Utilization and Recommendation Report
MCR Ocean Dredged Material Disposal Sites
For 2002-2003

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Final Report

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1.0 PURPOSE AND SUMMARY

1.1 General The U. S. Army Corps of Engineers is responsible for the operation and maintenance (O & M) of the federal deep-draft navigation channel at the Mouth of the Columbia River (MCR). Each year, 3-5 million cubic yards (MCY) of sand is dredged from the 6-mile long MCR channel using 2 hopper dredges; a government dredge and a private industry (contract) dredge. The dredged sand is placed at ocean dredged material disposal sites (ODMDS) or at sites permitted through Section 404 of the Clean Water Act (404 site). Figure 1 and 1a show the regional bathymetry of MCR and dredged material disposal sites.

Although the navigation channel is the primary Corps project feature at MCR, suitable open water dredged material disposal sites are necessary features and require a rationale for design, utilization, and designation. Management of an ODMDS is predicated on the need to efficiently utilize the site while minimizing impacts to navigation and environment outside the ODMDS. The *ultimate* capacity of an ODMDS is the volume (or height and area) of dredged material that can accumulate within a site's boundaries without adversely affecting navigation or the environment. MCR ODMDSs are managed to an *operational (or target)* level of accumulation that is below the ultimate capacity of the site. The target accumulation is based on the desire to limit dredged material accumulation such that mounded dredged material does not amplify waves, due to shoaling and refraction. The objective of managing an ODMDS to the target level of accumulation is to avoid adversely affecting navigation. The target accumulation can be different for each disposal site.

As part of the management plan for an active ODMDS, the bathymetry of the site is monitored during the dredging/disposal season to determine the extent of dredged material dispersion and accumulation on the seabed. If a given disposal site is at or near its target capacity, then site management changes accordingly. This report:

1) Describes observed bathymetric change at mouth of the Columbia River (MCR) dredged material disposal sites utilized during 2002, based on the comparison of hydrographic surveys;
2) Examines the relative usability of each disposal site based on observations made during 1997 to 2002;
3) Summarizes the potential for wave-related impact of (accumulated) dredged material placed at ODMDS E during May 1997 - October 2002; and
4) Presents recommendations for utilization of ODMDS E and the North Jetty site during 2003. In some cases, recommendations represent a departure from previous site utilization practices.

1.2 Dredging-Disposal for 2002 During the 2002 dredging season (July-October), 4.32 MCY of sand was dredged from the MCR navigation channel and placed in three in-water disposal sites: The North Jetty (404 site, site C), ODMDS E, and ODMDS F. Approximately 1.5 MCY of dredged sand was placed at ODMDS E, 498,800 cy (498 KCY) was placed at the North Jetty site, and 2.3 MCY (MCY) was placed at ODMDS F.

During July 16-19, 43,727 CY of MCR dredged material was placed at an upland site (the inter-tidal area of Benson Beach) via direct pump-out from a hopper dredge. The placement operation and fate of placed sediment was monitored. The upland placement and monitoring activity was done at the request of Congress, to examine alternate methods of dredged material disposal and assess the impacts of placing dredged material on Benson Beach. The placement of dredged material on Benson Beach during 2002 was the first time that MCR dredged material was placed on an upland disposal site. Additional information regarding the Benson Beach dredged material disposal action can be found in USACE [2003] or at http://www.nwp.usace.army.mil/issues/mcr/pubs.htm.

The North Jetty site (404 site) was first used in 1999 and is located along the southern side of the MCR north jetty, in water depths of 40–70 ft. Use of the North Jetty (NJ) Site is intended to protect the foundation of the north jetty from additional scour.

The site now known as ODMDS E has been used since 1973 under different names and configurations, i.e., Site E and "Expanded Site E". EPA intends to propose a Shallow Water ocean dredged material disposal site (SWS) for formal designation in vicinity of ODMDS E, but that action had not occurred when this report was completed. Throughout this report the term, ODMDS E, is used consistently to represent the area that may soon become known as the SWS. ODMDS E has become the primary location for dredged material disposal at MCR and is located on the ebb tidal delta of the Columbia River, about 1/4 mile seaward of the MCR north jetty, in water depth of 45-70 ft. Waves and currents disperse most of the dredged material placed at the site.

ODMDS E and the North Jetty (NJ) site are considered to be within the active littoral zone of MCR and are highly dispersive: A sizable fraction of the dredged material placed at these sites is transported out of the site by waves and currents and reintroduced into the littoral system of MCR and the adjacent coast. For this reason, the NJ site and ODMDS E are used to the maximum extent possible. To avert excessive mounding of dredged material placed within ODMDS E during 2002, an attempt was made to distribute dredged material uniformly throughout the site using a series of pre-assigned disposal lanes to control the release point for each disposal event [USACE 1999a and 2002]. A specified level of dredged material accumulation was prescribed for each disposal lane for the contract dredge, depending upon pre-disposal water depth (see figure 2). A similar approach was also used for placement of dredged material at the NJ site and ODMDS F. The detailed strategy for managing the MCR dredged material disposal sites during 2002 is described in the document "MCR Dredged Material Disposal Site Annual Use Plan for 2002" USACE [2002] http://www.nwp.usace.army.mil/issues/mcr/utilization.htm. To improve the utilization of ODMDS E and the NJ Site during 2003, some general observations and recommendations are made in this report (see page 12 and 14). After the

2003 predisposal surveys for each disposal site are acquired (April-May 2003), specific actions for utilizing available MCR disposal sites will be described in the "MCR Dredged Material Disposal Site Annual Use Plan for 2003."

After being designated in 1986, ODMDS F was first used for the disposal of MCR dredged material in 1993. The site is located about 4 miles offshore (WSW) from the north jetty in water depth of 100-170 ft. Although ODMDS F is located in fairly deep water and not frequently subjected to littoral processes, the site is heavily influenced by the wave, current, and sediment interactions associated with the evolving MCR ebb tidal shoal. Sediment has been observed to be "naturally" accumulating within ODMDS F at a rate of 0.1-0.6 ft/year. The Section 103 (MPRSA) part of ODMDS F (1993 expanded area) has expired and will not be available for use in 2003. Based on the potential for placed dredged material to accumulate within ODMDS F and adversely affect waves at or near the site, it has been proposed to not use ODMDS F after the 2002 dredging disposal season. This decision is predicated on EPA's proposed rule to designate the SWS and DWS, and de-designate MCR ODMDSs A, B, and F as described http://edocket.access.gpo.gov/2003/pdf/03-5743.pdf.

