US Army Corps
of Engineers
Philadelphia District

Philadelphia District
North Atlantic Division

Delaware River Main Channel Deepening Project

Supplemental Environmental Impact Statement

July 1997

DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT

FINAL SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

JULY, 1997

ERRATA SHEET

The quantity of sand that will be placed on sand stockpile site MS-19 has been reduced from 2.8 million cubic yards to 1.4 million cubic yards. This will reduce the area of MS-19 from 500 acres to 250 acres. The total quantity of sand for both sand stockpiles (MS-19 and L-5) will be reduced from 4.7 million cubic yards to 3.3 million cubic yards, and the total area for both sand stockpiles has been reduced from 730 acres to 480 acres.

DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT
(PENNSYLVANIA, NEW JERSEY, AND DELAWARE)

SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

U.S. Army Corps of Engineers, Philadelphia District
July 1997

Final Supplemental Environmental Impact Statement
Delaware River Comprehensive Navigation Study
Main Channel Deepening Project

The responsible lead agency is the U.S. Army Engineer District, Philadelphia.

Abstract: The Philadelphia District conducted Preconstruction, Engineering and Design (PED) studies for modifying the existing Delaware River Federal navigation channel (Philadelphia to the Sea Project) from the Philadelphia/ Camden waterfront to deep water in Delaware Bay. The Delaware River Main Channel Deepening Project was authorized by Congress in October 1992 as part of the Water Resources Development Act of 1992. The non-Federal sponsor who will cost share this project is the Delaware River Port Authority. The recommended plan of improvement modifies the depth of the existing navigation 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 in channel widths. The plan also includes channel bend widenings, as well as partial deepening of the Marcus Hook Anchorage to 45 feet. Approximately 33 million cubic yards of material would be dredged for initial project construction. In addition, 229,000 cubic yards of rock would be removed from the channel in the vicinity of Marcus Hook, Pennsylvania. Annual maintenance dredging for the 45-foot channel would increase to 6,007,000 cubic yards from the current 4,888,000 cubic yards for the 40-foot channel, for a net increase of 1,119,000 cubic yards. In the riverine portion of the project area, dredged material would be placed in nine active, Federal upland dredged material disposal sites, and four new upland sites identified as 17G, 15D, 15G and Raccoon Island. In Delaware Bay, dredged material from initial project construction would be used for wetland restoration 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.

The purpose of this Supplemental Environmental Impact Statement (SEIS) is to provide additional information and environmental analysis to address environmental concerns raised during review of the 1992 Feasibility Report and Environmental Impact Statement. Environmental analyses include: three- dimensional hydrodynamic modeling of the Delaware estuary to evaluate potential changes in salinity and circulation patterns; benthic invertebrate sampling to assess habitat quality at selected beneficial use sites in Delaware Bay; biological effects based testing to determine the impact of open water disposal on aquatic ecosystems; detailed environmental assessments of selected upland dredged material disposal sites; consultation with both the U.S. Fish and Wildlife Service and the National Marine Fisheries Service, pursuant to Section 7 of the Endangered Species Act; cultural resource investigations in dredging and disposal locations; and coordination with the regional oil spill response team to review the adequacy of existing Delaware River spill contingency plans.

PLEASE SEND YOUR COMMENTS
TO THE DISTRICT ENGINEER BY:

AUGUST 30, 1997

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DELAWARE RIVER
MAIN CHANNEL DEEPENING PROJECT
DRAFT SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

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1.0 Summary

1.1 Major Conclusions and Findings

The Final Delaware River Comprehensive Navigation Study Main Channel Deepening Interim Feasibility Report and Environmental Impact Statement was completed in February 1992. Subsequent to a public review period, the report was approved by the U.S. Army Corps of Engineers and the Board of Engineers for Rivers and Harbors, and transmitted to Congress. The project was authorized by Congress in October 1992 as part of the Water Resources Development Act of 1992. The Record of Decision for the Final Environmental Impact Statement(FEIS), dated December 17, 1992, documented supplementary environmental analyses to be conducted during the Preconstruction, Engineering and Design phase of project development to re-affirm conclusions reached during Feasibility investigations. The need for these analyses was based on the comments received during public coordination of the FEIS. The purpose of this Final Supplemental Environmental Impact Statement (FSEIS) is to report the findings of the additional studies.

The evaluation of environmental impacts associated with the proposed project included coordination of the additional investigations and results with appropriate Federal and State resource agencies. The evaluations included the upland disposal of dredged material (including wetlands/wildlife habitat; hazardous, toxic, and radioactive waste (HTRW); and groundwater impacts); beneficial use of dredged material in Delaware Bay (including investigations of benthic habitat and sediment transport); sediment quality; salinity modeling (including impacts to water quality, aquatic life, and groundwater aquifers); endangered species; cultural resources; oil spill planning; and rock blasting. A summary of the results of these environmental impact studies is given below. Detailed discussions of the impacts are presented in the following sections of this SEIS.

1.1.1 Upland Dredged Material Disposal Sites

1.1.1.1 Wildlife Habitat/Wetland Impacts

Three of the dredged material disposal areas (15D, 15G, and 17G) are mostly used for the production of row crops, primarily corn and soybeans. The fourth area, Raccoon Island, is vegetated almost entirely with common reed (Phragmites australis), with some small patches of woodlands. Most of the wildlife habitat is rated as low to moderate quality.

Approximately 396 acres of jurisdictional wetlands (ie. wetlands that are regulated under Federal and/or state law) will be impacted on the four sites. All of these wetlands are the result of past human activities. The amount of each is shown in Table 6-2; however, the most dominant type of manmade, jurisdictional

wetland inside the four confined disposal facilities (CDFs) is 365 acres of Phragmites australis, or common reed, comprising approximately 90% of the wetlands present on the four sites. Common reed is generally a poor quality wetland in terms of wildlife habitat; however, it can improve water quality by removing sediment from runoff water.

In order to minimize impacts to wetlands/wildlife habitat in the upland dredged material disposal areas, the berm alignments have been changed to avoid higher quality wetlands/habitat such as forested and shrub-scrub areas. In addition, construction during sensitive times of year for wildlife species, such as nesting or migratory periods, will be avoided as much as practicable.

Since all impacts to wetlands/habitat can not be avoided, the Philadelphia District coordinated with the New Jersey Department of Environmental Protection (NJDEP) and the U.S. Fish and Wildlife Service (FWS) to find ways to manage these areas to restore environmental values that will be impacted. Both agencies recommended that each CDF be divided into cells, so that a portion could be managed as wetlands between the disposal of dredged material. The Philadelphia District tasked the research scientists at the U.S. Army Waterways Experiment Station (WES) to develop a management plan for the CDFs that would maximize their use as wetlands and wildlife habitat, while maintaining their use for the disposal of dredged material. This plan was then coordinated with the NJDEP and the FWS, as well as the Environmental Protection Agency (EPA) for their concurrence. Preliminary indications are that these agencies concur with the management plan that was developed.

Table 6-4 shows the amounts and types of wetlands that presently occur on the disposal areas, and what will be present with the proposed plan. There is a net increase of approximately 200 acres of wetlands. All of the wetlands that will occur in the disposal areas will be palustrine emergent, mostly non-tidal fresh marsh. The quality of these wetlands is expected to be better than the predominantly common reed dominated wetlands that presently occur. These wetlands will be less likely to be dominated by common reed because of the water level manipulations that will be possible using the weirs that will be present at strategic locations.

In addition, approximately 372 acres of additional area outside of the CDFs will be purchased as part of the project, due to real estate requirements. This area is presently a mosaic of habitat types consisting primarily of tidal marsh, woodlands, common reed, and ruderal areas. Much of this area is moderate to high quality wildlife habitat located adjacent to either the Delaware River or to tidal creeks, including some tidal marshes that are considered exceptional value to fish and wildlife resources (FWS 1995a). This area will be maintained as undeveloped land, and it is likely that the habitat quality will increase as the woodlands mature and ruderal and common reed areas succeed to more valuable

habitats such as woodlands. In conclusion, the overall habitat value of the 1,612 acres that will be purchased for upland dredged material disposal areas will be greater during the 50 years of project life than what presently exists.

1.1.1.2 Hazardous, Toxic and Radioactive Waste (HTRW)

In accordance with the Hazardous, Toxic and Radioactive Waste (HTRW) Guidance for Civil Works Projects, ER 1165-2-132, dated 26 June 1992, a literature search was conducted on each of the proposed upland dredged material disposal sites. The purpose of the HTRW investigation was to research available information on past or present conditions or activities, which may have resulted in the disposal or presence of HTRW on the subject sites.

Although there is no evidence to suggest that any of the sites have been used for industrial purposes or that any HTRW has ever been generated, disposed of, stored, or treated at any of the sites, there are several areas of concern that were outlined in the literature search. Potentially contaminated areas included piles of 55-gallon drums at sites 17G, 15D, and Raccoon Island, an above ground storage tank at site 17G, and an abandoned ultralite plane and pickup truck at site 15D. No areas of concern were found on Site 15G. Consequently, as part of the preliminary assessment, chemical sampling was performed on the disposal areas in these localized areas of concern.

The purpose of the sampling and testing soils from the areas was to determine the level of constituents in background and debris areas described in the preliminary assessment. The sampling locations were chosen based on their proximity to debris, drums, and other viable solid waste piles. Thirteen samples were taken at the four areas. Only three samples had compounds minimally above Federal or State regulatory levels. Background sample HTRW-13 in area 15G had an arsenic content of 22 milligrams per kilogram (mg/kg), which slightly exceeds the New Jersey Department of Environmental Protection (NJDEP) non residential cleanup criteria of 20 mg/kg. Sample HTRW-7 in area 17G had a Toxicity Characteristics Leaching Procedure (TCLP) lead level of 6 milligrams per liter (mg/l), which slightly exceeds the Federal Regulatory level of 5 mg/l set for toxicity characterization. Sample HTRW-10 in area 17G (duplicate) had a benzo(a)pyrene content of 674 micrograms per kilogram (ug/kg), which slightly exceeds the NJDEP non-residential soil cleanup criteria of 660 ug/kg. At most sampling locations, volatile and herbicide compounds were not detected. Relatively low levels of semi-volatile, pesticide, and metal compounds were detected.

Based upon the literature search and subsequent chemical testing, the minimal exceedance of the stated regulatory levels, and the proposed use of the area as a dredged material disposal site, no additional testing or remediation of these areas is required.

The planned use of sites 17G, 15D, 15G and Raccoon Island as

disposal areas for the deepening of the Delaware River navigation channel will not have any adverse impacts on groundwater or lands beneath or adjacent to the sites with respect to HTRW. However, prior to utilization of these sites for the project, all debris, drums, tires, and all other solid waste must be removed and disposed of in accordance with relevant environmental laws and regulations. Recently, the storage tank at site 17G has been removed.

1.1.1.3 Groundwater

Concerns have been raised in regard to the use of the new and existing upland disposal areas and the potential impact to drinking water aquifers from leachate generated by disposal operations. It is hypothesized that water could percolate through the dredged material, leach out potential contaminants such as heavy metals, and carry them to the groundwater. Sediment testing of the channel and channel bends indicates that the dredged material meets the NJDEP Impact to Ground Water Soil Cleanup Criteria, without exception.

As a supplement to the sediment testing efforts, the United States Geological Survey was tasked with performing an evaluation of potential contaminant travel times from the proposed project disposal sites to nearby drinking water and industrial production wells. Their report determined that the disposal sites would not impact local wells as the sites provide a very small percentage of well recharge, and potential contaminant travel times were on the order of fifty to one hundred years. The mean travel times for groundwater from the new proposed disposal areas to reach any potential water supply well is in excess of 50 years, except for a cluster of wells near area 15G where the report states that "travel time to these wells could be relatively short, perhaps on the order of several years". It is important to consider all of the contributing factors when evaluating the potential negative impact of the travel times from all disposal areas. First, the existence of 20-40 feet of fine grained material from past dredging within the disposal areas greatly impedes the flow of water from the areas and increases the travel times substantially. In addition, the new dredged sediments from the 45 foot project contain no harmful levels of contamination; so in the event that the water were to reach the well from the disposal area, it would have no impact on water quality.

The aforementioned conditions with respect to travel time, recharge, contamination levels, and conclusions from a recent groundwater investigation conducted by the Corps of Engineers at Oldmans disposal area, indicate that possible risk of groundwater impacts at the dredged material disposal sites is negligible. The disposal of material in the proposed areas will have a negligible impact on the groundwater/aquifer system in both the local and regional area.

1.1.2 Beneficial Use Sites

1.1.2.1 Wetland Restoration Sites

Shore Erosion

The breakwaters and restored wetlands at Kelly Island will protect about 5,000 feet of severely eroding shoreline; those at Egg Island Point will protect about 10,000 feet. These shorelines have been eroding at the rate of 15 to 30 feet per year. The expected life of the geotextile tubes is estimated to be 30 years, so these areas will be afforded protection from erosion for up to that period of time. The Corps of Engineers will maintain the Kelly Island wetland restoration.

