US Army Corps of Engineers
Portland District

2006 Annual Use Plan

Management of Open Water Dredged Material Disposal Sites at the Mouth of the Columbia River

1. Purpose

The year-to-year management of open water dredged material disposal sites located at the mouth of the Columbia River (MCR) is controlled and documented through the preparation and adherence to an Annual Use Plan. This Annual Use Plan (AUP) serves as the primary mechanism for evaluating disposal site capacity and is revised for each dredging and disposal season, as required by disposal site designation [USEPA 2005]. The AUP is prepared by USACE and reviewed and approved by USEPA, Region 10.

This document is the 2006 AUP for utilizing open water dredged material disposal sites located offshore the mouth of the Columbia River. Only dredged material determined to be suitable for unconfined in-water disposal, through application of the current Dredged Material Evaluation Framework for the Pacific Northwest region, may be placed at the sites described within this AUP. The total volume of dredged material to be placed within MCR disposal sites during 2006 is expected to be 5-7 million cubic yards (MCY). During 2006, the dredged material that is to be placed within available MCR disposal sites will originate from the MCR channel navigation and the Lower Columbia River (LCR) navigation channel.

2. Background

Each year, the Corps of Engineers-Portland District dredges 3-5 MCY of sand at the mouth of the Columbia River (MCR) to maintain the inlet's 6-mile long deep draft navigation channel (figure 1). Most of the dredging occurs between river mile –2 and +2. The dredged material is fine-medium sand (0.19-0.25 mm) and fine-grained material (passing a 230 mesh sieve) content is 3% or less. The dredged sand is placed at designated ocean dredged material disposal sites (ODMDS) as described in USEPA 2005, or available under Section 404 of the Clean Water Act (404 site). Due to the exposed ocean conditions at MCR, only ocean-going hopper dredges can perform dredging and disposal at MCR; dredging is limited to summer when wave conditions are favorable for working on the bar. Refer to Appendix A for additional information describing the MCR navigation project, dredged material disposal sites, and hopper dredge operating characteristics.

Beginning in 2005, the 600-ft wide navigation channel within the lower Columbia River (between river mile 3 and 106.5) is being deepened from the authorized depth of -40 ft to -43 ft (-45 ft to -48 ft when considering advanced maintenance). The construction (new work) phase of the 3-ft channel deepening project is dependent on Federal appropriations, and at this point it is difficult to assess the completion date. However, use of the DWS for CRCIP should primarily be complete in FY06. In 2005, approximately 1.3 MCY of the "new work" sediment was dredged from the Lower Columbia River channel, between river mile (RM) 5 and 21, and was placed within the Deepwater Site (DWS) located 7 miles offshore the mouth of the Columbia River. In 2006, there may be 1-2 MCY of "new work" dredging conducted for the lower Columbia River channel, between RM 21 and 29. Much of this 2006 "new work" sediment may be placed within the DWS. Sediment located within the Lower Columbia River channel is classified as fine-medium sand (0.20-0.28 mm, with less than 3% silt-clay) and is suitable for placement within the DWS. Refer to Appendix A for additional information describing the lower Columbia River navigation project.

Available MCR Disposal Sites. MCR open water dredged material disposal sites available for use during 2006 are shown in figure 1 and 1a. As designated by USEPA-Region 10 in 2005, the Shallow Water Site (SWS) and Deep Water Site (DWS) can be used for the disposal of material dredged from either the MCR or the LCR. The beneficial uses of dredged material placed at the nearshore sites (SWS and North Jetty site) are preferred before dredged material is allocated to the DWS [USEPA 2005 and USACE/USEPA 1999, 2003, and 2005]. This means that priority will be given to utilize the available capacity of the nearshore sites. To control the long-term accumulation of dredged material placed within the DWS, specific drop zones will be assigned within the DWS to direct the placement of dredged material, depending upon the material volume and origination. If needed during 2006, the CR-DWS drop zone can be used for the disposal of LCR dredged material and the MCR-DWS can be used for the disposal of MCR dredged material. Note that EPA's ODMDS Site A, Site B, and Site F and all Corps Section 103 Sites have been de-designated or eliminated and are therefore no longer available for dredged material placement. Refer to Appendix A for additional information describing MCR dredged material disposal sites.

