BIOLOGICAL ASSESSMENT OF POTENTIAL IMPACTS TO ENDANGERED AND THREATENED SPECIES OF SEA TURTLES AND WHALES IN THE VICINITY OF THIMBLE SHOAL CHANNEL CHESAPEAKE BAY, VIRGINIA

Waterways and Ports Branch
Norfolk District Corps of Engineers
803 Front Street
Norfolk, Virginia 23510

April 1999

BIOLOGICAL ASSESSMENT OF POTENTIAL IMPACTS TO ENDANGERED AND THREATENED SPECIES OF SEA TURTLES AND WHALES IN THE VICINITY OF THIMBLE SHOAL CHANNEL CHESAPEAKE BAY, VIRGINIA

1.0 Introduction

This Biological Assessment has been prepared to address potential impacts on sea turtles and whales that could occur as a result of the maintenance dredging of the Thimble Shoal Federal Navigation Channel. The Thimble Shoal Channel normally requires dredging every 2 years. Quantities of material dredged from the channel range from 200,000 cubic yards to 1,000,000 cubic yards, depending on the shoaled conditions of the channel. The channel is dredged by hopper dredge and the material transported to the Dam Neck Ocean Dredged Material Disposal Site (DNODMDS). More details on this activity follows.

The potential exists for the disturbance or inadvertent taking of protected sea turtles and whales due to this project. The preventative actions to be taken as part of this project and the dispersed distribution of the sea turtles and whales make the potential for disturbance or taking low.

For the U.S. Army Corps of Engineers (USACE) and other Federal agencies, the implementation of the Endangered Species Act centers on the Section 7 consultation process. Section 7 requires USACE to consult with the National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USF&WS), as appropriate, on all actions that may affect threatened or endangered species. As a result of this consultation, the Norfolk District is preparing this biological assessment. A biological assessment is the evaluation of potential effects, both direct and indirect, of the proposed action on such species and habitat.

The proposed project raises two Endangered Species Act (ESA) concerns: (1) the entrainment of endangered and threatened species of sea turtles by the hopper dredge draghead and (2) vessel collisions with endangered species of whales and sea turtles. The following species may transit in the project area:

Loggerhead Sea Turtle ***Caretta caretta*** (threatened)
Kemp's Ridley sea turtle ***Lepidochelys kempi*** (endangered)
Green Sea Turtle ***Chelonia mydas*** (endangered)
Hawksbill turtle ***Eretmochelys imbricata*** (endangered)
Humpback whale ***Megaptera novaengliae*** (endangered)

Sea turtles do not normally nest in the project area and are not as common as in many other coastal areas. However, loggerheads can nest as far north as the beach at Virginia Beach, Virginia. Studies by the Waterways Experiment Station have indicated that sea turtles are seldom found in waters below 16 degrees C (61 degrees F) (Dickerson 1995). A more conservative estimate would be that turtles would not be in the project area when water temperatures are below 14 degrees C (57 degrees F). This condition could occur during the spring, summer, and fall seasons in the project area.

As a result of the coordination between NMFS and the USACE, NMFS has recommended that if hopper dredging is used when water temperatures are greater than 14 degrees C, then a Biological Assessment that considers impacts to endangered and threatened species of listed sea turtles and whales should be prepared. NMFS will then issue a biological opinion and incidental take statement.

2.0 Description of Action to Be Taken

2.1 Project Dredging

The Thimble Shoal Federal Navigation project was authorized by the River and Harbor Act of 8 August 1917 and modified by the River and Harbor Act of 3 September 1954, 27 October 1965, and the Water Resources Development Act of 1986. The project consists of a channel 55 feet deep, 1,000 feet wide, and approximately 13.4 miles long between 55-foot contours. Preconstruction engineering and design is complete for deepening the channel from 45 to 55 feet. Deepening the channel from 45 feet to an intermediate depth of 50 feet over an outbound width of 650 feet is complete. See Figure 1.

In the past, the Norfolk District Corps of Engineers has been successful in scheduling this hopper dredge work during the winter months. The anticipated 1999 dredging of Thimble Shoal Channel, however, has been postponed into the late summer and early fall due to funding delays. The channel normally requires dredging every 2 years, with quantities removed ranging from 200,000 cubic yards to 1,000,000 cubic yards. The next dredging is expected to remove approximately 600,000 cubic yards of material. The dredging is located in distinct shoaled areas within the channel. These shoaled areas vary from year to year, but are often located along the sides and side slope areas of the channel. It is important to note that the areas within the channel that are dredged during each dredging cycle are relatively small in comparison to the total channel dimensions.

2.2 Dredging Equipment and Methods

The Thimble Shoal Channel is typically dredged by a hopper dredge. Hopper dredges are self-propelled seagoing vessels (Figure 2). They are equipped with propulsion machinery, sediment containers (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. They also have excellent maneuverability. This allows hopper dredges to provide a safe working environment for crew and equipment dredging 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 (the greater the concentration of sediment pumped into the hopper). Hopper dredges are most efficient for noncohesive sands and silts, and low density clay. The sediments to be dredged in Thimble Shoal Channel vary from silt and clay to silty and fine sand.

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 and 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 hopper dredges is dependant on the distance between the dredging and placement sites; the more distant the placement site, the less efficient the hopper dredge.

2.3 Transit Area

The transit area is the area that the dredge will use when transporting material from the dredging site to the placement site, in this case the Dam Neck Ocean Dredged Material Disposal Area (DNODMDS), and then returning to the dredging area. It is shown on Figure 3. The distance from the dredging area to DNODMDS ranges from 10 to about 25 miles. Activities are expected to take place in late September through mid-November. There is a low likelihood that whales will be in the project area during construction this year. Sightings indicate that most whales are in the area from winter to early spring. Dredge speed is approximately 8 knots during transits to and from the placement site. The hopper dredge is expected to be 300 feet in length. Hopper dredge transits from the dredging area to the ocean placement site in 1999 will total approximately 275 trips. This could be slightly more or less in the future depending on the quantity of material to be dredged.

2.4 Placement Area

The Dam Neck Ocean Dredged Material Disposal Site (DNODMDS) was designated by EPA pursuant to Section 102(c) of the Marine Protection, Research, and Sanctuaries Act of 1972, as amended, as suitable for the ocean disposal of dredged material from three Federal navigation channels: the Atlantic Ocean Channel, the Cape Henry Channel, and the Thimble Shoal Channel. The final rule was promulgated by EPA on March 31, 1988 (FR. Vol. 53 No. 62), effective March 31, 1988. The DNODMDS boundary coordinates are as follows:

36° 51' 24.1" N., 75° 54' 41.4" W.,
36° 51' 24.1" N., 75° 53' 02.9" W.,
36° 46' 27.4" N., 75° 51' 39.2" W.,
36° 46' 27.5" N., 75° 54' 19.0" W.,
36° 50' 05.0" N., 75° 54' 19.0" W.

The DNODMDS has an area of about 9-square nautical miles. Water depth within the site averages about 40 feet. The topography is typical of the inner continental shelf, with a smooth bottom and a gradual seaward slope (less than 1 foot per 1,000 feet). Disposal of dredged materia at the DNODMDS has occurred using either a hopper dredge or bottom dump scow.

2.5 Endangered Species Protection Equipment Requirements

The dredging contractor will be required to instruct all personnel on the hopper dredge that endangered species may be present in the dredging area, transit area, and placement area. Endangered species observers approved by the National Marine Fisheries Service will be required to be onboard hopper dredges doing this work between May 15 and November 15 of any given year. All hopper dredge dragheads must be equipped with a rigid sea turtle deflector approved by the Corps of Engineers. In addition, screening baskets must be installed over each hopper inflow with no greater than 4 inch by 4 inch openings. Appendix A is a draft of the Endangered Species Protection requirements proposed to be placed in the dredging specification for the work. It provides additional details concerning observation and reporting requirement. This will be revised, as necessary, to reflect the Biological Opinion and Incidental Take Statement.

2.6 NEPA Compliance

The original environmental document for dredging the Thimble Shoal Federal navigation project was an Environmental Impact Statement finalized in 1973. A Supplemental Information Report was prepared in 1980. During the studies for the 55-foot deepening of the Norfolk Harbor Channels, which includes Thimble Shoal Channel, additional environmental coordination was done. The Final Supplement to the Final Environmental Impact Statement for the Norfolk Harbor and Channels, Virginia Deepening and Disposal includes information related to sea turtle impact. A copy of the relevant pages is included as Appendix B.

2.7 Prior Coordination with National Marine Fisheries Service

In the past, the Norfolk District has been successful in scheduling the hopper dredging of Thimble Shoal Channel during the winter months when sea turtles are usually absent from the project area. Representatives of NMFS and the Virginia Institute of Marine Science (Dr. Jack Musick, pers. comm.) have discouraged the use of hopper dredges from mid-May through Mid-November when water temperatures are over 14 degrees C (57 degrees F). They have indicated that formal consultation would be required to consider potential impacts on sea turtles and marine mammals if hopper dredges were to be used at any time other than this. Because of funding delays in 1999, formal consultation under Section 7 is being initiated with the transmittal of this biological assessment to NMFS. This biological assessment is based on currently available information. Much of the information is taken from recent work by the Baltimore District of the Corps of Engineers, which was conducted in Chesapeake Bay and along the Virginia coast *(Biological Assessment of Potential Impacts to endangered and Threatened Species of Sea Turtles and Whales in the Ocean City, Maryland Vicinity* (July 1997)).

3.0 Species to Potentially be Impacted

3.1 Loggerhead Sea Turtle (Caretta caretta)

3.11 Description

The threatened loggerhead sea turtle is the most abundant species of sea turtle in U.S. waters and is the most common species of sea turtle found in the project area. The foraging habits of the loggerheads make them the species of sea turtle most likely to be adversely impacted by hopper dredge operations.

The Loggerhead turtle was listed as a threatened species by the Federal government in 1978. Loggerheads, are by far, the most common of the sea turtles visiting the project area each summer.

The distinctly heart-shaped carapace of adult loggerhead turtles averages 80 cm in length and the average loggerhead weighs about 140 kg (Ernst and Barbour, 1972). Exclusive of hatchlings, loggerheads in Virginia's waters are mostly juveniles, and have carapace lengths from 20 cm to more than 120 cm and weights varying from 20 kg to 40 kg (Lutcavage, 1981; Lutcavage and Musick, 1985). The dorsum of the carapace and appendages are reddish brown to mahogany and the plastron and ventor of the appendages are cream to yellow (Musick, 1988). Encrusting barnacles and other organisms are common on the carapace. Four scutes occur between the eyes (prefrontals) and there are five lateral carpacial scutes (pleurals) on each side. Loggerheads usually have three bridge scutes (Carr, 1952; Musick, 1988).

3.12 Life History and Distribution

Loggerhead turtles are found worldwide in tropical and subtropical marine and estuarine waters. Loggerhead nesting in the U.S. typically occurs from Florida to Virginia Beach, Virginia, with some recorded nestings as far north as New Jersey (Pritchard, 1979; Brander, 1983). Musick, et al. (1987) concluded that the occasional nestings on beaches as far north as Virginia are beyond the periphery of the normal breeding range. As with other sea turtles, it is suspected that reproductive females return to the beach where they were hatched (natal beach) in order to lay eggs (Carr, 1987; Musick, et al., 1987). Yntema and Mrosovsky (1979) have shown that incubation is pivotal in determining the sex ratio of *C. caretta* hatchlings. Eggs

incubated between 26° and 28°C produced all males; 30°C yielded an approximate 1:1 ratio of females to males; and incubation temperatures of 32° to 34°C produced all females. Thus, incubation temperatures of Maryland and Virginia beaches may produce clutches of predominantly male hatchlings, with few or no females to return to their natal area at maturity and lay eggs in these more northerly areas.

Survival of hatchlings in waters as far north as the project area might also be quite limited. Once loggerheads hatch, usually between August and October, they swim away from land for two or three days in a "swimming frenzy". When the sea turtle hatchlings leave the nest and swim out to sea, they become prey to a number of other organisms, including ghost crabs, seagulls, and other pelagic birds, sharks, and many predatory fishes (Witham, 1974; Pritchard, 1979). Hatchlings have little or no buoyancy control and it has been theorized that the "swimming frenzy" is an attempt to reach the refuge and rich food environs associated with *Sargassum* rafts, weedlines, or other current-born debris (Frick, 1976; Carr, 1987 a&b). The problem with sea turtle hatchlings leaving Maryland and Virginia beaches is that there are no well-developed rafts of *Sargassum* nearshore. Hatchlings that did survive long enough to find suitable refuge in *Sargassum* rafts near the Gulf Stream (approximately 124 to 248 miles, 200 to 400 kilometers offshore) might then be trapped by falling temperatures. Waters off Virginia and Maryland fall to below 20°C by mid-October, 15°C by November, and as low as 10°C during the winter.

Hatchlings from the more southern reaches are believed to find refuge in the floating rafts of *Sargassum,* make one or more trips around the North Atlantic gyre until reaching sufficient size (20-40 cm carapace length), and then shift from offshore pelagic existence to enter inshore habitats and begin benthic feeding.

3.13 Loggerhead Turtles in the Project Area

Loggerheads are far more common than other sea turtles in the waters of Maryland and Virginia, and in the Chesapeake Bay during summer months. They can be found in the Bay south of Baltimore, in the estuarine parts of all major tributaries of the Bay, along Maryland and Virginia's Atlantic coast and in the channels and lagoons between and landward of barrier islands (Brady, 1925; Fowler, 1925; Lutcavage, 1981; Lutcavage and Musick, 1985; Keinath, et al, 1987; Byles, 1988). Loggerheads are most common in water depths of 4-20 m (13-67 feet) where the horseshoe crab *(Limulus polyphemus)* is a major prey.

Juvenile loggerheads enter Chesapeake Bay in late May or early June when the water temperature reaches 20°C. Klinger (1988) estimated that most loggerheads found in the Chesapeake are 7 to 15 years old (individual females reach sexual maturity when they are between 20 and 30 years of age).

