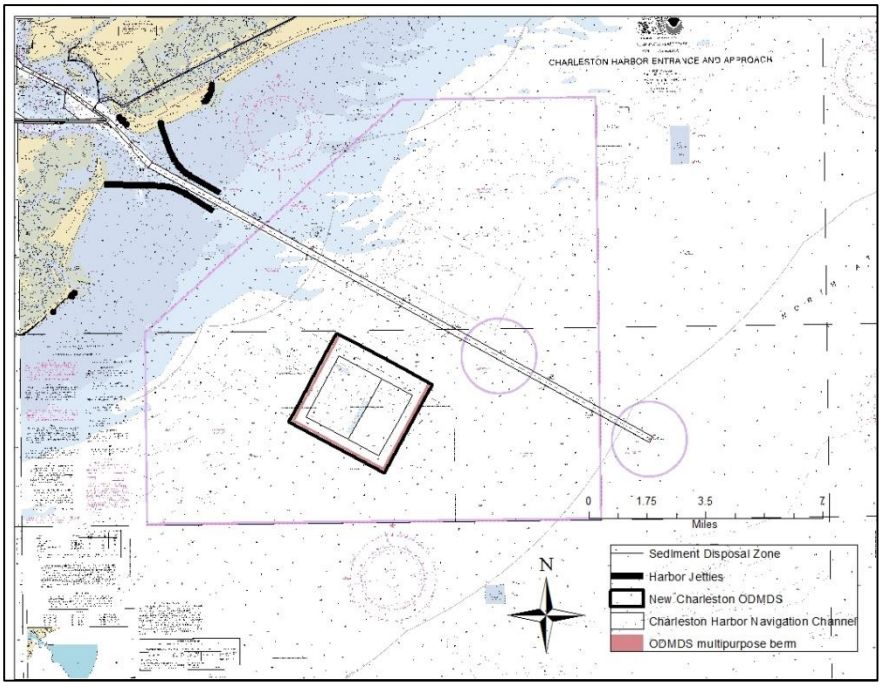
US Army Corps of Engineers®

CHARLESTON OCEAN DREDGED MATERIAL DISPOSAL SITE

SITE MANAGEMENT AND MONITORING PLAN



August 2016

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The following Site Management and Monitoring Plan for the Charleston ODMDS has been developed and agreed to pursuant to the Water Resources and Development Act Amendments of 1992 (WRDA 92) to the Marine Protection, Research, and Sanctuaries Act of 1972 for the management and monitoring of ocean disposal activities, as resources allow, by the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers.

21 Sep 16

MATTHEW W. LUZZATOO, P.E., PMP Date
Lieutenant Colonel, EN
Commander, U.S. Army Engineer District, Charleston

9/7/2016

V. Anne Heard Date
Acting Regional Administrator
U.S. Environmental Protection Agency
Region 4
Atlanta, Georgia

This plan is effective from the date of signature for a period not to exceed 10 years. The plan shall be reviewed and revised more frequently if site use and conditions at the site indicate a need for revision.

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CHARLESTON OCEAN DREDGED MATERIAL DISPOSAL SITE (ODMDS)
SITE MANAGEMENT AND MONITORING PLAN
2016

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INTRODUCTION

It is the responsibility of the U.S. Environmental Protection Agency (EPA) and the U.S. Army Corps of Engineers (COE) under the Marine Protection, Research, and Sanctuaries Act (MPRSA) of 1972 to manage and monitor Ocean Dredged Material Disposal Sites (ODMDSs) designated by the EPA pursuant to Section 102 of MPRSA. The goals of the monitoring and management are to ensure that ocean dredged material disposal activities will not unreasonably degrade the marine environment or endanger human health or economic potential. The Marine Protection, Research, and Sanctuaries Act (MPRSA), the Water Resources Development Act of 1992 (WRDA), and a Memorandum of Understanding (MOU) between EPA and USACE requires the development of a Site Management and Monitoring Plan (SMMP) to specifically address the disposal of dredged material at the Charleston ODMDS. A Site Management and Monitoring Plan (SMMP) for the Charleston ODMDS was originally developed as a result of issues related to resource protection in March 1993. In 2005, the SMMP was modified. As part of a Section 102 of the MPRSA modification to the existing ODMDS an Environmental Assessment was prepared to support federal designation of the new site. This modified SMMP replaces the original and incorporates subsequent monitoring results and provisions of WRDA 92 as well as replaces the 2005 revision. Upon finalization of this revised SMMP and designation of the new Charleston ODMDS, these SMMP provisions shall be requirements for all dredged material disposal activities at the site. All Section 103 (MPRSA) ocean disposal permits or evaluations shall be conditioned as necessary to assure consistency with the SMMP.

This SMMP has been prepared in accordance with the *Guidance Document for Development of Site Management Plans for Ocean Dredged Material Disposal Sites* (EPA and Corps, 1996). This document provides a framework for the development of SMMPs required by MPRSA and WRDA 92. The SMMP may be modified if it is determined that such changes are warranted as a result of information obtained during the monitoring process.

SITE MANAGEMENT AND MONITORING PLAN TEAM

An interagency SMMP team has existed since the development of the original plan and is responsible for this revised SMMP. The team consists of the following agencies and their respective representatives:

Charleston District Corps of Engineers	EPA Region 4
SC Dept. of Natural Resources	U.S. Fish & Wildlife Service
SC State Ports Authority	National Marine Fisheries Service

Other agencies such as the South Atlantic Fisheries Management Council and the South Carolina Department of Health and Environmental Control will be asked to participate as appropriate. The SMMP team will assist EPA and the COE in evaluating existing monitoring data, including the type of disposal, the type of material, location of placement within the ODMDS and quantity of material. The team will assist EPA and the Corps on deciding on appropriate monitoring techniques, the level of monitoring, the significance of results and potential management options.

Specific responsibilities of EPA and the Corps, Charleston District are:

> **EPA**: EPA is responsible for designating/de-designating MPRSA Section 102 ODMDSs, for evaluating environmental effects of disposal dredged material at these sites and for reviewing and concurring on dredged material suitability determinations.

Corps: The Corps is responsible for evaluating dredged material suitability, issuing MPRSA Section 103 permits, regulating site use, and developing and implementing disposal monitoring programs.

PROJECT DESCRIPTION

The new Charleston ODMDS has a total area comprising 9.8 mi^2. The coordinates are shown below (Table 1). The site will consist of a "U" shaped berm constructed of limestone rock dredged from the entrance channel upon new work construction of the Post 45 deepening project. Figure 1 also shows the monitoring zones of the new ODMDS and its proximity to the Charleston Harbor federal navigation channel.

Table 1. Coordinates of Charleston ODMDS

Site		Geographic(NAD83, Decimal Degrees)		State Plane (South Carolina US Survey Feet)		Area (nmi^2)	Area (mi^2)
		Latitude	Longitude	N	E		
Proposed Modified Charleston ODMDS	Center	32.63522	-79.73939	294137.61	2388059.58	7.4	9.8
	SE	32.60467	-79.72770	283067.786	2391795.475		
	SW	32.62744	-79.77627	291170.826	2376741.168		
	NW	32.66571	-79.75113	305185.821	2384312.304		
	NE	32.64299	-79.70253	297104.717	2399371.043		

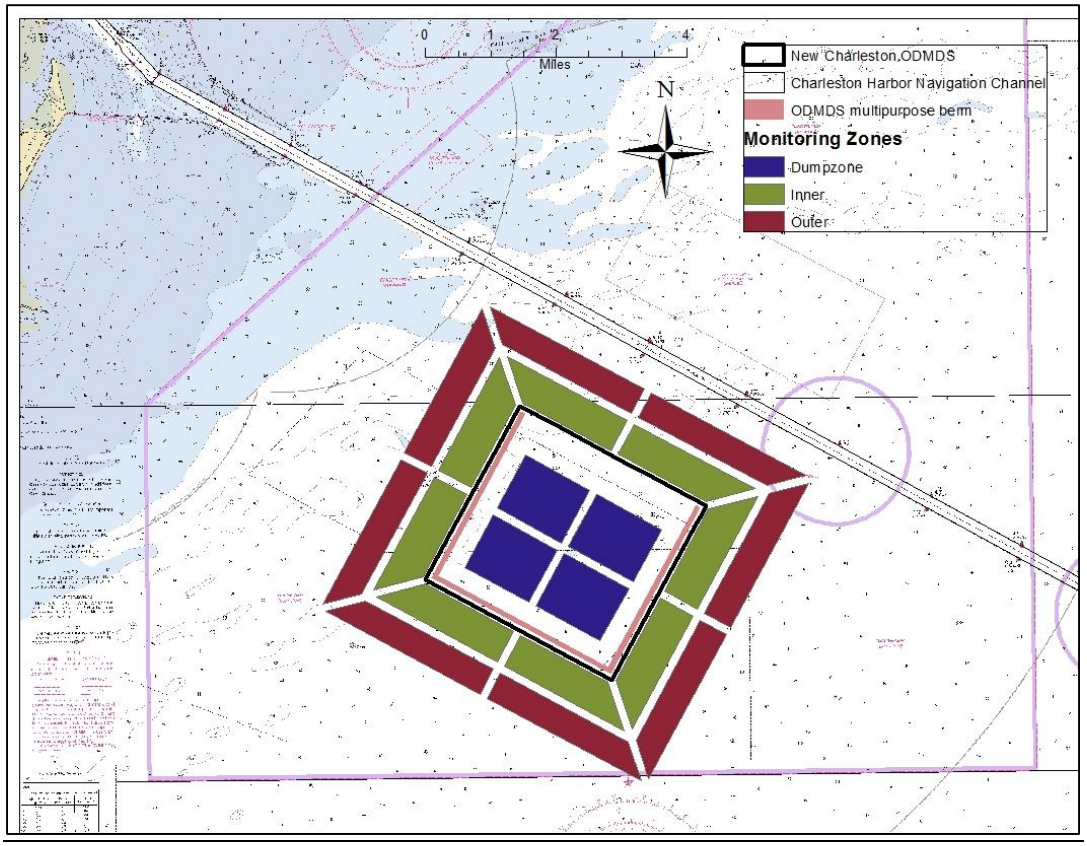

Figure 1. Charleston ODMDS and SCDNR monitoring schematic

DISPOSAL HISTORY AND SITE CHARACTERISTICS

The Charleston, South Carolina, Ocean Dredged Material Disposal Site is one of the most active, frequently used sites in the South Atlantic Bight (part of EPA's Region 4 area of responsibility). The general site has been in use since 1896 for disposal activities. The original management plan for ocean dredged materials disposal associated with the Charleston Harbor complex (1987) called for two sites. The permanently designated ODMDS was approximately 2.8 x 1.1 nautical miles in size. This site was designated to receive all dredged material emanating from maintenance dredging activities in the harbor and entrance channels. Surrounding the permanent ODMDS was a larger ODMDS. This site encompassed an area of approximately 5.3 x 2.3 nautical miles (Figure 2, labeled "larger ODMDS"), and was designated for one time use, only, for placement of material obtained during the Charleston Harbor Deepening Project. This larger ODMDS was designated for a seven year period of use (1987-1994) for placement of material obtained during the Charleston Harbor Deepening Project.

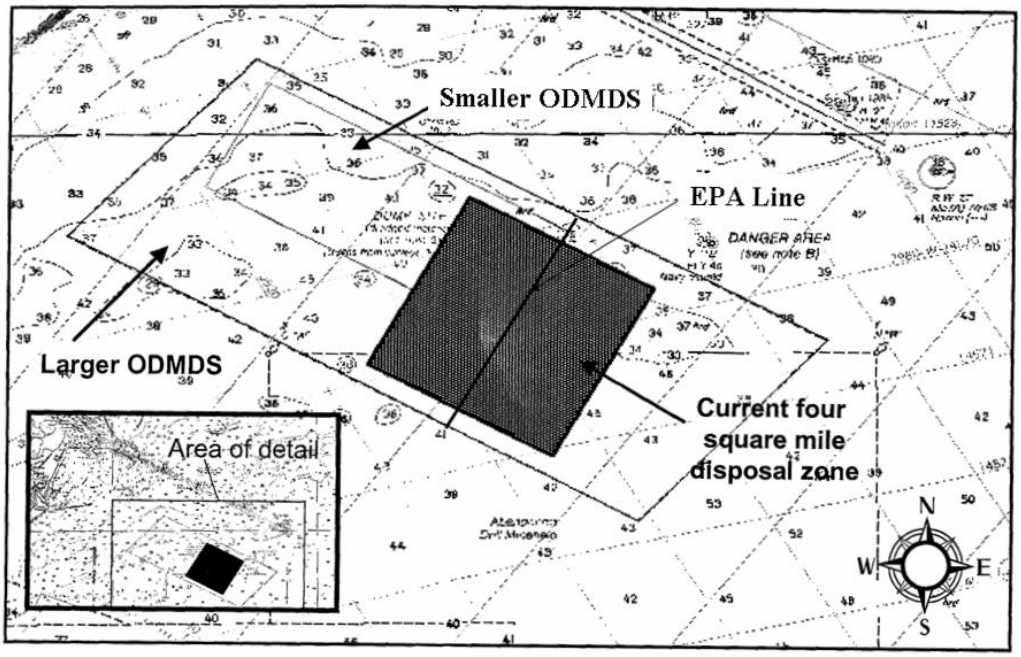

Figure 2. Location of the larger ODMDS, smaller ODMDS, and the currently designated four square mile disposal zone.

In the fall/winter of 1989-1990, local fishermen reported that disposal operations occurring in the permanently designated, smaller ODMDS were impacting a live bottom area within the western quarter of that area. Until that time, no significant live bottom areas were known by EPA and USACE to exist within or near either the larger or small disposal area. Due to the existence of live bottom habitat, a line was immediately put in place by the EPA that was located on the eastern edge of the smaller ODMDS, in an effort to protect these valuable resources (Figure 2, labeled "EPA line"). The final rule regarding this line was published in the Federal Register in 1991, and stated that "All dredged material, except entrance channel material, shall be limited to that part of the site east of the line between coordinates 32º39'04"N, 79º44'25"W and 32º37'24"N, 79º45'30"W unless the materials can be shown by sufficient testing to contain 10% or less of fine material (grain size of less than 0.074 mm) by weight and shown to be suitable for ocean disposal."

