Record of Decision for the Offshore Area

Former Nansemond Ordnance Depot, Suffolk, Virginia

6 May 2004

Site:

The Former Nansemond Ordnance Depot
Suffolk, Virginia
C03VA004500, Formerly Used Defense Site

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1. DECLARATION

This Record of Decision documents acceptance of the No Further Action (NFA) determination presented in the Proposed Plan (PP; USACE 2003) as the remedial alternative for the Offshore Area of the Former Nansemond Ordnance Depot (FNOD). This alternative was accepted after public and regulatory review of the PP.

1.1. SITE NAME AND LOCATION

The Former Nansemond Ordnance Depot (FNOD) was constructed and commissioned as the Pig Point Ordnance Depot between November 1917 and December 1918 for munitions storage and shipment of these munitions overseas. The FNOD is located on the southern banks of the James and Nansemond Rivers, in the northeast part of the City of Suffolk, Virginia (Figure 1-1). Between World Wars I and II, operations at the Former Depot included preparation of ammunition and components for permanent storage, painting and marking shells and containers, segregation of certain lots of ammunition, transference of powder charges from fiber to metal containers, salvage of munitions parts, and inspection and disposal of unserviceable ammunition by defusing or burning. On April 9, 1945, the Former Depot was incorporated into the demobilization planning conducted by the Ordnance Department. Currently, the FNOD is classified as a Formerly Used Defense Site (FUDS).

On January 19, 1999, EPA proposed the FNOD for inclusion on the National Priority List (NPL), (64 Federal Register No. 27, 2950). The CERCLIS identification for the site is VAD123933426. The NPL final listing included several "Source Areas" and "Areas of Concern" (AOCs) requiring investigation at the FNOD. The Offshore Area, extending from Streeter Creek to Pig Point, was included on this NPL listing as "Area of Concern Number 3" (EPA 1999), and is the subject of this Record of Decision (ROD). Based on differences in the type of equipment that could be used for conducting surveys in the subtidal and intertidal zones, the Offshore Area has been divided into the Offshore and Nearshore Areas, which are delimited by the Mean Lower Low Water (MLLW) line. The nearshore area will be addressed as a separate operable unit, and is thus not discussed in this ROD.

The Offshore Area was designated as an area of concern based on potential sources of contaminants from FNOD that could have affected the Offshore Area sediments. Potential sources of contaminants that could have contributed to the Offshore Area include the James River Beachfront (JRB), the former site of burn pits for the destruction of materials related to the disarmament of ordnance, and current shoreline areas containing metal debris, concrete and asphalt; Nansemond River Beachfront, and other nearshore waterways, such as Tidewater Community College (TCC) Lake, Area J Lake, Horseshoe Pond, and Streeter Creek, that have the potential to contribute contaminants to the James and Nansemond Rivers. Analysis of historical photographs showed that considerable loss of shoreline (greater than 300') has occurred along the James River Beachfront over the past 50 years (SAIC 2002), meaning that the Offshore Area was formerly located much closer to FNOD shoreline areas. Additionally, eroded material from upland areas on FNOD could have been deposited in the Offshore Area. These factors contributed to the determination to investigate the Offshore Area for FNOD-related contaminants.

1.2. STATEMENT OF BASIS AND PURPOSE

This decision document presents the Selected Remedy for the Offshore Area at the FNOD in Suffolk, Virginia. The remedy, No Further Action, was chosen in accordance with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA), and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). This decision is based on the Administrative Record file for this site.

1.3. ASSESSMENT OF SITE

The U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers have determined that no action is necessary to protect public health or welfare or the environment. The Commonwealth of Virginia concurs with the Selected Remedy.

1.4. DESCRIPTION OF SELECTED REMEDY

The results of extensive environmental characterization investigations and both Ecological and Human Health Assessments (described in detail in Section 2.7) have determined that site-related contaminants do not exist in the Offshore Area so as to result in unacceptable risk to human health or the aquatic environment. Therefore, no further action (NFA) is necessary to achieve site closure of the Offshore Area. Hence, under this alternative, no further remedial action will be performed at the site. Furthermore, no potential for unacceptable adverse environmental impacts remain at the site. As a result, CERCLA requirements are satisfied. For detailed information, all associated site documents are presented in the Administrative Record File.

1.5. STATUTORY DETERMINATIONS

The Selected Remedy (No Further Action, NFA) complies with the statutory requirements of CERCLA in that it is protective of human health and the environment. The Selected Remedy consists of No Further Action because no remedial action is necessary for the Offshore Area to protect human health and the environment. Statutory requirements pertaining to compliance of the Selected Remedy with Applicable or Appropriate and Relevant Requirements (ARARs), utilization of a cost-effective remedy, and utilization of permanent solutions, alternative treatment technologies and/or resource recovery technologies to the maximum extent practicable do not apply to a NFA determination.

1.6. AUTHORIZING SIGNATURES

_____ _____

Yvonne J. Prettyman-Beck **Date**
Colonel, U.S. Army
District Engineer
U.S. Army Engineer District, Norfolk

_____ _____

Abraham Ferdas, Director **Date**
Hazardous Site Cleanup Division
U.S. EPA Region III

2. DECISION SUMMARY

Based on the results of extensive site investigations and risk assessments, remediation of the Offshore Area is not warranted, and No Further Action (NFA) is necessary to close out this AOC. The following subsections present an overview of the evidence supporting this decision as presented in the Proposed Plan.

2.1. SITE NAME, LOCATION AND DESCRIPTION

The FNOD is located on the southern banks of the James and Nansemond Rivers, in the northeast part of the City of Suffolk, Virginia (Figure 1-1). The site is located within the Tidewater District, and is 6 miles across Hampton Roads from Newport News and approximately 11.5 miles by land west from Norfolk, Virginia. The FNOD consists of approximately 975 acres, acquired by the Department of the Army between 1917 and 1928 by various deeds, easements, permits, and Declaration of Takings (Foster Wheeler Environmental Corporation 1998).

The lead agencies are the U.S. Army Corps of Engineers (USACE), Norfolk District, and the U.S. Environmental Protection Agency (EPA) Region III. The source of remediation funds is the Defense Environmental Restoration Program (DERP), for Formerly Used Defense Sites (FUDS).

The Offshore Area extends from the low tide line to approximately 1 mile offshore to the James River and Nansemond River channels. Low tide occurs at different sea level elevations (and hence, distances from shore) based on natural monthly variations in the tides ranging from the "Spring" strong tides to the "Neap" weak tides. In order to derive a precise definition of the shoreline boundary, the Mean Lower Low Water (MLLW) line is used, being the average seawater elevation of the lower low tides in the study area over a 19-year period. This is the designation used by the National Oceanic and Atmospheric Administration (NOAA) National Oceanographic Survey (NOS) office as a boundary for the seaward limit of the intertidal zone. For the FNOD Offshore Area, the MLLW line, when projected on the measured seafloor elevations along the FNOD coastline, varies between 200' and 300' from the shoreline. Conversely, the Nearshore Area extends from the MLLW line to the high tide line, which in most areas of FNOD is the embankment at the shoreline.

The Offshore Area includes the remnants of a pier, called the "Old Pier Area", that extends from the shoreline out into the James River roughly 3000' (Figure 2-1). Another pier is located along the Nansemond River shoreline, adjacent to a stone breakwater at Pig Point, which is referred to as the Fishing Pier Area. This pier does not extend as far out into the waterway as the Old Pier, and as with the Nearshore Area, is the subject of a separate investigation.

The Offshore Area has been identified as an AOC based on the potential for transport of material from the FNOD site to the waterway. The primary transport mechanism is likely shoreline erosion, as over 300' of shoreline has eroded over the past 50 years (SAIC 2002), such that former inland site use areas are now proximal to the shoreline. This erosion has provided a significant transport mechanism for potential movement of site-related contaminants into the offshore environment. In addition, runoff from land could add to the transport of any contaminants.