1.3 ODMDS E ODMDS E is located along the southern flank of Peacock Spit within 2,000 ft north of the MCR navigation channel in a water depth of 45-70 ft (figure 1). ODMDS E is illustrated in figures 3 through 22a. ODMDS E is the principal disposal site for MCR dredged material. Since 1997, 65% of all MCR dredged material (sand) has been placed in ODMDS E. As of September 2002, waves and currents had dispersed 90% of all dredged material placed within the site (14.9 MCY since May 1997) in a north-northwesterly direction onto Peacock Spit. Less than 5% of the dredged material placed at the site has been transported southward into the MCR navigation channel. The lack of southward transport at ODMDS E is due to the predominate influence of ebb tidal currents that affect the site. The eastern half of the site has experienced net erosion since 1997. Based on monitoring conducted during 1997-2002 (see table 1), about 45% of the dredged material placed at ODMDS E was dispersed during the dredging/disposal season (June-October). The dispersion rate within the site during the ensuing winter (November-May) was about 45% of the volume placed at the site. The site's average annual dispersive rate was about 90% of the volume of dredged material placed each year during 1997-2002.

Typically, only 50-80% of the area within ODMDS E has been used in any given year. The presence of a navigation buoy (#7) within the middle of ODMDS E has contributed to the lack of complete site area utilization. In some cases, dredged material placement within ODMDS E (and deposition on the seabed) was concentrated to small areas. When localized mounding occurred within ODMDS E, less than 10% of the dredged material placed during the dredging/disposal season contributed to an accumulation that was greater than the management target [USACE 2001 and 2002a-c]. If the same "10%" of dredged material had been placed in the area of ODMDS E that was not used (20-50% of the site), the potential for mounding would have been greatly reduced if not eliminated. In short, using 100% of the site for the placement of dredged material will reduce the occurrence of localized mounding; not doing so will result in localized mounding of placed dredged material regardless of the volume placed.

Due to critical nature of successfully managing dredged material disposal at ODMDS E, an independent Federal Review Team was convened to review site management practices and make recommendations for improved future site management. Results can be found at: http://www.nwp.usace.army.mil/issues/MCR/reports/site_e/report.pdf.

During July-September 2002, about 1.5 MCY of dredged sand was placed within ODMDS E by a contract hopper dredge; a detailed yearly dredging summary can be found in table 2. By December 2002, waves and currents had transported 57% of the dredged material placed within ODMDS E during 2002 out of the site. As of 2 December 2002, the level of dredged material mounding in ODMDS E was 6 ft or less, with respect to (w.r.t.) the 1997 baseline condition. About 2% of the area within ODMDS E was covered by 5 ft or more of dredged material, w.r.t. the baseline condition. Depending upon the approach for utilizing of ODMDS E during 2003 (which will be specified in the 2003 Annual Use Plan, scheduled for May 2003), the site may be able to accept between 2 and 4 MCY.

Utilization of ODMDS E is intended to (re-) introduce dredged sand into the littoral zone of Peacock Spit and points north of north MCR. It is widely recognized that Peacock Spit is the reservoir of sand that maintains the littoral budget for the shoreline north of MCR. By maintaining Peacock Spit, the littoral budget of the Long Beach Peninsula will be maintained. Use of ODMDS E is believed to replicate the process of sand discharge from the MCR to Peacock Spit. At least 85% of the material placed at ODMDS E has been transported out to of the site onto Peacock Spit. Given that the small size of ODMDS E with respect to the present size of Peacock Spit (1 mi^2s vs. 25 mi^2), use of ODMDS E has been an effective method for supplying sand to the littoral budget of Peacock Spit. Continued use of ODMDS E is strongly recommended. See page 12 of this document for specific recommendations that will facilitate the avoidance of excessive mounding in 2003.

1.4 North Jetty (NJ) Site Much of the dredged material placed at the NJ site has abated a potentially destabilizing scour area along the southern toe of the MCR North jetty. This was the justification for using the NJ site. However, the target capacity of the NJ site is difficult to fully utilize due to the site's small areal size, proximity of the north jetty, and limited water depth on the site's east/south side (see figure 1). It is difficult to maneuver a ship the size of a medium-class hopper dredge through the entire site. The capacity of the NJ site to handle large volumes of dredged material is limited and requires care in operational planning and use. The NJ site is illustrated in figures 23 through 26.

As of April 2002, about 50% (1.0 MCY) of the material placed in the site during 1999-2001 had remained within the site. Sand transport from the NJ site appeared to be in several directions; some of the placed sand has moved south toward the MCR navigation channel and some has moved toward the toe of the north jetty. The accumulation of dredged material along the toe of north jetty is most desirable. Unless the volume of channel shoaling attributable to the NJ site becomes excessive, the value of protecting the toe of the North Jetty from destabilizing scour offsets minor channel shoaling. As of August 2002, about 45% (220,000 cy) of the material placed in the site during July 2002 remained within the site, and a total of 1.2 MCY was present within the NJ site when

compared to the baseline condition (June 1999). The NJ site is moderately dispersive w.r.t. the volume of dredged material placed there; about 46% of the material placed within the site since 1999 was on the seabed as of 31 July 2002.

Based on the 31 July 2002 vertical extent of dredged material accumulation, it is recommended that placement of dredged material during 2003 avoid the center of the NJ site until the accumulation (w.r.t June 1999) has been reduced to 8 ft or less. Assuming that the annual dispersion rate at the NJ site is 200,000-500,000 cy/yr (based on prior years' observed dispersion), the site may be able to receive 400,000 CY in 2003. See page 14 for additional recommendations.

1.5 ODMDS F Although this site is fairly large and is located away from the hazards of the MCR entrance, use of ODMDS F is constrained by inbound/outbound ships using the site as a staging area for transferring MCR bar pilots to/from ocean-going vessels transiting the MCR bar. ODMDS F is illustrated in figures 27 through 32. The target capacity of ODMDS F is limited, and misplaced dredged material (creation of a large mound) cannot be corrected, due to the depth at the site. As such, active management has been applied when planning for and placing dredged material at ODMDS F--to avoid adverse consequences. Approximately 2.3 MCY was placed within the northern half of this site during 2003. The total volume of dredged material placed in this site since 1986 is about 13.4 MCY and the maximum height of dredged material accumulation as of October 2002 is about 12 ft, w.r.t. the site's baseline 1981 condition. The target level for managing dredged material accumulation within ODMDS F is 15 ft. For 2003 and beyond, only the original EPA-designated area of ODMDS F (1,800 x 1,800 ft as designated in 1986) will available for use. The Section 103 part (as expanded to 10,000 x 10,000 ft in 1993) of this site has expired.

Approximately 0.4 ft/yr (average) of "natural" deposition has been occurring at the ODMDS F, effectively reducing the site's target capacity by 750,000 cy/yr. The total remaining capacity within ODMDS F as of October 2002 was about 4 MCY. The issue of present capacity within ODMDS F is mute. Based on the limited capacity of the site and EPA's draft rule to de-designate ODMDS F, the site will not be used for dredged material disposal during 2003 (or in the future).

