<u>Miami Harbor Deepening Incidental Harassment Authorization Application</u>

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1 A DETAILED DESCRIPTION OF THE SPECIFIC ACTIVITY OR CLASS OF ACTIVITIES THAT CAN BE EXPECTED TO RESULT IN INCIDENTAL TAKING OF MARINE MAMMALS;

The proposed project is located within the Miami Harbor, Port of Miami, in Miami-Dade County. The four (4) major components of this project include (Figure 1):

- Component 1 of the project will widen the seaward portion of Cut 1 from 500 to 800 feet and deepen Cut 1 and Cut 2 from a project depth of -44 to -52 feet.

- Component 2 of the project will add a turn widener at the southern intersection of Cut 3 with Fisherman's Channel and deepen to a project depth of -50 feet.

- Component 3 of the project will increase the Fisher Island Turning Basin from 1200 to 1500 feet, truncate the northeast section of the turning basin to minimize seagrass impacts, and deepen from -42 feet to a project depth of -50 feet.

- Component 5 consists of both the Federal Channel and the Port of Miami berthing areas. The berthing areas in Fisherman's Channel and in the eastern end of the Lummus Island Turning Basin (LITB) will be expanded by 60 feet to the south for a total of a 160-foot wide berthing area and will be deepened from -42 feet to a project depth of -50 feet. The Federal Channel will be widened 40 feet to the south, for a 100-foot total width increase in Fisherman's Channel. Component 5 will deepen Fisherman's Channel and the LITB from -42 feet to a project depth of -50 feet.

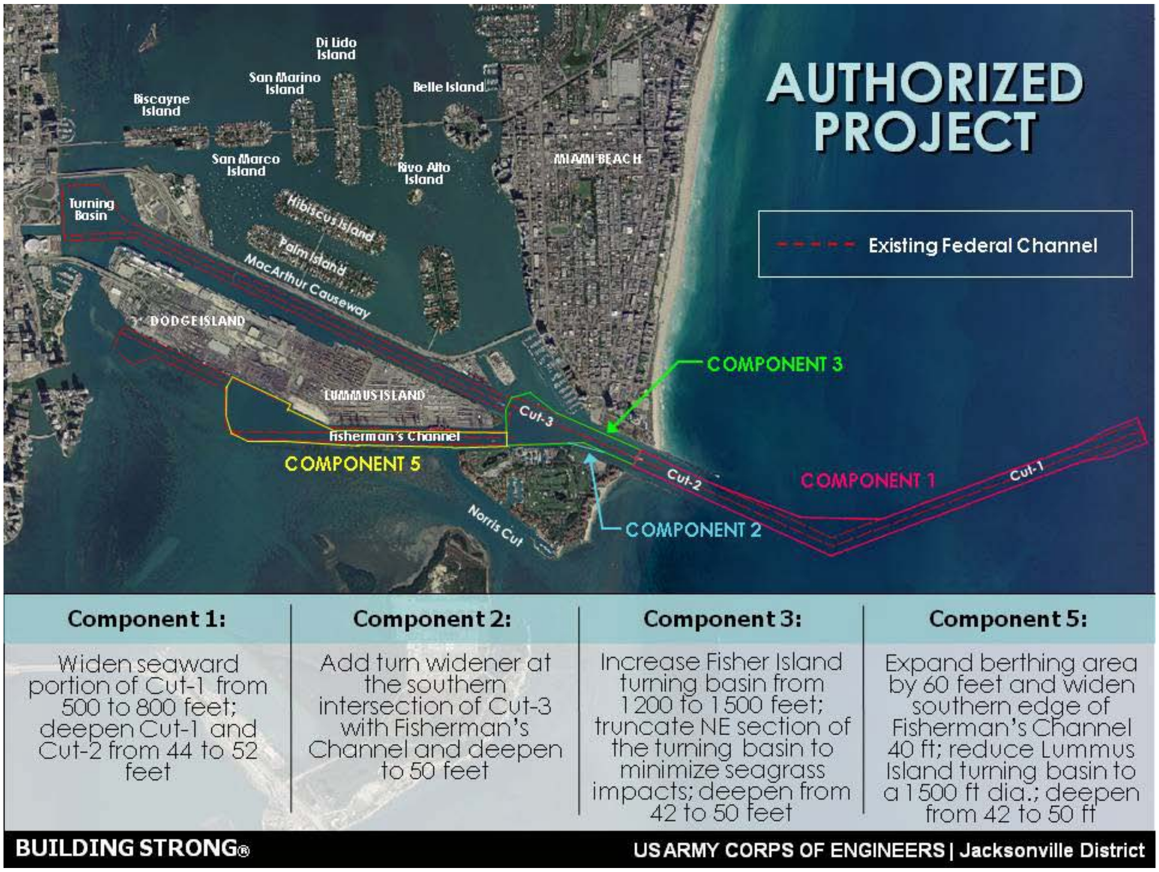

Figure 1 - Project Components

Disposal of the estimated five (5) million cubic yards of dredged materials will occur at up to three disposal sites (seagrass mitigation area, offshore artificial reef mitigation areas, and the Miami Ocean Dredged Material Disposal Site. This project was previously evaluated under an Environmental Impact Statement (EIS) prepared under the National Environmental Policy Act, and a Record of Decision for the proposed project was signed on May 22, 2006. The original proposed project included six components, two of which (#4 and #6) have been removed. The EIS provides a detailed explanation of project location as well as all aspects of project implementation. It is also available online for public review at:

http://www.saj.usace.army.mil/Divisions/Planning/Branches/Environmental/DOCS/OnLine/Dade/MiamiHarbor/NAV_STUDY_VOL-1_MIAMI.pdf

To achieve the deepening of the Miami Harbor from the existing depth of -45 feet to project depth of -52 feet, pretreatment of some of the rock areas may be required using confined underwater blasting, where standard construction methods are unsuccessful due to the hardness of the rock. USACE has used two criteria to determine which areas are most likely to need blasting for the Miami Harbor expansion:

1. Areas documented by core borings to contain hard and/or massive rock.
2. Areas previously blasted in the Harbor during the 2005 blasting/dredging project.

Duration of the blasting is dependent upon a number of factors including hardness of rock; how close the drill holes are placed, and the type of dredging equipment that will be used to remove the pretreated rock. Without knowing the answers to these questions, an exact estimate of how many “blast days” will be required cannot be determined. However, the harbor deepening project at Miami Harbor in 2005-2006 estimated between 200-250 days of blasting with one-shot per day (a blast day) to pre-treat the rock associated with that project, however the contractor completed the project in 38 days with 40 blasts. The upcoming expansion at Miami Harbor scheduled to begin in summer/fall of 2012 currently estimates a maximum of 600 blast days for the entire project footprint. Blasting operations will take place 24-hours a day, typically six days a week. The contractor may drill the blast array at night and then blast after at least two hours after sunrise (1-hour, plus one-hour of monitoring). After detonation of the first array, a second array may be drilled and detonated before the one-hour before sunset prohibition is triggered. Blasting activities normally will not take place on Sundays due to local ordinances.

At this time, the Corps has not selected a contractor and thus, does not have a contractor-developed blasting plan specifically identifying the number of holes that will be drilled, the amount of explosives that will be used for each hole, the number of blasts per day (usually no more than 2/day) or the number of days the construction is anticipated to take to complete. Blast holes are small in diameter and only 5-10 feet deep, drilling activities take place for a short time duration, with no more than three holes being drilled at the same time (based on the current drill-rigs available in the industry that range from 1-3 drills). During the 2005 blasting event, dolphins were seen near the drill barge during drilling events and avoidance behavior was not observed. No measurements associated with noise from drilling small blast holes have been recorded. The Corps does not expect incidental harassment from drilling operations and is not requesting take associated with this activity.

Charge weight and size of array are dependent upon the size and type of dredging equipment each contractor proposes to include in their contract bid. There is an inverse relationship between dredging equipment size (cutterhead size, horsepower behind the cutterhead, backhoe size) and the frequency, size and spacing of drill holes of individual detonation events. As the size of the equipment increases, the size and number of detonations decreases and the spacing between the individual holes increases. Since the Corps does not have contract bids at this time, and is required to have all authorizations and permits completed prior to release of the request for proposal, the Corps cannot provide this information as part of the application. The Corps must be in possession of an incidental harassment authorization prior to advertising the contract, per the Competition in Contracting Act, and the Federal Acquisition Regulations.

Although the Corps does not have a specific contractor-provided blasting plan, we have developed plans and specifications for the project that direct the contractor to do certain things in certain ways and are basing these plans and specifications on the previous deepening project in Miami Harbor (construction was conducted in 2005-2006).

The previous Miami Harbor project required a maximum weight of explosives used in each delay of 376 lbs and the contractors blasted once or twice daily from 25 June to 12 August, 2005 for a total of 40 individual blasts in 38 days of blasting. The 2005 project blasting was limited to Fisherman's channel and the Dodge-Lummus Island Turning Basin (Figure 2), whereas the project described in this application includes Fisherman's channel, Dodge Lummus Island Turning Basin, Fisher Island Turning Basin, and Inner and Outer Entrance Channel. This larger area will result in more blasting for this project than was completed in 2005, as it includes areas not previously blasted in 2005.

Figure 2 - Blasting Footprint for Phase II project

A copy of the original Incidental Harassment Authorization (IHA) from 2005, the IHA renewal in 2005 and the final biological monitoring report from the Miami Harbor Phase II project (completed in 2006) is attached to this application. For the new construction at Miami Harbor, the Corps expects the project may take multiple years, and the Corps will seek subsequent renewals of this IHA after issuance, with sufficient time to prevent any delay to the project.

For the proposed deepening at Miami Harbor, the Corps has consulted with blasting industry experts and believe, that based on the rock hardness and composition at Miami Harbor, a maximum charge weight per delay of 450 lbs should be expected. The minimum charge weight will be 10 lbs.

The focus of the proposed blasting work at the Miami Harbor is to pre-treat the massive limestone formation that makes up the base of Miami Harbor prior to removal by a dredge utilizing confined blasting, meaning the shots would be “confined” in the rock. Typically, each blast array is set up in a square or rectangle area divided into rows and columns (Figure 3 & 5).An average blast array is 10 holes long by 4 holes wide with holes being spaced 40 feet apart, covering an area of 4,000 ft^2. Blast arrays near bulkheads can be long-linear feature of one-hole wide by 8 or 10 holes long (Figure 4).

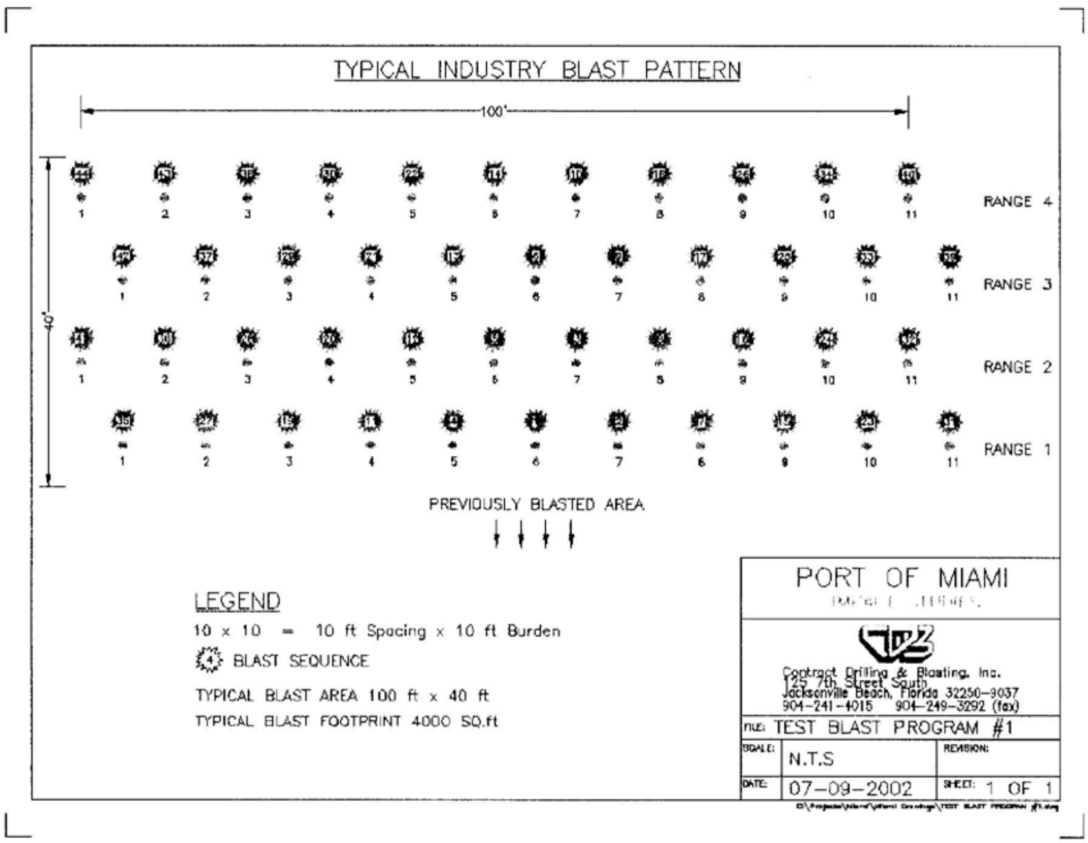

Figure 3 - Typical blast array – 10 holes x 10 holes; 100 feet long by 40 feet wide. 4000 sq foot area per detonation,