One such potential shoreline source of contaminants to the Offshore Area is the James River Beachfront. A separate AOC, the beachfront encompasses the locations of historic burn pits operated for the destruction of materials related to the disarmament of ordnance. The area was also used for disposal of large quantities of metal debris, concrete and asphalt (USACE 2000). Investigations of the James River Beachfront identified contaminants of concern in soils and debris; final investigations are nearing completion. A removal action has been completed, consisting of removal of contaminated soils and debris, and stabilization of the eroding banks and soil removal areas. The post-removal action Human Health Risk Assessment and Ecological Risk Assessment have not yet been completed for the onshore portion of the JRB.

Other potential sources of contaminants to the Offshore Area located along the beachfront include an overflow culvert for the Tidewater Community College (TCC) Lake, Streeter Creek, Area J Lake, Horseshoe Pond and the Nansemond River Beachfront. Investigations of each of these areas are either ongoing or under consideration. The Old Pier area may have also contributed contaminants, as ordnance or other materials could have been dropped during vessel loading. However, no ordnance materials were encountered during a Navy diver unexploded ordnance (UXO) survey of the James River area, which includes the Old Pier.

2.2. SITE HISTORY AND ENFORCEMENT ACTIVITIES

The FNOD operated between 1917 and 1950, and was occupied by the U.S. Army for ammunition supply, maintenance, and disposal functions. On April 9, 1945, the Former Depot was incorporated into the demobilization planning conducted by the Ordnance Department. In 1950, the site was transferred to the Department of the Navy, and was subsequently named the Corps Supply Forwarding Annex. Following Navy operation, the FNOD was deactivated in 1960, and ownership of the property was transferred to the Beasley Foundation. Tidewater Community College, the General Electric Company Jet Engine Division (GE), and the Hampton Roads Sanitation District (HRSD) now principally occupy the FNOD land. Smaller parcels of land are owned by the Virginia Department of Transportation, (Interstate 664), Dominion Lands, Inc., Continental Properties and SYSCO Food Services (USACE 2000).

On January 19, 1999, EPA proposed the FNOD for inclusion on the National Priority List (NPL), (64 Federal Register No. 27, 2950). The NPL final listing included several "Source Areas" and "Areas of Concern" (AOCs) requiring investigation at the FNOD. The Offshore Area, extending from Streeter Creek to Pig Point, was included on this NPL listing as "Area of Concern Number 3" (EPA 1999), and is the subject of this Record of Decision (ROD).

On July 22, 1999, the U.S. Environmental Protection Agency (EPA) made a final determination and placed the FNOD on the General Superfund List for private sites (64 Federal Register No. 140, 39878). On the final determination, the FNOD was listed as a Non-Federal Facility Superfund Site, as the Federal Government does not currently control any property at the FNOD. However, the EPA has named the Federal Government, specifically the Department of Defense (DoD), as a Potentially Responsible Party (PRP) for addressing environmental issues at the FNOD.

To address environmental issues in the Offshore Area at the FNOD, the USACE, with technical guidance from EPA Region III, commissioned an environmental characterization study of this AOC. The goal of this investigation was to characterize the marine habitat and identify potential alteration due to disposal activities from past operations at the FNOD, as well as identify the

nature and extent of chemical contamination, in part to refine exposure models for the planned Ecological Risk Assessment (ERA). Contaminant data from this investigation, supplemented with data collected during a survey of the Old Pier, were used in preparation of the ERA and subsequent Human Health Risk Assessment (HHRA) for this AOC. These studies are discussed in detail in Section 2.7.

2.3. COMMUNITY PARTICIPATION

To fulfill the public participation requirement under Section 117(a) of CERCLA, as amended by SARA, the Proposed Plan for the Offshore Area was released to the public on December 4, 2003, and is available in the Administrative Record Files maintained at the Tidewater Community College Library in Portsmouth, Virginia; and at the USACE, Norfolk District building in Norfolk, Virginia. The Proposed Plan was available for public comment from December 4, 2003, to January 4, 2004. A Notice of Availability for the Proposed Plan and notification of the public comment period was published in the Virginia Pilot and Daily Press on November 24, 2003. The notice stated that a public meeting concerning the Proposed Plan was planned for December 4, 2003. The public meeting was held on December 4, 2003, to present the Proposed Plan to a broader audience than those that had already been involved at the site. At this meeting, representatives from EPA and the Army Corps of Engineers were available to answer any questions raised about the site and the Selected Remedy.

No comments were received in response to the notice or at the Public Meeting, as described in the Responsiveness Summary (Section 5) of this ROD. This ROD presents the "No Further Action" decision for the Offshore Area at the FNOD located in Suffolk, Virginia, chosen in accordance with CERCLA, as amended by SARA, and to the extent practicable, the NCP.

2.4. SCOPE AND ROLE OF THE RESPONSE ACTION

This Record of Decision addresses the evaluation of remedial alternatives for the Offshore Area. This response action does not include or affect any other sites at the facility that fall under the CERCLA process. In addition to upland areas being investigated throughout FNOD, and as stated in Section 2.1 above, there are other waterway areas that are being evaluated separately from the Offshore Area, including the Nearshore Area, Fishing Pier, Streeter Creek, and the ponds that occur along the shoreline including TCC Lake, J Lake, and Horseshoe Pond. They are the subject of separate investigations and separate determinations of need for any remedial actions that may be necessary to protect human health and the environment.

Regarding the Offshore Area of Concern, the role of the preferred alternative in the Response Action is to address all potential FNOD-related threats posed by the Offshore Area and to eliminate current exposure pathways that may pose unacceptable human health or ecological risk from contamination.

2.5. SITE CHARACTERISTICS

This section of the Record of Decision contains information on the physical and biological conditions of the Offshore Area and the nature and extent of contamination, and human health and ecological risk assessments. Site characteristics were documented by two marine investigations (2000 Environmental Survey and the 2002 Old Pier Survey, Section 2.5.1)

summarized in the subsection below. The nature and extent of contamination was determined from these surveys, and identification of Contaminants of Potential Concern (CoPCs) was accomplished through the Ecological Risk Assessments (ERA) and Human Health Risk Assessment (HHRA). Summaries of ecological and human health CoPCs and site-related risks are provided in Section 2.7 below.

The complete reports for each investigation can be found in the associated Information Repository and Administrative Record files at the locations provided below:

Tidewater Community College Library
7000 College Drive
Portsmouth, Virginia 23703
(757) 822-2130

U.S. Army Corps of Engineers, Norfolk District
803 Front Street
Norfolk, Virginia 23510-1096
(757) 441-7507, FNOD Project Manager

2.5.1. Site Investigations

2000 Environmental Survey. A broad field survey of the entire Offshore Area was conducted in 2000 and involved a multipart geophysical survey employing bathymetry, side-scan sonar, subbottom profiling, magnetometry and sediment profile image (SPI) photography, as well as the collection of sediment cores and surface grab samples to characterize extent and nature of chemical contamination (Figure 2-2). A total of 234 sediment profile images were collected at 136 stations throughout the Offshore Area to characterize bottom sediments and benthic habitat conditions. Sediment grab samples and cores were collected at 31 stations for characterization of grain size, total organic carbon, sediment chemistry, and sediment toxicity tests. The sediment cores collected were up to 2 meters in length and were used to evaluate sediment chemistry at greater depths than the surface grab sample sediment characterizations. Sediment chemistry analyses consisted of determination of metals, Simultaneously Extracted Metals (SEM) and Acid Volatile Sulfides (AVS), polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides, dioxins and explosive compounds. Amphipod toxicity testing was also performed on grab samples.

Findings from the Environmental Survey investigation indicate that the Offshore Area consists of a relatively flat intertidal and shallow subtidal zone extending from the shoreline to a break in slope approximately 2500' to 3000' offshore. Scattered metal objects were detected during the magnetometer survey, including numerous identifiable objects (e.g., crab pots) as detected with the side-scan survey. Sub-bottom profiles showed evidence of layering in nearshore areas, presumably due to recent high rates of deposition associated with erosion of the adjacent uplands. Grain size consists predominantly of fine sand, with a trend toward finer grain sizes with increased depth. The sediment profile interface (SPI) photographs revealed that recently colonized organisms dominate the benthic community and are restricted to the top few centimeters of sediment; this is likely due to frequent physical disturbance of the sediment from waves and currents. The benthic community is dominated by opportunistic, Stage I organisms

(likely due to physical sediment reworking and high organic loading). These results were used to develop the conceptual model and design of the draft Screening Level Ecological Risk Assessment (SLERA) for the Offshore Area, as well as subsequent more detailed evaluations of ecological risk in the Baseline Ecological Risk Assessment (BERA), as well as in support of the Human Health Risk Assessment (HHRA). First and foremost was the observation from sediment profile interface (SPI) photographs that benthic epifaunal ecological receptors occupy a biologically active zone that is limited to the top few centimeters of sediment, and most often exist in the top few millimeters of sediment since deep burrowing organisms were not observed.