Water Quality

Sediment testing included bulk and elutriate analyses for heavy metals, pesticides, PCBs, PAHs, phthalates, volatile organics, and semi-volatile organics; bioassays; and bioaccumulation tests. The results of this testing indicates that the dredged material from the Delaware Bay portion of the project is acceptable for beneficial uses such as wetland creation and sand stockpiles for later beach nourishment.

Benthic Communities

No significant differences were found between the benthic communities at the proposed beneficial use sites and background conditions in Delaware Bay. No benthic resources were identified that would preclude development of the beneficial use sites. Therefore, no significant impact will occur to benthic resources due to the use of any of these sites as either wetland restorations or sand stockpiles.

Approximately 60 acres of mostly subtidal habitat adjacent to Kelly Island and 135 acres of subtidal habitat adjacent to Egg Island Point will be restored to intertidal 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 of these sites, which cover about 195 acres, would be eliminated and the bottom would be changed from subtidal to intertidal wetland, averaging about +5 feet MLW. These sites were among those having the poorest quality benthic communities. They were characterized by a considerably less diverse assemblage than the background benthic communities in Delaware Bay. Compared to other candidate sites, they contained a higher abundance of opportunistic species, which are typical of disturbed environments. LC-9 (Kelly Island) was characterized by a different species composition between the two years it was sampled, which is a further indication of an unstable benthic community. LC-9 and PN1A (Egg Island Point) also had the lowest percent of equilibrium taxa among all of the candidate sites.

Wetlands

Approximately 60 acres of mostly subtidal habitat adjacent to Kelly Island and 135 acres of subtidal habitat adjacent to Egg Island Point will be restored to intertidal habitat, consisting of mostly Spartina alterniflora (saltmarsh cordgrass). In addition, hundreds of acres of intertidal wetlands that exist behind the restored wetlands will be protected from erosion.

Fish and Wildlife Resources

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. 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 considered to be a significant impact.

1.1.2.2 Sand Stockpiles

Shore Erosion

Studies indicate that there will be sediment dispersion from the sand stockpiles. Transport rates will be slow, however, so most of the placed material will remain in the stockpiles for decades. The stockpiled sand that does leave will move predominately landward, then spread laterally along the shore, thereby providing fill material for nourishment of sand-starved bay beaches.

Water Quality

Temporary water quality degradation is expected due to elevation of suspended sediments. Brief periods of elevated turbidity will occur as a result of sand placement. Extended periods of elevated turbidity would occur if wind or water currents cause sediments to remain in suspension. Water quality degradation would be more severe and widespread with unconfined open water disposal than if the sand were deposited behind containment devices such as geotextile tubes.

Benthic Communities

No significant differences were found between benthic communities at proposed sand stockpile sites and background conditions in Delaware Bay. No benthic resources were identified that would preclude use of the sites. Therefore, no significant impact will occur to benthic resources due to the use of any of these sites as either wetland restorations or sand stockpiles.

Approximately 730 acres (500 acres for MS-19 and 230 acres for LC-5) of subtidal aquatic habitat averaging -8 feet MLW will be covered with approximately 4.7 million cubic yards of sand to a depth of -3.0 feet MLW.

Placement of up to 4.7 million cubic yards of dredged material at the proposed sand stockpile sites would result in burial of the existing benthic community. Benthic recolonization depends upon a number of factors, which include substrate type, distance from similar habitat, and water currents. Recovery of the benthic community would be further hindered by future disturbance as the material is taken from the stockpiles for beach nourishment projects.

Benthic recolonization is dependent upon recruitment from plankton dispersed by water currents. Changes in current patterns and velocities may alter dispersal of benthic larvae. The loss of the benthic community due to dredged material disposal is expected to be a short-term adverse impact. The Corps has constructed twenty-three underwater berms for storm attenuation or beach nourishment throughout the United States (Landin, 1992). For example, results of detailed studies of benthic recovery and fish use on a berm constructed at Dauphin Island, Alabama, indicated rapid benthic recovery. Fish use of the area also was reported as greater than in surrounding waters. The benthic recovery and greater fish use are related to slope, configuration, and orientation of the berm in the current (Landin, 1992).

Long-term impacts would likely result from the use of the sites as sand sources for future beach nourishment projects if the area is subjected to repeated disturbances. A regularly disturbed bottom would not necessarily provide the same abundance or species composition as the present site condition. However, these impacts would occur to relatively small portions of the sandpiles at a frequency of every 5 to 10 years.

Fish and Wildlife Resources

The offshore areas in the vicinity of both proposed stockpile sites support important fisheries for weakfish. Additionally, the offshore areas in the vicinity of Sites L-5 and MS-19 support summer flounder, black sea bass, and drum (FWS. 1995b).

The environmental impacts of dredged material disposal in open water are similar in some ways to impacts resulting from sand dredging. Direct impacts include water quality degradation and temporary loss of the benthic community. Benthic community loss will in turn impact finfish species that feed on benthic organisms.

Deposition of large quantities of dredged material in sand stockpiles would decrease water depth at the sites from current depths to approximately -3 feet below MLW. This depth reduction

could result in changes in the tidal regime and current patterns, which in turn could impact biological resources. Changes in the tidal regime may have some impact on biological resources associated with nearby rivers, as well as resources associated with adjacent beaches.

Placement of dredged material would result in some loss of finfish nursery and feeding areas. The loss of the food source would be expected to result in a temporary and localized reduction in recreationally and commercially important finfish species. As with effects to the benthic community, the repeated disturbance of the sand stockpile sites for future beach nourishment projects would likely result in long-term adverse impacts to local fisheries. However, these impacts would occur to relatively small portions of the sandpiles at a frequency of every 5 to 10 years.

1.1.2.3 Sediment Transport/Oyster Impact Investigations

Wetland Restorations

Commercially important oyster lease beds are located throughout the offshore area around Egg Island Point. Most of these lease beds are located 500 to 800 feet offshore; but in some cases lease beds are located within close proximity to the shoreline. Oyster seed beds occur to the northwest of Straight Creek; this area also supports a commercially important blue crab fishery (FWS. 1995b). In Delaware, commercially important oyster seed beds exist in the area offshore of Kent Island and Kelly Island. There are also oyster beds inside the mouth of the Leipsic River. Additionally, hard clams and blue crabs are distributed throughout the Kelly Island area. Blue crabs in this area are commercially important.

Concern was expressed by the resource agencies regarding potential impacts to oysters due to movement of sand used to build the wetland restorations at Egg Island Point and Kelly Island. In addition, concern was expressed regarding the fate of fine grained material that will be confined behind the sand berms and geotextile tubes at Kelly Island if there was a catastrophic failure of this structure. Concern was also expressed about the possible fate of sand placed in the sand stockpiles.

To address these concerns, studies were conducted to map potential sediment transport rates and pathways due to planned projects at Egg Island Point, Kelly Island, MS-19, and L-5 to assess potential impacts on neighboring shellfish areas. These studies were performed by the Waterways Experiment Station (Coastal Engineering Research Center), Offshore and Coastal Technology, Inc., and the Haskin Shellfish Research Laboratory of Rutgers University.

In order to perform the studies, numerical current and wave models were employed to aid in defining sediment transport

mechanisms. Tidal current data was collected in summer 1995 at each location during typical daily conditions to define ambient conditions, and to provide some model calibration data. To aid in calibrating sediment transport estimates, suspended solids data collected over several years was supplied by the Haskin Shellfish Research Laboratory. Based upon the models and data, calculations of current-driven and wave-driven sediment transport were made for both storm and normal conditions, which were then used in a shellfish survivability computer model to assess potential impacts on neighboring shellfish beds.

Shellfish survivability modeling was performed for the wetland restoration sites by examining the effect of a 4-day and a 30-day high-turbidity event in each season of the year with a turbidity level of 2 g/l, which was found to be approximately the maximum expected concentration during an extreme storm. The 4-day storm event was selected because it is longer than the extreme storms of record. The 30-day case was selected because it could be typical of the time required to detect and address a sediment leak from the containment areas, and to provide information on the variation in impacts with the duration of turbidity.

The results of the shellfish survivability calculations show that there is no expected impacts on oyster survivability or growth due to the events considered, except at Kelly Island in the month of August. Because August storm events are much shorter than the 4-day event considered, insignificant impacts are expected on oysters during expected real storm events at that time of year. The 30-day event, although also potentially causing an impact at Kelly Island in August, is most likely to be prevented in August because that time of the year is best for performing repair work on the containment system. In addition, any 30-day event in August will exhibit turbidity concentrations that are much less than 2 g/l, and more likely 150 mg/l. Similar 30-day simulations with turbidity levels of approximately 150 mg/l in August show much less impact, with the entire spawn not being lost and no increase in mortality over ambient conditions.

A monitoring and maintenance plan will be developed during the next study phase, Plans and Specifications, before construction.

In light of the sensitivity of the oyster resources of the Kelly Island area certain measures will be planned to protect the oyster beds. The beds exist under inherently low food supplies and do not have the reserves required to easily withstand increased turbidity levels. Before the construction of the Kelly Island wetlands restoration site, oyster populations will be measured so that comparisons can be made to conditions during construction. Parameters to be measured include abundance, size (biomass) frequency, disease infection intensity, reproductive state, and recent mortality. If turbidity levels increase during construction, the same parameters would be measured to determine the extent of impacts. If the impacts are considered to be significant, restoration of the oysters damaged by the turbidity

will be done.

Maintenance

Three areas of maintenance may be necessary at the Kelly Island Wetlands Restoration Project. These areas of maintenance include project structures, Mahon River navigation channel, and habitat within the wetland restoration.

Sand Stockpiles

The two stockpile sites MS-19 and LC-5 were modeled together in the same wave model and current model grids and simulations because of their proximity. In both cases, it was found that the sediment pathways were similar (i.e. net wave-driven mass transport is potentially onshore, and the potential longshore net transport is to the northwest). The stockpiles are expected to migrate slowly onshore; however, major 2- to 5-year storms can potentially transport 40,000 cubic yards in a single event in the onshore direction. Mean current-driven velocities along the coast due to astronomical tidal action were found to be to the south. Again, these transports indicate slow movement of material to the northwest and southeast, forcing the stockpiles to spread laterally.

A significant transport component is the wave-induced longshore transport potential at these sites. At Broadkill Beach (LC-5) average net transport potential is calculated to be about 230,000 cubic yards per year to the northwest (left). At Slaughter Beach (MS-19), net transport potential is calculated to be approximately 260,000 cubic yards per year in the same direction.

No change in longshore transport along the coast is calculated for the stockpiles with a crest elevation of -3 feet MLW or for either stockpile with a crest elevation of 0 feet MLW, if the stockpiles are kept a minimum of 1500-2000 feet from shore.

1.1.3 Sediment Quality

After review of sediment quality data for dredged material derived from the Delaware River Main Channel Deepening project area, it is concluded that the relative risk of contaminants in the dredged material to human health, wildlife, and especially endangered species such as the bald eagle and peregrine falcon should be very low and consequently, should not be a significant concern. The frequency of detection of contamination in sediment samples collected throughout the project area was low and therefore any detected contamination when placed in the designated disposal sites will be mixed to such a large extent that contaminant concentrations will end up very low.

1.1.3.1 Bulk Sediment Analyses

To evaluate potential human health impacts associated with

disposal of channel sediments, bulk data were compared to New Jersey Department of Environmental Protection (NJDEP) Residential, Non-Residential and Impact to Groundwater Soil Cleanup Criteria (NJAC 7:26D).

A total of 91 chemical parameters were compared to the NJDEP criteria. All 91 parameters in all five reaches met the NJDEP Impact to Ground Water Soil Cleanup Criteria, without exception. All 91 parameters in all five reaches met the NJDEP Residential and Non-Residential standards, with the exception of the pesticide toxaphene and the heavy metals thallium and cadmium. Toxaphene has Residential and Non-Residential standards of 0.10 and 0.20 ppm, respectively. While toxaphene was not detected in any of the 153 sediment samples tested, the laboratory quantification limits were consistently above NJDEP standards. As such, a definitive conclusion with regard to toxaphene is not possible. Worst case concentrations of toxaphene in channel sediments, calculated solely on laboratory detection levels, range from 0.26 ppm in Reach E to 0.56 ppm in Reach A. There is no reason to believe that toxaphene is a contaminant of concern in the Delaware Estuary. Therefore, the risk that actual concentrations of toxaphene in channel sediments are above NJDEP standards is considered low.