1.6 Outlook for Present MCR Dredged Material Disposal Sites Each of the presently available MCR dredged material disposal sites (ODMDS E (SWS), ODMDS A, the DWS and the NJ Site) is affected by a unique physical environment and presents unique challenges for site management. See figure 1 and 1a for the location of MCR dredged material disposal sites available for 2003.

At present, ODMDS E and the NJ site are expected to have a combined target capacity of 2.5-4.5 MCY for the 2003 dredging-disposal season. An improved estimate for the 2003 disposal (target) capacity of ODMDS E and the NJ will be ascertained when a pre-disposal survey for each site is acquired in April-May 2003. In the event that ODMDS E and the NJ site do not have the capacity to handle all 2003 MCR dredging disposal volume, parts of the Deep Water Disposal Site or ODMDS A could be used. Clarification for availability

and potential use of the DWS and ODMDS A during 2003 will be presented in the "2003 Annual Use Plan" for MCR disposal sites (scheduled for May 2003).

2.0 MANAGEMENT PROTOCOLS FOR ODMDS E

2.1 Management Goal for 2002 Successful management of ODMDS E is predicated on the requirement to avoid modification of the site's bathymetry (via dredged material mounding) such that the modification could potentially result in adverse wave amplification with respect to the May 1997 baseline condition [USACE 1998a, USACE 1999a]. With this criterion in mind, a target value of 5 ft was selected for managing the vertical accumulation of dredged material (with respect to the *baseline* condition of 1997) within ODMDS E during 2002 based on the water depth dependent thresholds discussed in USACE 2001a.

2.2 Management Target for 2002 The 5-foot target height for dredged material accumulation within ODMDS E during 2002 was based on a mound feature that would occupy an area of 2,000 x 2,000 ft. For smaller mound features that exceed the target height, there may be little or no wave amplification. A case-by-case examination of wave amplification potential was warranted only when dredged material accumulated to levels that far exceeded the "limiting mound height" and/or covered an area larger that 2,000 x 2,000 ft. A contingency plan for managing dredged material placement within ODMDS E during 2002 was based on 6 action levels (USACE 2002b). The objective of the 2002 Annual Use Plan was to avoid any action level above "Level 4." Action Level #4 was defined as: Limited Management Level = dredged material exceeds target mound height by 1-2 ft within an area greater than 500 x 500 ft. ACTION: Avoid placement in the affected location of accumulation and in adjacent areas. Continue to use areas not affected; adopt early exit strategy for site.

ODMDS E is typically managed in two parts, a western half and an eastern half. Each half of the site exhibits different physical characteristics; the eastern half is geometrically smaller but is 2x more dispersive than the western half. Demarcating ODMDS E in terms of two parts facilitates clear communication about site utilization and improves site management. The "dividing line" separating the site into an eastern and western half is oriented NW-SE and passes through the #7 buoy location (see figure 1). It is noted that since 2000, the western half of ODMDS E has been accumulating about 200,000 cy/yr of sediment; not all of the placed dredged material is transported out of the site on an annual basis. Depending upon annual conditions, the western half of ODMDS E is managed differently than the eastern half of the site to account for net deposition.

3.0 UTILIZATION OF ODMDS E DURING 2002

3.1 Objective The management objective for ODMDS E was to fully utilize the site for the disposal of MCR dredged material, while limiting the average vertical accumulation of placed dredged material so as to avoid adversely affecting navigation at or near the site.

The 2002 management target for the vertical accumulation of dredged material placed within ODMDS E was 5 ft, w.r.t. the site's *baseline* condition (9 May 1997) [USACE 1998b and 2002b]. The preference for continued use of ODMDS E is due to:

The dispersive nature of the site - dredged material placed at ODMDS E is quickly transported to the littoral (coastal) environment of MCR. This allows for the renewal of disposal (target) capacity at ODMDS E while using the process of dredged material disposal as a method to place or retain dredged material within the nearshore littoral environment of Washington and abate erosion of Peacock Spit and locations north. The State of Washington, thru issuance of water quality certification for MCR O & M dredging, urges Portland District to maximize use of ODMDS E, for the beneficial littoral aspects of the site.

The proximity of the site with respect to the MCR navigation channel – haul distance from MCR dredging to ODMDS E is short, making ODMDS E cost-effective to utilize and allows more dredging to be accomplished within the limited operational window at MCR.

Note that "fully utilizing" ODMDS E while not negatively affecting navigation (by limiting the accumulation of dredged material placed within the site) could be inferred as conflicted objectives. Management of conflicted objectives is problematic: This is why prudent management of ODMDS E during 2002 was essential. Additional details concerning the general strategy for utilizing ODMDS E are described in USACE [2003] and can be viewed at: http://www.nwp.usace.army.mil/issues/MCR/reports/mcrfinal03/MCRdraftffinalreport10mar03final.pdf.

3.2 Pre-disposal Condition of ODMDS E for 2002 The May 1997 *baseline* bathymetry for ODMDS E is shown in figure 3. Figure 2 shows the distribution of disposal lanes that were used to guide the placement of dredged material within ODMDS E during 2002. The backside of figure 2 lists the protocol for dredged material placement within ODMDS E.

Figure 4 shows the bathymetry at ODMDS E as of 3 July 2002, documents the pre-disposal condition of ODMDS E for 2002, and shows a zone of "limited capacity." The "limited capacity zone" is where dredged material had accumulated to 3 ft or greater with respect to the baseline condition and additional disposal was to be minimized. Figure 5 shows the difference between the surveys of October 2001 and 3 July 2002 and documents the post-disposal erosion of dredged material that had occurred during the winter of 2001-2002. About 1.75 mcy of sediment was eroded from ODMDS E during the winter 2001-2002 (about 3-5 ft of erosion); much of the eroded sediment moved north of the site (toward Peacock Spit). Figure 6 shows ODMDS E bathymetry change that had occurred between the time of the *baseline* condition (May 1997) and 3 July 2002. Note the erosion within the eastern quarter of the site; the bathymetry in eastern half of the site was 2-6 ft lower in 2002 than in 1997. As of 3 July 2002, there was some dredged material remaining within the western half of ODMDS E from preceding years' disposal operations: Accumulation w.r.t. the site's *baseline* condition ranged from 1-4 ft high and contained about 1.1 MCY.

Figure 7 shows the spatially varying target capacity of ODMDS E in terms of target accumulation levels within the site, based on the 3 July 2002 survey. Note that the total target capacity within Site E was 3.8 MCY, but the effective target capacity was 2.2 MCY. The effective target capacity of Site E to accept dredged material during 2002 was based on: The *vertical threshold* for which dredged material can accumulate within the *usable* area of Site E. The vertical threshold for accumulation in 2002 was 5 ft with respect to the baseline condition. The usable area of Site E was calculated as: The site's **total area** - "**Avoidance Zones**" - "**Non-effective Use Area** (due to presence of buoy #7, -8%) – non-**use along the site's margins** (-20% of the total site area). This means that at best, about 72% of ODMDS E could relied upon to fully accept dredged material assuming that there were no "avoidance zones." The site's target capacity estimate for 2002 did not account for the dispersive nature of Site E. Based on past observation (table 1), about 45% of all material placed in Site E during a dredging/disposal season is dispersed out of the site during the dredging/disposal season. In summary, the 2002 ODMDS E target capacity estimate of 2.2 MCY (based on the 3 July survey) was deemed to be conservatively low, and was subject to change depending upon the amount of natural deposition or erosion that occurred within the site during the course of the 2002 dredged material disposal season (June-October).