Sediment chemistry analyses indicated that contaminants were generally low in the surface (0-10 cm depth) and sub-surface (>10 cm depth) sediments. Additionally, no amphipod toxicity was observed in these sediments.

2002 Old Pier Survey. While the survey effectively characterized geophysical features and chemical extent within most of the Offshore Area, it did not effectively characterize the Old Pier area as remnant pilings and shallow water depths in this area impeded survey vessel access. Accordingly, a supplemental survey of the Old Pier area was conducted in 2002, and involved sidescan sonar, SPI photography and sediment grab sampling as conducted for the 2000 Environmental Survey (Figure 2-3). In addition, tissue samples (croaker and blue crab) were collected at sediment grab locations to provide collocated sediment and tissue chemistry data needed to complete trophic models for the BERA (Figure 2-4). In all, 202 SPI images, 7 sediment grab samples and 5 croaker and 6 blue crab samples were collected. As for the 2000 Environmental Survey, sediment samples were analyzed for metals, SEM:AVS, PAHs, PCBs, pesticides and explosive compounds. Dioxins were not quantified in sediment samples as they were in the 2000 survey because substantial elevated concentrations were not detected during that investigation in the subset of samples analyzed. Additionally, as in the 2000 survey, amphipod toxicity testing was performed on collected sediments.

In all, 202 SPI images, 7 sediment grab samples and 5 croaker and 6 blue crab samples were collected in the Old Pier Area. Concentrations of sediment contaminants within the Old Pier area were generally low, and no amphipod toxicity was observed in the sediment toxicity tests as in the 2000 Environmental Survey. Additionally, the croaker and blue crab tissue concentrations were also generally low. Results of a detailed evaluation of the measured contaminant in sediment and fish with respect to possible ecological and human health risks are discussed in the following Sections.

2.5.2. Remedial Actions

No remedial actions have been performed in the Offshore Area due to the finding of negligible risk described in Section 2.7, below.

2.5.3. Confirmation Sampling

As no remedial actions were performed in the Offshore Area, confirmation sampling was not required.

2.6. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

The Offshore Area is a shallow, sub-tidal waterway with no vegetated or hard-bottom habitat. Its current uses by humans are primarily for recreational and commercial fishing. During field

investigations, recreational hook and line fishermen were observed fishing from several shore side locations, including the banks near the Old Pier. Fishermen were also observed fishing from boats temporarily rafted along the Old Pier. Upon inquiry, most fishermen replied they were fishing for croaker, presumably for consumption, although frequent landings were not observed. In terms of commercial fishing, the blue crab trap fishery is active in the Offshore Area, as evidenced by observations during field surveys and detection of numerous crab traps in sidescan imagery collected during the 2000 Environmental Survey.

No additional information regarding site use was obtained through public comments, including in response to the public comment period on the Proposed Plan and at the public meeting held on December 4, 2003.

Risk to humans from contaminants in the Offshore Area as a result of these activities was assessed in the HHRA (Section 2.7.2). The HHRA concluded that risk was negligible as few contaminant elevations were identified in croaker and blue crab tissue, and these elevations were not related to elevated levels of contaminants in the sediments of the Offshore Area. It is anticipated that future site uses will be similar to current uses, and hence risk will continue to be negligible.

2.7. SUMMARY OF SITE RISKS

Risks from contaminants in the Offshore Area were evaluated in two assessments: the Baseline Ecological Risk Assessment (BERA; Section 2.7.1) and a Human Health Risk Assessment (HHRA; Section 2.7.2). These studies concluded that FNOD-related risks to ecological and human receptors presented by the Offshore Area are negligible, and do not warrant remedial action. (Note that this determination pertains to FNOD-related risks only, not other sources of risk in the region, as there is currently a VDEQ fishing advisory for this area of the James River.)

Both the ecological and human health risk assessments included identification of Contaminants of Potential Concern (CoPC). CoPC selection is a process that permits refinement of the list of the Target Analyte List (TAL) compounds to identify those chemicals that are potentially causing site related risks. The process involves screening maximum (or 95% confidence limit) site chemical concentrations against respective ecological and human benchmarks, with retention of analytes that have a maximum concentration that exceeds the appropriate, conservative benchmark value, per EPA guidance (EPA 1992). Screening was performed using the combined chemical concentration dataset from the 2000 and 2002 surveys. Two separate CoPC lists were generated, one based on ecological risk, the other on human risk, because the benchmarks for each evaluation are different. The results of these screenings are provided in Table 3.6-3 (summary table) and Appendices A-1 to A-3 of the *Baseline Ecological Risk Assessment for the Marine Offshore Area* (SAIC 2002) and in Table 2-1 of the *Human Health Risk Assessment of the Marine Offshore Area* (SAIC 2002b). Details of the screening process are contained in the respective sections of the reports, and brief summaries of the findings are provided below.

2.7.1. 2002 Baseline Ecological Risk Assessment (BERA)

Sediment chemistry and SPI data from the 2000 Environmental Survey, and sediment and tissue chemistry data from the 2002 Old Pier survey, were used to conduct the BERA, which was completed in September 2002 (*Baseline Ecological Risk Assessment for the Marine Offshore Area of the Former Nansemond Ordnance Depot*; SAIC 2002). The USEPA guidance on

Ecological Risk Assessment (ERA) prescribes an 8-step process separated into two primary phases; Screening Level and Baseline Risk Assessments (SLERA and BERA, respectively, USEPA 1997). Simply stated, the goal of the ecological risk assessment is to assess the probability that chemicals are present in the environment of biotic receptors at concentrations and form that can cause harm. EPA defines the SLERA as "a simplified risk assessment that can be conducted with limited data; where site-specific information is lacking, assumed values should consistently be biased in the direction of over estimating risk" (USEPA 1997). Ecological risk assessment for the Offshore Area was initiated as a SLERA investigation, utilizing a conservative approach to the hypothesis that ecological risk does not exist or that certain contaminants and exposure pathways can be eliminated as potential risks.

Subsequent data collection efforts for the Old Pier survey provided additional, site-specific information that allowed completion of a BERA, including utilization of exposure estimation calculations and trophic transfer models, using the site-specific tissue data. The risk characterization approach employed in the BERA involved estimation of exposure to CoPCs and then calculation of risk based on this exposure, with sediment toxicity test results providing supporting evidence in interpreting site-specific risk. Exposure estimation for sediment-associated receptors (e.g., clams, mussels, oysters) and demersal receptors (e.g., blue crabs, croaker) was accomplished through the calculation of Hazard Quotients (HQs), or the division of measured sediment concentrations by threshold effects values. Risks were then evaluated by ranking these HQs according to four levels of probability of adverse exposure (negligible, low, intermediate, high), and then comparing these findings to sediment toxicity test results. For aquatic avian (e.g., black-crowned night heron) and mammalian (e.g., raccoon) receptors, trophic transfer models were employed to estimate the dose of contaminants to these higher-level predators. These doses were screened against Toxicity Reference Values (TRVs) for available species representing night herons and raccoons, to estimate probability for adverse effects on these representative species.

These assessments concluded that ecological risks in the Marine Offshore Area, including the Old Pier area, were negligible and therefore there was no need for remediation on the basis of ecological risk. It was concluded that this finding was adequately documented and technically defensible as all data needs were adequately fulfilled by investigations to date.

