10.0 Endangered Species Concerns

Table 10-1 lists all Federally listed endangered and threatened species, and table 10-2 lists all state listed endangered and threatened species that are known to occur in or near areas that may be impacted by this project.

10.1 Federally Endangered Species of Concern

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

10.1.1.1 Bald Eagle (Haliaeetus leucocephalus)

The bald eagle was listed as an endangered or threatened species throughout the United States in 1978; the Chesapeake Bay Region (CBR) bald eagle population was determined to be threatened in 1995. The bald eagles in the project area are covered under the Chesapeake Bay Region Bald Eagle Recovery Plan: First Revision (USFWS. 1990).

The CBR bald eagle occupies shoreline habitat of the Chesapeake and Delaware Bays and their tributaries. The eagle requires large blocks of undisturbed mature forested habitat in proximity to aquatic foraging areas. The principal threat to its continued recovery is habitat loss due to shoreline development and other land use changes. The CBR eagle is also threatened by acute toxicity caused by continued use of certain contaminants, shooting, accidents, and natural environmental events (USFWS. 1990).

Bald eagles have been documented to be sensitive to human activity and disturbance, particularly during the breeding season, although sensitivity varies greatly between individuals (Mathisen, 1968; Stalmaster and Newman, 1978; USFWS, 1990; Grubb and King, 1991). The breeding cycle of CBR bald eagles can generally be divided into four phases with each phase having an associated level of sensitivity to human disturbance (Cline, 1990; Figure 10-1). Eagles are most sensitive early in the nesting cycle when nest selection, nest building, incubation and brooding occur (Mathisen, 1968). Bald eagles are moderately sensitive to disturbance when young are older and preparing to fledge. After young are fledged and before nest selection begins, the bald eagles are least sensitive to disturbance. Most bald eagle nests are located in large wooded areas associated with marshes and other water bodies. Sometimes nests are built in isolated trees located in marshes, farmland or clear cuts. Nest sites are typically remote from areas of intense human activity, although some have been observed near railroad tracks, highways, airfield runways and human residences (USFWS, 1990). Primary factors contributing to breeding habitat suitability are distance from human activity, availability of suitable nest trees, and an adequate forage base (USFWS, 1986).

Table 10-1 Delaware River Main Channel Deepening Project
Federally Listed Species
That Occur in the Project Area

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

Bald Eagle (Haliaeetus leucocephalus) - Threatened *
Peregrine Falcon (Falco peregrinus) - Endangered *
Sensitive Joint-Vetch (Aeschynomene verginica) - Threatened

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

Loggerhead Sea Turtle (Caretta caretta) - Threatened *
Kemp's Ridley Sea Turtle (Lepidochelys kempii) -Endangered*
Green Turtle (Chelonia mydas) -Endangered *
Hawksbill Sea Turtle (Eretmocheys imbricata) - Endangered *
Leatherback Sea Turtle (Dermochelys coriacea) - Endangered*
Finback Whale (Balaenoptera physalus) - Endangered *
Right Whale (Eubalaena glacialis) - Endangered *
Humpback Whale (Megaptera novaeanjliae) - Endangered*
Shortnose Sturgeon (Acipenser brevirostrum) - Endangered *

3. Action: Biological Assessments have been prepared for those species (*) that were requested by either the FWS or the NMFS. See Sections 10.3, 10.4, and 10.5 for a discussion of the biological assessments including the "reasonable and prudent" measures to minimize impacts.

Table 10-2 Delaware River Main Channel Deepening Project
State Listed Species
That Occur in the Project Area

1. New Jersey

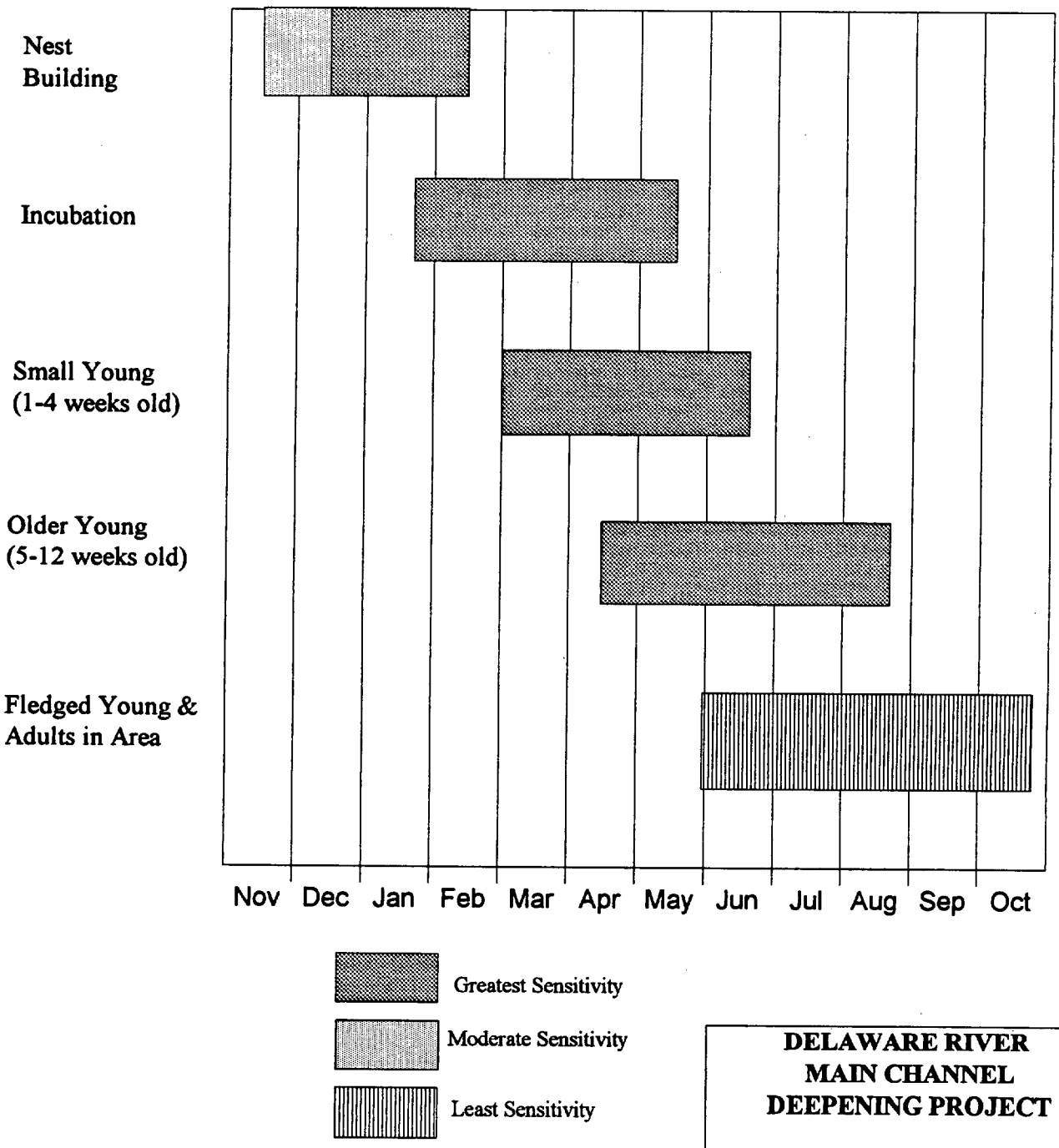
Bald Eagle (Haliaeetus leucocephalus) - Endangered
Peregrine Falcon (Falco peregrinus) - Endangered
Osprey (Pandion haliaetus) - Threatened
Great Blue Heron (Ardea Herodias) - Threatened (Breeding)
Northern Harrier (Circus cyaneus) - Endangered (Breeding)
Pied-Billed Grebe (Podilymbus podiceps) - Endangered (Breeding)
Loggerhead Sea Turtle (Caretta caretta) - Threatened
Kemp's Ridley Sea Turtle (Lepidochelys kempii) -Endangered
Green Turtle (Chelonia mydas) -Endangered
Hawksbill Sea Turtle (Eretmocheys imbricata) - Endangered
Leatherback Sea Turtle (Dermochelys coriacea) - Endangered
Finback Whale (Balaenoptera physalus) - Endangered
Right Whale (Eubalaena glacialis) - Endangered
Humpback Whale (Megaptera novaeanjliae) - Endangered
Shortnose Sturgeon (Acipenser brevirostrum) - Endangered
Sensitive Joint-Vetch (Aeschynomene verginica) - Endangered
Engelmann's Flatsedge (Cyperus engelmannii) - Endangered

2. Delaware

Bald Eagle (Haliaeetus leucocephalus) - Endangered
Peregrine Falcon (Falco peregrinus) - Endangered
Loggerhead Sea Turtle (Caretta caretta) - Threatened
Kemp's Ridley Sea Turtle (Lepidochelys kempii) -Endangered
Green Turtle (Chelonia mydas) -Endangered
Hawksbill Sea Turtle (Eretmocheys imbricata) - Endangered
Leatherback Sea Turtle (Dermochelys coriacea) - Endangered
Finback Whale (Balaenoptera physalus) - Endangered
Right Whale (Eubalaena glacialis) - Endangered
Humpback Whale (Megaptera novaeanjliae) - Endangered
Shortnose Sturgeon (Acipenser brevirostrum) - Endangered

