Amendment to the Draft Environmental Assessment on the Newark Bay Area of the New York and New Jersey Harbor Deepening Project

A Qualitative and Quantitative Analysis of the Potential Effect of USACE Dredging on the Newark Bay Study Area Remedial Investigation/Feasibility Study

Draft

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INTRODUCTION

1.1 BACKGROUND AND OBJECTIVES

The purpose of this Amendment to the Newark Bay Area Draft Environmental Assessment (NBSA DEA, USACE 2005) is to provide an analysis of the potential effects of the navigational dredging on the ability of the U.S. Environmental Protection Agency (USEPA) Region 2 to meet the goals of its Remedial Investigation and Feasibility Study (RI/FS) for the Newark Bay Study Area (NBSA). This amendment was prepared to update analysis on the best available information as contained in the current draft EA for the ongoing and planned navigational deepening dredging in the Arthur Kill (AK), Kill van Kull (KVK), and Newark Bay (NB). Other activities of the United States Army Corps of Engineers (USACE) in the NBSA are considered in the cumulative evaluation. In addition, while the analyses presented here focus primarily on the Phase I sediment sampling of the RI/FS, they are relevant as well to later phases of the RI/FS sampling, as well as sampling that may be performed as part of the Natural Resource Damage Assessment (NRDA).

Deep-draft navigational dredging is being performed in areas of NB, AK and KVK. The AK 41/40 Project, Contract Area 2/3 and the S-KVK-2 Contract Area of the 50 ft. Harbor Deepening Project (HDP) dredging program is underway and is planned for completion in 2006 and 2007. These areas of deep draft navigation dredging that are the subject of this document are shown in Figure 1a, which includes schedules for each area or contract reach. Other Federal activities in Newark Bay, which include operations and maintenance (O&M) activities as well as USACE permit actions under the Clean Water Act Section 404 and Section 10 of the Rivers and Harbors Act of 1899 (Table 1), are included in this analysis within a cumulative analysis framework.

These dredging locations are within the NBSA, which is an operational unit or study area of the Diamond Alkali Superfund Site. The Diamond Alkali Superfund site occupies approximately 1 acre immediately adjacent to the Passaic River, in Newark, Essex County, New Jersey, which discharges into Newark Bay at its northwestern end. The NBSA consists of Newark Bay, along with portions of the Hackensack River, the Arthur Kill and the Kill van Kull. A Remedial Investigation Work Plan (RIWP) has been developed for the NBSA, under the direction of the USEPA, as part of the RI/FS (Tierra Solutions 2005). The RIWP is to be conducted in phases. The initial data collection of the program includes Phase I sampling of sediments of Newark Bay, a bathymetry survey, and a field evaluation of the biologically active zone (BAZ). Phase I is slated to be conducted in November 2005. Later phases will include additional sampling of sediments, as well as water and biota. Although these later phases have been neither designed nor scheduled, the sampling goals of all phases of sampling is discussed in section 1.2 Description of the RIWP.

In addition, a NRDA may be performed for the NBSA to determine natural resource damages. Field studies for the NRDA have been neither designed nor scheduled, and thus the effects of the dredging cannot be evaluated to any degree of certainty at this time. The potential for dredging projects to affect the ability of the trustees to pursue an NRDA is discussed below in Section 4.

1.2 DESCRIPTION OF THE RIWP

Three goals have been established for the RI/FS (Tierra Solutions 2005, Volume 2a):

Goal 1: "*Determine the horizontal and vertical distribution and concentration of PCDDs, PCDFs, PCBs, PAHs, pesticides and metals for the NBSA sediments*." Sediment sampling will be conducted in phases. Tierra Solutions (2005) addresses the first phase of this work. Subsequent phases will be designed based upon the results of the Phase I investigation.

Goal 2: "*Determine the primary human and ecological receptors (endpoints) of PCDDs, PCDFs, PCBs, PAHs, pesticides, and metals contaminated sediments in the Newark Bay Study Area.*" This phase will involve conducting a human health and ecological risk assessment.

Goal 3: "*Determine the significant direct and indirect continuing sources of PCDDs, PCDFs, PCBs, PAHs, pesticides, and metals in the Newark Bay Study Area*." To meet this goal, a numerical simulation model of the study area will be developed.

Initial data collection will include the Phase 1 sampling of sediment data, assessment of the BAZ, and a bathymetry survey. The primary objective is to address RI/FS Goal 1. The Phase I program will also provide preliminary data for risk assessment (RI/FS Goal 2) and source identification (RI/FS Goal 3). Furthermore, when combined with the historical sediment information, the Phase I data set will be used to establish any future phases of data collection needed to meet RI/FS Goal 1.

The Phase I sampling locations were proposed by Tierra Solutions, Inc. (a Potentially Responsible Party (PRP)) and evaluated and approved by USEPA, with input from USACE. Sampling locations as proposed in the EPA approved RIWP dated September 6, 2005 are presented in Figure 1b. A total of 69 coring locations are to be sampled during the Phase I program (Tierra Solutions, 2005). At each location, samples will be analyzed for a suite of chemicals listed in the RIWP. At 51 of these locations, an additional core will be collected for radiochemical analyses. These samples will be analyzed for radioisotopes to aid in understanding historical sediment deposition rates and mixing. Cores will be collected in the following geomorphic areas:

- Southern Navigation Channels (Newark Bay Main Channel south of Port Newark, Kill Van Kull and Arthur Kill; 12 locations, none for radiochemical analyses);
- Northern Navigation Channels (North of Port Newark; 6 locations, 6 for radiochemical analyses);
- Port Channels (Elizabeth, South Elizabeth and Port Newark; 6 locations; none for radiochemical analyses);
- Transitional Slopes (5 locations; 5 for radiochemical analyses);
- Sub-tidal Flats (28 locations; 28 for radiochemical analyses);

- Inter-tidal Areas (3 locations; 3 for radiochemical analyses); and
- Industrial Waterfront Areas (9 locations; 9 for radiochemical analyses).

For cores that will be subjected to chemical analysis, the top 6 in. of each core will be sampled, as well as deeper portions of the core at intervals of one foot or greater. For radiochemical analyses, cores will be sampled at finer intervals (0-2 in., 2-4 in., 4-6 in., and a series of 2 in. or 5 in. segments located at intervals deeper within the core).

The BAZ investigation will be conducted at 14 locations, each placed immediately adjacent to a proposed Phase I core. Six locations will be in sub-tidal flats (six BAZ locations) five in inter-tidal areas and three in navigational channels (one location in the northern navigational channels and two locations in the southern navigational channels) to assess benthic invertebrate activity in disturbed areas, as well as to gain insight into the recolonization of previously dredged areas (Tierra Solutions 2005). At each location, a SPI camera will be deployed (Tierra Solutions 2005), and grab samples will be collected for in-field visual examination of texture, color, and general benthic invertebrate activity.

The bathymetry survey is to be performed in order to verify the identified geomorphic areas, and to assist the field crew in locating various cores.

1.3 APPROACH

The analyses presented here focus primarily on the potential effects of ongoing and planned navigation dredging on RIWP sediment samples. Potential effects on the bathymetry and BAZ surveys are also incorporated. The approach to this evaluation includes two components:

- assessing the potential effects of dredging on RIWP samples based on available data; and
- through coordination between USACE and USEPA, avoiding, minimizing and/or mitigating any identified potential effects in order to ensure that the RI/FS goals are met.

In addition, the potential effects of dredging on USEPA's ability to meet the general goals of the RIWP are discussed in this document. Potential effects on specific aspects of later phases (for example, water and biota sampling) are also incorporated to the extent possible, given that sampling plans have not been developed by the USEPA as of yet. Similarly, implications for other components of the RI/FS process such as remedy selection, as well as the NRDA, are incorporated to the extent possible, given the early stage of both investigations.

