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2013 National Ocean Dumping Site Monitoring Assessment Report




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Executive Summary

In the United States, uncontaminated dredged material is the primary material (in terms of volume) disposed into the ocean today. Dredged material is sediment excavated or otherwise removed from the bottoms of the navigable waters of the United States to maintain navigation channels and docks. Other materials disposed in the ocean include fish wastes, vessels, and human remains for burial at sea.

Under the Marine Protection, Research, and Sanctuaries Act (MPRSA), U.S. Environmental Protection Agency (EPA) is responsible for designating and managing ocean disposal sites for the permitted disposal of materials. In Fiscal Year 2013 (FY 2013), EPA managed 95 designated ocean disposal sites located off the U.S. Atlantic, Gulf and Pacific Coasts, and in the Caribbean, Hawaii and the Pacific Islands. All but one of these sites is for the disposal of uncontaminated sediment (dredged material) removed from our nation's waterways to support a network of coastal ports and harbors for commercial, transportation, national defense and recreational purposes. In FY 2013, marine transportation contributed more than $59 billion and 420,000 jobs to the US economy (National Ocean Economics Program, 2016).

EPA designates ocean disposal sites in areas that minimize the impact of ocean dumping on various amenities, such as fisheries, coral reefs, and endangered species; minimize interferences with other uses of the ocean, particularly navigation and fisheries; and support the cost-effective maintenance of the ports and harbors vital to the nation's economy and security.

Once designated, management of ocean disposal sites is necessary to ensure that disposal activities will not unreasonably degrade or endanger human health, welfare, the marine environment, or economic potentialities. Effective management of ocean disposal sites prevents chemical contamination of sediments, physical obstructions, and damage to tourist attractions like beaches and coral reefs.

Monitoring is a key component of management of ocean disposal sites. EPA monitors the environment within and around each ocean site to verify that permitted disposal does not cause unanticipated or significant adverse effects and that terms of MPRSA permits are met. While EPA's testing procedures and ocean dumping criteria effectively used to evaluate sediment that is proposed for ocean disposal, monitoring at ocean disposal sites is necessary to ensure that the marine environment is not being adversely impacted by disposal activities.

This national report presents EPA's ocean dumping monitoring activities in FY 2013. EPA conducted 13 surveys at 20 ocean disposal sites offshore from Puerto Rico, Virginia, South Carolina, Florida, Texas, Hawaii, and Oregon. This report summarizes each survey's objective(s), activities, conclusions, and recommended environmental management actions.

As part of the FY 2013 surveys, EPA scientists employed a wide range of well-established monitoring techniques, including sampling marine sediment, conducting dive operations and fish trawls, measuring waves and currents, and collecting video and still underwater imagery. These are scientifically sound techniques widely accepted in the scientific community. EPA assessed changes in biological community conditions, chemical contaminant levels in sediment and biota, water quality, and sediment grain size. At some sites, EPA evaluated fate and transport of material after disposal to determine if the material moved in unanticipated ways and had the potential to adversely impact other uses of the ocean, such as nearby fisheries.

EPA confirmed that environmentally acceptable conditions were met at 14 of 20 ocean disposal sites surveyed in FY 2013. At these 14 sites, EPA determined that dredged material disposal had not adversely impacted the ecosystem, permitted disposal could continue, and no further

action was needed. At three of the six other ocean disposal sites surveyed (Sabine-Neches Sites 3 and 4, and Mouth of the Columbia River Deep Water Site), further investigation of the site conditions is necessary to determine if any changes in management practices are needed. And at the last three ocean disposal sites (Charleston, Jacksonville, and Chetco), EPA determined that modifications to the boundaries and/or permitted use of the site are necessary to sustain environmentally acceptable conditions for future management of the sites. Findings at these six sites are discussed in the following paragraphs.

Surveys at Sabine-Neches Sites 3 and 4 and Mouth of the Columbia River Deep Water Site showed that additional investigation is necessary. Monitoring at Sabine-Neches Sites 3 and 4 (TX) revealed hotspots of high metal concentrations in sediments. High metal concentrations in sediments can cause adverse effects to organisms that live on, in, or near the seafloor. These metals can also magnify as they are transferred up the food chain, ultimately impacting higher trophic level species, such as large marine predators and humans. EPA plans to conduct additional surveys at these sites focused on the hotspots to identify if any management actions are needed to prevent the occurrence of adverse effects. From the survey at the Mouth of the Columbia River (OR), EPA found that the migration of dredged material after disposal was different than anticipated. EPA plans to conduct additional studies at the site to explore the fate and transport of material after disposal and ensure that it will not impact marine life or navigation in this area.

Finally, surveys at Charleston, Jacksonville, and Chetco led EPA to determine that, in order to sustain environmentally acceptable conditions for future management of the sites, modifications to site boundaries and/or permitted use were necessary. EPA conducted a wave and current study at Charleston (SC) to better understand the fate and transport (and potential impacts) of a significant increase in dredged material disposal planned for the site. This material will come from a project to deepen Charleston Harbor to accommodate post-Panamax ships. Based on the data and information evaluated to date, EPA currently anticipates that the material is likely to move outside of site boundaries and that the disposal zone within the site should be enlarged to prevent adverse environmental impacts offsite. At Jacksonville (FL), EPA analyzed sediment profile imagery, which demonstrates that dredged material had migrated off the site to the north and south. As a result, EPA plans to restrict the release zone at the disposal site farther from site boundaries to prevent impact to the benthic communities outside of site boundaries. Lastly, EPA (with USACE) conducted a survey at Chetco (OR) to evaluate whether dredged material disposal was impacting nearby rocky reef habitat. EPA determined that, while disposal activities had not yet adversely impacted reef communities, adjustments to site usage are warranted to safeguard this valuable habitat resource.

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ACRONYMS AND ABBREVIATIONS

ADCP	acoustic Doppler current profilers
CTD	conductivity, temperature, depth
DDT	dichlorodiphenyltrichloroethane
DWS	deep water site
EA	environmental assessment
EIS	environmental impact statement
EPA	United States Environmental Protection Agency
ERL	effects range low
ERM	effects range median
MCR	Mouth of the Columbia River
MPRSA	Marine Protection, Research, and Sanctuaries Act
NOAA	National Oceanic and Atmospheric Administration
ODMDS	Ocean Dredged Material Disposal Site
OSV	ocean survey vessel
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PVP	plan view photography
ROV	remotely operated vehicle
R/V	research vessel
SEF	sediment evaluation framework
SL	screening level
SMAR	site monitoring assessment report
SMMP	site management and monitoring plan
SPI	sediment profile imaging
SQGs	sediment quality guidelines
USACE	United States Army Corps of Engineers

1.0 Introduction

The Marine Protection, Research, and Sanctuaries Act (MPRSA), sometimes referred to as the Ocean Dumping Act, regulates the dumping and transportation for the purpose of dumping of any material into ocean waters. Generally, ocean dumping cannot occur unless a federal permit is issued under the MPRSA.

Under the MPRSA, U.S. Environmental Protection Agency (EPA) established environmental criteria for the evaluation of all permit applications. EPA also issues the ocean dumping permits for all materials other than dredged material. In the case of dredged material, U.S. Army Corps of Engineers (USACE) issues the ocean dumping permits (or, in the case of federal projects, authorizes ocean dumping of dredged material) using EPA's environmental criteria. All MPRSA permits and federal projects involving the ocean dumping of dredged material are subject to EPA review and concurrence. All dredged material proposed for ocean dumping must be tested using published testing guidance and must meet the published dumping criteria.

EPA is responsible for designating ocean disposal sites under the MPRSA. To minimize the adverse impacts of ocean dumping on human health and the marine environment, EPA designates sites based on environmental studies of the proposed site, environmental studies of regions adjacent to the proposed site, and historical knowledge of the impact of disposal on areas having similar in physical, chemical, and biological characteristics. EPA carefully considers specific criteria (published at 40 CFR 228.5 and 229.6) as part of a site designation evaluation to ensure that the site selected for designation will not likely cause significant adverse impacts to the surrounding marine environment. EPA analyzes these impacts through environmental assessments or environmental impact statements for site designations. In general, EPA designates sites only in areas where ocean dumping will not have a significant impact on various amenities, such as fisheries, coral reefs, and endangered species.

EPA is also responsible for managing all ocean disposal sites designated under the MPRSA. EPA management helps ensure that disposal activities will not unreasonably degrade or endanger the marine environment, human health, welfare, or economic potentialities. Management of the ocean disposal sites involves:

- regulating the times, quantity and characteristics of the material dumped at the site;
- establishing disposal controls, conditions and requirements to avoid and minimize potential impacts to the marine environment; and
- monitoring the site and surrounding environment to verify that unanticipated or significant adverse effects are not occurring from past or continued use of the ocean disposal site and that terms of the MPRSA permit are met.

All designated sites are required to have a site management and monitoring plan (SMMP). EPA, in conjunction with USACE, develops an SMMP for each ocean disposal site. Each SMMP includes, but may not be limited to:

- a baseline assessment of site conditions;
- a program for monitoring the site;
- special management conditions or practices to be implemented at each site that are necessary for protection of the environment;
- consideration of the quantity of disposed materials, and the presence, nature, and bioavailability of the contaminants in the material;

- consideration of the anticipated long-term use of the site; and
- a schedule for review and revision of the SMMP.

A key component of the SMMP is the monitoring program. The monitoring program for each site is designed to assess current environmental conditions and trends at and around the disposal site, evaluate disposal impact to ensure that the dumped material is being adequately tested and there are no unexpected impacts, evaluate movement and deposition of the dumped material to determine whether or how to modify site use, and support SMMP development and updates. EPA typically evaluates environmental impact at a site by comparing current conditions to the conditions at the time of designation (baseline conditions) and before recent disposals. Reference (control) areas, which are close to the disposal site but that do not receive disposed materials, are also used to assess the impact of disposal. Guidelines for ocean disposal site baseline and trend assessment surveys are set forth in 40 CFR 228.13. EPA conducts these surveys using scientifically sound monitoring techniques widely accepted in the scientific community.

Fiscal Year 2013

In fiscal year (FY) 2013, EPA Regional Offices managed 95 ocean disposal sites off the U.S. Atlantic, Gulf of Mexico, and Pacific Coasts, Hawaii, and near U.S. territories in the Caribbean Sea and Pacific Ocean. All but one of the 95 ocean disposal sites are designated for the disposal of dredged material permitted or authorized under the MPRSA. These sites are often located offshore of major ports, harbors, and marinas nationwide.

During FY 2013, EPA scientists conducted 13 oceanographic surveys at 20 ocean dredged material disposal sites (ODMDSs), located in six of the seven EPA coastal Regions (Figure 1). EPA conducted these monitoring surveys using vessels accessed through contracts and through interagency agreements with National Oceanic and Atmospheric Administration (NOAA) and USACE, as well as vessels owned and operated by EPA Regions.