3. Pennsylvania

Peregrine Falcon (Falco peregrinus) - Endangered



Source: Cline, 1990

DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT

Bald Eagle Sensitivity to Human Disturbance

U.S. Army Corps of Engineers, Philadelphia District

Figure 10-1

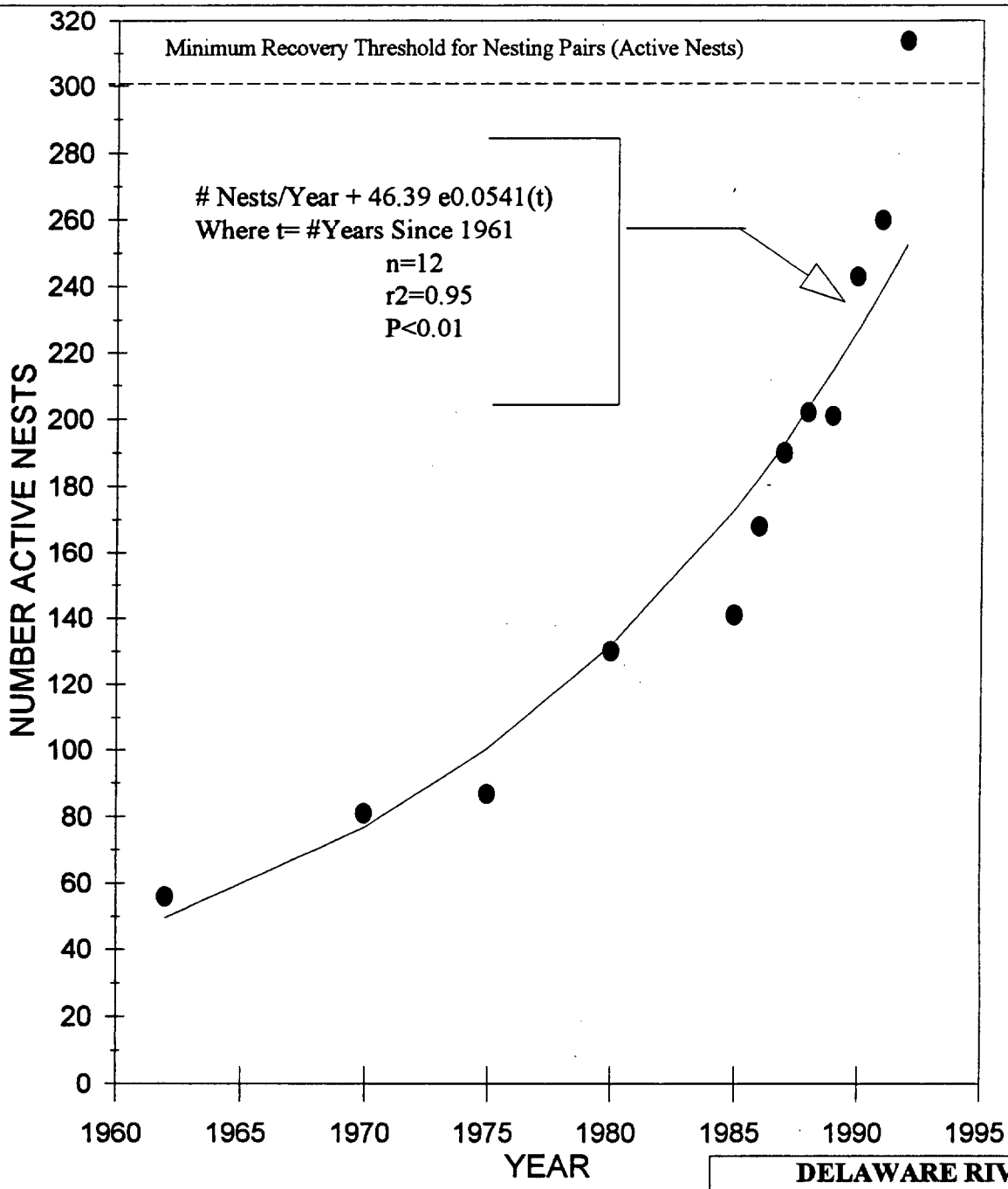
In the CBR, the bald eagle is found feeding most often along river, lake, and bay shoreline, or perched in the trees bordering them; and in extensive freshwater marshes on hillocks, muskrat houses, bare sand or mud bars, and isolated trees. Since they typically snatch fish from the water's surface, shallow water is an important component of live fish availability to eagles. Most bald eagle nests are less than 1.6 km from feeding areas, although some nests are up to 3.2 km from their primary food source (USFWS. 1990).

The CBR bald eagle population was listed as endangered in 1978 (43 CFR 6233) and, at that time, the major limiting factor for the population was identified as lowered productivity resulting from pesticide contamination (USFWS, 1990). Secondary limiting factors included shooting, disturbance, and habitat destruction. A recovery plan for the CBR bald eagle population was released in 1982. The original plan was revised in 1990 (USFWS, 1990). The draft version of the revised recovery plan lists 11 known major bald eagle concentration areas in the CBR, including one in southern New Jersey (USFWS. 1990).

The CBR bald eagle population has exponentially increased from 1962 to 1992, as evidenced by increases in the number of active nests (an index of nesting pairs) (Figure 10-2). In part, this has been a result of improved population recruitment, indexed by young/nest/year, since 1985 (Figure 10-3). The population growth curve (Figure 10-2) exhibits an instantaneous rate of increase of 0.0541 ($N = 46.39e$; where t = number of years since 1961). This translates into a 5.6% average increase in the number of active nests per year, although from 1991-1992 the number of active nests increased by nearly 20%. These rates compare favorably with the maximum growth rate of 11% predicted by the USFWS for the Northern States bald eagle population (USFWS, 1983). The population would double to roughly 600 nests by the year 2007, based on these population data and growth rates, and in absence of increased environmental resistance (i.e., density dependent factors such as limited available habitat) (NASA. 1993).

The CBR bald eagle population is approaching thresholds judged to indicate full recovery. For full recovery, the CBR must contain 300 to 400 nesting pairs with a productivity level of 1.1 eaglets per active nest sustained over 5 years (USFWS, 1990). The current documented population of 307 nesting pairs already exceeds the lower range of the goal. Based upon the population data discussed above and in absence of increased environmental resistance, the CBR bald eagle population would exceed 400 nesting pairs around 2001. The goal of producing 1.1 or more eaglets per active nest per year has been sustained from 1985 to 1992 (1993 data were not available), exceeding the 5 year requirement (NASA. 1993).

Nesting habitat availability has recently replaced pesticide contamination as the major limiting factor on the CBR bald eagle population (USFWS, 1990). Density dependent influences will

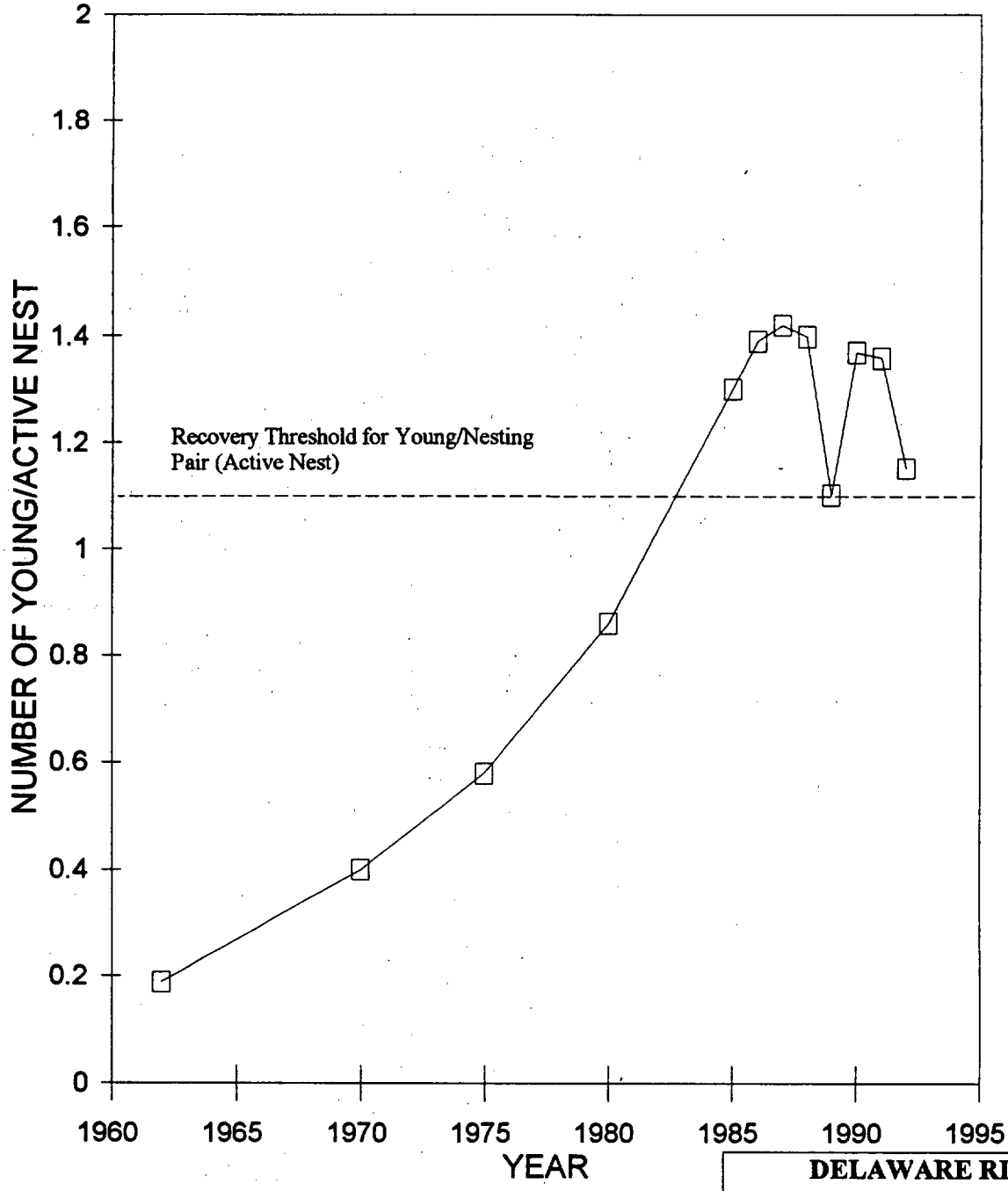


Source: USFWS, 1990; USFWS, 1993b

DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT

Number of Active Bald Eagle Nests in the Chesapeake Bay Region for Selected Years from 1962 to 1992