Finally, the cumulative effects of all dredging projects in the NBSA, including the deepening projects, O&M dredging and Federal permit actions are also considered.

SECTION 2
THE EFFECTS OF DREDGING ON RIWP SAMPLING

The AK 41/40 (contract area 2/3) and HDP (contract area S-KVK-2) combined dredging program is underway, and additional dredging is planned for the next several months (Figure 1b). Currently, Phase I sampling planned in the RIWP is slated to begin on November 7, 2005 and continue for approximately one month.

The HDP will involve future dredging to 50 ft. in Newark Bay Channel from the confluence with the Kill van Kull (near Bergen Point) and Arthur Kill (near Shooters Island) northwards to the Elizabeth Channel, including the South Elizabeth Channel (Figure 1b). Dredging is anticipated to begin in 2006 for S-NB-1, in 2008 for S-NB-2, and in 2011 for S-E-1 (Figure 1b). Rock encountered in the deepening project(s) may need to be blasted. Not all areas will need to be blasted. For example, it is currently anticipated that only approximately 6% of the S-NB-1 Contract Area by volume of material constitutes rock.

No aspect of the future-dredging program will influence the RI/FS Phase I sampling. Potential effects on later phases will be considered once those phases are designed and scheduled. Coordination with USEPA is ongoing so as to best plan these future phases, if needed, to minimize effects from current and future deepening.

USACE maintenance dredging in the Port Newark Pierhead and Port Newark Channels is scheduled to begin in March 2006. Phase I sampling is projected to be complete by this time. The schedule for the later RIWP sampling phases has not been developed.

The following discussion addresses and evaluates the extent to which dredging may affect the utility of samples collected pursuant to the RI/FS before and after dredging.

2.1 RIWP PHASE I SEDIMENT SAMPLING

The channels of the NBSA are a dynamic environment for sediment transport since:

- Sediments are resuspended on an ongoing basis due to tidal currents (Burke 2002) and storms;
- Ship traffic resuspends sediments on a regular basis over large geographic areas of the bay;
- The three southern navigation channels have been substantially dredged within the past seven years and periodically dredged in the decades prior; and
- Future dredging is anticipated in order to keep the harbor economically viable, whether as part of this project or USACE navigation channel maintenance requirements.

Because of these processes, sediment resuspension, deposition and mixing are more active in the navigational channels than in the nearby subtidal flats. The current and future dredging that is the subject of this draft Amendment to the DEA will not materially change the dynamic nature of these areas: the channels will continue to be subject to sedimentation and mixing, as well as dredging, for the foreseeable future.

Because of the elevated rates of deposition in the deepened areas of the NBSA (*e.g.*, channels), samples of surface sediments collected in these areas may provide a ready source of recently settled material which can aid in estimating current food web exposure as well as characterizing current sources of contaminants to the NBSA. USEPA plans to collect samples of sediments from the top 6 in. of the bed within the channels for this purpose. (See the summary of the September 8, 2005 coordination meeting, provided in Appendix C of this document). Subsurface samples in the channels are likely to be of limited use, as described in Section 2.1.1.2, below.

Samples collected adjacent to the navigation channels will provide several types of information including current exposure levels for ecological and human health risk assessment, historical trends in exposure levels to aid in estimating the rate of natural recovery, and spatial gradients in surface sediment concentrations to aid in determining the sources of contaminants to the NBSA. Both surface and subsurface portions of the cores will be important to these evaluations.

In the discussion below, the impacts of dredging are considered separately for cores that are in the southern navigation and port channels and thus potentially impacted directly by dredging and cores that are adjacent to the channels, and thus potentially affected indirectly through deposition of resuspended sediments.

2.1.1 Cores To Be Collected Within the Southern Navigation and Port Channels

Twelve of the 69 RIWP Phase I cores will be collected in or adjacent to navigation channels that will be dredged during the deepening projects to be conducted over the next several years. These cores are located south of the Port Newark Channel in the Newark Bay, Arthur Kill and Kill Van Kull Channels, the South Elizabeth and Elizabeth Channels, and on the transitional slopes in the southern part of the NBSA.

2.1.1.1 Surface sediment samples

The cores that are collected prior to the dredging considered in this DEA will provide a record that includes material deposited since the previous dredging event, in some combination with material left after the last dredging event (the dredging residual). Whether or not these sediments are subsequently dredged is immaterial to the interpretation of the core data.

Furthermore, the removal of channel sediments post-sampling will not affect the utility of the surface samples to the RI/FS. To the extent that there is a need for further evaluation of contamination in newly deposited material, future sampling can be conducted in other areas, for example in the subtidal flats or in other areas that were historically deepened but are now not actively maintained. To improve cost-effectiveness it will also be possible to sample in recently dredged areas, after sufficient deposition has occurred. Given estimates of deposition rates in the channels as high as 11 in/yr (Tierra Solutions 2005, Vol 2a), it is anticipated that sufficient new material will deposit, at least in some areas within the NBSA, within the time frame of the RI/FS for subsequent sampling.

2.1.1.2 Subsurface sediment samples

Subsurface portions of the channel sediments are unlikely to be of much use in evaluating historical loadings, in part because much of the material is likely to be either preindustrial-aged deposits (oftentimes from the Pleistocene epoch) that are likely to be relatively free of contamination or are sediments of recent origin due to the high deposition rates (due to the potential for mixing of recent material with older residuals from ship traffic resuspension and previous dredging projects).

The RIWP concludes, “the informational value of the vertical segments is expected to be relatively low” (Tierra Solutions 2005, Vol. 2a, p. 6-9). To evaluate historical deposition, USEPA will focus on data collected in the flats (12 samples in the NBSA), where the subsurface layers that provide the historical record is much less likely to be disturbed by dredging. Therefore, the dredging of the channels will not adversely affect USEPA’s ability to collect historical data.

2.1.1.3 Drilling and Blasting

A small portion of the deepening project will be performed by drilling and blasting rock that cannot be removed otherwise. Blasted rock will subsequently be removed with a bucket dredge or excavator. Current estimates of rock removed for S-NB-1 (Figure 1a) are only 109,000 CY or 6% by volume of the total S-NB-1 contract. The USEPA RIWP projects 5 sample locations in the S-NB-1 Contract area. Blasting is only expected to occur only where there is no other way to remove rock efficiently.

A typical shot pattern impacts a limited area approximately 150 feet long and of varying width from 20 feet to 80 feet depending on the number of ranges drilled. In general, one to three shot patterns can be completed in a 24-hour period per drill barge. Each hole has a placement of an explosive charge and a detonator. The hole is stemmed above the explosive charge with coarse gravel at the top of the hole to confine and direct the blast energy into the rock. Placement, volume of explosives, stemming and the sequential detonation (timing delays) causes the rock to fracture and move laterally rather than having a violent explosion released up into the water column thus minimizing resuspension.

Considering the limited surface area affected by blasts per day, the minimal sediment on the bedrock, the cohesive nature of the sediment, and the timing of the work being coordinated with the Phase 1 sampling, drilling and blasting is not expected to adversely affect EPA's RIWP.

2.1.1.4 Coordination plan

The Phase I sediment sampling is currently scheduled for November and December of 2005. EPA has notified USACE that the RIWP process is iterative and adaptive, and thus schedules may change; however, the current coordination plan is based upon the most recent information and ongoing collaboration will allow adjustments to be made as necessary.