Pound net captures near the mouth of the Chesapeake Bay (at Lynnhaven in Virginia Beach, VA) were highest during late May and early June when the sea turtles were migrating into the Bay. Observers noted that the migrating turtles moving into the Bay were highly visible; the observers attributed this visibility to the higher number of turtles coming through the Bay mouth and also to migrating turtles spending more time on the surface than foraging turtles.

Each year, in October or November, when the first severe northerly storm strikes the Bay (Musick, 1983) or when the water temperature drops to around 18°C (Keinath, et al. 1987), turtles migrate from the Chesapeake Bay. According to Musick (1986), the loggerhead turtles migrate south along the coast to Cape Hatteras and beyond. He suspected that some of the turtles from the Chesapeake over winter in the warm waters of the Gulf Stream on the continental shelf off Florida. At least one loggerhead has been recovered in the Chesapeake that had been tagged the winter before off Cape Canaveral.

3.14 Potential Direct Effect of the Proposed Dredging

The Virginia coast is a potential habitat for adults and juvenile loggerhead sea turtles. Hopper dredging between May and November of any year when the water temperature is above 14°C could possibly result in the taking of some loggerhead turtles that might be foraging. Hopper dredges cycle up and down, making shallow cuts, and can come upon sea turtles that are drifting with tidal currents just above the bottom, while foraging for crabs, and entrain the sea turtles in the draghead. As indicated previously, draghead turtle deflectors will be used. This is expected to eliminate any significant adverse impacts on loggerheads that could occur due to dredging.

Vessel strikes of loggerhead sea turtles by hopper dredges occasionally occur along the Atlantic coast but are not common. This can at least partially be attributed to the large amount of time that the loggerheads spend on the bottom foraging as opposed to the surface. No significant adverse impacts to loggerheads are expected as a result of any vessel strikes that could occur.

3.15 Potential Indirect Effect of the Proposed Dredging

The dredging will remove some crabs and other benthic organisms from the bottom. Some of these organisms will survive the process but be transported from the dredging area to the dredged material placement site. Hence, the food resource value of the dredging areas might be temporarily reduced for the loggerheads. Because of the mobility of the crabs and the potential for rapid recolonization of disturbed benthic communities, resource values are expected to recover quickly.

At the placement site, other threats to loggerhead turtles in the area may include drowning in trawl nets (Henwood and Stuntz, 1987; NRC, 1990; Keinath and Musick, 1991e); entanglement and drowning in crab pot lines and pound net leader hedging (Bellmund, et al., 1987; Musick, 1988; NRC, 1990); wounding from boat propellers (Bellmund, etal, 1987; Keinath, et al., 1987; Schroeder, 1987; Schroeder and Warner, 1988; Teas and Martinez, 1989); intentional destruction by crab fishermen (Keinath and Musick, 1991e); and entanglement, ingestion, and other complications from contact with marine debris, including petroleum products (Balazs, 1985; Vargo, et al., 1986; Carr, 1987b; Plotkin and Amos, 1988; Stanley, et al., 1988).

Dredging of the project channel will neither augment nor diminish any of these threats to the loggerheads in the area. The dredging will have no impact on trawling, pound net fishing, or crabbing. The transiting of hopper dredge will temporarily increase commercial vessel traffic in the Atlantic at the dredging and the placement areas during dredging operations, but vessel traffic is expected to drop to historical levels after dredging concludes. The dredging operations will not significantly add pollutants or marine debris to the aquatic environment.

3.2 Kemp's Ridley Sea Turtle (Lepidochelys kempi)

3.21 Description

With almost no exceptions, the entire world population of adult female Kemp's Ridley turtles nests annually on a single stretch of beach in Rancho Nuevo, Tamaulipas, Mexico (Carr, 1963; Hildebrand, 1963). Films of the 1947 nesting aggregations (or *arribada;* Spanish for "arrival") at Rancho Nuevo show the adult female population to have been in excess of 40,000 (estimated Hildbrand, 1963). The most recent estimates of the total population of adult females nesting at Rancho Nuevo place the

number at fewer than 500 (Pritchard, 1990). Thus, the Kemp's Ridley is considered to be the species of sea turtle in greatest danger of extinction. The Kemp's Ridley was listed as an endangered species by the Federal government in 1973.

Kemp's Ridley sea turtles mature at about 70 cm carapace length with weights up to 50 kg (Pritchard, 1979). The Kemp's Ridleys found in the Chesapeake Bay are juveniles of 20 to 58 cm carapace length and typically weigh less than 20 kg (Lutcavage and Musick, 1985; Barnard, et al., 1989). The dorsum of the carapace and appendages are charcoal gray to drab olive green, and the plastron and lower surfaces of appendages are white. In older specimens, the white extends onto dorsal areas (Musick, 1988). The carapace is roundish. Four prefrontal scutes occur on the head and there are five pleural scutes. The cervical scute touches the first pleural scute an each side. Ridleys have four inframarginals, each with a pore posteriorly (Carr, 1952; Musick, 1988).

3.22 Life History and Distribution

Little is known about the movement of Kemp's Ridley hatchlings. It is believed that hatchlings might adapt a pelagic existence in weedlines of major currents in the Gulf of Mexico and the North Atlantic Ocean and then shift to a nearshore benthic existence with age (Meylan, 1986; Phillips, 1989; Ross, et al., 1989). Many juvenile Kemp's Ridleys have been observed in eastern U.S. coastal waters from Florida to the Canadian portions of the Gulf of Maine (Lazell 1980). Pritchard and Marquez (1973) suggest that the usual dispersal of some young Kemp's Ridleys is from passive transport via the Gulf Stream up the eastern coast of the U.S. However, Morreale et al., (1992) hypothesize that passive drift would result in only sporadic occurrences of Kemp's Ridleys in the northeastern U.S., and that the observed annual occurrences suggest some alternate transport mechanism.

While Hendrickson (1980) suggests that the Kemp's Ridleys found in northeastern waters may be expatriates or waifs lost to the breeding population, Lazell (1980) contends that juvenile *L. kempi* may migrate to northeastern nursery grounds as a normal part of their life history pattern. Because nesting females return to Rancho Nuevo annually, adult *L. kempi* must maintain closer proximity to the Gulf of Mexico and the nesting site. This would explain why few adult Kemp's Ridleys are found offshore in northern waters and why the movement into the Chesapeake is comprised almost exclusively of juveniles.

Kemp's Ridleys appear to feed and grow rapidly during transport northward and soon become large enough for active swimming. As juveniles, they become benthic feeders. Adult and juvenile Kemp's Ridleys feed primarily in shallow coastal waters on bottoming living crustaceans. Organisms identified from the stomachs of Kemp's Ridleys include crabs (*Spp. Polyonchus, Hepatus, Callinectes, Panopeus, Mineppe, Ovalipes, Calappa, Portunus, Arenaeus, Limulus, Labinia,* and *Cancer)*, fish (*Spp. Lutjanus* and *Leiostomus)*, and mollusks (*Spp. Noculana, Corbula, Mulinia, and Nassarius)* (Dobie, et al., 1961; Pritchard and Marquez, 1973; Bellmund, et al, 1987; and Burke, et al., 1990a and 1990b).

3.23 Kemp's Ridley Sea Turtles in the Project Area

There is data to support the existence of Kemp's Ridley turtles, mostly juveniles, in the project area as part of their migration from the Gulf of Mexico to the northeastern U.S. and Canada. The migration pattern throughout the area has not been fully documented, but the number of turtles in the project area is expected to be small. The Chesapeake Bay provides forage for juvenile Kemp's Ridleys, and the lower salinity regime of the Bay affords some shelter. Pelagic predators such as tiger shark *(Galeocerdo cloven)* are known to feed on sub-adult and smaller adult turtles in coastal areas (Shoop, 1980; Lutcavage, 1981).

Young swimming Kemp's Ridleys enter northeast coastal embayments (such as the Chesapeake Bay) when water temperature approaches 20°C (Burke, *et al.*, 1989; Musick, *et al*, 1984). Fall emigration from the Chesapeake coincides with water coming to 18°C (Keinath *et al.*, 1987), typically in November. It is not known whether absolute temperature, rate of change in temperature, or onset of winter's northeast storms is the cue for the annual exodus. Lutcavage and Musick (1985) report *L. kempi* present in the Bay from May through November with peak abundance in June. A secondary abundance peak was reported in October.

In the Chesapeake Bay, juvenile Kemp's Ridleys eat benthic invertebrates, primarily blue crabs *(Callinectes sapidus)*, and prefer sea grass beds that are nursery areas for blue crabs. (Lutcavage, 1981; Lutcavage and Musick, 1985; Bellmund, et al., 1987; and Keinath ,et al, 1987). Distinct concentrations of *L. kempi* have been observed at the mouth of the York River. The mouth of the York River and adjacent bays are distinguished by extensive seagrass (*Zostera marina* and *Ruppia marina)* meadows that support large populations of macroinvertebrates (Orth and Heck, 1980), most notably *C. sapidus*.

3.24 Potential Direct Effect of the Proposed Dredging

The Thimble Shoal Channel is in the middle of the Chesapeake Bay entrance and well offshore and distant from grass beds in the coastal bays that could be utilized for foraging by Kemp's Ridleys. Based on the above discussion, the proposed dredging of the channel is unlikely to significantly adversely impact Kemp's Ridleys.

No significant adverse impact to Kemp's Ridleys or their favored habitat is expected from placing dredged sediments at the Dam Neck site. The Dam Neck Ocean Site is an unlikely habitat because of the absence of sea grass beds. No significant impact at the placement site is expected. No nesting impacts are expected because Kemp's Ridleys do not nest in the project area.

Kemp's Ridleys transit the project area when migrating. This area is not known as a feeding area. There is a very small possibility that a turtle could be struck by a vessel engaged in dredging operations. This risk will be reduced even further by the use of spotters aboard the dredge. Entrainment in the dredge draghead is not considered likely because the dredges will be equipped with turtle deflectors.

3.25 Potential Indirect Effect of the Proposed Dredging

Neither the dredging of channel nor the placement of dredged material at the Dam Neck site will significantly affect the habitat or prey resources of the Kemp's Ridley. Kemp's Ridleys typically forage in the sea grass meadows in shallow water where they prey on blue crabs. Dredging will occur in areas of the Chesapeake Bay with greater depths, where there is no submerged aquatic vegetation (SAV) and where foraging by the Kemp's Ridley would be atypical.

The transiting of hopper dredges will temporarily increase commercial vessel traffic in the channel and the placement areas during dredging operations, but traffic is expected to drop to historical levels after the dredging concludes. Dredging is expected to occur at Thimble Shoal Channel every 2 years. The dredging operations will not significantly add pollutants to the aquatic environment

Other threats to juvenile Kemp's Ridley turtles in the project area may include drowning in trawl nets (Henwood and Stuntz, 1987; Murphy and Hopkins-Murphy, 1989; NRC, 1990; Keinath and Musick, 1991c), drowning as the result of entanglement in debris and abandoned or lost fishing gear (Carr, 1987; Laist,

1987; Gregg, 1988; McGavern, 1989; Ross, et al., 1989; Keinath and Musick, 1991c), entanglement in stationary fishing gear (Van Meter, 1983; Balazs, 1985; O'Hara and Iudicello, 1987; Banard, et al., 1989; Keinath and Musick, 1991c), damage by boat propellers (Bellmund, et al., 1987; Keinath, et al, 1987; Schroeder, 1987; Schroeder and Warner, 1988; Teas and Martinez,1989), ingestion of plastics (Cottingham, 1988; Stanley, et. al., 1988; Plotkin and Amos, 1989), intentional destruction by crab fishermen (Keinath and Musick, 1991e), predation (Witzell, 1987; Marquez, et al, 1989), and pollution (Vargo, et al. 1986; Ross, et al., 1989).

Dredging of the Thimble Shoal Channel and placement of the material in the Dam Neck Site will neither augment nor diminish any of these threats to the juvenile Kemp's Ridley sea turtles in the project area. The dredging will have no impact on trawling, pound net fishing, or crabbing.

3.3 Atlantic Green Sea Turtle (*Chelonia mydas*)

3.31 Description

Green sea turtles are considered threatened throughout their range, but the breeding colonies in Florida and on the Pacific coast of Mexico are considered endangered. The Atlantic green sea turtle was listed by the Federal government on July 28, 1978 as a threatened species, except for the breeding populations of Florida and the Pacific coast of Mexico, which were listed as endangered. The National Marine Fisheries Service (NMFS), Northeast Region, holds all of the green sea turtles in Chesapeake Bay region during the summer to be endangered because there is no way to distinguish between the green sea turtles that overwinter in Florida waters and those that overwinter elsewhere. Atlantic green sea turtles are rare in the Atlantic portion of their range and are extremely rare in Maryland and Virginia.

Carapace lengths of mature green turtles are about 100 cm, 3.25 feet, and mature turtles weigh about 150 kg, 331 lbs. (Pritchard, 1979), but weights of up to 340 kg, 751 lbs. have been reported (Carr, 1952). Individuals found in the Chesapeake typically have carapace lengths ranging from 20 to 50 cm and weigh less than 20 kg (Banard, at al., 1989). The dorsum of the carapace and appendages are dark green to brown, often with lines radiating from the posterior margin of each carapace scute. The carapace is roundish. The plastron and venter of the appendages are cream white. Yellow may occur at the interface between the dorsal and ventral coloration in some specimens. There are two prefrontal and four lateral pleural scutes. The cervical scute

does not touch the pleural scutes (Carr, 1952; Musick, 1988). The green coloration is derived from the fat inside the plastron, called calipee, not external coloration. Calipee is the principal ingredient in clear turtle soup, relished by connoisseurs.

3.32 Life History and Distribution

Green sea turtles are distributed circumglobally, mainly in waters between the northern and southern 20°C isotherms (Hirth, 1971). Juveniles are commonly found in subtropical waters during summers, while adults remain strictly tropical (Carr, 1952). In the western Atantic Ocean, juveniles have been found from Argentina to New England. Although green sea turtles were historically reported to be abundant in the Chesapeake Bay (Brady, 1925), very few juvenile green sea turtles now visit the Bay during summer (Keinath, et al., 1987; Banard, et al., 1989).