U.S. Army Corps of Engineers, Philadelphia District
Figure 10-2



Source: USFWS, 1990; USFWS, 1993b

DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT

Bald Eagle Young/Nest in the Chesapeake Bay Region for Selected Years from 1962 to 1992

U.S. Army Corps of Engineers, Philadelphia District

Figure 10-3

limit the availability of unoccupied nesting habitat and will ultimately slow the population growth as the number of nesting pairs increases. One result of the increased competition for nesting areas will be greater use of suboptimum nest areas.

Additional factors limiting population growth include habitat destruction and disturbance, shooting, continued use of certain environmental contaminants, natural phenomena, and accidents. Although all limiting factors are addressed to the extent possible, current recovery efforts are particularly focused on improving habitat availability, protecting existing habitat, and eliminating mortality due to shooting (USFWS. 1990).

Bald Eagle Populations in the Project Area

New Jersey. Clark et. al. (1994) reports that there were six (6) active bald eagle nests in the project area. Four (4) of these nests produced 8 young in 1994, while two (2) of the nests failed to produce young that year. One pair of eagles that nested near Raccoon Creek (designated as the Raccoon Creek site) is suspected to be the same pair that nested near Gibbstown in the past. The nest is located less than 2 miles from one of the proposed dredged material upland disposal sites (15D). This site and one near Welchville (the Home Run site) have not produced young in the last 2 years and are believed to have contaminant problems. Infertile eggs collected from the Home Run site had a high enough level of PCBs to cause death (Clark. 1995. Personal Communication). None of the other nests are located within 4 miles of either the Federal navigation channel, upland disposal areas, or beneficial use sites; however, eagles from all the nests would be expected to forage along the Delaware Bay.

Thirty-one bald eagles were counted in the 1994 bald eagle winter survey along the Delaware Bay coastline. The Maurice and Cohansey River drainages held the highest concentrations, while the Maurice River watershed continued to support the greatest number of wintering bald eagles in southern New Jersey (Clark et. al. 1994).

Preliminary results of contaminant testing by the New Jersey Department of Environmental Protection of blood and feather samples from eaglets along the New Jersey side of the Delaware Bayshore indicate that eaglets have moderate to high levels of DDT compounds compared to eaglets from the Great Lakes (Clark et. al. 1994). Studies by Steidl et. al. (1991 a and c) compared reproductive success in Delaware Bay and Atlantic coast osprey populations in New Jersey. The Delaware Bay population had lower reproductive success, and the eggs from this population contained significantly higher levels of DDE, DDD, PCB's, dieldrin, and heptachlor epoxide than Atlantic coast eggs. This suggests that contaminants from within the Bay contributed to reduced hatching success in this population.

Delaware. Gelvin-Innvaer (1994) reports that there were 10 active bald eagle nests in Delaware in 1994. Six of these nests produced 7 chicks to banding age, yielding a productivity of 0.7 chicks per occupied nest. In 1995 there were about 10 past or present eagle nest locations where the birds would be expected to forage along the Delaware Bay (Gelvin-Innvaer. 1995. Personal Communication). Trends in the numbers of banding-aged chicks, occupied nests, and successful nests have increased in the past 17 years, especially since the mid-1980's (Gelvin-Innvaer. 1994). One nest that is located in the Bombay Hook National Wildlife Refuge is about 6 miles from the Kelly Island beneficial use site (Smith. 1995. Personal Communication). Another eagle nest is located in the Prime Hook National Wildlife Refuge, about 0.5 miles from the shore of Delaware Bay (O'Shea. 1995. Personal Communication). As in New Jersey, contaminants are suspected to be a factor in nest failures at three nest sites including the one at Bombay Hook. Disturbance, habitat loss and habitat degradation increasingly threaten the long-term maintenance and expansion of eagle numbers in Delaware (Gelvin-Innvaer. 1994).

Eighteen bald eagles were reported to have wintered in Delaware in 1994; however, no significant concentrations of wintering eagles occur in Delaware (Gelvin-Innvaer. 1994).

Pennsylvania. In the Pennsylvania portion of the study area, the bald eagle is a transient; there are no nests or wintering concentrations (Brauning. 1995. Personal Communication).

10.1.1.2 Peregrine Falcon (Falco peregrinus)

The peregrine falcon was placed on the Federally Protected Migratory Bird List in March, 1972. In 1970, the U.S. Fish and Wildlife Service listed the American peregrine falcon under the Endangered Species Conservation Act of 1969, and in 1984, all peregrines in the lower 48 states were listed under the Endangered Species Act of 1973 as endangered by similarity of appearance. The peregrine falcons in the project area are covered under the Peregrine Falcon (Falco peregrinus), Eastern Population Recovery Plan - 1991 Update (USFWS. 1991).

The peregrine falcon nests on high cliffs, tall buildings, and bridges. It requires an uncontaminated avian prey base and undisturbed nest sties. The primary threats to the eastern population at the present time are disturbance of habitat by humans at existing sites and predation by great horned owls, which may limit population expansion in the southern Appalachians, Great Lakes, and southern New England/Central Appalachians recovery regions, except at urban sites.

Prey for the peregrine consists primarily of common passerine bird species such as bluejays, flickers, meadowlarks and pigeons. During migration and on the wintering grounds, passerines, shorebirds and waterfowl are taken while starlings, other passerines, and pigeons serve as the principal source of food for

falcons occupying metropolitan areas.

Population trends of peregrines can be monitored with greater reliability than with many other birds because these falcons exhibit a high degree of nest site fidelity. An inventory of eastern peregrine eyries conducted in the late 1930s and early 1940s showed 408 eyries in the eastern United States, Canada, Labrador, and Greenland. Of these sites, 275 were located in the eastern United States and at least 210 were active eyries.

Former breeding distribution of the eastern population extended from northern New England through the Adirondacks and along the Appalachian Range to Georgia and Alabama. Populations also existed in the upper Mississippi River area of Wisconsin and Minnesota. Tree nesting populations were also present in Tennessee and Kentucky.

Falcons generally reach sexual maturity at age three. Usually, the male arrives first at a cliff site and performs a series of aerial acrobatic displays to attract a mate. Historically in the eastern region, peregrine pairs were usually on their breeding grounds and had re-established territories by March. Their eggs, usually four in a clutch, were laid in late March and April; if this clutch was lost early in the laying period, a second clutch was laid. Reintroduced birds are following this pattern. Peregrines vigorously defend the immediate area surrounding their nesting ledge, but are more tolerant to human intrusion into their hunting territory.

Incubation lasts 32-34 days. The female does most of the incubating and brooding while the male hunts. The juvenile peregrines are most vulnerable during their first year when they are still developing their flying skills and learning to hunt. This is the period when the birds are especially vulnerable to shooting or predation, and the first year mortality from all causes is much higher than in subsequent years.

In the early 1960s the number of peregrine falcons nesting in the United States declined rapidly, with extensive use of organochlorine pesticides considered to be the primary cause. High levels of organochlorines, particularly the widely used insecticide DDT, proved lethal to birds, and sublethal doses induced reproductive failure. DDE, a metabolite of DDT, disrupted calcium metabolism so that peregrine falcons accumulating sufficient DDE residues produced abnormally thin-shelled eggs, which often broke before hatching. Eggshell thinning in combination with other effects of organochlorines upon reproduction greatly reduced the nesting success of peregrine falcons, and the recruitment rate of young peregrine falcons fell below the number necessary to replace natural and pesticide-caused mortalities. Subsequently, peregrine falcon numbers dwindled to the point where, by the mid-1960s, the breeding population of the peregrine falcon in the eastern United States was extirpated. Due to successful efforts to captively

breed and reintroduce peregrine falcons into areas where they once bred, as well as new areas, the peregrine again breeds in many regions of the Northeast, and have steadily increased in numbers (Steidl et. al. 1991).

Protection of peregrines from the effects of pesticides has been indirectly enhanced through the Federal Pesticide Control Act and similar state laws. These acts led to restricted use of chlorinated hydrocarbons in the United States. As a result, the mean DDT and dieldrin levels in indicator species such as starlings have declined significantly since 1967. During the past few years, there have been eggs recovered from coastal sites in the mid-Atlantic region that contained relatively high residues of DDE. The source of the material is uncertain, but migrating prey is suspected. Although the worst offenders have been banned, environmental contamination persists as a localized threat to the full recovery of these raptors.

Direct human disturbance of nesting birds is the primary threat to the eastern peregrine population at this point. In combination with this, great horned owls prey on young (and occasionally adult) peregrines.