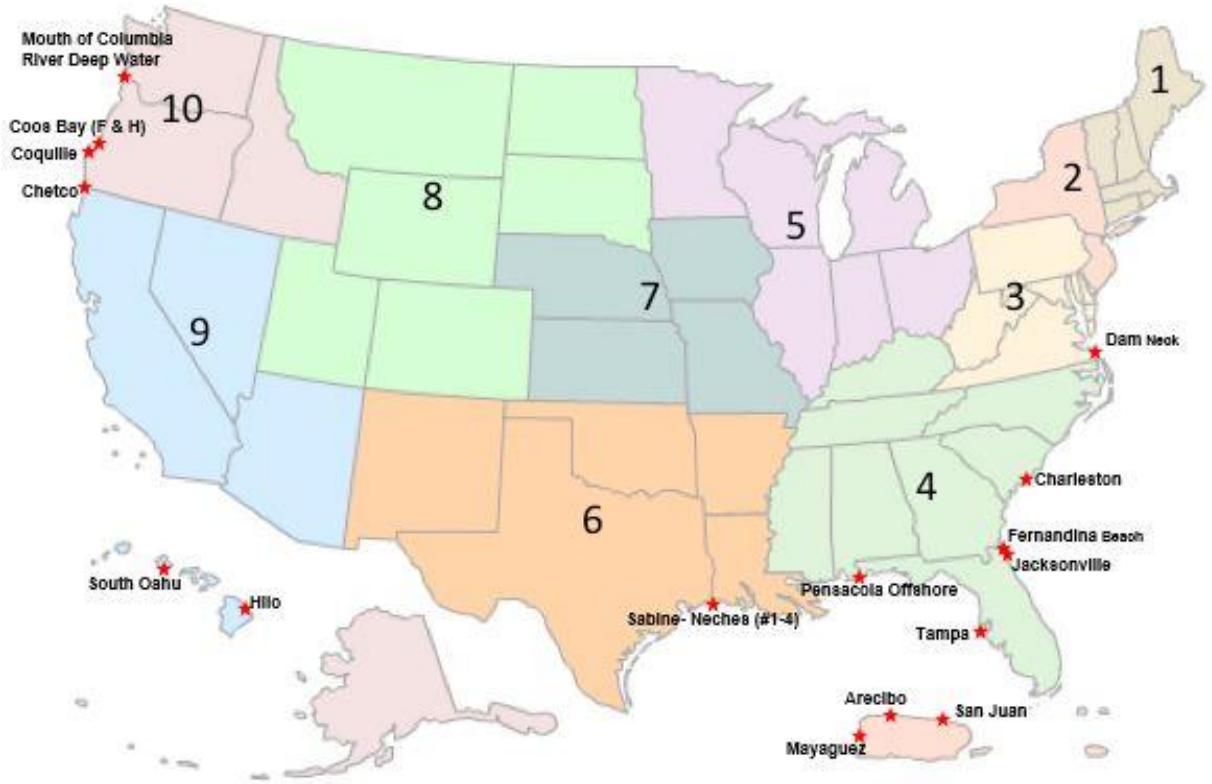

Figure 1. Locations of the 20 Disposal Sites surveyed in 2013

2.0 Objectives

This national report serves as a comprehensive summary of the 2013 ODMDS monitoring surveys. Specifically, the report summarizes survey objectives, activities, results, and environmental management decisions as reported in the Site Monitoring Assessment Reports (SMARs) prepared by EPA Regions. In 2013, EPA Regions submitted 13 SMARs for the 20 ODMDSs surveyed:

- San Juan, Puerto Rico (Region 2);
- Arecibo, Puerto Rico (Region 2);
- Mayaguez, Puerto Rico (Region 2);
- Dam Neck, Virginia (Region 3);
- Charleston, South Carolina (Region 4);
- Fernandina Beach, Florida (Region 4);
- Jacksonville, Florida (Region 4);
- Pensacola Offshore, Florida (Region 4);
- Tampa, Florida (Region 4);
- Sabine-Neches Site 1, Site 2, Site 3, and Site 4, Texas (Region 6);
- South Oahu, Hawaii (Region 9);

- Hilo, Hawaii (Region 9);
- Chetco, Oregon (Region 10);
- Coos Bay Site F and Site H, Oregon, (Region 10);
- Coquille River, Oregon (Region 10);
- Mouth of the Columbia River Deep Water Site, Oregon (Region 10).

3.0 Summary of Monitoring Surveys

In 2013, EPA funded and conducted monitoring surveys to assess ocean disposal site conditions, support designations of new ocean disposal sites, support modifications in the size or use of existing ocean disposal sites, and provide information for updates of SMMPs at existing ocean disposal sites. These surveys employed a wide range of acceptable monitoring approaches including collecting sediment grab samples, conducting dive operations and fish trawls, collecting wave and current measurements, and obtaining video and still underwater imagery. Depending on the purpose of each specific survey and the information needed, the surveys used techniques that varied from simple and straightforward to complicated and highly technical. Using this information, EPA assessed the physical, chemical, and biological conditions of the sediment and water in and around the disposal site to determine if conditions at the site are acceptable or if disposal is causing unacceptable impacts. In some cases, EPA evaluated the spatial extent (footprint) of dredged material to better understand if the dredged material is behaving as expected following disposal at a site; i.e., remaining within the bounds of the site or moving outside of a site. Sediment grain size was commonly assessed to detect the presence of dredged material, which is typically fine-grained, organic-rich sediment. The presence of macroinfaunal organisms, or organisms inhabiting sediments that are large enough to be seen with the naked eye, was the most common biological condition assessed in these surveys.

EPA commonly compares contaminant concentrations in site sediments to sediment quality guidelines (SQGs) to evaluate the potential for dredged material disposed at a site to have an impact on the benthic communities at or near disposal sites. SQGs are informal benchmarks used to relate chemical concentrations in sediments to the potential toxicity to benthic or aquatic organisms. SQGs are used to estimate the toxicity of sediments, to identify areas and specific chemicals of concern, and to direct further investigations (Long and MacDonald, 1998). Different SQGs have been established by various entities at the national and regional levels. Many EPA Regions rely on Effects Range Low (ERL) and Effects Range Medium (ERM) national SQGs developed by NOAA (NOAA, 1999) to assess conditions at ocean disposal sites. Chemical concentrations below the NOAA ERL cause adverse effects infrequently, while chemical concentration above the NOAA ERM are likely to cause adverse effects.

The quantity and distribution of samples collected in each of the EPA monitoring surveys vary considerably. A number of factors cause the differences in sampling in the FY 2013 surveys. For example, if past surveys and historical data from an ODMDS have shown a high variance in the measurements taken at that site, EPA typically collects additional samples to adequately characterize the site. If existing data shows the site to be consistently homogenous over many years, sampling need not be so rigorous. Sampling may also be influenced by other factors including, but not limited to, the specific objectives of the survey and the scope of the investigation. The protocols for sample collection are designed not only to be scientifically sound, but also to be logistically and financially practical.

A summary of FY 2013 survey objectives, activities, and results, as well as the environmental management decisions made following these surveys is presented below, by EPA Region.

3.1 Region 2 – Arecibo, Mayaguez, and San Juan ODMDSs, Puerto Rico

Region 2 monitored three ODMDSs (Arecibo, Mayaguez, and San Juan), located along the north and west coasts of Puerto Rico. The Region conducted this monitoring survey in February 2013 aboard the NOAA research vessel (R/V) *Nancy Foster.* The objective of this survey was to assess the quality of previously identified hard bottom habitats along and adjacent to transit routes used by dredging scows from Arecibo, Mayaguez, and San Juan harbors to the disposal sites. Region 2 sought to determine if coral is present along these routes or at these ocean disposal sites. Seven coral species found near Puerto Rico are listed as threatened under the Endangered Species Act.

Region 2 used a remotely operated vehicle (ROV) and drop camera to obtain video and still imagery. The Region also collected multibeam bathymetry data of the disposal sites, transit routes, and surrounding areas of similar depth. EPA collected images of both hard and soft bottom habitats within the disposal sites and hard bottom habitats adjacent to and along transit routes.

From the images collected in this FY 2013 survey, EPA identified that the habitat within the disposal sites, along the transit routes, or directly adjacent to transit routes appeared to be low quality (low organism abundance) with no coral presence. EPA scientists identified higher quality hard bottom habitats that support corals (that is, with high organism abundance, including corals) far outside the transit routes between Arecibo and Mayaguez harbors and the disposal sites.

Region 2, using multibeam imagery, identified sheer vertical walls at the continental shelf edge, located inshore of the disposal sites. These vertical walls likely inhibit the shoreward transport of dredged material disposed at the sites. Although these data do not relate to assessing habitat quality at the disposal sites, they do provide insight regarding the extent of the disposal footprint at these sites.

Based on the data collected in the survey, Region 2 confirmed that the transit routes for scows to transport dredged material to the Arecibo, Mayaguez, and San Juan ODMDSs from the primary harbor for which the ODMDS was designated (Arecibo, Mayaguez, and San Juan harbors) do not threaten valuable hard-bottom habitats. These findings confirmed the route restrictions already in place in the Arecibo ODMDS SMMP, supported the lack of restrictions in the San Juan ODMDS SMMP, and will be used to modify the Mayaguez ODMDS SMMP to include route restrictions when active use resumes at that site.

3.2 Region 3 – Dam Neck ODMDS, Virginia

Region 3 monitored the Dam Neck ODMDS, located offshore from Virginia Beach, VA. The Region conducted this monitoring survey in July 2013 aboard the NOAA R/V *Nancy Foster*. The objective of this survey was to compare environmental conditions at Dam Neck ODMDS to a control site to evaluate whether and the extent to which disposal of dredged material at the ODMDS was causing significant adverse impacts.

Region 3 scientists collected sediment samples from 50 stations, including 25 stations within the disposal site and 25 stations at the control site. Sediment samples were analyzed for benthic community status, metal concentrations, and grain size. Region 3 statistically analyzed the data to determine if there was a significant difference between the conditions at the disposal site and

the conditions at the control site. Region 3 then compared the results of this analysis to the results of biennial surveys conducted at the Dam Neck ODMDS between 2005 and 2013.

Region 3 found statistically significant differences between the benthic communities at the Dam Neck ODMDS and the control site in 2013. Benthic communities typically are assessed using three parameters: richness (the number of species in a community), evenness (the relative abundance of each species in a community), and diversity (a combination of richness and evenness). Benthic community diversity and richness were determined to be significantly lower at the disposal site compared to the control site. These determinations are consistent with previous studies conducted to evaluate the disposal site since 2005. Benthic community evenness was also lower at the disposal site in 2013, but the difference was not significant. These benthic community differences seen at both sites are within the level of disturbance expected due to disposal operations and, therefore, are not a concern for Region 3.