Video mapping of the seafloor was conducted during this same time period (1990) by the EPA in the vicinity of the ODMDSs in an effort to precisely map the location and extent of live bottom within and beyond the boundaries of

both the smaller and larger ODMDSs. Based on the results of the video survey, the interagency SMMP Team (EPA, SCDNR, COE, and SCSPA) jointly decided in 1993 that the area actively used for disposal should be moved to a new location within the larger ODMDS to avoid future disposal of materials on sensitive live bottom habitat. This location was four square miles in size, and agreed upon by all agencies (Figure 2, four square mile Disposal Zone). The creation of this four square mile Disposal Zone within the larger ODMDS required the development of a Management Plan which included a comprehensive Monitoring Plan for the site. The monitoring plan was regarded as a flexible strategy with the various task and techniques applied as appropriate and as dictated by disposal activities. (Charleston ODMDS Site Management Plan, 1993). The four square mile Disposal Zone and surrounding areas were divided into three zones, which formed 20 discrete areas (or strata) of comparable size (one square mile). Based on the Site Management Plan, the COE began building an L-shaped berm on the western side of the four square mile Disposal Zone using material from the 42-ft deepening project. The berm was to be constructed of harder and/or cohesive materials and was designed to serve as a barrier, with finer, unconsolidated materials to be placed to the east of the barrier.

In 1995, the smaller ODMDS was officially de-designated in the Federal Register due to the presence of live bottom habitat in the area. The language describing the larger ODMDS was modified such that the site could be used for all disposal materials permitted for offshore disposal, which meant that the site was no longer limited for the disposal of deepening materials. In addition, the time limit restricting the use of the larger disposal area to a seven year period was removed, and the site was promulgated for "continued use."

The U.S. Congress authorized the most recent Charleston Harbor Deepening Project in 1996. The project was planned to deepen the entrance channel from 42 ft to 47 ft, and the inner harbor channel from 40 ft to 45 ft. Approximately 20-25 million cubic yards of sediments were planned for disposal in the four square mile Disposal Zone selected by the Task Force in 1993.

On October 10, 2001, a proposed rule was published in the Federal Register [66 FR 51628] to modify the site name and restriction of use. The proposed action was (1) to define the four square mile Disposal Zone as the only area in which disposal can continue, (2) to shorten the official name of the site from the Charleston Harbor Deepening Project ODMDS to the Charleston ODMDS and (3) to remove the line that restricts the disposal of fine-grained material. The only letter received during the 45 day comment period came from the Office of Ocean and Coastal Resource Management, South Carolina Department of Health and Environmental Control. Upon receipt of the consistency determination for the Coastal Zone Management Act, EPA proceeded with the final rule which became effective on June 6, 2002.

In response to the need to deepen the navigation channel, USACE Charleston District has proposed several navigation improvements to meet anticipated shipping requirements. These improvements consist of deepening and widening portions of the federal navigation channel (Post 45 Project). Based on this proposed new work material and subsequent increase in maintenance material, the Corps requested a Section 102 study to modify the existing ODMDS to accommodate the increased demands from dredged material. The EPA and the Corps have been working together to perform the necessary environmental studies and documentation to support the rule-making to modify the ODMDS.

DREDGED MATERIAL VOLUMES

It is intended that the Charleston ODMDS will be used for dredged material from the greater Charleston, South Carolina vicinity. The two primary users of the Charleston ODMDS have been and are expected to be:

1) U.S. Army Corps of Engineers for Civil Works
2) South Carolina State Ports Authority

Since 1987, approximately 52,000,000 million cubic yards of dredged material have been disposed of at the Charleston ODMDS. In addition, the estimated projected use of the ODMDS from new work dredging for the Post 45 project and twenty-five years of maintenance is approximately 65,600,000 cubic yards. The SC State Ports Authority has historically used the ODMDS and their past use of the ODMDS is shown in Table 2.

Table 2. Historical Use of the Charleston ODMDS by a Non-Federal User

DATE	PROJECT (SPA Terminal)	SPONSOR	CUBIC YARDS	NEW WORK OR MAINTENANCE
Mar-91	Union Pier	State Ports Authority	43,195	Maintenance
Mar-91	Columbus Street	State Ports Authority	24,898	Maintenance
Jan-92	Union Pier	State Ports Authority	117,266	Maintenance
Feb-92	Columbus Street	State Ports Authority	141,400	New Work
Aug-92	Wando Welch	State Ports Authority	1,056,425	New Work
Jun-00	Wando Welch	State Ports Authority	55,430	Maintenance
Aug-00	Wando Welch	State Ports Authority	106,235	New Work
Oct-00	Union Pier	State Ports Authority	119,809	Maintenance
Jun-01	Wando Welch	State Ports Authority	37,363	Maintenance
Mar-02	Wando Welch	State Ports Authority	54,273	Maintenance
June-03	Union Pier	State Ports Authority	69,889	Maintenance

Annual disposal from the federal projects is shown in Table 3. No restrictions are presently placed on disposal volumes. Disposal of unrestricted volumes is dependent upon results from future monitoring surveys and studies of site capacity, as well as concerns for navigational safety.

Material suitability. Two basic sources of material are expected to be placed at the site, new work dredged material and maintenance material. These materials will consist of mixtures of soft limestone rock, silt, clay and sand in varying percentages.

Table 3. Historical Use of the Charleston ODMDS by the US Army Corps of Engineers, Charleston District since 1994 (thousand CY per fiscal year)

Reach or Segment Typically Dredged	Primary Dredge Method [1]	Thousand CY per Fiscal Year																						Placement Area Used
		1994	1995	1996 [4]	1997 [4]	1998 [4]	1999	2000 [3]	2001	2002 [3]	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Total	Yearly AVG	
Entrance Channel/Fort Sumter Reach/Mt. Pleasant Reach	1		1,735		775		1,563	1,147		708		1,377		1,179		967		1,291		1,304			**12,046**	**574**	ODMDS
Rebellion Reach	2	41						13															**53**	**3**	ODMDS/Daniel Isl/Morris
Shem Creek Access	2	198										141										151	**490**	**23**	Morris Island
Anchorage Basin	2	708																				333	**1,041**	**50**	Daniel Isl/Morris
Folly Reach	3							9															**9**	**0**	ODMDS
Shutes Reach	3							5															**5**	**0**	ODMDS
Horse Reach	3							34															**34**	**2**	ODMDS
Tidewater Reach	3	297				163					203						59			84			**807**	**38**	ODMDS
Custom House Reach	3			66		10		44			191	93			127	64	53		96				**745**	**35**	ODMDS
Town Creek Lower (w/tb)	3	352		359	77	415		136			583	182			326	404	272		432	352	212		**4,102**	**195**	ODMDS
Hog Island Reach	3	210		169		221		106			188	189			246	164	138		177	135	152		**2,092**	**100**	ODMDS
Town Creek Upper	3																						**0**	**0**	ODMDS
Drum Island Reach	3			244	142	317		69			165	127			186	160	69		116	115	86		**1,795**	**85**	ODMDS
Myers Bend	3			48				90				77			61		14		53	15	17		**375**	**34**	ODMDS
Wando River Lower Reach	3			121		126		74			157	120			137	93	67		82	149	44		**1,168**	**56**	ODMDS
Wando Uppper TB	3			286		241		186			214	186			186	175	59		132	104	51		**1,820**	**87**	ODMDS
Wando Upper Reach	3			222		168		182			225	116			183	134	131		145	147	66		**1,720**	**82**	ODMDS
Total ODMS			**1,735**		**775**		**1,563**	**2,061**		**708**	**1,927**	**2,191**		**1,179**	**1,452**	**2,161**	**862**	**1,291**	**1,233**	**2,406**	**628**	**485**	**22,654**	**1,079**	**Total ODMS**

NOTES:

1. Dredging Method: 1- Hopper Dredge, 2- Pipeline Dredge, 3- Mechanical (Clamshell), 2. All quantities are based on required pay prism and not gross yardage, 3. New Work Quantities were excluded from these numbers, 4. During the 1996, 1997, 1998 Dredging events, all Lower Harbor shoals and some Upper Harbor Shoals were deposited in Daniel Island, with the exception of Ordnance Reach and Ordnance Reach TB, which were deposited in Clouter Creek.

BASELINE ASSESSMENT OF CONDITIONS

Extensive monitoring of the Charleston ODMDSs has occurred throughout the years. The following sections describe these efforts by type.

Bathymetry:

Detailed bathymetric monitoring of the smaller ODMDS and surrounding area have generally been conducted every 12-18 months by the U.S. Army Corps of Engineers (COE) since 1972 (Winn *et al.* 1989). The primary objectives of these bathymetric surveys were to: (1) document the location and configuration of mounds created with dredged material, which was placed along narrow corridors within the smaller ODMDS, and (2) determine whether these mounds were remaining stable.

Sediment Characteristics and Sediment Contaminants*:*

Numerous nearshore studies have evaluated the distribution of sediments for a variety of purposes. These include core and sub-bottom sonar profiling to evaluate the thickness of the surficial sand lens and studies that have evaluated the characteristics of surficial sediments collected in conjunction with benthic community sampling for various environmental investigations. In general, nearshore sediments consist mainly of fine to very fine-grained sands with some river-derived silts (USACE 1987). A reference sample for the Charleston Harbor Post 45 Section 103 Evaluation collected approximately 7 miles northeast of the ODMDS was comprised primarily of sand (>93% sand) and was classified as poorly-graded sand/silty sand (ANAMAR 2013). Sediment grab samples collected as part of the 2012-2013 hardbottom and cultural resources survey largely consisted of fine to coarse sands, with some areas containing extensive coarse grains and shell hash. Fines were typically less than 10% (Gayes et al. 2013).

An assessment of bottom sediment characteristics and sediment contaminant levels in the area was first completed in 1978 by the South Carolina Wildlife and Marine Resources Department. (SCWMRD 1979, now the South Carolina Department of Natural Resources). The SCWMRD study provided sediment data at 40 sites and contaminant levels at 24 sites in and around the larger ODMDS (SCWMRD 1979, Van Dolah et al. 1983). Interstate Electronics Corporation (IEC) tested sediments at 10 sites in the area of the larger ODMDS during 1979 (USEPA 1983). These studies did not find elevated levels of contaminants. The SCWMRD study found higher levels of mercury and cadmium than the IEC study, which may have been due to analytical methodology (USEPA 1983).

Winn et al. (1989) tested samples at 28 sites in the larger ODMDS and surrounding areas. None of the stations displayed contaminant levels above the range observed in the 1978 SCWMRD study. Minor changes in sediment characteristics were detected, with some movement of material away from the disposal site. However, surficial sediment composition outside the disposal site did not appear to be altered.

A baseline assessment of the current 4-mi^2 disposal zone was completed in 1993 and 1994, and 200 sediment samples were collected in and around the disposal zone during both years (Van Dolah et al. 1996, 1997). Bottom sediments in the area were comprised primarily of medium to fine-grained sands, with variable concentrations of silt/clay and shell hash. In 1993, relatively high concentrations of mud (>10%) were found within the disposal area, although most of the muddy sediments had dispersed by the 1994 assessment. Forty composite sediment chemistry samples were also collected during the 1993-1994 assessment. Metal contaminants were detected in several strata, but concentrations were generally below known bioeffects levels.

In 2000, the sediment characteristics and sediment contaminants within and surrounding the Charleston ODMDS were assessed approximately halfway through the 1999-2002 Charleston Harbor Deepening Project (Zimmerman et al. 2002). Study results indicate that sediment contaminant levels were low within the disposal zone and surrounding areas, as would be expected of material approved for ocean disposal. Trace metal, PAH, PCB, and pesticide concentrations were found above the detection limit in several of the monitoring and disposal cells, with the highest levels consistently in disposal zone sediments. Contaminant concentrations were all below published bioeffects guidelines. These findings indicate that sediments containing detectable contaminants were largely limited to the disposal zone and comprised a small proportion of the deposited material.

In 2002, sediment characteristics and sediment contaminants within and surrounding the Charleston ODMDS were

assessed after completion of the Charleston Harbor Deepening Project (Jutte et al. 2005). This deepening project involved placement of approximately 20 to 25 mcy of material at the ODMDS. Levels of contaminants within the disposal zone and surrounding areas were low. Trace metal, PAH, PCB, and pesticide concentrations were below published bioeffects guidelines, with the exception of cadmium levels in one stratum within the disposal area. These findings suggest that the presence of contaminated sediments was low and limited to the designated disposal zone. It should be noted that detection limits were above published bioeffects guidelines (effects range low [ERL] levels) for six contaminants, which were therefore not adequately assessed as part of this study and could potentially be present at levels that could adversely affect biological resources.

Biological Communities:

Benthic habitats are comprised of a variety of sediments, substrates, and marine life that are commercially and economically valuable. The structural foundation of sand and mud in soft-bottom (sedimentary) areas can be enhanced by sand waves or shell aggregations created by physical processes and by tube assemblages, burrows, or depressions created by plants or animals (Lindholm et al. 1998). Soft-bottom habitats contain epifauna (organisms that live on the sediment), infauna (organisms that live within the sediment), and pelagic species (free-swimming species that migrate in and out of the area), whereas hardbottom habitats typically contain only epifaunal and pelagic assemblages.

Benthic assemblages in the vicinity of the Charleston ODMDS have been monitored since 1978. SCWMRD (1979) completed an assessment in 1978. No major differences were found in the benthic communities collected within the larger ODMDS compared to adjacent areas (Van Dolah et al. 1983). The IEC sampled the benthos at 10 sites during March and December 1979 in the vicinity of the larger ODMDS (EPA 1983). Their findings did not indicate any differences in the benthic communities present that could be attributed to previous disposal operations.

An updated assessment was completed in 1987 by SCWMRD due to the changes in the site designation that occurred at that time (Winn et al. 1989). The benthic sampling program was designed around the corridor disposal concept with a network of stations positioned to intercept the migration of material over the bottom, if it occurred, and to assess changes in the benthic communities resulting from the movement of dredged material. The 1987 baseline survey detected minor changes in benthic community structure related to a disposal operation completed in 1986, and some movement of the material was detected away from the disposal site (Winn et. al. 1989). However, this movement did not appear to significantly alter benthic communities outside the smaller ODMDS.

SCDNR completed intensive benthic infaunal sampling in the 4-mi^2 disposal zone and surrounding boundary areas in 1993 and 1994 as part of a baseline assessment of the area (Van Dolah et al. 1996, 1997). They collected benthic samples at 200 stations each of these years in 20 zones within and around the current disposal site. Species composition, faunal density, and number of species varied among zones and strata. The density of some general taxonomic groups was found to be related to sediment type, a finding which suggests that future large-scale disposal operations could lead to disposal-related changes in the benthic communities.