To address the issue of potential conflicts between the RIWP sampling and the dredging, the USACE and USEPA are coordinating their efforts to: (1) identify those cores in or adjacent to areas where dredging is scheduled for Fall 2005, based upon a detailed assessment of dredging plans and core locations; and (2) change the locations of these cores to areas that will achieve the RIWP goals but minimize effects of dredging on the sampling. Coordination between Tierra Solutions and these agencies is described in the RIWP (Tierra Solutions 2005, Vol 2a, p. 2-22). As part of the coordination activities, USACE will provide the USEPA with a description of the history of dredging activity throughout the NBSA, along with the results of previous data collections, in order to aid USEPA in the interpretation of historical deposition in the channels. This coordination effort has included several meetings of the USEPA and USACE teams. At these meetings, a technical working group was established to address the details of the two programs. As of this writing, several Phase I sampling locations have already been moved to alternate locations that consider recent and proposed dredging activity which better meet the objectives of the RI/FS with little to no overall impact to the data collection grid. Details of the changes are documented in Appendix C. This coordination team will continue to meet throughout the lifetime of the RI/FS to coordinate NBSA activities.

2.1.2 Cores To Be Collected Adjacent to Dredged Areas

In areas adjacent to the channels and/or on the tidal flats, resuspended sediments may be deposited on the sediment surface, thus potentially affecting the interpretation of future core data. In these areas, only core slices at or near the surface may be affected; the subsurface segments of the cores will not be affected, thus preserving the ability of the RIWP data to provide the information necessary to evaluate deposition rates and characterize historical loads. The effects of the resuspended dredged material on the surface sediments of the NBSA will be determined by the contaminant concentrations of the resuspended sediments, the amount of sediment resuspended, and the spatial extent of the resuspension. To evaluate these effects, the amount and spatial extent of material resuspended by dredging, the contaminant concentrations in the resuspended material, and the resultant contaminant concentrations in surficial sediments following redeposition analyses are assessed below.

2.1.2.1 Dispersal of Resuspended Material

The dispersal of resuspended material in Newark Bay was measured in two recent studies performed by USACE to supplement the analyses presented in the 1999 HDP FEIS/ROD.

The 2001 Resuspension Study

The USACE conducted a study in 2001 (USACE 2002) to investigate total suspended solids concentrations (TSS) in New York/New Jersey Harbor, including the area now known as the NBSA. Four types of investigation were carried out. The results of each investigation are summarized below:

(a) Ambient Water Quality – Ambient levels of TSS in the southern half of the NBSA were measured 13 times between March 2001 and March 2002 at 8 stations both inside and adjacent to the channel areas in the surface and bottom stratum of the water column at each station (depth of bottom stratum varies by the bathymetry at each station). The ambient TSS ranged between 4.3 and 44 mg/L in bottom waters. The stations located in the shallower areas of the Bay (i.e., flats areas) tended to have higher levels of TSS in the bottom stratum than were measured in the bottom stratum of the stations located within the channels. Ambient levels of TSS in the surface stratum ranged between 3.3 and 40 mg/L, but usually were between 5.0 and 23 mg/L. These measurements were collected independent of tidal phase.

(b) Post-storm Event – TSS levels were measured on May 25, 2001, 48 hours after a rainstorm, which produced just over two inches of rainfall over a three-day period. TSS levels remained within the range of ambient values, however, it is likely that the sampling occurred too late to capture any storm-induced resuspension that may have occurred; thus the results are inconclusive.

(c) Container Ship Passage – TSS levels were measured in the plumes of two passing container ships in the area referred to now as the NBSA on November 14, 2001. One container ship was located near the South Elizabeth Channel and the other near the Howland Hook Terminal in the Arthur Kill. The plumes were located visually. TSS levels in Newark Bay ranged between 10 and 797 mg/L at the surface, between 75 and 432 mg/L at mid-depth, and between 14 and 952 mg/L at deeper depths. The levels measured above 75 mg/L occurred at sampling stations in the off-channel, flats area located south of the South Elizabeth Channel. On March 14, 2002, TSS values at the top, mid-depth and bottom stratum were measured in various stations in Newark Bay and Arthur Kill following the passage of several container ships. The TSS measured in the surface, mid-depth and bottom stratum ranged from 10.0 mg/L to 136.0mg/L, 9.0 mg/L to 113.0 mg/L, and 9.0 mg/L to

108.7 mg/L, respectively. Thus, ship passage resulted in elevated TSS values both within and adjacent to the channel areas: the levels measured in off-channel, flats areas following container ship passage exceeded ambient levels by more than 10-fold.

(d) Active Dredging Activities with Closed Bucket Dredges – TSS levels were measured downstream of an active dredge in the Port Elizabeth Channel roughly located in the middle of Newark Bay. The dredge was using a closed-clamshell bucket to remove surficial silty material for upland placement. The plume from the dredge was identified visually. The TSS levels measured 80m up current of the dredge in Elizabeth Channel ranged between 12.3 and 27.3 mg/L in the mid-depth and bottom strata. TSS levels measured 30m downstream of the dredge ranged from 30 to 78 mg/L and decreased to ambient, up-current conditions within 125m from the dredge.

2005 Resuspension Study

In 2005, the USACE performed a study of the resuspension of sediments from dredging operations in southern Newark Bay (USACE 2005). Turbidity was measured and TSS samples were collected on four dates in the vicinity of dredging operations east of Shooter's Island where the Kill van Kull opens into Newark Bay. Monitoring occurred during both ebb and flood tides. The primary dredge in operation in the area during the sampling was the "Bean 2" dredging surficial silt material with a closed, 8 cubic yard Cable Arm® clamshell bucket for upland beneficial use. During the August 1st and 15th sampling events, the excavator dredge "Taurocavor" was dredging hard Historic Area Remediation Site (HARS) suitable glacial till, clay and rock material in the vicinity of the "Bean 2", approximately 1,500 ft and 3,000 ft away, respectively. Samples were collected upstream of "Bean 2" dredge operation to measure background turbidity and TSS levels at distances typically ranging from 250 to 350 ft. Measurements were made downstream of the "Bean 2" dredge at distances of approximately 250, 500 and 1000 ft. At each distance downstream of the "Bean 2" dredge, three samples were targeted, one in the plume and two located along a perpendicular to the plume ("north" and "south" stations), in order to estimate the lateral extent of the plume. Turbidity measurements were performed at several depths throughout the water column. Wherever possible, TSS samples were collected at surface, mid and bottom depths. Duplicate samples were collected at most locations.

Figures 5a-5d present the TSS levels measured on each sampling date. The data collected during ebb and flood tides are presented in the left- and right-hand columns, respectively. Data collected along the estimated plume centerline and at the north and south edges of the plume are presented in the center, top and bottom panels, respectively. The patterns exhibited by the turbidity data were similar to those exhibited by the TSS data, and a full report is presented in Appendix B. A brief discussion of the TSS data follows.

(a) July 1st, 2005 (Figure 5a) – TSS levels upstream of the dredge ranged from 5 to 15 mg/L. Approximately 250 ft downstream of the "Bean 2" dredge, levels ranged up to 72 mg/L in the channel during ebb tide measurement. However, these concentrations fell to levels similar to up current levels as measured 500 ft and 1000 ft from the dredge. During flood tide measurements, stronger currents were visually observed around the dredge than were present during ebb tide. TSS concentrations measured during flood tide were greater downstream from the dredge than the upstream levels. Nonetheless, all downstream values, except for the ebb tide values measured closest to the dredge, were within the range of ambient TSS levels measured in 2001. Furthermore, the TSS levels measured at 1000 ft downstream in the deeper waters at the center station were higher than the TSS levels measured at 500 or 250 ft. Thus, dredging cannot be conclusively established as the cause of the higher TSS levels downstream of the dredge.