Data and information comparing the Dam Neck ODMDS and the control site indicate that conditions in these two areas are similar in sediment grain size but significantly different in some metal concentrations. Sediment grain size at both sites was predominately sand (>95%). Copper, nickel, lead, and zinc concentrations were found to be statistically different at the disposal site compared to the control site. The concentrations of these metals have been consistently and relatively higher at the disposal site compared to the control site since 2005. However, these metals are naturally occurring, and although differences were statistically different, these metal concentrations are very low when compared to the NOAA ERL/ERM. Sediment chemical concentrations above the NOAA ERL, but below the NOAA ERM, are not likely to be harmful to benthic organisms, but are considered by EPA, in the context of other evidence, when making environmental management decisions. These metal concentrations remain low enough to not trigger any management decisions. Additionally, low to undetectable concentrations of other metals, including cadmium, mercury, and silver, have been measured at both sites since 2005.

Based on the data collected in the survey, Region 3 confirmed that environmentally acceptable conditions are being met at the site and the Region does not recommend any changes to the site's SMMP at this time. From information collected during this survey, Region 3 found statistically significant differences in benthic community parameters (diversity and richness) and four metal concentrations (copper, nickel, lead, and zinc) between Dam Neck ODMDS and its control site. The differences seen in benthic communities at both sites are within the level of disturbance expected from disposal operations at the site. Therefore, Region 3 does not believe these differences are a cause of concern. Additionally, although some metal concentrations were statistically different between Dam Neck ODMDS and its control site, these concentrations fall below the NOAA ERL/ERM, and therefore, Region 3 does not expect that these concentrations are toxic to benthic organisms.

Region 3 used a portion of the 2013 Dam Neck ODMDS survey to collect samples in support of non-Ocean Dumping EPA programs. Given the uncertainties associated with conducting oceanographic surveys, EPA scientists typically include extra time in their survey plans to accommodate potential delays due to severe weather. During July 2013 survey, the weather conditions were favorable; therefore, Region 3 used the extra time built into the survey to collect additional water quality samples. These samples were used to support the Region's long-term monitoring effort to analyze trends in nutrient data along the Mid-Atlantic Bight. EPA also used these samples, for the first time, to develop a baseline for future evaluation of ocean acidification.

Ocean acidification is a significant stressor for calcifying organisms because it affects the ability of these organisms to grow and maintain aragonite-based structure (e.g., shells, reefs) when Ω

is low. Ocean acidification evaluation is relevant to EPA's work because of the potential ecological and economic impacts caused by this phenomenon, as well as its use as an indicator of climate change. Region 3 deployed a rosette sampler, equipped with conductivity, temperature, and depth (CTD) probe, to obtain seawater samples for the measurement of total alkalinity (TA) and dissolved inorganic carbon (DIC). These parameters provide insight on a marine system's buffer intensity, which is a measure of the ability of seawater to resist appreciable pH changes. Due to the inter-relationship of carbonate parameters, measurement of TA and DIC allows the calculation of the partial pressure of dissolved carbon dioxide (pCO_2) and aragonite saturation state (Ω).

Based on the data collected in the survey, Region 3 plans to continue this monitoring effort to better understand the condition of these Bays and the effects of ocean acidification on near coastal and open ocean water bodies. Water sampling results identified areas in the Mid-Atlantic Bight that were experiencing low Ω and high pCO_2 concentrations. For transects conducted from the mouth of the Chesapeake Bay to 100 kilometers seaward, low Ω and high pCO_2 conditions were observed from the mouth of the Bay to 30 kilometers seaward, and in pockets between 50 and 100 kilometers seaward. For transects conducted from the mouth of the Delaware Bay to 60 kilometers seaward, low Ω was observed over the extent of the transect. These observations of low Ω suggest that calcifying organisms (e.g., crabs, sea snails, coral, etc.) in the monitoring area may be subject to acidification-related stress. The impact that this stress would have on the ability of these organisms to grow shell could have a significant effect on fisheries production.

3.3 Region 4 – Charleston Harbor ODMDS, South Carolina

Region 4 monitored the Charleston Harbor ODMDS, located offshore of Charleston, South Carolina. The Region conducted the monitoring survey between November 2012 and May 2014 aboard the 28-foot Parker, a Region 4 vessel, supported by Region 4 and USACE funds. The objective of this survey was to assess wave and current patterns and their impact on site capacity. The Region anticipates a significant increase in the amount of dredged material to be proposed for disposal at the Charleston Harbor ODMDS due to a project planned to deepen the harbor to accommodate post-Panamax vessels. Region 4 plans to use the data in water quality models to assess potential dispersion of dredged material after disposal at the ODMDS as well as potential impacts on benthic communities. USACE will also use the wave and current data to evaluate beneficial use options for their Regional Sediment Management Program.

For this study, acoustic Doppler current profilers (ADCPs) were deployed a total of five times inshore, within, and seaward of the Charleston Harbor ODMDS. Deployments lasted between three and five months each. The ADCPs measured wave directionality, wave height, wave period (time between waves), current directionality, and current velocity.

From the wave measurements, Region 4 identified differences between the waves at the three survey locations. At the disposal site and offshore, waves originated from the east-southeast with long wave periods of 4 to 11 seconds. Inshore, waves also had long periods of 5 to 13 seconds. Wave heights were highest offshore and smallest inshore. In general, inshore and offshore waves were highest in June (inshore= 0.8 m; offshore= 1.6 m) and within the disposal site, waves were highest in November (1.2 m).

Currents in the vicinity of Charleston ODMDS were found to have a significant tidal component. The disposal site's currents flowed predominately east and west. Currents flowed differently in the northern inshore stations than in the southern ones. In the north, currents flowed predominately west-southwest. In the south, currents flowed north-northwest and east-southeast. The offshore station did not have a dominant flow direction. Within the disposal site,

there was a dominant offshore current during the summer months and an inshore current during the winter months. Surface currents at the disposal site were almost twice as strong as near-bottom currents at both stations. The average current magnitude was about 18 cm/sec. Two distinct high and low tides per day were documented at the disposal site.

Region 4 plans to use the results of this survey to modify the existing disposal site. The wave and current measurements collected in this study and the shallow depths in the vicinity of the Charleston ODMDS suggest that the relatively large, long wave periods are likely to re-suspend and redistribute bottom sediments frequently. As such, the large quantity of dredged material that will be generated by the deepening of Charleston Harbor likely would be transported outside of the Charleston ODMDS boundaries. The large quantities of dredged material have the potential to cause adverse impacts to benthic communities in a manner that was not evaluated during the original site designation process. To accommodate the anticipated increase in dredged material disposal without causing unacceptable impacts, EPA will modify the existing Charleston ODMDS by increasing the dredged material disposal zone (from 4 mi^2 to 9.8 mi^2). By increasing the disposal zone, dredged material can be managed so that it does not impact the benthic community outside of the zone. EPA will also modify the existing Charleston ODMDS by de-designating the area outside of the disposal zone (which decreases the overall size of the ODMDS from 15.1 mi^2 to 9.8 mi^2). This de-designated area includes recently-identified marine habitat. By decreasing the overall size of the site, this habitat will be protected from the impact of dredged material disposal.

3.4 Region 4 – Fernandina Beach ODMDS, Florida

Region 4 monitored the Fernandina Beach ODMDS, located off the Atlantic coast of Florida. The Region conducted this monitoring survey in conjunction with the Jacksonville ODMDS survey in August 2013 aboard the NOAA R/V *Nancy Foster*. The primary objective of the survey was to characterize and quantify the hard bottom habitat previously assessed within the Fernandina Beach ODMDS. Hard bottom habitats provide substrate for attachment of sessile organisms, as well as food and shelter for smaller fish and invertebrates. EPA compared the hard bottom habitats, initially identified during a 2011 survey, to a natural hard bottom ledge located outside the disposal site (reference area). Since identified, the hard bottom areas have been avoided during disposal operations pending further analysis of the habitat.

In the 2013 study, an EPA dive team conducted habitat assessments at 20 stations, including 15 stations within the disposal site and five stations at the reference area. The habitat assessments included, but were not limited to, counts of the occurrences of fish, macroinvertebrate, and live bottom cover at the assessment stations. Live bottoms occur when animals form a dense layer of living creatures that completely covers the underlying hard surface.

Region 4 found little difference between the hard bottom habitats within the disposal site and the reference area. Both areas had an abundance of fish, relief, and live cover. Areas with little to no relief tended to have fewer and smaller fish as well as fewer macroinvertebrates and different assemblages of live cover. The reference area had higher fish biomass (larger fish) compared to stations within the Fernandina Beach ODMDS. The highest fish abundances were identified at stations within the Fernandina Beach ODMDS. The two most abundant fish species found during this survey were the tomtate and black sea bass. The black sea bass populations exhibited the highest biomass and were observed at every station. The two stations within the disposal site with the highest fish abundance also had the highest numbers of purple-spined sea urchins, the most dominant macroinvertebrate observed. However, there did not appear to be a relationship between the number of purple-spined sea urchins and the number of fish. Although

the reference area had the lowest number of purple-spined sea urchins observed, the reference area also had the largest amount of live sessile colonies.

Based on the data collected in the survey, Region 4 confirmed that environmentally acceptable conditions are being met at the site and the Region does not recommend any changes to the site's SMMP at this time. Overall, Region 4 found very little difference between the live bottom area surveyed within the Fernandina Beach ODMDS and the naturally occurring hard bottom areas outside the disposal site at the reference area, indicating that the habitat created by the dredged material serves a similar ecological function as nearby natural habitat. Region 4 plans to share the results and coordinate with state and federal resource agency partners to determine if additional studies or site management actions are needed. Examples of potential site management actions could include but would not be limited to changes to the SMMP for the Fernandina Beach ODMDS to support and maintain the continued protection of one or more of the areas evaluated, further evaluation of the habitat, or no further action. Region 4 also anticipates using information collected in this survey to support management of rocky dredged material disposal at ODMDSs across the Region.

3.5 Region 4 – Jacksonville ODMDS, Florida

Region 4 monitored the Jacksonville ODMDS, located off the Atlantic coast of Florida. The Region conducted this monitoring survey in conjunction with the Fernandina Beach ODMDS survey in August 2013 aboard the NOAA R/V *Nancy Foster*. The objective of this survey was to determine if dredged material disposed between 2010 and 2013 at the Jacksonville ODMDS caused significant adverse impacts. Region 4 also sought to confirm the adequacy of site management practices that limit the disposal zone to 500 feet inside of the site boundaries to prevent the movement of dredged material offsite.

Region 4 collected sediment profile imagery (SPI) from 50 stations, including 46 stations distributed within and surrounding the disposal site and four stations at reference areas. This information was used to analyze the dredged material fate and transport, sediment grain size, and benthic infaunal communities. The 2013 survey results were compared to previous SPI surveys conducted prior to disposal activities (survey in late 2010 to early 2011) and during disposal activities (survey in April 2012).

From the 2013 survey results, the Region found that the dredged material footprint has expanded beyond the disposal site's boundaries. The SPI showed the presence of dredged material, more than 5 centimeters thick, well past the southern boundary of the disposal site (Figure 2). A thinner layer of dredged material was observed past the northern boundary of the site in both the 2012 and 2013 SPI surveys (Figure 2). The orientation of the dredged material footprint changed between 2012 and 2013. The movement and expansion of the footprint likely resulted from both disposal of material after the 2012 survey and the influence of currents (EPA and USACE, 2007).