Both the Residential and Non-Residential standards for thallium are two ppm. Mean concentrations of thallium were above the standard in Reaches A and B. Mean concentrations were 3.76 and 2.48 ppm, respectively. A total of 82 separate sediment samples were collected from Reaches A and B over three sampling events. All of these samples were analyzed for thallium. The initial event in 1991 collected 42 samples. Thirty of these samples had laboratory quantification limits greater than two ppm. Four samples had actual thallium detections greater than two ppm (5.5-9.0 ppm). Twenty additional sediment samples were collected in 1992, and the final 20 samples were collected in 1994. These 40 samples showed thallium concentrations in channel sediments to be less than two ppm. All 40 samples had laboratory quantification limits or actual detections of thallium below 0.4 ppm. While mean thallium concentrations for channel sediments in Reaches A and B are above the NJDEP standard, it appears that high detection levels from the 1991 sampling event is responsible for skewing the means. Two subsequent sampling events failed to reproduce the earlier results. Like toxaphene, there is no reason to believe that thallium is a contaminant of concern in the Delaware Estuary. Based on the above information, it is concluded that the calculated mean concentrations are high, and that the true mean thallium concentration in channel sediments is actually below two ppm.

The mean cadmium concentration of channel sediment samples collected from Reach A was 1.66 ppm. This is above the NJDEP Residential standard of one ppm, but well below the Non-Residential standard of 100 ppm. Cadmium was detected in a

number of samples at concentrations above one ppm, so there is no reason to suspect that the calculated mean is high. Since the material dredged from Reach A would be placed in an upland, dredged material disposal site that would not be used for residential development, and since the mean concentration of cadmium is so far below the NJDEP Non-Residential sediment standard of 100 ppm, it is concluded that the concentration of cadmium in sediments from Reach A would not pose any significant human health concerns.

PCBs. The highest concentrations of PCB-1254 and PCB-1248 observed in one out of 49 samples from Reach B of the project area were 1.19 and 0.53 ppm, respectively. After dredging and placement in a disposal site, the overall final PCB concentration will no doubt be below 0.25 ppm. Bioaccumulation of PCBs in wetland and upland soil dwelling animals have been observed to be less than one half the concentration measured in the dredged material. For example, at the Corps of Engineers' Field Verification Program field sites, both earthworms in an upland site and sandworms in a wetland site bioaccumulated approximately 3 ppm PCBs from dredged material containing 6.7 ppm PCBs (Lee et al. 1995). FDA action levels for human consumable food have been set at 2 ppm PCBs. While there are no set action levels for wildlife food, it is reasonable to assume that foodchain components that contain above 2 ppm could represent significant risk to wildlife. It would appear that reduced concentrations of sediment PCBs, such as 0.25 ppm, should not be a significant risk to wildlife exposed to an ecosystem developed on the proposed disposal sites for dredged material from the Delaware Estuary.

Pesticides. Few sediment samples showed detected pesticides. One sediment sample out of 33 showed 0.060 ppm heptachlor epoxide (Reach A), while another sample out of 49 showed 0.06 ppm Endosulfan (Reach B), and finally a third sample out of 19 showed 0.026 and 0.045 ppm of DDD and DDE, respectively. Dredging and placement of sediments in the disposal sites will result in reduced concentrations of these pesticides. The reduced concentrations should not represent a significant risk to wildlife.

PAHs. Sediment samples did show detectable amounts of PAHs. The highest concentrations of PAHs were observed in 2 out of 49 samples in Reach B. One sample approached a total PAH concentration of 10 ppm. Concern for exposure of foodchain components to sediments containing 10 ppm or more of PAHs could be warranted. However, when this sediment is dredged and placed in a disposal site with the other 48 sampled sediments within the Reach, the resultant reduced concentration of PAHs should be approximately 0.2 ppm and of little concern or risk.

Metals. Most sediment samples showed detectable metals. Metals that were detected at levels that might be of concern were cadmium (1.66 ppm, mean concentration for Reach A) and thallium (3.76 and 2.48 ppm mean concentration for Reaches A and B,

respectively). These concentrations were above NJ DEP Residential Direct Contact Soil Cleanup Criteria, which can give some perspective of sediment chemical data, but may not relate well at all to the risk to wildlife. All other metals are considered low and should not be a significant risk.

1. Cadmium. Up to 1994, 2.7 ppm cadmium was the soil concentration allowed for land receiving sewage sludge and used in crop production for human and animal food (Lee et al. 1991). Newly established EPA 503 regulations for land application of sewage sludge raised the soil levels to 34 ppm cadmium for unrestricted use of land. It would appear that dredged material containing an average concentration of 1.66 ppm cadmium should be of low risk in light of the 503 limitations. Bioaccumulation of cadmium in foodchains has been observed on dredged material containing 11 ppm cadmium (Stafford et al. 1987). Cottonwood trees that colonized the Times Beach Confined Disposal Facility at Buffalo, NY took up cadmium from the dredged material into their leaves. The leaf litter on the soil surface was inhabited by earthworms which bioaccumulated cadmium up to 100 ppm, resulting in a significant potential risk to wildlife foodchains on the disposal site. This example is an order of magnitude more sediment cadmium than that observed in Delaware River sediments and illustrates that bioaccumulation can occur at higher soil cadmium concentrations.

2. Thallium. The risk of thallium to foodchains is unknown. While there are water quality criteria for thallium for human risk assessment, there are no FDA action levels for thallium in human or animal food. The concentration of thallium observed, 2.48 and 3.76 ppm, appears to be above the NJDEP Residential Direct Contact Soil Cleanup Criteria of 2.00 ppm, however, the magnitude above the criteria is below 2X times. Concern for concentrations of potential contaminants usually becomes warranted when magnitudes above criteria approach 5X times. Until a more applicable criterion is established for the risk of thallium to wildlife foodchains, the risk to wildlife should be considered low.

1.1.3.2 Elutriate Sediment Analyses

The discussion above is related to disposal site impacts. The potential for impacts and risk to fish and wildlife is minimal from the dredging of sediments in the Delaware River, based on the collected data. Elutriate test results show very little release of contaminants of concern to the water column. Dredging will temporarily suspend sediments, but the duration and exposure will be temporary and should not result in significant risk. Bioassay tests with suspended sediments showed no toxicity or bioaccumulation of any significance. Therefore, the risk to fish and wildlife should be insignificant.

1.1.3.3 Bioassay and Bioaccumlation Testing

All water column and whole sediment bioassays resulted in 100 percent survival of all test species. The results of the water column bioassays suggest that sediment disturbance, and associated water column turbidity, at the point of dredging and at dredged material disposal locations would not result in mortality of aquatic organisms in the vicinity. Likewise, the results of the whole sediment bioassays suggest that aquatic organisms that colonize sediment placed for beneficial uses in Delaware Bay would also be unaffected by sediment contaminants.

With regard to bioaccumulation, there was no evidence that contaminants accumulated in clam tissue (Mercenaria mercenaria) exposed to Delaware Bay sediment at greater concentrations than clam tissue exposed to clean laboratory sediment. All of the tissue residues were representative of what one would expect in organisms exposed to uncontaminated material. With regard to bioaccumulation and the polychaete Nereis virens, there were no statistical differences between contaminants in worms exposed to channel sediments and worms exposed to reference sediments, with the exception of the heavy metal arsenic. The mean arsenic concentration in worms exposed to one channel sediment sample (0.700 ppm) was statistically higher than concentrations in worms exposed to reference sediment samples (0.360 and 0.460 ppm). The measured tissue concentration of arsenic in worms exposed to the channel sediment did not appear to be deleterious. No more mortality was observed in the channel sediment test worms than in worms exposed to other sediments. Furthermore, a mean tissue concentration of arsenic in worms exposed to the control sediment (0.680 ppm), which was obtained in Maine where the worms were collected, was virtually identical to that measured for the channel sediment worms (0.700 ppm). Both of these values are well below the range of acceptable background tissue arsenic concentrations for test organisms from East Coast sites, which is reported to be 1.5 to 3.9 ppm in the USEPA Guidance Manual for Bedded Sediment Bioaccumulation Tests (EPA-600-R-93-183). Overall, test results suggest that open water placement of Bay sediment is acceptable with regard to bioaccumulation concerns.

1.1.4 Salinity Modeling

A fundamental conclusion from the study is that deepening the existing navigation channel from 40 feet to 45 feet will result in salinity (chlorinity) increases in the Philadelphia area during a recurrence of the drought of record. However, the increases will not have an adverse impact on water supply. The present DRBC drought management plan, including reservoir storage added since the drought of record, prevents the intrusion of ocean salinity into the Philadelphia area in excess of existing standards. With the deepened channel and a recurrence of the drought of record (1961-1965), the maximum 30-day average chlorinity at River Mile (RM) 98 is about 150 parts per million (ppm).

During normal to high flow periods with the deepened channel,

oyster bed areas in the lower bay will experience increases in salinity due to steeper longitudinal salinity gradients. The impact of those increases on oyster production is viewed as negligible. Changes in the subtidal circulation over the oyster beds due to channel deepening will also be minimal, e.g., less than 1 centimeters per second (cm/sec). Results from the simulation of a 1.0 ft sea level rise combined with channel deepening are ambiguous due to a number of limitations. The principal limitation is the apparent need for a model domain encompassing the entire Chesapeake Bay, not just the portion of the bay above Annapolis, MD, as was the case with the present model. Model results clearly show the need to include the exchange between the Delaware Bay and the Upper Chesapeake Bay when addressing problems dependent upon subtidal processes. The impact of this exchange with the deepened channel depends upon the direction of the net flow through the C&D Canal. The direction of the net flow is highly variable in time and depends upon the particular winds, tides, and freshwater inflows.

1.1.5 Endangered Species

1.1.5.1 Section 7 Consultation

In compliance with Section 7 (c) of the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), biological assessments were prepared that evaluate the potential effects of the Channel Deepening Project on species listed by either the U.S. Fish and Wildlife Service (October 1995) or the National Marine Fisheries Service (September 1995). These assessments were prepared in accordance with the Joint Regulations on Endangered Species (50 CFR Section 402.12). Both of the biological assessments concluded that there will be no impact that would jeopardize the continued existence of any of the listed species, or their critical habitat, as a result of this project.

In a letter dated January 18, 1996 (See Appendix A), the U.S. Fish and Wildlife Service stated that they concur with the District's determination that the Delaware River Main Channel Deepening Project is not likely to adversely affect federally listed species under the Service's jurisdiction. This is based on implementation of the "reasonable and prudent measures to minimize impacts" that are described in Section 10.5. A Biological Opinion was issued by the NMFS on November 26, 1996 for all dredging projects permitted, funded, or conducted by the District. The Opinion stated that dredging projects within the Philadelphia District may adversely affect sea turtles and shortnose sturgeon, but are not likely to jeopardize the continued existence of any threatened or endangered species under the jurisdiction of the NMFS.

U.S. Fish and Wildlife Service (FWS)

A meeting was held in the Philadelphia District office on

December 14, 1994 with representatives from the FWS. Ms. Dana Peters, FWS, stated that the species of concern are the bald eagle and the peregrine falcon. For the bald eagle, the concerns are possible exposure to contaminants from the additional dredging, and disturbance during nesting. The FWS recommended that the following potential impacts be addressed in a biological assessment: disturbance, increased development, contaminants, and increased oil spills. FWS recommended that the assessment be coordinated with Larry Niles of the NJDEP. For the peregrine falcon, FWS recommended that the biological assessment address disturbance at their nest/roosting sites at the Walt Whitman and Commodore Barry bridges, as well as contaminants. There are presently no restrictions for dredging in the Delaware River for the peregrine falcon.

National Marine Fisheries Service (NMFS)

On August 21, 1993 NMFS forwarded a letter to the Philadelphia District formally requesting that the District conduct a district-wide consultation. Further coordination determined that the Philadelphia District would prepare a biological assessment to evaluate potential dredging impacts to right, humpback, and fin whales; and Kemp's ridley, loggerhead, leatherback, green and hawksbill sea turtles in the Delaware Estuary and along the Atlantic coasts of New Jersey and Delaware. The District would also evaluate potential dredging impacts to shortnose sturgeon in the Delaware River and Bay. A Biological Opinion was issued by the NMFS on November 26, 1996 for all dredging projects permitted, funded, or conducted by the District. The Opinion stated that dredging projects within the Philadelphia District may adversely affect sea turtles and shortnose sturgeon, but are not likely to jeopardize the continued existence of any threatened or endangered species under the jurisdiction of the NMFS. They also stated that while endangered whales may be present in the action area of these dredging projects, effects from increase dredging traffic are expected to be minimal.

1.1.5.2 Reasonable and Prudent Measures to Minimize Impacts

Species Under the Authority of the U.S. Fish and Wildlife Service (FWS)

1. Bald Eagle

Prior to construction of the upland, confined, dredged material disposal areas, the Philadelphia District will coordinate with the USFWS and the NJDEP to determine if there are any bald eagle nests within 0.25 miles or a line of site distance of 0.5 miles from an upland dredged material disposal area. If there is an active nest within these distances, construction of the site and the use of the site for the disposal of dredged material will be staged to avoid disturbance impacts.