Identification of Ecological CoPCs. For identification of sediment CoPCs, sediment concentrations were screened against the lowest available, conservative, sediment benchmarks, including NOAA Effects Range –Low (ER-L), EPA's Apparent Effects Threshold (AET), and Florida Department of Environmental Protection (DEP) Threshold and Probable Effects Levels (TEL/PEL) benchmarks. Comparisons to upper benchmarks (e.g., Effects Range- Medium or ER-Ms) were used to assess the magnitude of potential hazard posed by a CoPC. CoPCs consist of analytes detected in greater than 5% of the samples, and for which the maximum concentration exceeded the most conservative, lower screening benchmark.

Metals, PAHs, and dioxins were detected in sediments in more than 20% of the samples, but at low concentrations when compared to conservative ecological benchmarks (95% upper confidence limit of the mean were below lower benchmarks, NOAA Effects Range – Low, ER-Ls). Only arsenic and mercury exceeded the ER-L benchmarks for metals. Arsenic exceedances occurred in seven samples, of which only two were surface sediment samples (at the stations farthest from shore) and the remainder were samples from depths greater than 20 cm. Mercury exceeded the benchmark in three sub-surface samples, and not in any surface samples. An

additional analysis for metals availability (SEM:AVS; see SAIC 2000) revealed that the divalent metals (copper, cadmium, lead, nickel, and zinc) were not biologically available to aquatic biota. The biological availability of arsenic and mercury could not be addressed in a manner similar to the divalent metals. However, the results of the biological testing of sediments that indicate a lack of toxicity provides evidence that these metals are not biologically available to the aquatic biota.

For PAHs, only acenaphthene and fluorene were found at concentrations higher than the NOAA ER-L (but not at concentrations exceeding the upper benchmarks, ER-Ms). Dioxins were detected in the majority of samples and thus were retained as a CoPC. Dioxin concentrations were compared to low- and high-risk thresholds using ecological sediment quality guidelines recommended by EPA, and sediment concentrations were an order of magnitude lower than the lower threshold for fish and birds, and only occasionally exceeded the lower threshold for mammals by a slight margin.

In the pesticide group, five chemicals, 4,4'-DDD, 4,4'-DDT, aldrin, dieldrin and endrin ketone, were detected with a frequency >5% and had maximum concentrations that exceeded the ER-L benchmark, and thus were retained as CoPCs. Of these, only dieldrin exceeded the upper screening benchmark (ER-M).

As for the PCBs, most of the 24 congeners were detected only infrequently. Seven congeners were detected with at least 5% frequency (52, 153, 169, 170, 180, 195, 206, and 209); PCB congener 153 was the most frequently detected (42% of the samples). However, total PCBs only exceeded the benchmark in one location, and total PCBs were not retained as a CoPC based on frequency of detection below 5%. Finally, neither explosives nor kepone were detected and thus were not retained as CoPCs.

Results of the sediment toxicity tests using 10-day exposures of the amphipod, *Leptocheirus plumulosus*, indicated no sediment toxicity.

In summary, the ecological CoPC screening process identified the following chemical classes and compounds as CoPCs:

- Metals: arsenic and mercury;
- PAHs: acenaphthene and fluorene; and
- Pesticides: 4,4'-DDD, 4,4'-DDT, aldrin, dieldrin and endrin ketone.

Ecological risk calculations were conducted on these identified sediment CoPCs as summarized in the following section.

Ecological Risk Characterization. The risk characterization approach to evaluate potential ecological risks associated with these CoPCs involved estimation of exposure to CoPCs and then calculation of risk based on this exposure, with sediment toxicity testing results providing supporting evidence in interpreting site-specific risk. Details of the exposure modeling efforts are presented in Section 4 of the BERA report. The analysis includes consideration of organisms that would be subject to direct, continuous exposure (Infaunal, Epibenthic and Demersal Receptors), and those that would be subject to discontinuous exposure to the sediments in the Offshore Area (avian and mammalian receptors), discussed in the sections below.

Risks to Infaunal, Epibenthic and Demersal Receptors. Direct, continuous exposure was conservatively assumed for organisms living in the sediment (e.g., clams, mussels, oysters) and demersal predators (e.g., blue crabs, croaker). Potential risk for these organisms was evaluated through the calculation of Hazard Quotients (HQs), or the division of measured sediment concentrations by threshold effects values (Table 4.2-1 in the BERA). Highly conservative threshold effects levels were used to account for all potential risk and to account for long-term, chronic effects of exposure. Risks were then evaluated by ranking these HQs according to four levels of probability of adverse exposure (negligible or below lower benchmark, low, intermediate, high or more than two-fold above the upper benchmark), and then comparing these findings to sediment toxicity test results.

Probability of adverse exposure was determined based on a qualitative evaluation of the frequency and magnitude of benchmark exceedances for each CoPC. Statistical comparisons among stations were not conducted, and estimations of FNOD background conditions were not incorporated into the evaluation. Consideration was given to the depth in the sediment at which the elevated concentrations occurred, as the type of organisms living in the sediment and feeding in the Offshore Area sediments would not likely be in contact with sediments at greater depth in the substrate. For identified ecological CoPCs, benchmark exceedances were generally of relatively low magnitude (i.e., not substantially higher than the very conservative screening benchmarks used), infrequent (occurred in a limited number of samples), and/or occurred at substrate depths greater than 20 cm.

Evaluation of the sediment CoPCs indicated that mercury exceeded the lower benchmark at only three locations and at depths greater than 20 cm. Arsenic exceeded the benchmark at seven stations, only two of which occurred in the upper 20 cm of sediment, located at stations furthest from the shoreline. PAH exceedances of the lower benchmark only occurred at one station. Similarly, isolated occurrences of benchmark exceedance for the pesticides DDD, DDT, and dieldrin were highly localized and appeared unrelated to any FNOD source areas.

Results of sediment toxicity tests (no toxicity observed) and evaluation of pore water exposure to CoPCs (modeled based on the sediment concentrations) supported the conclusions that the constituents identified as CoPCs do not appear to be an important source of risks to infaunal, epibenthic and demersal receptors at the site.

The characterizations of potential effects based on benchmarks are conservative given that many of the species do not spend their entire life span at a single location. The acute toxicity tests confirm the prediction of lack of effects based on these benchmark comparisons. The spatial analysis, indicating a lack of widespread contamination additionally suggests that any location-specific benchmark exceedances are likely not a significant concern given the mobility of most species.

Risks to Avian and Mammalian Receptors. Discontinuous exposure scenarios were evaluated for mammalian (raccoon) and avian (black-crowned night heron) aquatic predators that could feed in the Offshore Area. Trophic transfer models were employed to estimate the dose of contaminants to these higher-level predators. Exposure levels were calculated by determining the dose of chemical (chemical concentration in prey, sediment and/or pore water times the ingestion rate), the exposure factor (the duration the animal is exposed to the contaminants), and

the bioavailability of the contaminants (how much chemical is absorbed by the animal's tissues per unit food consumed). These doses were screened against Toxicity Reference Values (TRVs) to represent the local species including black crowned night herons (Table 4.2-5 in BERA) and raccoons (Table 4.2-6 in BERA), to estimate probability for adverse effects on these representative species. Trophic transfer models include numerous assumptions about the food preferences, size and behavior of the animals that are incorporated from the available literature. The models include the highly conservative assumption that the animals spend their entire lives feeding in the Offshore Area. In addition, the most conservative dose-based benchmarks are used, or No Observed Adverse Effect Level (NOAEL), to provide the most conservative evaluation possible and account for possible chronic effects.

Results for black-crowned night heron indicated that only metals (chromium, lead and zinc) were detected in surface sediments at several sampling locations at sufficient concentrations to predict an exposure that would exceed the TRV. Hazard Quotients for the exceedances for these comparisons were all less than 10.

Results for raccoon indicated that the metals arsenic, cadmium, and chromium, were found in surface sediments at sufficient concentrations to predict an exposure that would exceed the TRV. Additionally, isolated exceedances were observed for PCBs, aldrin and heptachlor. All exceedances corresponded to Hazard Quotients less than 10, and none of the analytes with TRV exceedances indicated a trend of increased concentration near the FNOD shoreline.