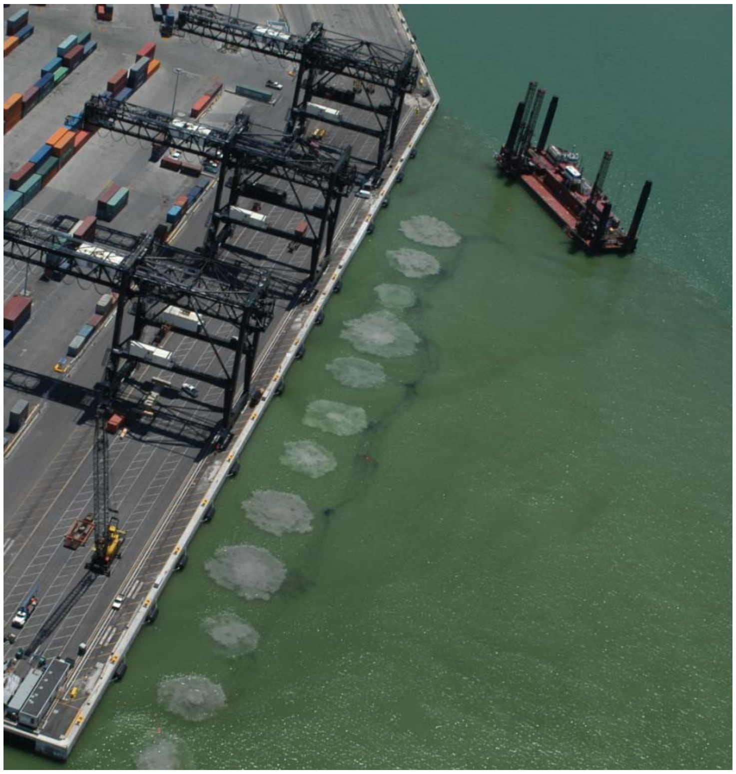

Figure 4 – Linear blast array along a bulkhead

Figure 5 – Typical rectangular blast array

In confined blasting, each charge is placed in a hole drilled in the rock approximately 5-10 feet deep; depending on how much rock/concrete needs to be broken and the intended project depth. The hole is then capped with an inert material, such as crushed rock. This process is referred to as "stemming the hole" (Figure 6 & 7; each bag as shown contains approximate volume of material used per discharge). The Corps used this technique previously at the Miami Harbor Phase II project in 2005. NMFS issued an IHA for that operation on May

29, 2003 (and renewed the IHA on April 19, 2005). For the Phase II project the stemming material was angular crushed rock. The optimum size of stemming material is material that has an average diameter of approximately 0.05 times the diameter of the blast hole. The selected material must be angular to perform properly (Konya, 2003). In the Miami Harbor Phase II project, the following requirements were in the specifications regarding stemming material:

> 1.22.9.20 Stemming
> All blast holes shall be stemmed. The Blaster or Blasting Specialist shall determine the thickness of stemming using blasting industry conventional stemming calculations. The minimum stemming shall be 2 feet thick. Stemming shall be placed in the blast hole in a zone encompassed by competent rock. Measures shall be taken to prevent bridging of explosive materials and stemming within the hole. Stemming shall be clean, angular to subangular, hard stone chips without fines having an approximate diameter of 1/2-inch to 3/8-inch. A barrier shall be placed between the stemming and explosive product, if necessary, to prevent the stemming from settling into the explosive product. Anything contradicting the effectiveness of stemming shall not extend through the stemming.

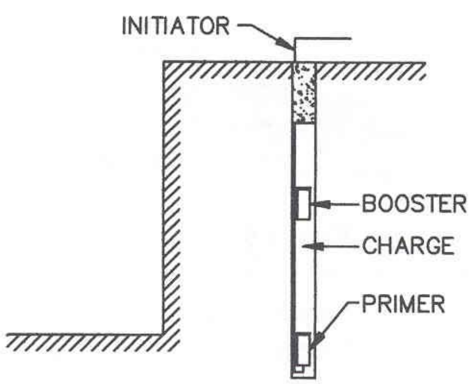

Figure 6 - Typical Drillhole configuration with stemming

Figure 7 Stemming Material

The specifications for any construction utilizing blasting for the Miami Harbor Deepening have similar stemming requirements as those that were used for the Miami Harbor Phase II project in 2005-2006. The length of stemming material will vary based on the length of the hole drilled, however minimum lengths will be included in the project specific specifications. Studies have shown that stemmed blasts have up to a 60-90% decrease in the strength of the pressure wave released, compared to open water blasts of the same charge weight (Nedwell and Thandavamoorthy, 1992; Hempen *et al*., 2005; Hempen *et al*., 2007). However, unlike open water blasts (Figure 8), very little peer-reviewed research exists on the effects that confined blasting can have on marine animals near the blast (Keevin *et al*., 1999). The visual evidence from a typical confined blast is shown in Figure 9.

Figure 8 Unconfined Blast of Seven Pounds of Explosives

Figure 9 Confined Blast of 3,000 lbs Total Charge Weight of Explosives

In confined blasting, the detonation is conveyed from the drill barge to the primer and the charge itself by Primacord and Detaline. These are used to safety fire the blast from a distance to ensure human safety from the blast. The Primacord and Detaline used on this project have a specific grain weight, and they burn like a fuse. They are not electronic. Time from activation to detonation is less than one second.

As part of the development of the protected species protection and observation protocols, which will be incorporated into the plans and specifications for the project, USACE will continue to coordinate with the resource agencies and NGOs to address concerns and potential impacts associated with the use of blasting as a construction technique.

In addition to coordination with the agencies and NGOs, any new scientific studies regarding the effects of blasting (confined or unconfined) on species that may be in the area (marine mammals, sea turtles, fishes (both with a swim bladder and without) and reptiles will be incorporated into the design of the protection measures that will be employed in association with confined blasting activities in the port. Any best new science and possible adaptive measures will be incorporated into any new IHA applications for this, and future, USACE blasting projects.

As part of these protective measures, USACE will develop four safety radii (Figure 10) based on the use of an unconfined blast. The use of an unconfined blast in development of the safety radii for a confined blast will increase the protections afforded marine species in the area. These four zones are referred to as the "Danger zone" – which is the inner most zone, located closest to the blast; the "Exclusion Zone" – is the Danger zone + 500 feet to add an additional layer of conservatism to protect species in the project area; the "Safety zone" – which is the third zone and the "Watch zone" the outer most zone. All of these zones are noted in Figure 10.

These zone calculations will be included as part of the specifications package that the contractors will bid on before the project is awarded. Ideally the safety radius should be large enough to offer a wide buffer of protection for marine mammals while still remaining small enough that the area can be intensely surveyed.

The calculations are as follows:

1) Danger Zone (ft) = 260 [79.25 m] X the cube root of weight of explosives in lbs per delay (equivalent weight of TNT).

2) Exclusion Zone (ft) = Danger +500

3) The Safety zone (ft) = 520 [158.50 m] X cube root of weight of explosives in lbs per delay (equivalent weight of TNT).

4) The Watch Zone is three times the radius of the Danger Zone to ensure that animals entering to traveling close to the Exclusion Zone are spotted and appropriate actions can be implemented before or as they enter any impact areas (i.e., a delay in blasting activities).

Detonation will not occur if a marine mammal or reptile is known to be (or based on previous sightings, may be) within a circular area around the detonation site equaling the Danger Zone + 500 feet. This is referred to as the Exclusion Zone.

Danger Zone Development

The danger zone radius will be calculated to determine the maximum distance from the blast at which mortality to protected marine species is likely to occur. The danger zone was determined by the amount of explosives used within each delay (which can contain multiple boreholes). The original basis of this calculation was to protect human Navy Seal divers from underwater detonations of underwater mines (Goertner, 1982). Goertner's calculations were based on impacts to terrestrial animals in water when exposed to a detonation suspended in the water column (unconfined blast) as researched by the U.S. Navy in the 1970s (Yelverton *et al*., 1973; Richmond *et al.,* 1973). Additionally, observations of sea turtle injury and mortality associated with unconfined blasts for the cutting of oil rig structures in the Gulf of Mexico (Young, 1991; Young and O'Keefe, 1994) were also incorporated in this radius beyond its use by the Navy. The State of Florida has adopted this method for protection of marine mammals (particularly the endangered Florida manatee) within state waters (FWC, 2005) in the document entitled "May 2005 Guidelines for the Protection of Marine Mammals and Sea Turtles during the Use of Explosives in the Waters of the State of Florida**."**

The U.S. Navy Dive Manual and the FWC 2005 Guidelines set the danger zone formula for an unconfined blast suspended in the water column, which is as follows:

R = 260 (cube root w)
R = Danger zone radius
W = Weight of explosives

This formula is a conservative for the blasting being done in the Port of Miami since the blast will be confined within the rock and not suspended in the water column.

The reduction of impact by confining the shots more than compensates for the presumed higher sensitivity of marine species. USACE believes that the danger zone radius, coupled with a strong protected species observation and protection plan is a conservative, but prudent, approach to the protection of marine wildlife species. Based on a review of this proposed method for the Miami Harbor phase

II project, both NMFS (PRD and OPR) and FWS found these protective measures sufficient to protect marine mammals under their respective jurisdictions (NMFS, 2005; FWS 2002).

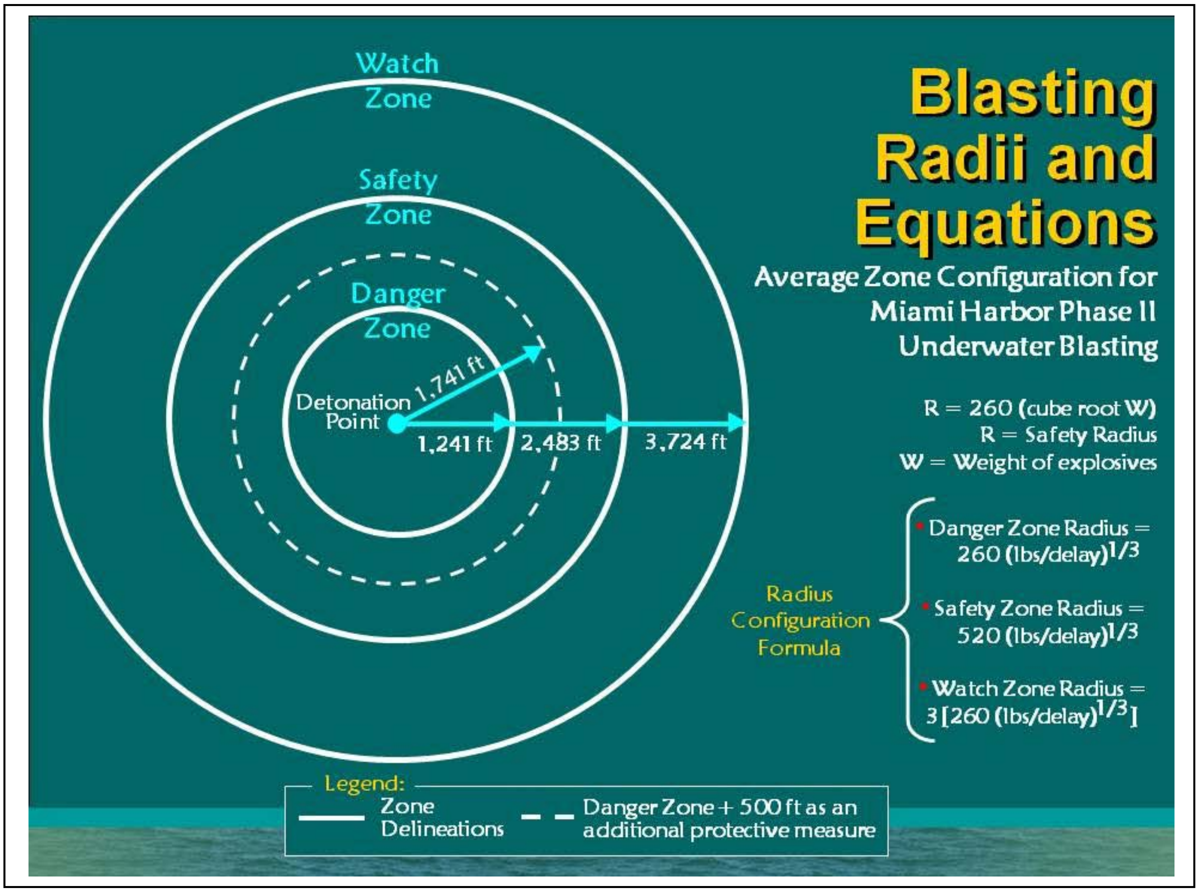

Figure 10 Average Blast Zone Radii and Equations from Miami Harbor 2005 Project

To estimate the maximum poundage of explosives that may be utilized for this project, USACE has reviewed two previous blasting projects, one at San Juan Harbor, Puerto Rico in 2000 and one at Miami Harbor in 2005. The San Juan Harbor project's heaviest delay was 375 lbs per delay and in Miami it was 376 lbs per delay. Based on discussions with USACE's geotechnical engineers, it is expected that the maximum weight of delays for Miami Harbor will be larger since the rock is much harder than what is seen at the Port of Miami.

Based upon industry standards and USACE Safety & Health Regulations, the blasting program may consist of the following:

- The weight of explosives to be used in each blast will be limited to the lowest poundage of explosives that can adequately break the rock.
- Drill patterns are restricted to a minimum of 8 ft separation from a loaded hole.

- Hours of blasting are restricted from two hours after sunrise to one hour before sunset to allow for adequate observation of the project area for protected species.
- Selection of explosive products and their practical application method must address vibration and air blast (overpressure) control for protection of existing structures and marine wildlife.
- Loaded blast holes will be individually delayed to reduce the maximum pounds per delay at point detonation, which in turn will reduce the mortality radius.
- The blast design will consider matching the energy in the “work effort” of the borehole to the rock mass or target for minimizing excess energy vented into the water column or hydraulic shock.
- Delay timing adjustments with a minimum of 8ms between delay detonations to stagger the blast pressures and prevent cumulative addition of pressures in the water.

