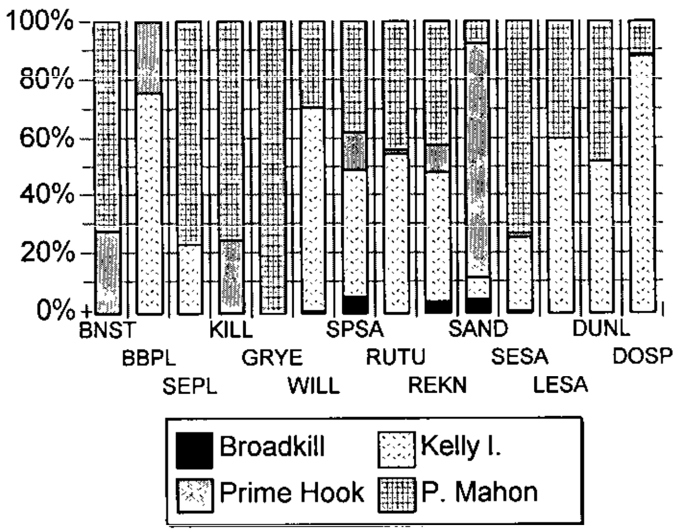
The relative abundance of the various species during the whole study is shown in Figure 3. As shown, two species (Ruddy Turnstone and Semipalmated Sandpiper) far outnumbered other species (88% of the grand mean); the two next most common species (Dunlin and dowitchers) comprised only 8% of the mean.

Figure 3. Relative abundance of shorebird taxa on 4 Delaware Bay beaches, Delaware, May 2001 (note log scale). See Appendix 4 for species codes and names).



Most species were found at the four study sites in numbers that were commensurate to the totals of all shorebirds counted at the sites, but a few stand out as having skewed occurrence (Figure 4).

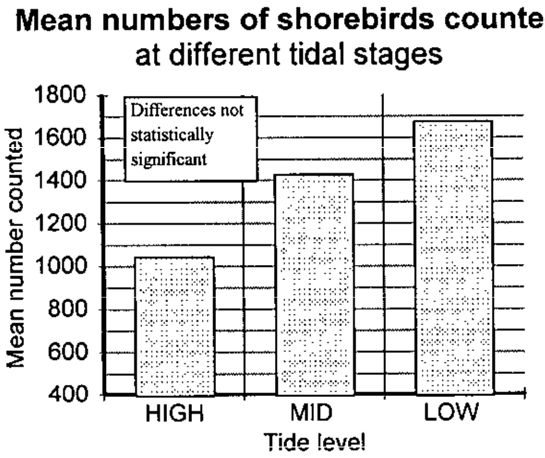
Figure 4. Relative occurrence of shorebird taxa at 4 Delaware Bay shore locations, Delaware, May 2001. See Appendix 4 for species names and codes.



For example, 70% of the Willets were found at Kelly Island (where slightly less than half of all shorebirds were counted). More than half of the Sanderlings were counted at Prime Hook, where only a small fraction of all shorebirds were counted. Most (>70%) of the Semipalmated Sandpipers were found at Port Mahon, whereas most of the Least Sandpipers (>60%) and dowitchers (> 88%) were at Kelly Island. In some other species, for example Killdeer or Black-bellied Plover, the percentages look skewed, but too few were found to make meaningful site comparisons. Finally, in only two species, Willet and Semipalmated Sandpiper, were the mean counts statistically significantly different (P <0.05) among the four locations.

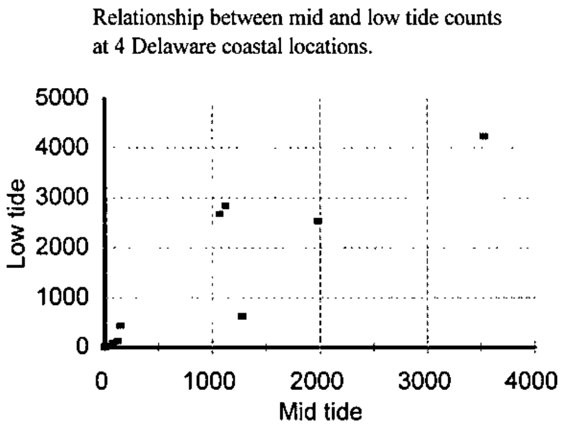
B. Results, counts in relation to tides.

Figure 5.



Numbers of shorebirds counted tended to be lower at high tides than at low tides (Figure 5), but the difference was significant only at Port Mahon; in aggregate there was no significant difference of mean counts made at low, mid, or high tide. However, given the large difference of numbers counted at the 3 locations we would not expect to find differences of the means of counts combined from all sites.

Figure 6. Correlation between mid- and low tide counts (r=0.91).



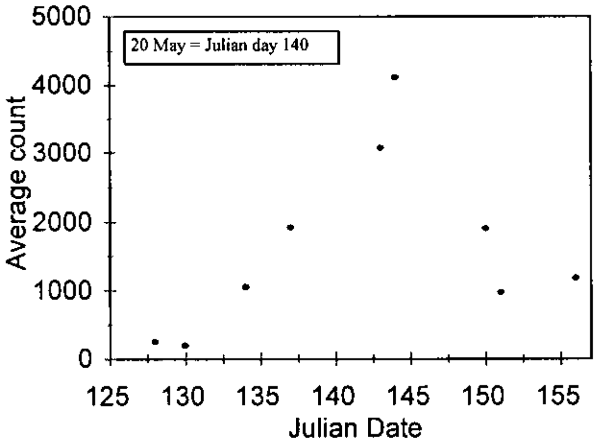
Relationship between mid and low tide counts at 4 Delaware coastal locations.

We found a close correlation between counts made at low tides versus mid-tides (Figure 6, r=0.91); the correlation between counts made at mid- and high tides was somewhat lower (r=0.77).

The overall results show the best time for counting is at lowest tides. The results also suggest that some shorebirds may use habitats away from the beaches during higher tidal phases.

C. Results, Migration chronology.

Figure 7. Mean combined counts of shorebirds by date at Port Mahon and Kelly Island.



The chronology of the 2001 Spring shorebird migration at the study sites (Figure 7) shows a noticeable build-up beginning between May 10th and 14th. Numbers evidently then increased steadily until May 25th before declining sharply sometime between then and May 30th.

Two species, Ruddy Turnstone and Semipalmated Sandpiper, predominated in these counts, and both showed an essentially similar pattern.

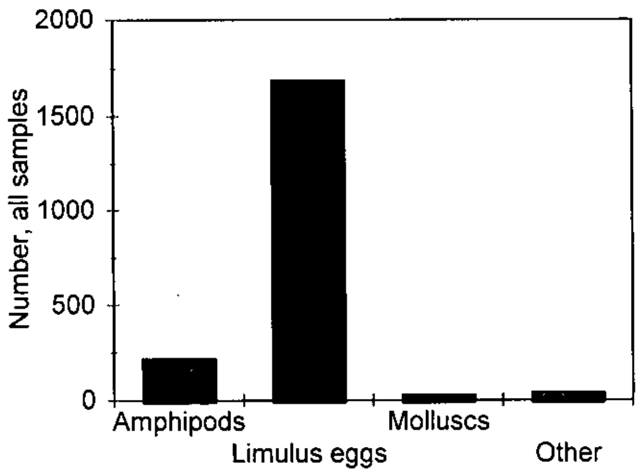
D. Flight-line counts. Dawn and dusk observations (detailed in Appendix 2) did not reveal any strong pattern of movement into and out of marshlands (Table 1). In part this was due to insufficient sampling effort. Most flying shorebirds were moving along the coast; the small numbers moving towards or away from the shoreline followed the course of the Mahon River.

Table 1. Dawn and dusk counts of shorebirds flying along the Delaware Bay shoreline and up/down the Mahon River, May 2001. See Appendix 4 for species names and codes

	RUTU	SESA	DOSP	Total
Dawn, upstream	27	0	42	69
Dawn, downstream	64	32	6	102
Dusk, upstream	51	6	14	71
Dusk, downstream	12	0	0	12
				254
Dawn, coast sw	322	260	0	582
Dawn, coast ne	643	1668	58	2369
Dusk, coast sw	262	1133	48	1443
Dusk, coast ne	188	122	2	312
				4706

Part II. Invertebrate results.

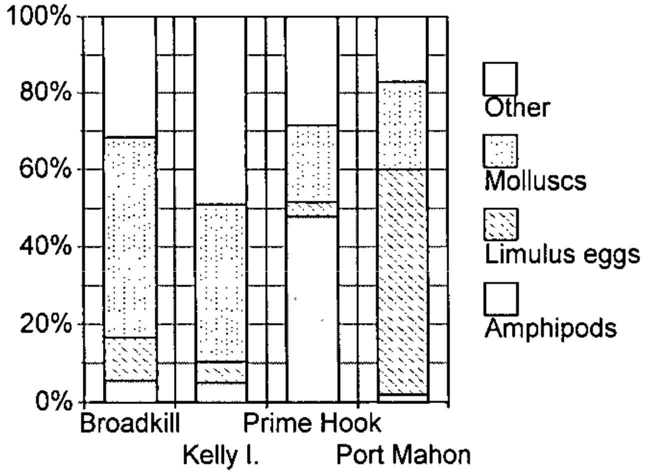
Figure 8. Relative counts of invertebrates in 4 Delaware Bay study areas, May 2001.



The most common "invertebrate" found in the sampling were horseshoe crab (*Limulus polyphemus*) eggs (Figure 8); the next most common invertebrates were amphipods, mostly of the genera *Gammarus* and *Haustorius*. Other forms of potential invertebrate shorebird food were relatively scarce.

Because the goal of the invertebrate sampling was to simply characterize the types present, any quantitative evaluation of the samples collected could well be inaccurate. However, crude comparisons of the percentages of each category found in the different study locations (Figure 9) suggest that there are differences in the invertebrate assemblage between the sites. This was especially evident for the most abundant item, the *Limulus* eggs.

Figure 9. Relative occurrence (based on mean counts) by four invertebrate categories in four Delaware Bay study sites, May 2001.



Discussion

This project was oriented to provide baseline information on shorebird use of two areas on the Delaware Bay shore, each one of which was subdivided into 2 sections, one of which is slated for restoration efforts and one of which is not. The premise underlying this design was that one of the sites in each pair would act as a 'control' in comparisons that would be made after restoration efforts were completed. A key question is whether our selection of 'subsites' was appropriate. We have evaluated our information with respect to bird numbers, relative species abundance, and in a very limited way (not adequately quantified), invertebrate animal presence.