These screenings were based on the NOAEL benchmark, which is a factor of ten below the Lowest Observed Adverse Effects Level (LOAEL) benchmark typically representing a chronic or sub-chronic (non-lethal) endpoint and is thus highly conservative. Additionally, calculation of a station-specific HQ (maximum site concentration compared to TRV) assumes the animal would feed on prey items exclusively at that particular station, which also represents a highly conservative approach.

Based on the highly conservative assumptions used in the exposure assessment, and the very conservative TRV values used, it was concluded that the few identified exceedances do not represent a high probability of adverse effects to aquatic predators such as black-crowned night heron, and mammalian predators, such as raccoon, at the site.

Ecological Risk Summary. Based on these assessments presented in the BERA, chemical contaminants detected in the sediments of the Offshore Area do not appear to be related to activities on the site and are unlikely to pose risks to ecological receptors. Uncertainties associated with this conclusion are discussed in Section 4.2.3 of the BERA and include uncertainties associated with sample collection and identification of CoPCs, and uncertainties associated with the various modeling efforts undertaken to assess the potential risks of those CoPCs to ecological receptors. The final determination of the BERA is that ecological risks in the FNOD Offshore Area, including the Old Pier Area, are negligible and there is no need for remediation because of ecological risk.

The BERA was based on thorough documentation of the site conditions and chemical distributions; thorough review of site history; development of conceptual models, data needs, study boundary and decision criteria, following Data Quality Objectives (DQOs); exposure estimates based on conservative assumptions and using maximum chemical concentrations; calculation of Hazard Quotients using conservative benchmarks to indicate which contaminants might pose ecological threats; and incorporation of sediment toxicity test results using site

sediments. Uncertainties were minimized to the extent possible for the BERA, and multiple approaches were undertaken to substantiate the lack of site-related risks to ecological receptors. Therefore, it was concluded that this finding was adequately documented and technically defensible, as all data needs were adequately fulfilled by investigations to date.

2.7.2. 2002 Human Health Risk Assessment (HHRA)

The HHRA for the Offshore Area (SAIC, 2002b) was prepared in accordance with EPA guidance described in Risk Assessment Guidance for Superfund (RAGS), Volume 1, Human Health Evaluation Manual, Part A (EPA, 1989) and Part D (EPA, 2001), and EPA Region III guidance documents for Risk Assessment. These methods consist of identifying likely potential exposure pathways in the Offshore Area, which were determined to consist of exposure to contaminants through consumption of recreationally caught fish and shellfish. Accordingly, the croaker and blue crab tissue concentrations utilized in the BERA were screened against human health Risk-Based Concentration (RBC) benchmarks for fish and regional background concentrations to identify Contaminants of Potential Concern (CoPCs) that could pose risks to humans. It was determined that direct human contact with sediment in the Offshore Area was unlikely, and sediment CoPCs were identified for comparison to tissue CoPCs and not for identification of potential human health risks.

Conceptual Site Model. In the Conceptual Site Model for the FNOD Offshore area, potential routes of exposure to FNOD-related contaminants include the consumption of chemicals in fish and crabs by adults, adolescents and children. Recreational fishing occurs in the Offshore Area and around the Old Pier pilings, and presents a plausible exposure pathway for humans based on consumption of chemicals in finfish and crabs that have be taken up chemicals into their tissues from ingestion of the sediment and sediment-associated prey items.

As the Offshore Area is limited to waters offshore of the subtidal zone, there is no residential access. The area is too deep for wading and other recreational activities such as swimming are not likely to occur in the Offshore Area; therefore, it was determined that human contact with the sediment would be unlikely. There is potential for human contact with sediment while pulling traps set in the Offshore Area, but based on the prevalence of sandy substrate, it is unlikely that any appreciable amount of sediment would be carried to the surface on a trap. It was therefore determined that direct contact with sediment was not a likely pathway for exposure of humans to contaminants in the FNOD Offshore Area. Accordingly, these pathways were not evaluated. The ingestion of sediment or water during fishing is possible but is not considered a likely route of chemical exposure and therefore this pathway was not evaluated quantitatively. The conceptual site model included evaluation of potential exposure from consumption of fish and crabs by adults, adolescents, and children based on recreational (i.e., not commercial) fishing patterns, based on known patterns of use in the area.

Identification of Human Health CoPCs. The sediment and tissue chemistry data that were used in the BERA were also used for the HHRA. For the HHRA, the tissue concentrations of croaker and blue crab collected during the Old Pier survey were compared to the human health Risk-Based Concentrations (RBCs) for fish. Appropriate adjustments were made to ensure consistent units and to account for additive effects on non-carcinogenic analytes, consistent with EPA Region III guidance (EPA 2002). Results are presented in Appendices B-1 to B-3 of the HHRA report, with comparisons to EPA RBC values provided in Section 2.2.3 of the report.

For six blue crab (claw meat analyzed) and five fish (croaker, cross-section of tail section analyzed) tissue samples analyzed, several metals were either not detected or were detected at low concentrations similar to those measured in blank samples (aluminum, antimony, cadmium, lead, nickel, silver). Arsenic, chromium, copper, iron, mercury, and zinc were detected frequently, while silver was detected in two of 11 samples.

PAHs were either not detected or were detected at low levels (e.g., maximum concentrations less than 100 µg/kg) with the exception of four PAHs detected at somewhat elevated concentrations (> 100 µg/kg), including benzo(b)fluoranthene, fluoranthene, phenanthrene and pyrene.

PCB congeners were either not detected or detected at very low concentrations (*i.e.*, less than 10 µg/kg), with only one congener exceeding this value (PCB 153, 12 µg/kg). The highest Total PCB concentration observed was 33 µg/kg. Two pesticides, 4,4'-DDE and 4,4'-DDT, were detected at concentrations of 3.3 µg/kg and 7.7 µg/kg, respectively. Dioxins were not measured in fish tissue samples. Finally, 14 explosives compounds were analyzed in the tissues of crabs and fish, but concentrations were non-detect in all samples.

To address the fact that the tissue samples were collected from motile species that would be expected to feed over a broad area, not limited to the FNOD Offshore Area, tissue CoPCs were selected using a tiered analysis approach. First, predicted tissue residue concentrations were developed from the measured sediment chemical concentrations at the site (using regionally applicable bioaccumulation factors developed for this project) and compared to the EPA RBCs. Subsequently, for those chemicals where a prediction of fish tissue residues to exceed the RBCs was obtained, the corresponding measured fish and crab tissue concentrations were screened against the same RBCs. Because not all elevated CoPCs in tissue were elevated in site sediments, this method ensured that the human health risk analysis focused only on those site-related sediment-associated CoPCs.

The EPA Region III RBC screening values used in screening the predicted and measured fish tissue concentrations incorporated the EPA guidance regarding target lifetime cancer risks ($1x10^{-6}$) for carcinogenic analytes as well as possible cumulative additive effects of non-carcinogenic analytes. Comparison of predicted tissue concentrations with the appropriate RBCs eliminated all but eight analytes as CoPCs (Table 2-1 in the HHRA report). CoPCs include two metals (arsenic and manganese), three PAH compounds (benzo(a)anthracene, benzo(a)pyrene and benzo(b)fluoranthene, Total PCBs, and the pesticides aldrin and dieldrin.

Based on these exceedances, these analytes were further evaluated by comparing the measured tissue concentrations to the RBCs (Table 2-2 in the HHRA report). Aldrin and dieldrin were eliminated as CoPCs based on this screening as they were not detected in any of the tissue samples. Manganese is not on EPA's list of bioaccumulative chemicals and has no corresponding Bioaccumulation Factor (BAF), and thus was not retained as a CoPC. The remaining analytes initially identified as CoPCs were retained as CoPCs for further quantitative risk analysis.

In summary, the human health CoPC screening process identified the following chemical classes and compounds as CoPCs:

- Metals: arsenic;
- PAHs: benzo(a)anthracene, benzo(a)pyrene, and benzo(b)fluoranthene; and

- Total PCBs.

Human health risk calculations were conducted on these identified tissue CoPCs as summarized in the following section.