Test Blast Program. Prior to implementing a construction blasting program a test blast program will be completed. The test blast program will have all the same protection measures in place for protected species monitoring and protection as blasting for construction purposes. The purpose of the test blast program is to demonstrate and/or confirm the following:

- Drill Boat Capabilities and Production Rates
- Ideal Drill Pattern for Typical Boreholes
- Acceptable Rock Breakage for Excavation
- Tolerable Vibration Level Emitted
- Directional Vibration
- Calibration of the Environment

The test blast program begins with a single range of individually delayed holes and progresses up to the maximum production blast intended for use. The test blast program will take place in the project area and will count toward the pre-treatment of material, since the blasts of the test blast program will be cracking rock. Each test blast is designed to establish limits of vibration and air blast overpressure, with acceptable rock breakage for excavation. The final test event simulates the maximum explosive detonation as to size, overlying water depth, charge configuration, charge separation, initiation methods, and loading conditions anticipated for the typical production blast.

The results of the test blast program will be formatted in a regression analysis with other pertinent information and conclusions reached. This will be the basis for developing a completely engineered procedure for construction blasting plan.

During the testing the following data will be used to develop a regression analysis:

- Distance
- Pounds Per Delay
- Peak Particle Velocities (Threshold Limit Value TLV)
- Frequencies (TVL)
- Peak Vector Sum
- Air Blast, Overpressure

2 THE DATE(S) AND DURATION OF SUCH ACTIVITY AND THE SPECIFIC GEOGRAPHICAL REGION WHERE IT WILL OCCUR;

At this time the Corps has not set a specific date for the initiation of construction activities within the Port. However, the Corps requires the IHA to be issued by NMFS no later than 30 November, 2011 to allow for the advertisement of the contract for construction in January 2012; award the contract and provide notice to proceed in May 2012 to the selected contractor, resulting in construction beginning after June 2012. Blasting will begin based on the contractor's work plan; however it may start as early as June 2012. Construction is expected to take up to 24 months and at this time; it is possible that blasting could take place at any time during construction. As previously stated, the Corps also notes that multiple IHAs (up to three) will be needed and requested for this project due to the project duration, and appropriate plans will be made to allow sufficient time for processing of those subsequent IHAs.

The specific geographic area of the construction will be within the boundaries of the Port of Miami, in Miami, Florida (Figure 11). The Port is an island facility consisting of 518 upland acres and is located in the northern portion of Biscayne Bay in South Florida. The City of Miami is located on the west side of Biscayne Bay; the City of Miami Beach is located on an island on the northeast side of the bay, opposite Miami. Both cities are located in Miami-Dade County, Florida, and are connected by several causeways crossing the bay. The Port is the southernmost major Atlantic Coast port. The port's landside facilities are located on Dodge-Lummus Island. GPS location for the island is 25°46'05N 80°09'40W.

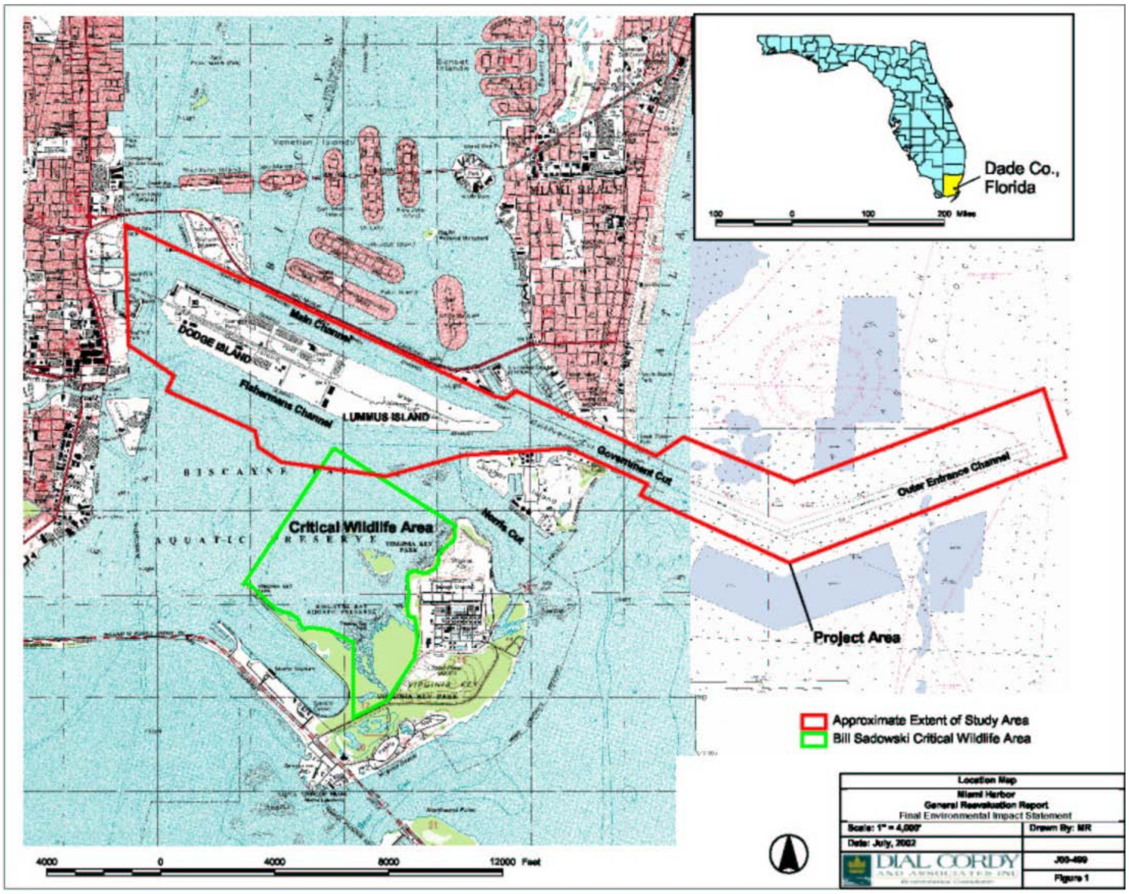

Figure 11 – Location of the Port of Miami

3 THE SPECIES AND NUMBERS OF MARINE MAMMALS UNDER NMFS JURISDICTION LIKELY TO BE FOUND WITHIN THE ACTIVITY AREA;

Several cetacean species and a single species of sirenian are known to or could occur in the Miami Harbor action area and off the Southeast Atlantic coastline (see Table 1 below). Species listed as endangered under the U.S. Endangered Species Act (ESA), includes the humpback (*Megaptera novaeangliae*), sei (*Balaenoptera borealis*), fin (*Balaenoptera physalus*), blue (*Balaenoptera musculus*), North Atlantic right (*Eubalaena glacialis*), and sperm (*Physeter macrocephalus*) whale, and West Indian (Florida) manatee (*Trichechus manatus latirostris*). The marine mammals that occur in the Atlantic Ocean off the U.S. southeast coast belong to three taxonomic groups: mysticetes (baleen whales), odontocetes (toothed whales), and sirenians (the manatee). The West Indian manatee in Florida and U.S. waters is managed under the jurisdiction of the U.S. Fish and Wildlife Service (USFWS) and therefore is not considered further in this analysis.

Table 1. The habitat and conservation status of marine mammals inhabiting the proposed project area in the Atlantic Ocean off the U.S. southeast coast.

Species	Habitat	ESA[1]	MMPA[2]
Mysticetes			
North Atlantic right whale (*Eubalaena glacialis*)	Coastal and shelf	EN	D
Humpback whale (*Megaptera novaeangliae*)	Pelagic, nearshore waters and banks	EN	D
Bryde's whale (*Balaenoptera brydei*)	Pelagic and coastal	NL	NC
Minke whale (*Balaenoptera acutorostrata*)	Shelf, coastal, and pelagic	NL	NC
Blue whale (*Balaenoptera musculus*)	Pelagic and coastal	EN	D
Sei whale (*Balaenoptera borealis*)	Primarily offshore, pelagic	EN	D
Fin whale (*Balaenoptera physalus*)	Slope, mostly pelagic	EN	D
Odontocetes			

Sperm whale (*Physeter macrocephalus*)	Pelagic, deep seas	EN	D
Cuvier's beaked whale (*Ziphius cavirostris*)	Pelagic	NL	NC
Gervais' beaked whale (*Mesoplodon europaeus*)	Pelagic	NL	NC
True's beaked whale (*Mesoplodon mirus*)	Pelagic	NL	NC
Blainville's beaked whale (*Mesoplodon densirostris*)	Pelagic	NL	NC
Dwarf sperm whale (*Kogia sima*)	Offshore, pelagic	NL	NC
Pygmy sperm whale (*Kogia breviceps*)	Offshore, pelagic	NL	NC
Killer whale (*Orcinus orca*)	Widely distributed	NL EN (Southern Resident)	NC D (Southern Resident, AT1 Transient)
Short-finned pilot whale (*Globicephala macrorhynchus*)	Inshore and offshore	NL	NC
False killer whale (*Pseudorca crassidens*)	Pelagic	NL	NC
Mellon-headed whale (*Peponocephala electra*)	Pelagic	NL	NC
Pygmy killer whale (*Feresa attenuata*)	Pelagic	NL	NC
Risso's dolphin (*Grampus griseus*)	Pelagic, shelf	NL	NC
Bottlenose dolphin (*Tursiops truncatus*)	Offshore, inshore, coastal, estuaries	NL	NC S(Biscayne Bay) D (Western North Atlantic Central Florida Coastal)
Rough toothed dolphin (*Steno bredanensis*)	Pelagic	NL	NC
Fraser's dolphin (*Lagenodelphis hosei*)	Pelagic	NL	NC
Striped dolphin (*Stenella coeruleoalba*)	Pelagic	NL	NC
Pantropical spotted dolphin (*Stenella attenuata*)	Pelagic	NL	NC D (Northeastern Offshore)
Atlantic spotted dolphin (*Stenella frontalis*)	Coastal to pelagic	NL	NC

Spinner dolphin (*Stenella longirostris*)	Mostly pelagic	NL	NC D (Eastern)
Clymene dolphin (*Stenella clymene*)	Pelagic	NL	NC
Sirenians			
West Indian (Florida) manatee (*Trichechus manatus latirostris*)	Coastal, rivers and estuaries	EN	D

[1] U.S. Endangered Species Act: EN = Endangered, T = Threatened, NL = Not listed.

[2] U.S. Marine Mammal Protection Act: D = Depleted, S = Strategic, NC = Not classified.

Of all the species listed above, USACE believes that blasting activities for the Port of Miami project will only result in take of bottlenose dolphins living near the Port within Biscayne Bay (specifically the Biscayne Bay stock) or transiting the outer entrance channel (western north Atlantic central Florida coastal stock). The Corps expects impacts to be limited to Level B harassment as defined by the MMPA. Dolphins and whales have not been documented as being directly affected by dredging activities. The Corps is not requesting incidental take associated with dredging activities, and NMFS has previously stated it does not believe dredging activities result in take of bottlenose dolphins under the MMPA (70 FR 21174, April 25, 2005)

The construction activities will be limited to waters shallower than 60 feet and located entirely on the continental shelf and will not take place seaward of the outer reef. Although many other marine mammals (including sperm; blue; fin; sei and humpback whales) are known to transit through the area immediately offshore of the continental break east of Miami Harbor, the Corps does not believe the project will result in take associated with those species. The Corps completed a consultation under Section 7 of the Endangered Species Act on the previously mentioned large whale species as part of the project development and NEPA review. During the ESA consultation, the Corps stated:

> Six species of endangered marine mammals may be found seasonally in the waters offshore southeastern Florida. The Corps believes that only the sperm and humpback whales may be adversely affected by activities associated with the proposed action. These effects would be a result of acoustic harassment.
>
> The blue, fin, northern right and sei whales are not discussed because they are unlikely to be within the vicinity of the project. Additional information on blue, fin and sei whales can be found in Waring *et al*. (1999). Due to the rarity of sightings of these four whale species near the project area, the Corps believes that any effects to them by the project are discountable. Discountable effects under Section 7 of the ESA are those "extremely unlikely to occur. Based on best judgment, a person would not: (1) be able to meaningfully measure, detect, or evaluate insignificant effects; or (2) expect discountable effects to occur."

We believe that this determination remains correct. In the biological opinion for the project dated February 26, 2003 (F/SER/2002/01094), the NMFS SERO-PRD stated:

> Blue, fin, sei, and sperm whales are predominantly found seaward of the continental shelf. Northern right whales and humpback whales are coastal animals and have been sighted in the nearshore environment in the Atlantic along the southeastern United States from November through March on their migration south. Right whales are rarely sighted south of northeastern Florida. None of these whale species are expected to be found in the shallow waters inshore of the outer reef. NOAA Fisheries believes that these whales could be affected by the use of explosives offshore of the outer reef; however, the COE has modified the proposed action such that explosives are not expected to be used seaward of the outer reef. NOAA Fisheries believes that this change in the proposed action, in combination with the above mentioned mitigation measures decreases the effects of the proposed action on listed whales to insignificant levels."

We believe this determination remains correct.

In addition to an ESA consultation with NMFS for all listed species associated with the blasting, the Corps completed an ESA consultation with the USFWS for effects of the project on manatees on June 17, 2003 (Service Log No. 4-1-03-I-786). The final concurrent is included in the Final Fish and Wildlife Coordination report and can be found on page 64.

4 A DESCRIPTION OF THE STATUS, DISTRIBUTION, AND SEASONAL DISTRIBUTION (WHEN APPLICABLE) OF THE AFFECTED SPECIES OR STOCKS OF MARINE MAMMALS LIKELY TO BE AFFECTED BY SUCH ACTIVITIES;

The Corps is incorporating by reference the most recent stock assessments for the Biscayne Bay stock and the western north Atlantic central Florida coastal stock of bottlenose dolphin that was completed by NMFS in 2010 (Waring *et al*, 2010), and have been incorporated into this application.