(b) July 19th, 2005 (Figure 5b) - TSS levels upstream of the "Bean 2" dredge ranged up to 20 mg/L. All values measured downstream of the dredge during ebb tide were less than 25 mg/L. During flood tide, values at one station (the south station) located approximately 250 ft downstream of the dredge ranged up to 90 mg/L in the deeper waters while all other downstream measurements were not statistically different from the up-current measurements. Further, except for this single station, all other measurements were within the range of ambient levels reported in the 2001 study (USACE 2002). This suggests that either the plume was actually located in the vicinity of the south station and/or that the elevated TSS was not due to dredging (a large container ship was noted passing in the vicinity during the flood tide measurements).

(c) August 1st, 2005 (Figure 5c) – During ebb tide, TSS levels in the bottom stratum of water upstream of the "Bean 2" dredge were approximately 55 mg/L with levels of approximately 2 to 21 mg/L in all other upstream and downstream measurements. During flood tide, all levels ranged from 10 to 55 mg/L. Sampling during flood tide was limited due to in-water obstructions (*e.g.*, heavy ship traffic) in the area and time/tide constraints. Given that all the downstream measurements were within the range of ambient or up-current conditions, there was no evidence for a significant effect of resuspension from dredging.

(d) August 15th, 2005 (Figure 5d) – Samples were collected only during the flood tide. TSS levels measured at multiple stations upstream of the dredge "Bean 2" ranged from 15 to 38 mg/L. Levels at one station, approximately 300 ft downstream from the dredge, ranged up to 60 mg/L in the deeper water stratum. All other downstream values were similar to or below the up-current measurements. Thus, the resuspension at this location was relatively minor and within 250 ft of the dredging operation.

Discussion

The site-specific studies conducted by the USACE show that dredging may produce TSS concentrations downstream of dredging activity that are greater than concentrations measured upstream. That is, a plume is observable.

In general, however, plumes were localized to within 250 ft downstream of the dredge and were limited to the channel. In addition, elevated concentrations were observed only in some samples, and in most cases, downstream concentrations remained within the range of ambient TSS levels measured in the NBSA. Thus, the data indicate that the effects of dredging on suspended sediment dynamics, especially in the flats adjacent to the channels, are minimal, both temporally and spatially.

Dredging is not the only or necessarily the largest cause of resuspension in Newark Bay. In the 2001 study, the passage of container ships was observed to cause a dramatic increase in TSS concentrations to levels considerably greater than background. From 2002 to 2004, there were between 2,700 and 3,200 transits of ships longer than 700 ft that passed Bergen Point each year (LCDR Ernest Morton, New York Vessel Traffic Service, United States Coast Guard, personal communication, September 14, 2005). This equates to approximately 7 to 9 ship transits on average each day. This level of activity indicates that resuspension due to ship traffic cannot be dismissed as insignificant relative to dredging resuspension. Furthermore, a dredge moves slowly, resulting in a plume that is fairly contained and localized to the location being dredged, whereas ships traverse much of the study area, influencing larger areas of the Bay and Kills. Consequently, the data indicate that ship traffic may result in higher levels of resuspension over a geographically broader area and on a more frequent basis than does dredging. Thus, while dredging may increase TSS levels locally, it is not clear that any such increase is significant relative to resuspension caused by natural processes and ship traffic.

These two resuspension studies are preliminary because of the limited amount of data and the study design. The USACE plans to supplement these results with future studies to be conducted as part of a continuing monitoring program. The design of future resuspension studies is currently being refined in conjunction with the USACE Engineer Research and Development Center (ERDC), with the goal of providing information that will be of use not only to the USACE dredging programs in the NBSA, but to ERDC's larger efforts to evaluate and refine dredging operations (see Appendix B). These efforts include the planned development of a numerical model of sediment dynamics in the NBSA using the framework Suspended Sediment FATE (SSFATE) (Johnson et al. 2000, Swanson et al. 2000). The field sampling will be designed to provide the data needed to refine the SSFATE modeling for the NBSA, which is planned by ERDC. [The previous demonstration project involving the use of the early version of the SSFATE model (NYNJ Harbor Partnership 2003) suffered from typical model imperfections that made the results variable; see Appendix A]. Future evaluations will include the use of the updated model to aid in interpreting the field data.

Furthermore, these data and model results will be available to support USEPA's future efforts. Thus, the USACE dredging programs' environmental support and protection initiatives will provide valuable field data and model results to USEPA that otherwise would not be available.

Finally, the results of the two studies demonstrate that elevated concentrations that may be observed in locations down-current of a dredge are not necessarily directly linked to the dredge, due to natural variability as well as the presence of other factors that lead to elevated TSS, *e.g.*, storms tides, ship passage, etc. (Bohlen, W.F. 1980),

2.1.2.2 Contaminant Concentrations in Resuspended Material

The effect of dredging on contamination throughout the NBSA will depend on whether contaminant concentrations in the resuspended material are likely to be similar to, greater than, or less than the contaminant concentrations in the surface sediments of the study area.

To investigate this issue, contaminant levels measured in the surface sediments of the southern portion of the NBSA were compared with contaminant levels that have been measured in subsurface sediments and in samples representing dredged material. These analyses rely upon all available sediment data collected within the study area since 1990. These include data compiled with the NOAA Newark Bay Database (NOAA 2004). The NOAA data were supplemented with data reported more recently by USEPA through the Regional Environmental Monitoring and Assessment Program (REMAP; USEPA 2003). Additional data from Newark Bay generated through the Contaminant Assessment and Reduction Program (CARP) and by Bopp and colleagues (*eg*. Chaky 2004) were collected adjacent to the study area and therefore not included.

A total of 49 core and grab samples were collected within the southern portion of the NBSA and are used in this analysis. The area from which these samples were taken is indicated in Figure 1a. Many of these cores included a surface slice of up to 6 inches in thickness, which was used here to represent surface contamination. These cores also included a series of subsurface slices that were used to investigate vertical gradients.

In addition, a series of cores were collected by USACE in sediments currently being dredged or planned for dredging in southern Newark Bay (contract area S-NB-1), Arthur Kill (contract area AK-2/3) and Kill van Kull (contract area S-KVK-2). These cores were collected by USACE for the purpose of evaluating the dredged material for placement options. The penetration of these cores ranged in length/depth typically a few feet but up to 25 ft in some locations. Laboratory analyses were performed on composites of one to three whole cores, consistent with regulatory requirements. These composites provide a representation of the contaminant levels expected to be observed on material resuspended by the dredging operation. These levels were compared with surface sediment contaminant levels, estimated using the database described above. Analyses were performed for 2,3,7,8-TCDD, total PCBs, benzo(a)pyrene, mercury, total DDT (pp-DDT, pp-DDE, and pp-DDD), and chromium. These are contaminants of major importance in the study area. Chromium was included, as Tierra Solutions has suggested the possibility that contamination may have occurred for more than 100 years due to historical leather tanning activities in the area (Tierra Solutions 2005) and thus may be present in deeper strata of the sediment bed.

To represent dioxins and furans, the analyses presented here focused on the concentration of 2,3,7,8-TCDD. One congener was chosen, because not all databases include multiple congeners. Furthermore, the calculation of toxic equivalents (TEQs) introduces an additional source of uncertainty into the evaluation of gradients, insofar as toxic equivalency factors (TEFs) are, in general, only order-of-magnitude estimates of the relative toxicity of individual congeners. 2,3,7,8-TCDD constitutes approximately 50% of the total TEQs for total dioxins + furans (based upon an analysis of multiple dioxin and furan congeners measured in the USACE composites).

Benzo(a)pyrene (BAP) was used to represent polynuclear aromatic hydrocarbons (PAHs), because it is relatively more toxic than the others (Collins et al. 1991), and because the list of PAH compounds is not consistent across databases.