Atantic green sea turtles nest on tropical beaches of the Gulf of Mexico, the Caribbean Sea, and the Atlantic Coast of Florida (Carr, 1952, 1984; Ernst and Barbour, 1972). As with other species, hatchlings leave the beach and take refuge in weedlines, Sargassum rafts, etc., in the open ocean (Carr, 1987a) and drift with the currents. Post-hatchling, pelagic-stage green turtles are presumably omnivorous, but dietary data are lacking (NRC, 1990).

When they reach 20-25 cm carapace length, they leave the pelagic habitat and enter benthic feeding grounds. The juveniles are mainly herbivorous, preferring sea lettuce (*Ulva lactuca*), eelgrass (*Zostera marina*), algaes (*Fucus sp.*), and hydrozoans (Bellmund, et al., 1987). Ernst and Barbour (1972) report that green turtles are omnivorous, dieting on invertebrates. However, Van Meter (1983) reports that though green turtles can thrive on crustaceans while in captivity, in the wild, they avoid crustaceans as food items. Foraging habitats are most commonly pastures of sea grasses or algae, but small green turtles are also found over reefs and rocky bottoms (NRC, 1990).

3.33 Atlantic Green Sea Turtles in the Project Area

Green turtles may be occasionally found in the project area, but numbers are expected to be very small.

3.34 Potential Direct Effect of the Proposed Dredging

As with the Kemp's Ridley, the foraging habitat of the green

sea turtle is likely to be centered on seagrass meadows far removed from the offshore dredging area. Green turtles are rare in the project area and it is unlikely that dredging will impact Green turtles. Accordingly, the proposed dredging should not adversely impact the Atlantic green sea turtle.

Green turtles do not nest in the area. Placement of dredged material is not expected to adversely impact Atlantic green sea turtles or their habitat

Green turtles are rare in the project area and it is unlikely that vessel strikes will occur.

3.35 Potential Indirect Effect of the Proposed Dredging

The potential indirect effect of the proposed dredging and dredged material placement on the green sea turtle should be similar to that already identified for the Kemp's Ridley turtle. In short, the proposed dredging will not have an indirect effect on the green sea turtle and will not have a direct or indirect effect on green sea turtle habitat or food resources.

3.4 Hawksbill Sea Turtle (*Eretmochelys imbricata*)

3.41 Description

Hawksbill turtles were considered endangered throughout their range by the U.S. Fish and Wildlife Service in 1970 and were listed as endangered in the ESA of 1973.

The sizes of adult hawksbill turtles vary significantly. Carapace lengths at maturity range from 65 to over 90 cm, 2.25 to over 3.5 inches and weights range from 35 to over 125 kg, 77 to over 276 lbs. (Prichard, 1979, Witzell, 1983). The only hawksbill recorded in the Chesapeake Bay was a juvenile with carapace length of 31 cm and weight of 4.0 kg (Keinath and Musick 1991b). The dorsum of the carapace and appendages is a combination of amber, brown, and black. The plastron and venter of the appendages are yellow, often with dark brown or black spots in young individuals. The carapacial scutes overlap at the posterior edges and the posterior margin of the carapace is distinctly serrated. There are four prefrontal and three pleural scutes. The cervical scute does not touch the pleural scutes (Carr, 1952; Musick, 1988).

3.42 Life History and Distribution

Hawksbill sea turtles are rare in all portions of their range and are considered extralimital as far north as Virginia (Keinath and Musick, 1991b). Adult hawksbill turtles do not travel beyond the tropics, although presumably, lost young turtles are found at higher latitudes (Carr, 19S2; Pritchard, 1979). Small hawksbills have stranded as far north as Cape Cod, Massachusetts (STSSN database, 1990); but most of these strandings have been observed after hurricanes or offshore storms (NMFS, 1993). Hawksbills typically inhabit coral reefs and rocky places, but they have been found in other shallow coastal habitats (Ernst and Barbour, 1972; Pritchard, 1979; Witzell, 1983).

Hawksbills were considered omniverous 1952; Ernst end Barbour, 1972), but recent evidence suggests that Hawkbills feed preferentially on sponges (Meylan, 1988).

3.43 Hawksbill Sea Turtles in the Project Area

A single live, juvenile specimen was caught incidentally at the mouth of the James River in November 1990 (Keinath, et at, 1991). This was the first confirmation of a hawksbill in the Chesapeake Bay. This specimen was considered to be a lost waif as would any hawksbill that may occur in the project area.

3.44 Potential Direct Effect of the Proposed Dredging

The proposed dredging is not expected to directly effect any Hawksbill turtles that might enter the project area. If individual Hawksbill turtles enter the area on rare occasions, their habitat and food preferences will favor their foraging near oyster bars and other hard bottom microenvironments. The sponges they eat are a type that typically grows on hard substrates, oyster reefs, and manmade structures (Keinath,, et al., 1991) not usually found in the offshore areas except at artificial fishing reefs. With the exception of artificial reefs, these habitats are not in close proximity to the offshore areas proposed for dredging.

3.45 Potential Indirect Effect of the Proposed Dredging

In addition to the same threats to other species of sea turtles, the Hawksbill's shell is prized for use in tortoise shell jewelry and ornaments. Because of this shell value, the Hawksbill turtle continues to be hunted throughout the world (Van Meter, 1983).

Dredging of the project area will not increase or lessen these threats to the Hawksbill sea turtle. The dredging and the placement of dredged material at the respective sites will not significantly impact habitat or prey of the Hawksbill turtle.

3.5 Humpback Whale (*Megaptera novaengliae*)

3.51 Description

The humpback whale *(Magaptera novaengliae)* was placed on the list of endangered species in 1973.

The humpback whale usually attains a length of about 12 to 15 meters (40 to 50 feet). It is black, with a variable amount of white below, and is characterized by very long, narrow flippers, scalloped at the forward edge, and by large knobs, each associated with one or two hairs, on its head and jaws. The dorsal fin is small and set far back, and there are about 20 lenghwise grooves on the throat and chest

3.52 Life History and Distribution

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 off the Gulf of Maine stock 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 (*Achoa Mitchiffi* and Atlantic menhaden (*Bevoortia tyrannus*). 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,

at al., 1992). Humpbacks are most frequently spotted through the winter and late spring in the project area with peak spottings occurring in December and April.

3.53 Potential Direct Effect of the Proposed Dredging

The only potential for direct effect on humpback whales comes from collision with hopper dredges or tugs and scows transporting dredged material to the placement site. This potential for impact is not significant because the area is not heavily used by whales, and humpbacks have shown some skill in avoiding vessels. However, collisions with vessels could be fatal. Between 100 and 450 round trips to the placement site will be required for the Thimble Shoal Channel dredging during each dredging event depending on the amount of dredging required. Dredge speeds will be low enough (about 8 knots) that the operators should be able to maneuver to avoid whales, and the whales will have ample time to, and are likely to avoid the dredges.

3.54 Potential Indirect Effect of the Proposed Dredging

The proposed dredging and placement of dredged material at the placement site will not adversely affect habitat or food resources of the humpback whale.

4.0 Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation. One of the main activities to note here, as noted previously with each species, is commercial and to a smaller extent recreational, fishing. This state regulated activity uses pound nets, gill nets, and/or trawling to capture large schools of fish. Frequently, endangered and threatened sea turtles are caught in the nets and are injured or drowned. Also, entanglement and drowning in crab pot lines, and entanglement, ingestion, and other complications from contact with marine debris, including petroleum products can be lethal. Unfortunately, these takes are not regulated or reported. Increased recreational boating activity can also increase the number of turtles taken by injury or mortality in vessel collisions and from boat propellers.

The periodic dredging of Thimble Shoal Channel will neither augment or diminish any of these threats to sea turtles. The transiting of the hopper dredge will temporarily increase commercial vessel traffic in the channel and Atlantic Ocean, but this traffic is small compared with the large number of commercial, government, and recreation vessels that transit the area. The dredging operations will not significantly add pollutants or marine debris to the aquatic environment.

5.0 Relevant Reports

Included in the Appendix is a copy of the summary and relevant endangered species section of the *Norfolk Harbor and Channels, Virginia Deepening and Disposal Final Supplement to the EIS*, prepared by the Norfolk District corps of Engineers in May 1985. The main report referenced in this Biological Assessment is the *Biological Assessment of Potential Impacts to endangered and Threatened Species of Sea Turtles and Whales in the Ocean City, Maryland Vicinity* (July 1997), prepared by the Baltimore District of the U.S. Army Corps of Engineers.

6.0 References

Abernathy,S. Atlantic Outer Continental Shelf Description of the Mid-Atlantic Environment. U.S. Department of the Interior, Mineral Management Service, Atlantic OCS Region, Environment Assessment Section, Herndon, VA.

Balazs, G.H. 1985. Impact of ocean debris on marine turtles: entanglement and ingestion. In: Shomura, R.S. and Y.O. Yoshida (Eds.); Proceeding of the Workshop on the Fate and Impact of Marine Debris, 27-29 November 1984, Honolulu, Hawaii. NOAA Technical Memorandum NMFS-SWFC-54, National Oceanic and Atmospheric Administration. Pp. 387-429.

Barnard, D.E., J.A. Keinath, and J.A. Musick. 1989. Distribution of ridley, green, and leatherback turtles in the Chesapeake Bay and adjacent waters. In: Eckert, S., K. Eckert, and J. Richardson (Comp.), Proceedings of the Ninth Annual Workshop on Sea Turtle Conservation and Biology, 7-11 February 1989, Jekyll Island, Georgia. NOAA Technical Memorandum NMFS-SEFC-232. National Oceanic and Atmospheric Administration. Pp. 201-203.

Bellmund, S.A., J.A. Musick, R.C. Klinger, R.A. Byles, J.A. Keinath, and D.E. Barnard. 1987. Ecology of sea turtles in Virginia. Virginia Institute of Marine Science Special Science Report No. 119, Virginia Institute of Marine Science, College of William and Mary at Gloucester, VA.

Brady, M.K. 1925. Notes on the herpetology of Hog Island. *Copeia* (137):110-111.

Brandner, R.L. 1983. A sea turtle nesting at Island Beach State Park, Ocean County, New Jersey. *Herpetological Review* 14:110.

Burke, V.J., E.A. Standora, and S.J. Morreale. 1989. Environmental factors and seasonal occurrence of sea turtles in Long Island, New York. In: Eckert, S.A., K.L. Eckert, and T.H. Richardson (Compilers); Proceedings of the Ninth Annual Workshop on Sea Turtle Conservation and Biology, 7-11 February 1989, Jekyll Island, Georgia. NOAA Technical Memorandum NMFS-SEFC-232, National Oceanic and Atmospheric Administration. Pp. 21-23.

Burke, V.J., E.A. Standora, and S.J. Morreale. 1990a. Comparisons of diet and growth of Kemp's ridley and loggerhead turtles from the northeaster U.S. In: Richardson, T.H., J.I. Richardson, and M. Donnelly (Compilers); Proceedings of the Tenth Annual Workshop on Sea Turtle Biology and Conservation, 20-24 February 1990, Hilton Head Island, South Carolina. NOAA Technical Memorandum NMFS-SEFC-278, National Oceanic and Atmospheric Administration. P. 135.

Burke, V.J., E.A. Standora, and S.J. Morreale. 1990b. Diet of the Kemp's ridley sea turtle in Long Island, New York. Report to the National Marine Fisheries Service, Silver Spring, MD.

Butler, R.W., W.A. Nelson, and T.A. Henwood. 1987. Trawl survey method for estimating loggerhead turtle, *Caretta caretta*, abundance in five eastern Florida channels and inlets. Fishery Bulletin, 85(3):447-453.

Byles, R.A. 1988. Behavior and ecology of sea turtles from Chesapeake Bay, Virginia. A dissertation presented to the faculty of the School of Marine Science, The College of William and Mary in Virginia, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

Carr, A.F. 1952. *Handbook of turtles; the turtles of the United States, Canada, and Baha California*. Cornell University Press, Ithaca, NY.

Carr, A.F. 1963. Panspecific reproductive convergence in *Lepidochelys kempi*. *Ergeb. Biol.*, 26:298-303.

Carr, A.F. 1987a. New perspective on the pelagic stage of sea turtle development. *Conservation Biology* 1:103-121.

Carr, A.F. 1987b. Impact of nondegradable marine debris on the ecology and survival outlook of sea turtles. *Marine Pollution Bulletin* 18:352-356.

Cottingham, D. 1988. Persistent marine debris: Challenge and response - the Federal perspective. Alaska Sea Grant College Program. 44 pp.

Dickerson, D.D., Reine, K.J., Nelson, D.A., and Dickerson, C.E., Jr. (1995). " Assessment of sea turtle abundance in six South Atlantic U.S. channels," Miscellaneous Paper EL-95-5, U.S. Army engineer Waterways Experiment Station, Vicksburg, MS.

DOA. 1991. Waterborne commerce of the United States - calendar year 1989: Part 1, waterways and harbors, Atlantic Coast. WRSC-WCUS-89-1. Department of the Army, Corps of Engineers, Water Resources Support Center, Fort Belvoir, VA.

Dobie, J.L., L.H. Ogren, and J.H. Fitzpatrick, Jr. 1961. Food notes and records of the Atlantic ridley turtle (*Lepidochelys kempi*) from Louisiana. *Copeia* 1961(1):109-110.

Endangered Species Monitoring Program, Contract CENAP-OP-R-119200913-38,Dredge "Atlantic American" Bethany Bay Delaware.

Ernst, C.H. and R.W. Barbour. 1972. *Turtles of the United States*. University of Kentucky Press, Lexington, KY. 347 pp.

Evans, P.G.H. 1987. *The Natural History of Whales and Dolphins*. Christopher Helms Ltd., Kent, England, UK.

Final Environmental Report on Proposed Exploratory Drilling Offshore North Carolina. U.S. Department of the Interior, Mineral Management Service, Atlantic OCS Region, Herndon, Va. (1990)

Fowler, H.W. 1925. Records of amphibians and reptiles for Delaware, Maryland, and Virginia III: Virginia. *Copeia* (146):65-67.