<u>Biscayne Bay Stock</u>

The Biscayne Bay stock of bottlenose dolphins is bounded by Haulover Inlet to the north and Card Sound Bridge to the south. This range corresponds to the extent of confirmed home ranges of bottlenose dolphins observed residing in Biscayne Bay by a long-term photo-ID study conducted by the Southeast Fisheries Science Center (Litz 2007; SEFSC unpublished data). It is likely that the range of Biscayne Bay dolphins extends past these boundaries; however, there have been few surveys outside of this range. These boundaries are subject to change upon further study of dolphin home ranges within the Biscayne Bay estuarine system and comparison to an extant photo-ID catalog from Florida Bay to the south.

Dolphins residing within estuaries north of this stock along the southeastern coast of Florida are currently not included in any Stock Assessment Report. There are insufficient data to determine whether animals in this region exhibit affiliation to the Biscayne Bay stock, the estuarine stock further to the north in the Indian River Lagoon Estuarine System (IRLES), or are simply transient animals associated with coastal stocks. There is relatively limited estuarine habitat along this coastline; however, the Intracoastal Waterway extends north along the coast to the IRLES. It should be noted that during 2003-2007, there were 3 stranded bottlenose dolphins in this region in enclosed waters. One of these had signs of human interaction from a boat strike and another was identified as an offshore morphotype bottlenose dolphin.

Bottlenose dolphins have been documented in Biscayne Bay since the 1950's (Moore 1953). Live capture fisheries for bottlenose dolphins are known to have occurred throughout the southeastern U.S. and within Biscayne Bay during the 1950's and 1960's; however, it is unknown how many individuals may have been removed from the population during this period (Odell 1979; Wells and Scott 1999).

The Biscayne Bay bottlenose dolphin stock has been the subject of an ongoing photo-ID study conducted by the NMFS Southeast Fisheries Science Center since 1990. From 1990 to 1991, preliminary information was collected focusing on the central portion of the Bay. The survey was re-initiated in 1994, and it was expanded to include the northern portion of the Bay and south to the Card Sound Bridge in 1995 (SEFSC unpublished data; Litz 2007). Through 2007, the photo-ID catalog included 229 unique individuals. Approximately 80% of these individuals may be long-term residents with multiple sightings over the 17 years of the study (SEFSC unpublished data). Analyses of the sighting histories and associations of individuals from the Biscayne Bay photo-ID data demonstrated that there are at least 2 overlapping social groups of animals within Biscayne Bay segregated along a north/south gradient (Litz 2007).

Remote biopsy samples of Biscayne Bay animals were collected between 2002 and 2004 for analyses of population genetic structure and persistent organic pollutant concentrations in blubber. Genetic structure was investigated using both mitochondrial

DNA (mtDNA) and nuclear (microsatellite) markers, and the data from Biscayne Bay were compared to data from Florida Bay dolphins to the south (Litz 2007). Within Biscayne Bay, dolphins sighted primarily in the northern half of the Bay were significantly differentiated from those sighted primarily in the southern half at the microsatellite loci but not at the mitochondrial locus. There was not sufficient genetic differentiation between these groups to indicate true population subdivision (Litz 2007). However, genetic differentiation was found between the Biscayne Bay and Florida Bay dolphins in both markers (Litz 2007). The observed genetic differences between resident animals in Biscayne Bay and those in an adjacent estuary combined with the high levels of sight fidelity observed, demonstrate that the resident Biscayne Bay bottlenose dolphins are a demographically distinct population stock.

POPULATION SIZE

The total number of bottlenose dolphins residing within the Biscayne Bay stock is unknown. An initial evaluation of the abundance of bottlenose dolphins in Biscayne Bay was conducted with aerial surveys in 1974-1975 covering predominantly the central portion of the Bay from Rickenbacker Causeway to the northern end of Card Sound. Bottlenose dolphins were observed in the Bay on 7 of 22 aerial surveys with the sightings totaling 67 individuals. Only 1 group was seen on each survey. This led the authors to conclude that there was likely 1 herd of approximately 13 animals occupying the Bay (Odell 1979). It was noted that this encounter rate was much lower than that in the adjacent Everglades National Park, and that the apparent low density of dolphins in Biscayne Bay had limited the effectiveness of the collection of live animals for display.

Between 1994 and 2007, 394 small boat surveys of Biscayne Bay were conducted for the bottlenose dolphin photo-ID study. A day's survey effort covered either the northern (Haulover Inlet to Rickenbacker Causeway), central (Rickenbacker Causeway to Sands Cut) or southern (Sands Cut to Card Sound Bridge) region of the Bay. Each area was surveyed 8-12 times per year on a monthly basis from 1994 to 2003. From 2003 to 2007, the number of surveys was lower and ranged between 4 and 8 per year, and the lowest amount of effort was expended in the southern portion of the Bay. When dolphins were encountered, estimates of group size were made, and photographs of fins were taken of as many individuals as possible. The fins were cataloged and individuals identified using standard methods (SEFSC unpublished data). There were 157 unique individuals identified in the photo-ID surveys between 2003 and 2007. However, this catalog size does not represent a valid estimate of population size because the residency patterns of dolphins in Biscayne Bay are not fully understood. It is currently not possible to develop a mark-recapture estimate of population size from the photo-ID catalog. However, research is currently underway to estimate the abundance of the Biscayne Bay stock using a photographic mark-recapture method.

Minimum Population Estimate

Present data are insufficient to calculate a minimum population estimate for the Biscayne Bay stock of bottlenose dolphins.

Current Population Trend

There are insufficient data to determine the population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES

Current and maximum net productivity rates are unknown for this stock. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL

Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a "recovery" factor (MMPA Sec. 3. 16 U.S.C. 1362; Wade and Angliss 1997). The minimum population size of the Biscayne Bay stock of bottlenose dolphins is unknown. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is of unknown status. PBR for the Biscayne Bay stock of bottlenose dolphins is unknown*.*

STATUS OF STOCK

From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the western North Atlantic, and the entire stock was listed as depleted as a result of the 1987-1988 mortality event. Scott *et al.* (1988) suggested that dolphins residing in the bays, sounds and estuaries adjacent to these coastal waters were not affected by the mortality event and these animals were explicitly excluded from the depleted listing (Federal Register: 54(195), 41654-41657; 56(158), 40594-40596; 58(64), 17789-17791).

The status of the Biscayne Bay stock relative to OSP is unknown. The species is not listed as threatened or endangered under the Endangered Species Act. There are insufficient data to determine population trends for this stock. The total human-caused mortality and serious injury for this stock is unknown and there is insufficient information available to determine whether the total fishery-related mortality and serious injury for this stock is insignificant and approaching zero mortality and serious injury rate. Documented human-caused mortalities in recreational fishing gear entanglement and ingestion of gear reinforce concern for this stock. Because the stock size is currently unknown, but likely small and relatively few mortalities and serious injuries would exceed PBR, the NMFS considers this stock to be a strategic stock.

Based on the Waring *et al*, 2010 the minimum population that may be in the project area is 69 animals, based upon Litz's (2007) determination that 69 animals in Biscayne Bay have a northern home range. The maximum population of animals that may be in the project area is equal to the total number of uniquely identified animals for the entire photo-ID study of Biscayne Bay – 229 animals. The best population estimate for Biscayne Bay is also based on Waring et al, 2010 at 157 animals during the 2003-2007 photo-ID survey seasons when the most consistent survey effort was in place by the SEFSC.

Western North Atlantic Central Florida Coastal Stock

Geographic Range and Coastal Morphotype Habitat

The coastal morphotype of bottlenose dolphin is continuously distributed along the Atlantic coast south of Long Island, New York, around the Florida peninsula and along the Gulf of Mexico coast. Based on differences in mitochondrial DNA haplotype frequencies, nearshore animals in the northern Gulf of Mexico and the western North Atlantic represent separate stocks (Rosel *et al*. 2009; Duffield and Wells 2002). On the Atlantic coast, Scott *et al*. (1988) hypothesized a single coastal migratory stock ranging seasonally from as far north as Long Island, to as far south as central Florida, citing stranding patterns during a high mortality event in 1987-1988 and observed density patterns. More recent studies demonstrate that the single coastal migratory stock hypothesis is incorrect, and there is instead a complex mosaic of stocks (Rosel *et al*. 2009; McLellan *et al*. 2003).

The coastal morphotype is morphologically and genetically distinct from the larger, more robust morphotype primarily occupying habitats further offshore (Hoelzel *et al*. 1998; Mead and Potter 1995; Rosel *et al*. 2009). Aerial surveys conducted between 1978 and 1982 (CETAP 1982) north of Cape Hatteras, North Carolina, identified two concentrations of bottlenose dolphins, one inshore of the 25-m isobath and the other offshore of the 50-m isobath. The lowest density of bottlenose dolphins was observed over the continental shelf, with higher densities along the coast and near the continental shelf edge. It was suggested, therefore, that north of Cape Hatteras, North Carolina, the coastal morphotype is restricted to waters < 25 m deep (Kenney 1990). Similar patterns were observed during summer months in more recent aerial surveys (Garrison and Yeung 2001; Garrison *et al*. 2003). However, south of Cape Hatteras during both winter and summer months, there was no clear longitudinal discontinuity in bottlenose dolphin sightings (Garrison and Yeung 2001; Garrison *et al*. 2003). To address the question of distribution of coastal and offshore morphotypes in waters south of Cape Hatteras, tissue samples were collected from large vessel surveys during the summers of 1998 and 1999, from systematic biopsy sampling efforts in nearshore waters from New Jersey to central Florida conducted in the summers of 2001 and 2002, and from winter biopsy collection effort in 2002 and 2003 in nearshore continental shelf waters of North Carolina and Georgia. Additional biopsy samples were collected in deeper continental shelf waters south of Cape Hatteras during winter 2002. Genetic analyses using mitochondrial DNA sequences of these biopsies identified individual animals to the coastal or offshore morphotype. Using the genetic results from all surveys combined, a logistic regression was used to model the probability that a particular bottlenose dolphin group was of the coastal morphotype as a function of environmental variables including depth, sea surface temperature, and distance from shore. These models were used to partition the bottlenose dolphin groups observed during aerial surveys between the two morphotypes (Garrison *et al*. 2003).

The genetic results and spatial patterns observed in aerial surveys indicate both regional and seasonal differences in the longitudinal distribution of the two morphotypes in coastal Atlantic waters. During summer months, all biopsy samples collected from nearshore waters north of Cape Lookout, North Carolina (< 20 m deep), were of the coastal morphotype, and all samples collected in deeper waters (> 40 m deep) were of the offshore morphotype. South of Cape Lookout, the probability of an observed bottlenose dolphin group being of the coastal morphotype declined with increasing depth. In intermediate depth waters, there was spatial overlap between the two morphotypes. Offshore morphotype bottlenose dolphins were observed at depths as shallow as 13 m, and coastal morphotype dolphins were observed at depths of 31 m and 75 km from shore (Garrison *et al*. 2003).

Winter samples were collected primarily from nearshore waters in North Carolina and Georgia. The vast majority of samples collected in nearshore waters of North Carolina during winter were of the coastal morphotype; however, one offshore morphotype group was sampled during November just south of Cape Lookout only 7.3 km from shore. Coastal morphotype samples were also collected farther away from shore at 33 m depth and 39 km distance from shore. The logistic regression model for this region indicated a decline in the probability of a coastal morphotype group with increasing distance from shore; however, the model predictions were highly uncertain due to limited sample sizes and spatial overlap between the two morphotypes. Samples collected in Georgia waters also indicated significant overlap between the two morphotypes with a declining probability of the coastal morphotype with increasing depth. A coastal morphotype sample was collected 112 km from shore and a depth of 38 m. An offshore sample was collected in 22 m depth at 40 km from shore. As with the North Carolina model, the Georgia logistic regression predictions are uncertain due to limited sample size and high overlap between the two morphotypes (Garrison *et al.* 2003).

In summary, the primary habitat of the coastal morphotype of bottlenose dolphin extends from Florida to New Jersey during summer months and in waters less than 20 m deep, including estuarine and inshore waters. South of Cape Lookout, the coastal morphotype occurs in lower densities over the continental shelf (waters between 20 m and 100 m depth) and overlaps spatially with the offshore morphotype.

Distinction Between Coastal and Estuarine Bottlenose Dolphins

In addition to inhabiting coastal nearshore waters, the coastal morphotype of bottlenose dolphin also inhabits inshore estuarine waters along the U.S. east coast and Gulf of Mexico (Wells *et al.* 1987; Wells *et al.* 1996; Scott *et al.* 1990; Weller 1998; Zolman 2002; Speakman *et al.* 2006; Stolen *et al.* 2007; Balmer *et al.* 2008; Mazzoil *et al.* 2008). There are multiple lines of evidence supporting demographic separation between bottlenose dolphins residing within estuaries along the Atlantic coast. For example, long-term photo-identification (photo-ID) studies in waters around Charleston, South Carolina, have identified communities of resident dolphins that are seen within relatively restricted home ranges year-round (Zolman 2002; Speakman *et al.* 2006). In Biscayne Bay, Florida, there is a similar community of bottlenose dolphins with evidence of year-round residents that are genetically distinct from animals residing in a nearby estuary in Florida Bay (Litz 2007). The Indian River Lagoon system in central Florida also has a long-term photo-ID study, and this study identified year-round resident dolphins repeatedly observed across multiple years (Stolen *et al.* 2007; Mazzoil *et al.* 2008).

A few published studies demonstrate that these resident animals are genetically distinct from animals in nearby coastal waters; a study conducted near Jacksonville, Florida, demonstrated significant genetic differences between animals in nearshore coastal waters and estuarine waters (Caldwell 2001; Rosel *et al*. 2009), and animals resident in the Charleston Estuarine System show significant genetic differentiation from animals biopsied in coastal waters of southern Georgia (Rosel *et al*. 2009). In addition, stable isotope ratios of O relative to O (referred to as depleted O or depleted oxygen) in animals sampled along the Outer Banks of North Carolina between Cape Hatteras and Bogue Inlet during February and March were very low (Cortese 2000). One explanation for this depleted oxygen signature is that a resident group of dolphins in Pamlico Sound moves into nearby nearshore areas in the winter.