All surface and subsurface concentrations are compared in two ways. First, mean concentrations are presented. These provide an indication of average levels to which biota would be exposed and therefore are directly relevant to risk assessment. Uncertainty is reported using error bars that represent +/- two standard errors of the mean. However, averages can be strongly influenced by individual outliers. Therefore, box plots are presented as well. These display the 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentiles of the data, as well as outliers, defined as values that extend beyond the 10^{th} and 90^{th} percentiles. For data sets with less than 15 points, all observations are presented on the box plots. In addition, direct comparison of the contaminant concentrations in individual core segments of sliced cores (non-USACE cores only) are provided as cross-plots.

In the first analysis, average contaminant concentrations were calculated for core sections within specified depth bins: 0 – 0.15 m, 0.15 – 0.85 m, and 0.85 – 2.0 m below the sediment surface (Figure 2). The average concentrations of each of the compounds analyzed here were found not to change significantly with depth, as indicated by the similarity in the means and the overlap of the error bars (calculated as two times the standard error (bottom panels); in the case of DDT and BAP, there is a suggestion of a decline in concentration with depth. Box plots of the same data support the conclusion that there is no evidence of an increase in concentrations with depth (top panels).

In an extension of this analysis, contaminant concentrations in each surface slice (0 – 0.15 m) were compared with subsurface concentrations measured in the same core (Figure 3). Values are generally scattered around the 1-to-1 line or fall below it, indicating that concentrations at the surface are similar to or higher than those in deeper sediments.

In an additional analysis, the average contaminant concentrations measured in the composited USACE cores were compared with the average concentrations measured in surface sediments (Figure 4). Average composite core concentrations of the contaminants measured in the Newark Bay and Kill van Kull areas were similar to or less than concentrations in the surface sediments, indicating that resuspended dredged material will not likely increase surface sediment contaminant concentrations. Similarly, average concentrations of 2,3,7,8-TCDD in Arthur Kill composite cores were similar to concentrations in the surface sediments. Average concentrations of the other compounds in Arthur Kill composite cores were greater than the overall averages for the surface sediments.

In summary, these analyses support the conclusion that the deposition of resuspended dredged material is unlikely to change surface 2,3,7,8-TCDD concentrations in the southern bay significantly. There may be effects due to other chemicals present in Arthur Kill. These potential effects were evaluated further, as described in the next section.

2.1.2.3 Effect of Resuspended Material on the RIWP Samples

The effect of the resuspended materials on contaminant levels in surface sediments was calculated using estimates of the extent of deposition of the resuspended material and the concentrations of contaminants on the resuspended material. The theory underlying the analyses presented here is generic, and is relevant to the entire NBSA. The application of this theory focuses on the Arthur Kill contract 2 material because of the typically higher concentrations of some contaminants found in this contract area when compared to other dredging contract areas' data (*i.e.*, S-NB-1, and S-KVK-2).

The extent of deposition

The extent of deposition was calculated based upon estimates of resuspension losses from dredging operations and deposition rates in Newark Bay. This information was used to produce an estimate of the thickness of a sediment deposit that might be expected in the flats due to dredging.

Resuspension results in a flux of sediments to the water column that is given by Equation (1):

$$W = \frac{\alpha V_{dr} B}{T} \tag{1}$$

where:

$W =$ load of suspended dry solids into the water column (kg/yr)

$\alpha =$ the proportion of dredged material that is resuspended

$V_{dr} =$ volume of sediments dredged (m^3)

$B =$ dry bulk density of the dredged material (kg/m^3)

$T =$ duration of dredging (yr)

This load is divided into two components, one of which settles in the channel and one in the flats:

$$W = F_c + F_f \tag{2}$$

where:

$F_c =$ load of sediments to the bed of the channel (kg/yr)

$F_f =$ load of sediments to the bed of the flats (kg/yr)

These loads are given by:

$$\begin{aligned} F_c &= v_{d,c} M A_c \\ F_f &= v_{d,f} M A_f \end{aligned} \tag{3}$$

where:

$v_{d,c} =$ deposition velocity in the channel (m/yr)

$v_{d,f} =$ deposition velocity in the flats (m/yr)

$M =$ concentration of solids in the water column (kg/m^3)

$A_c =$ channel area (m^2)

$A_f =$ flats area (m^2)

The deposition rates in the channels and flats are related using a proportionality factor β:

$$v_{d,c} = \beta v_{d,f} \tag{4}$$

Combining Equations (1) through (4) and rearranging, the fluxes settling on the sediment bed are given by:

$$F_c = \frac{\beta V_{dr} B A_c}{(A_f + \beta A_c)T}$$
$$F_f = \frac{V_{dr} B A_f}{(A_f + \beta A_c)T} \tag{5}$$

The total depths of sediment deposited on the bed over the entire dredging period (T years) are given by:

$$D_f = \frac{F_f}{BA_f}T$$
$$D_c = \frac{F_c}{BA_c}T \tag{6}$$

where:

D_f = extent of deposition rate in the flats (m)

D_c = extent of deposition rate in the channel (m)

Combining Equations (5) and (6), the total depths of sediment deposition are given by:

$$D_c = \frac{\alpha\beta V_{dr}}{(A_f + \beta A_c)}$$
$$D_s = \frac{\alpha V_{dr}}{(A_f + \beta A_c)} \tag{7}$$

The effects of dredging on deposition adjacent to the dredging areas was estimated for the Arthur Kill flats, since contaminant levels were greatest in the dredged material from this area. This includes both remaining AK 41/40 (currently underway) and the future HDP work in the Arthur Kill (not scheduled to begin until 2007). Parameters of Equation (7) were estimated as follows:

- Recent estimates of the amount of sediment resuspended from standard clamshell bucket operations in estuaries range from about 0.1% to about 1.0% of the material dredged (Hayes et al. 2004, USACE 2003). A value of 1% was considered to be conservative for environmental or closed clamshell buckets (Hayes et al. 2004) and was used here to estimate the load of sediment released by dredging (parameter α).
- The amount of material resuspended (Vdr) was estimated based upon the sum of "hard" material (*i.e.*, preindustrial-age glacial till and clay), and soft material unsuitable for placement at HARS. This represents a conservative estimate, because all of the hard material is preindustrial-age sediment deposits that are suitable for HARS placement. The total volume of dredged material for the Arthur Kill contract areas 1, 2 and 3, including both the AK 40/41 material and the 50 ft material is estimated to be 3,800,000 yd3 (Vdr), the majority of which is preindustrial-age sediments that have been or are expected to be found suitable for placement at the HARS.
- Some of this material is likely to be transported within the channel and some is likely to leave the NBSA via either the Arthur Kill or the Kill van Kull (Caplow et al. 2003). The calculation presented here rested on the conservative assumption that all resuspended material remains within the NBSA.
- The flats and the channels are very different depositional environments. Deposition rates have been estimated to be about 0.35 cm/yr in the flats of Newark Bay (vf; Suszkowski 1978) and to range from about 5.0 to 10.0 cm/yr in the channels (vc; Suszkowski 1978; Tierra 2005, Vol 2a, page 3-6f). These provide estimates of the relative rates at which resuspended dredged material is likely to deposit on the beds of the flats and channel (β = 75/3.5 = 21).
- The total aquatic area of the Arthur Kill contract areas 1, 2 and 3 is approximately 860,000 yd2 (Ac). An equal area of flats in the vicinity of the Arthur Kill was assumed for this calculation (As). The calculation is found not to be sensitive to uncertainty in the area of flats.

Based on Equation (7), for the Arthur Kill, the overall average thickness of the sediment layer that is expected to deposit, from dredging, on the sediment bed in the flats is less than 0.2 cm. This is less than 2% of the thickness of the 6 in. core segment to be collected by USEPA.