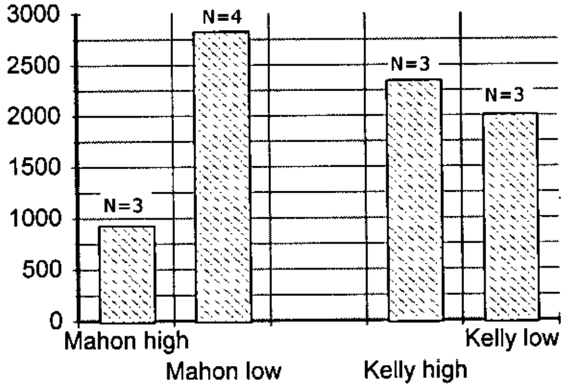
It is important to stress that our counts do not necessarily represent other Delaware Bay shoreline beaches or other habitats such as impoundments behind the beaches. We have included a single graph in Appendix 3 to reinforce this statement; it shows dramatically different species composition in impoundment versus beachfront habitats from some brief survey work completed in 1997. It also shows very different species ratios on beachfront habitats than we found in the 2 areas studied in May 2001. Although we cannot evaluate the causes underlying these differences, we believe that they are derived from differences in the ways that shorebirds are using different habitats (eg. mudflats of impoundments versus sandy beaches) and from differences of the food resources in those habitats.

We believe that the bird counts from May/June 2001 provide a good basis for describing the numbers of shorebirds using the 4 shoreline sections. The counts at the southern (Broadkill/Prime Hook) location were similar to each other, and the northern counts (Port Mahon/Kelly Island) were similar to each other. In contrast, the northern pair of sites had much higher counts than the southern pair.

The level of invertebrate sampling that we were able to collect was insufficient to reliably quantify differences of the invertebrate animal populations between the sites, but it is clear that horseshoe crab eggs were far and away the most available food item, and that they were far more abundant at Port Mahon than at the other three locations.

Figure 10

Mean shorebird counts at high and low tides at Port Mahon and Kelly Island



Field time also was inadequate for documenting activities of shorebirds, including prey selection, while they were being counted, but it was clear that for most species Kelly Island was used principally as a roosting site whereas the other three areas were used primarily as foraging sites. If Kelly I wwas used principally for roosting, we would expect greater numbers of shorebirds to have been counted there at times when foraging habitats were restricted or inaccessible, i.e. during high tides. We have only limited samples for evaluating this, and they show the expected pattern (Figure 10); however, the differences are not statistically significant, perhaps due to the small sample sizes.

Ideally the pairs of sites we selected for this work would have been identical with respect to bird numbers, species composition, activity budgets of the birds, and accessibility of prey populations. This, of course, was not the case (Table 2). Perhaps the most important disparity was the difference of foraging activities between the Port Mahon and the Kelly Island sites. It remains to be seen whether this difference will be maintained after restoration work is completed at the Kelly Island site, i.e. whether it will continue to be principally used by shorebirds as a roosting site or whether

Table 2. Estimated similarity of key habitat components within two pairs of Delaware Bay shoreline habitats (see Appendix one for location information).

	Comparable bird numbers?	Comparable bird foraging activities	Comparable invertebrates	Similar substrates	Comparable human activity
Port Mahon/Kelly Island	yes	no	no	no	no
Prime Hook/Broadkill	yes	yes	marginally ?	yes	no

alterations to it will make it an attractive foraging site. Another consideration is human activity at the sites. As shown (Table 2), human activities were not comparable between the paired sites at both the northern and the southern locations. At the northern location the 'control' site (Port Mahon) is substantially more accessible to human activities than at the restoration site (Kelly Island). This did not appear to be a major issue in 2001 with respect to numbers of birds counted. However, human activities may have contributed to the lower counts at the Broadkill versus Prime Hook locations, but we had insufficient data to analyze for this.

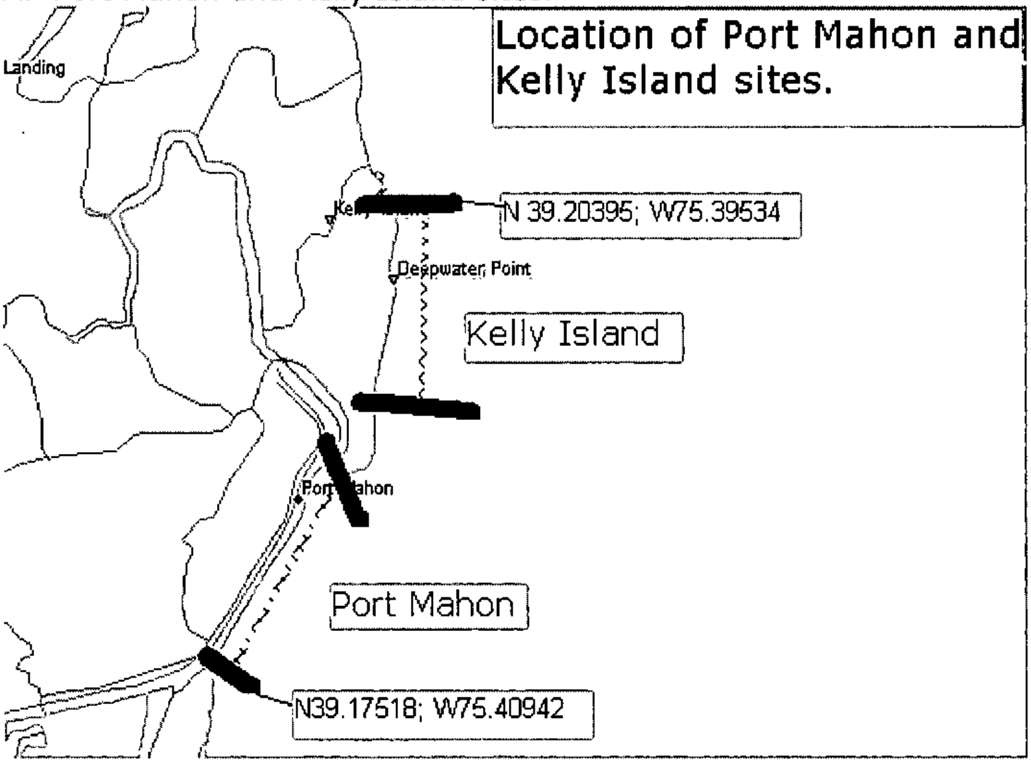
Recommendations.

Based on our work in 2001, we believe that work in later phases of this project can be improved by:

- Increased design and time given to the invertebrate sampling, including observations from locations heavily used by shorebirds but not necessarily appropriate as study sites for comparing effects of restoration activities, for example foraging habitats at the mouth of the Mispilllion River. (Goal would be to better understand characteristics of heavily used locations to improved restoration design) [work would require an additional, full-time field hand]
- Collection of data on shorebird foraging rates and success rates [would require an additional half-time field hand]
- Collection of data on numbers of birds foraging/not foraging during each count series (relatively small increased time requirement)
- Collection of data on shorebird prey preferences [work would need to commence 3 weeks prior to major shorebird arrival period, and continue through mid-June, and would require an additional half-time field hand].

Appendix 1. Locations of four Delaware study sites evaluated for shorebird usage, May 2001.

A. Port Mahon and Kelly Island sites.



B. Broadkill and Prime Hook sites.

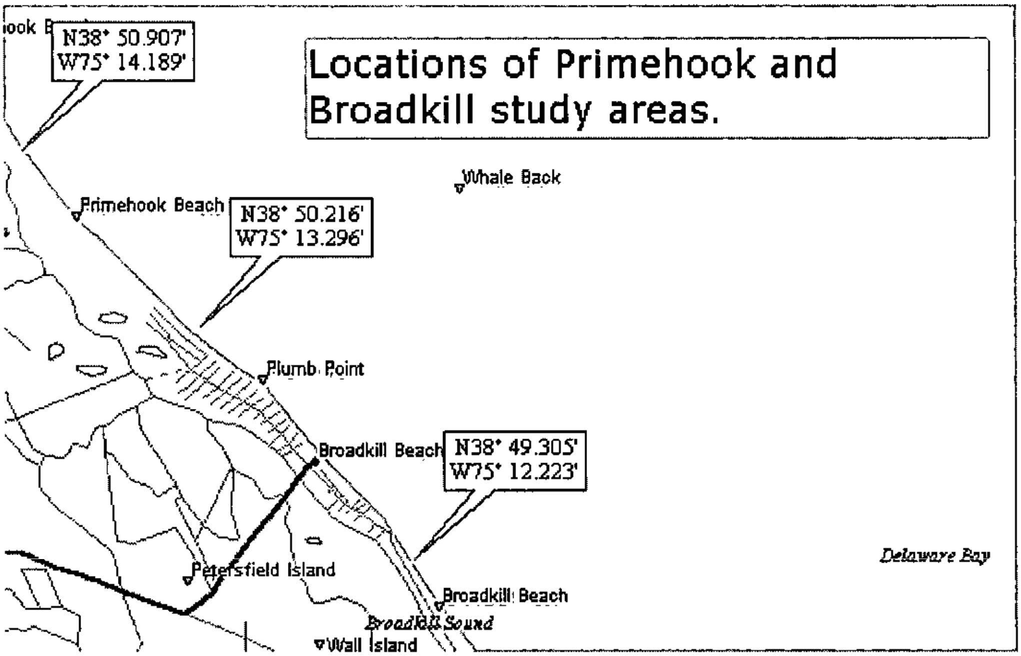


Table A1. Locations of transect markers.

Port Mahon Rd.