Friar, W., R.G. Ackman, and N. Mrosovsky. 1972. Body temperature of *Dermochelys coriaceas*: warm turtle from cold water. *Science* 177:791-793.

Frick, J. 1976. Orientation and behavior of hatchling green turtles (*Chelonia Mydas*) in the sea. *Animal Behavior* 24:849-857.

Gambell, R. 1985. Fin whale (*Balaenoptera physalus*). In: Ridgeway, S.H. and R. Harrison (Eds.); Handbook of marine mammals, Vol. 3: the sirenians and baleen whales. Academic Press, London.

Gregg, S.S. 1988. Of soup and survival. *Sea Front.*, 34:297-302.

Hech, K.L. and T.A. Thoman. 1984. The nursery role of sea grass meadows in the upper and lower reaches of the Chesapeake Bay. *Estuaries*, 7:70-92.

Hendrickson, J.R. 1980. The ecological strategies of sea turtles. *American Zoology*, 20:597-608.

Henwood, T.A. 1990. An overview of the Endangered Species Act of 1973, as amended, and its application to endangered species/dredging conflicts in Port Canaveral, Florida. In: Dickerson, D.D. and D.A. Nelson (Comps.); Proceedings of the National Workshop on Methods to Minimize Dredging Impacts on Sea Turtles, 11-12 May 1988, Jacksonville, Florida. Miscellaneous Paper EL-90-5. Department of the Army, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. February, 1990. Pp. 17-25.

Henwood, T.A. and W.E. Stuntz. 1987. Analysis of sea turtle captures and mortalities during commercial shrimp trawling. *Fisheries Bulletin*, 85:813-817.

Hildbrand, H.H. 1963. Hallazgo del area de anidacion de la totuga marina "loro", *Lepidochelys kempi* (Garman), en la costa occidental del Gulfo de Mexico. *Ciencia*, 22(4):105-112.

Hillestad, H.O., J.I. Richardson, and G.K. Williamson. 1978. Incidental capture of sea turtles by shrimp trawlermen in Georgia. In: Proceedings of the 32nd Annual Conference of the Southeastern Association of Fish and Wildlife Agencies, 5-8 November 1978, Hot Springs, Virginia.

Hirth, H.F. 1971. Synopsis of biological data on the green turtle *Chelonia mydas* (Linnaeus) 1758, FAO Fisheries Synopsis No. 85. Pp. 1-77.

Hrabovsky, L. 1990. Hydraulic cutterhead pipeline dredging. In: Dickerson, D.D. and D.A. Nelson (Comps.); Proceedings of the National Workshop on Methods to Minimize Dredging Impacts on Sea Turtles, 11-12 May 1988, Jacksonville, Florida. Miscellaneous Paper EL-90-5. Department of the Army, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. February, 1990. Pp. 56-58.

Keinath, J.A. and J.A. Musick. 1991a. Atlantic green sea turtle, *Chelonia mydas mydas* (Linnaeus). In: Terwilliger, K. (Coord.); Virginia's Endangered Species. McDonald and Woodward Publishing Company, Blacksburg, VA. Pp. 448-450.

Keinath, J.A. and J.A. Musick. 1991b. Atlantic hawksbill sea turtle, *Eretmochelys imbricata imbricata* (Linnaeus). In: Terwilliger, K. (Coord.); Virginia's Endangered Species. McDonald and Woodward Publishing Company, Blacksburg, VA. Pp. 450-451.

Keinath, J.A. and J.A. Musick. 1991c. Kemps's ridley sea turtle, *Lepidochely kempii* (Garman). In: Terwilliger, K. (Coord.); Virginia's Endangered Species. McDonald and Woodward Publishing Company, Blacksburg, VA. Pp. 451-453.

Keinath, J.A. and J.A. Musick. 1991d. Leatherback sea turtle, *Dermochelys coriacea* (Linnaeus). In: Terwilliger, K. (Coord.); Virginia's Endangered Species. McDonald and Woodward Publishing Company, Blacksburg, VA. Pp. 453-455.

Keinath, J.A. and J.A. Musick. 1991e. Loggerhead sea turtle, *Caretta caretta* (Linnaeus). In: Terwilliger, K. (Coord.); Virginia's Endangered Species. McDonald and Woodward Publishing Company, Blacksburg, VA. Pp. 445-448.

Keinath, J.A., J.A. Musick, and R.A. Byles. 1987. Aspects of the biology of Virginia's sea turtles: 1979-1986. *Virginia Journal of Science* 38:329-336.

Keinath, J.A., J.A. Musick, and W.M. Swingle. 1991. First verified record of the hawksbill sea turtle (*Eretmochelys imbricata*) in Virginia waters. *Catesbeiana* 11(2):35-38.

Klinger, R.C. 1988. Age and growth of juvenile loggerheads (*Caretta caretta*) from Chesapeake Bay. Master's Thesis. Virginia Institute of Marine Science, College of William and Mary in Virginia, Gloucester, VA.

Laist, D.W. 1987. Overview of the biological effects of lost and discarded plastic debris in the marine environment. *Marine Pollution Bulletin*, 18:319-326.

Lazell, J.D. 1980. New England waters: critical habitat for marine turtles. *Copeia*, 1980(2):290-295.

Lindholm, B. 1990. Clamshell dredges. In: Dickerson, D.D. and D.A. Nelson (Comps.); Proceedings of the National Workshop on Methods to Minimize Dredging Impacts on Sea Turtles, 11-12 May 1988, Jacksonville, Florida. Miscellaneous Paper EL-90-5. Department of the Army, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. February, 1990. Pp. 54-55.

Lutcavage, M. 1981. The status of marine turtles in Chesapeake Bay and Virginia coastal waters. Master's thesis. Virginia Institute of Marine Science, College of William and Mary at Gloucester Point, VA.

Lutcavage, M. and J.A. Musick. 1985. Aspects of the biology of sea turtles in Virginia. *Copeia* 1985:449-456.

Marine Fisheries Review Vol 50. No 3 1988, NMFS Silver Spring Md.

Marine Mammals and Noise. Richardson W. et al. Academic Press, 1995, San Diego 76 pp.

Marine Mammal Commision, Annual Report to Congress 1996. Marine Mamal Commission Bethesda Md. 20814

Marquez, M.R., M.S. Perez, J.D. Flores, and I. Arguello. 1989. Kemp's ridley research at Rancho Neuvoo, 1987. *Marine Turtle Newsletter*, 44:6-7.

Mauer, D., R.T. Keck, J.C. Tinsman, and W.A. Leathem. 1981a. Vertical migration and mortality of benthos in dredged material - Part I: Mollusca. *Marine Environmental Resources*, 4:299-319.

Mauer, D., R.T. Keck, J.C. Tinsman, and W.A. Leathem. 1981b. Vertical migration and mortality of benthos in dredged material - Part II: Crustacea. *Marine Environmental Resources*, 5:301-317.

Mauer, D., R.T. Keck, J.C. Tinsman, and W.A. Leathem. 1982. Vertical migration and mortality of benthos in dredged material - Part III: Polychaeta. *Marine Environmental Resources*, 6:49-68.

McGavern, L. 1989. Plastics: Sealing the fate of marine life. MIT Sea Grant College Program for Coastweeks. 1 pp.

McLellan, T.C., R.N. Havis, D.F. Hayes, and G.L. Raymond. 1989. Field studies of sediment resuspension characteristics of selected dredges. Improvement of Operations and Maintenance Techniques Research Program, Technical Report HL-89-9, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

Md. DNR Fisheries Service, Cooperative Oxford Laboratory marine Mammal /Sea Turtle Stranding Project(1991-1995)

Meylan, A. 1986. The riddle of the ridley's. *Natural History Magazine*, 11:90-96.

Meylan, A. 1988. Spongivory in hawksbill turtles: A diet of glass. *Science* 239:393-395.

Morgan, P.J. 1989. Occurence of leatherback turtles (*Dermochelys coriacea*) in the British Isles in 1988 with reference to a record specimen. In: Eckert, S.A., K.L. Eckert, and T.H. Richardson (Comps.); Proceedings of the Ninth Annual Workshop on Sea Turtle Conservation and Biology, 7-11 February 1988, Jekyll Island, Georgia. NOAA Technical Memorandum NMFS-SEFC-232, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Regional Fisheries Center, Miami, FL. Pp. 119-129.

Morreale, S.J., A.B. Meylan; E.A. Standora, and S.S. Sadove. 1992. Annual occurrence and winter mortality of *Lepidochelys kempi* and other marine turtles in New York waters. *Journal of Herpetology*, 26:3:301-308.

Mrosovsky, N. and P.C.H. Pritchard. 1971. Body temperature of *Dermochelys coriacea* and other sea turtles. *Copeia* 1971:624-631.

Murphy, T.M. and S.R. Hopkins-Murphy. 1989. Sea turtle and shrimp fishing interactions: A summary and critique of relavent information. Center for Marine Conservation, Washington, DC.

Musick, J.A. 1988. *The sea turtles of Virginia* (2nd. Ed.). VIMS Educational Series, No. 24, Virginia Sea Grant Program, Virginia Institute of Marine Science, Gloucester Point, VA.

Musick, J.A., R. Byles, R.E. Klinger, and S. Bellmund. 1984. Mortality and behavior of sea turtles in Chesapeake Bay, 1979-1983. Summary Report by Virginia Institute of Marine Science, Gloucester Point, VA for National Marine Fisheries Service. Contract No. NA80FAC00004.

Musick, J.A. 1986. Trail of the sea turtle; pulling the pieces together in Virginia. *Virginia Wildlife* (June 1986):22-25

National Marine Fisheries Service and U.S. Fish and Wildlife Service, 1995. Status Reviews for Sea Turtles Listed under the Endangered Species Act of 1973. National Marine Fisheries service, Silver Spring, Maryland

Natinal Marine Fisheries Service. 1991. Recovery Plan for the Right Whale (Eubalaena glacialis). Prepared by the Right Recovery Whale Team for the national Marine Fisheries Service, Silver Spring, Maryland 86 pp.

NMFS. 1991. Endangered Species Act Section 7 Consultation: Biological Opinion on the dredging of channel in the Southeastern United States from North Carolina through Cape Canaveral, Florida. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine fisheries Service, Silver Spring, MD. 25 November 1991.

NMFS. 1993. Endangered Species Act Section 7 Consultation: Biological Opinion on the channel deepening and subsequent maintenance by hopper dredge in the York River Entrance Channel, Virginia. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine fisheries Service, Silver Spring, MD. 30 March 1993.

NRC. 1990. Decline of the sea turtle: causes and prevention. Committee on Sea Turtle Conservation, Board on Environmental Studies and Toxicology, Board on Biology, Commission on Life Sciences, National Research Council. National Academy Press, Washington, DC.

O'Hara, K.J. and S. Iudicello. 1987. Plastics in the ocean: More than a litter problem. Center for Environmental Education. 128 pp.

Orth, R.J. and K.L. Heck, Jr. 1980. Structural components of eel-grass (*Zostera marina*) meadows in the lower Chesapeake Bay. *Estuaries* 3:278-288.

Palermo, M.R. 1990. Introduction to alternative dredging methods. In: Dickerson, D.D. and D.A. Nelson (Comps.); Proceedings of the National Workshop on Methods to Minimize Dredging Impacts on Sea Turtles, 11-12 May 1988, Jacksonville, Florida. Miscellaneous Paper EL-90-5. Department of the Army, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. February, 1990. Pp. 53.

Phillips, P. 1989. *The great ridley rescue*. Mountain Press Publishing Company, Missoula, MT.

Plotkin, P., and A.F. Amos. 1988. Entanglement in and ingestion of marine debris by sea turtles stranded along the south Texas Coast. In: Schroeder, B.A. (Comp.), Proceedings of the 8th Annual Workshop on Sea Turtle Conservation and Biology, 24-26 February 1988, Fort Fisher, North Caroline. NOAA Technical Memorandum NMFS-SEFC-214, National Oceanic and Atmospheric Administration. Pp. 79-82.

Pritchard, P.C.H. 1979. *Encyclopedia of turtles*. T.H.F. Publications, Neptune City, FL.

Pritchard, P.C.H. 1980. *Dermochelys coriacea*. Catalogue of American Amphibians and Reptiles 238.1-238.4.

Pritchard, P.C.H. 1990. Kemp's ridleys are rarer than we thought. *Marine Turtle Newsletter*, 49:1-3.

Pritchard, P.C.H. and R. Marquez. 1973. Kemp's ridley turtle or Atlantic ridley. I.U.C.N. Monograph No. 2, Morges, Switzerland.

Pritchard, P.C.H., P.R. Bacon, F.H. Berry, A.F. Carr, J. Fletemeyer, R.M. Gallagher, S.R. Hopkins, R.R. Langford, R. Marquez M., L.H. Ogren, W.G. Pringle, Jr., H.A. Reichart, R. Witham. 1983. Manual of sea turtle research and conservation techniques, 2nd Ed. Prepared for the Western Atlantic Turtle Symposium, 17-22 July 1983, San Jose, Costa Rica, Intergovernmental Oceanographic Commission Association for the Caribbean and Adjacent Regions. Bjorndal, K.A. and G.H. Balazs (Eds.). Center for Environmental Education, Washington, DC.

Rebel, T. P. 1974. *Sea turtles and the turtle industry of the West Indies, Florida, and the Gulf of Mexico*. University of Miami Press, Coral Gables, FL.

Reed, C.F. 1957. Contributions to the herpetofauna of Virginia, 2: the reptiles and amphibians of the northern neck. Washington Academy of Science 47:21-23.

Rhoads, D.C., and J.D. Germano. 1982. Characterization of organism-sediment relation using sediment profile imaging: An efficient method of remote ecological monitoring of the seafloor (REMOTS® system). Mar. Ecol. Prog. Ser. 8:115-128.

Rhoads, D.C., and J.D. Germano. 1986. Interpreting longterm changes in benthic community structure; A new protocol. Hydrobiologia 142:291-308.