Due to safety restrictions at the SWS (which limits access to SWS to one dredge at a time), it may be necessary to intermittently use the DWS before the capacity of the SWS is fully used (when two dredges would otherwise attempt simultaneous disposal within the SWS). Limiting the use of the SWS to one dredge reduces the likelihood of mounding within the site (overloading of the site's capacity to disperse placed dredged material). Utilization of MCR disposal sites will be coordinated to minimize use of the DWS, while capacity still remains within the SWS or NJ Site.

Management of an open water disposal site is predicated on the need to efficiently utilize the site's capacity while minimizing impacts to navigation and offsite environment and meeting statutory requirements. The capacity of an open water dredged material disposal site is defined by the volume (or height and area) of dredged material that can accumulate within a site's boundaries without unacceptable impacts to navigation or the environment. The potential for dredged material accumulation to have an effect upon waves (mound-induced wave shoaling) is an important site management consideration at MCR [USEPA 2005 and USACE 2005 & 2003].

2006 Dredging Year. The disposal sites at MCR will be used for the placement of sediment dredged from the MCR channel (between RM –2 and 2) and the Lower Columbia River channel (between RM 21 and 29). The total volume of dredged material to be placed within MCR disposal sites during 2006 is expected to be 5-7 MCY. The USACE and USEPA have assigned a target capacity for each disposal site to be used during the 2006 dredging season. General utilization procedures and constraints for each disposal site are described in Appendix A. Appendix B summarizes key special studies conducted during 2005, associated with MCR-ODMDS use and impacts.

During 2006, two hopper dredges will be used to perform maintenance dredging at MCR. A government operated dredge and a contractor operated dredge, each with different capacities and operating characteristics. Due to unusually rough conditions on the MCR bar during winter 2005-2006, a recent MCR channel survey could not be obtained and was unavailable during the preparation of this AUP. The volume of shoaling within the MCR bar (and required dredging effort) was unknown as of March 2006. To add uncertainty into forecasting the dredging effort for 2006, high river flows associated with winter 2006 combined with “rougher than normal” offshore wave conditions may have increased or decreased the volume of shoaling within the MCR channel. It is assumed that there could be at least 4.5 MCY potential for MCR channel dredging during the 2006 dredging season. In additional to performing MCR maintenance dredging, the contract hopper dredge will be used to perform the initial phase of channel deepening (new work dredging) within the Lower Columbia River along RM 21 to 29. Based on recent surveys of the LCR navigation channel, the volume of maintenance dredging required from RM 5 to 21 is expected to be 0.5 to 1 MCY and “new work” dredging required from RM 21 to 29 is expected to be 1 to 2 MCY.

Available Disposal Site Capacity. At the time of this AUP preparation, recent surveys were not available for the SWS or NJ Site. A reliable assessment of disposal site capacity for the SWS and NJ site for the 2006 dredging season could not be made. Surveys from October 2005 were used to assess the provisional capacity of the SWS and NJ site. It is noted that no winter-time dispersion of the sediment placed with the SWS and NJ during 2005 had occurred as of October 2005; dredged material had been placed within the SWS until 17 October. Typically, 50% of the dredged material placed within the SWS is dispersed out of the site during winter (Table A1). Based on the vigorous costal storm-wave action of winter 05-06, significant dispersion of sediment placed within the SWS and NJ site during 2005 is expected to occur; the October 2005 surveys will not reflect this dispersion. Results presented within this AUP for the SWS and NJ sites are based on the October 2005 surveys, underestimate the available capacity within those sites, and are therefore considered provisional. It is required that the SWS and NJ site be surveyed during April or May 2006 to realistically plan for disposal site utilization during 2006. Spring 2006 bathymtry surveys of the MCR channel, the LCR channel, and dispersive disposal site should also be used to update this AUP during the dredging season.

As of 17 October and 28 September 2005, the target capacity of the SWS and NJ site was estimated to be 1 MCY and 0.15 MCY, respectively. This assumes that the SWS and the

NJ site experience NO dispersion over the 2006 winter season, which is unreasonable. The total MCR O&M dredging requirement for 2006 (4.5 MCY) is expected to exceed the present combined capacity of the SWS and NJ site by 3.5 MCY. Obviously, the capacity of the SWS and the NJ site will be fully utilized based on the MCR O&M estimated dredging requirement; based on the provisional site capacity assessment (noted above). MCR dredged material that can not be placed within the nearshore sites, will be placed within the DWS (drop zone MCR-06-DWS). The present capacity of the MCR-06-DWS is estimated to be 4-5 MCY, which is sufficient to handle the disposal needs at MCR 2006, assuming the worst case of no winter dispersion at the SWS and NJ. Within the next 2-4 years, another area within the DWS will need to be selected to handle recurring MCR disposal needs (assuming a rate 1-1.5 MCY/yr use for the present MCR-DWS).