	Deg. north	Deg. west	min North	Min West
1	39.17518	75.40942	10.51	24.57
2	39.17559	75.40884	10.54	24.53
3	39.17596	75.40832	10.56	24.50
4	39.17638	75.40790	10.58	24.47
5	39.17689	75.40753	10.61	24.45
6	39.17720	75.40726	10.63	24.44
7	39.17766	75.40691	10.66	24.41
8	39.17814	75.40654	10.69	24.39
9	39.17859	75.40614	10.72	24.37
10	39.17905	75.40577	10.74	24.35
11	39.17952	75.40539	10.77	24.32
12	39.17999	75.40502	10.80	24.30
13	39.18044	75.40464	10.83	24.28
14	39.18091	75.40426	10.85	24.26
15	39.18137	75.40389	10.88	24.23
16	39.18185	75.40349	10.91	24.21
17	39.18231	75.40314	10.94	24.19
18	39.18278	75.40275	10.97	24.16
19	39.18324	75.40238	10.99	24.14
20	39.18370	75.40203	11.02	24.12
21	39.18419	75.40176	11.05	24.11
22	39.18472	75.40157	11.08	24.09
23	39.18525	75.40139	11.12	24.08
24	39.18578	75.40121	11.15	24.07
25	39.18630	75.40096	11.18	24.06
26	39.18679	75.40064	11.21	24.04
27	39.18725	75.40028	11.23	24.02
28	39.18772	75.39990	11.26	23.99
29	39.18818	75.39952	11.29	23.97
30	39.18866	75.39917	11.32	23.95
31	39.18913	75.39884	11.35	23.93

Kelly Island

	Deg. north	Deg. west		
1	39.19164	75.39620	11.50	23.77
2	39.19219	75.39637	11.53	23.78
3	39.19271	75.39634	11.56	23.78
4	39.19323	75.39627	11.59	23.78
5	39.19377	75.39606	11.63	23.76
6	39.19432	75.39601	11.66	23.76
7	39.19480	75.39606	11.69	23.76
8	39.19533	75.39606	11.72	23.76
9	39.19585	75.39594	11.75	23.76
10	39.19641	75.39609	11.78	23.77
11	39.19694	75.39630	11.82	23.78
12	39.19737	75.39670	11.84	23.80
13	39.19793	75.39686	11.88	23.81
14	39.19848	75.39687	11.91	23.81
15	39.19902	75.39681	11.94	23.81
16	39.19956	75.39681	11.97	23.81
17	39.20010	75.39673	12.01	23.80
18	39.20062	75.39670	12.04	23.80
19	39.20119	75.39651	12.07	23.79
20	39.20161	75.39643	12.10	23.79
21	39.20192	75.39635	12.12	23.78
22	39.20243	75.39613	12.15	23.77
23	39.20304	75.39533	12.18	23.72
24	39.20363	75.39525	12.22	23.72
25	39.20395	75.39534	12.24	23.72

Broadkill

1	38.82174	75.20362	49.3044	12.22
2	38.88217	75.20407	52.9302	12.24
3	38.82277	75.20464	49.3662	12.28
4	38.82318	75.20497	49.3908	12.30
5	38.82370	75.20551	49.422	12.33
6	38.82414	75.20606	49.4484	12.36
7	38.82455	75.20663	49.473	12.40
8	38.82492	75.20708	49.4952	12.42
9	38.82543	75.20763	49.5258	12.46
10	38.82589	75.20811	49.5534	12.49
11	38.82647	75.20879	49.5882	12.53
12	38.82701	75.20944	49.6206	12.57
13	38.82741	75.20991	49.6446	12.59
14	38.82790	75.21063	49.674	12.64
15	38.82861	75.21156	49.7166	12.69
16	38.82930	75.21231	49.758	12.74
17	38.83013	75.21342	49.8078	12.81
18	38.83070	75.21387	49.842	12.83
19	38.83116	75.21440	49.8696	12.86
20	38.83167	75.21499	49.9002	12.90
21	38.83215	75.21544	49.929	12.93
22	38.83265	75.21595	49.959	12.96
23	38.83314	75.21638	49.9884	12.98
24	38.83359	75.21705	50.0154	13.02
25	38.83404	75.21756	50.0424	13.05
26	38.83450	75.21811	50.07	13.09
27	38.83503	75.21877	50.1018	13.13
28	38.83549	75.21946	50.1294	13.17
29	38.83590	75.22009	50.154	13.21
30	38.83647	75.22090	50.1882	13.25
31	38.83690	75.22147	50.214	13.29

Prime Hook

1	38.83778	75.22286	50.2668	13.37
2	38.83827	75.22367	50.2962	13.42
3	38.83882	75.22470	50.3292	13.48
4	38.83928	75.22527	50.3568	13.52
5	38.83990	75.22606	50.394	13.56
6	38.84023	75.22656	50.4138	13.59
7	38.84054	75.22693	50.4324	13.62
8	38.84095	75.22743	50.457	13.65
9	38.84132	75.22801	50.4792	13.68
10	38.84165	75.22843	50.499	13.71
11	38.84211	75.22922	50.5266	13.75
12	38.84251	75.22977	50.5506	13.79
13	38.84310	75.23040	50.586	13.82
14	38.84355	75.23094	50.613	13.86
15	38.84400	75.23162	50.64	13.90
16	38.84457	75.23223	50.6742	13.93
17	38.84496	75.23265	50.6976	13.96
18	38.84551	75.23336	50.7306	14.00
19	38.84606	75.23398	50.7636	14.04
20	38.84623	75.23472	50.7738	14.08
21	38.84659	75.23455	50.7954	14.07
22	38.84701	75.23502	50.8206	14.10
23	38.84751	75.23547	50.8506	14.13
24	38.84797	75.23590	50.8782	14.15
25	38.84851	75.23642	50.9106	14.19

Appendix 2. Dawn and dusk counts of shorebirds moving along the Delaware Bay shoreline at Port Mahon, and counts of shorebirds moving up and down the Mahon River, May 2001. (Species codes are shown in Appendix XX).

8 May. The dusk survey along Port Mahon Rd. had 3 large flocks of RUTU moving north along the coastline, and some 45 SBDO moving upstream along the Mahon River (northwest).

14 May, Kelly Island. The 10 minute mud flat survey yielded very little: 4 LESA at mid-tide and a flock of 30 DUNL at high tide.

17 May, Port Mahon. The 10-min marsh scan revealed 4 GRYE, 6 SBDO, 130+ DUNL

23 May, Port Mahon marsh scan, 10 min. Flying sw along shoreline, 70 SESA, 42 RUTU, 17 SBDO, 13 DUNL. Courtship flights, 4 WILL.

Dusk scan. RUTU: 214 se along shore
72 nw along shore
12 downstream along Mahon R.
38 Upstream along Mahon R.

SBDO: 48 se along shoreline
2 nw along shore
14 upstream along Mahon R.

SESA: 320+ se along shoreline
54 nw along shoreline

24 May, Dawn scan. RUTU: 322 se along coast
64 downstream along Mahon R.
SESA: 1025 nw along shore (apparently from impoundment)
14 se along coast
SBDO 32 downstream along Mahon R.
9 NW from impoundments
BBPL 6 flying high NE, from inland.

30 May, Dawn scan. RUTU: 643 moving N along coast
27 nw along Mahon R.
SBDO: 49 N. along coast
43 nw up Mahon R.
SESA: 1341 N. along coast
246 S. along coast
6 downstream along Mahon R.

Mid-day scan: GRYE: 6 nw along shore

WILL: 4 displaying

31 May, Dusk.

RUTU: 48 sw along coast
24 ne along coast
13 upstream along Mahon R.

SESA 542 sw along coast
6 upstream along Mahon R.

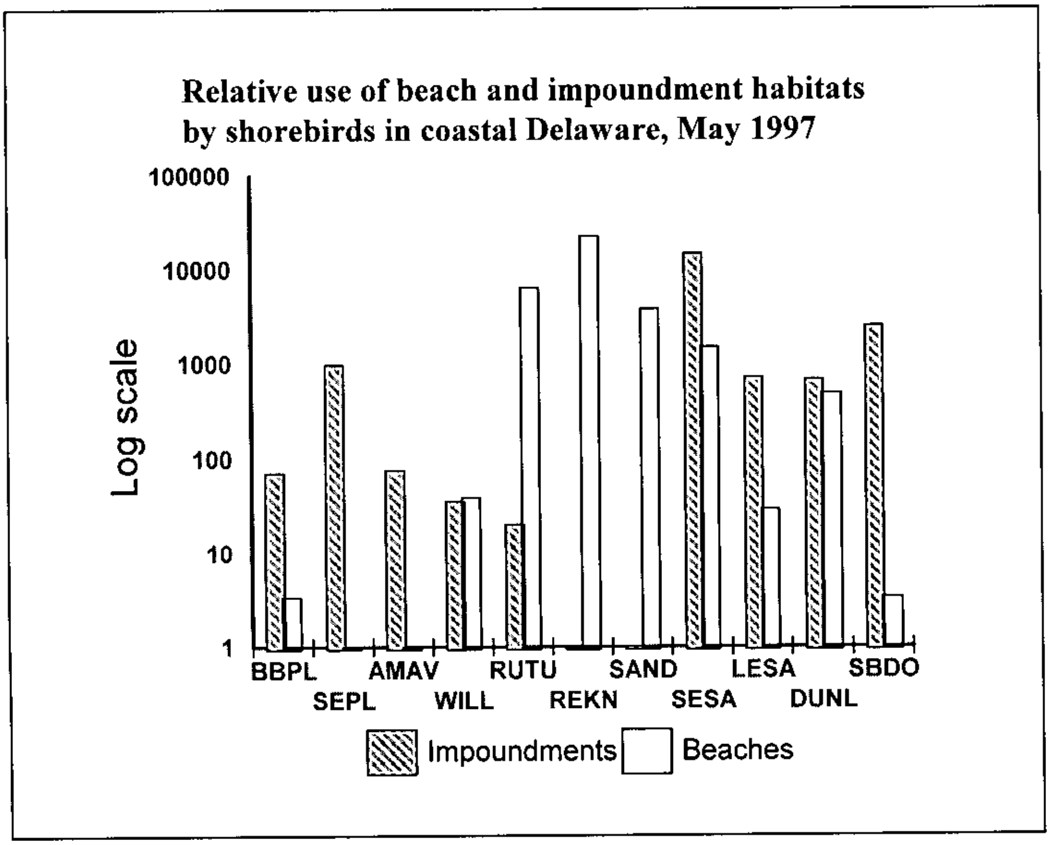
5 June, 10-min Marsh scan

WILL: 6 displaying
SBDO: 6 flying north

Dusk Survey

SESA: 271 sw along coast
68 ne along coast
RUTU: 104 ne along coast

Appendix 3.



Relative use of beach and impoundment habitats by shorebirds in coastal Delaware, May 1997

Appendix 4. Species codes, common and binomial names used in this report.

Code	Common name	Binomial name
BBPL	Black-bellied Plover	*Pluvialus squatarola*
PIPL	Piping Plover	*Charadrius melodus*
SEPL	Semipalmated Plover	*C. semipalmatus*
KILL	Killdeer	*C. vociferus*
BNST	Black-necked Stilt	*Himantopus mexicanus*
GRYE	Greater Yellowlegs	*Totanus melanoleuca*
LEYE	Lesser Yellowlegs	*T. flavipes*
WILL	Willet	*Catoptrophorus semipalmatus*
SPSA	Spotted Sandpiper	*Actitis macularia*
RUTU	Ruddy Turnstone	*Arenaria interpres*
REKN	Red Knot	*Calidris canutus*
SAND	Sanderling	*C. alba*
SESA	Semipalmated Sandpiper	*C. pusilla*
LESA	Least Sandpiper	*C. munitilla*
DUNL	Dunlin	*C. alpina*
DOSP	Dowitcher spp.[a]	*Limnodromus* spp.