Results from benthic studies conducted in 2000 and 2002 to assess impacts from Charleston Harbor Deepening project are summarized below.

Overview—2000 Benthic Data

Zimmerman et al. (2002) assessed the bottom habitats within and surrounding the Charleston ODMDS approximately halfway through the 1999-2002 Charleston Harbor Deepening Project. The ODMDS disposal zone and surrounding boundary area were divided into 20 discrete strata of comparable size, approximately 1 mi^2. Benthic grabs were collected at 10 randomly selected locations within each of the 20 strata.

The soft-bottom benthic assemblages of the coastal ocean off South Carolina, which include the proposed ODMDS modification area, are typical of the subtropical continental shelf. During the 2000 study, 402 taxa were collected with a site-wide mean density of 3,939 individuals per square meter. Polychaetes were the most abundant taxonomic group, comprising 56% of all organisms identified in samples collected during the survey. The category 'other taxa' (e.g., Nemertina, *Branchiostoma* sp., Polygordiidae) made up 21% of the total abundance, and amphipods and mollusks comprised 13% and 10% of the total abundance, respectively.

At the ODMDS, the monitoring cells affected by disposal activities had benthic assemblages somewhat different than those of the non-impacted cells. A statistical comparison showed that while seven of the 11 numerically dominant taxa were common to both non-impacted and impacted cells, the impacted cells had fewer *Prionospio cristata* and Polygordiidae and more *P. dayi* and Nemertina than the non-impacted cells. Furthermore, *Branchiostoma* sp. and *Eudevenopus honduranus* were among the top 11 taxa for the non-impacted cells but not for the impacted cells. Both of these taxa, according to Zimmerman et al. (2002), are not characteristic of muddy sediments. *Magelona* sp. and *Protohaustorius deichmannae*, both associated with muddy sediments, were among the dominants in the impacted cells but not in the non-impacted cells. These changes indicate that the disposal of fine-grained material, which has occurred almost every year since 1988 (USACE et al. 2005), has somewhat changed the composition of the benthic infaunal community at the ODMDS, although Zimmerman et al. (2002) characterize the changes as subtle.

Overview—2002 Benthic Data

Jutte et al (2005) assessed the biological condition of bottom habitats within and surrounding the Charleston ODMDS after the conclusion of disposal activities associated with the 1999-2002 Charleston Harbor Deepening Project. During the 2002 study, more than 18,600 organisms representing 448 taxa were collected. The general taxonomic structure of the benthic assemblage was dominated by polychaetes, which comprised 35% of the total number of individuals collected. Dominant polychaetes included *Prionospio cristata*, *Microspio pigmentata*, *P. dayi*, *Prionospio* sp., *Mediomastus* sp., *Myriochele oculata*, *Bhawania heteroseta*, and *Magelona* sp. Amphipods composed approximately 14% of the total abundance, with mollusks and other taxa contributing 26% and 25% of the total number of individuals collected, respectively. Table 4 summarizes the 25 numerically dominant taxa from the 2000 and 2002 studies.

Table 4. Numerically Dominant Taxa Collected in and around the ODMDS in 2000 and 2002

2000 Data			2002 Data		
Species Name	**Type**	**Total Abundance**	**Species Name**	**Type**	**Total Abundance**
Prionospio dayi	P	3078	Polygordiidae	O	4785
Pionospio cristata	P	2413	*Crassinella martinicensis*	M	2180
Branchiostoma sp.	O	1840	*Prionospio cristata*	P	2078
Rhepoxynius epistomus	A	1818	*Rhepoxynius epistomus*	A	2005
Sabellaria vulgaris	P	1728	Nemertea	O	1560
Nemertinea	O	1633	*Parvilucina multiilineata*	M	1260
Prionospio sp.	P	1163	*Crassinella lunlata*	M	1233
Sabellariidae	P	1103	*Eudevenopus honduranus*	A	1030
Magelona sp.	P	1018	*Branchiostoma* sp.	O	913
Polygordiidae	O	1008	*Caecum pulchellum*	M	865
Mediomastus sp.	P	870	*Microspio pigmentata*	P	825
Eudevenopus honduranus	A	835	*Prionospio dayi*	P	788
Protohaustorius deichmannae	A	800	Tellinidae	M	758
Myriochele oculata	P	633	*Strigilla mirabilis*	M	720
Bhawania heteroseta	P	578	*Cylichnella bidentata*	M	663
Mediomastus californiensis	P	555	*Prionospio* sp.	P	663
Mellita sp.	O	555	Sipuncula	O	628
Goniada littorea	P	495	*Mediomastus* sp.	P	590
Ophiuroidea	O	493	Oligochaeta	O	568
Acanthohaustorius itermedius	OA	455	*Myriochele oculata*	P	560
Oligochaeta	PO	453	*Tellina agilis*	M	553
Synelmis ewingi	P	435	*Bhawania heteroseta*	P	540
Armandia maculate	P	380	Pelecypoda	M	523
Natica pusilla	M	370	*Aspidosiphon gosnoldi*	O	485
Crassinella martinicensis	M	343	*Magelona* sp.	P	450

P = Polychate, A = Amphipod, M = Mollusk, O = Other

Sources: Zimmerman et al. (2002), Jutte et al. (2005)

Spatial comparisons of the 2002 benthic community data included a variety of metrics and statistical techniques and documented patterns in the benthic community structure indicating that disposal-related effects are still present and detectable in the boundary areas surrounding the Charleston ODMDS. Comparisons between non-impacted (east of the disposal area) and impacted strata (west and northwest of the disposal area) found significantly greater abundance of mollusks and amphipods and a greater diversity of polychaetes, amphipods, mollusks, and other taxa in non-impacted areas compared to impacted areas. Cluster analyses revealed that the benthic community structure in most impacted strata was similar based on species composition and relative abundance. A second strata group resulted from the cluster analysis and was composed of both impacted and non-impacted strata, suggesting either recovery of benthic communities in some impacted strata or the occurrence of disposal-related effects in non-impacted strata.

Analyses of the ten dominant taxa collected in 2002 indicated that five of these species were found in significantly fewer numbers in impacted strata than in non-impacted strata, and one species was found in significantly greater numbers in impacted strata than in non-impacted strata. The remaining species showed no significant differences among strata types. Patterns in the abundance of individual species are likely consequences of physiological or behavioral responses to alterations in sediment characteristics caused by disposal operations.

Temporal comparisons of benthic assemblages from the baseline assessment (1993-1994), interim assessment (2000), and post-disposal assessment (2002) indicate significant effects on benthic community structure related to disposal operations completed as part of the 1999-2002 Charleston Harbor Deepening Project. A general trend of decreased benthic abundance, reduced species numbers, and decreased diversity was observed in impacted strata to the west and northwest of the ODMDS. In strata classified as non-impacted, many biological metrics were not significantly different from baseline assessments or did not exhibit a significant trend over time. Temporal analyses of general taxonomic structure suggested that these community metrics showed alterations in the impacted strata following disposal operations. However, since many differences were also observed in non-impacted strata, differences cannot be attributed directly to disposal activities. Additional analyses were completed on the abundance of the five dominant taxa collected in 1993, 1994, and 2002. In most impacted strata, two species showed significant declines in abundance in 2002 when compared to the baseline assessment, a response that was likely due to physiological or behavioral responses to changes in sediment composition from disposal operations. The other three dominant taxa showed either no significant change over time or shifts in abundance that appear related to natural population fluctuations.

Hydrographic Data:

Hydrographic data has been collected as part of most assessments of the Charleston ODMDSs. In 1978, SCWMRD collected hydrographic data at 40 sites during their August sampling effort (SCWMRD 1979). The IEC assessment in 1979 provided additional hydrographic data for the larger ODMDS in the March and December sampling seasons (EPA 1983). Water quality data were collected by SCWMRD in 1987 during the summer and winter (Winn *et al.* 1989). Hydrographic data were also collected by SCDNR during summer sampling periods in 1993 and 1994 (Van Dolah *et al*. 1996, 1997).

Data on ocean currents at the Charleston ODMDSs were collected by EPA in summer and winter 1991, and NOAA also collected a limited number of observations in the seaward reaches of the Charleston Harbor Entrance Channel. The ocean current data were used by the Corps of Engineers, Waterways Experiment Station (WES), for input into a model simulating sediment plume dispersion for a dumping episode at the site. Ocean current data revealed a predominant NNE component during the summer. While the strong NNE component was also present during the winter, a westerly component was evident during that season as well. Currents toward the southern, and neighboring sectors, were minimal during these sampling periods.

The National Ocean Service (NOS), Coastal Estuarine and Oceanography Branch (CEOB) deployed a 1200 kHz acoustic Doppler current profiler (ADCP) in the larger ODMDS from January 1994 through September 1995 in an effort to measure ocean currents in the vicinity of the site. The results of this study found that the currents in the vicinity of the Charleston ODMDS consist of tidal, wind-driven, and density-driven currents. The currents flowing toward the southwest or west could potentially transport dredged material to the benthic communities in the southwest corner of the larger ODMDS (Williams *et al.* 1997).

USEPA 2014 summarized the waves and currents at the Charleston ODMDS with the following: "Currents in the vicinity of the Charleston ODMDS tend to have a significant tidal component with predominant currents in the cross-shore direction. Non-tidal currents show periodic oscillations that may be related to overtides. There was a consistent northeasterly drift to the non-tidal currents until September 2013, upon which the drift shifted southwesterly. The depth averaged median current velocity was 18 cm/sec (0.6 ft/sec) with 90 percent of the measurements below 30 cm/sec (1.1 ft/sec).

Waves in the vicinity of the Charleston ODMDS are out the east-southeast. The highest measured waves were in excess of 2.5 meters (8.2 feet) and occurred in the spring (April – June) and were out of the east. Ninety percent of the wave measurements were less than 1.6 meters (5.2 feet) with wave periods in the 4 to 11 second range. Based on linear wave theory, wave periods in excess of 4.4 seconds are of sufficient length to influence bottom velocities at the depths of the ODMDS (USACE, 1984) and therefore waves are likely to frequently affect resuspension and transport of dredged material at the ODMDS."

***Sediment Mapping Surveys*:**

To assist in defining dredged material placement and migration within the Charleston Harbor ODMDSs, real time mapping of the seafloor sediments in the Charleston ODMDS and surrounding areas has been conducted. Two sampling techniques were used in these surveys, one sled equipped to detect selective stable gamma isotopes in the surficial sediments (gamma sled), and another sled selective to fine surficial seafloor sediments (CS_3 sled). Sites were mapped along transects spaced approximately 1000 feet apart.

The EPA, in conjunction with the University of Georgia's Center for Applied Isotope Studies (CAIS), completed a survey within the smaller ODMDS site in July 1988, and within the larger ODMDS site in March 1990. Survey results indicated the seafloor within the smaller site was relatively homogeneous, from a selected gamma isotope perspective, and relatively void of fine sediments since the CS_3 sled, which is selective to sediments generally smaller than 400 microns, did not retrieve any material. The larger site was mapped again on the following dates: August 1991, May 1993, and June 1994. Each of these surveys was successful in tracking and documenting the dispersion of the dredged material deposited at the disposal site. The construction of the L-shaped berm was clearly indicated, as well as other areas of elevated silt/clay concentrations due to historical disposal operations or unidentified origins (Noakes 1995).

Based on reports from commercial shrimpers (January 2000), SCDNR staff investigated muddy areas found outside the four square mile Disposal Zone. SCDNR sampled in February-March 2000, and confirmed that sediments high in silt/clay content were found in areas surrounding the ODMDS. SCDNR identified these concerns to the COE, who reviewed logs and found unauthorized dumps made outside the four square mile Disposal Zone. Reconnaissance of about 50 unauthorized dump sites was completed by a subcontractor to the dredging company and reviewed by SCDNR staff. At least one of the unauthorized dump sites appeared to have occurred over live bottom, and other dumps may also have occurred over other live bottom areas, but if so, the bottom and evidence of reef growth were completely buried by the unauthorized dumps. A report summarizing these findings (Jutte *et al.* 2000) was sent to USACOE, the contractor (Norfolk Dredging Company), and USEPA. SCDNR made several recommendations to the COE regarding future disposal operations:

1. For the remainder of this disposal operation, and for all subsequent offshore dredge material disposal projects off South Carolina, electronically unalterable cruise tracks and dump locations should be examined on a weekly basis by the COE and made available upon request to state and federal resource agencies. The coordinates of any unauthorized dumps should be reported immediately after discovery by the COE to those concerned agencies so that immediate actions can be taken to investigate the problem.
2. The dredge material scows or hopper dredges (loaded or unloaded) should never use routes that cross known live bottom areas. Currently this includes any area outside of the ODMDS and south of a line from the center of the ODMDS to the seaward tip of the south jetty. This would avoid any inadvertent dump of material over sensitive bottom areas due to equipment failure.
3. The dredge material scows or hopper dredges should close their doors before leaving the ODMDS. This will ensure that all disposal materials are released within the authorized area, and that no trails of sediment are left outside the ODMDS from barges that have not completely released their material.
4. In the event of additional "misdumps" similar investigations should be conducted to determine what measures would be necessary to restore or to mitigate the impacted bottoms as appropriate.

During the March 2000 SMMP meeting, the COE noted that the berms under construction at the ODMDS were being built with a mixture of materials, rather than the more consolidated materials as originally planned. It was agreed that future barge loads of material would be assessed by the subcontractor, with more consolidated materials (e.g. cooper marl, rocky material) being placed on the berm, and finer, unconsolidated, materials placed to the SE of the berm. The SMMP Team also discussed the path of barge traffic over live bottom reef habitat en route to the ODMDS. Team members agreed that by traveling a northerly track to the shipping channel, the potential for accidental dumps over live bottom reefs could be eliminated.

An interim assessment of the biological, sediment, contaminant, and bathymetric conditions was planned to occur approximately halfway through the current Charleston Harbor Deepening Project. This effort was initiated in 2000, with some portions of the study expedited to further investigate unauthorized dumping activities. In March 2000, Coastal Carolina University's Center for Marine and Wetland Studies, in cooperation with the US-Geological Survey, completed a side scan sonar survey, swath bathymetry survey, and CHIRP sub-bottom profiling of the ODMDS and surrounding areas. During the same year (September), SCDNR staff also collected biological and sediment samples

at 200 sites in and around the ODMDS, and composite sediment contaminant samples in each strata. A sediment mapping survey by the University of Georgia's Center for Applied Isotope Studies was conducted in October 2000.