The 2013 SPI showed no significant differences in grain size and benthic communities within the disposal site, surrounding the disposal site, and at the reference areas. Most stations visited primarily contained very fine sand, similar to the 2012 SPI survey results. In contrast, fine sand was observed at most stations within the disposal site in the 2010-2011 SPI survey. In the 2013 survey, stage I was the most common benthic successional stage seen at sampled stations. Stage I infauna are the first organisms to colonize the sediment surface following a disturbance. The benthic communities observed around the periphery of the dredged material footprint in 2013 were more mature (stage II), than what was observed in the 2012 survey. The stage I and stage II benthic communities seen at the stations in the 2013 SPI survey are typical of the

benthic communities found in this part of the ocean and suggest that dredging has had a minimal effect on benthic communities.

Based on the data collected in the survey, Region 4 plans to modify the SMMP to change the release zone for ocean disposal, increasing the buffer of 500 feet to 1000 feet on the north and south site boundaries in order to maintain the disposal foot boundary within the disposal site. Region 4 would like to contain the dredged material within the site to avoid any impact to offsite benthic communities and concluded that the 500-foot buffer from the site boundary for the disposal of dredged material is not sufficient to prevent movement of material offsite. The 2013 SPI results indicate that dredged material extended past the north and south boundaries of the site. Region 4 concluded that the dredged material has not adversely impacted the benthic communities. Disposal activities have shifted the bottom sediments to be more fine-grained, which support more mature benthic communities.

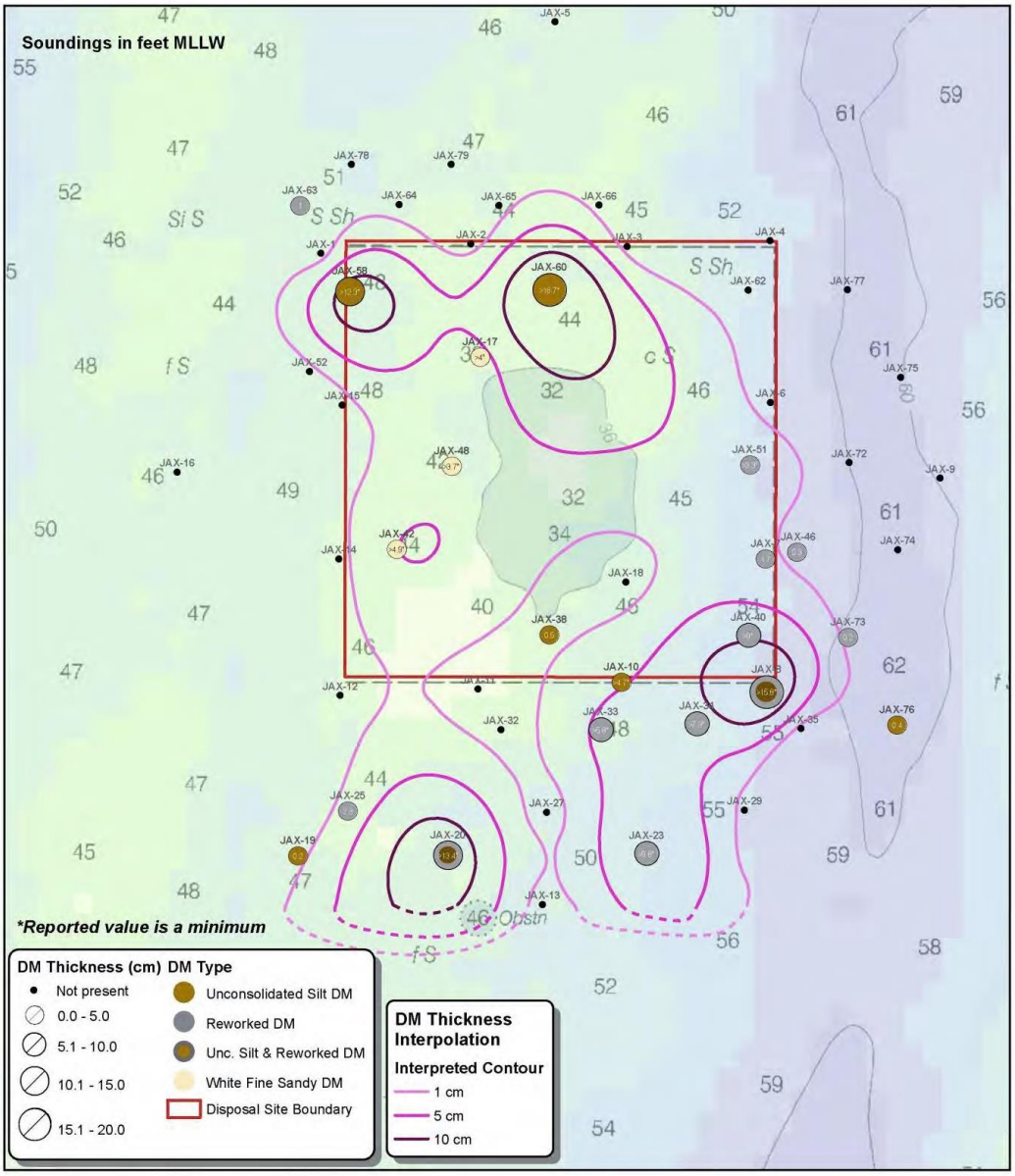

Figure 2. Map of 2013 SPI Dredged Material Thickness, Jacksonville ODMDS

3.6 Region 4 – Pensacola Offshore ODMDS, Florida

Region 4 monitored the Pensacola Offshore ODMDS, located off the Gulf coast of Florida. The Region conducted this monitoring survey in conjunction with the Tampa Bay ODMDS survey in September 2013 aboard the NOAA R/V *Nancy Foster*. The objective of this survey was to evaluate impacts of ocean disposal at the site on the marine environment.

Region 4 collected sediment samples from 12 stations distributed within and surrounding the disposal site. The Region analyzed the samples for grain size, chemical contaminants, and benthic infaunal community parameters. Region 4 also collected water quality samples from four of those 12 stations (two within and two outside the site) from near surface and bottom waters using water sampler with a CTD probe.

Analysis of water samples found that water quality was similar within and outside the site. No toxic chemical constituents were found. All four stations sampled were nearly identical in temperature, salinity, dissolved oxygen, and density. However, the analysis did indicate that the disposal site has a poorly mixed water column, with warmer, fresher water at the surface and cooler, more saline waters towards the bottom. Chemical analysis detected six metal contaminants (arsenic, chromium, copper, lead, nickel, and zinc) in the water samples, but all were below levels of concern, based on marine water quality criteria established by the Clean Water Act. Region 4 uses this data to validate water column models that predict chemical concentrations in the water column after dredged material disposal.

With the exception of two stations, PE11 and PE12, the stations sampled within and surrounding the Pensacola Offshore ODMDS were generally biologically, physically, and chemically similar. Most bottom sediments were predominantly sand (96.3- 99.9%). Sediments at stations PE11 and PE12 averaged 64% sand and 36% fine-grains. Most stations had a very low percent total organic carbon (<0.1%), while PE11 and PE12 had a higher percentage of total organic carbon (1.25% and 0.56%, respectively). These two stations also had the lowest percent solids of all the stations sampled. Chemical analyses of the sediments revealed detectable amounts of several contaminants, all of which were highest at either PE11 or PE12. The contaminants detected, including metals, polycyclic aromatic hydrocarbon (PAHs), and butyltins, were all below levels of concern. Most stations had healthy benthic infaunal communities with similar taxa diversities including polychaetes (78.8- 87.9%), mollusks (6-12%), and arthropods (0.4-7%). Only one benthic infaunal species was observed at PE11 (a polychaete) and PE12 (a brachiopod).

Based on their analysis of the data collected in the survey, Region 4 confirmed that environmentally acceptable conditions are being met at the site and does not recommend any changes to the site's SMMP at this time. Region 4 found the benthic community structure to be healthy and similar across 10 of the 12 stations surveyed, both within and surrounding the disposal site. Region 4 concluded that recent disposal activity, which occurred less than eight weeks prior to survey, affected stations PE11 and PE12 within the disposal zone more than the other stations sampled. The effect of the disposal was indicated by the lower percent solids and higher total organic carbon levels present, which is typical of dredged material. The two stations were not located in proximity to one another, suggesting a patchy spatial distribution of dredged material within the site. Region 4 attributed low benthic diversity at stations PE11 and PE12 to insufficient recovery time after a recent disposal event.

3.7 Region 4 – Tampa Bay ODMDS, Florida

Region 4 monitored the Tampa Bay ODMDS, located off the Gulf coast of Florida. The Region conducted this monitoring survey in conjunction with the Pensacola Offshore ODMDS survey in

September 2013 aboard the NOAA R/V *Nancy Foster*. The objective of this survey was to evaluate the impact of disposal on the marine environment at Tampa Bay ODMDS.

Region 4 collected sediment samples from 12 stations, including 10 stations within the disposal site and two stations surrounding the disposal site. Of the 10 stations within the site, six stations were within the area in the northeast corner of the site where the Region currently directs users to release dredged material (disposal zone). Water samples were collected from four of the 12 stations (two within and two outside the site) from near surface and bottom waters using a water sampler with a CTD probe. Sediment samples were analyzed for grain size, chemical contaminants, and benthic infaunal community parameters. Region 4 conducted statistical analyses to determine if there were significant differences in water and sediment characteristics between the stations within and surrounding the disposal site.

Analysis of the water samples showed similar water quality within and outside the site and no toxic chemical constituents. Nearly identical temperature, salinity, dissolved oxygen, and density were observed in water samples collected from the four sampling stations. Region 4 found the disposal site has a well-mixed water column, with no apparent layering (stratification). Chemical analyses detected six different metal contaminants (arsenic, chromium, copper, lead, nickel, and zinc) in the water samples. All metal contaminant concentrations were found to be below levels of concern, based on marine water quality criteria established by the Clean Water Act. Region 4 uses this data to validate water column models that predict chemical concentrations in the water column after dredged material disposal.

The sediments sampled at the Tampa Bay ODMDS were, generally, chemically and physically similar. Although not statistically significant, analysis showed that sediments from outside the disposal zone had higher metal contaminant concentrations. Two stations outside the disposal zone had arsenic exceedances of the NOAA ERL (NOAA, 1999). Sediment chemical concentrations above the NOAA ERL, but below the NOAA ERM, are not likely to be harmful to benthic organisms, but are considered by EPA, in the context of other evidence, when making environmental management decisions. All metal concentrations except zinc were highest at stations outside of the disposal zone. Bottom sediments at all stations were predominantly sand (73.4- 97.3%) and primarily solids (68.3- 82.4%).

Healthy, productive (and biologically similar) benthic infaunal communities were found at all stations sampled. Annelids dominated the benthic infaunal communities at 9 of 12 stations. EPA Region 4 compared the benthic communities within and outside the disposal zone and found no significant differences.