Human Health Risk Characterization. In order to evaluate potential risks associated with the identified tissue CoPCs, exposure assessments (estimates of the magnitude, frequency and duration of exposure) and toxicity assessments (assessment of potential adverse health effects of the CoPCs) were used to develop numerical human health risk estimates. Exposure point concentrations were estimated from the data for the highest exposures reasonably expected to occur.

Exposure parameters required include body weight, exposure duration, averaging time, which are common to all or most exposure pathways, and fish ingestion rate, exposure frequency and fraction ingested from the contaminated source, which would be variable for given populations. Selection of these factors for adults, adolescents, and children is described in Section 3.3.2 of the HHRA report. These factors and the exposure point concentrations were used to quantify chemical intakes for each segment of the population. The chemical intakes for the five tissue CoPCs were then evaluated in terms of toxicity risks to humans using hazard identification and dose-response assessment for carcinogenic and non-carcinogenic risks.

Carcinogenic effects to humans from exposure to chemicals were estimated quantitatively using cancer slope factors (CSFs) that convert estimated exposures to incremental lifetime cancer risks, and using EPA classifications for potential carcinogens (classes defining known, probably, possible, etc., carcinogens). Of the five tissue CoPCs, arsenic is a Group A carcinogen or has known carcinogenic effects, while the remainder are Group B2 carcinogens or agents for which there is sufficient evidence for carcinogenicity in animals but inadequate or lack of evidence in humans.

Cancer risks were characterized as the incremental increase in the probability that an individual would develop cancer during his or her lifetime due to site-specific exposure. The term "incremental" implies the risk due to environmental chemical exposure above the background cancer risk experienced by all individuals in the course of daily life. For example, a $2x10^{-6}$ cancer risk means that for every one million people exposed to the carcinogen under the specified exposure conditions throughout their lifetimes, the incidence of cancer may increase by two cases.

The combined risk from exposure to multiple chemicals was evaluated by adding the risks from individual CoPCs for adults, adolescents and children. The EPA considers action to be warranted at a site when the total carcinogenic risk to a receptor exceeds 10^{-4} (EPA 1991). Action is generally not required for risks falling within 10^{-4} to 10^{-6}; however, this is judged on a case-by-case basis. Risks less than 10^{-6} usually are not of concern to regulatory agencies.

The Reasonable Maximum Exposure (RME) risks were calculated for adult, adolescent and child receptors (summarized in Tables 7-1 to Table 7-3 in the HHRA report). Risks from exposures to Arsenic, the three PAHs and total PCBs were each greater than 10^{-6} for all receptors (adult, adolescent and child); the respective combined risks were 1×10^{-4}, 2×10^{-5} and 6×10^{-5}. In each case, the majority of risks were due to benzo(a)pyrene. Risks were higher for adult exposures due to a substantially higher rate of fish ingestion and exposure duration. As the calculated risks

to adults, adolescents and children are within EPA's acceptable risk range of 1 $x10^{-4}$ to 1 $x10^{-6}$, risks to these receptor groups due to carcinogenic effects is considered acceptably low.

In the present study, all PCB congeners were non-detect for the crab samples. A few positive detections for dioxin-like congeners were observed in fish samples from two stations. To address the dioxin-like toxicity of these PCB detections, dioxin toxic equivalence concentrations (TECs) were calculated to evaluate potential for dioxin-like toxicity associated with PCBs. The maximum calculated TEC concentration for the two fish samples was 1.62 x 10^{-7} mg/kg. Using this value as the EPC value for dioxin, a risk value of 2.6 x 10^{-6} for dioxin-like PCB congeners was obtained. From this calculation, it is clear that the dioxin-like congeners contributed little to the observed overall risk to adult receptor (RME risk = 1 x 10^{-4}).

Non-carcinogenic effects were evaluated using chronic reference doses, which define the daily exposure likely to be without appreciable risk of adverse effects during a lifetime. The sole non-carcinogenic tissue CoPC was arsenic. Estimated exposure point concentrations for arsenic were an order of magnitude below reference dose values for each population (adult, adolescent and child receptors). As arsenic was the only CoPC contributing to the total non-cancer risk resulting from the fish ingestion, and HI values were < 1, it was concluded that acceptable risks to all human receptor populations were present for consumption of non-carcinogenic chemicals in fish and shellfish due to recreational fishing in the FNOD Offshore area.

2.8. DOCUMENTATION OF SIGNIFICANT CHANGES

No significant changes have been made to the "No Further Action" decision selected in the Proposed Plan.

3. RESPONSIVENESS SUMMARY

The Proposed Plan document pertaining to this Record of Decision has been submitted for public review. This Responsiveness Summary summarizes public participation completed in support of the ROD. A Responsiveness Summary is required by CERCLA to provide a summary of citizen comments and concerns about the site, as raised during the public comment period, and the agency responses to those concerns.

3.1. BACKGROUND ON COMMUNITY PARTICIPATION

The U.S. Army Corps of Engineers (USACE) completed the Proposed Plan for the Offshore Area at the FNOD in Suffolk, Virginia, in December, 2003 (USACE 2003). The USACE, Norfolk District, together with the EPA Region III, and the Virginia Department of Environmental Quality (VDEQ), established a public comment period from December 4, 2003, to January 4, 2004, for interested parties to comment on USACE's Proposed Plan for the Offshore Area.

A public meeting was held on December 4, 2003, in order to provide the public more detailed information and opportunity to comment on the rationale for the selected alternative of "No Further Action" presented in the Proposed Plan.

At the time of the Public Comment Period, the preferred alternative for the Offshore Area at the FNOD in Suffolk, Virginia addressed the rationale for "No Further Action." The "No Further Action" alternative presented in the Proposed Plan was based on the findings of previous

investigations which determined that there are no existing and potential risks to human health and the environment.

No copies of the Proposed Plan were picked up at the Information Resource Center; several copies were obtained by members of the public at the public meeting for review. There were no questions or comments received from individuals in attendance at the public meeting on December 4, 2003.

3.2. STAKEHOLDER ISSUES AND AGENCY RESPONSE

The public comment period was held for 30 days, from December 4, 2003, to January 4, 2004. No comments were received by the U.S. Environmental Protection Agency (EPA) Region III, the Virginia Department of Environmental Quality, or the Norfolk District of the U.S. Army Corps of Engineers in response to the public comment period or at the public meeting held on December 4, 2003. As no comments were received, no agency response is required.

The fact that no comments were received during the public comment period supports the "No Further Action" remedy. As a result, the preferred alternative of "No Further Action" has been selected at the Offshore Area as presented in the Proposed Plan.

3.3. TECHNICAL AND LEGAL ISSUES

There are no technical or legal issues to be resolved regarding the Offshore Area and NFA determination.

4. ACRONYMS

AET	Apparent Effects Threshold
AOC	Area of Concern
ARARs	Applicable or Appropriate and Relevant Requirements
AVS	Acid Volatile Sulfide
BAF	Bioaccumulation Factor
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoPC	Chemical of Potential Concern
CSF	Cancer Slope Factor
BERA	Baseline Ecological Risk Assessment
DEP	Department of Environmental Protection
DERP	Defense Environmental Restoration Program
DQO	Data Quality Objective
EPA	United States Environmental Protection Agency
ERA	Ecological Risk Assessment
ER-L	Effects Range-Low
ER-M	Effects Range-Medium
FNOD	Former Nansemond Ordnance Depot
FUDS	Formerly Used Defense Site
GE	General Electric
HHRA	Human Health Risk Assessment
HRSD	Hampton Roads Sanitation District

HQ	Hazard Quotient
LOAEL	Lowest Observed Adverse Effects Level
MLLW	Mean Lower Low Water
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NFA	No Further Action
NOAA	National Oceanic and Atmospheric Administration
NOAEL	No Observed Adverse Effects Level
NOS	National Oceanographic Survey
NPL	National Priority List
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PEL	Probable Effects Level
PP	Proposed Plan
PRP	Potentially Responsible Party
RAGS	Risk Assessment Guidance for Superfund
RAO	Remedial Action Objective
RBC	Risk-Based Concentration
RME	Reasonable Maximum Exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SEM	Simultaneously Extracted Metals
SLERA	Screening Level Ecological Risk Assessment
SPI	Sediment Profile Image
TAL	Target Analyte List
TEL	Threshold Effects Level
TCC	Tidewater Community College
TRV	Toxicity Reference Dose
USACE	United States Army Corp of Engineers
UXO	Unexploded Ordnance

5. REFERENCES

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Figure 1-1. Location of the Former Nansemond Ordnance Depot (FNOD) in Suffolk, VA.