Alteration of peregrine falcon nesting and migrating/wintering habitat is occurring at a low to moderate level, particularly in the coastal reaches of the eastern population's range. Many nests have been established within publicly owned areas; protection of this habitat is secured. Migratory and wintering peregrine habitat is more at risk, although protection of this habitat is also proceeding in many areas concomitant to protection of shorebird habitat. In addition, illegal shooting of peregrine falcons in the eastern United States remains a sporadic cause of bird mortality.

Natural increases in peregrine population levels are anticipated over the long run, given sufficient protection of the species' habitat. If implementation of recovery activities continues, reclassification of this population of the peregrine falcon should be possible when the number of nesting pairs reaches approximately one-fourth to one-third of the historical population level. As the population continues to grow, full recovery will be achieved when approximately one-half the historical number of 350 nesting pairs is shown to be self-sustaining and distributed across the falcon's former range (USFWS. 1991).

Peregrine Falcon Populations in the Project Area

New Jersey. Within the New Jersey portion of the study area there are 5 nest locations. Three of the locations are on bridges over the Delaware River between New Jersey and Pennsylvania (Benjamin Franklin, Walt Whitman, and Commodore Barry). The other locations are at the Heislerville Wildlife Management Area and near Egg Island Point, both in Cumberland

County. The same pair may be using the last two locations in different years (Clark. 1994 and Clark. Personal Communication). Production of young at New Jersey sites near the Delaware River and Bay has been lower than those from other parts of the state. Eggshell thinning due to contaminants continues to be a problem. Eggshell thickness reported from eggs collected from 1985-88 in New Jersey averaged 16.4% below pre-DDT levels and apparently has decreased steadily since 1979. This decrease in eggshell thickness suggests that falcons continue to be exposed to environmental contaminants. All peregrine populations where egg thinning exceeded 17% were either declining or became extirpated (Steidl, et. al. 1991). In addition, total PCBs and chlordane in New Jersey and other eastern peregrine falcon eggs continue to be higher than those from other parts of the country, while total DDT remains high (Clark. 1994).

Delaware. Peregrine falcons have nested on the Delaware Memorial Bridge that connects Delaware to New Jersey. They have also attempted to nest on high buildings in Wilmington. There is no recent data on peregrine falcons in Delaware (Gelvin-Innvaer. Personal Communication).

Pennsylvania. Peregrine falcons have nested on two bridges in the project area (Walt Whitman and Commodore Barry) and have been cooperatively monitored by the Pennsylvania Game Commission and the New Jersey Department of Environmental Protection. Eggs from the first clutch from these two nests were removed and hacked in urban locations in Pennsylvania and New Jersey. The two pairs of falcons failed to renest (Clark. 1994). Productivity in captive-rearing facilities was higher than historically has been experienced with bridge-nesting peregrines (Brauning. 1994).

Migratory. In addition to the peregrine falcons that nest within the project area, many migrate through with up to 800 passing by Cape May, New Jersey in the fall, as well as a few birds that winter in the area (Herpetological Associates, Inc. 1992).

10.1.1.3 Other Species

Sensitive Joint-Vetch (Aeschynomene verginica). This plant species is listed as threatened. The New Jersey Natural Heritage Program database has identified that this species may occur at the 4 proposed new dredged material disposal areas. It is an obligate wetland species that occurs in freshwater tidal marshes. It was not observed during the vegetation inventories that were performed on these sites (Dames and Moore. 1994a, b, c, and d). Since there are no freshwater tidal marshes within the proposed dredged material disposal areas, there will be no impact to this species.

Bur-Marigold (Bidens bidentoides) - This plant species is listed as a candidate species for Federal listing. The New Jersey Natural Heritage Program database has identified that this species may occur at the 4 proposed new dredged material disposal

areas. It is a wetland species that occurs on tidal shores and mudflats. It was not observed during the vegetation inventories that were performed on these sites (Dames and Moore. 1994a, b, c, and d). Due to the disturbed nature of these sites, it is unlikely that this species occurs within the proposed dredged material disposal areas.

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

Listed species that may occur within Delaware Bay include loggerhead (Caretta caretta), Kemp's ridley (Lepidochelys kempi), green (Chelonia mydas), leatherback (Dermochelys coriacea), and hawksbill (Eretmochelys imbricata) sea turtles; and the right(Eubalaena glacialis), humpback (Megaptera novaeangliae), and fin (Balaenoptera physalus) whales. The shortnose sturgeon (Acipenser brevirostrum) has been known to inhabit the Delaware River and bay. All of these species are endangered, except for the loggerhead sea turtle, which is threatened.

10.1.2.1 Sea Turtles

Sea turtles spend most of their lives in an aquatic environment, and males of many species may never leave the water (Hopkins and Richardson 1984, Nelson 1988). The recognized life stages for these turtles are egg, hatchling, juvenile/subadult, and adult (Hirth 1971).

Reproductive cycles in adults of all species involve some degree of migration in which the animals return to nest at the same beach year after year (Hopkins and Richardson 1984). Nesting generally begins about the middle of April and continues into September (Hopkins and Richardson 1984, Nelson 1988, Carr 1952). Mating and copulation occur just off the nesting beach. A nesting female moved shoreward by the surf lands on the beach, and if suitable crawls to a point above the high water mark (Carr 1952). She then proceeds to excavate a shallow body pit by twisting her body in the sand (Bustard 1972). After digging the body pit she proceeds to lay her eggs, size and egg shape is species specific (Bustard 1972). Incubation periods for loggerheads and green turtles average 55 days, but range from 45 to 65 days depending on local conditions (Nelson 1988).

Hatchlings emerge from the nest at night, breaking the egg shell and digging their way out of the nest (Carr 1952). They find their way across the beach to the surf by orienting to light reflecting off the breaking surf (Hopkins and Richardson 1984). Once in the surf, hatchlings exhibit behavior known as "swim frenzy," during which they swim in a straight line for many hours (Carr 1986). Once into the waters off the nesting beach, hatchlings enter a period known as the "lost year". It is not known where this time is spent, what habitat this age prefers, or mortality rates during this period. It is currently believed the period encompassed by the "lost year" may actually turn out to be

several years. Various hypotheses have been put forth about the "lost year." One is that hatchlings may become associated with floating sargassum rafts offshore. These rafts provide shelter and are dispersed randomly by the currents (Carr 1986). Another hypothesis is that the "lost year" for some species may be spent in a salt marsh/estuarine system (Garmon 1981).

The functional ecology of sea turtles in the marine and/or estuarine ecosystem is varied. The loggerhead is primarily carnivorous and has jaws well-adapted to crushing mollusks and crustaceans, and grazing on encrusted organisms attached to reefs, pilings and wrecks. The Kemp's ridley is omnivorous and feeds on swimming crabs and crustaceans. The green turtle is a herbivore and grazes on marine grasses and algae while the leatherback is a specialized feeder preying primarily upon jellyfish. Until recently, sea turtle populations were large and subsequently played a significant role in the marine ecosystem. This role has been greatly reduced in most locations as a result of declining turtle populations. These population declines are a result of natural factors such as disease and predation, habitat loss, commercial overutilization, and inadequate regulatory mechanisms for their protection. This has led to several species being in danger, or threatened with extinction.

However, due to changes in habitat use during different life history stages and seasons, sea turtle populations are difficult to census (Meylan 1982). Because of these problems, estimates of population numbers have been derived from various indices such as numbers of nesting females, numbers of hatchlings per kilometer of nesting beach, and number of subadult carcasses (strandings) washed ashore (Hopkins and Richardson 1984).

10.1.2.2 Whales

A former resource of the Delaware Estuary, whales convinced Dutch settlers to establish their first permanent settlement in Delaware on Cape Henlopen, in 1631. Since then the numbers of whales off of the New Jersey and Delaware coast have decreased. Records indicate that the endangered humpback whales (Megaptera novaeangliae), fin whales (Balaenoptera physalus) and right whales (Eubalaena glacialis) were occasionally sighted in the Delaware Estuary. However, since the introduction of the Endangered Species Act in 1973, whales have been sighted with increasing frequency along the New Jersey and Delaware Coast, and have become the subject of a growing whale watch industry in the mid-Atlantic.

Humpback Whale Humpback whales are found throughout the oceans of the world, migrating from tropical and subtropical breeding grounds in winter to temperate and Arctic feeding grounds in summer (Evans, 1987). Several stocks occur in the northwestern Atlantic. Adults and newborns of the Gulf of Maine migrate from summer feeding grounds off the coast of New England to winter breeding grounds along the Antillean Chain of the West Indies,

primarily on Silver Bank and Navidad Bank north of the Dominican Republic. Some individuals remain in the Gulf of Maine throughout the year.

Until recently, humpback whales in the mid-Atlantic were considered transients. Few were seen during aerial surveys conducted in the early 1980's (Shoop, et al., 1982). However, since 1989, sightings of feeding juvenile humpbacks have increased along the coast of Virginia, peaking in the months of January through March in 1991 and 1992 (Swingle, et al., 1993). Studies conducted by the Virginia Marine Science Museum indicate that the whales are feeding on, among other things, bay anchovies, and Atlantic menhaden. In concert with the increased sightings, strandings of whales have increased in the mid-Atlantic during this time, with 32 strandings reported between New Jersey and Florida since January 1989. Sixty percent of those that were closely investigated showed either signs of entanglement, or vessel collision (Wiley, et al., 1992).