Richardson, J.I. 1990. The sea turtles of the King's Bay area and the endangered species observer program associated with construction dredging of the St. Mary's Entrance Ship Channel. In: Dickerson, D.D. and D.A. Nelson (Comps.); Proceedings of the National Workshop on Methods to Minimize Dredging Impacts on Sea Turtles, 11-12 May 1988, Jacksonville, Florida. Miscellaneous Paper EL-90-5. Department of the Army, U.S. Army Engineer Waterways Experiment Station,
Vicksburg, MS. February, 1990. Pp. 32-46.

Right Whales: Past and Present Status, Reports of the International Whaling Commission. Special Issue 10 Cmabridge 1986.

Ross, J.P., S. Beavers, D. Mundell, and M. Airth-Kindree. 1989. *The status of the Kemp's ridley.* Center for Marine Conservation, Washington, DC.

Schroeder, B.A. 1987. 1986 Annual Report of the Sea Turtle Stranding and Salvage Network - Atlantic and Gulf Coasts of the United States - January to December 1986. National Oceanic and Atmospheric Administration Technical Memorandum NMFS-SEFC-214. CRD-87/88-12. Coastal Resources Division, National Marine Fisheries Service, Miami, FL. 45 pp.

Schroeder, B.A. and A.A. Warner. 1988. 1987 Annual Report of the Sea Turtle Stranding and Salvage Network - Atlantic and Gulf Coasts of the United States - January to December 1987. National Oceanic and Atmospheric Administration Technical Memorandum NMFS-SEFC-2__. CRD-87/88-28. Coastal Resources Division, National Marine Fisheries Service, Miami, FL. 45 pp.

Shoop, C.R. 1980. Sea turtles in the northeast. *Maritimes*, 24:9-11.

Shoop, C.R. and R.D. Kenney. 1992. Seasonal distributions and abundance of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetological Monographs, 6. 1992. Pp. 43-67.

Shoop, C.R., T. Doty, and N. Bray. 1982. A characterization of marine mammals and turtles in the mid- and north-Atlantic areas of the U.S. outer continental shelf: final report. University of Rhode Island, Kingston, RI. December 1982.

Standora, E.A. 1990. Radio tagging of sea turtles. In: Dickerson, D.D. and D.A. Nelson (Comps.); Proceedings of the National Workshop on Methods to Minimize Dredging Impacts on Sea Turtles, 11-12 May 1988, Jacksonville, Florida. Miscellaneous Paper EL-90-5. Department of the Army, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. February, 1990. Pp. 66-68.

Standora, E.A., J.R. Spotila, J.A. Keinath, and C.R. Shoop. 1984. Body temperature, diving cycles, and movement of subadult leatherback turtle, *Dermochelys coriacea. Herpetologica* 40:169-176.

Stanley, K.M., E.K. Stabenau, and A.M. Landry. 1988. Debris ingestion by sea turtles alonmg the Texas Coast. In: Schroeder, B.A. (Comp.), Proceedings of the 8th Annual Workshop on Sea Turtle Conservation and Biology, 24-26 February 1988, Fort Fisher, Noerth Carolina. NOAA Technical Memorandum NMFS-SEFC-214, National Oceanic and Atmospheric Administration. Pp. 119-121.

Sternberg, J. 1981. Worldwide distribution of sea turtle nesting beaches. Center for Environmental Education, Washington, DC.

STSSN. 1990. Sea Turtle Stranding and Salvage Network Database, National Marine Fisheries Service, Southeast Fisheries Science Center, Miami, FL.

Swingle, M., S. Barco, T. Pitchford, W. McLellan, and D.A. Pabst. 1993. The occurrence of foraging juvenile humpback whales (*Megaptera novaengliae*) in Virginia Coastal Waters. *Marine Mammal Science* (in press).

Taylor, A.C. 1990. The hopper dredge. In: Dickerson, D.D. and D.A. Nelson (Comps.); Proceedings of the National Workshop on Methods to Minimize Dredging Impacts on Sea Turtles, 11-12 May 1988, Jacksonville, Florida. Miscellaneous Paper EL-90-5. Department of the Army, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. February, 1990. Pp. 59-63.

Teas, W.G. and A. Martinez. 1989. 1988 Annual Report of the Sea Turtle Stranding and Salvage Network - Atlantic and Gulf Coasts of the United States - January to December 1988. National Oceanic and Atmospheric Administration Technical Memorandum NMFS-SEFC-__. Contibution No. CRD-88/89-19. Coastal Resources Division, National Marine Fisheries Service, Miami, FL.

USAEWES. 1993. Assessment of sea turtle relative abundance in York Spit Channel and Cape Henry Channel within Chesapeake Bay, Virginia. Scope of Work submitted to U.S. Army Engineer District, Baltimore. U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS. 20 April 1993.

Van Dolah, R.F., P.P. Maier, S.R. Hopkins-Murphy, G.F. Ulrich, and D.M. Cupka. 1992. Survey of turtle populations in the Charleston Harbor Entrance Channel. Report by Marine Resources Division, South Carolina Wildlife and Marine Resources Department, for U.S. Department of the Interior, U.S. Fish and Wildlife Service, Charleston, SC. February, 1992.

Van Meter, V. 1983. Florida's sea turtles, 2nd Ed. Florida Light and Power Company, Maimi, FL. 46 pp.

Vargo, S., P. Lutz, D. Odell, E. Van Vleet, and G. Bossart. 1986. Final report of the effects of oil on marine turtles - Executive summary. MMS 14-12-0001-30063. Minerals Management Service, United States Department of the Interior, Washington, DC.

Wiley, D.N., R.A. Asmutis, and D.P. Gannon. 1992. Preliminary investigation in the strandings of the humpback whale, *Magaptera novaengliae*, in the mid-Atlantic and southeast regions of the United States, 1985-1999. Report to the International Wildlife Coalition. December, 1992.

Winn, Howard E. et al,. 1982. A Characterization of Marine Mammal and Turtles in the Mid- and North Atlantic areas of the U.S. Outer Continental Shelf. Final Report of the Cetacean and Turtle assessment Program. University of Rhode Island. Prepared for the U.S. Department of the Interior, Bureau of Land Management, Washington DC under contract AA551-CT8-48.

Witham, R. 1974. Neonate sea turtles from the stomach of pelagic fish. *Copeia* 1974 (2):548.

Witzell, W.N. 1983. Synopsis of biological data on the hawksbill turtle, *Eretmochelys imbricata* (Linnaeus, 1766). FAO Fisheries Synopsis No. 137, Food and Agriculture Organization of the United Nations, Rome, Italy. Pp. 78.

Yntema, C.L. and N. Mrosovsky. 1979. Incubation temperature and sex ration of hatchling loggerhead turtles: a preliminary report. *Marine Turtle Newsletter* 11 (March, 1979): 9-10.

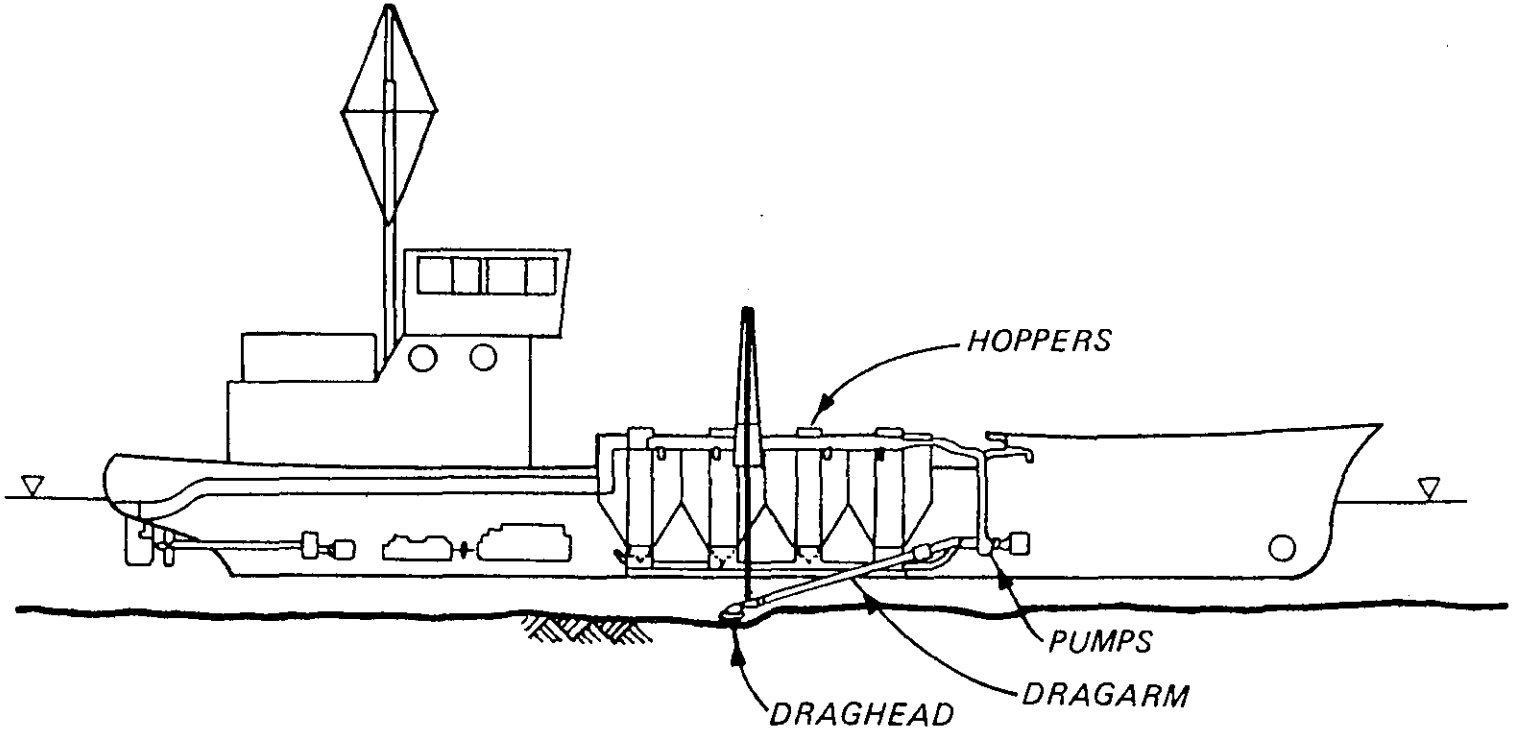

Figure 2. Self-propelled seagoing hopper dredge

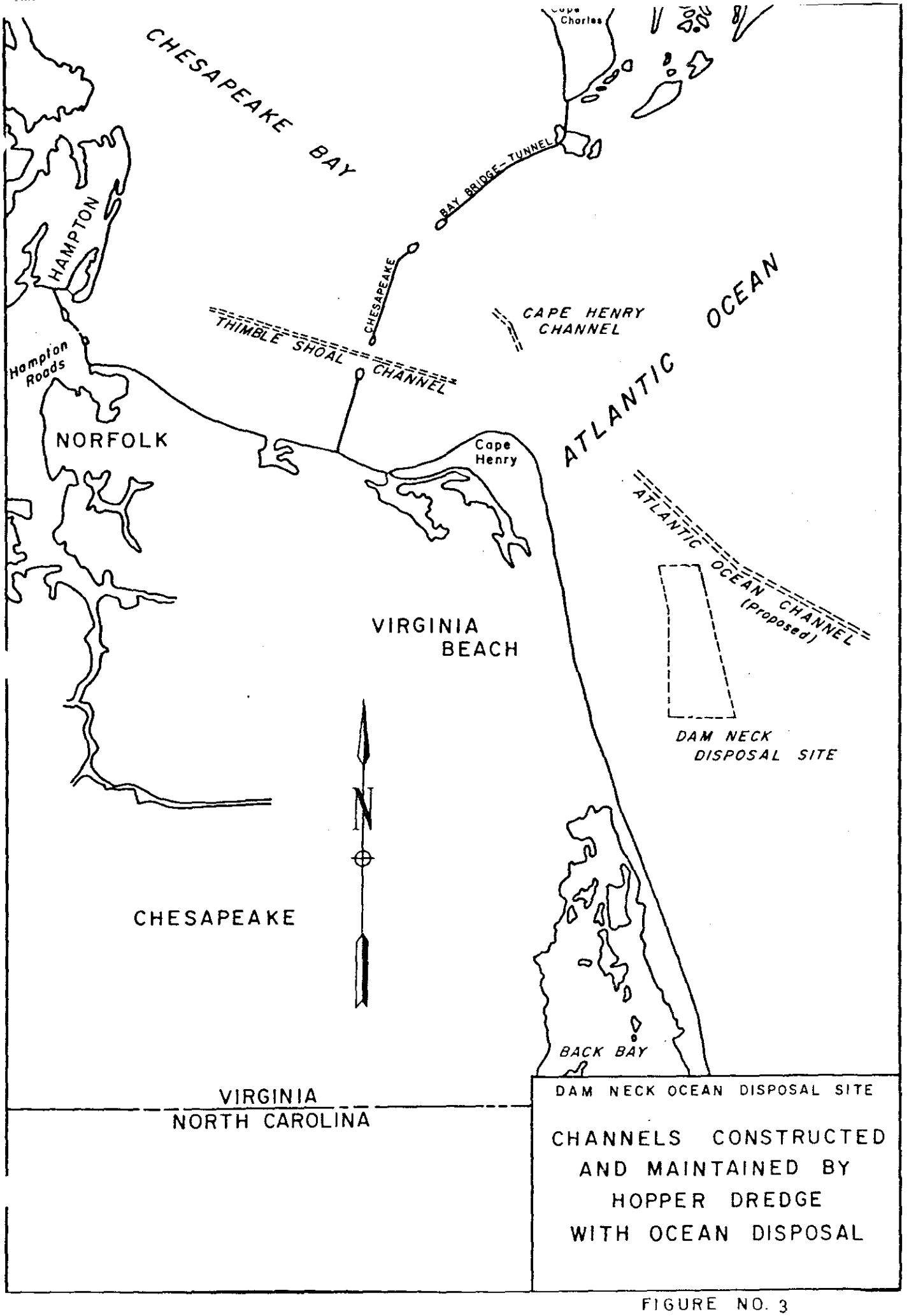
CHESAPEAKE BAY
Cape Charles
BAY BRIDGE-TUNNEL
HAMPTON
CHESAPEAKE
THIMBLE SHOAL CHANNEL
CAPE HENRY CHANNEL
ATLANTIC OCEAN
Hampton Roads
NORFOLK
Cape Henry
ATLANTIC OCEAN CHANNEL (proposed)
VIRGINIA BEACH
DAM NECK DISPOSAL SITE
N
CHESAPEAKE
BACK BAY
VIRGINIA
NORTH CAROLINA
DAM NECK OCEAN DISPOSAL SITE
CHANNELS CONSTRUCTED AND MAINTAINED BY HOPPER DREDGE WITH OCEAN DISPOSAL

FIGURE NO. 3

APPENDIX A

This is a specific portion of an Environmental Protection specification prepared by Norfolk District in accordance with past practice and experience in Waterways and Ports Branch, as well as incorporation of the most recent design guidance from the Jacksonville District Specifications and Design Requirements. Please note areas within brackets "[ ]" require input from the designer and are subject to being edited to suit project requirements.