In July and August 2001, exploratory dives were completed in areas surrounding the four square mile Disposal Zone likely to have hard bottom with epifaunal sponge and coral growth based on available data. Several general areas with possible hard bottom reef habitat were selected for exploratory dives. These general areas were chosen based on (1) side scan sonar and CHIRP sub-bottom profiling surveys collected in March 2000 by Coastal Carolina University's Center for Marine and Wetland Studies (CMWS) and US-Geological Survey (USGS), (2) reports of hard bottom locations from the SEAMAP Bottom Mapping Project, (3) communication with knowledgeable SCDNR staff, (4) 1990 EPA video survey data, and (5) additional side scan sonar and video camera tows in August 2000. Four suitable study sites were located outside the boundary areas to the west, east, and southwest, and within the boundary area in the southwest corner. Two reference study sites were also identified.

Each of the six sites has been surveyed numerous times to date. During each sampling period, video surveys of sponge/coral communities, video surveys of fish communities, surficial sediment depths, surficial sediment characteristics, and sedimentation rates are collected. In addition, a detailed side scan sonar survey with simultaneous underwater video has been completed annually to determine any changes in the areal extent of each reef site. Biannual assessments of these index hard bottom reef sites continued through spring 2005 although reporting of the results are not anticipated prior to spring 2006.

Two cruises completed in 2001 collected additional data in the vicinity of the Charleston ODMDS. The EPA's OSV Anderson July 2001 cruise, in cooperation with CMWS, collected detailed side scan and bottom video in the areas surrounding the six index reef sites also being studied by SCDNR. In addition, approximately 25% of the four square mile Disposal Zone, inner boundary zone, and outer boundary zone was resurveyed. During this same cruise, University of South Carolina (USC) staff, in cooperation with the EPA and SCDNR, deployed a sedimentation sensor (optical backscatter sensor) and current profiler (acoustic Doppler velocimeter) near the ODMDS to measure the combined actions of waves and currents in the ODMDS, measure the local suspended sediment concentration, and calculate threshold conditions for re-suspension. The reporting of these efforts failed to produce the anticipated threshold conditions due to the limited nature of field measurements actually obtained.

The CMWS conducted a second geophysical cruise, using the NOAA Ship Ferrel, in August 2001. The remaining area of the disposal site and the boundary areas surrounding the disposal site were imaged. In addition, side scan coverage was extended offshore 1.5 kilometers as a preliminary assessment of the area seaward of the existing disposal site. Also in support of the ODMDS study, CMWS and SCDNR, using the Ferrel, recovered the USC equipment deployed on the July EPA cruise.

A post-assessment was conducted upon completion of the 1996 harbor deepening project (Crowe et al., 2006). The goal of this study was to establish biological, sediment, sediment contaminant, and bathymetric conditions following large-scale disposal activity, and compare these findings with baseline and interim assessments. In addition, this study documented to what extent the deepening project filled available space within the four square mile Disposal Zone.

The post-assessment incorporated the same sampling strategies and previous assessments (see below). Biannual assessments of index hard bottom reef sites continued through 2006 (see details below). Based on the data collected during these studies, specific recommendations for monitoring in subsequent years of the program may change, and findings may warrant an extension in the length of the monitoring program. Crow et al. (2006) concluded that the hardbottom reef areas that were monitored showed no evidence of substantial degradation from possible sediment movement from the ODMDS. Specifically, they found the following:

Large Scale Reef Assessment:

- Four consecutive years of sidescan-sonar surveying (five years at site SWA) and five years of video data have been collected at the study sites. Net hard bottom change during the study period has been a small gain at all sites with the exception of SWA. With most net hard bottom changes being just a few percent, it is likely that sediment dumped at the ODMDS is not significantly changing the surrounding habitats.
- Comparisons between backscatter intensity, textural analysis, and coded video data suggest that a thin veneer of sand is sometimes capable of disguising hard bottom, especially since a much larger portion of each study

area provided a hard bottom textural signature via sidescan sonar, which was not always supported by evidence of sessile invertebrate growth using the television sled.

Small Scale Reef Assessment:

- Analyses of sand and CaCO3 content found at the study sites and reference areas show that any changes observed within sites or between sampling periods are likely due to natural variability.
- In general, silt/clay was a minor component of sediment composition at all sites and any changes observed were probably attributable to seasonal rainfall or storm activity rather than significant movement of fine-grained material from the ODMDS.
- Changes observed in grain size of the sand fraction of sediment cores also do not appear to be related to movement of sediments from the disposal area.
- Surficial sediment depths/measurements at the sites in the vicinity of the disposal area have not been significantly altered, suggesting that migration of disposal area sediments has not been a major problem to date.
- Analyses of sediment trap contents suggest that there is a higher silt/clay load in the bottom waters near the ODMDS and at the inshore sites. These materials would not be expected to remain on the bottom when strong currents and storm events are present.
- The abundance of finfish individuals or species observed at study sites and reference areas does not appear to be affected by disposal activities during the five year survey period.
- The percent occurrence of selected sessile, erect growth forms at the sites studied also did not change significantly at most sites, and sites where significant changes did occur do not appear to be related to movement of disposal material.
- The presence of 7Be and 137Cs in the offshore diver-grab and sediment-trap samples indicate that this sediment was of terrestrial origin. The novel approach of utilizing 7Be and 137Cs as tracers in this study to identify the relative contribution of density driven sediment from the harbor versus disposal material migration suggests that some terrestrial sediment has been transported to a subset of the hard bottom reef monitoring stations through natural and anthropogenic processes.
- The presence of 137Cs in the recently deposited dredged material at the ODMDS as well as several of the reef monitoring sediment trap samples would support the dredged material dispersion. However, with the absence of 137Cs and 7Be on the seafloor, it was clear that at the reef monitoring sites, most of the sediment settling from the water column was either resuspended or winnowed away and did not readily accumulate at the sites.

The following table (Table 5) summarizes studies conducted at the Charleston ODMDS.

Table 5. History of monitoring at the Charleston ODMDS

Survey type	Agency/dates	
Bathymetry	Charleston District, USACE, approx. every 12-18 months since 1972	
Benthic characterization (sediments and biology)	SC Wildlife & Marine Resources Dept. - 1978	
Benthic characterization (sediments and biology)	Interstate Electronics Corp (under contract to EPA/HQ - 1979	site designation studies
Sediment mapping	UGA/Center for Applied Isotope Studies - 1988	
Benthic characterization (sediments and biology)	SC Wildlife & Marine Resources Dept. - 1989	
Video/photography of hard bottoms	EPA/Region 4 - 1990	
Currents	EPA/Region 4 - 1991	
Sediment mapping	UGA/Center for Applied Isotope Studies - 1990	SMMP monitoring of harbor deepening project

Sediment mapping	UGA/Center for Applied Isotope Studies - 1991	SMMP monitoring of harbor deepening project
Physiological effects of disposal on *Oculina sp.* and *Lophogorgia sp.*	UGA/Dept. of Ecology - 1992	
Sediment mapping	UGA/Center for Applied Isotope Studies - 1993	SMMP monitoring of harbor deepening project
Benthic characterization (sediments and biology)	SC Dept of Natural Resources - 1993	SMMP monitoring of harbor deepening project
Sediment mapping	UGA/Center for Applied Isotope Studies - 1994	SMMP monitoring of harbor deepening project
Benthic characterization (sediments and biology)	SC Dept of Natural Resources - 1994	SMMP monitoring of harbor deepening project
Currents	NOAA/NOS - 1995	One year/one location
Sidescan sonar	Coastal Carolina Univ. - 2000	
Video/photography of hard bottoms	SC Dept of Natural Resources - 2000	
Hard bottom reef assessments	SC Dept of Natural Resources - 2000	
Benthic characterization (sediments and biology)	SC Dept of Natural Resources - 2000	SMMP monitoring of harbor deepening project
Sidescan sonar	Coastal Carolina Univ. - 2001	
Sedimentation rates	Univ. of SC - 2001	
Hard bottom reef assessments	SC Dept of Natural Resources - 2001	
Hard bottom reef assessments	SC Dept of Natural Resources - 2002	
Hard bottom reef assessments	SC Dept of Natural Resources - 2003	
Hard bottom reef assessments	SC Dept of Natural Resources - 2004	
Hard bottom reef assessments	SC Dept of Natural Resources - 2005	
Benthic characterization (sediments and biology)	SC Dept of Natural Resources - 2005	SMMP monitoring of harbor deepening project
Hardbottom Monitoring	SC Dept of Natural Resources, Coastal Carolina Univ, and Univ of Georgia	
Currents/waves	EPA/Region 4 - 2014	Part of new deepening project and ODMDS modification

The following is a list of reports and journal articles written based upon studies conducted as a result of the original SMMP.

Crowe, S.E., Van Dolah, R.F., Jutte, P.C., Gayes, P.T., Viso, R.F., Noakes, S.E., 2006. An environmental monitoring study of hard bottom reef areas near the Charleston ODMDS. Final Report Prepared by the South Carolina Department of Natural Resources; the Center for Marine and Wetland Studies, Coastal Carolina University; and the Center for Applied Isotope Studies, University of Georgia submitted to the U.S. Army Corps of Engineers. p. 121.

Crowe, S.E., Gayes, P.T., Viso, R.F., Bergquist, D.C., Jutte, P.C., Van Dolah, R.F., 2010. Impact of the Charleston ODMDS on nearby hard bottom reef habitats. Marine Pollution Bulletin 60, 679-691. 2010.

Gayes, P.T., Ojeda, G.Y., Jutte, P.C., Van Dolah, R.F., 2002. Geophysical Characterization of the Seafloor: Charleston ODMDS, July 2001. Final Report Prepared by the Center for Marine and Wetland Studies and the South Carolina Department of Natural Resources for the U.S. Army Corps of Engineers, Charleston District. P. 54.

Gayes, Paul, Cheryl Ward, Jenna Hill, Shinobu Okanu, Jeff Marshall, Brian Johnson, Jamie Phillips, Bradley Craig, Richard Viso. 2013. Hardbottom and Cultural Resource Surveys of the Post 45 Charleston Harbor Project Study Area, Charleston, South Carolina. Prepared by Coastal Carolina University, Burroughs and Chapin Center for Marine and Wetland Studies. Prepared for US Army Corps of Engineers, Charleston District. (URL: http://www.sac.usace.army.mil/Portals/43/docs/civilworks/post45/1_CCU%20Charleston%20Harbor%20Post%2045%20final.pdf). Appendices available upon request.

Jutte, P.C., Levinsen, M.V., Van Dolah, R.F., 2001. Analysis of Sediments and Habitat in the Areas Surrounding the Charleston ODMDS, Including Unauthorized Disposal Operations. Final Report Submitted to the Norfolk Dredging Company and the U.S. Army Corps of Engineers, Charleston District. p. 23.

Jutte, P.C., Crowe, S.E., Van Dolah, R.F., Weinbach, P.R., 2005. An Environmental Assessment of the Charleston ODMDS and Surrounding Areas: Physical and Biological Conditions after Completion of the Charleston Harbor Deepening Project. Final Report to the Charleston District, U.S. Army Corps of Engineers.

Noakes, S. 2001. Postdisposal Areal Mapping of Sediment Chemistry at the Charleston, South Carolina ODMDS. Center for Applied Isotope Studies, Athens, GA. Submitted to South Carolina Department of Natural Resources.

Noakes, S. 2003. Postdisposal Areal Mapping of Sediment Chemistry at the Charleston, South Carolina ODMDS. Final Report Prepared by the Center for Applied Isotope Studies for the South Carolina Department of Natural Resources. p. 60 and Appendices.

Noakes, S.E., Jutte, P.C., 2006. Utilizing Gamma Isotope Tracers to Determine Sediment Source at Reef Sites Near the Charleston ODMDS. Marine Pollution Bulletin 52, 666-673.

Porter, J.W., 1993. The Physiological Effects of Dredge-Spoil on the Oxygen Metabolism of Charleston Harbor, SC marine benthic invertebrates. 1993. Final Report Prepared for the U.S. Environmental Protection Agency, Region 4 by the Institute of Ecology at the University of Georgia. p. 33.

Williams, R., Sun, C., Bourgerie, R., 1997. Collection of ocean current data at the Charleston, South Carolina ODMDS. Final Report Prepared by the National Oceanic and Atmospheric Administration, National Ocean Service, Coastal and Estuarine Oceanography Branch for the U.S. Environmental Protection Agency. p. 13.

Winn, R.N., Van Dolah, R.F., Frankenburg, A., Kana, T.W., 1989. Benthic and Sedimentologic studies of the Ocean Dredged Material Disposal Site (ODMDS) for Charleston, South Carolina. Final Report to the Charleston District, U.S. Army Corps of Engineers, Contract No. DACW60-87-H-0001.

Van Dolah, R.F., Calder, D.R., Knott, D.M., 1983. Assessment of Benthic Macroinfauna in an Ocean Disposal Area Near Charleston, SC. South Carolina Marine Resources Center Technical Report No. 56. p. 97.

Van Dolah, R.F., Wendt, P.H., Goldman, D.A., Wrona, A.B., Pardieck, R.A., Levinsen, M.V., 1997. An Assessment of Benthic Infaunal Assemblages and Sediments in the Vicinity of the Charleston ODMDS Area. Final Report, Prepared by the South Carolina Department of Natural Resources, Marine Resources, Research Institute for the U.S. Army Corps of Engineers, Charleston District. p. 59.

Voulgaris, G., 2002. Disposal Material Mobility and Transport in the Vicinity of the Charleston ODMDS. Final Report Prepared by the University of South Carolina, Coastal Processes and Sediment Dynamics Laboratory for the South Carolina Department of Natural Resources. p. 21.

Zimmerman, L.E., Jutte, P.C., Van Dolah, R.F., 2003. An Environmental Assessment of the Charleston ODMDS and Surrounding Areas: Physical and Biological Conditions after Partial Completion of the Charleston Harbor Deepening Project. Marine Pollution Bulletin 46 (11), 1408-1419.

SITE MANAGEMENT

ODMDS management involves a broad range of activities including regulating the schedule of use, the quantity, and the physical/chemical characteristics of dredged materials to be dumped at the site. It also involves establishing disposal controls, conditions and requirements to avoid and minimize potential impacts to the marine environment. Finally, ODMDS management involves monitoring the site environs to verify that unanticipated or significant adverse effects are not occurring from past or continued use of the site and that permit conditions are met.