2. Peregrine Falcon

1. Coordination with the NJDEP will occur before initiating any new work at the Raccoon Island upland dredged material disposal site between 15 March and 15 April.

2. The Philadelphia District will move the nest structure located at Egg Island Point to a safer location as determined in coordination with the NJDEP.

Species Under the Authority of the National Marine Fisheries Service (NMFS)

1. Sea Turtles

The Philadelphia District is concerned with the possible negative impacts that dredging may exert on threatened and endangered populations of sea turtles both in the Delaware Estuary and along the Atlantic coast of New Jersey and Delaware. We also recognize the need to monitor activities which may present a genuine threat to species of concern. It is the intention of the Philadelphia District to continue monitoring in soft-bottomed shipping channels such as the Delaware Estuary, when warranted. Sea turtle observer(s) shall be on board any hopper dredge working in areas of concern during the first week of the dredging operation from 1 June to 30 November. Following the first week, the observer shall be on board the dredge on a biweekly basis or as appropriate, so that the total aggregate time on board the dredge equals 50 percent of the total time of the dredging operation. While on board the dredge the observer shall provide the required inspection coverage on a rotating, six hours on and six hours off, basis. In addition, these rotating six hour periods should vary from week to week. All such dredging and monitoring will be conducted in a manner consistent with the Incidental Take Statement issued by NMFS for this District. It is also the District's opinion that any program implemented for observation or protection of sea turtles should remain somewhat flexible pending results of such procedures. The District will continue to coordinate monitoring results with NMFS, and work to develop appropriate measures to minimize impacts.

2. Whales

Due to the slow nature of right whales, it is the District's intention to slow dredging vessels to 3 - 5 mph operating speed after sun set or when visibility is low, when a right whale is known to be in the project area. Contract plans and specifications will require a hopper dredge operator to monitor and record the presence of any whale within the project vicinity.

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.

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. Bucket dredging is prohibited from March 15 to May 31 from the Delaware Memorial Bridge to the Kinkora Range. In all areas in the Delaware Bay to the Delaware Memorial Bridge, turtle monitors are required from June 1 to November 30 on hopper dredges.

State Listed Species of Concern

1. Osprey

The construction and operation of the Raccoon Island dredged material disposal area may disturb ospreys that are nesting nearby. The Philadelphia District has been in contact with the NJDEP to find ways to avoid and/or minimize impacts. Ospreys are most vulnerable to disturbance during nest initiation and incubation, which occurs between March 20 and May 31 (Clark. 1995). Construction activities and operating vessels near the nest site will be avoided during this period. Activities such as berm construction may be able to be done during this period if the activities take place strictly on land, and construction vehicles are sufficiently hidden and/or their sound muted relative to the osprey's location. The District will continue to coordinate closely with the NJDEP to follow these guidelines as much as is practicable.

1.1.6 Oil Spill Planning

In general, the Delaware Main Shipping Channel is safe. Despite its length, the volume of traffic and the number of turns required, there are few casualties and few oil spills occurring in the waterway. The high degree of skill and training by pilots, navigation aids built and maintained by the U.S. Coast Guard, and an overall sense of cooperation among various waterway interests, contribute to the navigation safety of the Delaware River. Based on historical spill data, the existing oil spill contingency plan for the Delaware River/Bay appears adequate to handle the vast majority (over 99 percent) of oil spills that may occur in the area. From interviews with experts knowledgeable about the Delaware shipping channel, the channel deepening project, with its selective bend easings, will continue the record of safety in the Delaware River/Bay that has been achieved by the local waterway users. The channel deepening is expected to reduce lightering operations at the Big Stone Beach Anchorage by 40%. This is expected to reduce barge traffic servicing the benefiting oil refineries located in the Delaware River portion of the project area and therefore the likelihood of oil spills.

In addition, a combined effort between the Corps of Engineers, New Jersey Department of Environmental Protection, the US Fish and Wildlife Service and Environmental Systems Research Institute (ESRI), has resulted in The Marine Spill Analysis System (MSAS) for Arc View 2. The system is a personal computer based analysis tool that utilizes Geographic Information Systems (GIS) technologies to combine environmental data, emergency response themes, and digital imagery in order to identify natural resources at risk in the event of an oil spill. The MSAS has the capability to import spill trajectory boundaries produced by other spill models allowing for a quick calculation of quantities for those areas in danger, thus providing timely information to help protect resources threatened by the spill. A comprehensive database consisting of numerous environmental resource datasets are available to the user for impact analysis. Also, an emergency facilities database is linked to the system helping the user in deciding which emergency personnel to contact during a spill event. All output from the system can be used by the Philadelphia Area Committee for practice spill drills and to help emulate various levels of spill scenarios.

1.1.7 Rock Blasting

Adverse impacts to fish will be minimized by conducting blasting between 1 December and 15 March, as recommended by the Delaware River Basin Fish and Wildlife Cooperative, and by using techniques such as delayed blasting and "stemming" to reduce the amount of energy that would impact fish. Monitoring of impacts to fish from blasting will also be conducted.

1.1.8 Cultural Impacts

The draft report of the final cultural resources investigation and the District's finding of "No Effect" was submitted to the Pennsylvania, New Jersey and Delaware SHPO's in September and October, 1995 (see Appendix A). No further cultural resource investigations are anticipated for this project. Section 106 coordination with the Delaware SHPO is continuing and will be concluded prior to any project construction activity.

1.1.9 Environmental Windows

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.

1.2 Relationship to Environmental Statutes

Table 1-1. Environmental Windows

RESOURCE	ACTIVITY	ENVIRONMENTAL WINDOW	REFERENCE SEIS SECTION
Fish	Rock Blasting Overboard Disposal in All Areas	15 March-30 Nov. (Delaware Memorial Bridge to Betsy Ross Bridge)	13.4.3
Shortnose Sturgeon	Hydraulic Dredging in Non-Federal Channels	15 April-21 June (Delaware Memorial Bridge to Kinkora Range)	10.5.2.3
Shortnose Sturgeon	Bucket Dredging in All Areas	15 March-31 May (Delaware Memorial Bridge to Kinkora Range)	10.5.2.3
Sea Turtles	Hopper Dredging in All Areas	1 June-30 November (Delaware Bay to Delaware Memorial Bridge; Sea Turtle Monitors Required)	10.5.2.1
Nesting and Migratory Birds	Construction of Upland Confined Disposal Facilities	Varies	6.6.2
Shorebirds and Horseshoe Crabs	Construction of Wetland Restorations	1 April-30 June	3.3.4.3
Pea Patch Island Wading Bird Colony	Dredging within 2600 ft of Colony	1 April-1 August	10.4.3.6
Bald Eagle and Peregrine Falcon	Construction of Upland Confined Disposal Facilities	Varies	10.5.1
Osprey	Construction of Upland Confined Disposal Facilities	20 March-31 May	10.5.3.1

In accordance with the Fish and Wildlife Coordination Act, two planning aid reports were obtained from the U.S. Fish and Wildlife Service during this study. One of the planning aid reports provided information to assist the District in the beneficial use of dredged material, and the other provided information on managing the upland dredged material disposal areas as wetlands and wildlife habitat. Both of these reports are included in the Appendix B.

In compliance with Section 7 (c) of the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.), biological assessments were prepared that evaluate the potential effects of the Channel Deepening Project on species listed by either the U.S. Fish and Wildlife Service (October 1995) or the National Marine Fisheries Service (September 1995). These assessments were prepared in accordance with the Joint Regulations on Endangered Species (50 CFR Section 402.12). Both of the biological assessments concluded that there will be no impact that would jeopardize the continued existence of any of the listed species, or their critical habitat, as a result of this project.

Based on the information developed during preparation of this Draft Supplemental Environmental Impact Statement, and the application of appropriate measures to minimize project impacts, it was determined in accordance with Section 307(c) of the Coastal Zone Management Act of 1972 that the proposed project complies with an will be conducted in a manner that is consistent with the approved Coastal Zone Management Programs of Pennsylvania, New Jersey and Delaware. Letters of conditional concurrence with our statement of Coastal Zone consistency have been provided by the three States (See Appendix A).

The Philadelphia District of the U.S. Army Corps of Engineers has been involved with the on-going Delaware Estuary Program. District personnel served on the Management Committee and the Science and Technical Advisory Committee (STAC). The District has made project presentations to the Management Committee, the STAC and the Citizens Advisory Committee (CAC). The Delaware Estuary Program has recently prepared a Comprehensive Management Plan to efficiently manage the resources of the Delaware Estuary. The Corps will remain involved to insure that their activities are consistent and supportive of the program.

In order to implement the requirements of Section 404 of the Clean Water Act, an exemption was granted under Section 404(r) when the project was authorized by Congress in October 1992, under the Water Resources Development Act of 1992. A Section 404(b)(1) evaluation has been prepared and follows Table 1-1. This evaluation concluded that the proposed action would not result in any significant environmental impacts relative to the areas of concern under Section 404 of the Clean Water Act.

Table 1-2 provides a list of Federal environmental quality

Table 1-2. Compliance with Environmental Quality Protection Statues and Other Environmental Review Requirements.

Federal Statues	Proposed Plan
Archaeological and Historical Preservation Act, as amended	Full Compliance
Clean Air Act, as amended	Full Compliance
Clean Water Act of 1977	Exempted *
Coastal Zone Management Act of 1972, as amended	See below**
Endangered Species Act of 1973, as amended	Full Compliance
Estuary Protection Act	Full Compliance
Federal Water Project Recreation Act, as amended	N/A
Land and Water Conservation Fund Act, as amended	N/A
Fish and Wildlife Coordination Act	Full Compliance
Marine Protection, Research and Sanctuaries Act	Full Compliance
National Historic Preservation Act, as amended	Full Compliance
National Environmental Policy Act, as amended	Full Compliance
Rivers and Harbors Act	Full Compliance
Watershed Protection and Flood Prevention Act	N/A
Wild and Scenic Rivers Act, as amended	N/A
Executive Orders, Memorandum, etc.:	
EO 11988 Floodplain Management	Full Compliance
EO 11990 Protection of Wetlands	Full Compliance
EO 12114 Environmental Effects of Major Federal Actions	Full Compliance
Analysis if Impacts on Prime and Unique Farmlands	Full Compliance
State and Local Policies	
Coastal Area Management Amendments 1974	Full Compliance
State/Local Permits	See Below***

NOTES: The compliance categories used in this table were assigned based on the following definitions:
Full - All requirements of the statute, E.O., or other policy and related regulations have been met for this stage of project review.
N/A - Statute, E.O., or other policy not applicable.

* This project was granted an exemption under Section 404(r) of the Clean Water Act.
** CZM has been obtained from PA and DE, and will be obtained from NJ prior to construction.
*** All appropriate state and local permits will be obtained prior to construction.

statues applicable to this document, and their compliance status relative to the current stage of project review. Aside from the approvals discussed above, no other permits or approvals are required for implementation of the proposed plan of improvement.

1.2.1 Relationship to the Delaware Estuary Plan

The Delaware Estuary Plan (September, 1996) was reviewed to determine how construction of the Main Channel Deepening Project would effect the implementation of the Plan. The Action Items of the Plan that would be effected are discussed below:

Action L3: Support the Implementation of Coastal Zone Act Management Measures.

The project will be in compliance with this act.

Action W7: Coordinate Dredging Activities and Priorities and the Management of Dredged Material Within the Region.

As described in the SEIS, this project has been coordinated with the three states, as well as Federal conservation agencies. Dredged material from this project will be used for wetland restoration and protection in New Jersey and Delaware. Confined, upland, dredged material disposal areas will be managed to provide wetland habitat. These project features were developed in coordination with the U.S. Fish and Wildlife Service, the U.S. Environmental Protection Agency, the New Jersey Department of Environmental Protection, and the Delaware Department of Natural Resources and Environmental Control.

Action H1: Assure Compliance with Existing Interstate Species Management Plans and Prepare Plans for Additional Appropriate Species.

As described in the SEIS, this project has been coordinated with the U.S. Fish and Wildlife Service, the National Marine Fisheries Service and the conservation agencies from the three effected states. Measures have been added to avoid or minimize impacts to Federally and state listed species as well as other significant resources. Endangered Species consultation has been completed with the FWS and NMFS. Reasonable and prudent measures have been implemented to avoid and minimize impacts.

Action H4: Coordinate and Enhance Wetlands Management within the Estuary.

Refer to response W7 above.

Action H7: Implement Measures to Protect Shoreline and Littoral

Habitats that are Threatened by Sea Level Change.

Refer to response to W7 above. The wetland restoration and protection projects in New Jersey and Delaware using dredged material will help protect these areas from sea level change.

Action H8: Facilitate Coordination among the States to Update and Improve Environmental Sensitivity Index Mapping for Hazardous Spill Response Information.

The Philadelphia District has contributed funds for developing this information as part of this project.