Figure 8 shows the layout for a grid system that was used to partition ODMDS E into placement cells. As areas of the site became filled, the respective cells would be specified as not available for use or as "Limited Capacity Zones." The grid system was used to adaptively manage ODMDS E and communicate site utilization strategy between Portland District and dredges.

3.3 Dredged Material Placement During 13 July – 7 August 2002, the contract hopper dredge (*Sugar Island*) placed 786,000 CY in the western half of ODMDS E. During 8 August - 24 September, the contract hopper dredge placed 718,000 CY within the eastern half of ODMDS E. The government dredge did not use ODMDS E during 2002. The total volume of dredged material (sand) placed within ODMDS E during 13 July – 24 September 2002 was 1.5 MCY. During 2002, the dredging contractor was responsible for monitoring the level of dredged material accumulation with ODMDS E to ensure compliance with the criteria as described in figure 2. In others words, the contractor was responsible for the level of accumulation within the site. If the contractor significantly exceeded the management target (see section 2.2) for dredged material accumulation within ODMDS E (as specified in the plans and specifications), then the contractor would be required to remove the placed dredged material such that accumulation would be within compliance.

The intent of the MCR dredging contract plans and specifications was to have the contractor fully utilize all available areas of ODMDS E without exceeding the management target for dredged material accumulation. This required the contractor to monitor the accumulation within ODMDS E by conducting bathymetry surveys of the site on a 48-hour interval. While not explicitly stated, the outcome of utilizing ODMDS E during 2002 was

to achieve uniform deposition of dredged material throughout the site based on the 5-foot accumulation target, with respect to the site's baseline condition.

Unfortunately, not all of the area within ODMDS E was available for use at the beginning of the dredging-disposal season. The area shown as "limited capacity zone" in figure 4 was inadvertently shown as a "restricted area" in the contract plans and specifications for dredged material disposal during 2002: The dredging contractor was not allowed to use the "limited capacity zone" shown in figure 4. This greatly reduced the ability of the contract hopper dredge to use most of the western half of ODMDS E for evenly distributing dredged material placement (and promoting uniform deposition).

Dredged material placement within ODMDS E commenced on 13 July. Based on a 19 July survey of the site, there was no indication of uneven deposition of dredged material placed within ODMDS E during 2002. However, surveys conducted independently by the Corps and contractor during August 2 and 5, indicated a localized area of dredged material accumulation within the western half of ODMDS E near buoy #7. The maximum height of accumulation was about 8 ft high w.r.t. the site's baseline condition (May 1997). The contractor was advised to avoid this area and subsequently shifted disposal to an area along the southern boundary of the site. On 7 August, part of ODMDS E was re-surveyed by the Corps to verify the 2 August survey. A composite of the 2 and 7 August surveys is shown in figure 9. Superimposed on figure 9 are the disposal events that occurred within ODMDS E during 13 July – 7 August. Note the clustering of disposal events near the areas of localized accumulation. Figure 10 shows the accumulation that had occurred at ODMDS E between 3 July and 7 August 2002. Approximately 786,000 CY of sand was placed within the western half of ODMDS E during 13 July – 7 August. Comparing figures 9 and 10 shows that the distribution of disposal events gives an accurate indication of disposal accumulation within ODMDS E. In this sense, the accurate plotting of disposal events could be used as a surrogate for assessing the local accumulation of dredge material placed within ODMDS E, as compared to directly monitoring the site's bathymetry and performing "survey differencing."

Also shown on figure 9 is an "avoidance zone" associated with the dredged material accumulation as of 7 August 2002, and a "limited capacity zone" associated with dredged material accumulation previous to 2002. Recall that the contractor was not permitted to use the "limited capacity zone," due to language in the contact plans and specifications. The combination of these two non-use areas within ODMDS E basically restricted the contract dredge from effectively using any part of the western half of the site (mostly due to concern of exacerbating present accumulation).

Based on the 5 and 7 August surveys of ODMDS E, the accumulation within the western half of the site was judged to be at an action "Level 4" (see section 3.0). On 8 August, the government instructed the contract dredge to stop using the western half of ODMDS E and shift dredged material disposal to the eastern half of the site, to avoid adding to localized accumulation shown in figure 10. For the remainder of the 2002 dredging-disposal season (8 August to 24 September), the dredging contractor used the eastern half of ODMDS E for dredged material disposal. Figure 11 shows the bathymetry of ODMDS E on 26

September, with the distribution of disposal events superimposed. Note the clustering of disposal events in both the east and west half of ODMDS E.

Figure 12 shows the spatially varying target capacity of ODMDS E in terms of target accumulation levels within the site, based on the 26 September 2002 survey (compare to figure 7). Although ODMDS E was not used after 24 September, it is instructive to note that as of 26 September, the site could have accepted an additional 1.8 MCY of dredged material. Had ODMDS E been used to its full potential during 2002, about 3.3 MCY of dredged sand could have been placed within the site. This includes the "discounting effect" on site target capacity due the presence of buoy #7 (-8% of the site area) and inability to place dredged material exactly to the site boundary during 2002 (-20% of the site area).

3.4 Placement Summary for 2002 In summary, the accumulation of dredged material placed within ODMDS E during 2002 did not exceed the "Action Level 4," an objective that was specified in the 2002 Annual Use Plan. Due to localized accumulation in the western half of ODMDS E and concern for affecting any other problems in the site, the site was significantly under utilized during 2002.

3.5 Dredged Material Accumulation and Dispersal The year-to-year management of *total* dredged material accumulation within ODMDS E is exercised w.r.t. the site's baseline (9 May 1997) condition. To assess the dispersion of dredged placed within the site during a specific time (of a given year), pre- and post-disposal surveys for a given year are compared.