Despite evidence for genetic differentiation between estuarine and nearshore populations, the degree of spatial overlap between these populations remains unclear. Photo-ID studies within estuaries demonstrate seasonal immigration and emigration and the presence of transient animals (e.g., Speakman *et al*. 2006). In addition, the degree of movement of resident estuarine animals into coastal waters on seasonal or shorter time scales is poorly understood. However, for the purposes of this analysis, bottlenose dolphins inhabiting primarily estuarine habitats are considered distinct from those inhabiting coastal habitats. Bottlenose dolphin stocks inhabiting coastal waters are the focus of this report.

Definition of the Central Florida Coastal Stock

Initially, a single stock of coastal morphotype bottlenose dolphins was thought to migrate seasonally between New Jersey (summer months) and central Florida based on seasonal patterns in strandings during a large scale mortality event occurring during 1987-1988 (Scott *et al.* 1988). However, re-analysis of stranding data (McLellan *et al.* 2003) and extensive analysis of genetic (Rosel *et al.* 2009), photo-ID (Zolman 2002) and satellite telemetry (NMFS unpublished data) data demonstrate a complex mosaic of coastal bottlenose dolphin stocks. Integrated analysis of these multiple lines of evidence suggests that there are five coastal stocks of bottlenose dolphins: the Northern Migratory and Southern Migratory stocks, a South Carolina/Georgia Coastal stock, a Northern Florida Coastal stock and a Central Florida Coastal stock.

The spatial extent of these stocks, their potential seasonal movements, and their relationships with estuarine stocks are poorly understood. Migratory movement and spatial distribution of the Northern Migratory stock is best understood based on tag-telemetry, photo-ID and aerial survey data and migrates seasonally between coastal waters of central North Carolina and New Jersey. It is not thought to overlap with the South Carolina/Georgia Coastal stock in any season. The Southern Migratory stock is defined primarily on satellite tag telemetry studies and is thought to migrate south from waters of southern Virginia and north central North Carolina in the summer to waters south of Cape Fear and as far south as coastal Florida during winter months. It is unclear whether this stock overlaps with the Central Florida Coastal stock in any season.

During summer months when the Southern Migratory stock is found in waters north of Cape Fear, North Carolina, bottlenose dolphins are still seen in coastal waters of South Carolina, Georgia and Florida, indicating the presence of additional stocks of coastal animals. Speakman *et al.* (2006) using photo-ID studies documented dolphins in coastal waters off Charleston, South Carolina, that are not known resident members of the estuarine stock. Genetic analyses of samples from northern Florida, Georgia and central South Carolina (primarily the estuaries around Charleston), using both mitochondrial DNA and nuclear microsatellite markers indicate significant genetic differences between these areas (NMFS 2001; Rosel *et al*. 2009). This stock assessment report addresses the Central Florida Coastal stock, which is present in coastal Atlantic waters from 29.4°N south to the western end of Vaca Key (~24.69°N –81.11°W) where the stock boundary for the Florida Keys stock begins (Figure 1). There has been little study of bottlenose dolphin stock structure in coastal waters of southern Florida; therefore the southern boundary of the Central Florida stock is uncertain. There is no obvious boundary defining the offshore extent of this stock. The combined genetic and logistic regression analysis (Garrison *et al*. 2003) indicated that in waters less than 10 m depth, 70% of the bottlenose dolphins were of the coastal morphotype. Between 10 and 20 m depth, the percentage of animals of the coastal morphotype dropped precipitously, and at depths >40 m nearly all (>90%) animals were of the offshore morphotype. These spatial patterns may not apply in the Central Florida Coastal stock, as there is a significant change in the bathymetric slope and a close approach of the Gulf Stream to the shoreline south of Cape Canaveral.

POPULATION SIZE

Aerial surveys to estimate the abundance of coastal bottlenose dolphins in the Atlantic were conducted during winter (January-February) and summer (July-August) of 2002. Survey tracklines were set perpendicular to the shoreline and included coastal waters to depths of 40 m. The surveys employed a stratified design so that most effort was expended in waters shallower than 20 m deep where a high proportion of observed bottlenose dolphins were expected to be of the coastal morphotype. Survey effort was also stratified to optimize coverage in seasonal management units. The surveys employed two observer teams operating independently on the same aircraft to estimate visibility bias. The winter survey included the region from the Georgia/Florida state line to the southern edge of Delaware Bay. A total of 6,411 km of trackline was completed during the survey, and 185 bottlenose dolphin groups were sighted including 2,114 individual animals. No bottlenose dolphins were sighted north of Chesapeake Bay where water temperatures were <9.5ºC. During the summer survey, 6,734 km of trackline were completed between Sandy Hook, New Jersey, and Ft. Pierce, Florida. All tracklines in the 0-20 m stratum were completed throughout the survey range while offshore lines were completed only as far south as the Georgia/Florida state line. A total of 185 bottlenose dolphin groups were sighted during summer including 2,544 individual animals.

In summer 2004, an additional aerial survey between central Florida and New Jersey was conducted. As with the 2002 surveys, effort was stratified into 0-20 m and 20-40 m strata with the majority of effort in the shallow depth stratum. The survey was conducted between 16 July and 31 August and covered 7,189 km of trackline. There were a total of 140 sightings of bottlenose dolphins including 3,093 individual animals. A winter survey was conducted between 30 January and 9 March 2005 covering waters from the mouth of Chesapeake Bay through central Florida. The survey covered 5,457 km of trackline and observed 135 bottlenose dolphin groups accounting for 957 individual animals.

Abundance estimates for bottlenose dolphins in each stock were calculated using line-transect methods and distance analysis (Buckland *et al*. 2001). The 2002 surveys included two teams of observers to derive a correction for visibility bias. The independent and joint estimates from the two survey teams were used to quantify the probability that animals available to the survey on the trackline were missed by the observer teams, or perception bias, using the direct-duplicate estimator (Palka 1995). The resulting estimate of the probability of seeing animals on the trackline was applied to abundance estimates for the summer 2004 and winter 2005 surveys. Observed bottlenose dolphin groups were also partitioned between the coastal and offshore morphotypes based upon analysis of available biopsy samples (Garrison *et al*. 2003).

For the Central Florida Coastal stock, the mean of the summer 2002 and 2004 abundance estimates provided the best estimate of abundance. There is strong inter-annual variation in the abundance estimates and observed spatial distribution of bottlenose dolphins in this region that may indicate movements of animals in response to environmental variability. The abundance estimate for this stock from the summer 2002 survey was 718 (CV=0.51) and that from summer 2004 was 11,918 (CV=0.27). The best abundance estimate is the unweighted average of these two surveys and is 6,318 (CV=0.26). It is unknown why the abundance estimates from 2002 and 2004 differ by nearly an order of magnitude. Survey methodologies did not differ significantly between the years, although a larger amount of survey effort was expended in the Northern Florida and Central Florida strata during 2004 than in 2002. The disparity most likely represents variability in dolphin spatial distribution between those two years. Because the two abundance estimates differ so dramatically, using an inverse-variance weighted mean when combining the estimates would heavily weight the smaller of the two estimates, and therefore would likely introduce negative bias into the estimate of stock size. Therefore, an unweighted mean of the 2002 and 2004 abundance estimates was calculated and used as the best estimate of stock abundance.

Minimum Population Estimate

The minimum population size (Nmin) for each stock was calculated as the lower bound of the 60% confidence interval for a log-normally distributed mean (Wade and Angliss 1997). The best estimate for the Central Florida Coastal stock is 6,318 (CV=0.26). The resulting minimum population estimate is 5,094.

Current Population Trend
There are insufficient data to determine the population trends for this stock.

CURRENT AND MAXIMUM NET PRODUCTIVITY RATES
Current and maximum net productivity rates are not known for the western North Atlantic coastal morphotype. The maximum net productivity rate was assumed to be 0.04. This value is based on theoretical modeling showing that cetacean populations may not grow at rates much greater than 4% given the constraints of their reproductive life history (Barlow *et al.* 1995).

POTENTIAL BIOLOGICAL REMOVAL
Potential Biological Removal (PBR) is the product of the minimum population size, one-half the maximum productivity rate, and a “recovery” factor (MMPA Sec. 3. 16 U.S.C. 1362 (Wade and Angliss 1997). The minimum population size of the Central Florida Coastal stock of bottlenose dolphins is 5,094. The maximum productivity rate is 0.04, the default value for cetaceans. The recovery factor, which accounts for endangered, depleted, threatened stocks, or stocks of unknown status relative to optimum sustainable population (OSP), is assumed to be 0.5 because this stock is depleted. PBR for this stock of bottlenose dolphins is 51.

STATUS OF STOCK
From 1995 to 2001, NMFS recognized only a single migratory stock of coastal bottlenose dolphins in the western North Atlantic, and the entire stock was listed as depleted. This stock structure was revised in 2002 to recognize both multiple stocks and seasonal management units and again in 2008 and 2010 to recognize resident estuarine stocks and migratory and resident coastal stocks. The total U.S. fishery-related mortality and serious injury for the Central Florida Coastal stock likely is less than 10% of the calculated PBR, and thus can be considered to be insignificant and approaching zero mortality and serious injury rate. However, there are commercial fisheries overlapping with this stock that have no observer coverage. This stock retains the depleted designation as a result of its origins from the originally delineated depleted coastal migratory stock. The species is not listed as threatened or endangered under the Endangered Species Act, but this is a strategic stock due to the depleted listing under the MMPA.

Based on Waring et al, 2010, the minimum population estimate for the western North Atlantic central Florida stock is 5,094 animals, and the best population estimate is 6,318 animals.

5 THE TYPE OF INCIDENTAL TAKING AUTHORIZATION THAT IS BEING REQUESTED (I.E., TAKES BY HARASSMENT ONLY; TAKES BY HARASSMENT, INJURY AND/OR DEATH) AND THE METHOD OF INCIDENTAL TAKING;

The Corps is requesting authorization of incidental taking by Level B harassment only, acoustic harassment associated with blasting activities. As previously stated in section 2 of the application, the Corps also notes that multiple IHAs (up to three) will be needed and requested for this project due to the project duration. NMFS' dual-criteria for determination of take are included below.

Criterion	Criterion Definition	Threshold
Level A (mortality)	Onset of severe lung injury (mass of dolphin calf)	31 psi-msec
Level A (injury)	50% animals would experience ear drum rupture	205 dB re: 1 μPa^2-s
Level A (injury)	Onset of slight lung injury (mass of dolphin calf)	13 psi-msec
Level B	TTS and associated behavioral disruption (dual criteria)	12 psi peak (> 2000 lb*) 23 psi peak (< 2000 lb)
Level B	TTS and associated behavioral disruption (dual criteria)	182 dB re: 1 μPa^2-s, 1/3 octave band
Level B	Sub-TTS behavioral disruption (for multiple detonations only)	177 dB re: 1 μPa^2-s, 1/3 octave band

6 BY AGE, SEX, AND REPRODUCTIVE CONDITION (IF POSSIBLE), THE NUMBER OF MARINE MAMMALS (BY SPECIES) THAT MAY BE TAKEN BY EACH TYPE OF TAKING IDENTIFIED IN PARAGRAPH (A)(5) OF THIS SECTION, AND THE NUMBER OF TIMES SUCH TAKINGS BY EACH TYPE OF TAKING ARE LIKELY TO OCCUR;

Biscayne Bay Stock

The Biscayne Bay stock of bottlenose dolphins is bounded by Haulover Inlet to the north and Card Sound Bridge to the south. Biscayne Bay is 428 square miles in area. The Port of Miami channel, within the boundaries of Biscayne Bay, is approximately 7,200 feet long by 500 feet wide, with the 3,425 feet long by 1,400-foot wide Dodge-Lummus Island turning basin (total area 0.30 sq miles) at the western terminus of Fisherman's channel. The Port's channels make up approximately 0.1% of the entire area of the Bay.

To determine the maximum area of the bay in which dolphins may experience pressure levels in excess of NMFS' 23 psi criteria, which would result in a level B Harassment take by a Temporary Threshold Shift, the Corps utilized a maximum charge weight of 450 lbs/delay with a calculated Danger Zone of 1,995 feet. The area of this radius is also 0.1% of Biscayne Bay (12,503,617 sq ft).

For an open-water, non-confined blast, the pressure at the edge of the Danger Zone will be 23 psi. For a fully confined detonation, the pressure at the edge of the Danger Zone will be 6 psi. Utilizing the pressure data collected from Phase II, for a maximum charge weight of 450 lbs in a fully confined blast, 700 feet from the blast the pressure would be 22 psi and below NMFS' criteria. However, to ensure the protection of animals, and in case of a detonation that is not fully confined, the Corps assumes that any animal within the boundaries of the Danger Zone would be taken by level B Harassment.

Litz (2007) identified 69 animals of the Biscayne stock that she classified as the "northern dolphins" meaning animals with a mean sighting history from 1994-2004 north of 25.61^{o}N. The photo-ID study that Litz's data is based on encompassed an area of approximately 200 mi^2, approximately 50% of Biscayne Bay. The maximum population of animals that may be in the project area is equal to the total number of uniquely identified animals for the entire photo-ID study of Biscayne Bay – 229 animals (Waring *et al*, 2010). The best population estimate for Biscayne Bay is also based on Waring *et al*, 2010 at 157 animals during the 2003-2007 photo-ID survey seasons when the most consistent survey effort was in place by the SEFSC.

Table #2 presents estimated take levels for varying charge weight delays likely to be seen during the project and estimated impacts based on the population estimates used in this analysis. In all cases, less than one dolphin is expected to be taken by the blast: (0.162 max – 0.049 min). This assumes that dolphin distribution is equal throughout all of Biscayne Bay.