[a] All or almost all were Short-billed Dowitchers

Delaware River Main Channel Deepening Project
Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
Use dredged material to create and establish 60-acre tidal wetland that provides habitat for native species (horseshoe crab, shorebirds, fish, *Spartina*, waterfowl) and prevents continued erosion of Kelly Island without significant adverse impacts to contiguous habitats.	Prevent deleterious effects to adjacent shellfish (oyster) populations and habitat.	No significant increase in anaerobic (smothered) conditions of shellfish beds when compared to pre-project conditions in the same locations.	Using sediment profiling camera with plan view attached, develop reference photographs of existing oysters so that reasonable color comparisons can be made in the future. Reference photos of anaerobic sediments will be obtained from existing imagery files. Photos will be taken quarterly during preconstruction and construction and for three years following construction. Transects will be set up between Kelly Island and the nearest oyster areas as well as control transects both north and south of Kelly Island.	1. Validate cause of anaerobic conditions to determine if project related. 2. Investigate restoration technology and methods. 3. Restore oyster habitat.
		No transport of placed sand from project onto nearby oyster beds or leases.	Sediment grab sampling of bay bottom between project and oyster beds (Drum Bed, Silver Bed, and Pleasanton's Rock) once during preconstruction, and quarterly for one year after construction when the need for future sampling will be reevaluated. In addition, grab samples will be taken between the project and the nearest oyster beds after major storms, which is defined as either (1) a tide based storm where post-storm surveys shall be obtained when water levels at Lewes and/or Port Mahon equal or exceed +7.5 ft above MLLW during a storm event, regardless of whether there are erosion impacts detected/observed at the Kelly Island berm; or (2) Observation-based, where post storm surveys shall be obtained if there is apparent scarping or shoreline retreat of the Kelly Island berm, even if tide gage measurements at Lewes and Port Mahon fail to equal or exceed +7.5 ft MLLW. Samples taken after construction will be compared to samples taken prior to project construction. This assumes that the sand from the project will be (Continued on next page)	1. Alternatives will be developed to divert sediment transport away from oyster grounds. 2. Construct diversions. 3. If diversions are not successful, investigate restoration technology and methods. 4. Restore oyster habitat.

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
			distinctly different from the pre-project bay bottom and will therefore be traceable. Within one year before construction, side scan sonar or a similar imaging technology will be used to characterize the bay bottom between Kelly Island and the nearest oyster areas.This will be repeated one year after construction..Transects will be set up between Kelly Island and the nearest oyster areas as well as control transects both north and south of Kelly Island.	
		No significant increase in suspended solids from fine grained material contained by the berm. A significant increase would be more than 25% above the yearly preconstruction mean.	Install a turbidity measuring instrument. Data will be gathered for one year prior to the construction of Kelly Island, during construction, and for three years after construction. In addition quarterly inspections will be done to inspect the berm for breaches.	Repair berm. Restore oyster habitat.
	Silt retained for periods between maintenance of the offshore sand dike and other features.	Shoreline retreat rate of less than 14 ft per year on average over 10-year period after construction. Additionally, equilibration of dike slope in first year should not result in shoreline recession of greater than 30 ft. (WES design criteria).	Annual cross-sectional surveys of offshore dike from landward edge of crest of dike to offshore toe of slope. Annual aerial photographs at 1:2400 scale.	Replenish cross-section of dike with sand if deemed necessary by the Corps and DNREC. Evaluate reasons for accelerated erosion. Mitigate with appropriate volume of sand to restore berm to expected condition.
	Contain silty dredged material.	Sufficient capacity in site to contain 200,000 cubic yards of fine sediments mixed with an additional 500,000 cubic yards of sandy sediments.	Observation of placement operation to be sure that placement of sand over silts reasonably mixes in the site. Water quality standards in the discharge from the site should not exceed those specified prior to dredging. During disposal of dredged material into the wetland restoration area, water quality will be monitored at the discharge pipes with an automatic sampler. Emphasis will be on monitoring total suspended solids.	If water quality standards are not met, dredging operation will be modified to bring discharges within limits by methods such as increasing the ponding period, or decreasing the discharge rate.

Delaware River Main Channel Deepening Project

Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
	Average annual sediment transport rate away from structure should not exceed 35,000 cubic yards.	Annual topographic and bathymetric surveys of offshore sand dike show change in dike volume not exceeding 35,000 cubic yards per year. (Some sediment will move on and offshore but can be accounted for in the volume calculations. Interest here is sand lost from the project to the north or south.)	Annual cross-sectional surveys of offshore dike from landward edge of crest of dike to offshore toe of slope. Annual aerial photographs at 1:2400 scale.	Assess cause and determine appropriate action .
	Created marshes similar to native low marshes on 40 acres (including hummocks).	Similar to adjacent reference marsh located on northern third of Bombay Hook tidal marsh.	1 year after tidal exchange established, survey area to assess natural plant recruitment using random or systematic 1-m plot methods used by the National Wildlife Refuge to be sure desired plants are present.	Assess cause and determine appropriate action.
			3 years after tidal exchange established, within +/- 3% species composition similarity with reference marsh or a desirable species composition as determined by the Corps, DNREC, and Federal Resource Agencies. In the creation of the vegetated low marsh, flexibility will be used when evaluating if the marsh is a success. Although the standard of having the vegetation within +/- 3% of the reference marsh will be used as a guideline, the Corps, DNREC and the Federal resource agencies will determine if the marsh is a "success" after vegetation has become established.	Consider modification of topography, eradication of undesirable species, planting of desired species, modification of water flow characteristics, and protection against geese and other animals eating the plants.
	Establish 50 ft width of beach grass on crest of berm/dike.	75% survival after 1 year from planting.	Field surveys for survival of planted stems yearly for three years.	More plantings of beach grass.

Delaware River Main Channel Deepening Project

Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
	Optimize habitat for use by summer and winter flounder juveniles. Although the objective of maximizing summer and winter flounder habitat will focus on these species, an attempt will be made to create a diverse aquatic community that is similar to that which exists in the adjacent reference tidal marsh waterways.	Establish at least 1000 linear feet of tidal channel at least 0.1 m deep at mean low water (NMFS, 1999) within 1 year after tidal exchange is established. The width of the channel will be determined to maximize tidal exchange without causing erosion to the sides of the channels.	Yearly air photos. Seining in new and reference channels of created marsh and adjacent tidal marsh waterways in late spring one year after tidal flow is established to determine if species are present.	Assess cause and determine appropriate action such as modification of topography and modification of water flow characteristics.
	Maximize habitat for horseshoe crabs.	At mean high water line: 1. Depth of sand is at least 16 inches. 2. Sand has 2 to 6 % moisture at 3.7 in. below the surface. 3. Beach slope is 5 to 9 %. 4. Grain size is between 0.5 and 1.0 mm at 3.7 inches below the surface.	Measure variables as described in Brady and Schrading (1996) every 500 feet along the berm face, biweekly between 1 May and 1 July, for three years after construction. Measure density of horseshoe crabs eggs at same locations following protocol that is being developed by the Atlantic States Marine Fisheries Commission.	1. Adding sand to berm. 2. Grade berm.
	Insignificant horseshoe crab mortality due to design of project. For example, in or around structures, or in the marsh (if they were to migrate over the sand dike).	Less than 10 % of crabs trapped in structures or on landward side of berm.	Yearly visual observation and counts of crabs during spawning season. Comparisons will be made between the project and other natural areas where mortality occurs.	Sand fence at edge of vegetated top of berm.

Delaware River Main Channel Deepening Project
Kelly Island - Wetland Restoration/Protection: Goals Table

1-Nov-00

Goal	Objectives	Performance Standard	Measurement Method	Remedial Action
	On beachface, maximize feeding habitat for sanderlings, red knots, turnstones.	Since the main food for these species in Delaware Bay is horseshoe crab eggs, if horseshoe crab habitat is maximized, feeding habitat for these species will be as well.		
	In marsh, maximize habitat on a minimum of 20 acres for migratory shorebirds such as dowitchers, dunlin, semiplamated sandpiper, etc.	Less than 25% vegetative cover (Manomet, 1999) with 75% in a combination of mud flats and shallow water less than 12 cm at mean low water (Harrington, Undated).	Yearly air photos. Observations and counts of species using area during spring and fall migrations (could be incorporated into the aerial census being done by NJ and DE).	Assess cause of failure and determine appropriate action such as modification of topography and modification of water flow characteristics.
	Limit invasion of *Phragmites* Create marshes similar to native low marshes (including hummocks).	Less than 1% populated by *Phragmites* in monotypic stands in the marsh, as well as the berm and back dike.	Yearly air photos. Ground surveys.	Control of *Phragmites* using methods such as spot treatment of herbicides or water level manipulation.

Kelly Island Shorelines
1926 Aerial Photo

SHORTNOSE AND ATLANTIC STURGEON

SHORTNOSE AND ATLANTIC STURGEON CONCERNS

NUMBER OF EXHIBIT/COMMETOR:73, 77, 111, 116, Clyde Roberts

BACKGROUND

Impacts to the shortnose sturgeon were discussed in the EIS (1992) **(EXHIBIT 7)** in Section 5.1.10:

> *"The shortnose sturgeon is a Federally endangered species of fish in the Delaware River. Spawning and nursery habitats for this species are located well upstream of the project area. This species may migrate through the project area during the spring and fall. Migrations are protected through established seasonal dredging restrictions. The Corps will continue its efforts to coordinate the project with the National Marine Fsheries Service, with regard to this species."*

Impacts to the shortnose sturgeon were also discussed in the SEIS (1997) (Exhibit 3) in Sections 10.5.2.3 and 10.5.2.4:

"10.5.2.3 Shortnose Sturgeon

The Philadelphia District will continue to follow the recommended dredging windows established by the Delaware Basin Fish and Wildlife Management Cooperative:

Hydraulic dredging, is prohibited from the Delaware Memorial Bridge to the Kinkora Range in non-Federal areas between April 15th and June 21st. No hydraulic dredging restrictions exist for the Federal channel or anchorages.