Figure 10 shows the bathymetry change that occurred within ODMDS E during 3 July and 7 August 2002. As of 7 August, approximately 786,000 CY of sand had been placed within the western half of ODMDS E during the 2002 dredged disposal season and 550, 000 CY had deposited on the seabed within the site. This meant that about 30% of the material placed during 13 July – 7 August had been dispersed out of ODMDS E (by waves and currents) during or shortly after placement. Figure 13 shows the difference between the May 1997 and 7 August 2002 surveys and documents the total accumulation of dredged material placed within ODMDS E as of 7August 2002, w.r.t the baseline condition. The management target for vertical accumulation of dredged material within ODMDS E (during 2002) was 5 ft. Areas that exceeded 5 ft within ODMDS E (on 7 August) covered about 8% of the site and are shown by the yellow or bold contour line in figure 13. About 80,000 CY (or 10 % of the dredged material placed in ODMDS E during 13 Jul -7 Aug) had contributed to exceedance of the 5-ft accumulation level on 7 August 2002. Had the subject 80,000 CY been placed in other areas of the site, there would have been little or no exceedance of 5 ft management objective for dredged material accumulation. Note that as of 7 August, much of the western half of the site could have received additional dredged material (about 700,000 cy) without exceeding the 5-ft target.

Figure 14 shows the bathymetry change that occurred within ODMDS E during 3 July - and 26 September 2002. As of 24 September, approximately 786 KCY of sand had been placed within the western half, and 718 KCY had been placed in the eastern half of ODMDS E during the 2002 dredged disposal season. Approximately 700 KCY had

deposited on the seabed within the western half and 580 KCY within the eastern half site (see figure 14). This meant that about 15% of the material placed during 13 July – 24 September had been dispersed out of ODMDS E (by waves and currents) during or shortly after placement. During this time, the eastern half of the site was 2 times more dispersive than the western half. It is noted that there was additional deposition within the western half of the site, during 7 Aug-26 Sept, possibly from sediment moving into the site from Peacock Spit. The 15% dispersion value described above effectively defined the short-term dispersion rate of ODMDS E during 2002. Figure 15 shows the difference between the May 1997 and 26 September 2002 surveys and documents the total accumulation of dredged material placed within ODMDS E as of 24 September 2002, w.r.t the baseline condition. Areas that exceeded 5 ft within ODMDS E (on 26 September) covered about 8% of the site and are shown by the yellow or bold contour line in figure 15. About 60,000 CY (or 4 % of the dredged material placed in ODMDS E during 13 Jul - 24 Sept) had contributed to exceedance of the 5-ft accumulation level on 26 Sept 2002 and affected 8% of the site. Had the subject 60,000 CY been placed in other areas of the site, there would have been little or no exceedance of 5 ft management objective for dredged material accumulation. Note that as of 26 September, much of the eastern half of the site could have received additional dredged material (about 1,100,000 cy) without exceeding the 5-ft level.

3.6 Post-Disposal Condition of ODMDS E Figure 16 shows the post-disposal condition of ODMDS E on 2 December 2002, about 9 weeks after the 26 September survey. Figure 17 shows the difference between the 2 December and 3 July 2002 surveys and documents the net bathymetry change that occurred within ODMDS E during 2002. By comparing figures 14 and 17, it can be seen that much of the dredged material that had been deposited on the seabed of ODMDS E during 2002 3 July – 24 September had been dispersed (by waves and currents) out of the site by 2 December. Figure 18 describes the bathymetry change that occurred at ODMDS E during 2 December and 26 September 2002. Several statistics of interest are highlighted in figures 17 and 18. Approximately 650 KCY (43 %) of the total volume (1.5 MCY) of dredged material placed within the site during 2002 remained on the seabed on 2 December. This means that 57% of the material placed at ODMDS E during 2002 was transported out of the site by 2 December: 36 % for the west half and 79% for the east half of ODMDS E. During September – December 2002, waves and current transported 907 KCY out of ODMDS E and deposited 73 KCY within the site. Most of the material that transported out of ODMDS E during 2002 occurred during October-December. It is noted that several severe storm systems passed through the area during this time, bringing strong winds, large waves, and energetic coastal currents, very likely causing the high rate of dispersion at ODMDS E.

Figure 19 shows the difference between the 9 May 1997 and 2 December 2002 surveys and documents the total accumulation of dredged material placed within ODMDS E as of 2 December 2002, w.r.t the baseline condition. As of 2 December 2002, the level of dredged material mounding in ODMDS E was 6 ft or less. About 2% of the area within ODMDS E was covered by 5 ft or more of dredged material, w.r.t. the baseline condition. About 16,000 CY (or 1 % of the dredged material placed in ODMDS E during 13 Jul - 24 Sept) had contributed to exceedance of the 5-ft accumulation level on 2 December 2002. Much

of the eastern half of ODMDS E has experienced 2-4 ft of erosion since 1997, despite the annual placement of dredged material.

Since 1997, approximately 14.9 MCY has been placed within ODMDS E. As of 2 December 2002, only 10% (or 1.6 MCY) of all dredged material placed within the site since 1997 was observed to have accumulated on the seabed of the site. Based on observations made at ODMDS E between 1990 and 2002, the average winter (October – June) erosion rate of dredged material placed at ODMDS E is estimated to be 1-1.5 MCY. Assuming that an additional 800,000 CY is transported out of ODMDS E during winter 2002-2003 (beyond 2 December 2002), less than 1 MCY may be present within ODMDS E in June 2003 (as compared to the site's *baseline* condition). Depending upon the approach for utilizing of ODMDS E during 2003 (as specified in the 2003 Annual Use Plan, to be prepared in May-June 2003), the site may be able to accept between 2-4 MCY.

As of 2 December 2002, the accumulation of dredged material within ODMDS E was considered to be within the management target of 5 ft.

4.0 REGIONAL BATHYMETRY CHANGE and WAVE ANALYSIS AT ODMDS E

4.1 Bathymetric Changes Figure 20 shows ***regional*** bathymetric changes observed at MCR during May 1997 to August 2002 (refer to figure 1 for location of regional bathymetry change). During 1997-2002, moderate bathymetry change had occurred throughout the MCR region. The tops of the dredged material mounds at ODMDS A and B were eroded by 6-8 ft and much of the eroded material (sand) has been deposited near the flanks of the dredged material mounds. The crest of Peacock spit (MCR ebb tidal shoal) was eroded by 2-4 ft; with the eroded sediment appearing to have been deposited along the northern and seaward flank of the spit. Clatsop Spit was eroded by 4-8 ft.

The cumulative effect of using expanded ODMDS E can be seen by the extension of the "2" ft deposition contour to the north, onto Peacock Spit. This subtle change in bathymetry occurred over a period of 6 years and indicates the effectiveness of using Site E, for the purpose of introducing dredged sand into the littoral budget north of MCR and to maintain Peacock Spit. The extension of the "0" ft deposition contour from ODMDS E south into the MCR channel may be an indication that some of the dredged material placed at Site E has being transported southward or that sediment eroded from Clatsop Spit has been transported northward. Deposition of 2-4 ft has occurred near the seaward end of the south jetty and extends into the MCR entrance channel, in the form of a 1,500-foot wide strand oriented north-south: This feature may be an indication of sand-bypassing the south jetty to the north. There appears to be a wide tongue of (2 ft thick) deposition about 1 mile south of ODMDS B and within ODMDS F.