Fin Whale During the summer, in the eastern North Atlantic, fin whales can be found along the North American coast to the Arctic and around Greenland. The wintering areas extend from the ice edge south to the Caribbean and the Gulf of Mexico.

Fin whales in the North Atlantic feed on fish: herring, cod, mackerel, pollock, sardines, and capelin, as well as squid, euphausiids, and copepods. Peak months for breeding in the North Atlantic are December and January. Although fin whales are sometimes found singly, or in pairs, they commonly form larger groups of 3-20, which may in turn coalesce into a broadly spread concentration of a hundred or more individuals, especially in the feeding grounds (Gambell, 1985). The fin whale was a prime target for commercial whaling after the Norwegian development of the explosive harpoon in 1864. The number of whales in the North Atlantic was quickly depleted.

Fin whales are often spotted in mid-Atlantic waters. Some fin whales were seen off the Delmarva peninsula during aerial surveys conducted in the early 1980's (Shoop, et al., 1982). Since 1989, sightings of feeding juvenile fin whales have increased along the coast of Virginia in the same area as the humpback whales. Fin whales are more difficult to study due to their speed. However, it is believed that they are feeding with the humpback whales, on bay anchovies and menhaden.

Right Whale The northern right whale is the world's most endangered large whale. Current estimates place the total number of remaining animals at no more than 600 (NMFS 1991). Right whales have been protected from commercial whaling since 1949. The right whale was placed on the list of endangered species in 1973, and it remains so today.

The north Atlantic right whale is one of the most endangered large whales in the world. Right whales are often near shore in

shallow water, and sometimes sighted in large bays. Populations concentrate in five known areas; coastal Florida and Georgia, the Great South Channel east of Cape Cod, Massachusetts, Cape Cod Bay and Massachusetts Bay, the Bay of Fundi, and Browns and Baccaro Banks south of Nova Scotia. The population appears to migrate seasonally.

In recent years, two to six northern right whales have been sighted each winter off Long Island and off of New Jersey Beaches. In February 1983, an animal stranded in New Jersey was identified as a two-year old northern right whale that had first been photographed in the Bay of Fundi in 1981 (NMFS 1991). It is now believed that a portion of the North Atlantic right whale population is migrating along the United States east coast each year from Iceland to Florida. There is growing evidence that calves are born when the whales are at the southern end of their migration, in the Atlantic off northeastern Florida, Georgia, and possibly the Carolinas.

10.1.2.3 Shortnose Sturgeon

The shortnose sturgeon (Acipenser brevirostrum) is an endangered species of fish found in major rivers of eastern North America, from the Saint John's River in Florida to the Saint John River in New Brunswick, Canada. This species may also be found in estuaries and in ocean regions adjacent to river mouths. Although typically an anadromous species, landlocked populations of shortnose sturgeon are known to exist. In September 1986 the Philadelphia District initiated formal consultation under Section 7 of the Endangered Species Act of 1977 (16 U.S. C. 1531 et seq.), with regard to maintenance dredging of the Delaware River Federal Navigation Projects from Trenton to the sea and potential impacts to the Federally endangered shortnose sturgeon (Acipenser brevirostrum). "A Biological Assessment of Shortnose Sturgeon (Acipenser brevirostrum) Population in the Upper Tidal Delaware River: Potential Impacts of Maintenance Dredging" was forwarded to NMFS for their review.

Shortnose sturgeon spawn in freshwater, usually above tidal influence. In northern latitude river systems, spawning grounds are generally characterized by fast flows (40-60 cm/sec) and gravel or rubble bottoms. Spawning occurs in the spring. In the Delaware River, spawning normally occurs during the middle 2 weeks of April (Meehan, 1910; Hoff, 1965; Brundage, 1982).

Shortnose sturgeon range from the Saint John River, New Brunswick, Canada, to the Saint John's River, Florida (Dadswell et al., 1984). Throughout its range, the shortnose sturgeon occurs in rivers, estuaries, and occasionally in the sea. Populations tend to be most abundant in, and upstream from the estuarine section of the inhabited river system.

Sampling by O'Herron and Able in the Trenton - Roebling, New Jersey region during October, 1985, through March, 1986, confirms

the existence of an annually occurring overwintering aggregation of shortnose sturgeon in the immediate vicinity of Duck Island Creek. An overwintering population of 2122 adults was calculated using the modified Schnable population estimator (Ricker, 1975).

In the fall, the bulk of the population migrates downstream and utilizes the lower estuary as an overwintering area (Hastings, 1983b). This group includes non-ripening adults, ripe but not running males, and older juveniles. The remaining portion of the population, including ripening adults, some non-ripening adults, and juveniles, overwinters in freshwater near the spawning grounds. In the spring, when water temperatures reach 8 to 9° C, adults migrate from the lower estuary and freshwater overwintering sites, upstream to upper tidal and lower non-tidal spawning grounds (Dovel, 1978; Squires, 1982). In the Delaware River, recent studies indicate that the area below Scudder's Falls is commonly used by shortnose sturgeon to spawn (Brundage, 1984). After spawning, adults migrate downstream to summer foraging areas. Some remain in freshwater while others move to mid-estuary.

10.2 State Endangered Species of Concern

Table 10-2 also shows state-listed species that may be impacted by the project.

10.2.1 New Jersey. The bald eagle, peregrine falcon, and sensitive joint-vetch are also Federally listed species and are discussed above.

10.2.1.1 Osprey (Pandion haliaetus). This species is listed as threatened by New Jersey. In recent years ospreys have nested near one of the proposed dredged material disposal areas (Raccoon Island). They are also likely to forage along the tidal creeks bordering the proposed dredged material disposal areas, as well as in the vicinity of Egg Island Point.

10.2.1.2 Great Blue Heron (Ardea Herodias). The breeding population of this wading bird is listed as threatened by New Jersey. No breeding areas (rookeries) are known from any of the project areas. The great blue heron feeds in wetlands and shallow water areas and is likely to occur in these habitats in the dredged material disposal areas.

10.2.1.3 Northern Harrier (Circus cyaneus). The breeding population of this raptor is listed as endangered by New Jersey. This bird of prey of grasslands and marshes has been reported in the vicinity of Egg Island Point.

10.2.1.4 Pied-Billed Grebe (Podilymbus podiceps). The breeding population of this species of waterfowl is listed as endangered by New Jersey. This bird has been reported from the tidal marshes adjacent to dredged material site 15G. It may also occur in other open water areas.

10.2.1.5 Engelmann's Flatsedge (Cyperus engelmannii). This plant species is listed as endangered by New Jersey. It is a wetland species and is known from emergent marshes, shores, and tidal mudflats. The New Jersey Natural Heritage Program database has identified that this species may occur at the 4 proposed new dredged material disposal areas. It was not observed during the vegetation inventories that were performed on these sites (Dames and Moore. 1994a, b, c, and d). Due to the disturbed nature of these sites, it is unlikely that this species occurs within the proposed dredged material disposal areas.

10.2.2 Delaware and Pennsylvania. The species listed in Table 10-2 by Delaware and Pennsylvania are also listed on the Federal list and are discussed above.

10.3 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 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 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.

10.3.1 U.S. Fish and Wildlife Service

In a planning aid report (USFWS. 1989), the U.S. Fish and Wildlife Service (FWS) stated that the endangered peregrine falcon has nested or attempted to nest on Delaware River bridges within the project area, and that aside from occasional transient individuals, no other federally listed or proposed threatened or endangered species under FWS jurisdiction are known to occur within the project area. The report further stated that it is unlikely that the areas potentially impacted by the proposed

project provide essential habitat for peregrines.

In a letter forwarding the Draft Fish and Wildlife Coordination Act Report, Section 2(b) (USFWS. 1992), the FWS stated that both the peregrine falcon and the bald eagle nested within the project area and requested that the Corps prepare a biological assessment to address potential project related adverse impacts to these species. The letter further stated that aside from occasional transient individuals, no other federally listed or proposed threatened or endangered species under FWS jurisdiction are known to occur within the project area.

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 disturbance at their nest/roosting sites at the Walt Whitman and Commodore Barry bridges, as well as contaminants, would need to be addressed in the biological assessment. There are presently no restrictions for dredging in the Delaware River for the peregrine falcon.

10.3.2 National Marine Fisheries Service (NMFS)

In September 1995 the Philadelphia District initiated formal consultation under Section 7 of the Endangered Species Act of 1977 (16 U.S. C. 1531 et seq.), with regard to maintenance dredging of Delaware River Federal Navigation Projects from Trenton to the sea, and potential impacts to the Federally endangered shortnose sturgeon (Acipenser brevirostrum). " A Biological Assessment of the Shortnose Sturgeon (Acipenser brevirostrum) Population in the Upper Tidal Delaware River: Potential Impacts of Maintenance Dredging" was forwarded to NMFS for their review.

It was determined by the Corps that maintenance dredging activities in the southern reaches of the Delaware River, specifically from Philadelphia to the sea, were not of concern with respect to impacting shortnose sturgeon. The area, between Philadelphia and Wilmington, was considered the "pollution zone" and is only utilized as a migratory route by adults during the early spring and late fall. South of Wilmington the shortnose sturgeon population is limited to adults due to increased salinity.

The Corps has followed certain recommended dredging windows established by the Delaware River Basin Fish and Wildlife Management Cooperative (Cooperative), and has conducted informal

consultation for maintenance dredging activities. The Cooperatives' Fisheries Technical Committee (FTC) decided to implement the following restrictions as part of the Cooperatives Dredging Policy effective as of April 1997:

> 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.