3.6 ENDANGERED SPECIES PROTECTION

The area of work, including the dredging areas, placement areas, and the navigation area between the dredging and placement areas, may have endangered species present. The Contractor shall instruct all personnel associated with the operation of the vessel and any attendant plant regarding the possible presence of endangered sea turtles [and whales] and the need to avoid collisions with these animals. The Contractor shall advise all personnel associated with the operation of the vessel of the civil and criminal provisions of the Endangered Species Act and the Marine Mammal Protection Act. In the event that the Contractor performs work under this contract with a hopper dredge, the Contractor shall comply with all laws and regulations governing the work and the provisions set forth in this section. In the event that endangered species are affected by this work, the work under this contract may be suspended or terminated, as determined by the Contracting Officer. The Contractor shall develop a written operational plan to minimize turtle takes [and whale collisions] and submit it as part of the Environmental Protection Plan. The Contractor shall comply with all requirements of this specification and the Contractor's accepted Environmental Protection Plan. The contents of this specification and the Contractor's Environmental Protection Plan shall be shared with all applicable crew members of the hopper dredge and attendant plant employed on the work.

3.6.1 Endangered Species Bridge Watch

The Contractor shall maintain a bridge watch on all self-propelled vessels and plant in accordance with U.S. Coast Guard rules. The Contractor shall require personnel on bridge watch duties to observe the surface of the water for the presence of sea turtles [from May 15 to November 15], and for whales at all times. In the event that bridge watch personnel observes endangered species, they shall inform the master of the vessel, and appropriate action shall be taken to avoid a vessel collision with these animals.

3.6.2 Endangered Species Observers

If a hopper dredge is used for this work [from May 15 through November 15,] the Contractor shall provide National Marine Fisheries Service-approved endangered species observers with demonstrated abilities to identify sea turtle species and turtle parts. One observer is required to be onboard the dredge for the first week of dredging operations. Subsequent observer assignments shall be made in shifts on alternating weeks (one week on and on week off) until the work is completed[, or November 15, whichever comes first]. The observers shall be on duty for watches of 6 hours on duty, 6 hours off duty, for a total of 12 hours of observation duty daily during each weekly assignment. The observer shall inspect the approved screening devices for sea turtles and turtle parts during each loading cycle that occurs during the observer's 6 hour watch and report all findings as a part of the Daily Contractor Quality Control Report.

3.6.3 Endangered Species Observation Reports

If a hopper dredge is used for this work, the Contractor shall submit written reports weekly, prepared by the approved endangered species observers, to the National Marine Fisheries Service Northeast Regional Office, Habitat and Protected Resources Division, Gloucester, Massachusetts, and the Contracting Officer, within seven days of the reporting period. The Contractor shall prepare observation sheets for each dredging cycle monitored by the observer and shall submit as indicated above a weekly summary report which includes the load observation sheets and any relevant incident reports for each week covered by an observer. The endangered species observation sheets and incident reports shall be in the National Marine Fisheries Service format to be provided by the Contracting Officer. The Contractor shall immediately report any sea turtle takings [and whale collisions] to the Contracting Officer. The Contractor shall submit a final endangered species observation report for the entire work to the National Marine Fisheries Service Northeast Regional Office with a copy furnished to the Contracting Officer within twenty working days of completion of dredging.

3.6.4 Hopper Dredge Special Recording Requirements

All hopper dredges shall be equipped with recording devices for each drag head that capture real time, drag head elevation, slurry density, and at least two of the following for each respective pump: Pump slurry velocity measured at the output side, pump vacuum, or pump RPM. The Contractor shall record continuous real time positioning of the dredge, by plot or electronic means, during the entire dredging cycle including dredging area and disposal area. The recording system shall be capable of capturing data at variable intervals but with a frequency of not less than every 60 seconds. All data shall be time correlated to a 24 hour clock and the recording system shall include a method of daily evaluation of the data collected. Data shall be furnished to the Contracting Officer for each day's operation on a daily basis. A written plan of the method the Contractor intends to use in order to satisfy these requirements shall be included with the Contractor's Quality Control Plan.

3.6.5 Endangered Species Disposition

The Contractor shall notify the National Marine Fisheries Service within 24 hours of the recovery of any sea turtle or turtle parts. The person(s) to notify are [Douglas Beach, telephone (508) 281-9254 or Colleen Coogan, telephone (508) 281-9291]. Any dead sea turtles or turtle parts shall be placed in plastic bags and labeled to show the time, date, location, load number, and placed in cold storage. In addition, the remains shall be labeled to indicate if the remains appear to be recent or old remains at the time when they were discovered. Any live sea turtles shall be examined for injury, size, and condition, and all pertinent data recorded on the observation sheets and incident reports. Uninjured sea turtles shall be released by the observer in a manner approved by the National Marine Fisheries Service. Injured turtles shall be attended by the observer and shall be transported to the National Aquarium in Baltimore, Maryland, or other disposition as determined by the National Marine Fisheries Service. All turtle remains shall be delivered to the National Marine Fisheries Service in accordance with their instructions at the completion of the work.

3.6.6 Hopper Dredge Endangered Species Special Equipment

The Contractor shall submit drawings and specifications of all

proposed endangered species special screening and lighting equipment for the review and approval of the Contracting Officer. The Contractor shall provide the following special equipment on all hopper dredges used on this work during the period [of May 15 through November 15].

3.6.6.1 Drag Head Deflectors

If a hopper dredged is used on this work, all hopper dredge drag heads shall be equipped with rigid sea turtle deflectors which are rigidly attached. No dredging shall be performed by a hopper dredge without a turtle deflector device that has been approved by the Contracting Officer. The turtle deflector device shall be maintained in operational condition for the entire dredging operation.

3.6.6.1.1 Deflector Design

The leading vee-shaped portion of the deflector shall have an included angle of less than 90 degrees. Internal reinforcement shall be installed in the deflector to prevent structural failure of the device. The leading edge of the deflector shall be designed to have a plowing effect of at least 6 inch depth when the drag head is being operated. Appropriate instrumentation or indicator shall be used and kept in proper calibration to insure the critical "approach angle". If adjustable depth deflectors are installed, they shall be rigidly attached to the drag head using either a hinged aft attachment point or an aft trunnion attachment point in association with an adjustable pin front attachment point or cable front attachment point with a stop set to obtain the 6 inch plowing effect. This arrangement allows fine-tuning the 6 inch plowing effect for varying depths. After the deflector is properly adjusted there shall be no openings between the deflector and the drag head that are more than 4 inch by 4 inch.

3.6.6.2 Screening Equipment

The Contractor shall install baskets or screening over each respective hopper inflow with no greater than 4 inch x 4 inch openings. The method selected shall depend on the construction of the dredge used and shall be approved by the Contracting Officer prior to commencement of dredging. The screening shall provide 100 percent screening of the hopper inflow. The screens and baskets shall be maintained in operational condition and shall remain in place throughout the performance of the work.

3.6.6.3 Lighting Equipment

The areas where screens or gratings are installed shall be provided with suitable lighting to allow safe observations of the screen devices during periods of darkness or reduced visibility and shall be approved by the Contracting Officer. Safe access shall be provided to the inflow baskets or screens to allow the observer to inspect for turtles, turtle parts or damage.

3.6.7 Hopper Dredge Special Operating Procedures

The Contractor shall operate the hopper dredge to minimize the possibility of taking sea turtles [and to comply with the requirements stated in the Incidental Take Statement provided by the National Marine Fisheries Service in their Biological Opinion]. When initiating dredging, suction through the dragheads shall be allowed just long enough to prime the pumps, then the dragheads must be placed firmly on the bottom. When lifting the dragheads from the bottom, suction through the dragheads shall be allowed just long enough to clear the lines, and them must cease.

Pumping water through the dragheads shall cease while maneuvering or during travel to/from the disposal area. During turning operations the pumps shall either be shut off or reduced in speed to the point where no suction velocity or vacuum exists. The Contractor shall not raise the drag head off the bottom to increase suction velocities. The primary adjustment for providing additional mixing water to the suction line shall be through water ports. To ensure that suction velocities do not drop below appropriate levels, the Contractor's personnel shall monitor production meters throughout the job and adjust primarily the number and opening sizes of water ports. Water port openings on top of the drag head or on raised stand pipes above the drag head shall be screened before they are utilized on the dredging project. If a dredge section includes sandy shoals on one end of a tract line and mud sediments on the other end of the tract line, the Contractor shall adjust the equipment to eliminate drag head pick-ups to clear the suction line.

APPENDIX B

US Army Corps
of Engineers
Norfolk District

FINAL SUPPLEMENT I
to the
FINAL ENVIRONMENTAL IMPACT STATEMENT

and APPENDIX:
DAM NECK OCEAN DISPOSAL SITE
SITE EVALUATION STUDY

NORFOLK HARBOR and CHANNELS, VIRGINIA
DEEPENING and DISPOSAL

May 1985

FINAL
SUPPLEMENT I
to the
FINAL ENVIRONMENTAL IMPACT STATEMENT

Norfolk Harbor and Channels, Virginia
Deepening and Disposal, July 1980

May 1985

The responsible lead agency is the Norfolk District, U.S. Army Corps of Engineers.

Abstract. This supplement addresses modifications to the proposed disposal plan for the Norfolk Harbor and Channels project not discussed in previous project documents. The original project description is contained in the Feasibility Study and Final Environmental Impact Statement (July 1980) where planned disposal of dredged material originating within the harbor is at a confined upland disposal area in Suffolk, Virginia. New work and maintenance material from channels outside Hampton Roads were then, and continue to be, planned for disposal at sea. In December 1980, an addendum to the FEIS was issued to reflect the Board of Engineers for Rivers and Harbors post-review decision. The Board concluded that the plan for confined upland disposal in Suffolk, Virginia should be removed from any further consideration; instead, disposal of dredged material originating within Hampton Roads should be placed in the existing Craney Island diked disposal facility.

The site specifically identified by the addendum for ocean disposal is Norfolk Disposal Site, located 17 nautical miles due east of the Chesapeake Bay mouth. This supplement identifies an expansion of the existing Dam Neck Disposal Site as an additional alternative site for disposal of dredged material.

SEND COMMENTS TO
THE DISTRICT ENGINEER

If you would like further information
please contact:
Mr. Richard J. Muller
Norfolk District, U.S. Army Corps of Engineers
803 Front Street, Norfolk, Virginia 23510-1096
Commercial Telephone (804) 441-3767
FTS Telephone 827-3767

1. SUMMARY

1.01 The Norfolk Harbor Deepening and Disposal Study is an effort which began as separate studies concurrently initiated to determine the advisability of improving the deep-water channels and adjacent anchorages in Hampton Roads and to determine an overall plan for future disposal of material dredged from the Hampton Roads area. The first of these studies was adopted by the Senate Committee on Public Works by a resolution on 20 June 1969 authorizing a study to determine the advisability of improving the deep-water channels in Hampton Roads and the anchorages adjacent thereto. Subsequently, identical resolutions were adopted by the Senate and House Committees on Public Works on 24 June 1974 and 10 October 1974, respectively, authorizing a study to determine the advisability of providing additional improved anchorage areas in an adjacent to Norfolk Harbor.

1.02 A concurrent investigation had been underway concerning the disposal of dredged material in Hampton Roads. The purposes of this study were to consider possible courses of action to provide for the future disposal of dredged material and to recommend the most beneficial overall solutions with the least social, environmental, and economic cost. The study was undertaken in response to a resolution adopted 3 October 1968 by the Committee on Public Works of the U.S. House of Representatives.

1.03 Since investigations required as a result of these separate resolutions are closely related, it was determined that the reports required under each authority should be combined. The combining of the reports was approved by the Office of the Chief of Engineers.

1.04 Descriptions of the deepening and disposal plans were first presented in the project Feasibility Study (including Final Environmental Impact Statement (FEIS) and Appendices). The study had determined that, for channel and anchorage improvements, the best overall plan responding to the problems and needs of the port of Hampton Roads and surrounding region is to deepen a portion of the existing 45-foot channels to 55 feet; deepen a portion of the existing 40-foot channel to 45 feet; and deepen a portion of the existing 35-foot channel to 40 feet. These dimensions remain unchanged.

1.05 The plan also recommended construction of three sets of fixed mooring anchorage areas capable of handling six vessels at any one time. It is now proposed to replace the fixed mooring concept with a single circular anchorage 55-feet deep with a 1,400-foot radius in naturally deep water near Hampton, Virginia. Also planned is the improvement of one anchorage at Sewell's Point by increasing its radius from 1,200 feet to 1,400 feet and maintaining its depth at 45 feet. All other anchorages, which are part of the project, will be maintained at their authorized depths.