Bucket dredging, overboard disposal, and blasting are prohibited from the Delaware Memorial Bridge to the Betsy Ross bridge in all areas between March 15th and May 31st. From the Delaware Memorial Bridge to Trenton overboard disposal and blasting are prohibited, but bucket dredging is permitted between June 1st and November 30th.

10.5.2.4 Incidental Take Statement

Section 7(b)(4) of the Endangered Species Act requires that, when a proposed agency action is found to be consistent with section 7(a)(2) of the act and the proposed action may incidentally take individuals of listed species, NMFS must issue a statement that specifies the impact of any incidental taking of endangered or threatened species. Only incidental takings caused by activities approved by the agency, that are identified in the Biological Opinion and that comply with the specified reasonable and prudent alternatives, and terms and conditions, are exempt from the takings prohibition of section 9(a), pursuant to section 7(o) of the ESA.

For projects within the Philadelphia District, the anticipated incidental take by injury or mortality is as follows:

three (3) shortnose sturgeon; and

four (4) loggerhead, or one (1) Kemp's ridley or green sea turtle.'

The Biological Opinion prepared by the NMFS and dated February 2, 2001 **(EXHIBIT 22)** states:

"After reviewing the current status of the species discussed herein, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the NMFS' biological opinion that the proposed action may adversely affect but is not *likely to jeopardize the continued existence of* the Delaware River subpopulation of shortnose sturgeon. No critical habitat has been designated for this species, therefore, none will be affected."

The Biological Opinion also lists a number of reasonable and prudent measures that are necessary and appropriate to minimize impacts of incidental take of endangered shortnose sturgeon. These will be followed by the Corps when the project is constructed, and incorporated into the blasting plans and specifications and contract(s) that are awarded.

THE FOLLOWING CONCERNS HAVE BEEN RAISED:

Comment.

- **a.** What formal commitments have been made by the Corps of Engineers to identify Atlantic sturgeon spawning areas?

Response.

The Corps of Engineers has made no formal commitments to specifically identify spawning areas, but is willing to continue to work with DNREC to minimize the probability of adverse impacts to Atlantic sturgeon. We have agreed to monitor for Atlantic sturgeon between 1 May and 1 October for hopper dredging between Bombay Hook, DE and the PA/DE boundary as requested by DNREC. The protocol would be the same as that described for sea turtles. Attached is a typical scope of work that would be part of a dredging project to monitor sea turtles

Comment.

- **b.** Blasting will jeopardize the continued existence of the shortnose sturgeon in the Delaware River because no one knows where the juveniles are during the blasting period. Information suggests that they may be in the blasting area. The Corps' 3D Hydrodynamic salinity model did not include the months when blasting would be done, and cannot predict salinity levels at the blasting area for that time period. The conditions by the NMFS for protection of shortnose sturgeon during blasting are not adequate.

Response.

As has been previously noted the Biological Opinion prepared by the NMFS and dated February 2, 2001 **(SEE EXHIBIT 22)** states:

"After reviewing the current status of the species discussed herein, the environmental baseline for the action area, the effects of the proposed action and the cumulative effects, it is the NMFS' biological opinion that the proposed action may adversely affect but is not likely to jeopardize the continued existence of the Delaware River subpopulation of shortnose sturgeon. No critical habitat has been designated for this species, therefore, none will be affected."

The Biological Opinion also lists a number of reasonable and prudent measures that are necessary and appropriate to minimize impacts of incidental take of endangered shortnose sturgeon. These will be followed by the Corps when the project is constructed, and incorporated into the blasting plans and specifications and contract(s) that are awarded.

The Biological Opinion lists a number of conservation recommendations. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The NMFS has determined that the rock-blasting portion of the Deepening Project as proposed is not likely to jeopardize the continued existence of endangered shortnose sturgeon located in the project area. To further reduce the adverse effects of the blasting project on listed species, the NMFS recommends that the Corps implement these conservation measures. The Corps, in coordination with NMFS, is presently helping to fund a study with the primary purpose to obtain an estimate of the shortnose sturgeon population in the Delaware River. The study also includes sampling for juveniles. The three-year study was completed in 2001. The study was not able to adequately sample for juvenile shortnose sturgeon because gear to sample for juveniles was beyond the funding levels of this study (O'Herron J. C. Personal Communication", January 2002). The Corps will consider funding other studies suggested by the NMFS.

The following discussion explains where the information concerning juvenile shortnose sturgeon was found and presents the logic for reaching the conclusions that were presented in the biological assessment. Information from the National Marine Fisheries Service's Biological Opinion on juvenile shortnose sturgeon is also presented.

In order to put answers to these questions in perspective, it is noted that shortnose sturgeon are not known to heavily use the blasting area (River Mile 76.4 to 84.6) from available data. As stated in the Biological Assessment, tagging studies done by O'Herron et al. (1993) show that the most heavily used portion of the river appears to be between river mile 118 below Burlington Island and the Trenton Rapids at river mile 137. In the early 1980's a few juveniles were found by O'Herron (Personal Communication, June 20, 2001) between Trenton, New Jersey and Petty Island (River Mile 102), north of the channel deepening project; however, no other information on juveniles in the Delaware estuary exists (McDaniel, C., National Marine Fisheries Service, Personal Communication, June 19, 2001; John O'Herron, Personal Communication, June 20, 2001).

Section 5.3 (Juvenile Shortnose Sturgeon) of the biological assessment (May 2000) reads as follows:

"***5.3 Juvenile Shortnose Sturgeon.***

Very little data exists about the location of juvenile shortnose sturgeon. In other river systems, they are found upstream of the salt water- freshwater boundary (0.5 to 1.0 ppt) (Dadswell, et al., 1984). In the Delaware River, the location of the juvenile shortnose sturgeon is not known, but is believed to be on the fresh side of the oligohaline/fresh water interface (0.5 ppt). During the year, juvenile sturgeon could be found between Artificial Island (rm 54) and the Schuykill River (rm 92) (O'Herron, 2000). The locations of selected isohalines were modeled for monthly average inflows and for regulated drought conditions from August to November (Philadelphia District, 1997). The average location of the maximum intrusion of the 0.5 ppt isohaline during monthly average infows for November was river mile 73.9 under current channel depths and at river mile 88.9 during regulated drought conditions. Although no information is available, the 0.5 ppt isohaline would likely be downstream of the November location during December through March since larger freshwater inflows enter the river during this period. Nevertheless, it is possible that juvenile shortnose sturgeon could be present in the vicinity of the blasting and could be impacted."

A 3-D hydrodynamic/salinity model was used to predict the locations of the 0.5 ppt isohaline locations. This model is described in Section 5 of the Supplemental Environmental Impact Statement (Philadelphia District 1997) **(EXHIBIT 4).**

These are the references quoted above:

Dadswell, M.J., B.D. Taubert, T.S. Squiers, D. Marchette, and J. Buckley. 1984. *Synopsis of biological data on the shortnose sturgeon (Acipenser brevirostrum) (LeSueur, 1818).* NOAA Technical Report, NMFS 14, National Marine Fisheries Service. October 1984. 45 pp. **(EXHIBIT 40, Binder 2 and #6).**

McDaniel, C., National Marine Fisheries Service, Gloucester, MA, Personal Communication with John Brady, Philadelphia District, U.S. Army Corps of Engineers, June 19, 2001.

O'Herron, J.C. II, Able, K.W., and Hastings, R.W., 1993, *Movements of the Shortnose Sturgeon (Acipenser brevirostrum) in the Delaware River,* Estuaries 16 (2): 235 - 240. **(EXHIBIT 40, Binder 2 and #5).**

O'Herron, J.C. , O'Herron Biological and Environmental Consulting, Mount Holly, NJ. 2000. Personal Communications with John Brady, Philadelphia District, U.S. Army Corps of Engineers. 28 March 2000, 11 January 2002.

Philadelphia District, 1997, *Delaware River Main Channel Deepening Project (Pennsylvania, New Jersey, and Delaware) Supplemental Environmental Impact Statement*, U.S. Army Corps of Engineers, Philadelphia District **(EXHIBIT 4).**

The following information was presented in the Biological Opinion by the NMFS (February 2, 2001) **(EXHIBIT 22)** concerning the location of juvenile sturgeon:

" Due to the limited information on juvenile shortnose sturgeon, it is difficult to ascertain their distribution and nursery habitat (O'Herron 2000, pers. comm.). In other river systems, juvenile sturgeon (less than 10 years) move downstream to tidal areas and concentrate at, or just upstream of, the salt front during the summer months (June through August). However, there is no evidence that this population moves into the region of the freshwater-saltwater interface during the summer. In the Delaware River, the oligohaline/fresh interface can range from as far south as Wilmington, Delaware, north to Philadelphia, Pennsylvania, depending upon meteorlogical conditions such as excessive rainfall or drought. As a result, it is possible that in the Delaware River, juveniles could range from Artificial Island (river mile 54) to the Schuylkill River (river mile 92; O'Herron 2000, pers. comm.). O'Herron (2000, pers. comm.) believes that if juveniles are present within this range they would likely aggregate closer to the downstream boundry in the winter when freshwater input is normally greater. However, due to a lack of data, the exact status of juvenile shortnose sturgeon in the Delaware River has yet to be determined. Hypotheses constructed about juvenile shortnose sturgeon distribution in the Delaware River have been based on comparisons of sturgeon in other river systems."

The Corps, in coordination with NMFS, is presently helping to fund a study with the primary purpose to obtain an estimate of the shortnose sturgeon population in the Delaware River. The study also includes sampling for juveniles. The three-year study was completed in 2001. The study was not able to adequately sample for juvenile shortnose sturgeon because gear to sample for juveniles was beyond the funding levels of this study (O'Herron J. C. Personal Communication, January 2002). The Corps will consider funding other studies suggested by the NMFS.

Although the Corps of Engineers continues to believe that the blasting associated with this project is not likely to jeopardize the continued existence of the Delaware River subpopulation of shortnose sturgeon, we will coordinate with the NMFS, DNREC, and NJDEP, to design a study that would monitor the area near the blast site. Mr. O'Herron believes that a properly designed and conducted study would greatly minimize possible impacts to juvenile shortnose sturgeon (Personal Communication, January 11, 2002).

O'Herron, J.C. , O'Herron Biological and Environmental Consulting, Mount Holly, NJ. 2000. Personal Communication with John Brady, Philadelphia District, U.S. Army Corps of Engineers. January 11, 2002.

Comment.

- **c.** There are no site-specific studies on shortnose sturgeon or their foods habits in the blasting area.

Response.