Table #2 – Calculated take of Biscayne Bay stock dolphins based on max charge weight/delay

Max lbs/delay	Danger Zone radius (ft)	Min pop est (69)	Best pop est (157)	Max pop est (229)
450	1,995	0.049	0.111	0.162
200	1,525	0.042	0.096	0.140
119	1,280	0.030	0.038	0.099
50	960	0.017	0.038	0.056
17	670	0.008	0.019	0.027

The Corps access the NMFS-SEFSC Photo-ID survey data from 1990-2004 covering 12 years of survey in the bay via the OBIS-Seamap database (http://seamap.env.duke.edu/) and downloaded the Google Earth overlay of the data. Figure 11 shows the general area of the Port (labeled within the circle) and hotspots of dolphin sightings both north and south of the Port. This sighting frequency data was NOT used to determine potential take levels associated with this project. It was used to see if sighting levels across all parts of the bay were equal.

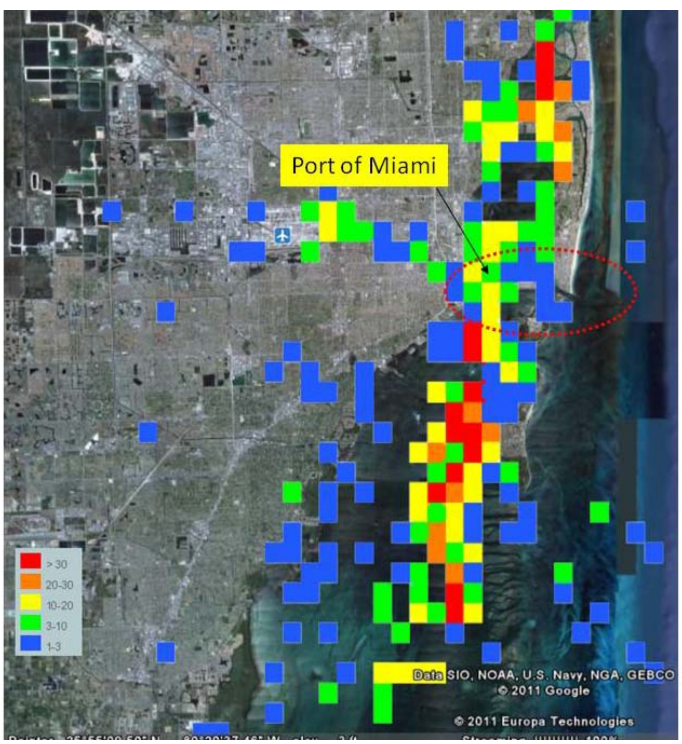

Figure 12 NOAA Southeast Fisheries Science Center, South Florida Bottlenose Dolphin Photo-identification Cooperative

Reviewing the data from the 2005 Phase II blasting, the Corps noted that for the 40 detonations, 28% of all animals sighted within the project area (Fisherman's channel) were dolphins (the remaining animals were manatees and sea turtles). Dolphins were spotted inside the Exclusion Zone 12 times with a total of 30 individuals, with an average of 2.5 animals per sighting, out of the total 58 dolphins recorded during the project. This means that multiple times animals entered the Exclusion Zone in groups. It also means that 30% of the detonations dolphins entered the exclusion zone. Not all exclusion zone entries result in a project delay, it is dependent upon when during the countdown the animals cross the Exclusion line, and how long they stay in the Exclusion zone.

During Phase II, dolphins in the Exclusion Zone triggered delays on 4 occasions of the 13 delays (31%) for the project. If the maximum 313 detonations (assuming construction starts in June with blasting June 2012-June 2013 time frame, with no blasting on Sundays) for this one year IHA have an equal percentage of delays (33% for all species) as the 2005 project, 94 of the detonations would be delayed for some period of time for protected species (dolphins, manatees and sea turtles) and 29 of those delays would specifically be for dolphins.

As a worst case, using the area of the Danger Zone, recognizing that the port is within the boundaries of Litz's northern area, and that the Danger Zone of any detonation equal to or less than 450 lbs/delay will be approximately 0.1% (0.001) of the bay, the Corps assumes that because animals are not evenly distributed throughout Biscayne Bay, that they travel as singles and in groups, as is documented in the Seamap data and the Phase II monitoring data, and that without any protective measures to minimize impacts, up to three (3) dolphins from the Biscayne Bay stock may be taken by each detonation by level B harassment.

Assuming that delays will be spread equally across the project area and using the delay calculation of 29 delays and that 3 dolphins would be inside the Danger Zone, 15 of the delayed detonations would take place in Biscayne Bay since it comprises 52% of the project area. Three (3) dolphins x 15 detonations = 45 dolphins may be exposed to a TTS over the one year IHA period in association with blasting activities.

Western North Atlantic Central Florida Coastal Stock

The Western North Atlantic Central Florida coastal stock of bottlenose dolphins is present in the coastal Atlantic waters, shallower than 20 m in depth between latitude 29.4^{o}N to the western end of Vaca Key (~29.69^{o}N – 81.11^{o}W) where the stock boundary for the Florida Key stock begins, with an area of 7,789 sq km (3,007 sq miles). The Port of Miami outer entrance channel is approximately 15,500 feet long by 500 feet wide (0.28 sq miles). The Port's channels make up approximately 0.009% (0.00009) of the stock's boundaries.

The same calculations for impact assessment that were used in Biscayne Bay were also applied to this stock. To determine the maximum area of the coastal

Atlantic in which dolphins may experience pressure levels in excess of NMFS' 23 psi criteria, which results in a level B Harassment take by a Temporary Threshold Shift, the Corps utilized a maximum charge weight of 450 lbs/delay with a calculated Danger Zone of 1,995 feet. The area of this radius is 0.015% (0.00015) of the coastal Atlantic where this stock of dolphins is expected to be found.

For an open-water, non-confined blast, the pressure at the edge of the Danger Zone will be 23 psi. For a fully confined detonation, the pressure at the edge of the Danger Zone will be 6 psi. Utilizing the pressure data collected from Phase II, for a maximum charge weight of 450 lbs in a fully confined blast, 700 feet from the blast the pressure would be 22 psi and below NMFS' criteria. However, to ensure the protection of animals, and in case of a detonation that is not fully confined, the Corps assumes that any animal within the boundaries of the Danger Zone would be taken by level B Harassment.

Waring et al (2010) provides the minimum population estimate for the western North Atlantic central Florida stock of 5,094 animals, and the best population estimate of 6,318 animals.

Table #3 presents estimated take levels for varying charge weight delays likely to be seen during the project and estimated impacts based on the population estimates used in this analysis. In all cases, less than one dolphin is expected to be taken by the blast: (0.948 max – 0.102 min). This assumes that dolphin distribution is equal throughout all of the stock's range.

Table #3 – Calculated take of Biscayne Bay stock dolphins based on max charge weight/delay

Max lbs/delay	Danger Zone radius (ft)	Min pop est (5,094)	Best pop est (6,318)
450	1,995	0.764	0.948
200	1,525	0.458	0.569
119	1,280	0.306	0.379
50	960	0.153	0.190
17	670	0.102	0.126

Unlike the Biscayne Bay stock, there have not been any Photo-ID or habitat usage analysis conducted; other than the aerial surveys by NMFS used to develop the stock assessment report; that the Corps was able to locate for the western North Atlantic Central Florida coastal stock. As a result, the Corps is unable to determine if animals are evenly distributed throughout the stock's range, particularly in the southernmost portion of the stock's range where the project is located.

To be conservative, the Corps will use the same assumptions for the Central Florida stock as was used for the Biscayne Bay stock. We do not believe that the animals are evenly distributed throughout the range. Using the data from the

2005 Phase II blasting, the Corps noted that for the 40 detonations, 28% of all animals sighted within the project area (Fisherman's channel) were dolphins (the remaining animals were manatees and sea turtles). Dolphins were spotted inside the Exclusion Zone 12 times with a total of 30 individuals, with an average of 2.5 animals per sighting, out of the total 58 dolphins recorded during the project. This means that multiple times animals entered the Exclusion Zone in groups. It also means that 30% of the detonations dolphins entered the exclusion zone. Not all exclusion zone entries result in a project delay, it is dependent upon when during the countdown the animals cross the Exclusion line, and how long they stay in the Exclusion zone.

During Phase II, dolphins in the Exclusion Zone triggered delays on 4 occasions of the 13 delays (31%) for the project. If the maximum 313 detonations (assuming construction starts in June with blasting June 2012-June 2013 time frame) for this one year IHA have an equal percentage of delays (33% for all species) as the 2005 project, 94 of the detonations would be delayed for some period of time for protected species (dolphins, manatees and sea turtles) and 29 of those delays would specifically be for dolphins.

As a worst case, using the area of the Danger Zone and that the Danger Zone of any detonation equal to or less than 450 lbs/delay will be approximately 0.009% (0.00009) of the stock's range, the Corps assumes that because animals are not evenly distributed throughout the range, that they travel as singles and in groups, as in Phase II, and that without any protective measures to minimize impacts, up to three (3) dolphins from the western North Atlantic Central Florida coastal stock may be taken by each detonation by level B harassment.

Assuming that delays will be spread equally across the project area and using the delay calculation of 29 delays and that 3 dolphins would be inside the Danger Zone, 14 of the delayed detonations would take place in Biscayne Bay since it comprises 48% of the project area. Three (3) dolphins x 14 detonations = 42 dolphins may be exposed to a TTS over the one year timeframe of the IHA in association with blasting activities.

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The Corps has calculated up to 87 dolphins may be taken over the course of the one year IHA between the Biscayne Bay (45) and western North Atlantic central Florida coastal (42) stocks by Level B harassment. Due to the protective measures of confined blasts, implementation of the Danger and Exclusion Zones as well as an extensive observer based monitoring program, the Corps is requesting Level B take of 12 animals from the Biscayne Bay stock and 10 animals from the western North Atlantic central Florida coastal stock.

7 THE ANTICIPATED IMPACT OF THE ACTIVITY UPON THE SPECIES OR STOCK;

In general, potential impacts to marine mammals from explosive detonations could include both lethal and non-lethal injury (Level A harassment), as well as Level B harassment. In the absence of monitoring and mitigation, marine mammals may be killed or injured as a result of an explosive detonation due to the response of air cavities in the body, such as the lungs and gas bubbles in the intestines. Effects are likely to be most severe in near surface waters where the reflected shock wave creates a region of negative pressure called ‘‘cavitation.’’

A second potential possible cause of mortality is the onset of extensive lung hemorrhage. Extensive lung hemorrhage is considered debilitating and potentially fatal. Suffocation caused by lung hemorrhage is likely to be the major cause of marine mammal death from underwater shock waves. The estimated range for the onset of extensive lung hemorrhage to marine mammals varies depending upon the animal’s weight, with the smallest mammals having the greatest potential hazard range.

NMFS’ criteria for determining nonlethal injury (Level A harassment) from explosives are the peak pressure that will result in: (1) the onset of slight lung hemorrhage, or (2) a 50 percent probability level for a rupture of the tympanic membrane (TM). These are injuries from which animals would be expected to recover on their own.

NMFS has established dual criteria for what constitutes Level B harassment: (1) An energy based temporary threshold shift (TTS) received sound levels 182 dB re 1 μPa2–s cumulative energy flux in any 1/3 octave band above 100 Hz for odontocetes (derived from experiments with bottlenose dolphins (Ridgway *et al.*, 1997; Schlundt *et al.*, 2000); and (2) 12 psi peak pressure cited by Ketten (1995) as associated with a safe outer limit for minimal, recoverable auditory trauma (i.e., TTS). The Level B harassment zone, therefore, is the distance from the mortality, serious injury, injury (Level A harassment) zone to the radius where neither of these criterion is exceeded.

The primary potential impact to the Atlantic bottlenose dolphins occurring in the Miami Harbor action area from the proposed detonations is Level B harassment incidental to noise generated by explosives. In the absence of any monitoring or mitigation measures, there is a very small chance that a marine mammal could be injured or killed when exposed to the energy generated from an explosive force on the sea floor. However, the Corps believes the proposed monitoring and mitigation measures will preclude this possibility in the case of this particular activity.

Non-lethal injurious impacts (Level A harassment) are defined in this proposed IHA as TM rupture and the onset of slight lung injury. The threshold for Level A harassment corresponds to a 50 percent rate of TM rupture, which can be stated in terms of an energy flux density (EFD) value of 205 dB re 1 μPa2s. TM rupture is well correlated with permanent hearing impairment (Ketten, 1998) indicates a 30 percent incidence of permanent threshold shift (PTS) at the same threshold). The farthest distance from the source at which an animal is exposed to the EFD level for the Level A harassment threshold is unknown at this time.

Level B (non-injurious) harassment includes temporary (auditory) threshold shift (TTS), a slight, recoverable loss of hearing sensitivity. One criterion used for TTS is 182 dB re 1 μPa2 s maximum EFD level in any 1/3- octave band above 100 Hz for toothed whales (e.g., dolphins). A second criterion, 23 psi, has recently been established by NMFS to provide a more conservative range of TTS when the explosive or animals approaches the sea surface, in which case explosive energy is reduced, but the peak pressure is not. For the Miami Harbor project, the distance from the blast array at which the 23 psi threshold could be met for various charge detonation weights can be, and has been calculated.

Level B harassment also includes behavioral modifications resulting from repeated noise exposures (below TTS) to the same animals (usually resident) over a relatively short period of times. Threshold criteria for this particular type of harassment are currently still being considered. One recommendation is a level of 6 dB below TTS (see 69 FR 21816, April 22, 2004), which would be 177 dB re 1 μPa2s.

Individuals from other stocks and within these two stocks potentially move both inshore and offshore of Biscayne Bay due to the openness of this bay system and closeness of the outer shelf. These movements are not fully understood and the possibility exists that these other stocks may be affected in the same manner as the Biscayne Bay and western North Atlantic central Florida coastal stocks.