Action T1: Implement a Toxics Management Strategy to Assist Environmental Managers in Developing Regional Prevention and Control Strategies.

The District has collected a great deal of sediment information as a result of this project, and will continue to collect additional sediment data to monitor for possible toxic material. This data is shared with the States.

Action T5: Identify the Sources of Contaminated Sediments, Examine the Process Through Which these Substances are Transported up the Food Chain, and Identify Control Strategies and Mitigation Alternatives.

The District has done extensive physical and biological testing of sediments to determine if any problem areas exist. As discussed in Section 4, no significant impacts are expected.

SECTION 404 (b) (1) EVALUATION: DELAWARE RIVER COMPREHENSIVE NAVIGATION STUDY, MAIN CHANNEL DEEPENING PROJECT

I. PROJECT DESCRIPTION

A. Location: Delaware River and Bay from Philadelphia to the Sea, with dredging and confined, upland disposal sites in Delaware and New Jersey, and various placement locations in Delaware Bay for beneficial uses (See Figure 2-2).

B. General Description: The recommended plan of improvement modifies the depth of the existing navigation 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 in channel widths. The plan also includes widening 12 of 16 existing channel bends, as well as partial deepening of the Marcus Hook Anchorage to 45 feet. Approximately 33 million cubic yards of material would be dredged for initial project construction. In addition, 229,000 cubic yards of rock would be removed from the channel in the vicinity of Marcus Hook, Pennsylvania, with approximately 70,000 cubic yards being removed by blasting and the remainder being removed by mechanical methods such as a dragline. Annual maintenance dredging for the 45-foot channel would increase to 6,007,000 cubic yards from the current 4,888,000 cubic yards for the 40-foot channel, for a net increase of 1,119,000 cubic yards. In the riverine portion of the project area, dredged material would be placed in nine active, Federal, upland, dredged material disposal sites, and four new upland sites identified as 17G, 15D, 15G and Raccoon Island. In Delaware Bay, dredged material from initial project construction would be used for wetland restoration 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. All material that will be dredged from the Delaware Bay for channel maintenance will be deposited into the existing open water site at Buoy 10, as is the present practice.

C. Authority and Purpose
Authorized by a resolution adopted by U. S. House of Representatives, Committee on Public Works dated December 1, 1970 and resolutions adopted by the U. S. Senate, Committee on Public Works, dated March 1, 1954 and September 2, 1974. The Delaware River Main Channel Deepening Project was authorized by Congress for construction in October 1992 as part of the Water Resources Development Act of 1992.

D. General Description of Dredged or Fill Material

(1) General characteristics of Material: Rock, gravel, sand and silt.

(2) Quantity of Material (cubic yards): Approximately 33 million cubic yards of material would be dredged for initial project construction consisting of 17.5 million cubic yards of sand and gravel, and 15.9 million cubic yards of silt. Most of the material dredged from Delaware Bay is sand. In addition, 229,000 cubic yards of rock would be removed from the channel in the vicinity of Marcus Hook, Pennsylvania. Annual maintenance dredging for the 45-foot channel would increase to 6,007,000 cubic yards from the current 4,888,000 cubic yards for the 40-foot channel, for a net increase of 1,119,000 cubic yards(approximately 65% sand and gravel, and 35% silt).

(3) Source of Material: Delaware River Navigation Channel from the Beckett Street Terminal, Camden, NJ to the mouth of Delaware Bay.

E. Description of the Proposed Discharge Sites

(1) Location (map): The locations of dredged material disposal sites are shown on Figure 2-2.

(2) Size (acres): Proposed confined dredged material disposal sites: 17G - 295 ac.; 15D - 320 ac.; 15G - 275 ac.; and Raccoon Island - 350 ac.; Existing Federal, dredged material disposal sites: Reedy Point. - 255 ac. (2 sites); National Park - 115 ac.; Pedricktown North and South - 1085 ac. (2 sites); Penns Neck - 325 ac.; Killcohook - 1235 ac.; and Artificial Island - 300 ac.; Wetland Restorations: Kelly Island - 60 ac; and Egg Island Point - 135 ac.; Sand Stockpiles: MS-19 (Slaughter Beach) - 500 ac; and L-5 (Broadkill Beach) - 230 ac. The open water disposal site at Buoy 10 is approximately 1000 acres in size.

(3) Type of Sites: Proposed and existing upland dredged material disposal sites adjacent to the Delaware River and open water sites in Delaware Bay.

(4) Types of Habitat: All of the proposed confined dredged material disposal sites have previously been used for disposal of dredged material. These areas are predominantly vegetated with common reed and seasonal crops, with smaller areas of oldfield vegetation, and second growth forest; they contain approximately 396 acres of wetlands consisting primarily of common reed (See Table 6-2). The existing confined dredged material disposal sites are predominately vegetated with common reed. The wetland restoration sites are intertidal areas, and the sand stockpile sites are estuarine subtidal habitats in Delaware Bay.

(5) Timing and Duration of Discharge: 3 year initial dredging duration; maintenance dredging will occur annually in selected reaches over a 50 year period.

F. Description of Disposal Method: Hydraulic pipeline dredge or hopper dredge with direct discharge to upland diked disposal area

or beneficial use sites (wetland restorations and sand stockpiles) in Delaware Bay.

II. FACTUAL DETERMINATION

A. Physical Substrate Determinations

(1) Substrate Elevation and Slope: Increase in surface elevations at the open water beneficial use sites and the upland dredged material disposal sites.

(2) Sediment Type: The material to be dredged from the navigation channel is similar in grain size to the existing sediment types at the open water beneficial use sites, and the existing and proposed confined dredged material disposal areas. The rock will be placed in the Fort Mifflin dredged material disposal site, and will be significantly larger in particle size than the sand and silt that exists on the site; however, there will be no significant adverse impact.

(3) Dredged/Fill Material Movement: Not significant. There will be temporary increases in turbidity at the discharge points for the confined dredged material disposal areas, and at the beneficial use and Buoy 10 open water discharge locations. See Section 9.3 of the SEIS.

(4) Physical Effects on Benthos: Burial at beneficial use sites: Benthic evaluations have concluded that the existing benthic communities are neither significant nor unique. (See Sections 8 and 9 of the SEIS).

(5) Action Taken to Minimize Impact: Effluent from diked upland disposal areas will be controlled by adjustable weirs. Also, standard construction practices to minimize turbidity and erosion would be employed.

B. Water Circulation, Fluctuation, and Salinity Determinations

(1) Water. Consider effects on:

a. Salinity - No significant effect (See Section 5 of this document).

b. Water chemistry - No significant effect (See Section 4 of this document).

c. Clarity - Minor short-term increase in turbidity during construction at discharge sites.

d. Color - Minor short-term effect during construction.

e. Odor - No effect.

f. Taste - No effect.

g. Dissolved gas levels - No significant effect.

h. Nutrients - Minor effect.

i. Eutrophication - No effect.

j. Others as appropriate - None.

(2) Current patterns and circulation:

a. Current patterns and flow - No significant impact.

b. Velocity - No significant effects on tidal velocity and longshore current velocity regimes. See Sections 5.13 and 9.3 of this document.

c. Stratification - Thermal stratification occurs beyond the mixing region created by the surf zone at the wetland restoration sites. There is a potential for both winter and summer stratification. The normal pattern should continue post construction of the proposed project.

d. Hydrologic regime - The regime is largely marine and estuarine. This will remain the case following construction of the proposed project.

(3) Normal water level fluctuations - Construction of the proposed work would not affect the tidal regime. The wetland restoration sites are designed to permit regular tidal flushing.

(4) Salinity gradients - There should be no significant effect on existing salinity gradients. See Section 5 of this document.

(5) Actions that will be taken to minimize impacts - Use and monitoring of existing and proposed dredged material disposal area weirs for discharge of effluent to the Delaware River/Bay. Utilization of sand from a clean, high energy environment, and excavation with a hydraulic dredge would also minimize water chemistry impacts at the open water beneficial use sites and Buoy 10 maintenance dredged material disposal area.

C. Suspended Particulate/Turbidity Determinations

(1) Expected Changes in Suspended Particulates and Turbidity Levels in the Vicinity of the Disposal Sites: All silty dredged material will be placed in confined dredged material disposal sites. There will be minimal increases in suspended particulates and turbidity from upland sites due to use of adjustable weirs. There would be a short-term elevation of suspended

particulate concentrations during construction phases in the immediate vicinity of the dredging and the discharge at beneficial use sites.

(2) Effects (degree and duration) on Chemical and Physical Properties of the Water Column:

a. Light penetration - Short-term, limited reductions would be expected as a result of the discharge of effluent from confined dredged material disposal sites, and at the beneficial use disposal sites and Buoy 10 from the deposition of sand material.

b. Dissolved oxygen - There is a potential for a decrease in dissolved oxygen levels at the beneficial use sites, but the anticipated low levels of organics in the dredged material should not generate a high, if any, oxygen demand. No significant effects anticipated as a result of the short-term discharge of effluent from confined dredged material disposal sites.

c. Toxic metals and organics - No significant impacts. See Section 4 of this document.

d. Pathogens - Pathogenic organisms are not expected to be a problem in the areas to be dredged or at the dredged material disposal areas.

e. Aesthetics - No significant impact.

(3) Effects on Biota:

a. Primary production, photosynthesis - Minor, short-term effects related to turbidity. Increase in productivity due to wetland restorations.

b. Suspension/filter feeders - Minor, short-term effects related to suspended particulates outside the immediate deposition zone. Sessile organisms would be subject to burial within the deposition areas at the beneficial use sites.

c. Sight feeders - Minor, short-term effects related to turbidity.

(4) Actions taken to minimize impacts include the use of confined upland disposal areas which will minimize release of suspended solids into receiving waters which are well mixed. Approximately 50% of the area of each upland confined dredged material disposal sites will be managed as wetland habitat during the life of the project (See Section 3.2 of this document).

Appropriate siting of beneficial use sites will minimize impacts to benthic resources. Standard construction practices will also be employed to minimize turbidity and erosion.

D. Contaminant Determinations

The discharge of dredged material is not expected to introduce, relocate, or increase contaminant levels at either the confined upland dredged material disposal sites (including the water that will return to the Delaware River), or from the beneficial use sites in Delaware Bay (See Section 4 of this document).

E. Aquatic Ecosystem and Organism Determinations

(1) Effects on Plankton: The effects on plankton should be minor and mostly related to light level reduction due to turbidity. Significant dissolved oxygen level reductions are not anticipated.

(2) Effects on Benthos: Benthic communities will be displaced at the wetland restoration sites where subtidal habitat is changed into intertidal wetlands. Benthic communities that exist at the sand stockpiles will also be displaced. Recolonization is expected to occur in these areas through horizontal and in some cases vertical migrations of benthos. Impacts on benthic communities will not be significant (See Sections 8 and 9 of this document).

(3) Effects on Nekton: Only a temporary displacement is expected as nekton would probably avoid active work areas.

(4) Effects on Aquatic Food Web: Only a minor, short-term impact on the food web is anticipated. This impact would extend beyond the construction period until recolonization of beneficial use sites occurred (estimated to be up to 18 months).

(5) Effect on Special Aquatic Sites: The overall impact on wetlands will be positive due to management of the upland dredged material disposal areas for creation of wetland habitat, and use of dredged material to restore and protect tidal wetlands at Egg Island Point, NJ and Kelly Island, DE (See Section 3.2 and 6 of this document).

(6) Threatened and Endangered Species: No significant impacts are expected. Section 7 consultation has been performed with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service (See Section 10 of this document).

(7) Other Wildlife: The management of the confined dredged material disposal areas for creation of wetland habitat and the wetland restoration sites will have a positive impact on wildlife resources.

(8) Actions to minimize impacts: Environmental windows will be observed to minimize impacts to aquatic resources from rock blasting, and to shorebirds, horseshoe crabs, and peregrine falcons in constructing the wetland restoration sites. A peregrine falcon nesting tower will be moved to avoid construction impacts. The upland dredged material disposal areas will be managed to create wetlands between dredged material disposal events. Construction techniques will be used to reduce the impacts of rock blasting on fish.

F. Proposed Disposal Site Determinations

(1) Mixing Zone Determination: The following factors have been considered in evaluating the disposal sites:

a. Depth of water at disposal locations.

b. Current velocity, direction, and variability at disposal locations.

c. Dredged material characteristics, constituents, amount, and type of material, and settling velocities.

d. Number of discharges per unit of time.

e. Use of confined upland disposal sites with controlled weirs.

An evaluation of the factors above indicates that the disposal sites and/or size of mixing zone are acceptable (See Section 4 of this document).

(2) Determination of compliance with applicable water quality standards: Extensive testing of water quality parameters has been completed and is presented in Section 4 of this document. It is anticipated that the discharges from the upland dredged material disposal areas and at the beneficial use sites will be in compliance with all state and Federal water quality standards.