It should also be noted that, for areas adjacent to the channels, such a small degree of deposition means that the dredging will not affect the bathymetry survey, which is to be conducted during the Phase I activities. The USACE will provide to the USEPA highly detailed surveys of the depths of the channels after dredging. Furthermore, for the same reason, effects of dredging on the BAZ survey are likely to be insignificant.

Effects on contaminant concentrations in surface sediments

To assess the potential effects of the elevated concentrations observed in the Arthur Kill dredged material on the RIWP samples collected in the flats, a weighted average of the newly deposited dredged material and the existing surface sediments was computed, in order to simulate the concentration of each contaminant anticipated in a 6 in. (0.15 m) core post-dredging (C_{post}):

$$C_{post} = \frac{1}{0.15}\left[D_f C_{AK} + (0.15 - D_f) C_{av}\right] \qquad (8)$$

where:

C_{av} = the average contaminant concentration in the surface sediments of the Newark Bay area prior to deposition of the dredged material (based on surface segment of NOAA sediment cores) (mg/kg)

C_{AK} = the average concentration of the dredged material in Arthur Kill, which conservatively applies the average level of contaminant concentration of the surficial HARS unsuitable material to the volume of both the surficial HARS unsuitable material and the underlying HARS suitable material (mg/kg)

Based on Equation (8) and contaminant concentrations listed in Table 2, the contaminant concentrations in 6 in. surface sediment core segments would be increased by no more than 5%

for all chemicals due to the dredging of Arthur Kill sediments. As described above, this is a conservative estimate, because of the inclusion of "hard" preindustrial-age dredged material in the estimate of total volume dredged at the same average concentration levels as the surficial silty HARS unsuitable sediment, the use of a 1% loss rate, and perhaps most importantly, the assumption that all resuspended material stays within the NBSA.

The results of this analysis, while calculated using data collected in the Arthur Kill, are relevant to the rest of the NBSA; insofar as concentrations of some contaminants in dredged material from the Arthur Kill are higher than in the other dredged areas, potential effects elsewhere in the NBSA are likely to be less than those estimated here.

2.1.2.4 Conclusions

Based on a conservative analysis (*i.e.*, tending to overestimate), resuspended material is unlikely to result in the deposition of more than a thin layer of material on the flats of NBSA; this layer has been estimated to be less than 2% of the thickness of the 6 in. core segments to be collected by USEPA. Furthermore, this redeposited dredged material is unlikely to affect contaminant concentrations in surface sediments by more than 5%. Thus, the effect of the deepening work on the RI/FS cores is likely to be *di minimus* in nature.

Moreover, to the extent that deposition is sufficient to affect analyses, the USEPA sampling program is designed to provide information that will aid in the proper interpretation of cores collected in the study area. Discontinuities that may occur at the sediment surface due to newly deposited material may be observable in the contaminant and radiochemical analyses that will be performed. For example, the absence of Beryllium-7 or the presence of elevated Cesium-137 levels in the surface segment would be indicative of older subsurface material that had deposited on the bed.

2.2 RIWP PHASE II: WATER SAMPLING

The Phase I field investigations do not include water sampling (Tierra Solutions 2005). Later phases will likely include water column sampling. Because the extent and timing of this component of the RI/FS program has not been developed, the effects of the HDP cannot be determined at this time. Nonetheless, two aspects of the ongoing efforts will provide the basis for ensuring that any potential effects of the deepening projects on water sampling are minimized.

First, the USACE has collected and will continue to collect resuspension data to assess the extent of the dredging plume. Initial field efforts have indicated that dredging plumes are likely to be localized to within a few hundred feet of the dredge. The data will be interpreted in conjunction with analyses to be performed using the updated SSFATE model. These efforts will provide guidance on the appropriate distances that should be maintained between a dredge and a sampling device, as well as the timing of sampling (ebb vs. flood tide; minimum time after dredging ceases), for each area to be dredged.

Second, ongoing and planned coordination between USACE and USEPA will ensure that these programs are developed in a manner that ensures that the remedial investigation is tightly coordinated with the dredging schedule. The coordination team has met numerous times since September 2004, as USEPA revised and updated the RIWP. Many of the RIWP revisions were made based on recommendations and data provided by USACE.

2.3 RIWP PHASE II: BIOTA SAMPLING

The Phase I field investigations do not include biota sampling (Tierra Solutions 2005). Later phases will likely include biota sampling.

Contaminant levels in biota are controlled by contaminant levels in their exposure sources, that is, in the surface sediments and in the water column. Organisms that feed in the sediment bed are exposed to contaminants in the surface mixed layer, which is probably on the order of 6 in. in depth (e.g., Boudreau 1994). The BAZ samples to be collected during the Phase I activities will aid in defining the biologically active layer for the NBSA. As described above, insignificant deposition is expected in the flats, and average contaminant concentrations in surface sediments are unlikely to be affected significantly, and thus the deepening projects are unlikely to affect the exposure of the benthic food web significantly.

Effects on the water column food web will depend on the concentrations of contaminants on particles suspended in the water, the concentrations of contaminants dissolved in the water, the duration of exposure to potentially elevated concentrations, and the extent of movement of the species of interest throughout the Newark Bay area. Based upon the overall lack of vertical gradients in contaminant concentrations (see above), the concentrations of contaminants on particles resuspended by dredging are unlikely to be greater than concentrations on particles resuspended by other mechanisms, *e.g.*, tides, storms (Bohlen, W.F. 1980), ship traffic, etc. Based upon the USACE composite cores, some of the resuspended dredged material from Arthur Kill will likely exhibit contaminant concentrations greater than surface sediments, but the impact of these sediments on water column concentrations in the study area is likely to be small, because dredging plumes are limited in extent. Thus, food web exposure in the NBSA from this route is not likely to be affected materially.

Resuspended material may also contribute contaminants to the dissolved phase of the water column. The effect of this material is likely to be limited insofar as TSS concentrations measured in dredging plumes generally lay within the range of ambient TSS levels (see above). Future more refined TSS monitoring and modeling will permit a more accurate assessment of the extent of resuspension.

The other two factors contributing to the exposure of the food web, namely the duration of exposure and the spatial extent of exposure are typically the focus of the risk assessment phase of a remedial investigation. USEPA will be performing a risk assessment for the NBSA (Tierra Solutions 2005), which should provide the information needed to further evaluate impacts on water column exposure of the food web.

In summary, while the effect of the dredging on future biological sampling cannot be determined conclusively at this time, the preliminary analysis indicates that the effects will be limited. Furthermore, ongoing and planned interaction between USACE and USEPA will ensure that these programs are developed in a manner that minimizes potential effects of the dredging project on biota sampling.

SECTION 3
EFFECTS ON COMPONENTS OF THE REMEDIAL INVESTIGATION AND NRDA

3.1 THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY

Key components of a RI/FS are risk assessment, source assessment, and remedy selection. All of these rely upon field data. Insofar as effects on surface sediment contamination are likely to be minimal, in this case, effects on the ability of the USEPA to assess risks to people and wildlife, to assess sources, and to design a remedy are similarly likely to be minimal.

The basis for remedy selection for the NBSA cannot be conclusively determined at this point, since the remedial investigation is in its beginning stages. Historically, potential remedies include dredging, capping, in-situ remediation, and monitored natural recovery (USEPA 2002). Remedy selection will likely depend in part upon the estimation of the rate of natural recovery, upon the identification of contaminant sources, and upon an evaluation of the fate, transport and bioaccumulation of contaminants in the NBSA. The ongoing and planned dredging is unlikely to affect these aspects of the decision-making process significantly, for several reasons, including the following:

- The rate of natural recovery will likely be estimated in part based upon the analysis of vertical profiles of contaminant concentrations and radionuclides collected in the subtidal flats. Subsurface sediments in these areas will not be affected by the dredging. The rate of natural recovery may also be addressed by an evaluation of changes over time in contaminant concentrations in surface sediments. As described above, the dredging program is unlikely to result in more than an insignificant change in surface sediment contaminant concentrations adjacent to the channels, and thus is unlikely to materially affect the estimation of the rate of natural recovery.