The Philadelphia District will continue to follow these recommended dredging windows established by the Delaware Basin Fish and Wildlife Management Cooperative. Dredging for the Channel Deepening Project would occur from Philadelphia through the mouth of the Bay.

On August 17, 1992, the Philadelphia District met with NMFS regarding Section 7 and its applications to existing and proposed hopper dredging projects in the Philadelphia District. Due to the possibility of multiple District projects utilizing hopper dredges, it was determined that it would be practical to conduct a cumulative, district-wide consultation.

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 impacts to include right, humpback, and fin whales; and Kemp's ridley, loggerhead, leatherback, green and hawksbill sea turtles in the Delaware Estuary and the Atlantic coasts of New Jersey and Delaware. The District would also evaluate 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.

10.4 Assessment of Potential Impacts

10.4.1 Species Under the Authority of the Fish and Wildlife Service (FWS)

10.4.1.1 Bald Eagle

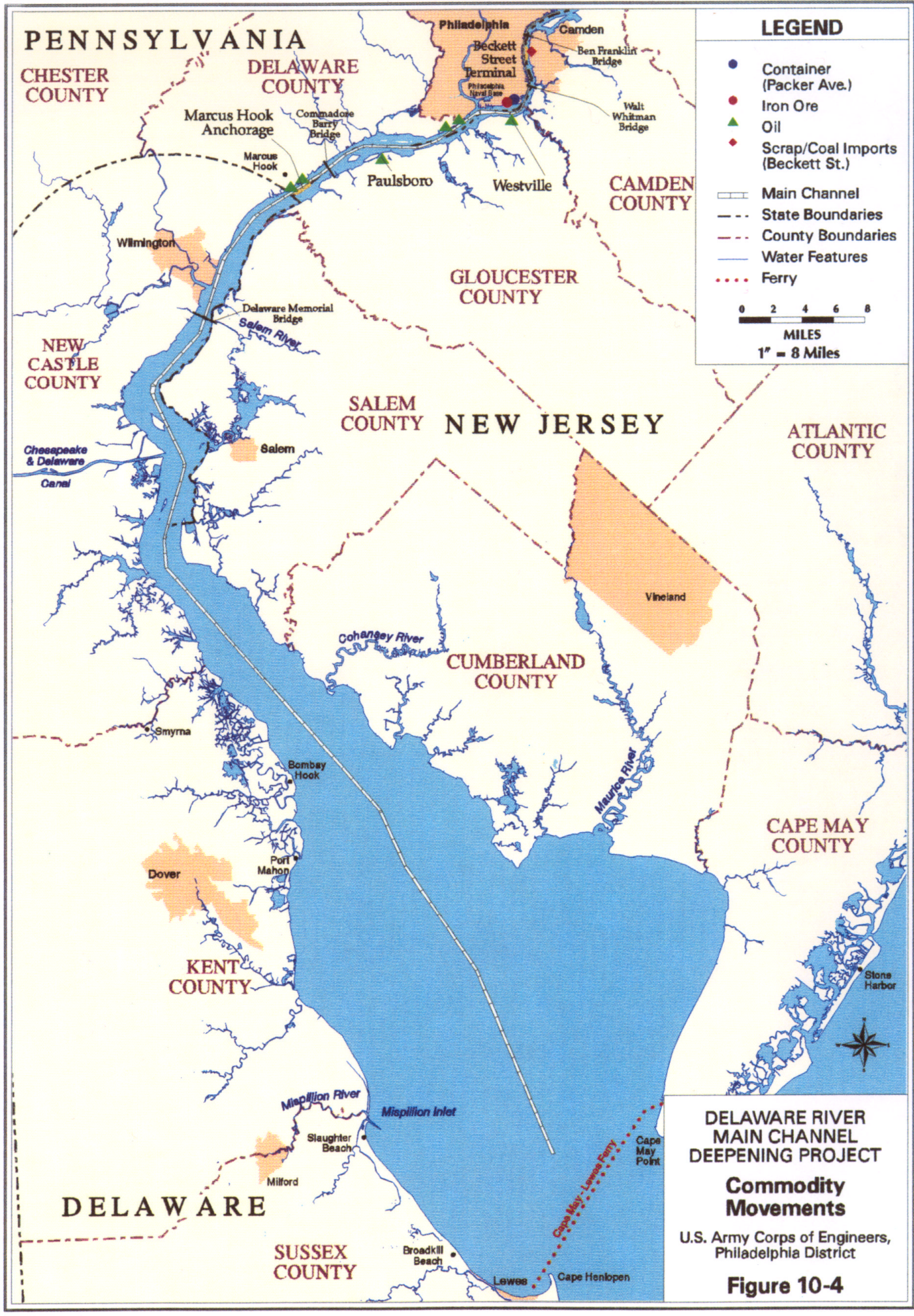
Disturbance of Nest Sites

1. Construction and Use of Upland Dredged Material Disposal Areas. One pair of eagles that nested near Raccoon Creek (designated as the Raccoon Creek site) is suspected to be the same pair that nested near Gibbstown in the past. The nest is located between 1.5 and 2 miles from one of the proposed dredged material upland disposal sites (15D). The FWS requires a buffer zone of 0.25 miles or a line of site buffer of 0.5 miles from the nest from January to July to avoid disturbance (Peters. Personal Communication). There would be no adverse impact provided that the eagles continue to nest in the locations that have been used in the past. At this time we can not tell if an eagle nest will be located near an upland disposal area in the year 2000 when the upland sites would be constructed. A contingency plan will be developed based on FWS recommendations. Construction of the site and use of the site for disposal of dredged material could be staged to avoid disturbance impacts where work would be performed within the dates recommended by Cline (1985).

2. Construction of Kelly Island and Egg Island Point Wetland Restoration Sites. The Kelly Island beneficial use site is about 6 miles from an eagle nest in the Bombay Hook National Wildlife Refuge, and there would be no impacts to the nesting bald eagles from construction of the site. There are no suitable bald eagle nesting trees near either the Kelly Island wetland restoration site or the Egg Island Point wetland restoration site.

Potential for Increased Development

There should be no impacts to bald eagles from increased development due to the channel deepening project. Although the greatest economic benefit for the channel deepening project is to the petroleum industry, the oil refining facilities in the project area are not expected to increase as a result of this project. The refinery capacity is expected to increase modestly in the future through technology changes, upgrading facilities, expansion, and new development in order to accommodate projected commodity flow. However, the economic benefits of this project will result from increased efficiency of oil transportation predominantly due to decreased lightering, and there is no additional increased development projected due to this project. The locations of the six oil refineries that will benefit from this project are shown in Figure 10-4 and consist of the following facilities: Sun Oil, Marcus Hook, PA; Tosco Oil, Marcus Hook, PA; Mobil Oil, Paulsboro, NJ; Sun Oil, Ft. Mifflin, PA; Sun Pipeline, Ft. Mifflin, PA; and Coastal Eagle Point Oil, Westville, NJ. None of the known current locations of eagle nests are near these refineries.



DELAWARE RIVER
MAIN CHANNEL
DEEPENING PROJECT

Commodity Movements

U.S. Army Corps of Engineers,
Philadelphia District

Figure 10-4

Potential for Increased Oil Spills

There should be no impacts to bald eagles from increased oil spills due to the channel deepening project. Although the channel deepening project will enable oil tankers to bring larger quantities of oil directly to the oil refineries, with less lightering in the Delaware Bay; this will be done more safely than it is under present conditions. Under present conditions, large oil tankers with full cargos need to transfer a portion of their cargos to smaller barges in the lower, deeper portion of Delaware Bay so that they can negotiate the 40 foot channel upriver. This process is called "lightering", and it is in this operation that there is a greater possibility for oil being spilled. With the new, deepened channel, lightering will be reduced approximately 40% for benefitting facilities. In addition, the navigation channel will be widened at certain bends such as the bend at Marcus Hook, PA. This is the only location in the estuary where bedrock is exposed, and over 37% of the major oil spills that have occurred since 1973 have taken place at this location by groundings. The widening and deepening of the navigation channel at Marcus Hook should reduce the possibility of oil spills in the Delaware Estuary. Information concerning oil spill planning in the Delaware estuary is presented in Section 12.0.

10.4.1.2 Peregrine Falcon

Disturbance of Nest Sites

1. Construction and Use of Upland Dredged Material Disposal Areas.

A pair of peregrine falcons has nested on the Commodore Barry bridge which crosses the Delaware River between Pennsylvania and New Jersey. The bridge is adjacent to the proposed Raccoon Island upland dredged material disposal site. The time when nesting peregrines are the most sensitive to disturbance is at the beginning of the nesting period (15 March to 15 April). During this period no work should be initiated; however, it may be possible to continue ongoing work without disturbing the falcons (Clark. 1995. Personal Communication). The Philadelphia District will coordinate closely with the USFWS and the NJDEP before work would be performed during this critical period.

2. Restoration of Wetlands at Egg Island Point and Kelly Island.

Another pair of peregrine falcons has nested on a structure near Egg Island Point where the Philadelphia District plans to restore a wetland that is eroding at a rate of up to 30 feet per year. Conversations with the NJDEP (Clark. 1995. Personal Communication) indicate that the nest structure is in danger of being destroyed by the continuing erosion. The Philadelphia District would move the nest structure to a safer location as determined in coordination with the NJDEP. The restoration of

wetlands at Egg Island Point and Kelly Island should have a beneficial impact by restoring and protecting tidal wetlands that provide habitat for waterfowl and shorebirds, which are prey species for peregrine falcons.