The NMFS stated in their Biological Opinion (February 2, 2001) **(EXHIBIT 22)** that while shortnose sturgeon forage on a variety of organisms, in the Delaware River, sturgeon primarily feed on the Asiatic river clam (*Corbicula manilensis*). *Corbicula* is widely distributed at all depths in the upper tidal Delaware River, but it is considerably more numerous in the shallows on both sides of the river than in the navigation channel. Foraging is heaviest immediately after spawning in the spring and during the summer and fall, and lighter in the winter. Juvenile sturgeon primarily feed in 33 to 66 feet deep river channels, over sand-mud or gravel-mud bottoms. However, little is known about the specific feeding habits of juvenile shortnose sturgeon in the Delaware River.

In the biological assessment, the statement that the Delaware River, Asiatic river clam (*Corbicula manilensis)* is considered to be the primary food source for shortnose sturgeon cites the following study:

O'Herron, J.C. II, Able, K.W., and Hastings, R.W. 1985, *A Study of the Shortnose Sturgeon (Acipenser brevirostrum) population in the upper tidal Delaware River: Assessment of impacts of maintenance dredging (Post- dredging study of Duck Island and Perriwig ranges)*, Draft final report. Prepared for the U.S. Army Corps of Engineers, Philadelphia District by the Center for Coastal and Environmental Studies, Rutgers, the State University of New Jersey, New Brunswick, NJ.

A survey of benthic organisms in the Delaware River from the C&D Canal to Trenton, New Jersey, which includes the blasting area, found that the benthic macroinvertebrate community was dominated by sludge worms, fly larvae, scuds, aquatic pill bugs, bristle worms and *Corbicula* (Environmental Consulting Services, Inc. 1993).

Environmental Consulting Services, Inc. 1993. *Survey of benthos: Delaware estuary: from the area of the C&D Canal through Philadelphia to Trenton.* Delaware Estuary Program.

Comment.

- **d.** The NMFS "take" limit is not reasonable.

Response.

The "take" limit for the shortnose sturgeon is the legal responsibility of the National Marine Fisheries Service.

SCOPE OF WORK

TURTLE OBSERVATION ABOARD HOPPER DREDGES

1.0 PROJECT: Monitoring for sea turtles aboard a hopper dredge for the Salem River maintenance dredging in Salem, New Jersey.

2.0 GENERAL: Under Section 7 of the Endangered Species Act of 1977 (16 U.S.C. 1531 et seq.) the National Marine Fisheries Service is now requiring whale and sea turtle monitoring for all hopper dredging activities conducted during June though mid November within the Philadelphia Corps of Engineers jurisdiction. The observer will work closely with the dredge crew to identify and record dredging incidents with sea turtles and other endangered species. Sampling for turtle and turtle parts will be accomplished through observation and inspection of the hopper along with screening of the intake structure or hopper overflow.

Endangered species are those whose prospects for survival are in immediate danger because of a loss or change of habitat, over-exploitation, predation, competition or disease. Threatened species are those that may become endangered if conditions surrounding the species begin or continue to deteriorate. Species may be classified on a Federal or State basis.

There are six species of endangered whales that have been observed along the Atlantic coast, and occasionally within the Delaware Bay. These include the sperm whale (*Physeter catodon*), fin whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), blue Whale (*Balaenoptera musculus*), sei whale (*Balaenoptera borealis*) and black right whale (*Balaena glacialis*). These are migratory animals that travel north and south along the Atlantic coast.

There are five species of threatened or endangered sea turtles that occasionally enter the project area. These include the endangered Kemp's ridley turtle (*Lepidochelys kempii*), leatherback turtle (*Dermochelys coriacea*), and hawksbill turtle (*Eretmochelys imbricata*), and the threatened green turtle (*Chelonia mydas*) and loggerhead turtle (*Caretta caretta*). With the exception of the loggerhead these species breed further south from Florida through the Caribbean and the Gulf of Mexico. The loggerhead may have historically nested along the coastal barrier beaches. No known nesting sites are within the project area.

3.0 PURPOSE: This Scope of Work (SOW) outlines the Contractor's requirements for conducting sea turtle monitoring for maintenance dredging in the Salem River. The Contractor will supply an endangered species observer(s) to be placed aboard the dredging plant to monitor for the presence of sea turtles. The Contractor must demonstrate previous experience in endangered species monitoring. Observers must be certified in writing as acceptable by NMFS for endangered species observing and handling.

4.0 DETAILED REQUIREMENTS: The Contractor shall complete the following tasks:

4.1 SITE DESCRIPTION/BACKGROUND: The observer will stay on board the hopper dredge and conduct monitoring of the baskets or screening over either the inflow or overflow for sea turtles.

4.2 ENDANGERED SPECIES PROTECTION: The Contractor shall provide education materials to dredge personnel on sea turtles, and whales, as well as instruct the dredge operator in the proper procedures used for documenting any whale sightings (the dredge operator is responsible for recording the presence of any whales within or around the project site). The contractor shall advise dredge personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles and whales that are protected under the Endangered Species Act and the Marine Mammal Protection Act.

4.3 GENERAL PROVISIONS OF OBSERVER WATCH: One observer is to be placed on board the dredge to provide observation coverage approximately 50 percent of the total dredging time. Observers will check for the presence of any sea turtles or fragments of sea turtles entrained with the dredged materials brought on board the dredge or seen in the vicinity of the vessel. The dredge operator will provide acceptable devices to screen inflow discharge water. Screens will remain in place and functional while the observer is on board the dredge. The dredge crew will assist the observer as needed to maintain the screening devices in working order. This may include assistance in emptying the specimen collecting baskets of clay and other accumulated debris at the end of each cut. Time will be made available for cleaning and examining the baskets.

4.4 OBSERVATION PERIOD: The sea turtle observer shall be on board the dredge during all dredging operation. While on board the dredge the observer shall provide the required inspection coverage on a rotating, six (6) hours on and six (6) hours off, basis. In addition, these rotating six (6) hour periods should vary from week to week. The Contractor will provide the above coverage for approximately 60 days.

4.5 DISPOSITION OF TURTLE PARTS: All specimens of sea turtles or their parts collected during the observation period will be described in detail and photographed. Any dead sea turtles or sea turtle parts shall be placed in plastic bags labeled to note location and time taken, and placed in a freezer (freezer space will be provided by the dredge operator). All sea turtle and sea turtle parts stored in the freezer will be collected by a Corps of Engineers representative and stored until such time as it is picked up or delivered to the National Marine Fisheries Service - Northeast Region (NMFS). In the event of an injured turtle, the Marine Mammal Stranding Center in Brigantine should be contacted (609-266-0538). Unless otherwise directed by the Stranding Center, injured turtles will be held on board the dredge until such time as the trained observer decides that the turtle is ready for release or should be transported to the National Aquarium in Baltimore for rehabilitation.

4.6 REPORTING: The Contractor will follow the reporting procedures listed below:

4.6.1. A sample observation sheet is appended to the end of this section and shall be used to record each observation. A sheet shall be completed for every cycle (load), whether sea turtles are present or not. The observation sheets will be submitted on a biweekly basis to the Contracting Officer's Representative. All data in the original form shall be forwarded directly to Beth Brandreth, Environmental Resources Branch, Wanamaker Building, 100 Penn Square East, Philadelphia, PA 19107-3390, within 10 days of collection, and copies of the data will be supplied to the Contracting Officer's Representative and NMFS. Following completion of the project, a copy of the Contractor's log regarding sea turtles shall be forwarded to Beth Brandreth.

4.6.2 Continuous liaison with Beth Brandreth, Environmental Resources Branch, Philadelphia District Office shall be maintained to avoid problems with execution of this contract and to assure compliance with prescribed Corps of Engineers' policies and procedures. It will be the responsibility of the Contractor to report all significant developments.

4.6.3 A summary report of observation shall be submitted to both Mr. Doug Beach of NMFS and the Corps of Engineers (COE) within 7 days of the completion of the contract period.

4.6.4 Any collisions with a whale or sea turtle or sighting of any injured or incapacitated whale or sea turtle will be reported immediately to the Corps of Engineers. The order of contact within the Corps of Engineers will be as follows:

Order of Contact of Corps Personnel for Observer to Report
Endangered Species Death or Injury (Including Those Not

Directly Related To the Dredging Activities)

Title	Telephone Number Work Hours	After Hours
Corps, Inspector	*	*
Beth Brandreth, Environmental Resources Branch	(215) 656-6558	(609) 435-4435

* Phone numbers will be provided upon initiation of work

5.0 GOVERNMENT-FURNISHED MATERIALS: The following materials will be furnished to the Contractor:

5.1 Observation sheets will be supplied by the Contracting Officer's Representative (Corps).

5.2 While on board, meals and sleeping quarter with a bathroom and a shower facility will be provided by the dredge operator.

5.3 Boat transportation will be provided by the dredge operator between the dredge and the mainland. Observers will strive to cooperate with existing crewboat schedules while maintaining minimum requirements of the observer contract.

5.4 The dredge operator will provide the observer with a statement of dangers associated with work on board the dredge. The observer will follow these safety requirements and recommendations while on board the dredge and while in transit between the dredge and the mainland.

5.5 Corps of Engineers Manual, EM 385-1-1, dated April 1981, entitled "General Safety Requirements" will be provided.

6.0 PERIOD OF PERFORMANCE: The Contractor shall report to the dredge on or around August 2, 2000 as indicated in paragraph 4.1. The work is expected to be completed approximately 60 days after the notice to proceed. Total time for performance of this work shall not exceed November 15, 2000.

TURTLE OBSERVATION REPORTING LOG

PROJECT: **Salem River Maintenance Dredging, 2000**.

TURTLE OBSERVER NOTES

LOAD NUMBER__________ DATE____________ TIME
LOCATION IN CHANNEL: LATITUDE___________________ LONGITUDE

WEATHER CONDITIONS

PORT BASKET CONTENTS

TURTLE OR TURTLE PARTS PRESENT YES_____________ NO
COMMENTS AND OTHER OBSERVATIONS

BRIDGE WATCH: TIME_________________ LOCATION

NUMBER OF TURTLES SIGHTED

_______________________________________ OBSERVER'S NAME

_______________________________________DATE

_____DAILY WHALE REPORTING LOG

PROJECT: **Salem River Maintenance Dredging, 2000**.