- Source assessment will be based in part upon an analysis of spatial gradients in surface sediment contaminant concentrations. The analyses presented here indicate that dredging is unlikely to affect surface sediment concentrations adjacent to the channel significantly. Samples are targeted in the channels to supplement samples collected in the flats, with the goal of assessing current contaminant concentrations depositing in the bay. These data will also be used to evaluate sources through the analysis of spatial gradients and fingerprints. By collecting these samples prior to the upcoming dredging, USEPA will be able to interpret these data as planned. This will be achieved based upon the ongoing coordination between USACE and USEPA.
- The risk assessment and the fate and transport and bioaccumulation modeling that are planned as part of the RI/FS will rely upon sediment data for model development and calibration. As described above, dredging is unlikely to materially affect surface sediment concentrations, and thus is unlikely to affect these aspects of the RI/FS significantly.

Furthermore, the biological, physical and chemical data that will be collected by the USACE, as well as the modeling that will be performed as part of the USACE comprehensive environmental monitoring program for the deepening projects, will provide information to USEPA that would not otherwise have been available for use in the feasibility phase of the RIWP study.

3.2 THE NATURAL RESOURCES DAMAGE ASSESSMENT

Natural Resource Damage Assessments require a quantification of injury to a resource, a pathway from the presumed source(s) of the injury to the target population, and a plan for restoration. As for the RI/FS, all of these rest upon field data. Field studies for the NRDA have been neither designed nor scheduled, and thus the effects of the dredging cannot be evaluated to any degree of certainty at this time. Nonetheless, the analyses presented in this amendment suggest that effects on the NRDA are likely to be insignificant, since dredging is unlikely to result in more than insignificant changes to surface sediment contaminant concentrations. In addition, as described above, information on historical loadings can be summized from the adjacent flats.

Coordination with the trustees, who include NOAA, the United States Fish and Wildlife Service (USFWS), the New Jersey Department of Environmental Protection (NJDEP), and the New York State Department of Environmental Conservation (NYSDEC), is ongoing and will be continued to ensure the utility of samples that may be collected for the NRDA, and to ensure that the effects of dredging on the NRDA process will be minimized to the greatest extent practicable.

SECTION 4
CUMULATIVE EFFECTS OF PROJECTS IN THE NBSA

The purpose of this section is to evaluate the effect on the environment which results from the incremental effect of the proposed deepening when added to other past, present, and reasonably foreseeable future actions. This portion of the assessment will provide analysis of the cumulative effect of the Corps' Deepening Projects, Operations and Management (O&M program) and Permits Program for the Clean Water Act Section 404 and Section 10 of the Rivers and Harbors Act of 1899 may have on the RI/FS for the Newark Bay Study Area.

The combined projects within the HDP are the largest planned dredging projects in the NBSA and are therefore the primary focus of this DEA. The NBSA as shown in Figure 1a, includes: 1) the Newark Bay, except for the Port Newark Channel and sections north of it, 2) approximately 2 miles of the northern section of the Arthur Kill Channel from the total 26 mile project, and 3) approximately 0.5 miles of the Kill Van Kull Channel of a 3 mile long project.
O & M dredging has been an ongoing activity in the Newark Bay Federal Channels and Arthur Kill Federal Channel for decades. Although no recent O&M dredging has occurred in the Kill Van Kull Federal Channel due to deepening activities that have occurred there since 1999, it too will be maintained in the future, as needed. Maintenance dredging is a without project condition or existing condition and is necessary to allow commercial navigation to utilize the channels and ports economically and safely.

Dredging in the upcoming year is planned for the Arthur Kill Federal Channel and in the Newark Bay in Port Newark Pierhead Channel and Port Newark channel. The area proposed for dredging in the Arthur Kill in the upcoming maintenance cycle is located outside of the NBSA. The Port Newark Channel also appears to be outside of the demarcated area on Figure 1a, but the Phase I sample plan currently depicts three sample locations within the area. The Port Newark Pierhead shoals proposed for dredging do not currently contain any Phase I sample locations.

Only three sample locations as currently contained in the Phase I sampling plan and recently presented by the EPA to the Corps are located within areas potentially planned for dredging. These samples are scheduled for collection by the EPA in November 2005. The dredging will not occur until March 2006 at the earliest and therefore will have no effect on EPA's RIWP. All future phases of sampling will be closely coordinated between EPA and USACE to ensure that neither agency's mission is significantly impacted. As per the Coordination plan in Appendix C, monthly meetings will occur between the two agencies to update each other on current and future activities and to minimize effects on each agency's respective programs.

Projects, located in the NBSA, associated with the permits issued under the USACE's permits program for the Clean Water Act Section 404 and Section 10 of the Rivers and Harbors Act of 1899 may have an effect on the RI/FS. These permits, on an annual basis, generally reflect work required adjacent to the channels to maintain commercial activities and allow facilities to accommodate vessels received. The permitted work (See Table 1) typically represents maintenance around pier areas with limited dredging in terms of volume, area, and duration. The work includes but is not limited to dredging, pier rehabilitation, pier maintenance, rehabilitation of wave breaks, bridge abutment rehabilitation, and wharf reinforcements. Additional information regarding specific permit actions is available on the Corps web page at http://www.nan.usace.army.mil/business/buslinks/regulat/permit.htm. Relevant environmental documents and the Statement of Findings or Record of Decision containing these evaluations are available upon written request.

The cumulative effects of these actions on the RIWP study goals are likely to be insignificant, since these activities are small in area and volume of dredged material and are short in duration, in addition to the AK 40/41 and the HDP. Coordination between USACE and USEPA is currently underway and is planned to continue for the duration of the RI/FS in order to ensure each agency's program goals are not adversely affected.

SECTION 5
COORDINATION PLAN

In an effort to coordinate activities and minimize potential conflicts between dredging operations and the NBSA RI/FS process, a coordination team has been established. Team members include:

- USACE,
- USEPA,
- U.S. Coast Guard (USCG),
- NOAA,
- USFWS,
- NJDEP
- NYSDEC, and
- Port Authority New York New Jersey (PANYNJ).

The coordination team has been charged with the development of a coordination plan to address potential conflicts between activities associated with dredging and the RI/FS process. This plan, attached as Appendix C, describes in detail how these activities will be coordinated between USACE and USEPA to ensure the goals of each project will be met.

This coordination effort has included several meetings of the USEPA and USACE teams. Meetings conducted prior to release of the RIWP resulted in revisions to the RIWP based on recommendations and data and information provided by USACE. These include:

- Historical dredging areas and volumes
- Database of sediment, water, and biota sampling results from dredging activity sample collections
- Datasets from discrete sampling events associated with other USACE activities, including:

- Confined Disposal Facility (CDF) constructions
- Barge removal
- Habitat surveys

More recently, a technical working group was established to address the details of the two programs. As of this writing, several NBSA Phase I sampling locations have already been relocated due to potential interference from dredging operations, in order to ensure that the goals of the RIWP are met. Details of the changes are documented in Appendix C[1].

The coordination team will continue to meet throughout the lifetime of the RI/FS to coordinate NBSA activities. Ongoing and planned coordination between USACE and USEPA will ensure that their respective programs are developed in a manner that ensures that the remedial investigation is tightly coordinated with the dredging schedule for Phase I sediment sampling activities as well as Phase II sediment, water, and biota sampling.