1.06 In considering alternative disposal sites during plan formulation, data pertaining to the quality of bottom materials were based on technical criteria which are no longer considered a reliable basis for the assessment of ecological effects of dredged material disposal. Use of

these criteria indicated that virtually none of the material within Hampton Roads was suitable for open water disposal and would require confined disposal. On this basis, the FEIS recommended the replacement of the Craney Island Disposal Area (CIDA) with a 6,000-acre confined upland dredged material disposal area in the city of Suffolk for the disposal of dredged material from all dredging in the Norfolk Harbor area. Ocean disposal of dredged material originating within Hampton Roads was not presented as a viable alternative in the FEIS. The FEIS did recommend use of a proposed ocean dredged material disposal area, located about 17 nautical miles east of Cape Henry, Virginia, for the disposal of dredged material from the Thimble Shoal Channel and the proposed Atlantic Ocean Channel. This area is known as the Norfolk Disposal Site.

1.07 During review of the report and FEIS by the Board, preliminary results of bioassays of dredged material from channels and anchorages inside Hampton Roads and studies of Norfolk Disposal Site became available. These bioassays, which are more reliable indicators of ecological impacts of dredged material disposal than past technical criteria, were conducted in accordance with Implementation Manual for Section 103 of Public Law 92-532 (Marine Protection, Research and Sanctuaries Act). This manual was developed jointly by the Environmental Protection Agency (EPA) and U.S. Army Corps of Engineers. Initial results indicated that a majority of the material is considered suitable for ocean disposal.

1.08 The enhanced potential for ocean disposal indicated by results of bioassays and other tests lessened the need for a large confined disposal area. Additionally, disposal operations at the Suffolk Site would have destroyed terrestrial habitat, introduced undesirable bird concentrations, and could have an unkown but possibly adverse impact on local groundwater aquifers. In view of these considerations, an Addendum to the FEIS was prepared and coordinated. Dredging requirements remained unchanged by the Addendum, but the Suffolk Site was eliminated therein as a recommended disposal area. Craney Island, with sufficient remaining capacity for containment of remaining dredged material from within Hampton Roads resulting from construction of the deepening project, is no longer being recommended for conveyance of ownership to the Commonwealth of Virginia by the Addendum. Also under the plan recommended by the Feasibility Study and Addendum, dredged material from the existing Thimble Shoal Channel, Cape Henry Channel, and a new channel, the Atlantic Ocean Channel, would be disposed of in the open ocean. The Norfolk Disposal Site was proposed for this purpose in the Addendum.

1.09 Economic and site management considerations for the Norfolk Disposal Site raised a need for availability of other disposal options. This document proposes to supplement the recommended disposal plan with the option for disposal at an expanded version of an existing disposal area offshore of Virginia Beach, Virginia. This area, known as Dam Neck Disposal Site, has been designated by EPA as an interim disposal site. The Dam Neck Site will be reconfigured to provide the required disposal capacity for the project, and thereby enable effective dredged material management.

1.10 Extensive environmental studies have been conducted to assess the effects of continued and more intensive disposal at Dam Neck. None of these studies have indicated a potential for project impacts to have a significant effect on regional fish or shellfish resources. The findings are presented in the attached appendix, and are summarized in the following table. The study documents will be coordinated through Supplemental Information Report (S.I.R.) procedures by early 1986.

1.11 The use of the Craney Island Disposal Area, for the confined disposal of any dredged material from the Norfolk Harbor and Channels Deepening project, is consistent with the operational and economic requirements of the project. Craney Island Disposal Area's capacity will be increased to provide the required disposal capacity by the use of advanced site management methods including use of sub-containment areas, dewatering techniques, dike raising, and other site improvements.

1.12 The use of area beaches and stockpile areas, for the disposal of suitable sandy material from the Norfolk Harbor and Channels Deepening project, is consistent with the operational and economic requirements of the project and the needs of the local, State, and Federal interests. Official interest has been expressed by the U.S. Army (Fort Story), the cities of Hampton, Norfolk, and Virginia Beach, and the Virginia Commission on the Conservation and Development of Public Beaches. Thimble Shoal Channel and the proposed Atlantic Ocean Channel are known to have substantial quantities of suitable material.

1.13 The use of dredged material from the Norfolk Harbor and Channels Deepening project as a borrow source for construction projects is consistent with the engineering, operational, and economic requirements of the project. The Virginia Department of Highways and Transportation has been granted a Corps of Engineers permit for the removal of 2.25 million cubic yards (mcy) of material from the Thimble Shoal Channel for use in the construction of the I-664 Bridge and Tunnel. The conditions of the permit will be consistent with the project deepening requirements.

1.14 It is planned to meet the dredged material disposal needs of the Norfolk Harbor and Channels Deepening project by the selected use of the disposal alternatives described in the FEIS, the Addendum to the FEIS, and this Supplement to the FEIS. No single disposal alternative is expected to meet all environmental and operational requirements during the construction and maintenance of the project. The purpose of providing a range of disposal alternatives is to assure the constructibility, economic viability, and environmental protection requirements of a large and complex harbor deepening project.

Table 1. DAM NECK DISPOSAL SITE SUMMARY

Criteria as Listed in 40 CFR 228.6		Summary of Site Evaluation Study (Appendix) Findings and Conclusions
(1)	Geographical Location	Approximately 3.5 miles offshore of Virginia Beach. See Figures 4 and 5 for location and Figure 12 for coordinates.
(2)	Location Relative to Important Resource Areas	Fish migrations into and out of Bay occur through the study area. Blue crabs spawn in lower Bay and larvae develop in offshore waters. Commercial and recreational fishing takes place in offshore waters both north and south of Chesapeake Bay mouth and in vicinity of Dam Neck Site. No interference with resources is anticipated.
(3)	Distance from Beaches	Site is approximately 3.5 miles from beach at Virginia Beach; net sediment transport at site is negligible. No onshore transport of deposited material is anticipated.
(4)	Types & Quantities of Materials	Total Volumes w/Port Improvements Thimble Shoal Channel - clays & silts with some fine to med. sand. - 32.5 m cu. yds. Cape Henry Channel - fine sands with little silt and shell. - 15.5 m cu. yds. Atlantic Ocean Channel - fine sand with little silt, clay, and gravel. - 20.0 m cu. yds TOTAL 68.0 m cu. yds.
(5)	Surveillance and Monitoring	Surveillance and monitoring easily facilitated due to nearness to shore, shallowness of site and availability of vessels and historical data.
(6)	Dispersal, Horizontal Transport, Vertical Mixing	General oceanic circulation patterns at Dam Neck Site produce conditions conducive to insignificant net sediment transport. Tides and wind-driven variability act to constrain net movement. Motion tends to be oscillatory and net sediment transport is negligible. Dredged material dumped and deposited near the bottom is not expected to be affected substantially by vertical mixing. Dam Neck Site and surrounding area is a hydraulically stable environment with little potential for significant net movement of dumped dredged material.

Table 1. DAM NECK DISPOSAL SITE SUMMARY
(Cont'd)

Criteria as Listed in 40 CFR 228.6	Summary of Site Evaluation Study (Appendix) Findings and Conclusions
(7) Effects of Previous Disposal in Ocean	No significant long term effects have been observed. Dam Neck Site has been used since 1967 - fauna, water quality, and sediment quality found at the site is typical to that found in adjacent, previously undisturbed offshore areas.
(8) Interference with other uses of the Ocean	Site is within a larger zone of commercial and recreational finfishing but should not interfere with use of area for fishing. The terminal end of the Atlantic Treatment Plant (HRSD) out-fall is located approx. 6,400 feet to the west of the Dam Neck Interim Disposal Site but will not interfere with operation of the facility. Other known uses of the ocean in the area, including military exercise, can be effectively coordinated to prevent conflict.
(9) Existing Water Quality and Ecology	Virginia State Water Control Board has classified the Atlantic Ocean in this area as Class I-B-a: a minimum D.O. requirement of 5.0 mg/l, pH range of 6.0 to 8.5 and a permissible rise above natural temperature of 4.0°F (September-May) and 1.5°F (June-August). Appendix B describes existing water quality in more detail. Ecology typical of inner continental shelf regions and positively influenced by position adjacent to mouth of Chesapeake Bay (Appendix A describes ecology in detail).
(10) Potential for Nuisance Species	Site has been used since mid-1960's with no apparent recruitment of nuisance species. Deposition of material composition comparable to that previously dumped is not expected to result in recruitment of nuisance species.
(11) Existence of Significant Natural or Cultural Features	Wrecks are known to exist in vicinity of Dam Neck but disposal of dredged material would not adversely disturb or otherwise impact marine archaeological resources in the area.

Areas of Controversy

1.15 The Suffolk Disposal Site was an area of controversy when the Final EIS was prepared. This site was strongly opposed by the citizens of Suffolk, including local government and business interests. Since this is no longer part of the overall plan, it is no longer an issue.

1.16 The proposed use of Dam Neck is an area of controversy, primarily because average annual disposal quantities will be greater in comparison to the past 20 years. Historically, 20 million cubic yards had been placed in Dam Neck between 1967 and 1982. While this would appear to average about 1.3 mcy per year deposited at the site over a 15-year period, records indicate that about 15 mcy were deposited at Dam neck during a 3-year period, 1967 to 1970, or 5 mcy per year. Ocean dumping rates at Dam Neck reached a peak during a 7-month period during 1969-1970, when over 12 mcy were placed at the site. It is now proposed to place 36 mcy during a construction period of 7 years (deepening Cape Henry and Thimble Shoal Channels, and construction of Atlantic Ocean Channel). The rates of ocean dumping for new work will average about 5 mcy per year, with a maximum of 11-12 mcy during the fourth year of construction. In addition, future maintenance of the deepened channels will require the placement of about 32 mcy during a 50-year period, at a rate averaging 700,000 cubic yards per year. These proposed rates of disposal are the same order of magnitude as historical dredged material disposal rate at the Dam Neck Site.

2. NEED FOR AND OBJECTIVES OF ACTION

2.01 Draft and Final Environmental Impact Statements, filed with EPA 6 November 1981 and 23 July 1982, respectively, were prepared for use of Norfolk Ocean Disposal Site. All environmental criteria have been met for long-term disposal of acceptable dredged material. Its distance from the proposed navigation improvements, however, presents economic and site management concerns. In anticipation of the high costs of dredged material transport to Norfolk Disposal Site, disposal at Dam Neck, a significantly closer location, in conjunction with Craney Island Disposal Area, is proposed. This would be for receipt of environmentally acceptable dredged material from channels associated with the Norfolk Harbor Deepening Project. (Craney Island and Norfolk Disposal Sites are discussed in detail in the Final Environmental Impact Statement, Norfolk Harbor and Channels, Virginia-Deepening and Disposal and the Addendum thereto. See references 4 and 5.)

2.02 Dam Neck Disposal Area is an overboard site located offshore of Virginia Beach, Virginia. It has been designated by the United States Environmental Protection Agency as a disposal site, with interim designation, for receipt of dredged material which meets the environmental criteria for ocean disposal. It is currently used for disposal of the majority of the material dredged from maintenance of the authorized Thimble Shoal Channel (45') project, and the Cape Henry Channel (42') portion of the authorized Baltimore Harbor and Channel project.

2.03 The overall configuration of the existing Dam Neck Site is rectangular with its long axis north-south oriented. Dimensions are 22,000 feet by 5,000 feet, and its northwest corner is located 3.6 miles east of Rudee Inlet, which is the only inlet in Virginia south of the Chesapeake Bay mouth. The subsurface elevation of Dam Neck averages between -35.0 and -40.0 mean low water, allowing the site a remaining capacity, when filled to an elevation of -30, feet of approximately 40 million cubic yards. In order to accommodate the increased yardage generated by the deepened project dimensions, the expanded site will have a width tapering from 13,000 to 6,000 feet, a length of 30,000 feet, and a bottom area of 290 million square feet or about ten square miles.

2.04 The Dam Neck Site would be used for the disposal of materials, both new work and maintenance, from deepening the Thimble Shoal and Atlantic Ocean Channels as part of the Norfolk Harbor and Channels project, and deepening Cape Henry as part of the Baltimore Harbor and Channels project. Thimble Shoal and Cape Henry sediments have been disposed at the Dam Neck Site since the mid-1960's. The maintenance dredging of both these channels, and subsequent ocean disposal of the dredged material at Dam Neck, are addressed in previously filed Final Environmental Impact Statements. A recent exception to ocean disposal occurred in 1974 when significant quantities of sandy material were removed from Thimble Shoal Channel and productively used. Over 600,000 cubic yards were used by a private contractor as landfill, and over 700,000 cubic yards removed by Government hopper dredge were stockpiled at Fort Story. Most of this stockpile was then truck hauled to the Virginia Beach oceanfront for the bay front beach and dunes. These events demonstrate that limited amounts of material with suitable qualities are produced by navigation channel dredging and can be used productively.

2.05 Material for the annual replenishment of the authorized beach erosion control project at Virginia Beach is now being partially provided by truck hauling the sand dredged from the Lynnhaven Inlet navigation project. However, a substantial quantity of sand will be required in the future to construct an authorized modification of the Virginia Beach erosion control project and to rebuild or nourish other area shorelines. The U.S. Army Transportation Center has requested the support of Norfolk District in obtaining sand from navigation channel dredging to restore eroded shorelines, rebuild dunes, and establish stockpiles at Fort Story for future renourishment. The cities of Hampton, Norfolk, and Virginia Beach have also expressed interest in obtaining sandy dredged material for placement on their respective Chesapeake Bay beaches. The planned Atlantic Ocean Channel and the eastern end of Thimble Shoal Channel are known to contain sand which could be placed on area beaches. To the maximum extent practicable, the Norfolk District will recommend the placement of suitable quantities and types of dredged material on nearby shorelines, the creation of stockpiles, and other such beneficial uses. However, beneficial use of dredged material must be consistent with all project engineering, environmental, economic, legal, local cooperation, and cost sharing requirements. Based on studies and coordination to date, it is expected that a maximum of about 2 to 2.5 million cubic yards each from Thimble Shoal Channel and Atlantic Ocean Channel could be beneficially used for beach fill, stockpiling, or construction purposes and the balance from these channels placed within the expanded Dam Neck Site.