Based on the limited capacity available within the nearshore disposal sites, the sediment dredged from the LCR (21-29) will be placed within the DWS (drop zone CR-06-DWS). The capacity of the CR-06-DWS is estimated to be 11 MCY. It is possible to place the LCR dredged material (0.5 to 2.0 MCY) within the SWS instead of the DWS, but this option would require a similar amount of MCR dredged material to be placed at the DWS. It was initially reasoned based on material characteristics that the SWS would be a better location to dump MCR dredged material, as compared to LCR dredged material. MCR dredged material would disperse more effectively when placed at the SWS, due to the MCR sand being slightly smaller in grain size than the LCR sand. Placement of LCR material at the SWS, due to its larger grain size, may decrease the site capacity at the SWS causing more material to be placed in the DWS in the long-term. Several pre-conditions also necessitated assigning all available nearshore site capacity to the MCR dredging requirement and included: 1) The bundling of several MCR and LCR dredging contracts, 2) Environmental restriction of MCR dredging to begin after 1 June, 3) Funding uncertainties associated with the LCR new work dredging, 4) Limited time available to dredge the MCR project due to weather and operational time restrictions placed on the government dredge *(Essayons)*.

<u>Timing of Site Use.</u> The contract hopper dredge is expected to dredge up to 1.5 MCY from the MCR channel and 1-2 MCY from the LCR Channel, and will begin utilizing MCR disposal sites in early June and continue though October. Based on the provisional capacity estimates for the SWS and NJ site, the contract hopper dredge may be able to place up to 1 MCY in the SWS, up to 0.1 MCY in the NJ site, and up to 2 MCY in CR-06-DWS. The NJ site will not be used after 1 October. The contract hopper dredge will begin dredging at MCR in early June and likely use the SWS first.

The government dredge (*Essayons)* is expected to dredge up to 2.5 MCY from the MCR channel, and will begin utilizing MCR disposal sites in late June and continue though October. Based on the provisional capacity estimates for the SWS and NJ site, the *Essayons* could be limited to placing less than 0.5 MCY in the SWS, and up to 3 MCY in MCR-06-DWS.

Based on the increased capacity of the SWS realized during 2005 due to intermittent use, it may be advantage to replicate the same pattern of SWS utilization in 2006. This means that during 2006, the SWS would be not be used during periods of 1-2 weeks to allow waves and currents to “disperse” recently placed dredged material out of the site. If needed, other sites (DWS and NJ Site) may be used concurrently with the SWS to avoid overloading the SWS and extend the time for which the SWS can be used (increase the capacity of the SWS).

3. Annual Use Plan Objective

The objective of this *Annual Use Plan* for 2006 is to: A) Provide a decision framework that allows MCR dredging operations managers to manage open water disposal sites on a day to day basis , and B) Define a strategy to collect information (via monitoring or assessment of operational data) on a frequent basis, so that potential problems can be identified and corrective action can be undertaken. The amount of dredged material that can be placed in an open water disposal site is limited by the site’s capacity to disperse or accumulate the material without adversely affecting the environment or navigation. ***The principal site management constraint for MCR is to avoid modification of a disposal site’s bathymetry (via dredged material mounding) that could potentially result in excessive wave amplification, due to wave shoaling over mounded dredged material.***

This AUP was developed to meet the requirement of the MCR ODMDS Site Management & Monitoring Plan [USEPA/USACE 2005]. As proposed, this *Annual Use Plan* is in place for the 2006 dredging season only. Elements of this annual use plan will be modified during the dredging season in accordance with adaptive site management.