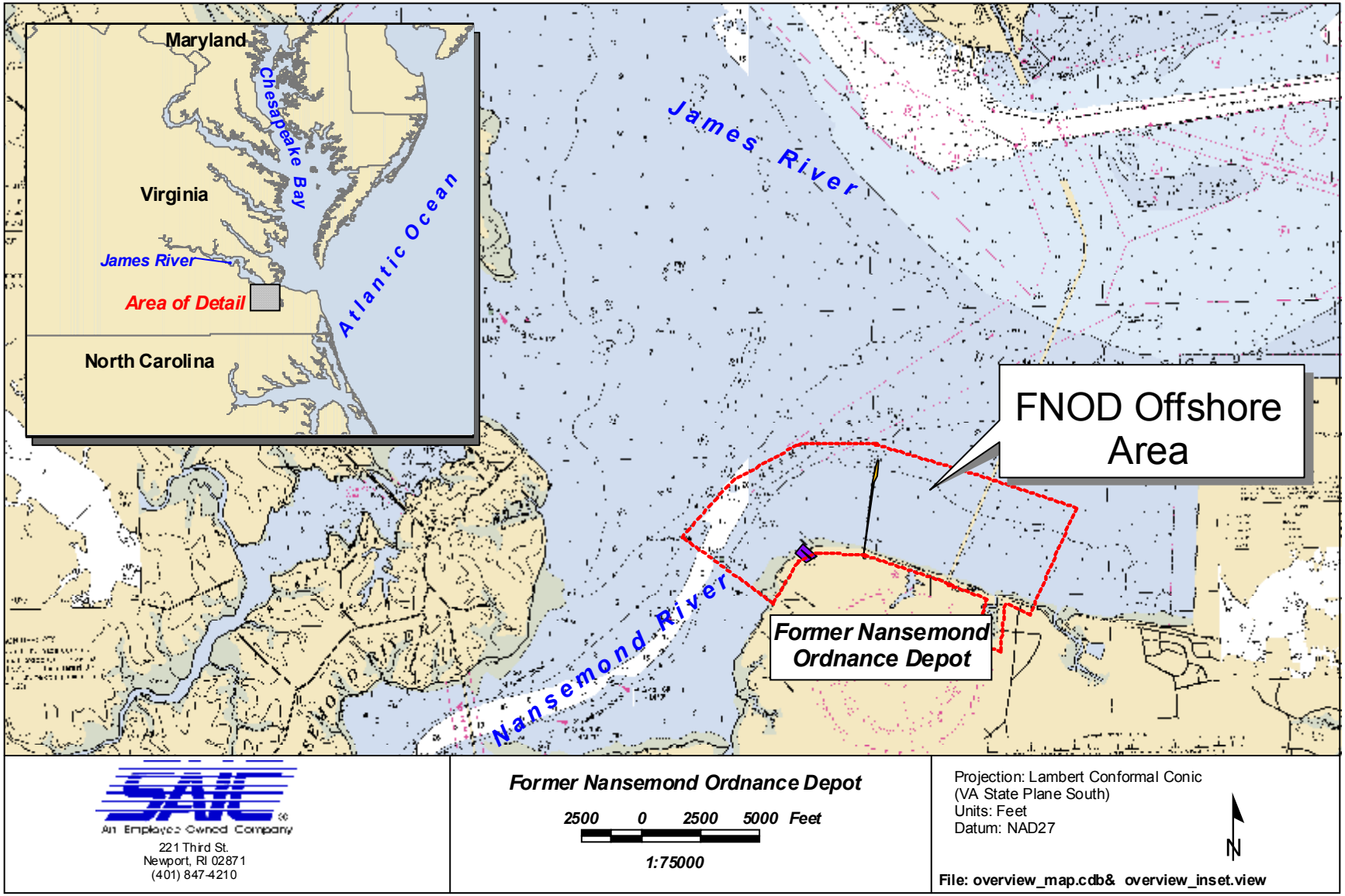

Figure 2-1. Marine aquatic areas being investigated at the FNOD site.

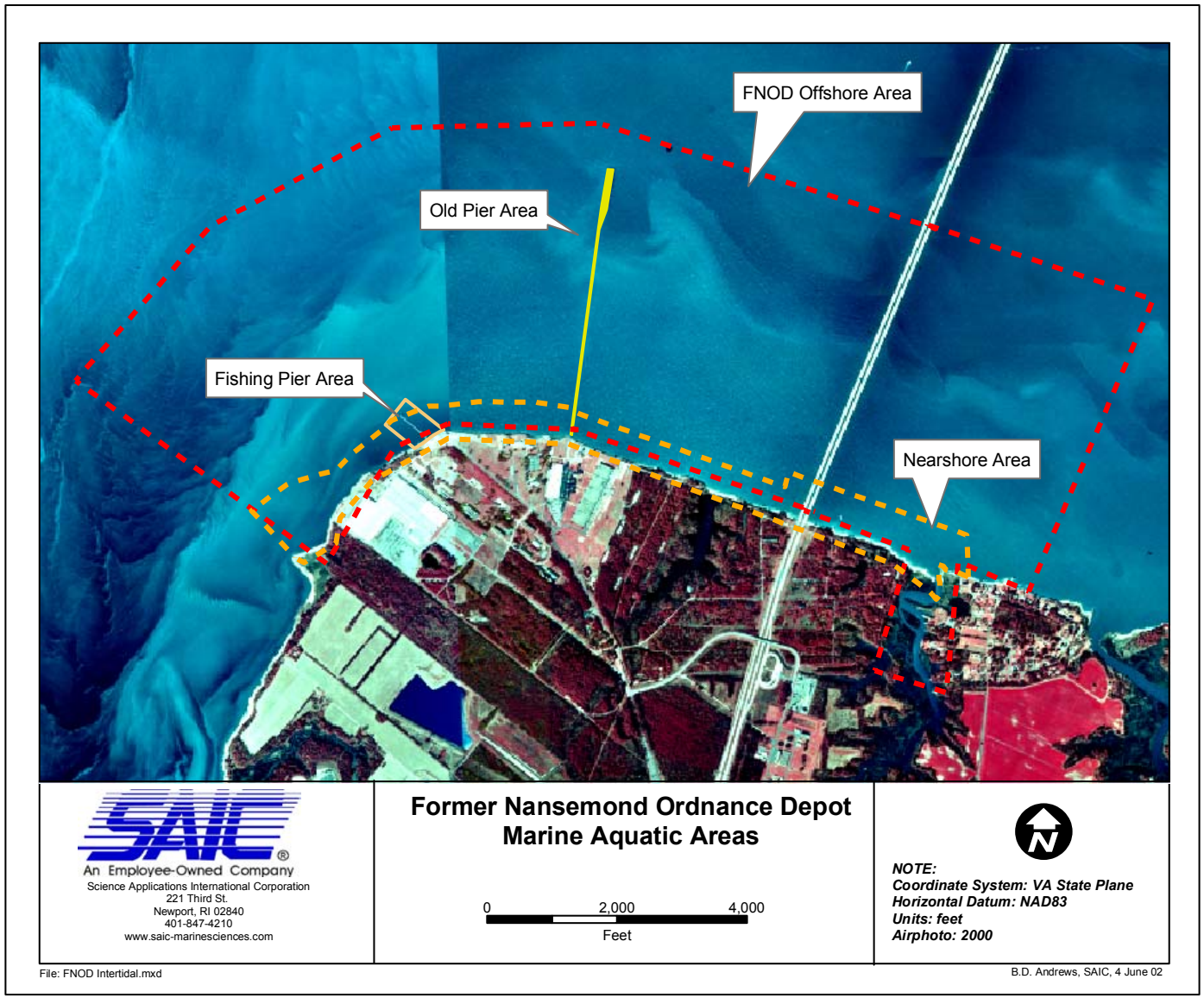

Figure 2-2. Sediment sampling locations in the FNOD Offshore Area.