Based on the data collected in the survey, Region 4 confirmed that environmentally acceptable conditions are being met at the site and does not recommend any changes to the site's SMMP at this time. Region 4 determined that all stations had healthy, productive benthic infaunal communities, with no significant differences found between stations within and surrounding the disposal site. Slight differences in benthic diversity among sites were attributed to differences in sediment composition. Despite the variable percentages of sediment grain sizes observed in this study, Region 4 found no distinctive pattern that could be attributed to the historical placement of dredged material. Further, Region 4 found no statistically significant differences in metal concentrations between stations within the disposal zone and stations outside of the disposal zone. Region 4 found no indication of adverse impacts to the marine environment.

3.8 Region 6 – Sabine-Neches ODMDSs 1, 2, 3, and 4, Texas

Region 6 monitored the Sabine-Neches ODMDSs 1, 2, 3, and 4, located in the Gulf of Mexico, off the Texas-Louisiana border (Figure 3). This monitoring survey was conducted in September

2013 aboard the NOAA R/V Manta. The objective of this survey was to collect data to assess the overall environmental impact of past and recent disposal operations to the benthic infaunal community and bottom sediments and determine if the disposal footprint has extended past the sites' boundaries.

The Region collected SPI at 130 total stations distributed within and surrounding the four disposal sites and two reference sites to analyze the dredged material footprint, sediment grain size, and benthic infaunal community parameters. Region 6 collected sediment samples from 22 stations within the four ocean disposal sites, 22 stations surrounding the ocean disposal sites, and three stations at each of the two reference sites. These 50 sediment stations were a subset of the 130 SPI stations. The sediment samples were analyzed for grain size, chemical constituents, and benthic infaunal community parameters. All stations within Sites 2 and 4 were evenly distributed. Stations within Sites 1 and 3 were distributed between the areas used for a 2012 disposal event and the areas not used during the 2012 disposal event.

Region 6 compared the data from this 2013 survey to data collected in previous surveys, including 1979-1980 field surveys and a 1995 baseline survey conducted at the four ODMDSs. Region 6 also compared the 2013 survey data to pre-disposal dredged material sediment testing results from 1993 to 2010, as contained in four contaminant assessment reports (1993, 1999, 2004, and 2010). In addition, the Region evaluated the sediment chemistry data against the benchmarks set by NOAA (NOAA, 1999).

Physical analyses revealed various grain size distributions in the sampled areas. Areas within Site 1 used for the 2012 disposal event had finer sediments compared to areas within the site not used in the 2012 disposal event. Sediment samples from Site 2 were found to be dominated by sand. Sediment samples from Site 3 and Site 4 were found to be dominated by fine sediments. Compared to data collected in 1980, grain size was found to have significantly changed at Sites 1 and 3, shifting to more fines; grain size was not found to have significantly changed at Sites 2 and 4 (Figure 4).

Region 6 compared sediment contamination results at the ODMDSs from 2013 to those previously reported in sediment contaminant assessment reports for the navigation channel, the reference sites, and the ODMDSs from 1993 to 2010. The concentrations of arsenic, nickel, beryllium, silver, zinc, selenium, and barium from 2013 exceeded the historical maximums within Sites 3 and 4. Sediment chemical analysis from the 2013 study found both arsenic and nickel at levels of concern. The arsenic and nickel concentrations exceeded the NOAA ERL in sediments collected within and surrounding Sites 3 and 4. Sediment chemical concentrations above the NOAA ERL, but below the NOAA ERM, are not likely to be harmful to benthic organisms, but are considered by EPA, in the context of other evidence, when making environmental management decisions. Selenium and barium concentrations in 2013 exceeded the historical maximums at Sites 1 and 2.

Using SPI, Region 6 observed that the dredged material footprint centered over the disposal sites and that the material extended beyond the boundaries of Sites 1, 3, and 4. Historic and recent dredged material was observed beyond the boundaries at Sites 1, and only historic dredged material beyond the boundaries at sites 3 and 4. Region 6 also reviewed the 2012 disposal records at Sites 1 and 3, and did not find any indication that dredged material was disposed beyond these ODMDS boundaries during 2012 disposal operations. (The Sabine-Neches Sites 1, 2, 3, and 4 are dispersive by nature; that is, dredged material disposed at the sites is being transported outside the site boundaries by the current.)

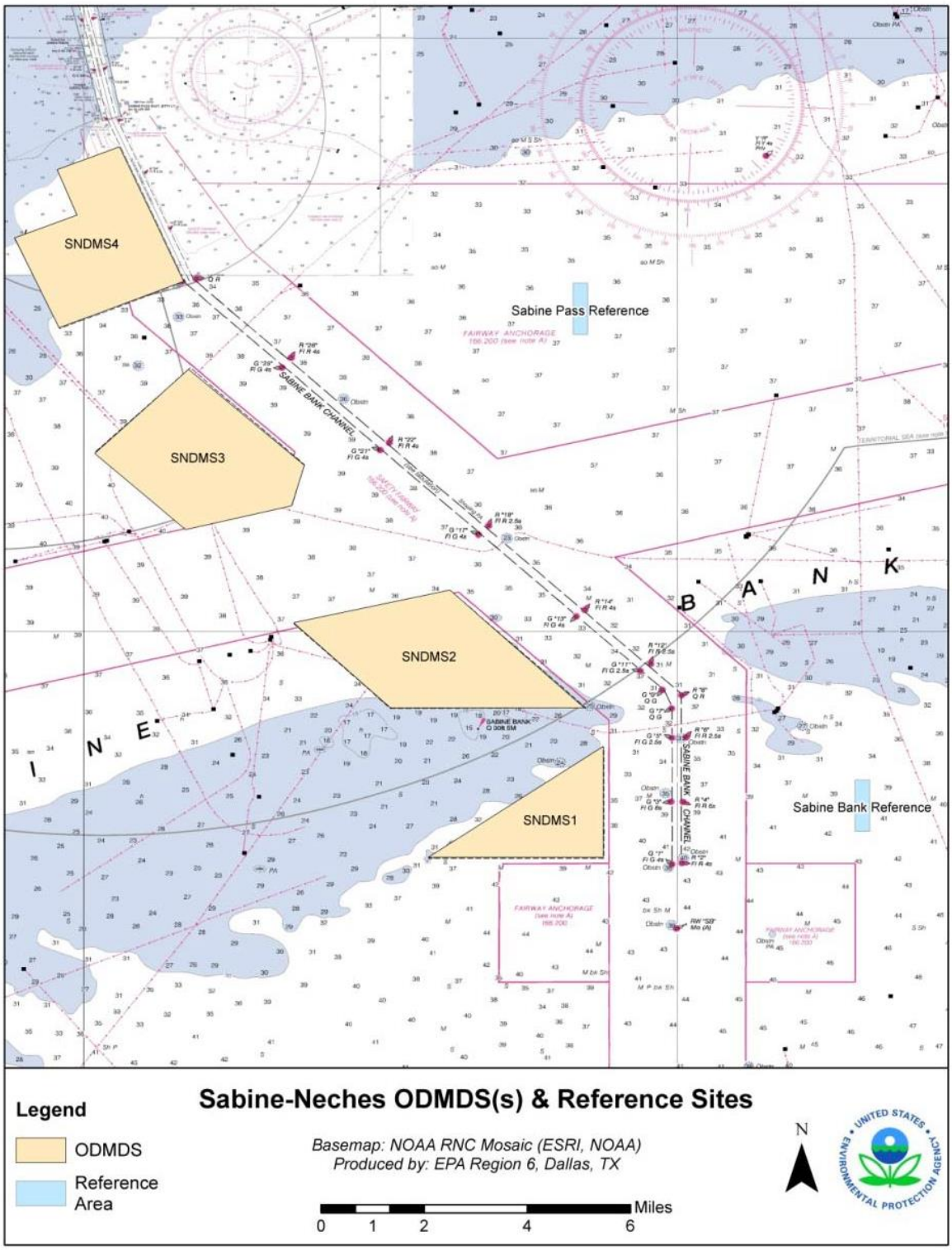

Figure 3. Map for Sites 1-4 and Reference Sites, Sabine-Neches ODMDS

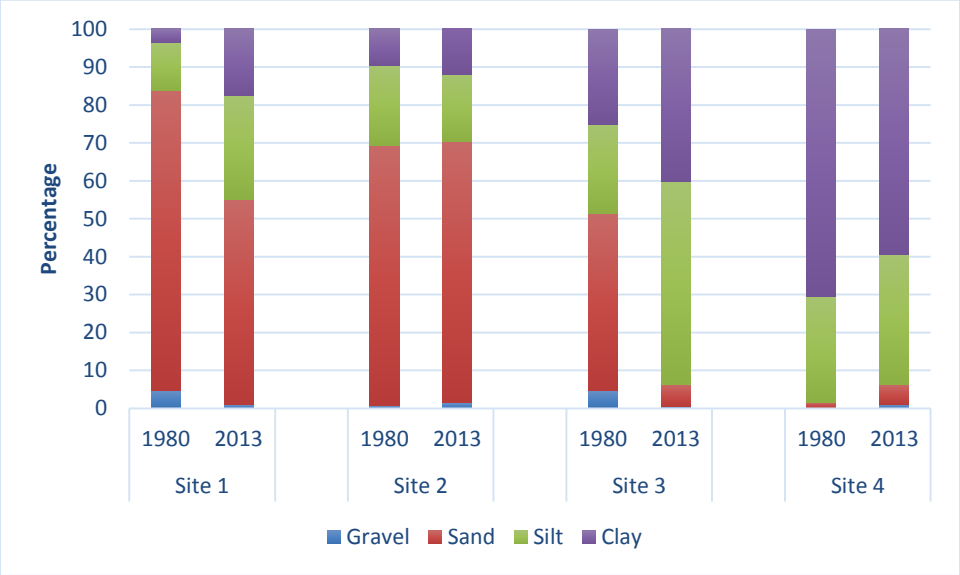

Figure 4. Sediment grain size distribution for Sites 1-4 in 1980 and 2013, Sabine-Neches ODMDS

Region 6 observed similar benthic infaunal assemblages at Sites 1, 2, 3, and 4 and the reference sites. Polychaete assemblages dominated the benthic communities at these sites. The specific polychaete taxa that were found to be dominant (Mediomastus, Meredithia, Paraprionospio, Prinospio, and Cossura) are very common in the Gulf of Mexico. Benthic macroinfaunal assemblages at the sites fell into two broad groupings based on sediment type. Taxa richness was typically greater at Sites 1 and 2 which were characterized by sandy or sand/silt sediments compared to Sites 3 and 4 which were dominated primarily by fines. The benthic community indices (Pielou, 1966), taxa richness and density, were not significantly different within the disposal sites, surrounding the disposal sites, and at reference sites for three of the four ODMDSs. For Site 3, taxa densities and richness at stations within the site where the 2012 disposal event occurred were found to be significantly higher than stations representing areas within the site that were not used during the 2012 disposal event. Taxa richness at all stations within and around Site 3 was significantly lower than taxa richness at the reference sites. Region 6 concluded that recent dredged material disposal at Sites 1 and 3 did not impact benthic assemblages, because taxa richness and densities were higher at stations where dredged material was placed during the 2012 disposal event.