As previously described in Section 1 of this application, the Corps is proposing to utilize a series of protective radii to monitor protected species locations in relation to the blast array. Two of these are particularly important to this application. The Danger Zone is where the Corps has determined the potential for Level B harassment to occur, and the Exclusion zone is the point that if an animal crosses and enters that zone that the blast will be delayed until the animal leaves the zone of its own volition. The Exclusion zone is outside the area where the Corps has determined that Level B harassment will occur, so if the monitoring works as expected and no detonation occurs when an animal is inside of the Exclusion zone, no take should occur. However, to be conservative, the Corps has calculated the potential exists for Level B harassment and is pursuing an IHA.

It has been noted on at least one previous occasion at the Miami Harbor Phase II project in 2005 where an animal outside the Exclusion zone, in the deeper water channel exhibited a startle response immediately following a blast. Details of that event are included below:

> Any animals near the exclusion were watched carefully during the blast for any changes in behavior or noticeable reaction to the blast. The only observation that showed signs of a reaction to blast was on 27 July when two dolphins were in the channel west of the blast. The dolphins were stationary at approximately 2400 feet from the blast array, feeding and generally cavorting. Due to the proximity of the dolphins, the drill barge was contacted prior to blast to confirm that the exclusion zone calculation was 1600’ for the lower weight of explosives used that day. The topography of the bottom in that area is very shallow (~1m) to the south, then an exceptionally steep drop off into the channel at 40+ ft ending at the bulkhead wall to the north. Westward, the channel continues and has a more gradual upward slope. At the time of the blast, one of the dolphins was at the surface in the shallows, while the other dolphin was underwater within the channel. The dolphin that was underwater showed a strong reaction to the blast. The animal jumped fully out of the water in a “breaching” fashion; behavior that had not been exhibited prior to the blast. The animal was observed jumping out of the water immediately before the observers heard the blast suggesting that the animal reacted to the blast and not some other stimulus. It is probable that, because this animal was located in the channel, the sound and pressure of the blast traveled either farther or was more focused through the channeling and the reflection from the bulkhead, thus causing the animal to react even though it was well outside the safety radius. These two dolphins were tracked for the entire 30-minute post blast period and no obvious signs of distress or behavior changes were observed. Other animals observed near the safety radius during blast were all to the south of the array, well up on the grass beds or in the pipe channel that runs through the grass beds. None of these animals showed any reaction to blast.

Based on the results of the monitoring from the Phase II construction project, the Corps expects limited effect of the construction activities on any marine mammals near the project area.

8 THE ANTICIPATED IMPACT OF THE ACTIVITY ON THE AVAILABILITY OF THE SPECIES OR STOCKS OF MARINE MAMMALS FOR SUBSISTENCE USES;

No subsistence use of the marine mammals that occur in or near Miami Harbor is planned as part of this project.

9 THE ANTICIPATED IMPACT OF THE ACTIVITY UPON THE HABITAT OF THE MARINE MAMMAL POPULATIONS, AND THE LIKELIHOOD OF RESTORATION OF THE AFFECTED HABITAT;

The COE is unable to determine if dolphins in the area utilize the port channels, both inner and outer as habitat for feeding, resting, etc. The bottom of the channel is previously blasted and dredged rock and sand, and the walls of the channels are vertical rock. The COE acknowledges that while the port may not be suitable foraging habitat for dolphins in Biscayne Bay, it is likely that animals may use the area to traverse to North Biscayne Bay or offshore via Government Cut..

Blasting with the boundaries of the port will be limited both spatially and temporally. Explosives utilized in the blasting are water soluble and non-toxic. If for some reason, a charge is unable to be fired and must be left in the drillhole, it is designed to breakdown as it is made of water soluble ammonium nitrate in a fluid gel format. Each drill hole also has a booster with detonator and detonation cord. Most of the cord is recovered onto the drill barge by pulling it back onboard the drill barge after the blast event. Small amounts of detonation cord can remain in the water after the blast has taken place, and will be recovered by small vessels with scoop nets. Any material left in the drill hole after the blast will be recovered through the dredging process, after the blasting when the cutterhead dredge excavates the fractured rock material.

10 THE ANTICIPATED IMPACT OF THE LOSS OR MODIFICATION OF THE HABITAT ON THE MARINE MAMMAL POPULATIONS INVOLVED;

Since we are unable to determine if resident dolphins in the area utilize the habitat of the walls and bottom of the port, we are also unable to determine how the temporary modification of the area by construction activities will impact this population of dolphins. If animals are using the port to travel from South Bay to North Bay or vice-versa and they may be exiting the Bay via the main ship channel and may delay or detour their movements during construction activities.

With regard to prey species (mainly fish), a very small number of fish are expected to be impacted by the project. Based on the results of the 2005 blasting project, the blasting consisted of 40 blast events over a 38-day time frame. 23 of these blasts were monitored (57.5%) by the state and had injured and dead fishes collected after the all clear was given. Noting that the “all-clear” is normally at least 2-3 minutes after the shot is fired is important, since seagulls and frigate birds quickly learned to approach the blast site and swoop in to eat some of the stunned, injured and dead fish floating on the surface. State biologists and volunteers collected the carcasses of floating fish (it should be noted that not all dead fish float after a blast, and due to safety concerns, no plans exist to put divers on the bottom of the channel in the blast zone to collect those non-floating carcasses). The fish were described to the lowest taxonomic level possible (usually species) and the injury types were categorized. The data forms are available from FWC and USACE on request.

A summary of that data shows that 24 different genera were collected during the Miami Harbor blasting. The species with the highest abundance were white grunts (*Haemulon plumieri*) (N=51); scrawled cowfish (*Lactophrys quadricornis*) (N=43) and Pygmy filefish (*Monocanthus setifer*) (N=30). Total fish collected during the 23 blasts was N=288 or an average of 12.5 fish per blast (range 3 to 38). In observation of the three blasts with the greatest number of fishes killed (Table 4) and reviewing the maximum charge weight per delay for the Miami Harbor project, it appears that there is no direct correlation between charge weight and fishes killed that can be determined from such a small sample. Reviewing the 23 blasts where dead and injured fish were collected after the all clear signal was given, no discernible pattern exists. Factors that affect fish mortality include, but are not limited to: fish size, body shape (fusiform, etc) proximity of the blast to a vertical structure like a bulkhead (see the Aug 10, 2005 blast for example; a much smaller charge weight resulted in a higher fish kill due to the closeness of a bulkhead).

Table 4 Confined Blast Maximum Charge Weight and Number of Observed Fish Killed

Date	Max Charge Wt/delay (lbs)	Fish killed
7/26/2005	85	38
7/25/2005	112	35
8/10/2005	17	28

In the past, to reduce the potential for fish to be injured or killed by the blasting, USACE has allowed, and the resource agencies have requested, that blasting contractors utilize a small, unconfined explosive charge, usually a 1-lb booster, detonated about 30 seconds before the main blast to drive fish away from a blasting zone. It is assumed that noise or pressure generated by the small charge will drive fish from the immediate area, thereby reducing impacts from the larger and potentially more-damaging blast. Blasting companies use this method as a "good faith effort" to reduce potential impacts to aquatic resources. The explosives industry recommends firing a "warning shot" to frighten fish out of the area before seismic exploration work is begun (Anonymous 1978 in Keevin *et al*. 1997).

There is limited data available on the effectiveness of fish scare charges at actually reducing the magnitude of fish kills and the effectiveness may be based on the fish's life history.

Keevin *et al* (1997) conducted a study to test if fish scare charges are effective in moving fishes away from blast zones. They used three freshwater species, largemouth bass; channel catfish and flathead catfish, equipping each fish with an internal radio tag to allow the fishes movements before and after the scare charge to be tracked. Fish movement was compared with a predicted Lethal Dose 0% mortality distance for an open water shot (no confinement) for a variety of charge weights. Largemouth bass showed little response to repelling charges and none would have moved from the kill zone calculated for any explosive size. Only one of the flathead catfish and two of the channel catfish would have move to a safe distance for any blast. This means that only 11% of the fish used in the study would have survived the blasts.

These results call into question the true effectiveness of this minimization methodology; however, some argue that based on the monetary value of fish (American Fishery Society 1992 in Keevin *et al.* 1997) including high value commercial or recreational species like snook and tarpon found in southeast Florida inlets like Port Everglades, the low cost associated with repelling charge use would be offset if only a few fish were moved from the kill zone (Keevin *et al*. 1997).

To calculate the potential loss of prey species from the project area as an impact of blasting, USACE used a 12.5 fish/blast kill estimate based on the Miami Harbor 2005 blasting, and multiply it by the 40 shots – reaching a total estimate of floating fish killed in the 2005 Miami project of 500 fish. As stated previously, not all carcasses float to the surface and there is no way to estimate how many carcasses did not float. However, it can be determined that at Miami Phase II, the minimum estimated fish kill for the entire project, was 500 fish.

Using the 12.5 fish killed/detonation estimate and the maximum 600 detonations for the project – the minimum number of fish expected to be killed by the project is 7,500 fish across the entire 28,500 ft long channel footprint, assuming the worst case scenario and the entire channel must be blasted.

11 THE AVAILABILITY AND FEASIBILITY (ECONOMIC AND TECHNOLOGICAL) OF EQUIPMENT, METHODS, AND MANNER OF CONDUCTING SUCH ACTIVITY OR OTHER MEANS OF EFFECTING THE LEAST PRACTICABLE ADVERSE IMPACT UPON THE AFFECTED SPECIES OR STOCKS, THEIR HABITAT, AND ON THEIR AVAILABILITY FOR SUBSISTENCE USES, PAYING PARTICULAR ATTENTION TO ROOKERIES, MATING GROUNDS, AND AREAS OF SIMILAR SIGNIFICANCE;

Over the last ten years, the Jacksonville district has been collecting data concerning the effects of confined blasting projects on marine mammals. This effort began in the early 1990s when the Corps contracted with Dr. Calvin Koyna, Precision Blasting Services to review previous Corps blasting projects, recommendations of Florida Fish and Wildlife Conservation Commission (FWC) (then known as the Florida Department of Natural Resources) and the U.S. Fish and Wildlife Service (FWS) prepared for a harbor deepening project at Port Everglades, Florida conducted in the mid 1980's. The recommendations prepared for the project were specifically aimed at protecting endangered manatees and endangered/threatened sea turtles.

As previously discussed, as part of the Miami Harbor Phase II project, the Corps monitored the blasting project and collected data on the pressures associated with confined blasts, while employing a formula to calculate zones that would be protective of protected species. Results from the pressure monitoring at Phase II demonstrate that stemming each drill hole reduces the blast pressure entering the water (Nedwell and Thandavamoorthy, 1992; Hempen *et al*., 2005; Hempen *et al*., 2007).

The following standard conditions have been incorporated into the project specifications to reduce the risk to marine mammals within the project area. While this application is specific to bottlenose dolphins, these specifications are written for all protected species that may be in the project area.

> If blasting is proposed during the period of 1 November through 31 March, significant operational delays should be expected due to the increased likelihood of manatees being present within the project area. If possible, avoid scheduling proposed blasting during the period from 1 November through 31 March. In the area where blasting could occur or any area where blasting is required to obtain channel design depth, the following marine mammal (manatees and dolphins) and reptile (sea turtles and crocodiles) protection measures shall be employed, before, during and after each blast:
>
> a. The Florida Fish and Wildlife Conservation Commission (FWC), the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries

Service (NMFS) must review the contractor's approved Blasting Plan prior to any blasting activities. Copies of this plan shall be provided to FDEP and FWC as a matter of comity. This blasting proposal must include information concerning a watch program and details of the blasting events. This information must be submitted at least 30 days prior to the proposed date of the blast(s) to the following addresses:

(1) FWC – ISM, 620 South Meridian Street; Mail Stop 6A, Tallahassee, FL 32399-1600 or ImperiledSpecies@myfwc.com
(2) NMFS-PR1, 1315 East West Highway, Silver Spring, MD 20910
(3) U.S. Fish and Wildlife Service; 1339 20th Street; Vero Beach, FL 32960-3559 OR 6620 Southpoint Drive, South; Suite 310, Jacksonville, FL 32216-0912 (Project location dependent)
(4) NMFS-SERO-Protected Species Management Branch, 263 13th Ave South, St. Petersburg, FL 33701

In addition to plan review, Dr. Allen Foley shall be notified at the initiation and completion of all in-water blasting allen.foley@myfwc.com.

b. It shall include at least the following information:
(1) A list of the observers, their qualifications, and positions for the watch, including a map depicting the proposed locations for boat or land-based observers. Qualified observers must have prior on the job experience observing for protected marine species (such as manatees, marine turtles, dolphins, etc.) during previous in-water blasting events where the blasting activities were similar in nature to this project.

(2) The amount of explosive charge proposed, the explosive charge's equivalency in TNT, how it will be executed (depth of drilling, stemming, in-water, etc.), a drawing depicting the placement of he charges, size of the safety radius and how it will be marked (also depicted on a map), tide tables for the blasting event(s), and estimates of times and days for blasting events (with an understanding this is an estimate, and may change due to weather, equipment, etc).

c. For each explosive charge placed, three zones will be calculated, denoted on monitoring reports and provided to protected species observers before each blast for incorporation in the watch plan for each planned detonation. All of the zones will be noted by buoys for each of the blasts. These zones are:

1) Danger Zone: The danger zone (ft) = 260 X the cube root of the weight of the explosive charge in pounds (tetryl or TNT).

2) Exclusion Zone: Danger Zone + 500 feet. Detonation will not occur if a marine mammal or reptile is known to be (or based on previous sightings, may be) within the Exclusion Zone.