10.4.1.3 Contaminants

After review of available data for dredged material derived from the Delaware River Main Channel Deepening Project (see Section 4.0), it would appear that the relative risk of contaminants in the dredged material to wildlife and especially endangered species such as the bald eagle and peregrine falcons 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 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.

PCBs. The highest concentrations of PCB-1254 and PCB-1248 observed in one out of 49 samples from Reach B of the project were 1.19 and 0.53ppm, 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). The Food and Drug Administration (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 were relatively low and should not be a significant risk.

1. Cadmium. Up to year 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. Until a more applicable criterion is established for the risk of thallium to wildlife foodchains, the risk to wildlife should be considered low.

Water Column Impacts The discussion above is related to disposal site impacts. The potential for impacts and risk to wildlife and especially the bald eagle and peregrine falcon is minimal from the dredging of sediments in the Delaware River, based on the collected sediment data. Elutriate test data 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 to fish or wildlife. Bioassay tests with suspended sediments showed no toxicity or bioaccumulation of any significance. Therefore, the risk to fish and ultimately the bald eagle or peregrine falcon should be insignificant.

10.4.1.4 Other Listed Species

Sensitive Joint-Vetch (Aeschynomene verginica). This species occurs in freshwater tidal marshes. Since this type of habitat will not be impacted, their will be no impact to this species.

Bur-Marigold (Bidens bidentoides). This species was not observed during the vegetation inventories that were performed on the upland dredged material disposal sites (Dames and Moore. 1994a, b, c, and d). Due to the disturbed nature of these sites, it is unlikely that this species occurs within the proposed dredged material disposal areas. Therefore, there should be no impact to this species.

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

10.4.2.1 Dredging Equipment and Methods

The primary potential impacts to these species are from dredging. A variety of dredge types and techniques will be employed, dependent upon the characteristics of the channel, availability of disposal, local environmental regulations, types of material to be removed, and proposed timing of the dredging. The Channel Deepening Project will use two types of dredges (hopper and pipeline dredge).

Typically, the USACE does not specify the type of equipment that a contractor must use to dredge a channel. Each type of dredging equipment has different strengths and weaknesses. Some jobs can be accomplished by any type of dredge; other projects require specialized equipment. Many times, one type of equipment will be more efficient than another. In these cases the bidding process usually results in the more efficient plant and equipment being used to accomplish the required dredging. Discussion of the different types of dredging equipment that would be suitable for dredging this project is provided below.

Self-Propelled Hopper Dredges: Hopper dredges are typically self-propelled seagoing vessels. They are equipped with propulsion machinery, sediment containers (i.e., hoppers), dredge pumps, and other specialized equipment required to perform their essential function of excavating sediments from the channel bottom. Hopper dredges have propulsion power adequate for required free-running speed and dredging against strong currents, and have excellent maneuverability. This allows hopper dredges

to provide a safe working environment for crew and equipment to dredge bar channels or other areas subject to rough seas. This maneuverability also allows for safely dredging channels where interference with vessel traffic must be minimized.

A hopper dredge removes material from the bottom of the channel in thin layers, usually 2-12 inches, depending on the density and cohesiveness of the dredged material (Taylor, 1990). Pumps within the hull, but sometimes mounted on the dragarm, create a region of low pressure around the dragheads. This forces water and sediment up the dragarm and into the hopper. The more closely the draghead is maintained in contact with the sediment, the more efficient the dredging (i.e., the greater the concentration of sediment pumped into the hopper). Hopper dredges are most efficient for noncohesive sands and silts, and low density clay. Hopper dredges are not as efficient with medium to high density clays, or with dense sediments containing a significant clay fraction.

Dredging is usually done parallel to the centerline or axis of the channel. Sometimes, a waffle or crisscross pattern may be utilized to minimize trenching and produce a more level channel bottom (Taylor, 1990). This movement up an down the channel while dredging is called trailing, and may be accomplished at speeds of 1-6 knots depending on sediment type, sea conditions, and numerous other factors.

In the hopper, the slurry mixture of sediment and water is managed to settle out the dredged material solids and overflow the supernatant water. When an efficient load is achieved, the vessel suspends dredging, the dragarms are heaved aboard, and the dredge travels to the placement site. Because dredging stops during the trip to the placement site, the overall efficiency of a hopper dredge is dependant on the distance between the dredging and placement sites (i.e., the more distant the placement site, the less efficient the hopper dredge).

Cutterhead pipeline dredge: A cutterhead pipeline dredge is the most commonly used dredging plant in the United States. The cutterhead dredge is suitable for maintaining harbors, canals, and outlet channels, where wave heights are not excessive and suitable placement areas are nearby. It is essentially a barge hull with a moveable rotating cutter apparatus surrounding the intake of a suction pipe (Taylor, 1989; Hrabovsky, 1990). By combining the mechanical cutting action with the hydraulic suction, the hydraulic cutterhead has the capability of efficiently dredging a wide range of material, including clay, silt, sand, and gravel.

The largest hydraulic cutterhead dredges have 30 to 42 inch diameter pumps with 15,000 to 20,000 horsepower. These dredges are capable of pumping certain types of material through as much as 5-6 miles of pipeline, though up to 3 miles is more typical.

The attached pipeline also limits the maneuverability of the dredge. In addition, the cutterhead pipeline plant employs spuds and anchors in a manor similar to floating clamshell dredges. Accordingly, as with floating clamshell dredge plants, the hydraulic cutterhead should not be used in high traffic areas, and cannot be safely employed in rough seas. Cutterhead dredges are normally limited to operating in protected waterways where wave heights do not exceed 3 ft.

10.4.2.2 Sea Turtles

Presently, NMFS has determined that pipeline dredges are unlikely to adversely affect sea turtles (biological opinion from NMFS to Corps of Engineers for dredging of channels in the Southeastern United States from North Carolina through Cape Canaveral, Florida November 25, 1991). Pipeline dredges are relatively stationary and only influence small areas at any given time. For a turtle to be taken with a pipeline dredge, it would have to approach the cutterhead and be caught in the suction. This type of behavior would appear unlikely, but may be possible. This position, of course, could change if new information suggests that sea turtle/pipeline dredge interactions occur.

Only the hopper dredge has been implicated in the mortality of endangered and threatened sea turtles. Among the several possible causes of death to sea turtles is the potential entrainment of individuals in hopper dredging apparatus.

Impacts from dredging in the Delaware Estuary to listed species of sea turtles are dependent on the timing of the operations and the type of equipment employed. No impacts to any listed species of sea turtle would be expected if dredging were to be completed between December and May, or if equipment other than hopper dredges were employed to complete the work. However, there are potential impacts associated with hopper dredging conducted between June and November, when sea turtles may be present in the Delaware Estuary. Any of the five species of sea turtles could transit the channel during the warmer months, but only loggerhead and Kemp's ridley turtles are likely to be foraging in the channels, near the channel bottoms. The leatherback turtle is a pelagic feeder, with minimal bottom exposure. The number of loggerheads and Kemp's ridleys foraging in the Delaware Estuary is unknown, and it is not understood what percentage of the population within this area will avoid entrainment.

Dredging the main channel will take crabs and other benthic organisms from the area. Some of these organisms will survive the process, but be transported from the channel to the respective dredged material placement site. Hence, the food resource values of these areas might be temporarily reduced for sea turtles. Because of the mobility of crabs and rapid recolonization of disturbed benthic communities in estuarine environments, resource values will begin to recover immediately.

Other threats to sea turtles in the Delaware Estuary and nearshore areas include drowning in trawl nets, entanglement and drowning in crab pot lines and pound net leader hedging, wounding from boat propellers, incidental capture at the Salem Generating Station, and entanglement, ingestion, and other complications from contact with marine debris, including petroleum products.

Even though any loss of an endangered or threatened species is important, the magnitude of the losses of loggerhead and Kemp's ridley sea turtles from hopper dredging within the Philadelphia District would not be expected to significantly impact the U.S. Atlantic Coast populations of these sea turtle species.

10.4.2.3 Whales

Impacts to listed species of whales is unlikely with any type of dredging equipment. During operation, a dredge moves very slowly. Only during dredge transit to and from a work area or disposal site does the speed increase. The only means of potential impact is thought to be by collisions between vessels and whales during transit. In light of the existing vessel traffic, this potential is considered insignificant.

10.4.2.4 Shortnose Sturgeon

The construction of the Channel Deepening project is not expected to impact the shortnose sturgeon. The project area begins in the worst section of the Chester-Philadelphia "pollution zone" where dissolved oxygen concentrations are relatively low from May through October. In recent years water quality in this section of the river has improved because of controls on non-point source pollution. As a result, the use of this area by shortnose sturgeon has increased, although no data is available to document the extent of increase. This "pollution zone" begins to dissipate in the vicinity of Wilmington, DE. It is probable that the river between Philadelphia and Wilmington is only utilized as a migratory route by adults during early spring and late fall. However it should be noted that because water quality has improved, this area could be considered a more valuable habitat. South of this reach to the sea, the shortnose sturgeon population is limited to adults due to increased salinity. Habitat destruction would be minimal in this area because a large percentage of the new construction and all of the maintenance dredging would occur in existing Federal navigation channel, which comprise a small portion of the river. In addition, studies conducted by Rutgers University did not identify any adult sturgeon mortalities as a result of dredging operations in the Delaware River between Philadelphia and Trenton. It is expected that adult sturgeon would usually, actively avoid a working dredge. However, in March 1996, three sub-adults were found in a dredged material disposal pool on Money Island, near the Newbold Range of the river. Both a hopper dredge and a cutterhead pipeline dredge were using the disposal site at the time the fish were found. Money Island is north (upstream) of the

Main Channel Deepening Project, between Philadelphia and Trenton, in an area where shortnose sturgeons are known to occur in greater numbers.