(3) Potential Effects on Human Use Characteristics:

a. Municipal and private water supply - No effect.

b. Recreational and commercial fisheries - No significant adverse impacts. Wetland restorations

will benefit fisheries.

c. Water related recreation - No significant impacts.

d. Aesthetics - No significant impacts.

e. Parks, national and historic monuments, national seashores, wilderness areas, etc. - Wetland restoration at Kelly Island will benefit the Bombay Hook National Wildlife Refuge.

G. Determination of Cumulative Effects on the Aquatic Ecosystem- None anticipated.

H. Determination of Secondary Effects on the Aquatic Ecosystem - Any secondary effects would be minor.

III. FINDINGS OF COMPLIANCE OR NON-COMPLIANCE WITH THE RESTRICTIONS ON DISCHARGE

A. No significant adaptation of the Section 404(b)(1) Guidelines were made relative to this evaluation.

B. The alternative measures considered for accomplishing the project objectives are detailed in Section 3 of the Final Environmental Impact Statement which was issued in February 1992 for which a 404(b)(1) analysis is a part.

C. It is not anticipated that the disposal of dredged material at the selected sites would violate any applicable state water quality standards. The disposal operation will not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act. In order to implement the requirements of Section 404 of the Clean Water Act, an exemption was approved under Section 404 (r) as part of the Congressional authorization for this project, Public Law 102-580, Section 101 (6) of the Water Resources Development Act of 1992.

D. Use of the selected disposal sites is not expected to harm any endangered species or their critical habitat. Formal consultation has been completed with the U.S. Fish and Wildlife Service and initiated with the National Marine Fisheries Service (See Section 10 of this document). There are no Marine Sanctuaries designated by the Marine Protection, Research, and Sanctuaries Act of 1972 in the project area.

E. The proposed disposal of dredged material will not result in significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. The life stages of aquatic life and other wildlife will not be adversely affected. Significant adverse effects on aquatic ecosystem diversity,

productivity, and stability, and recreational, aesthetic and economic values will not occur. Management of the upland dredged material disposal areas for wetland values and the restoration of wetlands in Delaware Bay using dredged material, will result in increased fish and wildlife habitat, erosion control, and increased water quality.

F. Appropriate steps to minimize potential adverse impacts of the discharge on aquatic systems includes limiting suspended solids in the diked upland disposal area effluent through control of weir structures. Environmental windows will be observed to minimize impacts to aquatic resources from rock blasting, and to shorebirds, horseshoe crabs, and peregrine falcons in constructing the wetland restoration sites. A peregrine falcon nesting tower will be moved to avoid construction impacts. The upland dredged material disposal areas will be managed to create wetlands between dredged material disposal events. Construction techniques will be used to reduce the impacts of rock blasting on fish.

G. On the basis of the guidelines, the proposed disposal sites for the discharge of dredged material are specified as complying with the 404 (b)(1) guidelines with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects to the aquatic ecosystem.

2.0 Purpose and Need for Action

2.1 Study Authority

The Delaware River Comprehensive Navigation Study was authorized by a resolution adopted by the United States House of Representatives, Committee on Public Works, dated December 2, 1970. That resolution requested an evaluation of existing conditions affecting waterborne commerce on the Delaware River from Trenton, New Jersey, to the sea, and the identification of feasible modifications that would promote and encourage the efficient, economic and logical development of the Delaware River port system. The resolution partially reads: "The scope of such review shall encompass investigation of current shipping problems, adequacy of facilities, delays in intermodal transfers, channel dimensions, storage locations and capacities, and other physical aspects affecting waterborne commerce, including the conduct of such model studies as may be necessary to establish an efficient layout of the port complex and the design of navigation facilities." Studies were also authorized by two resolutions adopted by the United States Senate, Committee on Public Works. The first resolution, adopted on March 1, 1954, requested a review of the Delaware River between Philadelphia and the sea, for the purpose of identifying the need for any modification to the existing channel dimensions and anchorage areas. The second resolution, adopted on September 20, 1974, requested development of a regional dredged material disposal plan for the tidal Delaware River, its tributaries, and Delaware Bay.

In order to implement this project, the project related costs and responsibilities are shared in accordance with the Water resources Development Act of 1986 (PL 99-662) with a non-Federal sponsor. The non-Federal sponsor for this project is the Delaware River Port Authority (DRPA).

2.2 Existing Project

The project area encompasses the Delaware River estuary from Philadelphia, Pennsylvania to the mouth of Delaware Bay (Figure 2-1). The area extends over 100 river miles, and borders 10 counties in the Commonwealth of Pennsylvania, and the States of New Jersey and Delaware. The upstream portion of the project area includes the cities of Philadelphia, Pennsylvania and Camden, New Jersey, which together form the fifth largest metropolitan area in the United States. In conjunction with the port of Wilmington, Delaware, this area supports the largest fresh water port in the world. The area maintains a high concentration of heavy industry, including the nation's second largest complex of oil refineries and petrochemical plants (DRBC, 1988a). Below Wilmington, Delaware, the river broadens into the Delaware Bay. Although many small towns are located along the bay's margins, the surrounding drainage basin is predominantly rural. The bay supports both commercial and sport fisheries along with other recreational activities, is broad and shallow,

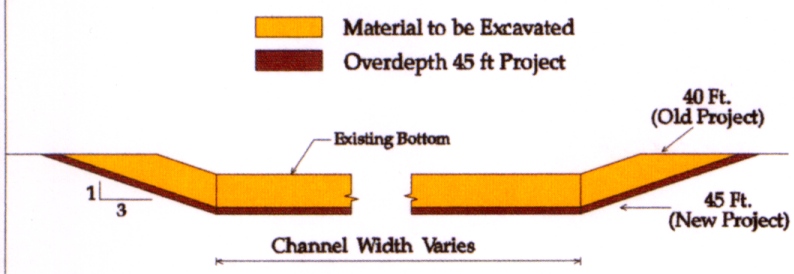
DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT

Study Area

U.S. Army Corps of Engineers, Philadelphia District

Figure 2-1

Typical Channel Cross Section



400 ft: Station 19 to 32
Transition: Station 32 to 43
800 ft: Station 43 to 326
Transition: Station 236 to 334
1000 ft: Station 334 to 515

MONTGOMERY COUNTY
BUCKS COUNTY
CHESTER COUNTY
DELAWARE COUNTY
BURLINGTON COUNTY
CAMDEN COUNTY
GLOUCESTER COUNTY
NEW JERSEY
NEW CASTLE COUNTY
SALEM COUNTY
ATLANTIC COUNTY
CUMBERLAND COUNTY
CAPE MAY COUNTY
SUSSEX COUNTY
DELAWARE

Trenton
133
125
120
110
Raccoon Creek
Philadelphia
Schuylkill River
40' Project Limit
45' Project Limit
Camden
A-A
Ben Franklin Bridge
Beckett Street Terminal
Philadelphia Naval Base
Walt Whitman Bridge
National Park
17C
90
BW9
BW10
BW11
BW12
BW8
Commodore Barry Bridge
Marcus Hook Anchorage
Marcus Hook
Raccoon Island
15D
15G
Oldmans
BW7
75
Wilmington
Pedricktown North
Pedricktown South
Delaware Memorial Bridge
BW6
Salem River
Penns Neck
BW5
Killcohook
100
Chesapeake Bay
Reedy Point North
Chesapeake & Delaware Canal
Salem
BW4
Reedy Point South
BW3
Artificial Island
50
BW2
300
Cohansey River
Vineland
Smyrna
Bombay Hook
Kelly Island
Port Mahon
Dover
400
BW1
25
Egg Island Point
Maurice River
Stone Harbor
Mispillion River
Mispillion Inlet
500
Buoy 10
Slaughter Beach
MS-19
Milford
Cape May Point
Cape May - Lewes Ferry
0
L-5
Broadkill Beach
Lewes
Cape Henlopen

0 2 4 6
MILES
1" = 6.5 Miles

LEGEND

- 0 DRBC River Miles
- 100 Channel Stationing
- Bend Widening Location (BW)
- Existing Disposal Areas
- Proposed Upland Disposal Areas
- Proposed Beneficial Use Areas
- Main Channel
- Channel Reaches
- State Boundaries
- County Boundaries
- Water Features
- Ferry

DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT

Recommended Plan

U.S. Army Corps of Engineers, Philadelphia District

Figure 2-2

and is surrounded by extensive salt marshes and agricultural land.

The existing Delaware River, Philadelphia to the sea, Federal navigation project was adopted in 1910 and modified in 1930, '35, '38, '45, '54 and '58 (Figure 2-2). The existing project provides for a channel from deep water in Delaware Bay to a point in the bay, near Ship John Light, 40 feet deep and 1,000 feet wide; thence to the Philadelphia Naval Base, 40 feet deep and 800 feet wide, with a 1,200-foot width at Bulkhead Bar and a 1,000-foot width at other channel bends; thence to Allegheny Avenue Philadelphia, PA, 40 feet deep and 500 feet wide through Horseshoe Bend and 40 feet deep and 400 feet wide through Philadelphia Harbor along the west side of the channel. The east side of the channel in Philadelphia Harbor has a depth of 37 feet and a width of 600 feet. All depths refer to mean low water. The 40-foot channel from the former Naval Base to the sea was completed in 1942. The channel from the former Naval Base to Allegheny Avenue was completed in 1962.

There are 19 anchorages on the Delaware River. The Mantua Creek, Marcus Hook, Deepwater Point, Reedy Point, Gloucester and Port Richmond anchorages are authorized under the Philadelphia to the sea project. The remaining 13 are natural, deep-water anchorages. The authorized anchorage dimensions are as follows:

Project	Authorized Dimensions
Mantua Creek:	40' X 2,300' X 11, 500' (mean)
Marcus Hook:	40' X 2,300' X 13, 650' (mean)
Deepwater Point:	40' X 2,300' X 5, 200' (mean)
Reedy Point:	40' X 2,300' X 8, 000' (mean)
Port Richmond:	37' X 500' (mean) X 6,400'
Gloucester:	30' X 400' (mean) X 3,500'

Mantua Creek anchorage is currently maintained to about 60% of the authorized width and a 37-foot depth. The Marcus Hook anchorage, enlarged in 1964, is maintained to authorized dimensions. The anchorage at Port Richmond is about 35 feet deep, as are the Reedy Point and Deepwater Point anchorages. The Gloucester anchorage requires no dredging and is currently deeper than authorized.

There are wide variations in the amount of dredging required to maintain the Philadelphia to the sea project. Some ranges are nearly self maintaining and others experience rapid shoaling. The 40-foot channel requires annual maintenance dredging in the amount of 4,900,000 cubic yards. Of this amount, the majority of material is removed from the Marcus Hook (44%), Deepwater Point (18%) and New Castle (23%) ranges. The remaining 15 percent of material is spread throughout the other 37 channel ranges. The historic annual maintenance quantities for the Marcus Hook and Mantua Creek anchorages are 487,000 and 157,000 cubic yards, respectively.

The Federal government has the responsibility for providing the necessary dredged material disposal areas for placement of material dredged for project maintenance. There are currently seven upland sites and one open-water site, located in Delaware Bay, that are used for this purpose.

In 1984, the Corps completed the Delaware River Dredging Disposal Study (USACE, 1984), which evaluated future dredging needs and existing dredged material disposal capacity. Dredged material disposal capacity required for continued maintenance of the existing 40-foot deep, Philadelphia to the sea, Federal navigation channel was evaluated for a 50-year study period (2005-2055). For the purpose of evaluating capacity requirements for the entire Philadelphia to the sea project, the channel was divided into five reaches. The limits of these reaches are defined in Figure 2-1. The following provides a description of the disposal area requirements for each reach during the study period. The ultimate capacity of existing sites and the number of new sites required will depend on maximum dike heights of existing disposal sites.

Reach A

Reach A extends from the upper project limit at Allegheny Avenue, Philadelphia, Pennsylvania to Billingsport Range, located near the Philadelphia International Airport. Approximately 153,000 cubic yards of material are dredged from these channel ranges on an annual basis. This material is dredged for both the Delaware River, Philadelphia to the sea project, and the Delaware River at Camden project. This material is currently placed in a single upland disposal area located at National Park, New Jersey (Figure 2-2). This site has a capacity of about 3.2 million cubic yards to a dike height of 50 feet. With the current rate of usage, this elevation would be reached in the year 2007. Raising the dike further could add an additional 3.3 million cubic yards of capacity, and extend the life of the site to 2027.

In order to continue maintenance dredging activities for the full 50-year term of the study period, an additional disposal area will be required in the vicinity of Reach A. The existing Fort Mifflin dredged material disposal site was considered, however, this site is required for the disposal of material dredged from the Schuylkill River project. As such, a new site would be required for disposal activities by the year 2027, assuming continued dike raising will occur.