Section 228.3 of the Ocean Dumping Regulations (40 CFR 220-229) states:

> "Management of a site consists of regulating times, rates, and methods of disposal and quantities and types of materials disposed of; developing and maintaining effective ambient monitoring programs for the site; conducting disposal site evaluation studies; and recommending modifications in site use and/or designation."

The plan may be modified if it is determined that such changes are warranted as a result of information obtained during the monitoring process. MPRSA, as amended by WRDA 92, provides that the SMMP shall include but not be limited to:

- A baseline assessment of conditions at the site;
- A program for monitoring the site;
- Special management conditions or practices to be implemented at each site that are necessary for the protection of the environment;
- Consideration of the quantity and physical/chemical characteristics of dredged materials to be disposed of at the site;
- Consideration of the anticipated use of the site over the long-term;
- A schedule for review and revision of the plan.

Management Objectives

There are three primary objectives in the management of the Charleston ODMDS:

- Protection of the marine environment, living resources, and human health and welfare;
- Documentation of disposal activities at the ODMDS and provision of information which is useful in managing the dredged material disposal activities;
- Provide for beneficial use of dredged material whenever practical.

The purpose of the SMMP is to provide guidelines in making management decisions necessary to fulfill mandated responsibilities to protect the marine environment as discussed previously. Risk-free decision-making is an impossible goal; however, an appropriate SMMP can narrow the uncertainty. The following sections provide the framework for meeting these objectives to the extent possible.

Timing of disposal

At present no restrictions have been determined to be necessary for disposal related to seasonal variations in ocean current or biotic activity. As monitoring results are compiled, should any such restrictions appear necessary, disposal activities will be scheduled so as to avoid adverse impacts. Additionally, if new information indicates that endangered or threatened species are being adversely impacted, restrictions may be incurred.

Disposal Techniques

No specific disposal technique is required for this site. However, it is the intent of this plan to maximize any advantages of strategic placement of materials.

Disposal Location

The new Charleston ODMDS is defined by the coordinates in Table 1, above and shown in Figures 1, 2, and 3.

Prior to any disposal of dredged materials, an agreement between EPA and COE will be reached concerning the exact placement of these materials. Permits/contracts will specify exact locations for the disposal of any material from the project. Fine-grained materials will be placed within the area surrounded by berms constructed of more consolidated material. Any coarse-grained material, or suitable consolidated material which is not used for another beneficial purpose (i.e., beach nourishment), will be used as needed to expand the boundary berms.

Information Management of Dredged Material Placement Activities

As discussed in the following sections, a substantial amount of diverse data regarding use of the Charleston ODMDS and effects of disposal is required from many sources (EPA, COE, SCDNR, SCSPA). If this information is readily available and in a useable format it can be used to answer many questions typically asked about a disposal site:

- What is being dredged?
- How much is being dredged?
- Where did the dredged material come from?
- Where was the dredged material placed?
- Was dredged material dredged correctly? Placed correctly?
- What will happen to the environment at the disposal site?

As part of site management, EPA and the COE will investigate alternatives for appropriate data management. The Dredged Material Spatial Management Analysis and Record Tool (DMSMART) is currently in development by the Engineering Research and Development Center (ERDC), formerly known as the Waterways Experiment Station. . This tool will include guidance to Districts for development of a database of dredging project history and a database of the dredging and disposal site monitoring data. Once available, the District, with assistance from EPA Region 4, will evaluate the best approach to implementing a data management system. This will enable the COE and EPA to better manage the Charleston ODMDS and account for the multiple users of the site. In addition, the Corps' Ocean Disposal Site Database is compiled by the ERDC. This database provides information on all of the ODMDSs in the United States with appropriate chemical, biological, and physical parameters of the proposed dredged material. .

Designated Route To and From the Charleston ODMDS

A transportation route to and from the Charleston ODMDS will be specified to minimize possible interference with nearby fishing grounds and commercial navigation. Dredge material scows or hopper dredges should not cross south of the line shown in Figure 3, and extends from the south jetty to a point defined by the following coordinates: 32.65663, -79.75716. Minor departures from the navigation channel to avoid traffic or facilitate safe vessel passage are acceptable. The ocean disposal verification plan discussed previously provides verification that the approved route was taken (Figure 3).

In a situation where the towed scow fails to open once triggered inside the disposal zone, the disposal vessel will remain inside the disposal zone making every effort to effect the disposal. Should the scow remain closed after a reasonable attempt has been made to dump the material within, the disposal vessel will make its return transit directly to the entrance channel by way of the shortest route directly back to the navigation channel. This will allow for the least amount of exposure of hardbottom habitat to leaking material. Habitat in this area is limited, patchy, and ephemeral in nature; therefore, the shortest route will minimize exposure.

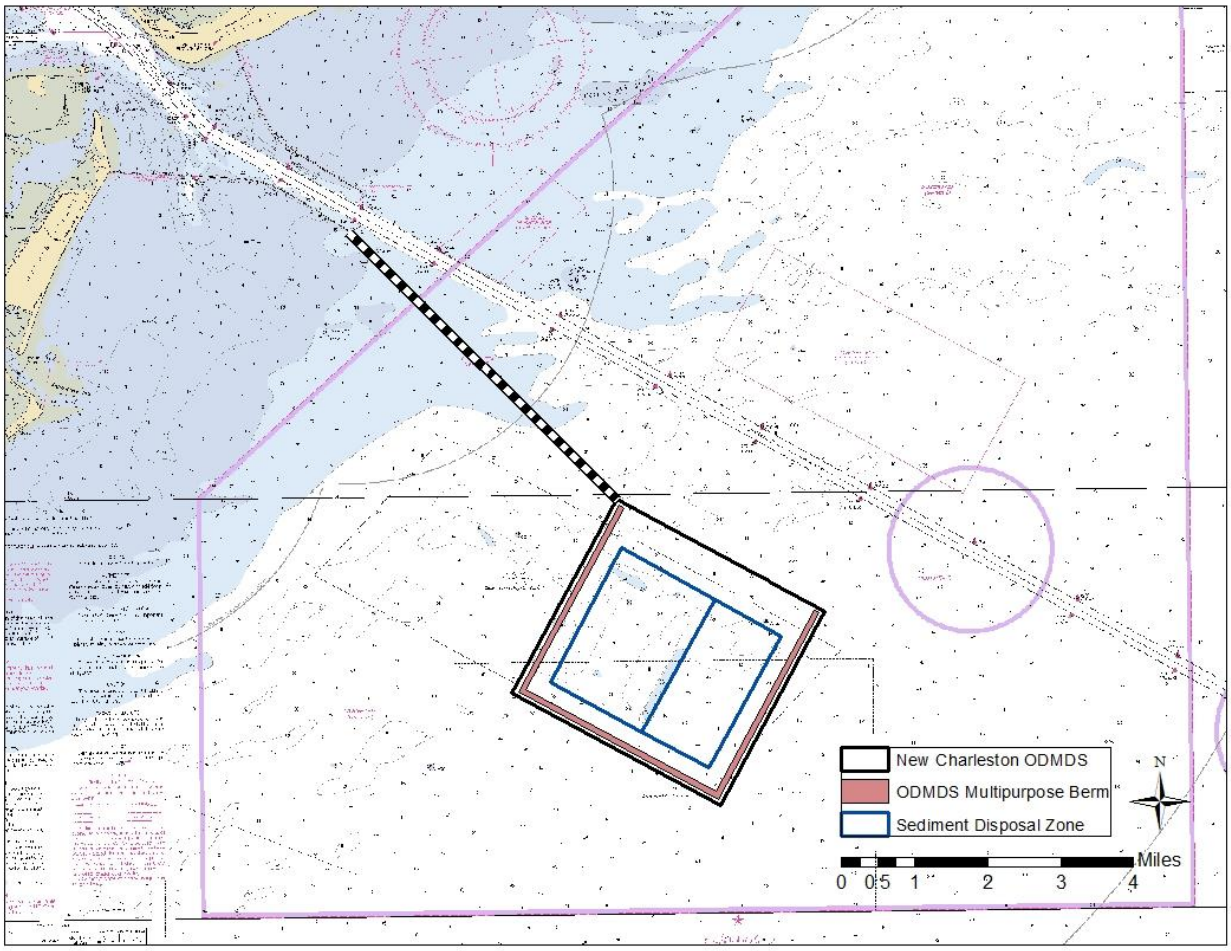

Figure 3. Designated route to ODMDS

Disposal 'Zone' Within the ODMDS

To manage site use, maximize site capacity, reduce multiple user conflicts, simplify monitoring and management, and reduce potential adverse impacts to the marine environment, the Charleston District, USACE in consultation with EPA Region 4, has designated a disposal zone within the ODMDS for dredged materials from ocean dumping activities (Figure 4).

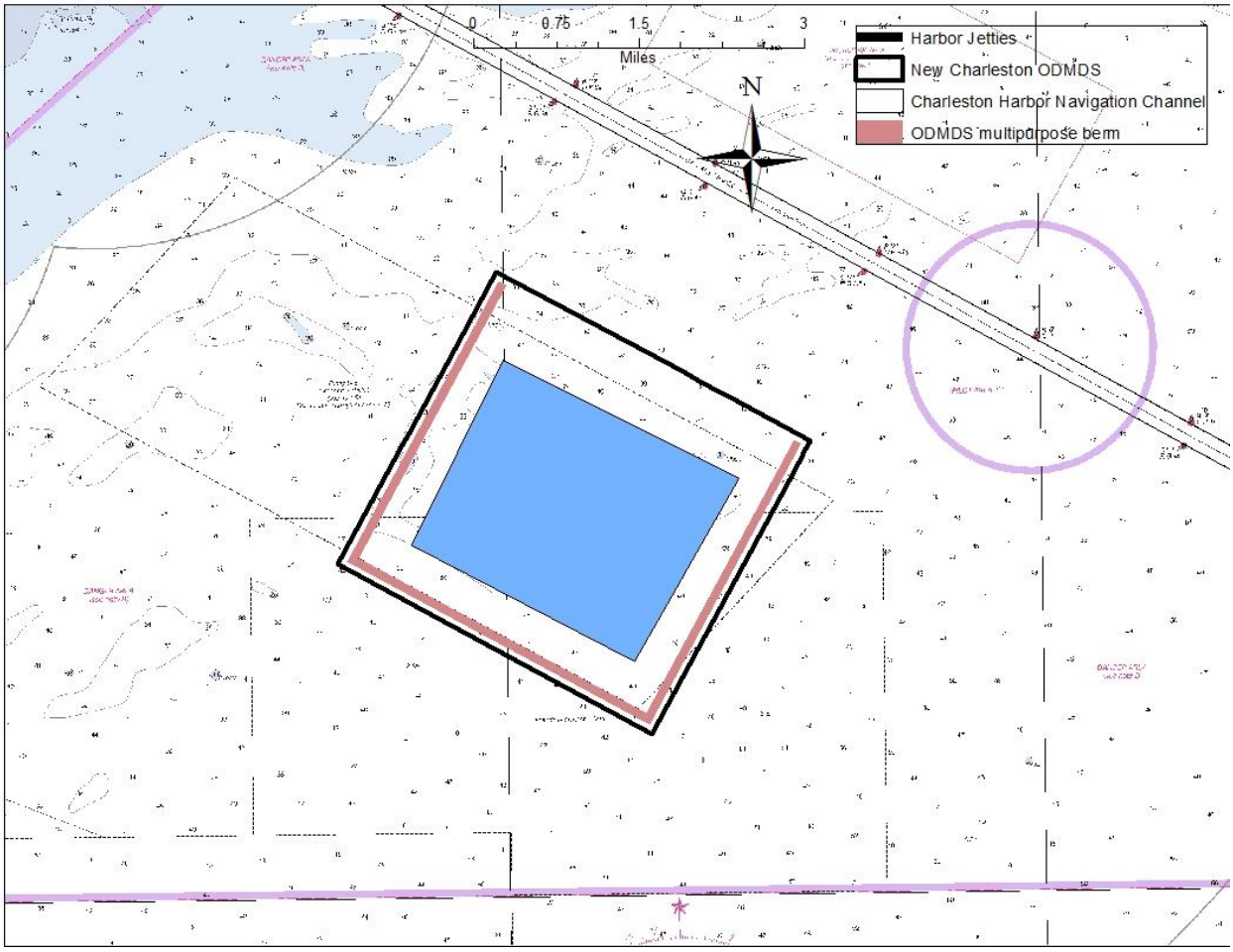

Figure 4. Charleston ODMDS, conceptual berm, and disposal zone (blue)

The disposal zone has the following coordinates (Table 6):

Table 6. Charleston ODMDS disposal zone coordinates

Site		Geographic (NAD83, Decimal Degrees)		State Plane (South Carolina US Survey Feet)		Area (mi^2)	Area (nmi^2)
Alternative 1 modeled disposal zone	SE	32.62953	-79.76731	291963.450	2379495.145	5.1	3.9
	SW	32.61220	-79.73030	285797.391	2390966.182		
	NW	32.63817	-79.71280	295312.397	2396237.184		
	NE	32.65600	-79.75011	301659.432	2384675.135		

The suitability of dredged material for ocean disposal must be verified by the Corps and agreed to (concurred) by EPA prior to disposal under Section 103 of the MPRSA. EPA concurrences are valid for three years from the date of the concurrence letter. Re-evaluation will involve the following:

1) a case-specific evaluation against the exclusion criteria (40 CFR 227.13(b));
2) a determination of the necessity for testing including bioassay (toxicity and bioaccumulation) testing for non-excluded material based on the potential for contamination of the sediment since last tested; and

3) completion of required testing (where needed) and determining that the non-excluded, tested material is suitable for ocean disposal.

Documentation of compliance with the Ocean Dumping Criteria (ODC) will be completed prior to any use of the site. Documentation will be in the form of a MPRSA Section 103 Evaluation. The Evaluation and any testing will follow the procedures outlined in the *Southeast Regional Implementation Manual (SERIM), August 2008.* Only material determined to be suitable through the compliance process by the Corps and EPA will be placed at the Charleston ODMDS.