Overall, the MCR ebb tidal delta has experienced net erosion during 1997-2002 with deposition occurring along the toe of the ebb tidal shoal. The above MCR bathymetry changes can be thought of as a "natural" occurrence, due to the process of waves and currents acting to re-distribute MCR sediment from the ebb tidal shoals that formed in

response to jetty construction. Had ODMDS E not been used during this time, the erosion of Peacock spit would have likely been much greater.

4.2 Simulating Wave Propagation at MCR for 1997 and 2002 During May 1997 to September 2002, about 14.9 MCY of dredged material (sand) was placed within ODMDS E. As of 26 September 2002, about 85% of all dredged material placed within ODMDS E remained within the site boundaries, however, dredged material mounding was observed to be 5-7 ft high in the western half of the site. Collectively, the locations where accumulation exceeded 5 ft (in height) were affected 8% of the site's total area. To ascertain the extent and effect of recent bathymetry change at MCR and ODMDS E upon the wave environment, USACE-Portland District examined the potential change in the wind-wave environment at MCR, as it relates to recent changes in seabed conditions on or near the ebb tidal shoal [USACE 2003]. An excerpt of the report is presented below. The entire USACE report can be view at: http://www.nwp.usace.army.mil/issues/MCR/reports/mcrfinal03/MCRdraftffinalreport10mar03final.pdf.

The wave analysis was performed using a numerical wave model (STWAVE computer simulation) to assess the potential effect of dredged material mounding at ODMDS E upon ocean waves traveling over Peacock Spit. STWAVE (STeady-State spectral WAVE) is a computer model used to predict the two-dimensional behavior of a wave field as it travels through winds and current, and encounters variable bathymetry. STWAVE simulates depth-induced wave refraction and shoaling, current-induced refraction and shoaling, depth-and steepness-induced wave breaking, wind-wave growth, wave-wave interaction, and white capping that redistribute and dissipate energy in a growing wave field [Smith et al 2001]. The STWAVE model was used to estimate the change in wave height (in terms of an "amplification factor" expressed as a ratio of 2002 wave height/1997 wave height) for areas near the MCR due to the change in bathymetry that occurred at MCR during 1997 to 2002.

4.3 Summary An excerpt of the results from the USACE [2003] report is shown in figures 21 and 22. Figure 21 is an estimate of wave amplification associated with bathymetry change during 1997 and 2002 for an offshore wave condition that corresponds to a summer swell with average wave height = 1.79 m (wave period = 11 sec, wave direction = W). The offshore wave environment is composed of local seas (chop) and some swell. The estimated wave amplification is shown in figure 21 highlights the potential for increased wave activity at Peacock Spit and ODMDS E due to seabed change. The maximum increase in wave height *within ODMDS E* was estimated to be 7% (or 2.1 m in 2002 vs. 2.0 m in 1997). For the offshore wave condition referenced in figure 21, there is no wave breaking expected to occur within the area of interest for either the 1997 or 2002 bathymetry.

Figure 22 is an estimate of wave amplification associated with bathymetry change during 1997 and 2002 for an offshore wave condition that corresponds to a winter swell with average wave height = 3.75 m (wave period = 16.7 sec, wave direction = W). The offshore wave environment is a bi-modal combination of swell (distant source) and seas (local

source). The estimated wave amplification is shown in figure 22 highlights the potential for increased wave activity at ODMDS E and especially Peacock Spit due to seabed change. The maximum increase in wave height *within ODMDS E* was estimated to be 9% (or 4.3 m in 2002 vs. 3.9 m in 1997). Figure 22a shows estimated wave breaking locations for both MCR bathymetry conditions (1997 and 2002). In some locations, waves (in 2002) now break closer to shore due to deeper water than was the case in 1997. This is due to the regional bathymetry change that occurred at MCR during this timeframe. An area of wave breaking on Peacock Spit (for 2002, shown in red) north and west of buoy #9 is likely due to a combination of dredged material accumulation within the site during 1997-2002 and bathymetry change on Peacock Spit.

Wave modeling results, presented in USACE [2003] and summarized here, indicate that utilizing the SWS during 1997-2002 have had a minimal effect on the MCR wave environment to date. The wave-related effects of regional bathymetry change at MCR during 1997-2002 far exceed the wave-related effects of using the SWS for dredged material disposal.

5.0 RECOMMENDATIONS FOR 2003 UTILIZATION OF ODMDS E

Concentrated placement of dredged material within a small area of ODMDS E (and within a short period of time) led to mounding above the 2002 management target within the site during 2002. The region affected by dredged material mounding was confined to a small area within the western half of the site. As of 7 August, 10% of the 786 KCY placed within the site contributed to mounding $\geq$ 5 ft high, and affected 8% of the site. On 26 September, 4% of the 1.5 MCY placed during 2002 contributed to mounding $\geq$ 5 ft high, and affected 8% of the site. About 9 weeks later (2 December), after waves and currents had dispersed a significant volume of sediment out of ODMDS E, only 2% of the site was affected by mounding $\geq$ 5 ft.

Minimizing the occurrence of dredged material mounding (above target levels) within ODMDS E is a matter of improving the management of less than 10% of all dredged material placed at the site. Recommendations to improve use of ODMDS E during 2003 are listed below:

1) *Remove or relocate Buoy #7 from ODMDS E during the MCR Dredging Disposal Season (May – September).* The presence of a navigation buoy (#7) within the middle of ODMDS E has been a controlling factor that has led to the lack of complete site area utilization.

2) *Management of ODMDS E should be based on the usable target capacity of the site.* Areas of the site that cannot be easily accessed by hopper dredges should be identified within the 2003 Annual Use Plan, after procurement of the site's 2003 pre-disposal survey. The capacity associated with these areas should be subtracted from the site's total available (target) capacity. This would then define the site's effective target capacity for a given

year. Based on the 2003 effective target capacity for ODMDS E, the frequency for monitoring the site's bathymetry will be specified in the 2003 Annual Use Plan.

3) *Invoke Measures to avoid placement of dredged material on or near areas exhibiting remnant mounding.* This was accomplished in 2002 using a grid system for ODMDS E to identify areas requiring specific management action. It is also recommended that the use of "limited capacity" and "avoidance" zones again be employed, if needed in 2003. However, it is strongly recommended NOT to over restrict use of the site: "limited capacity" zones must be used if the full utilization of ODMDS E is to be achieved.

4) *Enforce Uniform placement of dredged material throughout the entire site, by all dredges using the site, throughout the entire dredging season.* The concentrated placement of dredged material by the contract dredge during 2002 within the western half of the site led to limited mounding in 2002. By not restricting the contract hopper dredge from the "limited use" zone, the dredged could have used more of the assigned disposal areas to more uniformly place dredged material. This action by itself would have averted all mounding issues in 2002. It is recommended that all dredges using ODMDS E strive to continually distribute dredged material within the entire assigned disposal area. Assigned disposal areas within the site should be as large as possible to enhance distribution of placed dredged material.