2. WHALE SIGHTED: YES _____ NO

3. TYPE OF WHALE:

4. TIME:

5. NUMBER OF WHALES SIGHTED:
ADULT ________ JUVENILE

6. NUMBER OF WHALE INJURED:
ADULT _______ JUVENILE _______ WORK RELATED: YES_______ NO

7. NUMBER OF WHALES KILLED:
ADULT _______ JUVENILE _______ WORK RELATED: YES_______ NO

8. LOCATION:

9. REMARKS:

10. SIGNATURE:

11. TITLE:
PROJECT: <u>SALEM RIVER MAINTENANCE DREDGING 2000, INCIDENT REPORT OF SEA TURTLE MORTALITY AND DREDGING ACTIVITIES</u>

Species ____
Date ______________________________ Time 24 hour clock
Geographic site
Location: Latitude ________________________ Longitude
Vessel name
Type of dredging activity
Load #
Sampling method
Location specimen recovered
Draghead deflector? YES_____________ NO
Condition of Deflector
Weather conditions
Water temp: Surface _____________ Column
Head width
Plastron Length
Carapace S.L. Length
Carapace S.L. width

Carapace O.C. Length
Carapace O.C. width
Condition of specimen
Turtle tagged YES_______________ NO
Tag # ____________________ Tag Date
Comments/other

Observer's Name

ENVIRONMENTAL WINDOWS

ENVIRONMENTAL WINDOWS

NUMBER OF EXHIBIT: 73, 76,77,115

BACKGROUND

Environmental windows were discussed and listed in Section 1.1.9 and Table 1-1 of the Corps SEIS (1997) **(EXHIBIT 4):**

"Table 1-1 lists the times of year that certain activities are restricted or prohibited to protect sensitive resources. The Corps of Engineers will make every effort to abide with these restrictions, however, in some cases work must be done within these windows, in the case of horseshoe crabs spawning and shorebirds. All work done within these windows will be coordinated with the Federal and state resource agencies, and no significant impacts are expected. Please refer to the reference section of SEIS for a complete discussion."

Environmental windows are also discussed in Section 3.3.4.3 of the SEIS (1997) **(EXHIBIT 4):**

"This effort is expected to be carried forward into actual construction and monitoring of both Kelly Island and Egg Island Point. For example, environmental windows will require a phased, timed approach to construction to avoid and minimize impacts on organisms, especially the horseshoe crabs and shorebirds. Placement of sand foundations would be accomplished prior to movement of crabs to the beaches for spawning. On-site observations would dictate work activities. It is not expected that crabs will move in great numbers into the eroded peaty areas at either site since they avoid reduced sediments smelling of hydrogen sulfide and greatly prefer sandy beaches.

While horseshoe crabs are spawning and the spring migration of shorebirds is occurring, geotextile tube breakwaters will be installed piecemeal. This type of construction only requires a small work area for the placement and filling of each tube, so that crabs and birds could be in the vicinity and not be impacted. Initially, tubes would be filled at points furthest from major spawning areas, the tubes would be filled at an expected rate of one to three per day. As construction moves closer to pertinent sandy beaches, spawning, hatching, and migration activities should be completed. After that point in time, the inside of the confined disposal facility (CDF) at Kelly Island would be filled with fine-grained material, and any additional "unconfined" material would be placed behind tubes at Egg Island Point. This back-filling work and placement of sand berms inside the breakwaters will coincide with the fall migration of shorebirds, but should not present a displacement problem. Shorebirds tend to feed on freshly placed dredged material in great numbers to take advantage of the food resources coming through the dredge pipes. The dredged material would then have about six months to sort and settle before crab spawning and spring migration recurred. Utilization of freshly pumped dredged material by numerous species of birds has been well documented for many years. This is especially so for Great Lakes, Gulf Coast, and Atlantic Coast shorebirds, *seabirds, and wading birds, but has also been noted for geese, some duck species, and opportunistic feeding by such species as fish crows and bald eagles (Landin, Patin, and Allen 1989; Landin, Webb, and Knutson 1989).*

There should be no impact on motile organisms such as finfish. There are many finfish species utilizing Delaware Bay, but most are accustomed to the natural turbidity of the Bay (US Fish and Wildlife Service 1980, 1994). While anecdotal reports indicate that shortnose sturgeons may have been caught in the bay in the past, no studies have been done to access their current use of this area. The shortnose sturgeon is an endangered species that may be found in the Bay. Dredging activities in Delaware Bay are not known to have had an impact on this species. From June to November, trained monitors are required on hopper dredges to record all sightings of sea turtles and marine mammals and other pertinent information."

The windows have been modified based on new information. For the current windows, please refer to the attachment.

THE FOLLOWING CONCERNS HAVE BEEN RAISED:

Comment.

- **a.** Would like to see a comprehensive list.

Response.

Please refer to the attachment that contains the environmental windows. Decision will be made based on coordination with Federal and State resource agencies.

Comment.

- **b.** Who will decide what windows will be followed?

Response.

Please refer to the attachment that contains the environmental windows.

Comment.

- **c.** What will adherence to environmental windows cost?

Response. The dredging windows may have an effect on the cost of constructing projects in the Delaware Bay. The following is a summary of projects and their associated issues with regard to windows.

- **Kelly Island.** In order to construct Kelly Island, complete relief for one season from the horseshoe crab and winter flounder windows is required. No relief is required from blue crab, sandbar shark or other windows. The increase in cost to observe these windows is prohibitive to constructing the project, since any interrupted construction activity has a high degree of risk associated with total failure of the project.

- **Port Mahon.** The horseshoe crab window can be observed if relief is given from the blue crab and winter flounder windows or vice versa.(i.e. blue crab and winter flounder can be observed with relief from the horseshoe crab window). No other windows impact Port Mahon construction.

- **Broadkill Beach.** The sandbar shark window can be mitigated by construction revisions as detailed in response to 6 above. The additional cost is considered to be project inclusive. The anticipated dredging time for Broadkill Beach is between 10-12 months so observation of the horseshoe crab, blue crab and winter flounder windows in any combination will increase the cost to construct Broadkill Beach. An additional dredge or multiple barges will be required. Quantification of the cost increase is impossible due to the various combinations of windows and construction methods.

- **Egg Island Point.** Relief from the horseshoe crab, blue crab, and winter flounder windows is required to construct the project. The increase in cost to observe these windows is prohibitive to constructing the project, since any interrupted construction activity has a high degree of risk associated with total failure of the project.

**US Army Corps
of Engineers®**
Philadelphia District

DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT

ENVIRONMENTAL WINDOWS IN DELAWARE

DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT ENVIRONMENTAL WINDOWS IN DELAWARE

RESOURCE	ACTIVITY	EXISTING ENVIRONMENTAL WINDOWS	PROPOSED CHANGES TO WINDOWS*
Fish	Rock Blasting Overboard Disposal in All Areas	15 March-30 Nov. (Delaware Memorial Bridge to Betsy Ross Bridge)	None
Anadromous Fish	Bucker Dredging	16 March to 31 May above River Mile 62 (Pea Patch Island)	None
Shortnose Sturgeon	Hydraulic Dredging in Non-Federal Channels	15 April-21 June (Delaware Memorial Bridge to Kinkora Range)	None
Shortnose Sturgeon	Bucket Dredging in All Areas	15 March-31 May (Delaware Memorial Bridge to Kinkora Range)	None
Atlantic Sturgeon	Hopper Dredging in All Areas	Monitors required from 1 May and 1 October between Bombay Hook, DE and the PA/DE boundary	None
Sea Turtles	Hopper Dredging in All Areas	1 June-30 November (Delaware Bay to Delaware Memorial Bridge; Sea Turtle Monitors Required)	None
Pea Patch Island Wading Bird Colony	Dredging within 2600 ft of Colony	1 April-31 August	None
Shorebirds and Horseshoe Crabs	Construction of Kelly Island Wetland Restoration andBeach Nourishment	15 April to 31 August (Area of concern is on the beach)	See discussion below.
Sandbar Shark	Beach Nourishment at Broadkill Beach	1 May to 15 Sept. (Area of concern is in the water just offshore)	See discussion below.
Winter Flounder	Dredging and Sand Placement below River Mile 35.	1 January to 31 May	See discussion below.
Over-wintering female blue crabs	Channel Dredging in Bay below RM 32.	1 December to 31 March	See discussion below.

ANY CHANGES TO THE EXISTING ESTABLISHED ENVIRONMENTAL WINDOWS WOULD FOLLOW THE FOLLOWING PROTOCOL:

CORPS OF ENGINEERS PROCEDURES FOR REQUESTING CHANGES IN CLOSED ENVIRONMENTAL WINDOWS

- **PLANNED CHANGES**

  These changes would be requested where we believe that data indicates that work could be performed within the environmental window without significantly impacting species of concern. For the Delaware River Main Channel Deepening Project data is being gathered by the Corps for species such as the horseshoe crab, shorebirds, and blue crab that may indicate that work can be done within the environmental windows because of small numbers of animals within the work areas. This data will be coordinated with appropriate State and Federal agency personnel, including species experts, and submitted to the appropriate State offices (such as DNREC Coastal Zone or Wetlands) and/or Federal resource agency office (such as USFWS or NMFS) with the request for working within the windows. A meeting may be useful to discuss the issues.

  Another possibility is to modify construction techniques to eliminate potential impacts to the species in question. This is being considered for the winter flounder and sandbar shark where coordination is proceeding with the National Marine Fisheries Service as part of an Essential Fish Habitat Evaluation.

- **UNPLANNED CHANGES**

  This would occur when an unplanned event occurs such as an adverse weather condition that has delayed project construction. This would usually involve working in the window for a relatively short period of time. Coordination would be done with the appropriate State/Federal agency to determine if this work could be done without significantly impacting the species in question.

Shorebirds and Horseshoe Crabs

A monitoring/management plan was developed for the Kelly Island wetland restoration project and has been closely coordinated with DNREC and Federal resource agencies, including personnel from the Bombay Hook National Wildlife Refuge. Kelly Island has been eroding for many years. See the attached diagram that shows the 2001 shoreline superimposed on a 1926 photo. In 1926 the percent of sandy beach in the reach of shoreline that will be restored by the wetland restoration was 100%; in 2001 the amount of potential horseshoe crab spawning habitat in 49.9%. The project would restore this to 100%.

One of the goals of the monitoring/management plan for Kelly Island that was developed by this interagency group was to create spawning habitat for horseshoe crabs. The horseshoe crab egg density and habitat availability study was done at the three areas in Delaware Bay in Delaware where we propose to place dredged material: Kelly Island, Port Mahon, and Broadkill Beach. One of the goals of this study was to establish pre-construction conditions at these areas to be compared to post-construction horseshoe crab use. Another reason that this information was needed was to see if work could be done within the environmental window (15 April to 31 August) established by the Atlantic States Marine Fisheries Commission's *Interstate Fishery Management Plan for Horseshoe Crab* (1998).