10.4.3 State Listed Species of Concern

Only New Jersey has species listed that do not also occur on the Federal list. Impacts to these species are discussed below:

10.4.3.1 Osprey (Pandion haliaetus)

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 possible 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 coordinate closely with the NJDEP to follow these guidelines as much as is practicable.

10.4.3.2 Great Blue Heron (Ardea Herodias)

The management of approximately half of the upland dredged material disposal areas as wetlands, and the restoration of wetlands at Egg Island Point will benefit the heron by providing additional foraging habitat.

10.4.3.3 Northern Harrier (Circus cyaneus)

The restoration of wetlands at Egg Island Point will benefit this species by providing additional foraging habitat.

10.4.3.4 Pied-Billed Grebe (Podilymbus podiceps)

The management of approximately half of the upland dredged material disposal areas as wetlands will benefit this species by providing additional nesting and foraging habitat.

10.4.3.5 Engelmann's Flatsedge (Cyperus engelmannii)

It is unlikely that this species occurs on the upland dredged material disposal areas; therefore, there should be no impact.

10.4.3.6 Pea Patch Island Heronry

Since the early 1970's Pea Patch Island has provided nesting habitat to 5,000 to 12,000 pairs of wading birds (Parsons. 1996). Pea Patch Island is located in the New Castle Range of the Delaware River, immediately west of the Federal navigation

channel (See Plate 2). The wading birds feed in wetlands adjacent to the Delaware Estuary in Delaware and New Jersey.

Dredging Operations Near Pea Patch Island

Dredging to maintain the 40 foot Federal navigation channel has been done since 1942. Table 10-3 shows the distances of areas near Pea Patch Island that have been dredged over the last 20 years. These areas usually need to be dredged annually and the dredged material is removed by hydraulic dredge and transported by pipeline to the Killcohook disposal area, which is located nearby in New Jersey and Delaware. The majority of the dredging in the New Castle Range occurs downstream of Pea Patch Island (Tetra Tech, Inc. 1991). In addition, dredging usually occurs between August and December, except when an emergency occurs and dredging needs to be done to prevent ships from running aground.

Table 10-3. Dredging Distances from Pea Patch Island Wading Bird Colony:

Location	40 Foot Channel	45 Foot Channel	Side of Channel
Upstream	3,600 ft	3,600 ft	New Jersey
Downstream	4,400 ft*	2,800 ft	Delaware and New Jersey

* A small area adjacent to Pea Patch Island and 2,600 ft from the wading bird colony was dredged within the last 2 years.

The 45 foot channel will require an initial removal of 50,000 cubic yards from the areas no closer than 2,600 feet from the heronry. Maintenance dredging is estimated to be required yearly at these locations. The average yearly maintenance dredging quantities for the entire New Castle Range are estimated to be 1,126,000 cubic yards.

Potential for Impacts to Wading Birds

Concern has been expressed that dredging operations could adversely impact (1) the nesting wading birds on Pea Patch Island and (2) wading birds that need to fly over dredging operations to reach foraging areas in wetlands in Delaware and New Jersey. In addition there is concern that the continuing erosion of the island will be aggravated by the channel deepening project. Table 10-3 shows the distance between dredging operations and the Pea Patch Island wading bird colony for the 40 and 45 foot channels. The closest potential feeding areas to the new dredging are the mud flats immediately northeast of Pea Patch Island, which are used by young herons that have just learned to fly for feeding (Parsons. Personal Communication). These mud flats are about 2,400 feet from an area of the navigation channel which periodically requires maintenance dredging. Additional nearby

feeding areas are the wetlands on Pea Patch Island adjacent to Fort Delaware and the wetlands downstream of Fort Mott State Park in New Jersey, almost a mile away.

Impacts from dredging operations to build and maintain the 45 foot Federal navigation channel should not have a significant impact on the wading bird nesting colony on Pea Patch Island or their foraging activities. The critical period for the wading bird nesting colony is from April to July when the birds are breeding. Although nesting declines in July, some nesting, and occasionally significant nesting can occur in August (Parsons. Personal Communication). Dredging is normally done between August and December unless there is an emergency need. The fact that this colony has developed and grown on Pea Patch Island during a period where dredging has taken place to maintain the 40 ft channel, indicates a tolerance for the current level of dredging activity. Landin (Personal Communication) reports that the placement of dredged material within 100 yards of a wading bird colony should not have an adverse impact. She reports that the placement of dredged material can be an attractant to feeding herons and other waterbirds, because they scavenge the waters coming from the dredge pipe for food. In addition, any wading birds that forage on the mud flats northeast of Pea Patch Island must be used to the dredging that presently occurs, or any wading birds that forage in the wetlands adjacent to Fort Delaware must be used to disturbance during the tourist season.

Erosion Effects of the 45 Foot Channel

As part of the final design, potential shoreline erosion to Pea Patch Island was considered with regard to changes in current velocities and vessel-generated waves for the deepened channel compared to the existing channel. Changes in current velocity were evaluated through the application of a hydrodynamic model of the Delaware River and Bay. This model was used to determine if the channel deepening would lead to current velocity changes at the shoreline of Pea Patch Island, and thus to increased erosion potential. The potential role of ship waves on shoreline erosion was also evaluated specifically for Pea Patch Island. The objective was to determine if vessels using the deepened channel would generate larger waves than presently occur with the existing 40 foot channel. Procedures presented in "Bank Protection for Vessel Generated Waves" (Robert Sorensen, 1986, Lehigh University Imbt Hydraulics Laboratory Report IHL-117-86) were utilized for this evaluation.

Comparison of the model-predicted current velocities for the 40 ft and 45 ft channel geometries at Pea Patch Island showed negligible velocity differences attributable to the deepened channel. It was thus concluded that the channel deepening will have a negligible effect on current velocities and water levels at the subject shoreline, and there will be no shoreline erosion induced or exacerbated by the channel deepening.

channel. It was thus concluded that the channel deepening will have a negligible effect on current velocities and water levels at the subject shoreline, and there will be no shoreline erosion induced or exacerbated by the channel deepening.

The principal variables considered in the ship wave analysis included vessel shape characteristics, vessel draft, vessel speed, sailing direction, and distance from the shoreline. The analysis assumed that tankers, due to their size, speed, and number of transits, constituted the critical class of vessels for this analysis. Further, based on data developed for the economic analysis of the proposed deepening, it was assumed that the fleet distribution would be identical for the 40 and 45 foot channels, with vessels simply loaded five feet deeper. The results indicated that maximum wave heights at the shoreline of Pea Patch Island would increase in the order of 4 per cent for the case of the design vessel loaded to a five-foot greater depth. Thus it was concluded that the deepening project would not detectably increase the existing shoreline erosion problem related to ship waves.

10.5 Reasonable and Prudent Measures to Minimize Impacts

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

10.5.1.1 Bald Eagle

Prior to construction of the upland 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.

10.5.1.2 Peregrine Falcon

1. Coordination with the USFWS and the NJDEP 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.

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

10.5.2.1 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. However, we are concerned that a monitoring program based on the investigations and observations within the South Atlantic shipping channels, may not be the most reasonable approach to conserving sea turtles in the Philadelphia District.

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 15 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 issues 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.

10.5.2.2 Whales

Due to the slow nature of Right whales it is the District's intention to slow down 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 the hopper dredge operator to monitor and record the presence of any whale within the project vicinity.

10.5.2.3 Shortnose Sturgeon

The Philadelphia District will continue to follow the recommended dredging windows established by the Delaware Basin Fish and Wildlife Management Cooperative:

> Hydraulic dredging, is prohibited from the Delaware Memorial Bridge to the Kinkora Range in non-Federal areas between April 15th and June 21st. No hydraulic dredging restrictions exist for the Federal channel or anchorages.
>
> Bucket dredging, overboard disposal, and blasting are prohibited from the Delaware Memorial Bridge to the Betsy Ross bridge in all areas between March 15th and May 31st. From the Delaware Memorial Bridge to Trenton overboard

disposal and blasting are prohibited, but bucket dredging is permitted between June 1st and November 30th.

10.5.2.4 Incidental Take Statement

Section 7(b)(4) of the Endangered Species Act requires that, when a proposed agency action is found to be consistent with section 7(a)(2) of the act and the proposed action may incidentally take individuals of listed species, NMFS must issue a statement that specifies the impact of any incidental taking of endangered or threatened species. Only incidental takings caused by activities approved by the agency, that are identified in the Biological Opinion and that comply with the specified reasonable and prudent alternatives, and terms and conditions, are exempt from the takings prohibition of section 9(a), pursuant to section 7(o) of the ESA.

For projects within the Philadelphia District, the anticipated incidental take by injury or mortality is as follows:

three (3) shortnose sturgeon; and

four (4) loggerhead, or one (1) Kemp's ridley or green sea turtle.

No takes resulting in injury or mortality of endangered marine mammals are expected; therefore, no incidental take for marine mammals is authorized. Consultation must be reinitiated if the take level for any one species is exceeded.

10.5.3 State Listed Species of Concern

10.5.3.1 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 possible 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 coordinate closely with the NJDEP to follow these guidelines as much as is practicable.