5) *For advance planning purposes, ODMDS E should be considered (at this time) for 3.0 – 4.0 MCY of dredged material disposal during 2003.* Based on the observed Fall-Winter 2002 wave environment at MCR (intense compared to previous years) and past experience at the site, Site E may be "flushed" by June 2003. This recommendation will be verified, before commencement of the 2003 dredging-disposal season, when ODMDS E is surveyed in May or June 2002.

6) *Track the placement of dredged material within ODMDS E by frequent plotting of disposal locations within the site.* The accurate plotting of disposal events should be used as a surrogate for assessing the local accumulation of dredge material placed within ODMDS E, as compared to directly monitoring the site's bathymetry and performing "survey differencing." Frequent plotting of disposal locations will provide a continuous knowledge base for how placed dredged material is likely being depositing within the site and avoid mounding beyond the management target.

For 2003, it is recommended that the contractor dredge continue reporting beginning-ending coordinates for each disposal event, and that the government dredge begin doing so – particularly when placing dredged material at ODMDS E. The digital compilation of disposal coordinates should be sent to USACE-NWP (EC-R, EC-HR, and EC-HY) daily.

6.0 THE NORTH JETTY (NJ) SITE

6.1 General Figures 1 and 23 show the location of the NJ site. During 1990-1997, progressive lowering (erosion) of the seabed was occurring along the south side of the MCR north jetty, adjacent to the structure's toe. In many cases, rapid jetty deterioration of the north jetty has been attributed to the erosion of sediment at the structure toe. Placement of up to 1 MCY/yr of sandy dredged material at the NJ site is intended to replace sediment that has eroded from the southern toe of the north jetty, thereby protecting the structure from deterioration (caused by toe scour and related slope instability).

6.2 Bathymetry Change A total of 2.05 MCY was placed within the NJ site during 1999-2001; 498 KCY was placed during 2001. During August 2001 - April 2002, about 300,000 CY of material was dispersed out of the site; Figure 23 shows the bathymetric change that occurred at the NJ site during this time. Figure 24 shows the bathymetric change that occurred at the NJ site between June 1999 and April 2002. During June 1999- April 2002, about 50% (1,000,000 cy) of all material placed within the NJ site was dispersed out of the site. Some of the dispersed sediment was transported east of the site, and deposited along the northern edge of the MCR entrance channel. As of April 2002, dredged material remaining within the NJ site was 2-6 ft thick, w.r.t. the June 1999 pre-disposal condition.

Figure 25 shows the difference between the 18 April and 31 July 2002 surveys at the NJ site and documents the deposition of dredged material placed within the site during 2002. During July 2002, the government hopper dredge *Essayons* placed 498,000 CY of dredged sand within the NJ site, resulting in a 4-6 ft high accumulation of dredged material. Of the 498 KCY placed at the site during 2002, only 220 KCY deposited in the seabed. Figure 26 shows the difference between the June 1999 and 31 July 2002 surveys at the NJ site. During 1999-2002, the total volume of dredged material placed within the NJ site was 2.55 MCY. Bathymetry contours shown in figure 26 indicate the seabed elevation within the NJ site as of 31 July 2002, after placement of dredged material at the NJ site. Note the scour area paralleling the north jetty. The objective of placing dredged material within the NJ site during 1999-2002 was to fill the scour area. Although dredged material was placed 300 ft south of the jetty (offset for reasons of navigation safety and jetty slope stability), some of the dredged sand placed in the NJ site did directly accomplish the objective of protecting the toe of the north jetty from scour.

As of 31 July 2002, dredged material accumulation with the NJ site was 6-12 ft high, w.r.t. the June 1999 pre-disposal condition. It is anticipated that up to 400,000 CY will be dispersed out of the NJ site during winter 2002.

6.3 Recommendation for NJ site Based on shoaling trends along the north edge of MCR channel, between River Mile 1 and 2, it appears that some of the dredged material placed at the NJ site may be migrating into the MCR navigation channel. Given that the present accumulation of dredged material within the NJ site is sufficient to address erosion along the north jetty toe, and the recent southward migration of sediment from the site, use of the NJ site during 2003 should be no more than 400,000 CY. **Dredged material should be evenly dispersed through the site, with a preference along the northern edge of the**

site toward the north jetty. A pre-disposal survey of the NJ site should be obtained in spring 2003 (similar to coverage as the site's 31 July 2002 survey) to determine how much of the material placed at the NJ site during 1999-2002 remains in 2003. If it is determined that the annual dispersion rate (fall 2002-spring 2003) is significantly less than 400,000 cy/yr, then dredged material placement at the NJ site should be reduced accordingly.

7.0 BATHYMETRY CHANGE AT ODMDS F

7.1 General Figures 1 and 27 show the location and bathymetry for ODMDS F on 8 April 2002. After being designated in 1986, ODMDS F was used in 1989, when 2 MCY of silty sediment (removed from Tongue Point access channel and turning basin) was placed at the site. At the time of site designation, it was assumed that there would be minimal sediment transport at ODMDS F, due to the water depth being greater than 100 ft. Within 1 year after the placement of silty sediment within ODMDS F, the 10 ft high accumulation of dredged material was covered by more than 6" of native sand, inferring nominal sediment transport (deposition) at the site. During 1993 - 1997, 6 MCY of sand (dredged from MCR) was placed within the southern half of ODMDS F. Figure 28 shows the bathymetry change that occurred at ODMDS F during1981 - 1997. The survey from1981 represents the *baseline* condition for ODMDS F. Note that between 1981 and 1997, 8 MCY of dredged material was placed within the southern half of ODMDS F yet there was a net accumulation of 11 MCY within the overall site. The apparent gain of 3 MCY of sediment within ODMDS F infers that the site may be a net deposition environment. This stands to reason since the site is located at the base of the MCR ebb tidal shoal.

7.2 Site Constraints and Bathymetry Change To avoid potential mound-induced amplification (shoaling) of waves passing over ODMDS F, the vertical limit for managing the mounding within ODMDS F was set at 15 ft [USACE 1998a]. Beginning in 1997, dredged material disposal within ODMDS F was restricted to the northern half of the site. This was done to avoid placing additional material on top of the previously mounded material (10 ft high) located within the southern half of the site. Additionally, dredged material is placed uniformly to avoid localized mounding.

Approximately 2.3 MCY was placed within the northern half of ODMDS F during 9 July – 13 October 2002. Figure 29 shows the bathymetry of ODMDS F on 2 October 2002. Figure 30 shows the bathymetry change that occurred within ODMDS F during April – October 2002. The disposal of dredged material within the north half of the site during 2002 resulted in two areas of accumulation, having height of about 4 ft each. Note that much of ODMDS F experienced natural deposition of sediment; the government hopper dredge placed 2.3 MCY, but the site gained 7.4 MCY (of deposition). Based on 2002 surveys, the annualized rate of "natural deposition" within ODMDS F would be 1.4 ft/yr.