This is especially critical for Kelly Island wetland restoration that will take over a year to construct. There is a concern that if construction is not completed in a continuous manner, the structure may be compromised. We plan to gather additional data on spawning horseshoe crabs at Kelly Island in 2002, as well as at Broadkill Beach and Port Mahon. We have also gathered data on juvenile horseshoe crabs for these three areas, as well as Kitts Hummock (a known productive spawning area recommended by DNREC as a control), as well as data for spawning adults at Kelly Island and Port Mahon. After we have completed these studies, we are planning to meet with DNREC , the National Marine Fisheries Service, the U.S. Fish and Wildlife Service and other appropriate experts to discuss population levels and construction techniques that may be able to avoid or minimize impacts to horseshoe crabs. It is noted that only 49.9 % of Kelly Island and 26.9 % of Port Mahon was found to be suitable spawning habitat in 2001. Restoration efforts at Kelly Island and Port Mahon are expected to greatly enhance the spawning habitat. Much of the shoreline at Kelly Island is under lain with peat and unsuitable for spawning. The shoreline at Port Mahon is lined with rock rip rap that results in the mortality of many spawning horseshoe crabs each year.

Sandbar Shark

The habitat along the lower Delaware Bay coast in Delaware has been designated as "Habitat Areas of Particular Concern" by the NMFS. Pratt (1999) believes that there will be a great potential to impact shark pups and their food source of benthic organisms in the nursery areas along the Delaware Bay Coast, especially offshore from Broadkill Beach to Slaughter Beach, if sand is deposited near the beach (in areas 1 – 4 m deep) in the nursery season. Potential impacts may include but not be limited to: changing the habitat characteristics, depth, profile, odor, turbidity and fauna of the area. Loss of forage would also occur. Prey species, principally crabs and fish of many species, may be disrupted directly by the presence of physical activity in the area and indirectly by the covering of vulnerable food web organisms with sand. A "closed" window from 1 May to 15 September was recommended by the National Marine Fisheries Service (Gorski, 2000) to prevent potential impacts to newborn and juvenile sharks such as suffocation. After this time period, the young sharks have reached a larger size where they would be more able to avoid the sand placement operations.

On 7 November 2000 representatives from the Corps and the NMFS held a teleconference to explore methods to place sand on Broadkill Beach during the Spring/Summer without significantly impacting the sandbar sharks puping (females giving birth to live-born young) and the nursery area that is located offshore in shallow waters. It was agreed that sand placement can be performed during the period from 1 May to 15 September using the following conservation measures:

a. A sand dike, 200 to 300 feet in length, will be constructed above mean high water (MHW) to contain dredged material that is pumped landward of it. The dike will be constructed using existing sand on the beach. The dike will be long enough that most dredged material will drop out on the beach and not return to the bay. As material is deposited the dike may be repositioned seaward to contain the required filling above MHW for that section of Beach. The slurry will still be controlled by the dike along the shoreline. No dredged material will be hydraulically placed below MHW during the restricted period. The dike will be extended down the beach as the area behind the dike is filled and the dredged pipe is lengthened. The dredged material that has been deposited will be built into dunes. It is expected that little of this material will be re-deposited by wave action during the spring/summer window period since weather is generally mild, except for possible hurricanes. After September 15, some dredged material will be graded into the bay to widen the beach.
b. The dredged pipe will be placed on pontoons for a minimum of 1000 feet, beginning at approximately elevation –4.7 NGVD, extending offshore to avoid disrupting along shore traveling by the young sandbar sharks. This distance will be determined by the National Marine Fisheries Service. The remainder of the pipeline extending to the beach, and back to the dredge, can rest on the bottom.

References:

Gorski, Stanley W., 2000, Letter to John T. Brady dated February 10, 2000, National Marine Fisheries Service, Highlands, NJ.

Pratt, Harold "Wes", 1999, Letter to John T. Brady dated October 4, 1999, National Marine Fisheries Service, Narragansett, RI.

Winter Flounder

The winter flounder in Delaware Bay are part of the Mid-Atlantic population that migrate inshore in the fall and early winter and spawn in late winter and early spring. In Delaware Bay, spawning takes place January, February and March, with early life stages being present in April and May (Riportella, 2001). Trawl surveys by the Delaware Department of Natural Resources and Environmental Control indicate that they are not abundant and that they occur in the lower portion of Delaware Bay where there are higher salinity levels (Michels, 2000). Generally the concern for winter flounder extends from the mouth of Delaware Bay to River Mile 35.

Deepening the Navigation Channel has the potential to impact winter flounder if they were present; however, it is unlikely that the navigation channel has any significant use by this species.

The Deepening Project has the potential to impact eggs during the dredging of the channel and during the placement of the dredged material. It is likely that dredging will have a minimal impact on eggs of this species for the following reasons. First, most eggs have been found in shallow water, less than 5 meters. The navigation channel is presently 40 feet (12.2 meters) or greater and will be deepened to 45 feet (13.7 meters). Although eggs have been found in the 45 feet deep navigation channel of New York Harbor, the adjacent, shallow areas had greater densities, indicating that the more shallow water areas are preferred spawning habitat (Gallo, 2001). Another reason that winter flounder are likely to prefer areas adjacent to the navigation channel is that the deep draft vessels currently using the channel are creating more turbid conditions in the channel with their prop-wash that is likely to adversely impact spawning.

Since the larvae are non-dispersive, they are believed to occur in the same areas as the eggs, i.e. in shallow water. Because of the reasons listed above for eggs, it is unlikely that the navigation channel would provide preferred habitat for larvae.

Any juveniles or adults that use the channel could be adversely impacted by dredging, either by entrainment or increased turbidity. However, because of the channel's use by deep draft vessels and the resulting turbidity and prop wash, it is unlikely that the navigation channel has significant use from these life stages of winter flounder.

The placement of dredged material along the shallow shorelines of New Jersey and Delaware at the wetland restorations at Egg Island Point and Kelly Island and the beach restoration at Broadkill Beach and Port Mahon in Delaware Bay and Dewey-Rehoboth beaches along the Delaware Atlantic coast are more likely to have adverse impacts on spawning adults and early life stages (larvae and juveniles) than channel dredging. However, the impacts are not expected to be significant for the following reasons. First, as stated above, data from New Jersey and Delaware indicate that winter flounder populations currently using Delaware Bay are smaller than those further north in the range and become less abundant moving from northern New Jersey to southern New Jersey. In addition, the wetland restorations at Egg Island Point and Kelly Island will create tidal guts in the wetlands with abundant invertebrate fauna that will be beneficial to early life stages of winter flounder that will compensate for any temporary, minimal impacts that would occur from the construction of the two wetland restorations (Goodger, 2001). It is also noted that the construction of these structures is a one-time event except for occasional maintenance that can be done outside the winter flounder window.

Winter Flounder References:

Gallo, Jenine, Email to John Brady, New York District, Corps of Engineers, April 10, 2001.

Goodger, Personal Communication, National Marine Fisheries Service, Oxford, MD, April 20, 2001.

Michels, Stewart. Personal Communication, DNREC. December 13, 2000.

Riportella, Anita, 2001. Personal Communication, National Marine Fisheries Service, Highlands, New Jersey.

Over-Wintering Female Blue Crabs

A study titled *Delaware River Main Channel Deepening Project Delaware Bay Winter Crab Survey – 2000/2001* was completed in October 2001 and submitted to DNREC. This report covers the first year of pre-construction monitoring. Pre-construction monitoring will continue until construction begins and subsequent reports will be provided when available.

The study indicates that about 0.1 percent (about 70,000 crabs) of the crabs hibernating in lower Delaware Bay would be impacted. Although this loss should not impact the Delaware Bay blue crab population, the Philadelphia District will continue to coordinate with DNREC to explore methods to minimize this impact.

WINTER FLOUNDER

CONCERNS FOR WINTER FLOUNDER

NUMBER OF EXHIBIT: 111

BACKGROUND

Concerns for winter flounder have been raised during the Essential Fish Habitat EFH Evaluation with the National Marine Fisheries Service (NMFS). A table of contents of a draft EFH Evaluation dated November 2001 is attached. The complete report is being submitted on CD ROM. Coordination with NMFS, as discussed below, indicates that work can be done within the environmental windows without significant impact to this species.

THE FOLLOWING CONCERN WAS RAISED

Comment.

Dredging and sand placement will adversely impact winter flounder.

Response.

The winter flounder in Delaware Bay are part of the Mid-Atlantic population that migrate inshore in the fall and early winter and spawn in late winter and early spring. In Delaware Bay, spawning takes place in January, February and March, with early life stages being present in April and May (Riportella, 2001). Trawl surveys by the Delaware Department of Natural Resources and Environmental Control indicate that they are not abundant and that they occur in the lower portion of Delaware Bay where there are higher salinity levels (Michels, 2000). Generally the concern for winter flounder extends from the mouth of Delaware Bay to River Mile 35.

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The placement of dredged material along the shallow shorelines of New Jersey and Delaware at the wetland restorations at Egg Island Point and Kelly Island and the beach restoration at Broadkill Beach and Port Mahon in Delaware Bay and Dewey-Rehoboth beaches along the Delaware Atlantic coast are more likely to have adverse impacts on spawning adults and early life stages (larvae and juveniles) than channel dredging. However, the impacts are not expected to be significant for the following reasons. First, as stated above, data from New Jersey and Delaware indicate that winter flounder populations currently using Delaware Bay are smaller than those further north in the range and become less abundant moving from northern New Jersey to southern New Jersey. In addition, the wetland restorations at Egg Island Point and Kelly Island will create tidal guts in the wetlands with abundant invertebrate fauna that will be beneficial to early life stages of winter flounder that will compensate for any temporary, minimal impacts that would occur from the construction of the two wetland restorations (Goodger, 2001). It is also noted that construction of these structures is a one-time event except for occasional maintenance that can be done outside the winter flounder window.

References:

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Goodger, Personal Communication, National Marine Fisheries Service, Oxford, MD, April 20, 2001.

Michels, Stewart. Personal Communication, DNREC. December 13, 2000.

Riportella, Anita, 2001. Personal Communication, National Marine Fisheries Service, Highlands, New Jersey.

US Army Corps
of Engineers
Philadelphia District

DRAFT

DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT

ESSENTIAL FISH HABITAT EVALUATION

PREPARED BY:
PHILADELPHIA DISTRICT
U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA 19107

NOVEMBER, 2001

Delaware River Main Channel Deepening Project
Essential Fish Habitat Evaluation

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