Reach B

Reach B extends from Tinicum Range, located opposite of the Philadelphia International Airport to Cherry Island Range, located opposite of Wilmington, Delaware. This reach includes the Marcus Hook Range and the Marcus Hook Anchorage, which are the heaviest shoaling areas in the river. Approximately 2,400,000 cubic yards of material are dredged from Reach B on an

annual basis. This material is currently placed in three dredged material disposal sites. These sites are the Federally owned Pedricktown North and Pedricktown South sites, and the adjacent Oldmans site, which is leased (Figure 2-2). These sites currently have a combined capacity of 21.3 million cubic yards to a dike height of 50 feet. Replacement sites would be needed by the base year if dikes at the Federal sites are not raised and if the Oldmans lease cannot be extended beyond the current expiration date of 1996. Raising the dikes further could add an additional 36.5 million cubic yards of capacity, and extend the life of this complex to 2030. A new site would be required by the year 2030 assuming that dike raising continues.

Reach C

Reach C extends from Deepwater Point Range, located below Wilmington, Delaware to New Castle Range, located at the mouth of the Chesapeake and Delaware Canal. Approximately 2,000,000 cubic yards of material are dredged from Reach C on an annual basis. This material is currently placed in two Federally owned sites, Penns Neck and Killcohook (Figure 2-2). These sites have a disposal capacity of 42.3 million cubic yards to a dike height of 50 feet. Based on current usage, fill would reach that elevation in year 2014. Raising the dikes further would add an additional 48.7 million cubic yards of capacity and extend the lives of these sites throughout the planning period. As such, there is sufficient dredged material disposal capacity in Reach C to conduct maintenance dredging activities for the full term of the study period, assuming dike raising continues.

Reach D

Reach D extends from Reedy Island Range, located south of the Chesapeake and Delaware Canal to Liston Range, located just north of Delaware Bay. Approximately 226,000 cubic yards of material are dredged from Reach D on an annual basis. This material is currently placed in the Federally owned dredged material disposal site on Artificial Island (Figure 2-2). The Artificial Island site has a capacity of 15.8 million cubic yards to a dike height of 50 feet. By raising the dikes further, an additional 4.9 million cubic yards of capacity would be gained. There is sufficient dredged material disposal capacity to maintain the navigation channel in Reach D for the entire 50-year study period and beyond.

Reach E

Reach E covers the remaining portion of the study area from the lower portion of Liston Range in the upper portion of Delaware Bay to naturally deep water in the lower portion of the bay. Approximately 370,000 cubic yards of material are dredged from Reach E every five years. This material is currently placed in an overboard disposal site designated as Buoy 10 (Figure 2-2). Buoy 10 is a deep trench in the lower portion of Delaware Bay,

located approximately six miles northwest of Cape May Point. Sufficient capacity exists at the Buoy 10 site to continue maintenance dredging activities within Reach E for more than the 50-year study period.

About 250 piers, wharves and docks are located in the port system. Most of these service private facilities along the Delaware River. Public port facilities are located at the cities of Philadelphia, Pennsylvania; Camden, Gloucester and Salem, New Jersey; and Wilmington, Delaware. Several large oil refineries are located along the Delaware River between Philadelphia and Delaware City including Sun, Chevron, Mobil, Texaco, BP, Coastal and Atlantic. These refineries generate the majority of commodity movements on the region's waterways either by receipt of crude oil and refined products or by shipment of petroleum products and chemicals to other facilities in the region or domestic ports. Major dry and liquid bulk facilities are also found along the Delaware River at Wilmington, Delaware; Port Richmond in Northeast Philadelphia; Paulsboro, New Jersey; Greenwhich point in South Philadelphia; and along the Schuylkill River in Philadelphia. The numerous tributaries to the Delaware River support a variety of industries, and the waterways are used primarily for delivery of fuel oils and raw materials or shipment of products.

The Delaware River system can be entered or exited via the Delaware Bay entrance or through the Chesapeake and Delaware Canal. Two sets of ocean traffic lanes converge at a precautionary area at the bay entrance. Each set of lanes has a separation zone for safety between inbound and outbound vessels. The northern Cape Henlopen - Five Fathom Bank lanes have minimum depths close to the 40-foot main channel depth, and are used primarily by smaller vessels and those engaged in coastwise commerce. The southern Cape Henlopen - Delaware lanes are much deeper, with minimum depths of about 55 feet outbound and 59 feet inbound. These lanes are used by most vessels engaged in foreign commerce including the large bulk carriers and tankers, as well as for coastwise movements to the south. Each set of ocean lanes is marked by a series of buoys centrally located in each separation zone. Some vessels are piloted within the Delaware River system by members of the Pilot's Association for the Delaware River and Bay. They board incoming vessels in the pilot area at the bay entrance and at the Maryland/Delaware line in the C&D Canal.

From the bay entrance vessels can either proceed up the main Delaware River channel to the Philadelphia ports, or through naturally deep waters to the Big Stone Beach anchorage in lower Delaware Bay. This anchorage has been used for over 25 years by large tankers to lighter (primarily crude oil) onto barges. Maximum drafts for tankers entering the bay is 55 ft and lightering reduces the tanker's operation drafts to those acceptable for the 40 ft channel. In 1983 this anchorage was reclassified by the U.S. Coast Guard as a general purpose

anchorage, however lightering is still the dominant activity.

The 40-foot Delaware River channel provides for two-way traffic up to the Philadelphia Navy Yard where it transitions to a 400-ft width on the west side. Within Philadelphia Harbor the 37 foot east side of the channel allows two-way traffic, with shallower vessels yielding the 40-foot channel to deeper vessels. The 40-foot channel continues upriver to the steel facility at Fairless Hills, PA as the Philadelphia to Trenton segment of the Delaware River channel. The main channel serves numerous other tributary projects which provide both one-way and two-way access to facilities engaged in foreign, coastwise, and internal commerce. The main channel is connected to the Chesapeake Bay and Port of Baltimore by the C&D Canal. The canal is used by container liner services that call at Baltimore as well as by lesser draft domestic vessels, tug and barge traffic, and pleasure craft.

The six Federally authorized anchorages as well as the 13 naturally deep U.S. Coast Guard designated areas adjoin the Delaware River channel between Philadelphia and Delaware Bay. Included are general and special purpose anchorages. Vessels are permitted to anchor for a period up to 48 hours (or longer with a Coast Guard permit). Vessel usage is recorded by the U.S. Coast Guard only for the commonly used anchorages at Big Stone Beach, Mantua Creek, Marcus Hook, and Kaighn Point Gloucester in addition to the breakwater area at the bay entrance. Vessel length restrictions are enforced at Mantua Creek (700 feet) anchorage to avoid vessels swinging outside anchorage boundaries during a change of tide. Of the upriver anchorages, only Marcus Hook provides depths compatible with the 40 foot channel. The most heavily used anchorages on the river are Marcus Hook and Mantua Creek. The dominant usage at those anchorages is by tankers for the refineries and bulk vessels, respectively. The anchorages are generally used to avoid accidents during foul weather and poor visibility; during lightering, bunkering or repairs; or while awaiting berth space or favorable tide conditions.

The Pilot's Association and Mariner's Advisory Committee have established operating procedures for safe vessel movement. Vessel sailing drafts of up to 40 feet inbound and outbound can utilize the present Delaware River, Philadelphia to the sea project.

Traffic monitoring on the Delaware River system is accomplished by the U.S. Coast Guard, Philadelphia Maritime Exchange, and Pilot's Association. A major consideration in this effort is tidal conditions. Rising tides are used to maximize cargo while maintaining safe underkeel clearance. The U.S. Coast Guard is notified of vessel arrivals at least 48 hours ahead of time. The Maritime Exchange maintains a record of scheduled arrivals and departures. The pilots coordinate among themselves to ensure safe and efficient vessel movements and they also communicate

with the captains of other smaller vessels and tows operating on the river. Pilots also communicate with tug operators to arrange for docking assistance, if required. Tugs will accompany large vessels as they approach and depart port facilities for additional safety.

Vessel operations occur day or night on the major waterways using channel markers, range lights, and other physical references to guide navigation. Raycon (a radar transponder beacon, which emits a characteristic signal when triggered by the emissions of ship's radar) has been installed at selected locations at the bay entrance and Big Stone Beach anchorage. It enhances the ability of vessel operators to determine vessel location during poor visibility conditions.

Typical vessel speeds in the Delaware River vary between 5 and 12 knots. Larger tankers (275,000 DWT) operate with tug assistance during light traffic situations. Passing/meeting situations are limited at bends depending on vessel and traffic conditions. Traffic keep in touch with the Maritime Exchange.

Vessels with drafts of 37-foot or less can safely operate without use of the tides. Vessels with drafts in excess of 37-foot operating depth must rely on the tide. The critical area of concern for deep draft vessel operation in the Delaware River is the Marcus Hook Range, with its rock outcroppings in the channel. Typical travel times are about 7 1/2 hours upriver, and 12 hours downriver.

2.3 Previous Investigation

In accordance with the various study authorities, the Philadelphia District of the U.S. Army Corps of Engineers conducted a Feasibility level investigation to address and evaluate the potential for project modifications to improve navigation efficiencies in the Delaware River channel system between Philadelphia and the sea. It was determined that current Federal channel depths restrict efficient use of both present and future tankers, dry bulk carriers, and container vessels. These conditions result in significant light loading and lightering costs, vessel delays, and exclusion of some of the larger and more efficient world fleet from visiting Delaware River ports.

Based on economic and environmental analyses, a two way, full-width channel with a depth of 45 feet at mean low water (mlw) was selected as the recommended plan of improvement. From the Beckett Street Terminal located in Camden, New Jersey through Philadelphia Harbor, the 400 to 500-foot width west side channel, now at a depth of 40 feet mlw, would be deepened while the east side channel would remain 37 feet deep. Between the Philadelphia Navy Yard and Delaware Bay the existing channel would be deepened for its full 800-foot width. In the bay the full 1,000-foot width channel would be deepened. The plan would not modify existing authorized channel widths. As part of this plan, the

trapezoidal access channel to Beckett Street Terminal's bulk berths would also be deepened. This would modify the Delaware River in the Vicinity of Camden Project. Use of anchorages has been limited in recent years. Only the Marcus Hook anchorage would be partially deepened to provide space for two vessels for safety purposes. Bend widenings would also be provided, as required. This plan would provide deeper access to the major import and export facilities along the main channel, including six oil refineries, the Conrail coal and iron ore facilities at Piers 122 and 124, and the Beckett Street Terminal.

During the Feasibility study, it was estimated that 50,100,00 cubic yards of material would be dredged to deepen the currently authorized 40-foot channel to 45 feet. Three upland sites, 17O, 15D, and Raccoon Island, were determined to be most suitable for meeting dredged material disposal capacity requirements associated with construction and maintenance of a deeper channel (Figure 2-2). All three sites have been used for dredged material disposal in the past. In addition, two existing upland sites would also be required. These sites are Reedy Point North and Reedy Point South, located at the confluence of the Chesapeake and Delaware Canal and the Delaware River (Figure 2-2). The existing National Park, Oldmans, Pedricktown North, Pedricktown South, Killcohook, Penns Neck and Artificial Island sites would continue to be used for disposal of material attributed to maintenance of the existing 40-foot project. In Delaware Bay, several beneficial use options were under consideration for the disposition of sandy dredged material. These options included wetland restoration and sand stockpiling for future beach nourishment efforts.

Alternatives to the recommended plan of improvement were documented in the February 1992 Final Delaware River Comprehensive Navigation Study Main Channel Deepening Interim Feasibility Report and Environmental Impact Statement (USACE, 1992). Discussions on plans eliminated from further study, the no action plan, navigational improvements considered in detail, and alternative dredged material disposal plans were provided. Plans eliminated from further study included a 50-foot channel deepening alternative; channel deepening between Philadelphia and Trenton, New Jersey; channel realignment at the Benjamin Franklin Bridge; channel realignment at Marcus Hook, Pennsylvania; anchorage modifications; and the feasibility of an oil pipeline system as an alternative to channel deepening. Navigational improvements considered in detail included three alternatives for deepening the existing channel between Philadelphia Harbor and the mouth of Delaware Bay. These alternatives were deepening the entire width of the existing channel, and two asymmetric channel designs that would deepen various widths of the inbound lane, based on different sets of design criteria. Each alternative was evaluated for deepening in one-foot increments between 41 and 46 feet mlw. Each of the three alternative channel schemes would require widening of channel bends to safely facilitate turning of larger vessels in accordance with Corps design criteria. The no

action plan entailed continued maintenance of the existing 40-foot project. It was concluded that existing channel dimensions restrict the efficiency of bulk commodity vessels calling at Delaware River Ports. A significant percentage of tankers and dry bulk carriers are currently forced to employ non-structural practices such as lightering and light loading to transport their commodities to the Delaware River Valley. These practices increase transportation costs, which reduces the economic viability of the operations. In addition, inefficient channel conditions hinder the ability of Delaware River Ports to compete for waterborne commerce with other East Coast Ports.