Since 1997, an average of 860,000 cy/yr of dredged sand has been placed within the northern half of ODMDS F. Figure 31 shows the change in ODMDS F bathymetry between 1997and October 2002. The maximum height of dredged material accumulation within the site during this time was about 7 ft. Note that between 1997 – 2002, 5.4 MCY of

dredged material was placed at ODMDS F yet there was a net accumulation of 9 MCY throughout the site. The apparent gain of 3.6 MCY of sediment within ODMDS F suggests that the site may be a net deposition environment. Figure 32 shows the overall bathymetry change at ODMDS F during 1981- October 2002. The "gray box" in figure 31, shows where dredged material has been placed within ODMDS F since 1997. There is considerable accumulation that has occurred within the northern half of ODMDS F. Placement of dredged material within the crosshatched area (figure 32) was avoided.

Based on surveys conducted in 1981, 1997 and 2002, it was estimated that the rate of "natural" deposition at ODMDS F could range from 0.1 to 1 ft/yr. Although ODMDS F is located in water depth of 100-160 ft, the site lies at the base of the MCR ebb tidal shoal and the physical environment can be energetic during storm conditions. Bottom current measurements made at a location several miles south of ODMDS F in similar water depth indicated that time-averaged bottom current can approach 50 cm/sec and instantaneous bottom current can exceed 100 cm/sec [Moritz 2001]. Deposition of sand at ODMDS F and adjacent areas is believed to arise from:

1) Continual seaward migration of the MCR ebb tidal shoal in response to jetty construction and MCR channel deepening (1984) – fine sand is discharged further offshore as the MCR channel has becomes deeper; and
2) An offshore wave climate that has progressively increased in severity since the early 1990's – larger waves mobilize more bottom sediment and change coastal deposition patterns.

7.3 Future Use of ODMDS F The Corps-selected part of ODMDS F (expanded to 10,000 x 10,000 ft under Section 103 of MRPSA) has expired in 2003 and is no longer available for the placement of dredged material. The EPA-designated part of ODMDS F (designated in 1986 at 1,800 x 1,800 ft) is available for use. Based on the potential for placed dredged material to accumulate within the EPA-designated part of ODMDS F and adversely affect waves at or near the site, it has been proposed to not use ODMDS F after the 2002 dredging disposal season. This decision is predicated on EPA's proposed rule to designate the SWS and de-designate MCR ODMDSs A, B, and F as described http://edocket.access.gpo.gov/2003/pdf/03-5743.pdf.

8.0 ADDITIONAL SITES THAT MAY BE USED DURING 2003

The MCR Deep Water Disposal Site (DWS) and ODMDS A may be used for dredged material disposal during 2003. If these sites were to be used during 2003, only a small area of the DWS would be used. Use of the DWS and ODMDS A would be contingent on the utilization level of ODMDS E and NJ during 2003. Use of ODMDS A is also contingent upon final approval of the EPA rule to de-designate the site by EPA. If all material dredged from MCR during 2003 can be placed within ODMDS E and the NJ site, then the DWS and ODMDS A would receive no dredged material. Clarification for using the DWS and ODMDS A during 2003 will be presented in the "2003 Annual Use Plan" for MCR disposal sites (scheduled for May 2003).

9.0 LONG-TERM BATHYMETRIC CHANGE AT ODMDS E AND PEACOCK SPIT

9.1 General Construction of the MCR jetties during 1885-1917 redistributed a huge volume of sand (estimated at 600 MCY) offshore, and to the north and south, resulting in large ebb tidal deltas known as Peacock Spit and Clatsop Spit. Recent bathymetry change at ODMDS E must be placed in context to the rate and magnitude of historical change at MCR, since the jetties were built in 1885-1917. Figure 33 shows the historical change of the -40 ft depth contour at MCR, since 1889. Note the seaward advancement of the -40 ft contour in response to jetty construction (1885-1917). During 1993-2000 Peacock Spit has receded landward by 2,000 ft; as measured by the recession of the -40 ft contour. During this time, the rate of landward recession of the -40-ft depth contour on Peacock Spit was more than 4 times faster than during 1930-1993. Since 1997, 76% of sand dredged from the MCR channel (or 17.4 MCY) has been placed at ODMDS E and the North Jetty site, reducing the rate of Peacock Spit erosion and re-introduce sand into the littoral system north of MCR.

9.2 Long-term Bathymetry Change Near ODMDS E As estimate of the long-term fate of dredged material placed at ODMDS E by comparing the present bathymetry of Peacock spit with that of 1958 (using the difference between surveys, figure 34). This comparison integrates the effects of seabed change on Peacock Spit, due to natural forces and placement of dredged material at ODMDS E. Note that since 1973, approximately 63 MCY of dredged sand has been placed at ODMDS E (as compared to 15 million since 1997).

Figure 34 shows that the seaward half of Peacock Spit, between the 50-60 ft depth contour, has eroded during 1958-2002 while areas deeper than 70 ft have experienced pronounced deposition. Essentially, the top of Peacock Spit is being sheared-off (by waves and currents) and the sediment is being deposited at the west and northwest base of the spit. Note the significant erosion immediately south of ODMDS E, along the MCR entrance channel. This is believed to be due to:

1) MCR dredging and related channel sideslope adjustment. This is a localized process.
2) Natural channel migration, toward the north. This is a regional process.

It appears that as the "natural" MCR channel migrates northward, Clatsop Spit is following suite, or vice versa: Clatsop Spit is migrating north into the "project" limits of the MCR navigation channel.

Between 1958 and 2002, it appears that dredged material placed at ODMDS E has been transported primarily north-northwest (and then east-southeast) as indicated by the pink vectors in figure 34. Dredged material placed within the eastern half of ODMDS E is believed to be transported north northwestward onto the crest of Peacock Spit, and ultimately toward Benson Beach. Dredged material placed within the western half of ODMDS E is believed to be transported west-northwestward onto the crest and ocean-

facing slope of Peacock Spit. Dredged material that is transported onto the crest and ocean-facing slope of Peacock spit appears to be carried along the flank of the spit (parallel to the bathymetry contours) in a clockwise path, and ultimately carried back toward shore. Dredged material placed in the eastern half of ODMDS E appears to be subjected to a ***higher*** transport potential than dredged material placed in the western half of the site.

9.3 Summary It is speculated that if dredged material had not been placed at ODMDS E (63 MCY during 1973-2002), erosion would have occurred over a much larger area of Peacock Spit than what is indicated at present. Consequently, Benson Beach (Ft. Canby State Park) would have experienced significantly higher erosion (landward recession). Based on results shown in figure 34, dredged material placed at ODMDS E does not appear to be moving south toward the navigation channel (at least in any appreciable quantity).

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