Based on the data collected in the survey, Region 6 confirmed that environmentally acceptable conditions are being met at the sites and does not recommend any changes to the SMMPs at this time. Region 6 determined that disposal activities have not adversely impacted the benthic community at any of the ODMDSs. However, the source for the increased arsenic and nickel concentrations observed in sediments is unknown and warrants further investigation. To better assess the extent of the disposal footprint, Region 6 plans to collect samples from stations beyond the area of the 2013 survey during future surveys. Region 6 may also evaluate disposal placement records prior to the 2012 disposal event for Site 4 to determine if the material has naturally migrated past the site boundary since placement or if the material was inadvertently placed beyond the boundaries at the time of disposal.

3.9 Region 9 – Hilo ODMDS, Hawaii

Region 9 monitored the Hilo ODMDS, located offshore of Hilo on the island of Hawaii. The Region conducted this monitoring survey in conjunction with the South Oahu ODMDS survey in June and July 2013 aboard the NOAA R/V *Hi'ialakai.* The objective of this survey was to assess

the dredged material footprint at the Hilo ODMDS and identify if disposal activities were causing adverse impacts to the marine environment.

Region 9 obtained SPI and sediment samples from stations extending radially in 8 directions from the center of the site to outside of the site boundaries. Region 9 obtained SPI and plan view photography (PVP) from 46 stations, including 15 stations within the disposal site and 31 stations surrounding the disposal site to identify the horizontal extent and thickness of the dredged material. Region 9 used this information to identify eight sediment sampling stations (four within the disposal site and four surrounding the disposal site) to further characterize the seafloor. Sediment samples were analyzed for grain size, chemical constituents, and benthic infaunal community parameters. SPI were also analyzed for sediment and benthic community recolonization. Region 9 compared the results of the 2013 survey to the 1980 baseline conditions when the site was originally designated, including comparison of the chemical constituents concentrations to the applicable NOAA ERL (concentration below which adverse effects seldom occur) and NOAA ERM (concentration above which adverse effects frequently occur) limits (NOAA, 1999).

Dredged material was found beyond site boundaries and predictable changes to the sediments and the benthic community had occurred. SPI showed dredged material was thickest at the station located at the center of the site. The thickness of the dredged material decreased towards the edges of the site, where dredged material was only 0.1 to 1.0 centimeters thick. Outside the site, the dredged material was found to be either within this range of thickness or only seen in trace amounts. This is below the threshold of concern as defined by the EPA. Stations within and surrounding the site were dominated by stage I on III benthic communities. These communities are characterized by organisms present at the sediment surface (stage I) and more mature organisms present in burrows within the sediment (stage III). Stage I on III communities indicate rapid recolonization after dredged material disposal and a well-established infaunal community, suggesting no lasting long-term adverse impacts. The only station that did not have a well-established benthic community was located at the center of the disposal site. This station had the thickest layer of dredged material, which most likely altered its infaunal community. The overall abundance of infaunal organisms was slightly higher at stations surrounding the site than stations within. Crustaceans were more abundant within the disposal site, while annelids, mollusks, and miscellaneous taxa were more abundant surrounding the site. Despite these differences, stations located within the disposal site were not statistically different in terms of benthic abundance or diversity. Compared to the baseline data collected in 1980, the abundance of miscellaneous taxa decreased and the abundance of mollusks increased. The bottom sediments at Hilo were variable and ranged from gravel to fine-grains. More gravel and sand were observed within the disposal site and more fine sediments were observed surrounding the site. The percentage of fine sediments and gravel within the disposal site increased compared to the 1980 baseline.

The bulk chemistry data showed low, but variable, concentrations of most chemical constituents. At stations within and surrounding the disposal site, three metals (arsenic, chromium, and copper) were found at concentrations above their NOAA ERL. Sediment chemical concentrations above the NOAA ERL, but below the NOAA ERM, are not likely to be harmful to benthic organisms, but are considered by EPA, in the context of other evidence, when making environmental management decisions. Concentrations of these metals were highest outside the disposal site. Region 9 compared the metal concentrations of cadmium, copper, mercury, and lead to those recorded in the 1980 baseline. Only copper concentrations outside the disposal site were higher than concentrations recorded in the 1980 baseline. Because these elevated concentrations were found outside and shoreward of the disposal site, the increase could be due to other shore-side sources or historic “short-dumping” from disposal scows before compliance monitoring was implemented. Short-dumping is the disposal from

scows before they reach the disposal zone. Nickel was the only chemical constituent that exceeded its NOAA ERM. Nickel exceeded its NOAA ERM at all stations. Much of the geomorphological character of the sediments in this area is related to the original volcanic formation of the Hawaiian Islands, which are naturally elevated in nickel concentration. Therefore, these nickel concentrations are not reason for concern. There were no exceedances of the NOAA ERM for organic contaminants (dioxins, dichlorodiphenyltrichloroethanes (DDTs), organotins, PAHs, and polychlorinated biphenyls (PCBs)) within or surrounding the disposal site.

Based on the data collected in the survey, Region 9 confirmed that the environmentally acceptable conditions are being met at the site and, at this time, does not recommend any changes to be incorporated during the upcoming update of the site's SMMP. From information collected in this 2013 survey, Region 9 found that dredged material extended past site Hilo ODMDS boundaries. Region 9 concluded that the presence of dredged material outside the Hilo ODMDS is not due to recent ocean disposal activities, but rather is likely due to its proximity to historic disposal sites and lack of compliance monitoring prior to the 2000s which made detection of short-dumps outside of the ODMDS boundaries difficult. Region 9 also found that historic and recent dredged material disposal have not caused significant adverse impacts at this site. Sediment chemistry and benthic communities within and outside the disposal site were not statistically different. Differences between grain size, sediment chemistry, and benthic community parameters observed during this survey and the site data collected in the 1980 survey are due to minor and localized physical changes. Region 9 determined that continued use of the site should similarly result in no significant adverse effects.

3.10 Region 9 – South Oahu ODMDS, Hawaii

Region 9 monitored the South Oahu ODMDS, located offshore of Pearl Harbor on the island of Oahu. Region 9 conducted this monitoring survey in conjunction with the Hilo ODMDS survey in June and July 2013 aboard the NOAA R/V *Hi'ialakai*. A separate geophysical survey was conducted aboard a separate vessel owned by Sea Engineering. The objective of this survey was to assess the overall impact of disposal operations and determine if the disposal footprint extended past the site boundaries.

Region 9 collected images and sediment samples within and surrounding the disposal site. Region 9 obtained SPI and PVP from 40 stations, including 16 stations within the disposal site and 24 stations surrounding the disposal site to identify the horizontal extent and thickness of the dredged material. Region 9 used this information to select 10 sediment sampling stations (five within the disposal site and five surrounding the disposal site) to further characterize the seafloor. Sediment samples were analyzed for grain size, chemical constituents, and infaunal community parameters. SPI were also analyzed for sediment parameters and benthic community recolonization. Region 9 compared the survey results of the 2013 survey to 1980 baseline conditions when the site was originally designated, including comparison of the chemical constituent concentrations to the applicable NOAA ERL (concentration below which adverse effects seldom occur) and NOAA ERM (concentration above which adverse effects frequently occur) limits (NOAA, 1999).

Geophysical measurements were taken at the disposal site and surrounding areas using a high-resolution sub-bottom seismic-reflection profiler. Using the results, including an estimated overall dredged material volume based on a calculated average thickness, Region 9 evaluated the results of the estimated cumulative volume of dredged material present at the South Oahu ODMDS relative to the volume of dredged material disposed at the site, based on USACE ocean disposal records.

Survey results showed that dredged material was present well beyond the site boundary, but this is not likely due to recent ocean disposal because the variation in grain size or benthic communities present within or surrounding the site did not correlate with the patterns of current ocean disposal of dredging projects using the site. The thickest dredged material deposits outside the disposal site were observed just north of the site boundary, closer to the harbor entrance. This indicates historic "short-dumping," or disposal from scows before they reach the disposal zone with the site. The benthic communities within and surrounding the site were not statistically different in terms of species diversity, abundances, or richness. Successional stage evaluation of the dredged material deposits, including deposits found outside of the disposal site, showed fairly uniformly stage I on III benthic communities. These communities are characterized by organisms present at the sediment surface (stage I) and more mature organisms present in burrows within the sediment (stage III). Stage I on III communities indicate rapid recolonization after dredged material disposal and a well-established infaunal community, suggesting no adverse impacts. Species diversity was high and abundances tended to be low at all stations. The infaunal abundance in this 2013 survey was similar to the infaunal abundance measured by the 1980 baseline. Stations within the disposal site had substantially more gravel and more fine sediments than those outside the site that represent native sandy seafloor conditions. The percentage of fine sediments and gravel within the disposal site increased compared to the 1980 baseline. This pattern reflects the character of dredged material typically disposed at this site, which often includes gravel-sized coral rubble, and fine sediments from land-side runoff that settles in harbors, berths, and navigation channels.

Sediment chemical analysis showed low but variable concentrations of most chemical constituents. At both inside and outside stations, cadmium, chromium, copper, and mercury were found at concentrations above their NOAA ERL (Table 1). Sediment chemical concentrations above the NOAA ERL, but below the NOAA ERM, are not likely to be harmful to benthic organisms, but are considered by EPA, in the context of other evidence, when making environmental management decisions. Chromium, copper, and mercury concentrations were slightly higher at stations inside the disposal site than those outside the site. Except for copper concentrations, dredged material disposal generally had not appreciably increased the contaminant loads inside the site compared to 1980 concentrations. Nickel was the only chemical constituent that exceeded its NOAA ERM. Nickel concentrations exceeded its NOAA ERM at all stations inside the disposal site and at one station outside the site. Much of the geomorphological character of the sediments in this area is related to the original volcanic formation of the Hawaiian Islands, which are naturally elevated in nickel concentration. Therefore, these nickel concentrations are not reason for concern. Organic contaminant constituents (dioxins, DDTs, organotins, PAHs, and PCBs) were found in low concentrations. In general, PCB concentrations were found to be higher at stations inside the site compared to stations outside of the site. PCBs and DDTs exceeded their respective ERL at only one station inside and one station outside the disposal site. These screening level exceedances were relatively small in magnitude. The few constituents found at higher concentrations within the disposal site are not considered to represent a risk to the marine environment.

Geophysical measurements used to estimate the total volume of dredged material at South Oahu ODMDS and correlated well with the recorded volumes of dredged material disposed at this site, as reported by the USACE Honolulu District. The SPI and PVP showed dredged material present within and outside site boundaries. The sub-bottom seismic-reflection profiler showed that dredged material deposits varied from three to twelve feet in thickness. The calculated overall dredged material volume within the disposal site was 1,736,000 cubic yards. This was similar to the 1,855,230 cubic yards permitted by the USACE Honolulu District from 2002 to 2013.