Candidate dredged material disposal sites to meet future capacity requirements were identified during the 1984, Delaware River Dredging Disposal Study (USACE, 1984). Approximately 300 candidate sites were further considered during the Feasibility investigation. Plan formulation with regard to selection of suitable dredged material disposal sites involved several iterations of engineering, economic and environmental screening. Initial screening considered features such as archaeological zones, historic sites, recreational areas, groundwater recharge zones, groundwater protection zones, areas important to fish and wildlife, wetlands, development, navigation features, elevation and distance from dredging sites. Engineering considerations included minimum acreage requirements, accessibility for construction and maintenance, reasonable disposal pipeline routes and effluent water courses to the river. Institutional considerations included public park land, designated wildlife areas, proximity to residential communities, and consistency with Federally approved Coastal Zone Management Plans. Sites remaining after these screening iterations were subject to detailed cost analysis. Specific data with respect to site acquisition, initial dike construction, annual maintenance, site capacity and mitigation requirements were developed and evaluated to generate a relative ranking of the costs associated with each site.

2.3.2 Refinements of the Authorized Plan

The refinements of the recommended plan from the authorized plan and reasons are presented in the following paragraphs.

2.3.2.1 Upland Dredged Material Disposal Plan

The feasibility plan for disposal of Delaware River sediments from initial dredging called for use of two existing Federally owned upland disposal areas (Reedy Point North and South) and procurement of three additional sites by the sponsor, identified as 17O, Raccoon Island and 15D. The non-Federal sponsor(DRPA) would reimburse the Government on the usage of the Federal sites.

As part of the PED study, the selected disposal plan was reviewed to see if existing conditions or usage of disposal areas changed from that analyzed in the Feasibility Study. That review

indicated that disposal site 17G is now available, as plans for private development have been discontinued and a portion of site 15D (about 200 acres) is not available.

Site 17G was evaluated during the Feasibility Study and was eliminated from selection due to the expectation that it would be developed prior to implementation of the proposed 45 foot project. Site 17G is located upriver from site 17O. The two sites are physically similar and were ranked closely during the screening process. As a result, site 17O which has some cultural concerns, was eliminated, and site 17G was substituted.

To compensate for the 200 acre reduction in site 15D, site 15G was added. Similar to site 17G, site 15G was evaluated during the Feasibility Study and was closely ranked with site 15D. This substitution of the two sites (17G and 15G) had no impact on the previously estimated project construction costs. Based on coordination with the sponsor, the sponsor has the ability to acquire the selected candidate sites. As a result, disposal sites identified as 17G, Raccoon Island, 15D and 15G were selected as the candidate sites for detailed engineering and environmental field testing.

Using the above sites, a re-evaluation of the feasibility disposal plan was made. An analysis was conducted of disposal capacity of the existing Federal disposal sites that are currently being used for the disposal of dredged material for the existing 40 foot project. The analysis also included the disposal of the dredged material from the initial deepening of the 45 foot project as well as the subsequent maintenance.

Re-evaluation of the disposal plan determined that the most efficient manner to dispose of the initial quantities from Reaches AA-D would be to utilize the existing Federal disposal areas (National Park, Oldmans, Pedricktown North and South, Penns Neck, Killcohook, Reedy Point North and South and Artificial Island) in combination with the four proposed sites (17G, Raccoon Island, 15D, and 15G). This disposal plan was reviewed and approved by the sponsor. The sponsor will provide an equivalent amount of disposal capacity to the Federal Government from the four proposed sites to offset the loss of disposal capacity at the existing Federal sites incurred by the 45 foot deepening project (i.e. initial dredging and incremental maintenance for 50 years).

The use of existing Federal and sponsor upland disposal areas for the initial dredging and subsequent maintenance is a cost effective plan which provides enough capacity for all initial dredging and 50 year maintenance. The acquisition of 17G, Raccoon Island, 15D, and 15G disposal areas provides the Corps of Engineers with an equivalent disposal area capacity to offset the loss of capacity incurred by the deepening project. The proximity of the proposed disposal areas to critical high shoaling areas in the Delaware River is an additional long term benefit in that

future maintenance contracts will remain cost effective. In addition, the provision of the disposal capacity to the Federal Government at the proposed sites prolongs the life of the existing Federal areas and precludes the necessity for the Corps to purchase another disposal area for the next 50 years.

2.3.2.2 Beneficial Use Plan

As indicated in the Feasibility Report, the dredged material from the Delaware Bay portion of the project area was designated for beneficial use purposes (ie., wetland restoration/protection and sand stockpiling). Further benthic studies were deferred to the PED Study to finalize the design of the proposed sites. Detailed benthic studies were conducted during the PED Study phase to refine the proposed sites that were recommended in the Feasibility Report. Based on the benthic studies and the coordination with resource agencies, the location and size of the proposed sites were finalized. As a result of these refinements and coordination, the beneficial use plan consists of wetland restoration at Kelly Island, Port Mahon, Delaware, wetland protection/restoration at Egg Island Point, New Jersey and sand stockpiling offshore at Slaughter (MS-19) and Broadkill (L-5) Beaches in the State of Delaware.

2.3.2.3 Channel Bend Widening

As a result of the ship simulation modelling that was conducted by the Corps of Engineers Waterways Experiment Station and Pilot's Association for the Bay and River Delaware, the number of the channel bends requiring widening was reduced from 16 to 12.

2.3.2.4 Overdepth Reduction

Current guidance (Engineering Regulation 11130-2-307, Dredging Polices and Practices, Interim Guidance, 1 June 1991), specifies that "New work dredging plans and specifications, where hard materials exist (e.g. dense clays, rock or manmade materials), shall have a required depth, required overdepth, and an allowable overdepth". For the proposed deepening project, because of the nature of the material (i.e., most of the excavated material will consist primarily of sand or silt), only the allowable overdepth is deemed to be appropriate. This allowable overdepth has been determined to be 1 foot. As a result, the overdepth was reduced from 2 to 1 foot. This practice has successfully been used in maintaining the authorized 40 foot channel depth.

2.3.2.5 Summary

The above adjustments represent refinements to the authorized plan that was recommended in the 1992 Interim Feasibility Report. Furthermore, these refinements did not alter the environmental impacts that were presented in the Final Environmental Impact Statement.

2.4 Economic Benefits

The proposed deepening of the Delaware River channel from 40 to 45 feet will have a significant positive impact by reducing the cost of transporting commodities into and out of the port. The deepening will allow more efficient vessel loading by the current fleet, will reduce the lightering requirements of large crude oil tankers at the anchorage in the lower Delaware Bay, and will attract larger, more efficient container and dry bulk vessels to serve the port. The deepened channel is not expected to induce extra tonnage to shift to the port from competing ports. Equivalent tonnage, defined as current tonnage plus the incorporation of future commodity growth, will move through the port with either the current 40-foot channel or the deepened 45-foot channel. The 45-foot channel will allow this equivalent tonnage to be transported more cost-effectively. It is estimated that the proposed deepening will result in annual transportation savings of $40.1 million. Commodities that will benefit include crude oil imports, scrap exports, iron ore imports, and containers.

2.5 Previous NEPA Coordination

A notice of intent to prepare a Draft Environmental Impact Statement (DEIS) for the Delaware River Comprehensive Navigation Study Main Channel Deepening Project was published in the Federal Register on May 4, 1989. A notice of availability for that DEIS was published in the Federal Register on July 13, 1990. Subsequent to coordination of the DEIS it was determined that a DEIS amendment would be required to provide additional information regarding the environmental impacts of the proposed project. Areas of concern included the chemical characteristics of the sediments that would be dredged and potential water quality impacts; potential changes to salinity patterns of the Delaware Estuary as a result of channel deepening; potential impacts to groundwater resources in the project area; the feasibility of an oil pipeline system to limit the need for a navigation channel within the Delaware River; the impact of rock blasting on fishery resources in the vicinity of Marcus Hook, PA; the occurrence of wetlands in selected upland dredged material disposal sites; and an analysis of alternatives to the use of the existing open water disposal site in Delaware Bay. The DEIS amendment was comprised of seven sections that addressed each of these issues, as well as a project introduction/alternatives review section and an economic evaluation of the selected plan of improvement. A notice of availability for the DEIS amendment was published in the Federal Register on December 6, 1991. Subsequent to a 45-day public comment period, the information contained in the amendment and the comments received on the DEIS and the amendment were integrated into a Final Environmental Impact Statement (FEIS).

Subsequent to a public review and comment period, the February 1992 Final Delaware River Comprehensive Navigation Study Main

Channel Deepening Interim Feasibility Report and Environmental Impact Statement was approved by the North Atlantic Division of the U.S. Army Corps of Engineers and the Board of Engineers for Rivers and Harbors, and transmitted to Congress. The project was authorized by Congress in October 1992 as part of the Water Resources Development Act of 1992. The Record of Decision for the FEIS, dated December 17, 1992, documented supplementary environmental analyses to be conducted during the Preconstruction, Engineering and Design phase of project development to re-affirm conclusions reached during Feasibility investigations. These analyses are listed in Section 2.6, below.

2.6 PED Study Objectives

Upon approval of the Feasibility report and Environmental Impact Statement in 1992, the Preconstruction, Engineering and Design (PED) phase of study was initiated. The objectives of this study are to refine the recommended plan of improvement that was presented in the Feasibility report; to respond to outstanding resource agency concerns; and to finalize project design features.

The principal focus of this effort was to respond to environmental concerns, which were raised by Federal and State resource agencies during review of the Feasibility report and Environmental Impact Statement. The Record of Decision for the EIS states:

"Supplementary environmental analyses are planned for the Preconstruction, Engineering and Design phase of project development to verify conclusions reached during feasibility investigations. These analyses include: Three- dimensional hydrodynamic modeling of the Delaware estuary to evaluate potential changes in salinity and circulation patterns; Benthic invertebrate sampling to assess habitat quality at selected beneficial use sites in Delaware Bay; Biological effects based testing to determine the impact of open water disposal on aquatic ecosystems; Detailed environmental assessments of selected upland dredged material disposal sites; Consultation with both the U.S. Fish and Wildlife Service and the National Marine Fisheries Service, pursuant to Section 7 of the Endangered Species Act; Cultural resource investigations in dredging and disposal locations; and Coordination with the regional oil spill response teams to review the adequacy of existing Delaware River spill contingency plans. The results of these analyses will be appropriately coordinated with interested agencies and the concerned public, pursuant to the National Environmental Policy Act."

To address the outstanding environmental issues, scientific investigations were developed and conducted to collect sufficient data to evaluate the validity of conclusions reached during the Feasibility phase of study. The work efforts and results have been coordinated with appropriate resource agencies and

interested individuals. The results of these studies are presented in later sections of this document. Study results have been incorporated into the final design of the proposed project.

2.7 Problems, Needs and Public Concerns

The major problem associated with the existing Delaware River, Philadelphia to the sea, Federal navigation project is an insufficient channel depth to accommodate bulk commodity vessels at design drafts. These commodities, which include crude oil, coal and iron ore, are currently shipped in partially loaded vessels due to draft restrictions.

Existing channel dimensions reduce the economic efficiency of larger ships moving through this major commercial area. Crude and refined oil products are the highest volume commodity in United States freight trade and account for the overwhelming majority of tonnage moved in the Delaware River. The refineries located along the Delaware River account for a significant portion of the refinery capacity of the United States and provide petroleum products throughout the Mid-Atlantic states. A large amount of the crude oil that comes to the Delaware River facilities is lightered. Lightering is the transfer of cargo from a large, deep-draft vessel to a smaller vessel or barge to maximize the cargo tonnage carried over a long voyage. Vessels that require a depth greater than 40 feet must transfer a portion of their cargo in Delaware Bay before they can travel upriver. In addition, many of the coal vessels and iron ore vessels are also partially loaded. Provision of a deeper channel would reduce or eliminate inefficient non-structural practices such as lightering and light loading, now employed for restricted vessels. In addition, several users are likely to utilize larger vessels if a deeper channel is provided.

A critical element in the development of any navigation study is the disposal of dredged material. Approximately 4.8 million cubic yards of material for the existing 40-foot channel project are annually dredged from the Delaware River between Philadelphia and the sea. Acquisition of disposal areas for the existing channel is now solely a Federal responsibility. There are seven active upland disposal areas for the Philadelphia to the sea project. Additional dredged material disposal sites will be needed to adequately handle dredged material from the existing Federal project past the year 2020. New disposal areas will be required for new construction and maintenance of a deeper channel. A secondary objective of this project is to upgrade present disposal areas and locate additional sites with sufficient capacity to handle deepening and maintenance dredging operations over the full 50-year project life.

Public concerns with regard to the Delaware River and bay include protection of natural resources, specifically wetlands, fisheries and wildlife; air and water quality control; protection of cultural resources; and enhancement of economic conditions within

the Delaware Valley. A current concern with regard to water quality is prevention of oil spills in the river.