3) Safety Zone: The safety zone (ft) = 520 X cube root of the weight of the explosive charge in pounds (tetryl or TNT)

4) Watch Zone: Three times the radius of the Danger Zone to insure that animals entering or traveling close to the exclusion zone are spotted and appropriate actions can be implemented before or as the animal enters the exclusion zone (i.e. a delay in blasting activities).

d. The watch program shall begin at least one hour prior to the scheduled start of blasting to identify the possible presence of manatees, dolphins, marine turtles, crocodiles [If applicable – Monroe, Dade, Broward Counties] or whales (in the nearshore and offshore areas). The watch program shall continue until at least one half-hour after detonations are complete.

e. The watch program shall consist of a minimum of six Protected Species Observers. Each observer shall be equipped with a two-way radio that shall be dedicated exclusively to the watch. Extra radios should be available in case of failures. All of the observers shall be in close communication with the blasting subcontractor in order to halt the blast event if the need arises. If all observers do not have working radios and cannot contact the primary observer and the blasting subcontractor during the pre-blast watch, the blast shall be postponed until all observers are in radio contact. Observers will also be equipped with polarized sunglasses, binoculars, a red flag for backup visual communication, and a sighting log with a map to record sightings. All blasting events will be weather dependent. Climatic conditions must be suitable for optimal viewing conditions, determined by the observers.

f. The watch program shall include a continuous aerial survey to be conducted by aircraft, as approved by the FAA. The event shall be halted if an animal(s) is spotted within the Exclusion Zone (Danger Zone + 500 feet). An "all-clear" signal must be obtained form the aerial observer before detonation can occur. The blasting event shall be halted immediately upon request of any of the observers. If animals are sighted, the blast event shall not take place until the animal(s) moves out of the area under its own volition. Animals shall not be herded away or harassed into leaving. Specifically, the animals must not be intentionally approached by project watercraft. If the animal(s) is not sighted a second time, the event may resume 30 minutes after the last sighting.

g. The observers and contractors shall evaluate any problems encountered during blasting events and logistical solutions shall be presented to the Contracting Officer. Corrections to the watch shall be made prior to the next blasting event. If any one of the aforementioned conditions is not met prior to or during the blasting, the watch observers shall have the authority to terminate the blasting event, until resolution can be reached with Contracting Officer. The Contracting Officer will contact FWC, USFWS and NMFS.

h. If an injured or dead marine mammal or marine reptile is sighted after the blast event, the watch observers shall contact the Corps of Engineers and the Corps of Engineers will contact the resource agencies at the following phone numbers:

(1) FWC through the Manatee Hotline: 1-888-404-FWCC and 850-922-4300 (manatees).
(2) USFWS Vero Beach: 772-572-3909 (manatee and crocodile)
(3) NMFS SERO-PRD: 772-570-5312 (sea turtles and sawfish)
(4) NMFS- Emergency Stranding Hotline – 1-877-433-8299

The observers shall maintain contact with the injured or dead mammal or reptile until authorities arrive. Blasting shall be postponed until consultations are completed and determinations can be made of the cause of injury or mortality. If blasting injuries are documented, all demolition activities shall cease. The Corps will then submit a revised plan to FWC, NMFS and USFWS for review.

i. Within 30 days after completion of all blasting events, the primary observer shall submit a report to the Corps, who will provide it to FWC, NMFS and USFWS providing a description of the event, number and location of animals seen and what actions were taken when animals were seen. Any problems associated with the event and suggestions for improvements shall also be documented in the report.

Monitoring Protocol During Blast Events

The Corps will rely upon the same monitoring protocol developed for the Port of Miami project in 2005 (Barkaszi, 2005) and published in Jordan *et al*., 2007 and attached to this application. A summary of that protocol is summarized here:

A watch plan will be formulated based on the required monitoring radii and optimal observation locations. The watch plan will be consistent with the program that was utilized successfully at Miami Harbor in 2005 and will consist of at least five observers including at least one (1) aerial observer, two (2) boat-based observers, and two (2) observers stationed on the drill barge (Figures 12, 13, 14, & 15). The 6th observer will be placed in the most optimal observation location (boat, barge or aircraft) on a day-by-day basis depending on the location of the blast and the placement of dredging equipment. This process will insure complete coverage of the four zones as well as any critical areas. The watch will begin at least 1-hour prior to each blast and continue for one-half hour after each blast (Jordan *et al* 2007).

Figure 13 Typical observer helicopter

Figure 14 View of typical altitude of aerial observer operations

Figure 15   Typical vessel for boat-based observer

Figure 16   Observer on Drill Barge

The aerial observer will fly in a turbine engine helicopter (bell jet ranger) with doors removed at an average height of 500 feet. The helicopter will drop lower if they need to identify something in the water. This provided maximum visibility of the watch and safety zone as well as exceptional maneuverability and the needed flexibility for continual surveillance without fuel stops or down time, minimization of delays due to weather or visibility and the ability to deliver post-blast assistance. Although NMFS has determined that helicopter overflight of pinneped haulouts and flushing of animals off of those haulouts is a take under the MMPA, to date NMFS has not issued an IHA for take of dolphins associated with helicopter-based monitoring activities. Additionally, at least six commercial helicopter, small Cessna and ultra-light companies operate on Key Biscayne, immediately south of the Port and offer “flight-seeing” operations over downtown Miami, Bayfront and the Port. Recreational use of ultralights launching from Key Biscayne is also common in the area, as are overflights of commercial seaplanes, jet aircraft and helicopters. The area being monitored is a high traffic area, surrounded by an urban environment where animals are potentially exposed to multiple overflights daily. USACE conferred with Mary Jo Barkaszi, owner and chief observer of ECOS, Inc, a protected species monitoring company with 25-years experience, and has worked on the last five marine mammals/blasting events for the Corps throughout the country. All of these jobs had bottlenose dolphins in the project area. Ms. Barkaszi stated that in her experience, she has not observed bottlenose dolphins diving or fleeing the area because a helicopter is hovering nearby at 500 feet (pers comm. 9-12-2011). During monitoring events, the helicopter hovers at 500 feet above the watch zone and only drops below that level when helping to confirm identification of something small in the water, like a sea turtle. The Corps does not expect incidental harassment associated with helicopter-based monitoring of the blasting activities and is not requesting take associated with helicopter-based monitoring.

Boat-based observers are placed on one of two vessels, both of which had attached platforms that place the observer’s eyes at least 10 feet (3 m) above the water surface enabling optimal visibility of the water from the vessels. The boat observers cover the safety zone where waters are deep enough to safely operate the boats without any impacts to seagrass resources. The shallow grass beds south of the project site relegate the observer boats mainly to the channel east and west of the blast zone. At no time are any of the observer boats allowed in shallow areas where props could potentially impact the fragile seagrass.

At times, turbidity in the water may be high and visibility through the water column may be reduced so that animals are not seen below the surface as they would be under normal conditions. This may be more common on an ebb tide. However, animals surfacing in these conditions are still routinely spotted from the air and from the boats, thus the overall observer program is not compromised, only the degree to which animals were tracked below the surface. Adjustments to the program are made accordingly so that all protected species are confirmed out of the safety zone prior to T-minus 5 minutes, just as they are under normal visual conditions. It is important to note that the waters within the project area are exceptional for observation so that the decreased visibility below the surface during turbid conditions make the waters more typical of other manatee habitats and port facilities where observer programs are also effective throughout the US like New York and Boston Harbors where this monitoring method has been employed.

All observers are equipped with marine-band VHF radios, maps of the blast zone, polarized sunglasses, and appropriate data sheets. Communications among observers and with the blaster is critical importance to the success of the watch plan. The aerial observer is in contact with vessel and drill-barge based the observers and the drill barge with regular 15-minute radio checks throughout the watch period. Constant tracking of animals spotted by any observer is possible due to the amount and type of observer coverage and the excellent communications plan. Watch hours are restricted to between two hours after sunrise and one hour before sunset. The watch begins at least one hour prior to the scheduled blast and is continuous throughout the blast. Watch continues for at least 30 minutes post blast at which time any animals that were seen prior to the blast are visually re-located whenever possible and all observers in boats and in the aircraft assisted in cleaning up any blast debris.

If any protected species are spotted during the watch, the observer notifies the aerial observer and/or the other observers via radio. The animal is located by the aerial observer to determine its range and bearing from the blast array. Initial locations and all subsequent re-acquisitions are plotted on maps. Animals within or approaching the safety zone is tracked by the aerial and boat based observers until they exited the safety zone. Anytime animals are spotted near the safety zone, the drill barge is alerted as to the animal's proximity and some indication of any potential delays it might cause.

If an animal is spotted inside the safety zone and not re-acquired, no blasting is authorized until at least 30 minutes has elapsed since the last sighting of that animal. The watch continued its countdown up until the T-minus five (5) minute point. At this time, the aerial observer confirms that all animals are outside the safety zone and that all holds have expired prior to clearing the drill barge for the T-minus five (5) minute notice. A fish scare charge is fired at T-minus five (5) minutes and T-minus one (1) minute to minimize effects of the blast on fish that may be in the area of the blast array by scaring them from the blast area.

An actual delay in blasting only occurs when a protected species was located within the exclusion zone at the point where the blast countdown reaches the T-minus five (5) minutes. At that time, if an animal is in or near the safety zone, the countdown is put on hold until the zone is completely clear of protected species and all 30-minute sighting holds have expired. Animal movements into the safety zone prior to that point are monitored closely but do not necessarily stop the countdown. The exception to this would be stationary animals that do not appear to be moving out of the area or animals that begin moving into the safety zone late in the countdown. For these cases, holds on the T-minus 15 minutes may be called for in order to keep the shipping channel open and minimize the impact on Port operations.

12 WHERE THE PROPOSED ACTIVITY WOULD TAKE PLACE IN OR NEAR A TRADITIONAL ARCTIC SUBSISTENCE HUNTING AREA AND/OR MAY AFFECT THE AVAILABILITY OF A SPECIES OR STOCK OF MARINE MAMMAL FOR ARCTIC SUBSISTENCE USES, THE APPLICANT MUST SUBMIT EITHER A "PLAN OF COOPERATION" OR INFORMATION THAT IDENTIFIES WHAT MEASURES HAVE BEEN TAKEN AND/OR WILL BE TAKEN TO MINIMIZE ANY ADVERSE EFFECTS ON THE AVAILABILITY OF MARINE MAMMALS FOR SUBSISTENCE USES.

N/A – the project does not take place in or near a traditional Arctic subsistence hunting area, nor will it affect availability of a species or stock of marine mammal for Arctic subsistence uses.

13 THE SUGGESTED MEANS OF ACCOMPLISHING THE NECESSARY MONITORING AND REPORTING THAT WILL RESULT IN INCREASED KNOWLEDGE OF THE SPECIES, THE LEVEL OF TAKING OR IMPACTS ON POPULATIONS OF MARINE MAMMALS THAT ARE EXPECTED TO BE PRESENT WHILE CONDUCTING ACTIVITIES AND SUGGESTED MEANS OF MINIMIZING BURDENS BY COORDINATING SUCH REPORTING REQUIREMENTS WITH OTHER SCHEMES ALREADY APPLICABLE TO PERSONS CONDUCTING SUCH ACTIVITY. MONITORING PLANS SHOULD INCLUDE A DESCRIPTION OF THE SURVEY TECHNIQUES THAT WOULD BE USED TO DETERMINE THE MOVEMENT AND ACTIVITY OF MARINE MAMMALS NEAR THE ACTIVITY SITE(S) INCLUDING MIGRATION AND OTHER HABITAT USES, SUCH AS FEEDING. GUIDELINES FOR DEVELOPING A SITE-SPECIFIC MONITORING PLAN MAY BE OBTAINED BY WRITING TO THE DIRECTOR, OFFICE OF PROTECTED RESOURCES; AND

Mitigation Monitoring Reporting Requirements

If an injured or dead marine mammal or marine reptile is sighted after the blast event, the watch observers shall contact the Corps of Engineers and the Corps of Engineers will contact the resource agencies at the following phone numbers:

(1) FWC through the Manatee Hotline: 1-888-404-FWCC and 850-922-4300 (manatees).
(2) USFWS Vero Beach: 772-572-3909 (manatee and crocodile)
(3) NMFS SERO-PRD: 772-570-5312 (sea turtles and sawfish)
(4) NMFS- Emergency Stranding Hotline – 1-877-433-8299

The observers shall maintain contact with the injured or dead mammal or reptile until authorities arrive. Blasting shall be postponed until consultations are completed and determinations can be made of the cause of injury or mortality. If blasting injuries are documented, all demolition activities shall cease. The Corps will then submit a revised plan to FWC, NMFS and USFWS for review.

Within 30 days after completion of all blasting events, the primary observer shall submit a report to the Corps, who will provide it to FWC, NMFS (PRD and OPR) and USFWS providing a description of the event, number and location of animals seen and what actions were taken when animals were seen. Any problems associated with the event and suggestions for improvements shall also be documented in the report.

Monitoring to Increase Knowledge of the Species

The Corps will be conducting a study on fish kill associated with confined underwater blasting that will provide information on the effects of confined underwater blasting on prey species for dolphins in the project area.

Additionally, USACE will provide sighting data for each blast to researchers at NOAA-NMFS-SEFSC's marine mammal program (Garrison, Contillo and Litz) and any other researchers working on dolphins in the project area to add to their database of animal usage of the project area.

The Corps is not authorized to conduct general "research" associated with construction projects, but can conduct project specific monitoring efforts for environments or species being impacted by the project, directly associated with the project.

14 SUGGESTED MEANS OF LEARNING OF, ENCOURAGING, AND COORDINATING RESEARCH OPPORTUNITIES, PLANS, AND ACTIVITIES RELATING TO REDUCING SUCH INCIDENTAL TAKING AND EVALUATING ITS EFFECTS.

The Corps will coordinate monitoring with the appropriate federal and state resource agencies, including NMFS-OPR and NMFS-PRD, and will provide copies of any monitoring reports prepared by the contractors.

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Appendix A

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