Table 1. Summary of Sediment Physical and Chemical Analyses, South Oahu ODMDS

Analyte	Units	Inside ODMDS, Avg.	Outside ODMDS, Avg.
Gravel	%	22	3
Sand	%	44	77
Silt	%	21	14
Clay	%	12	5
TOC	%	1.36	0.55
Arsenic	mg/kg	22*	33*
Cadmium	mg/kg	0.53	0.42
Chromium	mg/kg	118*	67
Copper	mg/kg	59*	24
Lead	mg/kg	38	21
Mercury	mg/kg	0.19*	0.09
Nickel	mg/kg	88**	41*
Selenium	mg/kg	ND	ND
Silver	mg/kg	ND	ND
Zinc	mg/kg	89	54
Dioxins - Total TEQ	ppt	4.02	1.40
Total DDTs	ppb	ND	ND
Total Organotins	ppt	2.81	3.18
Total PAHs	ppb	324	565
Total PCB Congeners	ppb	19.58	7.83
*exceeds NOAA ERL		**exceeds NOAA ERM	

Based on the data collected in the survey, Region 9 confirmed that environmentally acceptable conditions are being met at the site and, at this time, does not recommend any changes to be incorporated during the upcoming update of the site's SMMP. Region 9 found that dredged material had extended past site boundaries, but concluded that this is not due to recent disposal activities. Historic and recent dredged material disposal have predictably caused changes to the sediment grain size within the ODMDS. Other characteristics, like sediment chemistry and benthic communities, were found to be similar within and outside the disposal site. Differences between sediment chemistry and benthic community data collected in 2013 and in 1980 are the result of localized impacts of disposal activities followed by relatively rapid recovery. Region 9 determined that these ocean disposal activities have not caused significant adverse impacts. Region 9 concluded that continued use of the site should similarly result in no significant adverse effects.

3.11 Region 10 – Chetco ODMDS, Oregon

Region 10 monitored the Chetco ODMDS, located off the Oregon coast. The Region conducted a monitoring survey in conjunction with the Coquille ODMDS survey in September 2013 aboard Oregon State University's R/V *Pacific Storm* through an interagency agreement with the USACE. In addition, supported by Region 10 funds, the Region conducted a dive survey in August 2013 aboard a Region 10 vessel. The objective of these surveys was to identify if disposal at Chetco ODMDS is causing significant adverse impacts and obtain information needed to update the SMMP.

For the monitoring survey, Region 10 collected sediment samples from eight stations, including four stations within the disposal site and four stations surrounding the disposal site. Region 10

analyzed sediment samples for grain size and benthic infaunal community parameters at all stations, and chemical constituents at stations within the disposal site. Region 10 compared the chemical analysis results to marine screening levels (SLs) established in the May 2009 Sediment Evaluation Framework (SEF) for the Pacific Northwest (USACE *et al*., 2009). Concentrations below the SEF SLs are not toxic to benthic organisms. The dive survey collected video imagery and still photography of the seafloor along five transects throughout the disposal site.

Analysis of sediment samples from the Chetco ODMDS found no chemical contaminants at levels exceeding SEF SLs. The metals arsenic, chromium, copper, lead, zinc, and mercury, as well as PAHs and other organic compounds, were detected in all samples, but the concentrations were well below the SEF SLs. There is no SEF SL for nickel, but Region 10 does not expect adverse impacts to the benthic community from the observed nickel concentrations. No tributyltins or pesticides were detected.

The results showed no discernable differences in grain size and benthic infaunal communities between sampling locations within and surrounding the site. Grain size of sediments varied from fine-grains to gravel. Six of the eight stations sampled were predominantly sand (>75%). The other two stations were either predominantly fine sediments or comprised of both sand and gravel. This was consistent with the dive survey results, which recorded various substrate types, including coarse sand, gravel/cobble, and rocky reefs. Analysis of benthic infauna found no discernable difference in community indices (abundance, richness, evenness, density, and diversity) within and surrounding the disposal site. There were, however, more individuals and taxa captured at the surrounding stations. The benthic infauna found at stations within and surrounding the site were typical for the sand dwelling communities on the Oregon coast.

The dive survey found both low- and high-relief rocky reefs within the disposal site. Some of the high-relief rocky reefs identified extended up to 10 feet above the seafloor. These large high-relief rocky reefs had well-established sessile invertebrate communities along with typical groundfish species.

From these surveys, Region 10 found that disposal activities are not adversely impacting the bottom sediments, benthic community, or reef communities. However, Region 10 believes that protecting the large high-relief rocky reef communities within the site should be a priority, and plans to adjust disposal operations accordingly to avoid disposal within these discrete areas. Region 10 plans to revise and update the SMMP for this site.

Based on the data collected in the survey, Region 10 confirmed that environmentally acceptable conditions are being met at the site, but recommends some changes to dredged material disposal operations and monitoring at the site to safeguard rocky habitat. Region 10 will continue to conduct physical, chemical, and infaunal analysis of the sediment and conduct visual surveys of macroinvertebrates along repeatable transects in order to obtain a better understanding of community structure and potential changes within the rocky substrate of the disposal site. Region 10 also plans to implement a sampling scheme designed to detect statistically significant differences in species composition within and surrounding of the disposal site.

3.12 Region 10 – Coos Bay Sites F and H, Oregon

Region 10 monitored the Coos Bay Sites F and H, located off the southern Oregon coast. The Region conducted this monitoring survey in August 2013 aboard the privately owned vessel R/V *Miss Linda* through an interagency agreement with the USACE and with additional USACE

support. The objectives of this survey were to evaluate the impact of disposal at Coos Bay Sites F and H and to provide sufficient information to update the SMMP.

Region 10 obtained samples from stations within and surrounding Sites F and H. The Region collected sediment samples from 26 stations, including seven stations within Site F, seven stations surrounding Site F, six stations within Site H, and six stations surrounding Site H. Sediment samples were analyzed for grain size and benthic infaunal community parameters at all stations, while only samples collected from within the disposal sites were analyzed for chemical constituents. Region 10 conducted four benthic trawls within and surrounding Site H and three benthic trawls within Site F to assess epibenthic invertebrates and demersal fish in those areas. Additionally, because Site H received an unexpectedly large volume of fine-grained dredged material in 2009, Region 10 conducted sediment biological assessments (bioassays) at the stations within Site H. The Region used the bioassay results to determine if benthic invertebrates were exposed to toxic pollutants. Region 10 compared the chemical analyses results to marine SLs established in the May 2009 SEF for the Pacific Northwest (USACE *et al*., 2009). Concentrations below the SEF SLs are not toxic to benthic organisms.

Sediment samples revealed no toxic chemical constituents in sediments collected from Sites F and H. Eight metals (antimony, arsenic, cadmium, chromium, copper, lead, zinc, and mercury) were detected in samples from all stations; the concentrations were well below the SEF SLs. There is no SEF SL for nickel, but the observed nickel concentrations are not expected to have any impacts on the benthic community. No PCBs or pesticides were detected. The tributyltins and organic compounds detected were at very low concentrations and well below the SEF SLs. In addition, all sediments passed the bioassay tests, supporting the chemical analysis that sediments within Site H did not have adverse effects on the test species. This indicates that the increased volume of material disposed of at Site H in 2009 did not expose benthic invertebrates to toxic pollutants.

There were no discernable differences between grain size and benthic infaunal communities within and surrounding the sites. At stations within and surrounding Site F, sediments averaged 96% sand. At stations within and surrounding Site H, sediments averaged 81% sand. Sediment within Site H had a greater percentage of total sand compared to the finer-grained sediment found surrounding the site. The benthic community indices, abundance and richness, were lower within Sites F and H than at areas surrounding the sites. However, the benthic community diversity was higher within the sites than surrounding the sites. Despite this variability between stations within and surrounding the disposal sites, the species density, richness, and diversity were within the normal range for soft-bottom nearshore habitats in the eastern Pacific.

Based on the data collected in the survey, Region 10 confirmed that environmentally acceptable conditions are being met at the site and, at this time, does not recommend any changes to be incorporated during the upcoming update of the sites' SMMP. Region 10 concludes that disposal activities are not adversely impacting the bottom sediments or benthic and epibenthic community. Benthic trawls indicate that benthic and epibenthic communities within and surrounding the sites appear to be healthy. Region 10 recommends further analysis to fully evaluate the impact of disposal activities on sediment characteristics and benthic community. Survey results indicate that the dredged material is moving beyond site boundaries. For confirmation, Region 10 plans to conduct additional physical sediment analyses surrounding the site. The Region also plans to direct their sampling to detect statistically significant differences between the benthic communities within and surrounding the disposal sites and the relationship between grain size and benthic community composition.

3.13 Region 10 – Coquille ODMDS, Oregon

Region 10 monitored the Coquille ODMDS, located off the southern Oregon coast. The Region conducted this monitoring survey in conjunction with the Chetco ODMDS survey in September 2013 aboard Oregon State University's R/V *Pacific Storm* through an interagency agreement with USACE. The objectives of this survey were to provide monitoring data as part of a continuing effort to evaluate disposal impacts, provide sufficient information to update the SMMP, and collect information to evaluate future disposal areas.

The Region collected sediment samples from 18 stations, including nine stations within the disposal site and nine stations surrounding the disposal site. They analyzed sediment samples for grain size and benthic infauna at all stations, and chemical constituents at stations within the disposal site. The Region also conducted four total benthic trawls within and surrounding the disposal site to assess epibenthic invertebrates (invertebrates that live close or on bottom sediments) and demersal fish (fish that live near bottom sediments). Region 10 compared the results from the chemical analyses to marine SLs established in the May 2009 SEF for the Pacific Northwest (USACE *et al*., 2009). Concentrations below the SEF SLs are not toxic to benthic organisms.

Sediment samples revealed no toxic chemical constituents in the Coquille ODMDS sediments. EPA scientists detected the metals arsenic, chromium, copper, zinc, and mercury in samples from most stations, but the concentrations were well below the SEF SLs. There is no SEF SL for nickel, but Region 10 does not expect any adverse impacts from the observed concentrations. No tributyltins, PAHs, PCBs, or pesticides were detected. Only two organic compounds were present in sediments at measurable concentrations (phenol and benzoic acid), which were present at two different stations at concentrations slightly above method detection limits.

The results showed no discernable differences between grain size and benthic infaunal communities at stations within and surrounding the site. Sediments from all stations averaged 96% sand. Analysis of benthic infauna found no discernable differences within versus surrounding the disposal site. The benthic infauna was typical for sand-dwelling communities on the Oregon coast. Region 10 did note the importance of the presence of the annelid species *Spiophanes bombyx*. Region 10 used this species as an indicator of disturbed habitats. This species is one of the first species to inhabit a newly disturbed area, such as areas with newly deposited dredged material. The high occurrence of this species at two stations located northeast of the disposal site suggested that this area is regularly disturbed either by disposal activities or natural processes.