Moreover, the USACE will continue to provide information to the USEPA. This will include:

- maps providing a history of dredging activities throughout the NBSA;
- future dredged material test results; and
- bathymetry data in the channel

In addition, the USACE is coordinating activities with the NBSA trustees: NOAA, the USFWS, the NJDEP, and the NYSDEC. Coordination is ongoing and will be continued to ensure the integrity of samples that may be collected for the NRDA to ensure the trustee's ability to pursue NRDA claims will not be materially affected.

[1] Sample locations presented in Figure 1b are those presented in the September 6, 2005 version of the RIWP (Tierra Solutions 2005); changes directed by the coordination work group are not reflected in this figure.

SECTION 6
CONCLUSIONS

The conclusions of this study are presented in the context of the goals of the remedial investigation. For each stated goal of the RI, a table describing the potential for effects of the deepening project is presented. After each table, a series of bullets provides supporting information for that table. Following a discussion of the three goals, cumulative impacts and coordination planning are summarized.

Goal 1:

Determine the horizontal and vertical distribution and concentration of PCDDs, PCDFs, PCBs, PAHs, pesticides and metals within the NBSA sediments.

Effects on RI Goal 1:

	Dredging Prior to Sampling	**Dredging During Sampling**	**Dredging After Sampling**
Cores in Channels	No Significant Effect; See Coordination Plan; Alternative sampling locations identified, where needed, for Phase I. No significant effect anticipated on Phase II.	No Significant Effect; See Coordination Plan	No Significant Effect
Adjacent to Channels	No Significant Effect	No Significant Effect; See Coordination Plan	No Significant Effect

Supporting Information:

The effects of dredging are considered separately for cores that are in the southern navigation and port channels and thus potentially affected directly by dredging, and cores that are adjacent to the channels and thus potentially affected indirectly, through deposition of resuspended sediments.

- Cores in channels, dredging prior to sampling
  - USACE and USEPA are coordinating efforts for the Phase I sample collection scheduled for November 2005 to ensure that all cores in areas scheduled for dredging are moved to alternative locations that are not to be dredged prior to sample collection, with no adverse effect on the data to be obtained. These efforts will continue during future phases of the RI.
  - Future sampling can be conducted in channel areas that have not yet been dredged or are not actively dredged, for example areas historically dredged but no longer maintained, to characterize current and historical contaminant levels. It will also be possible to sample in recently dredged areas, after sufficient deposition has occurred to obtain a core sample.
- Cores in channels, dredging after sampling
  - In Phase I, USEPA is targeting cores in the channels in large part to sample recently deposited material for contaminants. The cores that are collected prior to the construction of the deepening projects will provide a record that includes material deposited since the previous dredging event, and thus the planned dredging will not affect their interpretation.
- Cores adjacent to dredged areas, dredging prior to sampling
  - Dredging results in sediment resuspension. Measured field data collected on numerous occasions around operating dredges in Newark Bay indicates that resuspension from dredging is mostly localized to the dredge and generally contained within the deeper channel waters.
  - The effects of resuspension of this material from dredging are not likely to be significant, based upon the following:
    - Elevated concentrations were observed only in some samples, and in most cases, downstream concentrations remained within the range of ambient TSS levels measured in the NBSA.
    - In general, plumes were localized to within 250 ft of the dredge.
    - Evidence, albeit limited, suggests that transiting container ships may resuspend considerably higher levels of sediment, over larger areas of the

bay (including off-channel flats areas), and on a more continuous basis than does dredging.

  - Resuspension from dredging is expected to result in the deposition of a thin layer of material adjacent to the channel.
  - Contaminant concentrations of the material resuspended by dredging are likely to have a minimal effect on contaminant concentrations in the surface sediments of the flats.

- Cores adjacent to dredged areas, dredging after sampling
  - Cores that are collected prior to dredging will provide a record of current and past contaminant concentrations in sediments. By definition, the interpretation of this record will not be affected by the possible deposition of additional material after the cores are collected.

Goal 2:

Determine the primary human and ecological receptors (endpoints) of PCDDs, PCDFs, PCBs, PAHs, pesticides, and metals in contaminated sediments in the Newark Bay Study Area.

Effects on RI Goal 2:

	Dredging Prior Sampling	Dredging During Sampling	Dredging After Sampling
Cores in Channels	No Significant Effect	No Significant Effect	No Significant Effect
Adjacent to Channels	No Significant Effect	No Significant Effect	No Significant Effect

Supporting Information:

- Risk endpoints are likely to rely largely upon contaminant levels in aquatic biota. Biota are exposed to contaminants both in the sediments and in the water column.
- Dredging prior to sampling
  - Impacts on water column concentrations in the NBSA are likely to be small, because dredge plumes are limited in extent, and TSS concentrations in dredge plumes are generally within the range of ambient conditions.

- o Insofar as effects on contaminant concentrations in surface sediments and in the water column are likely to be small, impacts on benthic food webs are also likely to be small.
  - o Future resuspension studies, combined with ongoing coordination, will ensure that water sampling is scheduled to avoid direct influences of dredging.
- Dredging after sampling
  - o Samples of water and biota that are collected prior to dredging will provide a record of current contaminant concentrations in water and biota. By definition, the interpretation of this record will not be affected by the possible resuspension and deposition of contaminated material after the sample is collected.

Goal 3:

Determine the significant direct and indirect continuing sources of PCDDs, PCDFs, PCBs, PAHs, pesticides, and metals in the Newark Bay Study Area.

Effects on RI Goal 3:

	Dredging Prior to Sampling	**Dredging During Sampling**	**Dredging After Sampling**
Cores in Channels	No Significant Effect	No Significant Effect	No Significant Effect
Adjacent to Channels	No Significant Effect	No Significant Effect	No Significant Effect

Supporting Information:

- Sources will be assessed using a combination of field data and modeling. Insofar as samples in the channel will be collected prior to dredging and dredging is unlikely to adversely affect contaminant concentrations in surface sediments adjacent to the channel, it is unlikely to materially affect the ability of USEPA to evaluate sources of contaminants to Newark Bay.
- Cores within the channels are likely to provide limited information concerning historical contaminant levels and thus historical sources. To characterize historical contaminant levels, future sampling can be conducted in areas not actively dredged, for example the subtidal flats or areas historically dredged but no longer maintained. Therefore, the

removal of contaminated material from the channel after sampling will not affect the ability of USEPA to evaluate historical contaminant sources during later phases of the RI/FS.

Cumulative Impacts

- The harbor deepening projects are the largest planned dredging projects in the NBSA and are therefore the primary focus of this DEA.
- In addition to the HDP, O&M and permit actions will not affect Phase I RIWP sampling, as no such actions are planned in the NBSA prior to this fall 2005 sample collection.
- Effects on future phases of the RI are likely to be insignificant, because these dredging activities are small in area and volume of dredged material and are short in duration, as compared with the HDP.
- Coordination between USACE and USEPA is currently underway and is planned to continue for the duration of the RI/FS, in order to ensure each agency's program goals are not adversely affected.

Coordination Efforts

- Coordination between USACE and USEPA has been ongoing, including meetings, conference calls and provision of data and other information.
- Coordination meetings have resulted in improvements to the USEPA RI/FS program to ensure that USEPA's goals are met.
- A coordination plan has been developed and enacted.
- Future coordination is planned.
- Coordination with NRDA trustees is also ongoing and future coordination is planned.

In conclusion, based upon the analyses provide above, the effects of dredging on the ability of USEPA to achieve the RIWP study goals are determined to be insignificant and to have no material bearing on EPA's decision-making process regarding potential remedies.

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