2.06 Total dredging requirements over a 50-year project life for a deepened Norfolk Harbor and associated channels, including new work dredging and future maintenance, would be approximately 380 million cubic yards. Disposal of this quantity is planned to be divided primarily between Craney Island Disposal Area, Dam Neck Site, Norfolk Site, and both bay and oceanfront beaches. The disposal location selection will be dependent upon quantity and quality of material and local needs. Of immediate concern is new work dredging that would deepen Thimble Shoal Channel and create the Atlantic Ocean Channel. (Natural depths in the latter are greater than the present 45 feet but less than necessary for the proposed 57-foot channel). This dredging would generate approximately 36 million cubic yards of dredged material, all of which is approved for ocean disposal. The Dam Neck Site has the capacity to receive this quantity and is the only ocean site within the overall project area which currently has a designation status.

2.07 The use of the Dam Neck site for ocean disposal requirements will enable sediment management. During channel deepening, the quantities of sandy dredged material removed from Cape Henry, Thimble Shoal, and Atlantic Ocean Channels will likely exceed the immediate needs for sandy material, or local government capability to receive these quantities, at the beaches and land-based stockpile areas. Within the Dam Neck site, areas will be established for stockpiling the sandy materials which are excess to local need or capability. These materials would then be available for future beach nourishment or other needs.

3. ALTERNATIVES

3.01 The alternative disposal plans presented in the Norfolk Harbor Deepening and Disposal Study were based on confining all inner harbor dredged material in new permanent diked disposal areas and ocean disposal of suitable sediments from Thimble Shoal and Atlantic Ocean Channels. Other disposal alternatives for the uncontaminated sediments from these outer channels are as follows:

a. Open Water Disposal in the Chesapeake Bay. The material from Thimble Shoal Channel could be deposited in open water areas a short distance from the channel as it had been prior to the 1950's. While this would initially be less expensive than other alternatives, experience has shown that open water disposal near Thimble Shoal Channel has the potential to produce unwanted physical effects. Dumping grounds established south of the channel during the early part of this century had filled to capacity by the late 1940's. Additional materials deposited in or near these areas could possibly cause sedimentation of Little Creek Channel or Lynnhaven Inlet, both of which are authorized Federal navigation projects, or cause resedimentation of Thimble Shoal Channel. This disposal alternative would also have the potential to interfere with U.S. Navy activities in the lower Chesapeake Bay. Open water disposal within the Bay has not been ruled out, but is not being considered at this time.

b. Disposal at Craney Island. Material dredged from the outer channels could be deposited in the Craney Island Disposal Area; however, this alternative has the following disadvantages:

(1) The limited capacity of Craney Island would be unnecessarily reduced by volumes of dredged material which meets or exceeds the requirements for ocean disposal. Craney Island is better utilized for disposal of inner harbor sediments.

(2) As compared to ocean disposal, Craney Island would require several additional hours for each hopper dredge load. This includes increased travel time, and additional time for mooring, setup, and pump-out of the hopper dredge. This would substantially increase the project cost and duration.

(3) Sandy dredged material deposited at Craney Island could ultimately be used for retaining dikes or other construction purposes but would be better used for placement on eroding beaches or tunnel construction.

While disposal of Thimble Shoal and Atlantic Ocean Channel sediments at Craney Island would have no significant adverse environmental effects, this alternative is an inefficient use of existing disposal sites. It is more costly and time-consuming than ocean disposal at the Dam Neck Ocean Disposal Site and will only be used if another less costly, environmentally acceptable, disposal site is not available.

c. Beach Nourishment and Stockpiling. As stated in Paragraph 2.05, an alternative use for limited amounts of sandy dredged material would be direct beach nourishment and stockpiling for future nourishment needs. Norfolk District recommends this alternative to the maximum extent practicable where and when it is consistent with local cooperation, legal, cost-sharing, engineering, and environmental constraints. This could account for less than ten percent of the total dredging requirements at Thimble Shoal and Atlantic Ocean Channels, both new construction and maintenance. The balance of the material would still need to be deposited at an approved ocean disposal site.

4. EFFECTED ENVIRONMENT

Environmental Conditions

4.01 Dam Neck Disposal Site is situated on the nearshore continental shelf, surrounded by productive marine waters usually associated with shallow coastal areas. Due to its proximity to the mouth of the Chesapeake Bay the site is influenced by the flushing and tidal actions associated with the nation's largest estuary.

4.02 Inside the bay mouth is the Port of Hampton Roads, which has a water surface area of 25 square miles formed by the confluence of the James, Nansemond, and Elizabeth Rivers. Hampton Roads is the largest port complex in Virginia. It is located at the southern end of Chesapeake Bay approximately 300 miles south of New York, 180 miles southeast of Washington, D .C., and 20 miles west of the entrance to the Chesapeake

Bay. Hampton Roads is bordered by the cities of Chesapeake, Hampton, Newport News, Norfolk, Portsmouth, Virginia Beach, and Suffolk. These cities are the largest urban grouping in the Commonwealth of Virginia and one of the leading population centers in the South.

4.03 A full discussion of the environmental conditions and marine resources associated with the Dam Neck Site is contained in the attached Appendix (Dam Neck Ocean Disposal Site Evaluation Study).

5. ENVIRONMENTAL EFFECTS OF DISPOSAL

Dam Neck

5.01 Ocean dumping of dredged material involves two basics concerns: (1) the effects of water column perturbations and (2) the effects of sediments settling on the biota of the disposal area. The analysis of potential water column effects entails the determination of limiting permissible concentrations by means of liquid and suspended solid phase bioassays together with determination of the fate of dissolved and suspended material through analysis of mixing zone characteristics. Analysis of effects of dredged material accumulating as bottom sediments emphasizes physiological (as opposed to assumed mechanical or smothering) effects of dredged material on disposal site biota and involves use of solid phase bioassays. Because of the rapid dilution and dispersion of dissolved and suspended materials upon their release in a disposal area, water column perturbations are normally of short duration, and bottom sediments have the greatest overall potential for causing long-term undesirable effects. In the case at hand, however, which involves only material suitable for ocean disposal, this is not considered to be a problem.

5.02 Of further possible concern is the stability of dredged material and its effect on current patterns after disposal. The Dam Neck Disposal Site is situated beyond the effective area of normal offshore-onshore sediment transport processes. During storm events, the wave climate could result in bottom currents sufficient to cause sediment entrainment, but oscillatory water motion coupled with local sediment consolidation would produce insubstantial net transport.

5.03 As stated, material dredged to a 55-foot project depth from Thimble Shoal Channel is acceptable for open ocean disposal. Therefore, the release of dissolved or absorbed chemicals from the sediments will not be a factor.

5.04 The long inhabitation of the Tidewater Virginia area, in relation to the occupation of other areas of the United States, is a result of the presence of natural port facilities. Because of its rich history, the area has numerous sites and structures listed as historical landmarks. None of these will adversely be affected by disposal at the Dam Neck Site. Neither will any known recreational opportunities in the project vicinity be adversely affected by filling of this site with acceptable material. Field investigations, which were coordinated with John D. Broadwater of the Virginia Research Center for Archaeology (VRCA), have

shown that cultural resources will not be impacted by dredging activities. This issue of possible effects of disposal on cultural resources was dismissed during verbal coordination as having no significant impact.

5.05 Overall, disposal at the Dam Neck Site with acceptable materials from Thimble Shoal and Atlantic Ocean Channels will not create any permanent increases in air or noise pollution. Any such increases would be slight and temporary due to additional machinery operation during dredging and disposal. No significant adverse effect on community or regional growth is anticipated. Although temporary, a few jobs would be created for the dredging and disposal operation. Similarly, no adverse impact on public facilities and services is expected. The effect of the project on commercial and recreational fishery resources and water quality is expected to be minor and short term. These effects are discussed in more detail in the appendix.

5.06 The relationship of the proposed plan for use of the Dam Neck Site to various Federal Acts and Executive Orders regarding environmental well-being is summarized in the following table.

Table 2. COMPLIANCE WITH ENVIRONMENTAL STATUTES

Federal Policies	Compliance (a)
Archaeological and Historic Preservation Act, as amended	Full
Clean Air Act, as amended	Full
Clean Water Act of 1977, as amended	Full
Coastal Zone Management Act of 1972, as amended	Full
Endangered Species Act of 1973, as amended	Full
Estuary Protection Act (PL 90-454)	Full
Federal Water Project Recreation Act, as amended	Full
Fish and Wildlife Coordination Act, as amended	Full
Land and Water Conservation Fund Act of 1965, as amended	Full
Marine Protection, Research, and Sanctuary Act of 1969, as amended	Full
National Environmental Policy Act of 1969, as amended	Full
National Historic Preservation Act of 1966, as amended	Full
Rivers and Harbors Appropriation Act of 1899, as amended	Full
Watershed and Protection and Flood Prevention Act, as amended	N/A
Wild and Scenic River Act, as amended	N/A
Floodplain Management (E.O. 11988)	N/A
Protection of Wetlands (E.O. 11990)	N/A

(a) Full - having met all requirements of the Statute for the current stage of planning; N/A - not applicable

APPENDICES

APPENDIX I - Dam Neck Ocean Disposal, Site Evaluation Study.

APPENDIX II - Comment/Response Section

APPENDIX III - Pertinent Correspondence

REFERENCES

1. An Assessment of the Ecological Impact of Open Ocean Disposal of Materials Dredged from a Highly Industrial Estuary, final report for period 1 November 1978 to 31 December 1979. Prepared for National Oceanic and Atmospheric Administration by Department of Biological Sciences, School of Sciences and Health Professions, Old Dominion University, Norfolk, VA, September 1980.

2. Ecological Evaluation of Proposed Discharge of Dredged Material into Ocean Waters, Implementation Manual for Section 103 of Public Law 92-532 (Marine Protection, Research, and Sanctuaries Act of 1972), Environmental Protection Agency/U.S. Army Corps of Engineers Technical Committee on Criteria for Dredged and Fill Material, July 1977.

3. Final Environmental Impact Statement, Thimble Shoal Channel (Maintenance Dredging), Norfolk District, U.S. Army Corps of Engineers, Norfolk, Virginia 23510-1096, March 1973.

4. Feasibility Report, Norfolk Harbor and Channels, Virginia, Deepening and Disposal (including Final EIS), U.S. Army Corps of Engineers, July 1980.

5. Final Environmental Impact Statement, Norfolk Harbor and Channels, Virginia - Deepening and Disposal, U.S. Army Corps of Engineers, July 1980.

6. Addendum to Final Environmental Impact Statement for Norfolk Harbor and Channels, Virginia - Deepening and Disposal, U.S. Army Corps of Engineers, December 1980.

50. A small conch fishery occurs along Virginia Beach from about 1.5 to 3 miles offshore (figure 7). There are no oyster reefs or other benthic molluscs abundant enough to be commercially important.

51. The only endangered or threatened species which would occur in the study area on more than an occasional or transient basis are marine turtles. The lower Chesapeake Bay is a summer foraging area for several populations of juvenile sea turtles. Evidence suggests that Chesapeake Bay is an important nursery for immature loggerheads (C. caretta) and Kemp's ridleys (L. kempii) turtles. The Virginia Institute of Marine Science (VIMS) has initiated a sighting program in which they have positively identified over 1,000 turtles. Other data accumulated indicates an estimated 3600 loggerheads and 270 kemp's ridleys moving into the Bay each summer to forage. Migration from wintering sites near Cape Hatteras, North Carolina and from as far south as Florida begins about the end of May, as water temperatures reach 20°C (Musick, et. al., 1984), Bottom temperatures at Dam Neck range from 8 to 10°C during the period of May through mid-June (Alden and Butt, 1985), the time period during which sea turtles are migrating north into the Bay.

(a) Disposal Impacts - The use of Dam Neck Disposal Site is not expected to impact migrating sea turtles for the following reasons:

(1) following a dump, water quality impacts, including suspended sediment are short-lived and spatially limited effects (see paragraphs 83-90). These short-lived and localized impacts could easily be avoided by the actively swimming sea turtles

(2) migrating sea turtles are following the 20°C isotherm and are not likely to venture into waters 8 - 10°C to feed or swim

(3) since sea turtles are opportunistic feeders it is likely that food could and would be found elsewhere. The area of bottom impact from a dump represents a miniscule portion of the total area over which the sea turtles are migrating and feeding (it has not been established for certain that sea turtles are feeding enroute to the Bay)

(b) Dredging Impacts - Sea turtles are not known to breed or nest within Chesapeake Bay, therefore, neither of these activities will be impacted by dredging within the limits of the Bay. The Chesapeake Bay is, however, an important nursery area for immature loggerheads (Caretta caretta) and Kemp's ridleys (Lepidochelys kempii). Benthic foraging by both species is likely to occur during their migrations into and out of the Bay, which occur during May-June and August-September, respectively.

If Thimble Shoal Channel is located within the migration route of the immature sea turtles, then dredging could physically damage or destroy some individuals during the migration periods. Dredging could also interfere with their migration due to such factors as night lighting, vibration, altered currents and increased turbidity. In addition, since sea turtles spend approximately 95% of their time near the bottom, except during migration, presumably feeding, destructive effects on the benthic fauna of the channel could then, in turn, affect the turtles.

Regardless of whether or not dredging activities are being conducted, Thimble Shoal Channel is a hazardous area for sea turtles. This channel is heavily used by commercial ships such as coal colliers, which are not fully loaded but are loaded as full as channel depths will allow. In order to gain maximum benefit from their capacities, these ships are very near bottom and their screws are generating tremendous turbulent forces. Fortunately, the distance between the Virginia Capes is great enough that turtles are not funneled into Thimble Shoal Channel as they enter or leave the Bay. The cross-sectional distance of Thimble Shoal Channel is less than 4% of the cross-sectional distance of the mouth of the Bay.

In order to gain further insight into potential for adverse effects on sea turtles, which could result from dredging in Thimble Shoal Channel, the Corps of Engineers has required that the Federal Highway Administration adhere to a program of conditions during their proposed dredging of this channel to obtain fill for construction of I-664. These conditions were proposed in lieu of "time of year" restrictions, and adherence is required only during the period of May 15 through June 30, as follows:

i. Use a routine dredging operation which maximizes efficiency in order to minimize dredging time.

ii. Install a device with 6 to 8 inch openings over the hopper overflows to trap any turtle parts drawn into the dredge.