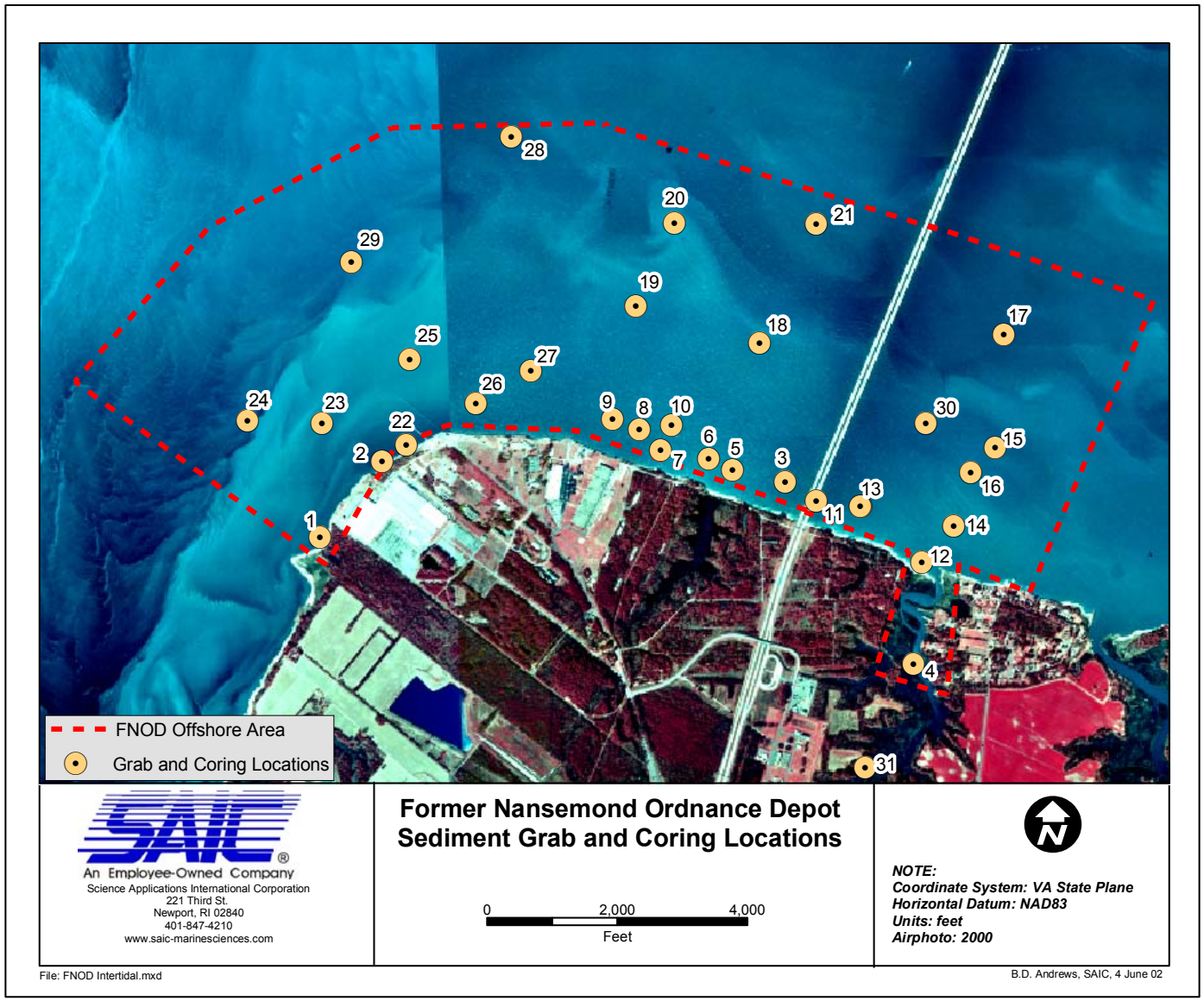

Figure 2-3. Sediment sampling locations in the FNOD Old Pier Area.

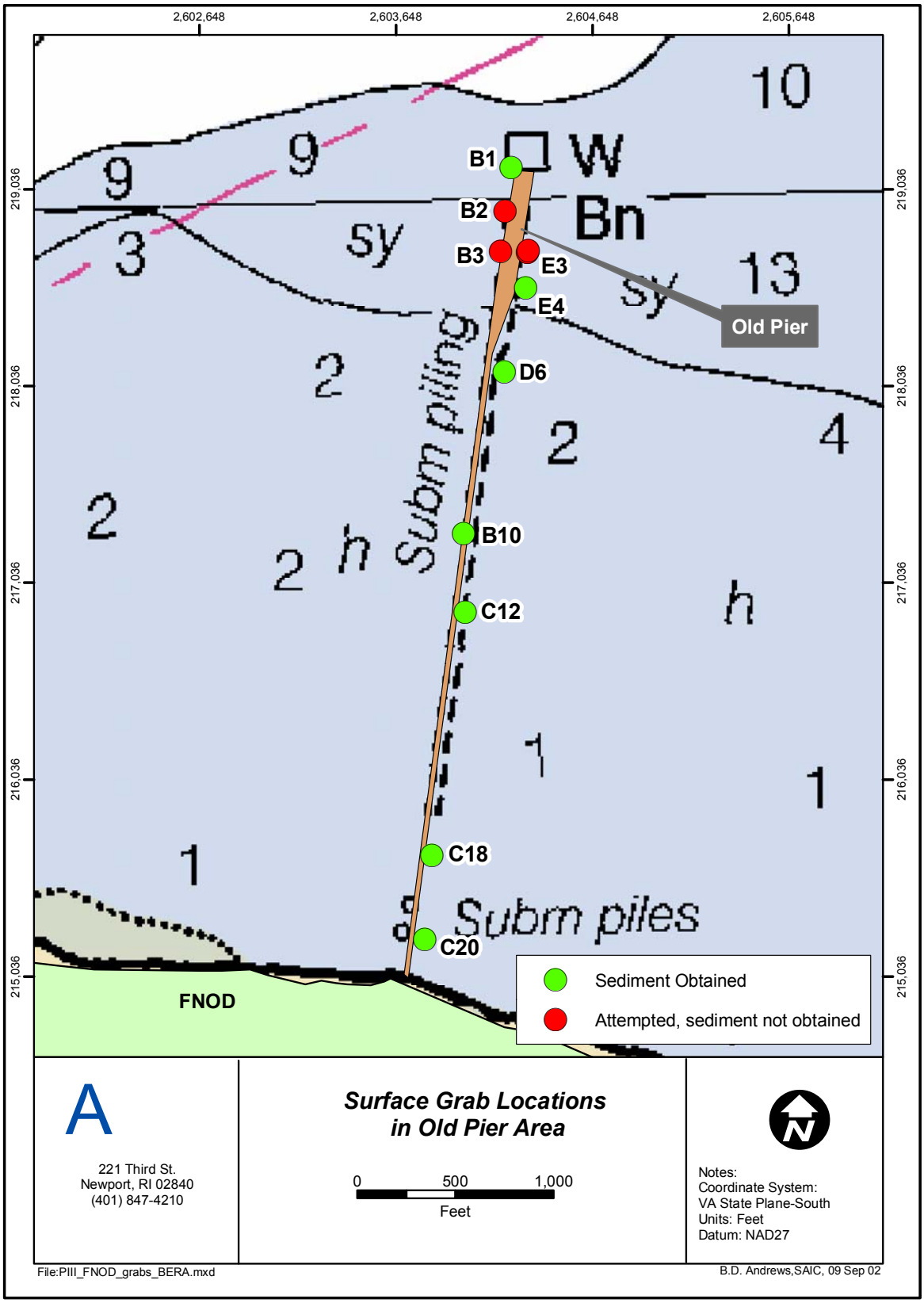

Figure 2-4. Crab and croaker sampling locations in the FNOD Old Pier Area.