It is unclear whether disposal activities have adversely impacted the demersal fish and epibenthic invertebrates present in the area. Comparisons among the sampled trawl sites indicated that the disposal site had lower diversities and abundances of demersal fish and epibenthic invertebrates. However, Region 10 was unable to determine if disposal activities directly caused the lower diversities and abundances. The low number of trawls executed does not allow Region 10 to perform statistical analyses on the data. Additionally, one trawl conducted within the disposal site was shorter than the other three, which would likely lead to fewer organisms being collected.

Based on the data collected in the survey, Region 10 confirmed that environmentally acceptable conditions are being met at the site and, at this time, does not recommend any changes to be incorporated during the upcoming update of the site's SMMP. Region 10 concludes that disposal activities are not negatively impacting the bottom sediments or benthic and epibenthic community. Region 10 plans to continue conducting monitoring to fully evaluate the impact of disposal activities on the benthic and epibenthic communities. A benthic video sled may be used

instead of a benthic trawl for future surveys because video eliminates the need to capture and release organisms and creates a permanent visual record of the seafloor. The Region may also use dive surveys to better evaluate bottom substrates. These dive surveys could focus on areas to the northeast of the disposal site to determine if disposal activities are regularly disturbing the area, as suggested by the high occurrence of *Spiophanes bombyx.*

3.14 Region 10 – Mouth of the Columbia River Deep Water Site, Oregon

Region 10 monitored the Mouth of the Columbia River (MCR) Deep Water Site (DWS), located off the coast of Oregon and Washington. The Region conducted this monitoring survey in August 2013 aboard two privately owned vessels, R/V *NRC Quest* and David Evans and Associate's S/V *Preston*, both obtained through an interagency agreement with the USACE. The objectives of this survey were to determine if dredged material has moved outside of the designated disposal zone, DWS-07, and qualitatively assess the stage of the benthic community. This monitoring survey focused on disposal zone DWS-07, one of four disposal zones established for the disposal of dredged material within the MCR DWS.

Aboard the *NRC Quest*, Region 10 collected sediment samples from within and outside of the DWS-07 disposal zone. The samples were obtained from six stations within the disposal site, including four stations within the designated disposal zone and two stations surrounding the designated disposal zone. SPI were obtained from 36 stations within disposal site, including 26 stations within the designated disposal zone and 10 stations surrounding the designated disposal zone). Sediment samples were analyzed for sediment grain size and SPI were analyzed for sediment grain size and benthic infaunal community parameters. Aboard the S/V *Preston*, Region 10 collected multibeam bathymetry data and side scan sonar data to determine the extent of the disposal footprint.

Analyses of SPI and multibeam bathymetry suggested that dredged material extended past the designated disposal zone, DWS-07. Grain size within and outside disposal zone DWS-07 was predominantly sand (89-97%). However, stations outside the disposal zone contained slightly more finer-grained material (10%) than stations within the disposal zone (3-4%). SPI results showed that dredged material found within the disposal zone consisted of both recent and older disposals while the dredged material found outside the disposal zone consisted of older disposals. Using the remote sensing data, USACE conducted a site capacity assessment in which they found that approximately 25% of the dredged material disposed within DWS-07 has moved northward after placement.

Derelict fishing gear is prevalent within the disposal zone. An unintended observation from the side-scan sonar data found 60 derelict crab pots on the seafloor. The disposal site is within commercial fishing grounds for the Dungeness crab. Therefore, the marine debris may be ghost-fishing because of the lost fishing gear. Region 10 would like to assess the prevalence of derelict crab pots within the disposal site. This information would inform the potential for creating a partnership with other federal agencies and the local fishing community to remove the debris.

Results from the SPI survey indicated that the benthic communities within and outside the disposal zone were in different stages of recovery from disposal. The USACE had disposed of dredged material from 2007 to 2013 (EPA's survey occurred prior to the disposal in 2013). The benthic community within the disposal zone was primarily stage I infauna, or the first organisms to colonize the sediment surface following a disturbance. This indicated that the benthic community within the disposal zone was disturbed and, at the time of the survey, was still in initial recovery 9 months after disposal. Outside of the disposal zone, however, the benthic community was in a more mature successional stage, stage I on III. These communities are characterized by organisms present at the sediment surface (stage I) and more mature

organisms present in burrows within the sediment (stage III). Although stage I on III communities are more mature benthic communities than stage I, it is inconclusive as to whether the stage I on III is a fully-recovered community. Interpretation of the benthic infaunal successional stages from SPI is not well understood in sandy sediments.

In this survey, Region 10 found that the SPI camera had difficulty penetrating the sandy bottom substrates of the disposal zone. Average penetration depth of the camera was four centimeters. This shallow penetration depth was not sufficient to determine depths of dredged material because the camera could not go deep enough to image native substrate. Furthermore, the dredged material is visually similar, albeit quantitatively and potentially ecologically different, from native sediments. Thus, even when it was believed the camera to have penetrated deep enough to reach native sediments, there was difficulty discerning the differentiation point between the two layers. For future studies, Region 10 will reconsider the use of SPI in disposal site surveys where the substrate is predominantly sandy.

Based on the data collected in the survey and additional work by USACE Portland District, Region 10 plans to change the sampling area for future surveys. Region 10 concluded that, contrary to what was understood at the time of site designation, dredged material is moving northward and southward by active bottom transport processes after disposal. To better understand this movement, future grain size sampling should have stations placed further away from the disposal zone and out of the northerly dispersal path. The multibeam survey area will also be expanded beyond disposal zone boundaries.

4.0 Conclusion

In FY 2013, EPA Scientists used various scientifically sound methods to obtain data at 20 ocean disposal sites monitored during 13 separate surveys. The most common survey methods were sediment grabs and video and still underwater imagery (SPI, PVP, multibeam bathymetry). EPA collected sediment grabs at 14 of the 20 disposal sites surveyed and video and still underwater imagery from seven of the 20 disposal sites surveyed. In all, scientists collected sediment grabs from a total of 200 stations and SPI from a total of 302 stations. In addition, EPA Regions conducted dive operations, fish trawls, bioassays, and water sampling.

EPA confirmed that environmentally acceptable conditions were met at 14 of 20 ocean disposal sites surveyed in FY 2013. At these 14 sites, EPA determined that dredged material disposal had not adversely impacted the ecosystem, permitted disposal could continue, and no further action was needed. At three of the six other ocean disposal sites surveyed (Sabine-Neches Sites 3 and 4 and Mouth of the Columbia River Deep Water Site), further investigation of the site conditions is necessary to determine if any changes in management practices are needed. And at the last three ocean disposal sites (Charleston, Jacksonville, and Chetco), EPA determined that modifications to the boundaries and/or permitted use of the site are necessary to sustain environmentally acceptable conditions for future management of the sites. Findings at these six sites are discussed in the following paragraphs.

Surveys at Sabine-Neches Sites 3 and 4 and Mouth of the Columbia River Deep Water Site showed that additional investigation is necessary. Monitoring at Sabine-Neches Sites 3 and 4 (TX) revealed hotspots of high metal concentrations in sediments. High metal concentrations in sediments can cause adverse effects to organisms that live on, in, or near the seafloor. These metals can also magnify as they are transferred up the food chain, ultimately impacting higher trophic level species, such as large marine predators and humans. EPA plans to conduct additional surveys at these sites focused on the hotspots to identify if any management actions are needed to prevent the occurrence of adverse effects. From the survey at the Mouth of the Columbia River (OR), EPA found that the migration of dredged material after disposal was

different than anticipated. EPA plans to conduct additional studies at the site to explore the fate and transport of material after disposal and ensure that it will not impact marine life or navigation in this area.

Finally, surveys at Charleston, Jacksonville, and Chetco led EPA to determine that, in order to sustain environmentally acceptable conditions for future management of the sites, modifications to site boundaries and/or permitted use were necessary. EPA conducted a wave and current study at Charleston (SC) to better understand the fate and transport (and potential impacts) of a significant increase in dredged material disposal planned for the site. This material will come from a project to deepen Charleston Harbor to accommodate post-Panamax ships. Based on the data and information evaluated to date, EPA currently anticipates that the material is likely to move outside of site boundaries and that the disposal zone within the site should be enlarged to prevent adverse environmental impacts offsite. At Jacksonville (FL), EPA analyzed SPI, which demonstrates that dredged material had migrated off the site to the north and south. As a result, EPA plans to restrict the release zone at the disposal site farther from site boundaries to prevent impact to the benthic communities outside of site boundaries. Lastly, EPA (with USACE) conducted a survey at Chetco (OR) to evaluate whether dredged material disposal was impacting nearby rocky reef habitat. EPA determined that, while disposal activities had not yet adversely impacted reef communities, adjustments to site usage are warranted to safeguard this valuable habitat resource.

Under the MPRSA, EPA is responsible for designating and managing ocean disposal sites for permitted disposal of dredged material. EPA monitors the environment within and around each site to verify that disposal does not cause unanticipated or significant adverse effects and that terms of MPRSA permits are met. The findings and conclusions that EPA reached based on the monitoring data collected in FY 2013 demonstrates that current conditions at the vast majority of ocean disposal sites show no evidence of adverse effects. At a few sites, EPA observed, suspected, or anticipated adverse effects. In these cases, EPA has taken site management actions to address the issues in the present and prevent adverse effects in the future.

5.0 Acknowledgements

This report is based on the monitoring surveys conducted, analyses performed, and conclusions drawn by EPA Regional Offices 2, 3, 4, 6, 9, and 10 during FY 2013. This report was developed with the support of Ocean Dumping staff from EPA Headquarters and all coastal Regional offices.

6.0 References

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7.0 Appendix – Site Characteristics of Disposal Sites Surveys in FY2013

Region	Disposal Site	Size (nm²)	Depth (ft)
2	Arecibo	1.00	333.36- 1368.11
2	Mayaguez	1.00	1151.57- 1259.84
2	San Juan	0.98	656.17- 1312.34
3	Dam Neck	8.00	Average 40.0
4	Charleston Harbor	7.50	Average 36.09
4	Fernandina Beach	4.00	37.0- 69.0
4	Jacksonville	1.00	32.0- 60.0
4	Pensacola Offshore	4.53	65.0- 80.0
4	Tampa Bay	4.00	70.0- 90.0
6	Sabine-Neches Site 1	2.40	36.09- 42.65
6	Sabine-Neches Site 2	4.20	29.53- 42.65
6	Sabine-Neches Site 3	4.70	39.37- 42.65
6	Sabine Neches Site 4	4.20	16.40- 29.53
9	Hilo	0.78	1082.68- 1115.49
9	South Oahu	1.52	1312.34- 1558.40
10	Chetco	0.09	60.0- 85.0
10	Coos Bay Site F	3.18	20.0- 160.0
10	Coos Bay Site H	0.13	160.0- 210.0
10	Coquille	0.17	40.0- 85.0
10	Mouth of Columbia River DWS	10.59	200.0- 300.0