SITE MONITORING

The MPRSA establishes the need for including monitoring program as part of the Site Management Plan. Site monitoring is conducted (1) to ensure the environmental integrity of a disposal site and the areas surrounding the site, and (2) to verify compliance with the site designation criteria, any special management conditions, and with permit requirements. Monitoring should provide useful and pertinent information to support site management decisions. Monitoring programs should be flexible, cost effective, and based on scientifically sound procedures and methods to meet site-specific monitoring needs. A monitoring program should have the ability to detect environmental change as a result of disposal activities and assist in determining regulatory and permit compliance.

The main purpose of a disposal site monitoring program is to determine whether dredged material site management practices, including disposal operations, at the site need to be changed to avoid significant adverse impacts. To use site monitoring as an effective tool, site managers need to define in quantitative terms thresholds for unacceptable impacts and desired beneficial effects of dredged material disposal. Exceeding or not exceeding the thresholds triggers specific management actions. A tiered strategy for a monitoring program is desirable. With a tiered approach, an unacceptable result may trigger further and often more complex monitoring. Continuous monitoring of all physical, chemical, and biological parameters and resources in and around the ocean dredged material disposal site is not necessary. A monitoring program should be structured to address specific questions (hypotheses) and measure key indicators and endpoints, particularly those defined during site designation or specific project issues that arise. For the New Wilmington ODMDS, the site designation environmental impact statement identified navigation, fishing (shrimping), and hard bottoms in nearby waters as resources of concern. These resources were not present within the site.

The goals of the site monitoring plan for the Charleston ODMDS are to provide the following:

1) Information indicating whether the disposal activities are occurring in compliance with the permit and site restrictions; and/or
2) Information concerning the short-term and long-term environmental impacts of the disposal; and/or
3) Information indicating the short-term and long-term fate of materials disposed of in the marine environment.

Pre Disposal Monitoring

The Corps or other site users will conduct a bathymetric survey prior to the start of the project. Surveys will not be required for projects less than 50,000 cubic yards. Surveys will conform to Navigation and Dredging Support Surveys for the respective bottom type as described in the Corps Engineering Manual, EM1110-2-1003, Hydrographic Surveying dated 1 Jan 2002. The number and length of transects required will be sufficient to encompass the area where disposal operations will occur within the Charleston ODMDS and a 500 foot wide area around that area.. The survey area may be reduced on a case-by-case basis if disposal zones are specified and adhered to. The surveys for soft bottom deposited material will be taken along lines spaced at 400-foot intervals or less with a depth recording density of less than 20 feet. The surveys for hard bottom deposited material will require full bottom coverage for vessel clearance throughout and at the conclusion of construction. Depth precision of the surveys will be +/- 1.0 feet. Horizontal location of the survey lines and depth sounding points will be determined by an automated positioning system utilizing a real time kinematic global positioning system (GPS) or post-processed kinematic GPS data. Vertical datum is mean lower low water, NOAA's VDatum model will be used to derive conversion values from NAVD88 throughout the projects extents. The horizontal datum will be Geographic NAD

1983 South Carolina SC39000 State Plane Feet. Bathymetric surveys will be used to monitor the disposal mound to insure a navigation hazard is not produced, to assist in verification of material placement, to monitor bathymetric changes and trends, to aid in environmental effects monitoring and to insure that the site capacity is not exceeded, i.e., the mound does not exceed the site boundaries. Copies of these surveys shall be provided to EPA Region 4 when completed.

Disposal Monitoring

For all disposal activities, an electronic tracking system (ETS) must be utilized. The ETS will provide surveillance of the transportation and disposal of dredged material. The ETS will be maintained and operated to continuously track the horizontal location and draft condition (nearest 0.5 foot) of the disposal vessel (i.e. hopper dredge or disposal scow) from the point of dredging to the disposal site and return to the point of dredging. Data shall be collected at least every 500 feet during travel to and from the ODMDS and every minute or every 200 feet of travel, whichever is smaller, while approaching within 1000 feet of the ODMDS and within the ODMDS. In addition to the continuous tracking data, the following trip information shall be electronically recorded for each disposal cycle:

- Load number
- Disposal vessel name and type (e.g. scow)
- Tow vessel name (if applicable)
- Captain of Disposal or tow vessel
- Estimated volume of load
- Description of material disposed
- Source of dredged material
- Date, time and location at start at initiation and completion of disposal event.

It is anticipated that disposal monitoring will be conducted utilizing the Dredge Quality Management (DQM) system for Civil Works projects [see http://dqm.usace.army.mil/Specifications/Index.aspx], although other systems are acceptable. The DQM system must be operational throughout the dredging and disposal project and that project data must be submitted to the DQM National Support Center in accordance with the specifications provided at the aforementioned website. The data collected by the DQM system shall, upon request, be made available to the Regulatory Division/Branch of the U.S. Army Corps of Engineers, Charleston District and to EPA Region 4. Uploading of raw project data to the DQM Support Center is required. (USACE REGULATORY GUIDANCE LETTER No. 08-01 Date: 05 February 2008, SUBJECT: Guidance for Implementing the Silent Inspector (SI) system for dredging projects requiring Department of the Army (DA) permits). The use of DQM is also required for USACE federal navigation projects.

Disposal monitoring and ETS data will be reported to EPA Region 4 and Charleston USACE (via the DQM system) on a weekly basis utilizing the eXtensible Markup Language (XML) specification and protocol (see the section to follow). EPA Region 4 and the Charleston District shall be notified within 24 hours if disposal outside of the ODMDS or specified disposal zone or if excessive leakage may have occurred. Excessive leakage is any change in draft (determined by adding vessel bow draft and vessel aft draft/dividing by 2) exceeding x.x feet from the point of departure from the dredging site to the disposal site.

Reporting and Data Formatting

Disposal monitoring data shall be provided to EPA Region 4 electronically on a weekly basis. Data shall be provided per the EPA Region 4 XML format and delivered as an attachment to an email to DisposalData.R4@epa.gov. The XML format is available from EPA Region 4. A summary report of operations shall be provided by the Charleston District, USACE to the EPA, Region 4, Ocean Dumping Coordinator at the completion of the dredging/ocean disposal project or activity within 90 days after project completion. For work under a Section 103 permit, the permit holder will be responsible for providing the requested information to the Charleston District, USACE. Minimum required data to be included in the summary report is as follows:

- General Information
  - Project name;
  - Location;

  - Public notice or permit date;
  - Section 103 evaluation date;
- Disposal Site Used;
- Project Type - Either Federal or Section 103 permit;
- Type of Work - New or maintenance work;
- Method of dredging and disposal;
- Disposal dates - start to finish;
- Quantity of dredged material disposed - in cubic yards;
- Number of loads completed;
- Contractor conducting the work;
- Identification of any misplaced materials;
- Dates of bathymetric surveys of ODMDS;
- Point of contact for project.

The disposal summary reports should be accompanied by the bathymetry survey results (paper plot and X,Y,Z ASCII data file), track plots for each disposal trip, a scatter plot of all dump locations, and a summary table of the information required above. If all data is provided in the required XML format, track plots, scatter plots and summary tables will not be necessary.

Post Disposal Monitoring

The Corps or other site users will conduct a bathymetric survey within 30 days after disposal project completion. Surveys will not be required for projects less than 50,000 cubic yards. Surveys will conform to Navigation and Dredging Support Surveys for the respective bottom type as described in the Corps Engineering Manual, EM1110-2-1003, Hydrographic Surveying dated 1 Jan 2002. The number and length of transects required will be sufficient to encompass the area where disposal operations will occur within the Charleston ODMDS and a 500 foot wide area around that area**..** The survey area may be reduced on a case-by-case basis if disposal zones are specified and adhered to. The surveys for soft bottom deposited material will be taken along lines spaced at 400-foot intervals or less with a depth recording density of less than 20 feet. The surveys for hard bottom deposited material will require full bottom coverage for vessel clearance throughout and at the conclusion of construction. Depth precision of the surveys will be +/- 1.0 feet. Horizontal location of the survey lines and depth sounding points will be determined by an automated positioning system utilizing a real time kinematic global positioning system (GPS) or post-processed kinematic GPS data. Vertical datum is mean lower low water, NOAA's VDatum model will be used to derive conversion values from NAVD88 throughout the projects extents. The horizontal datum will be Geographic NAD 1983 South Carolina SC39000 State Plane Feet. Bathymetric surveys will be used to monitor the disposal mound to insure a navigation hazard is not produced, to assist in verification of material placement, to monitor bathymetric changes and trends, to aid in environmental effects monitoring and to insure that the site capacity is not exceeded, i.e., the mound does not exceed the site boundaries. Copies of these surveys shall be provided to EPA Region 4 when completed.

Additional Material Tracking and Disposal Effects Monitoring

Surveys can be used to address possible changes in bathymetric, sedimentological, chemical, and biological aspects of the Charleston ODMDS and surrounding area as a result of the disposal of dredged material at the site. Baseline and trend surveys will be performed in accordance with 40 CFR 228.13. Upon initiation of construction of the Charleston Harbor Deepening Project (Post45) the following monitoring programs will be implemented, where possible and when funding is available. Additionally, trend surveys will be conducted following completion of the deepening project pursuant to 40 CFR 228.13. The purpose of these monitoring efforts is to build upon the knowledge gained from the extensive work performed in the 1990's and early 2000's throughout previous deepening projects. Specific monitoring objectives are defined below.

Monitoring Objectives**:** Monitoring objectives of the Charleston ODMDS SMMP are to:

1) Determine the fate of dredged material placed at the site,
2) Assess the impact of dredged material movement outside the ODMDS boundaries through the early detection of changes in sediment characteristics (physical and chemical), and biological communities which may be

deemed as adverse and chronic, and

3) Assess the extent and impact of unauthorized disposal activities outside the ODMDS boundary.

Since several different ecological components are susceptible to perturbation by dredged material disposal, and an alteration to one component may result in impacts on another, a comprehensive monitoring approach is proposed with several specific objectives. These specific objectives are to:

1. Continue bathymetric, side scan sonar, and sediment chemistry mapping of the ODMDS and surrounding areas based on the SCDNR identified monitoring zones, relate these findings to plotted coordinates of disposal events and previously collected data.
2. Use data collected to determine, to the extent possible, the direction, distance, and volume of dredged sediment migration.
3. Evaluate the success of the proposed submerged berm construction on (1) retarding the over-bottom movement of dredged material, (2) the development of habitat and attraction of recreationally important fish species to demonstrate beneficial uses of ODMDS berm design and (3) the recruitment of sessile invertebrates to the substrate.
4. Evaluate the effects of disposal and subsequent movement of dredged material on the physical and chemical characteristics of the sediments and benthic infaunal communities in and adjacent to the ODMDS.
5. Periodically map the distribution of live bottom in and around the ODMDS to monitor for changes in the size of these critical resource areas. At specific index reef sites, document any changes in sponge and coral density and/or condition, areal extent, and surficial sediment characteristics
6. Collect seasonal, long term, ocean current data to enhance dump model predictive capability at the Charleston sites.

Monitoring Approach and Rationale

Assessment of Baseline Conditions

Because modification of the ODMDS resulted in new areas being added to the monitoring zones for the Charleston ODMDS, it is necessary to establish baseline conditions in these areas prior to use of the ODMDS which might alter them. The same sampling design used for the previous deepening project will be followed although the level of specificity may not be the same. A tiered approach which will allow for flexibility in the number of replicates, etc will be developed by the SC DNR for use in establishing baseline conditions as well as assessing potential impacts in the post-disposal phase.
Once construction of the berm has begun, it will become necessary to assess the structure at various stages of its completion. As practicable as possible, remote sensing techniques will be used to determine exact location and dimensions of the structure. Using a tiered approach to trigger the need for use of techniques such as diver assessment, once construction of the berm and the deepening project has concluded, the structure will be monitored to determine 1) its effectiveness in restricting the migration of unconsolidated fine-grained materials to areas outside the ODMDS; 2) its potential utility as a fisheries enhancement structure; and 3) any role it may be serving as habitat.

Tracking Disposal Activity

An essential requirement for effective site monitoring activities at the Charleston ODMDS is accurate placement, recording, and plotting of all disposal events. The Charleston District, USACE, requires such information from all dredging contractors and will continue to compile and continuously update computer plots depicting placement of all maintenance and new work dredged material. Plotted coordinates will be collected using GPS in latitude/longitude in decimal degrees (NAD83 datum) and provided in a digital format on request to all agencies on the SMMP Team. Unauthorized dumps made outside the Disposal Zone could be investigated to determine what measures would be necessary to restore or mitigate the impacted bottoms, as appropriate. The scope, level of complexity and primary responsibility for conducting such investigations can only be determined on a case-by-case basis.

Sediment Mapping and Bathymetry

Close grid bathymetry and sediment mapping using gamma and CS3 sled techniques may be conducted as part of the

construction-related assessment and trend assessments. The mapping effort should encompass the entire area of the ODMDS and the monitoring zones (see figure 1). Due to the apparent highly dynamic nature of sediment transport at the site, detection of more discrete migration patterns may require mapping at a greater frequency, and targeting a specific disposal pile.

Side Scan Sonar Surveys

Side scan sonar surveys of the ODMDS and monitoring areas could be conducted as part of each assessment. When deemed necessary by SMMP Team, simultaneous side scan sonar and underwater video camera tows will be conducted.

Benthic Infaunal and Sediment Sampling

These monitoring activities should involve collecting samples in and around the ODMDS using a stratified random sampling design. All twenty zones should be sampled within the Disposal Zone, the inner boundary, and the outer boundary, with a minimum of ten grab samples collected within each zone. Each grab sample obtained for faunal assessment should be sub-sampled to determine sediment characteristics of the sample (e.g., grain size, percent silt, clay, sand, $CaCO_3$). A composite sample within each zone should be collected to measure sediment contaminant levels. The sediment characteristics and contaminant levels found in the zones within the Disposal Zone should be compared with zones outside the Disposal Zone to document any changes that occurred following disposal operations. Biological communities (e.g., faunal densities, biomass, species numbers, community structure, and feeding guilds) should be assessed by comparing samples collected in areas with high silt/clay content or high sediment contaminant concentrations with samples collected from a boundary zone where there is no evidence of change in sediment condition**.** As a cost-saving measure, benthic sampling could be conducted using a tiered approach. After collecting samples in all twenty zones (see above), sample processing would be limited to a subset of samples collected in areas with high silt/clay content or high sediment contaminant concentrations to be compared with another subset of samples collected from boundary zones where there was no evidence of change in sediment condition. The sediment samples should be used to further characterize the composition of surficial sediments in and around the ODMDS, and aid in interpreting changes in benthic infaunal composition.

The results of the post-assessment and three-year post-assessment should be statistically compared to results from the baseline and interim assessments. These surveys will determine whether benthic resources outside the Disposal Zone were affected by disposal of fine-grained materials, whether these changes were detrimental, and the duration of these effects. Impacts to benthic infaunal communities, such as changes in faunal composition, or significant alterations in species number or biomass, can affect trophic functions of predator species such as shrimp, fish, and crabs.

Live/Hard Bottom Mapping:

Biannual assessments of index hard bottom reef sites could be conducted to compare to baseline data from previous monitoring efforts. During each sampling period, video surveys of sponge/coral communities, video surveys of fish communities, surficial sediment depths, surficial sediment characteristics, and sedimentation rates should be collected. Side scan sonar surveys should be conducted annually to determine any changes in the areal extent of each reef site, and simultaneous underwater video surveys should be recorded when necessary. Based on data collected during the study, specific recommendations for monitoring in subsequent years of the program may change, and findings may warrant an extension in the length of the monitoring program.

Sediment Transport/Current Studies:

Longer term current data over an annual cycle would (1) elucidate the effectiveness of the berm constructed at the ODMDS, (2) enhance calibration of the STFATE model, (3) assist in development of a transport model by ERDC and (4) help clarify sediment redistribution patterns revealed by sediment mapping surveys.

Continuously recording equipment (such as acoustic Doppler current profilers, optical backscatter sensors, and sediment size transmissometers could be deployed to provide a long-term data base obtained over a year period to evaluate patterns and natural variability. Similar efforts have been utilized at the Wilmington ODMDS to determine

mound movement and sediment mobility (Davis and Miller 2001). Deployment of an Acoustic Doppler Current Profiler (ACDP) placed within or adjacent to the Disposal Zone would provide the best data base for this effort. Quarterly or semiannual retrieval of the data record would provide timely information on prevailing current patterns. Collection of such data should be coincident with the post-disposal assessment during which sediment mapping and sediment sampling occurs, allowing integration of current data into these programs.

Sediment Contaminant Monitoring:

Another component of this monitoring plan could be to periodically sample sediments in and adjacent to the ODMDS to monitor for changes in sediment contaminant levels. Sampling for sediment contaminants should be conducted in conjunction with the benthic monitoring effort, using a composite sample from each zone (N = 20) to reduce analytical costs. Samples should be collected as part of each assessment completed at the site. More frequent sampling of the sediments may be warranted if elevated levels of certain contaminants are found, but the analysis could be restricted to only those constituents which are above acceptable bioeffects levels.

Reporting and Data Formatting

Project Initiation and Violation Reporting

The USACE or other site user shall notify EPA 15 days prior to the beginning of a dredging cycle or project disposal. The user is also required to notify the USACE and the EPA within 24 hours if a violation of the permit and/or contract conditions related to MPRSA Section 103 or SMMP requirements occur during disposal operations.

Disposal Monitoring Data

Disposal monitoring data shall be provided to EPA Region 4 electronically on a weekly basis. Data shall be provided per the EPA Region 4 XML format and delivered as an attachment to an email to DisposalData.R4@epa.gov. The XML format is available from EPA Region 4.

Post Disposal Summary Reports

A Post Disposal Summary Report shall be provided to EPA within 90 days after project completion. These reports should include: dredging project title; permit number and expiration date (if applicable); contract number; name of contractor(s) conducting the work, name and type of vessel(s) disposing material in the ODMDS; disposal timeframes for each vessel; volume disposed at the ODMDS (as paid *in situ* volume, total paid and un paid *in situ* volume, and gross volume reported by dredging contractor), number of loads to ODMDS, type of material disposed at the ODMDS; identification by load number of any misplaced material; dates of pre and post disposal bathymetric surveys of the ODMDS and a narrative discussing any violation(s) of the 103 concurrency and/or permit (if applicable). The narrative should include a description of the violation, indicate the time it occurred and when it was reported to the EPA and USACE, discuss the circumstances surrounding the violation, and identify specific measures taken to prevent reoccurrence. The Post Disposal Summary Report should be accompanied by the bathymetry survey results (plot and X,Y,Z ASCII data file), a summary scatter plot of all disposal start locations, and a summary table of the trip information required by Section 3.2 with the exception of the disposal completion data. If all data is provided in the required XML format, scatter plots and summary tables will not be necessary.

Environmental Monitoring

Material tracking, disposal effects monitoring, and any other data collected shall be coordinated with and be provided to SMMP team members and federal and state agencies as appropriate. Data will be provided to other interested parties requesting such data to the extent possible. Data will be provided for all surveys in a report generated by the action agency. Environmental monitoring shall occur annually during the disposal of material during the new work dredging associated with the construction of the Post 45 deepening project. Subsequent monitoring shall be determined by the SMMP team members, but shall not be required more often than every other year. The reports should indicate:

1) How the survey relates to the SMMP and previous surveys at the Charleston Offshore ODMDS;

2) Provide data interpretations, conclusions, and recommendations; and

3) Project the next phase of the SMMP.

Monitoring results will be summarized in subsequent revisions to the SMMP.

MODIFICATION OF THE CHARLESTON ODMDS SMMP

Should the results of the monitoring surveys or valid reports from other sources indicate that continued use of the ODMDS could lead to unacceptable effects, then the ODMDS management could be modified to mitigate the adverse effects. The SMMP will be reviewed and updated at least every 10 years. The SMMP could be reviewed and updated as necessary if site use changes significantly. For example, the SMMP will be reviewed if the quantity or type of dredged material placed at site changes significantly or if conditions at the site indicate a need for revision. The plan should be updated in conjunction with activities authorizing use of the site.

IMPLEMENTATION OF THE CHARLESTON ODMDS SMMP

This plan shall be effective from date of signature for a period not to exceed 10 years. The EPA and the Corps shall share responsibility for implementation of the SMMP. Site users may be required to undertake monitoring activities as a condition of their permit. The Corps will be responsible for implementation of the SMMP for Federal maintenance projects.

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APPENDIX A

WATER COLUMN EVALUATIONS NUMERICAL MODEL (STFATE) INPUT PARAMETERS

Water Column Evaluations
Numerical Model (STFATE) Input Parameters
Charleston ODMDS

STFATE (Short-Term FATE of dredged material disposal in open water) models the discharge of a single load of dredged material from a scow or hopper. STFATE computes a prediction of the deposition and water quality effects of dredged materials disposed of in open water. This numerical model is used for required evaluations of initial mixing and water column effects. STFATE is an outgrowth of the first comprehensive model for predicting the fate of dredged material developed by Koh and Chang (1993). STFATE models three disposal phases, convective descent, dynamic collapse, and passive transport dispersion. STFATE models conventional displacement (bottom dumping) where the vast majority of the dredged material released from a barge or hopper dredge descends rapidly to the bottom in a high density jet known as the convective descent phase. The dynamic collapse phase begins when the jet impacts the bottom. The more dense material immediately deposits, while the less dense particles are spread outward as a density flow when the vertical energy is transferred into horizontal momentum. Over time the less dense material also settles.

Input data for the model includes information regarding the following:

- Disposal operation
- Disposal site
- Dredged material
- Model coefficients
- Input/output/execution controls

The STFATE input parameters are to be used in future evaluations of disposal operations. These parameters are based on information obtained during site designation studies as presented in the Charleston ODMDS FEA, previous applications of the disposal models, and default parameters. Additional project and site-specific information should be used in future STFATE applications to improve the predictive capability of the model.

The STFATE model input parameters include site description, ambient velocity data, disposal operation information, and coefficients. A 103 by 98 grid was chosen to provide the highest resolution. The grid spacing in the north/south and east/west directions was selected at 200 feet to keep the disposal plume within the grid during the model execution. An average depth of 36 feet is used and a two-point density profile is used. A depth averaged logarithmic velocity profile was selected using median values to the East. Disposal operation and execution parameters include disposal site boundaries and disposal location and model time step and duration. The duration is set to 14,400 seconds (4 hours) to meet the 4-hour dilution requirement. Project specific disposal operations data (i.e., vessel speed, dimensions and draft) will depend on the individual projects. Likewise, dredged material characteristics may vary based on specific sediment testing information. Model default values are specified where appropriate.

STFATE Model Input Parameters

Section 103 Regulatory Analysis for Ocean Water, Tier III, Short-Term Fate of Dredged Material from Split Hull Barge or Hopper/Toxicity Run Average sediment characteristics of recent sediment 103 evaluations were used to calculate the Volumetric Fractions. STFATE model input parameters utilized in the module were as follows:

Water Column Evaluations
Numerical Model (STFATE) Input Parameters
Modified Charleston ODMDS (17,000 X 16,000)

SITE DESCRIPTION

Parameter	Value	Units
Number of Grid Points (left to right)	103	
Number of Grid Points (top to bottom)	98	
Spacing Between Grid Points (left to right)	200	ft
Spacing Between Grid Points (top to bottom)	200	ft
Constant Water Depth	36	ft
Roughness Height at Bottom of Disposal Site	.005[1]	ft
Slope of Bottom in X-Direction	0	Deg.
Slope of Bottom in Z-Direction	0	Deg.
Number of Points in Ambient Density Profile Point	2	
Ambient Density at Depth = 0 ft	1.0215	g/cc
Ambient Density at Depth = 36 ft	1.0220	g/cc

AMBIENT VELOCITY DATA

Parameter	Value	Units
Water Depth	36	ft
Profile	Logarithmic	
Vertically Averaged X-Direction Velocity	0.0	ft/sec
Vertically Averaged Z-Direction Velocity	0.33	ft/sec

DISPOSAL OPERATION DATA

Parameter	Value	Units
Location of Disposal Point from Top of Grid	10,300	ft
Location of Disposal Point from Left Edge of Grid	9,800	ft
Dumping Over Depression	0	

INPUT, EXCECUTION AND OUTPUT

Parameter	Value	Units
Location of the Upper Left Corner of the Disposal Site - Distance from Top Edge	1,800	ft

Location of the Upper Left Corner of the Disposal Site - Distance from Left Edge	1,800	ft
Location of the Lower Right Corner of the Disposal Site - Distance from Top Edge	18,800	ft
Location of the Lower Right Corner of the Disposal Site - Distance from Left Edge	17,800	ft
Duration of Simulation	14,400	sec
Long Term Time Step	600	sec

COEFFICIENTS

Parameter	Keyword	Value
Settling Coefficient	BETA	0.000[1]
Apparent Mass Coefficient	CM	1.000[1]
Drag Coefficient	CD	0.500[1]
Form Drag for Collapsing Cloud	CDRAG	1.000[1]
Skin Friction for Collapsing Cloud	CFRIC	0.010[1]
Drag for an Ellipsoidal Wedge	CD3	0.100[1]
Drag for a Plate	CD4	1.000[1]
Friction Between Cloud and Bottom	FRICTN	0.010[1]
4/3 Law Horizontal Diffusion Dissipation Factor	ALAMDA	0.0225[2]
Unstratified Water Vertical Diffusion Coefficient	AKYO	Pritchard Expression
Cloud/Ambient Density Gradient Ratio	GAMA	0.250[1]
Turbulent Thermal Entrainment	ALPHAO	0.235[1]
Entrainment in Collapse	ALPHAC	0.100[1]
Stripping Factor	CSTRIP	0.003[1]

[1]Model Default Value
[2]Calculated from NOAA Field Work at Fort Pierce (1994)

APPENDIX B

TEMPLATE FOR MPRSA 103 STANDARD PERMIT CONDITIONS

GENERIC SPECIAL CONDITIONS FOR MPRSA SECTION 103 PERMITS CHARLESTON, SC ODMDS

I. DISPOSAL OPERATIONS

A. For this permit, the term disposal operations shall mean: navigation of any vessel used in disposal of operations, transportation of dredged material from the dredging site to the Charleston, SC ODMDS, proper disposal of dredged material at the disposal area within the Charleston, SC ODMDS, and transportation of the hopper dredge or disposal barge or scow back to the dredging site.

B. The Charleston, SC ODMDS is defined by the following coordinates:

Site		Geographic(NAD83, Decimal Degrees)		State Plane (South Carolina US Survey Feet)		Area (nmi^2)	Area (mi^2)
		Latitude	Longitude	N	E		
Charleston ODMDS	Center	32.63522	-79.73939	294137.61	2388059.58	7.4	9.8
	SE	32.60467	-79.72770	283067.786	2391795.475		
	SW	32.62744	-79.77627	291170.826	2376741.168		
	NW	32.66571	-79.75113	305185.821	2384312.304		
	NE	32.64299	-79.70253	297104.717	2399371.043		

The disposal zone within the ODMDS has the following coordinates:

Site		Geographic (NAD83, Decimal Degrees)		State Plane (South Carolina US Survey Feet)		Area (nmi^2)	Area (mi^2)
		Latitude	Longitude	N	E		
Dump zone	SE	32.62953	-79.76731	291963.450	2379495.145	3.9	5.1
	SW	32.61220	-79.73030	285797.391	2390966.182		
	NW	32.63817	-79.71280	295312.397	2396237.184		
	NE	32.65600	-79.75011	301659.432	2384675.135		

C. No more than [NUMBER] cubic yards of dredged material excavated at the location defined in [REFERENCE LOCATION IN PERMIT] are authorized for disposal at the Charleston, SC ODMDS. The permittee agrees and understands that all dredged material will be placed in such a manner that its highest point will not exceed –25 feet MLW.

D. The permittee shall use an electronic positioning system to navigate to and from the Charleston, SC ODMDS. For this section of the permit, the electronic positioning system is defined as: a differential global positioning system or a microwave line of site system. Use of LORAN-C alone is not an acceptable electronic positioning system for disposal operations at the Charleston, SC ODMDS. If the electronic positioning system fails or navigation problems are detected, all disposal operations shall cease until the failure or navigation problems are corrected.

E. The permittee shall certify the accuracy of the electronic positioning system proposed for use during disposal operations at the Charleston, SC ODMDS. The certification shall be accomplished by direct comparison of the electronic positioning system's accuracy with a known fixed point.

F. The permittee shall not allow any water or dredged material placed in a hopper dredge or disposal barge or scow to flow over the sides or leak from such vessels during transportation to the Charleston, SC ODMDS, to the extent practicable. In addition, the permittee understands that no debris is to be placed in the ODMDS.

G. A disposal operations inspector and/or captain of any tug boat, hopper dredge or other vessel used to transport dredged material to the Charleston, SC ODMDS shall insure compliance with disposal operation conditions defined in this permit.

1. If the disposal operations inspector or the captain detects a violation, he shall report the violation to the permittee immediately.

2 The permittee shall contact the U.S. Army Corps of Engineers, Charleston District's Regulatory Division (843) 329-8044 and EPA Region 4 at (404) 562-9395 to report the violation within twenty-four (24) hours after the violation occurs. A complete written explanation of any permit violation shall be included in the post-dredging report.

H. When dredged material is disposed, no portion of the hopper dredge or disposal barge or scow shall be farther than 100 feet from the center of the disposal lanes as assigned for that project.

I. The permittee shall use an electronic tracking system (ETS) that will continuously track the horizontal location and draft condition of the disposal vessel (hopper dredge or disposal barge or scow) to and from the Charleston ODMDS. Data shall be collected at least every 500 feet during travel to and from the ODMDS and every minute or every 200 feet of travel, whichever is smaller, while approaching within 1,000 feet of and within the ODMDS. The permittee shall use South Carolina State Plane or latitude and longitude coordinates (North American Datum 1983). State Plane coordinates shall be reported to the nearest foot and latitude and longitude shall be reported as decimal degrees to the sixth decimal place. Westerly longitudes are to be reported as negative. Draft readings shall be recorded in feet to the hundredths place.

J. The permittee shall record electronically for each load the following information:

a. Load Number
b. Disposal Vessel or Scow Name
c. Tow Vessel Name (if scow used)
d. Captain of Disposal or Tow Vessel
e. Estimated volume of Load
f. Description of Material Disposed
g. Source of Dredged Material
h. Date, Time and Location at Start of Initiation and Completion of Disposal event
i. The ETS data required by Special Condition I.I.

K. The permittee shall conduct a bathymetric survey of the Charleston ODMDS 30 days following project completion.

1. The number and length of the survey transects shall be sufficient to encompass the Charleston ODMDS and a 0.25 nautical mile wide area around the site. The transects shall be spaced at 500-foot intervals or less.

2. Vertical accuracy of the survey shall be ±0.5 feet. Horizontal location of the survey lines and depth sounding points will be determined by an automated positioning system utilizing either microwave line of site system or differential global positioning system. The vertical datum shall be mean lower low water (m.l.l.w) and the horizontal datum shall use South Carolina State Plane or latitude and longitude coordinates (North American Datum 1983). State Plane coordinates shall be reported to the nearest 0.10 foot and latitude and longitude coordinates shall be reported as decimal degrees to the fifth place.

K. Between December 1 and March 31, NMFS requires monitoring by endangered species observers with at-sea large whale identification experience to conduct daytime observations for whales. During daylight hours, the vessel must take precautions to avoid whales. During evening hours or when there is limited visibility due to fog or sea states of greater than Beaufort, 3, the vessel must slow down to 5 knots or less when traversing between areas if whales have

been spotted within 15nm of the vessel's path within the previous 24 hours. In addition, vessel shall maintain a 500 yard buffer zone between the vessel and any sighted whale.

L. Essential Fish Habitat (EFH). The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), 16 USC 1801 et seq. Public Law 104-208 reflects the Secretary of Commerce and Fishery Management Council authority and responsibilities for the protection of essential fish habitat. The Act specifies that each Federal agency shall consult with the Secretary with respect to any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by such agency that may adversely affect any EFH identified under this act. EFH is defined in the Act as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Detailed information on federally managed fisheries and their EFH is provided in the 1998 amendment of the Fishery Management Plans for the South Atlantic Region prepared by the South Atlantic Fishery Management Council (SAFMC). The 1998 generic amendment was prepared as required by the MSFCMA.

II. REPORTING REQUIREMENTS

A. All reports, documentation and correspondence required by the conditions of this permit shall be submitted to the following addresses: U.S. Army Corps of Engineers Charleston District, Regulatory Division and EPA Region 4, Ocean, Wetlands, and Streams Protection Branch. The permittee shall reference this permit number [INSERT PERMIT NUMBER], on all submittals.

B. At least 15 days before initiating any dredging operations authorized by this permit, the Permittee shall provide to the Corps and EPA a written notification of the date of commencement of work authorized by this permit.

C. Electronic data required by Special Conditions I.I and I.J shall be provided to EPA Region 4 on a weekly basis. Data shall be submitted as an eXtensible Markup Language (XML) document via Internet e-mail to Disposal Data.R4@epa.gov. XML data file format specifications are available from EPA Region 4.

D. The permittee shall send one (1) copy of the disposal summary report to the Charleston District's Regulatory Branch and one (1) copy of the disposal summary report to EPA Region 4 documenting compliance with all general and special conditions defined in this permit. The disposal summary report shall be sent within 90 days after completion of the disposal operations authorized by this permit. The disposal summary report shall include the following information:

1. The report shall indicate whether all general and special permit conditions were met. Any violations of the permit shall be explained in detail.

2. The disposal summary report shall include the following information: dredging project title; dates of disposal; permit number and expiration date; name of contractor(s) conducting the work, name and type of vessel(s) disposing material in the ODMDS; disposal timeframes for each vessel; volume disposed at the ODMDS (as paid *in situ* volume, total paid and un paid *in situ* volume, and gross volume reported by dredging contractor), number of loads to ODMDS, type of material disposed at the ODMDS; identification of any misplaced material (outside disposal zone or the ODMDS boundaries); dates of post disposal bathymetric surveys of the ODMDS and a narrative discussing any violation(s) of the 103 permit. The disposal summary report should be accompanied by the bathymetry survey results (plot and X, Y, Z ASCII data file).

III. PERMIT LIABILITY

A. The permittee shall be responsible for ensuring compliance with all conditions of this permit.

B. The permittee and all contractors or other third parties who perform an activity authorized by this permit on behalf of the permittee shall be separately liable for a civil penalty of up to $50,000 for each violation of any term of this permit they commit alone or in concert with the permittee or other parties. This liability shall be individual, rather

than joint and several, and shall not be reduced in any fashion to reflect the liability assigned to and civil penalty assessed against the permittee or any other third party as defined in 33 U.S.C. Section 1415(a).

C. If the permittee or any contractor or other third party knowingly violates any term of this permit (either alone or in concert), the permittee, contractor or other party shall be individually liable for the criminal penalties set forth in 33 U.S.C. Section 1415(b).

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APPENDIX C

TYPICAL CONTRACT LANGUAGE FOR IMPLEMENTING SMMP REQUIREMENTS

(for Federal Projects)

3.3 DISPOSAL OF DREDGED MATERIAL

3.3.1 General

All material dredged shall be transported to and deposited in the disposal area(s) designated on the drawings. The approximate maximum and average distance to which the material will have to be transported are as follows:

Disposal Area	Maximum Distance Statute Miles	Average Distance Statute Miles
Charleston ODMDS		
[INSERT DISPOSAL AREA]	[XX miles]	[XX miles]

[IF MATERIAL FROM DIFFERENT PROJECT AREAS GO TO DIFFERENT DISPOSAL AREAS, IT COULD BE SPECIFIED HERE]

3.3.2 Ocean Disposal Notification

a. The Corps or the contractor shall notify EPA Region 4's Ocean, Wetlands, and Streams Protection Branch (61 Forsyth Street, Atlanta, GA 30303) at least 15 calendar days and the local Coast Guard Captain of the Port at least 5 calendar days prior to the first ocean disposal. The notification will be by certified mail with a copy to the Contracting Officer. The following information shall be included in the notification:

(1) Project designation, Corps of Engineers' Contracting Officer's name and contract number, and the name, address, and telephone number of the Contractor;
(2) Port of departure;
(3) Location of ocean disposal area (and disposal zone, if applicable); and
(4) Schedule for ocean disposal, giving date and time projected for first ocean disposal.

3.3.3 Ocean Dredged Material Disposal Sites (ODMDS)

The material excavated shall be transported to and deposited in the Charleston ODMDS as shown on the drawings. When dredged material is disposed, no portion of the hopper dredge or disposal barge or scow shall be outside of the boundaries, or within 500 feet of, the boundaries of the ODMDS. Additionally, disposal shall only be initiated within the disposal release zone defined by the following coordinates:

[insert coordinates for appropriate release zone]

	Geographic NAD 83		State Plane NAD 83	
	latitude	Longitude	northing	easting
Center				
North				
West				
South				
East				

3.3.4 **Logs**

The Contractor shall keep a log for each load placed in the Charleston ODMDS. The log entry for each load shall include:

a. Load Number
b. Disposal Vessel or Scow Name
c. Tow Vessel Name (if scow used)
d. Captain of Disposal or Tow Vessel
e. Estimated volume of Load
f. Description of material disposed
g. Source of Dredged Material C-
h. Date, Time and Location (coordinates) at Start of Initiation and Completion of Disposal Event

At the completion of dredging and at any time upon request, the log(s) shall be submitted in paper and electronic formats to the Contracting Officer for forwarding to the appropriate agencies.

3.3.5 **Overflow, Spills and Leaks**

Water and dredged materials shall not be permitted to overflow or spill out of barges, hopper dredges, or dump scows during transport to the disposal site(s). Failure to repair leaks or change the method of operation which is resulting in overflow or spillage will result in suspension of dredging operations and require prompt repair or change of operation to prevent overflow or spillage as a prerequisite to the resumption of dredging.

3.3.6 **Electronic Tracking System (ETS) for Ocean Disposal Vessels**

The Contractor shall furnish an ETS for surveillance of the movement and disposition of dredged material during dredging and ocean disposal. This ETS shall be established, operated and maintained by the Contractor to continuously track in real-time the horizontal location and draft condition of the disposal vessel (hopper dredge or disposal barge or scow) for the entire dredging cycle, including dredging area and disposal area. The ETS shall be capable of displaying and recording in real-time the disposal vessel's draft and location.

[USE LANGUAGE BELOW FOR NON DQM PROJECTS]

3.3.6.1 ETS Standards

The Contractor shall provide automated (computer) system and components to perform in accordance with COE EM 1110-1-2909. A copy of the EM can be downloaded from the following website: http://www.usace.army.mil/inet/usace-docs'eng-manuals/em.htm. Horizontal location shall have an accuracy equal to or better than a standard DGPS system, equal to or better than plus/minus 10 feet (horizontal repeatability). Vertical (draft) data shall have an accuracy of plus/minus 0.5 foot. Horizontal location and vertical data shall be collected in sets and each data set shall be referenced in real-time to date and local time (to nearest minute), and shall be referenced to the same state plane coordinate system used for the surey(s) shown in the contract plans. The ETS shall be calibrated, as required, in the presence of the Contracting Officer at the work location before disposal operations have started, and at 30-day intervals while work is in progress. The Contracting Officer shall have access to the ETS in order to observe its operation. Disposal operations will not commence until the ETS to be used by the Contractor is certified by the Contracting Officer to be operational and within acceptable accuracy. It is the Contractor's

responsibility to select a system that will operate properly at the work location. The complete system shall be subject to the Contracting Officer's approval.

3.3.6.2 ETS Data Requirements and Submissions

a. The ETS for each disposal vessel shall be in operation for all dredging and disposal activities and shall record the full round trip for each loading and disposal cycle. (NOTE: A dredging and disposal cycle constitutes the time from commencement of dredging to complete discharge of material.) The Contracting Officer shall be notified immediately in the event of ETS failure and all dredging operations for the vessel shall cease until the ETS is fully operational. Any delays resulting from ETS failure shall be at the Contractor's expense.

b. Data shall be collected, during the dredging and disposal cycle, every 500 feet (minimally) during travel to the disposal area, and every minute or every 200 feet, whichever is smaller, while approaching within 1,000 feet and within the disposal area.

c. Plot Reporting (2 types):

i. Tracking Plot – For each disposal event, data collected while the disposal vessel is in the vicinity of the disposal area shall be plotted in chart form, in 200-foot intervals, to show the track and draft of the disposal vessel approaching and traversing the disposal area. The plot shall identify the exact position at which the dump commenced. A sample Track and Draft Plot Diagram is on the web site indicated in paragraph CONSTRUCTION FORMS AND DETAILS below.

ii. Scatter Plot – Following completion of all disposal events, a single and separate plot will be prepared to show the exact disposal locations of all dumps. Every plotted location shall coincide with the beginning of the respective dump. Each dump shall be labeled with the corresponding Trip Number and shall be at a small but readable scale. A sample Scatter Plot Diagram is on the web site indicated in paragraph CONSTRUCTION FORMS AND DETAILS below.

d. ETS data and log data required by Section 3.3.4 shall be provided to EPA Region 4 on a weekly or more frequent basis. Data shall be submitted to EPA Region 4 as an eXtensible Markup Language (XML) document via Internet e-mail to Disposal Data.R4@epa.gov. XML data file format specifications are available from EPA Region 4. All digital ETS data shall be furnished to the Contracting Officer within 24 hours of collection. The digital plot files should be in an easily readable format such as Adobe Acrobat PDF file, Microstation DGN file, JPEG, BMP, TIFF, or similar. The hard copy of the ETS data and tracking plots shall be both maintained onboard the vessel and submitted to the Contracting Officer on a weekly basis.

[FOR DQM PROJECTS]

See: http://dqm.usace.army.mil/Specifications/Index.aspx

For scows, the monitoring profile, TDS profile or Ullage profile shall be used.

3.3.6.3 Misplaced Materials

Materials deposited outside of the disposal zone specified in 3.3.3 will be classified as misplaced material and will result in a suspension of dredging operations. Redredging of such materials will be required as a prerequisite to the resumption of dredging unless the Contracting Officer, at his discretion, determines that redredging of such material is not practical. If redredging of such material is not required then the quantity of such misplaced material shall be deducted from the Contractor's pay quantity. If the quantity for each misplaced load to be deducted cannot initially be agreed to by both the Contractor and Contracting Officer, then an average load quantity for the entire contract will be used in the determination. Misplaced loads may also be subject to penalty under the Marine Protection, Research, and Sanctuaries Act. Materials deposited above the maximum indicated elevation or outside the disposal area template shown will require the redredging or removal of such materials at the Contractor's expense. In addition, the Contractor must notify the Contracting Officer and the EPA Region 4's Ocean, Wetlands, and Streams Protection Branch (61

Forsyth Street, Atlanta, GA 30303) within 24 hours of a misplaced dump or any other violation of the Site Management and Monitoring Plan for the Charleston ODMDS. Corrective actions must be implemented by the next dump and the Contracting Officer must be informed of actions taken.