The 2006 *Annual Use Plan* describes how each available MCR dredged material disposal site will be used and monitored. Two methods will be employed to monitor the placement of dredged material within each disposal site during 2006 and prevent mounding beyond the management target. The first monitoring method focuses on tracking the placement of dredged material within each disposal site on a daily basis, by plotting the location of each load placed. Frequent plotting of disposal locations will provide a continuous knowledge base of how placed dredged material is being deposited within a given site. During 2003-2005 daily tracking of hopper dredges (during dredged material disposal) significantly enhanced the management of dredged material disposal site capacity [USACE 2004]. The second monitoring method involves conducting frequent bathymetry surveys at active MCR disposal sites during the dredging season. Comparison of surveys to a site’s baseline condition will quantify deposition of dredged material placed within a given site. Timely use of this information can be used to manage dredged material accumulation within a given disposal site.

The 2006 *Annual Use Plan* is based on adaptive management. This means that MCR disposal sites will be proactively managed: As sites are used, they are monitored to verify that the sites are being managed according to 2006 capacity targets. If a given disposal site is at or near its target capacity, then site management changes accordingly. The *AnnualUse Plan* implements various recommendations made by a “*Federal Review Team”*

[USACE/USEPA 2001] which was convened in September 2001 for the purpose of reviewing management practices at MCR dredged material disposal sites.

4. Site Management Criteria

The level to which any site can be used for dredged material disposal is related to the capacity available within the site and the efficiency to which the site's capacity is used. This means that the dredged material would be distributed throughout the entire site, both in space and time. Placement will use a regimented procedure to produce a uniform continuous layer on the seabed, to avoid the formation of any localized mounding. Geometrically, the target capacity for a given disposal site is defined by the target height and area over which dredged material can accumulate (collectively referred to as a "target accumulation"), with respect to a baseline condition. The target capacity for a given disposal site defines a management condition for which an intermediate review action (decision point) occurs. At this point, the potential effects of additional use of a disposal site are assessed in conjunction with other physical processes. Use of an active disposal area may be discontinued upon reaching the specified target accumulation. The target accumulation is based on the need to manage dredged material accumulation such that mounded dredged material does not excessively amplify waves due to shoaling and refraction. The target accumulation may be different for each disposal site.

Target values for managing the accumulation of dredged material were obtained using the RCPWAVE model [Ebersole 1986] as discussed in USACE [1999, 2001, and 2002]. RCPWAVE is a computer program that simulates the behavior of waves as they interact with variable bathymetry (underwater mounds in this case). It must be noted that wave height results obtained using RCPWAVE can be 10-50% higher than the actual case: The RCPWAVE program overestimates how waves interact with variable bathymetry (the model is conservative). The target mound heights given in table 1 are conservative and should provide a safe operational limit to define an intermediate review action for site management.

A detailed analysis of various scenarios for dredged material placement (deposition and related wave effects) within the SWS was conducted by USEPA in 2003. The analysis concluded that the *target mound height* for dredged material accumulation, (the value presently being used for site management), is 2-3 ft below the level that would begin to affect waves passing over the SWS. The difference between the *target mound height* and the mound height that would actually begin to affect waves over the SWS, translates into a disposal volume of 1-2 MCY. This is the marginal capacity of the SWS that is not being realized in order to manage the site at a very safe operational limit.

Table 1 presents the target mound heights applicable for MCR disposal sites and Appendix A discusses site specific details concerning target mound heights, site utilization, and present disposal site capacity. Because of the need to assign capacity and concern for navigation safety, thresholds for increasing the level of monitoring intensity and management responses have been identified (see Section 5). The "target mound height" values shown in table 1 are intended to be used only as an ODMDS management guide (a screening tool to identify site management thresholds for concern). Dredged material disposal events that produce total accumulation levels less than or equal the "target mound height" throughout the site are acceptable. (Note: the values shown in Table 1 apply to a mound feature that occupies an area of 2,000 x 2,000 ft). Little or no wave amplification would be expected for smaller mound features that are equal to or marginally higher than the "target mound height" values in Table 1 [USACE 2002]. As dredged material accumulation approaches the "target mound height", efforts are enacted to minimize additional dredged material accumulation within the affected area (dredged material would be placed uniformly within other areas of the disposal site).

The target mound height corresponds to the **"present"** site condition (October 2005). It is the parameter that applies to the utilization of sites at the beginning of the 2006 dredging-disposal season. This "present" disposal site condition will be redefined based on subsequent site surveys. Note that the bathymetry at several disposal sites has changed since the establishment of the sites' baseline condition. For example, the eastern area of the SWS is now deeper than it was in 1997 (baseline condition) while the western area of the site is shallower than in 1997 (see Appendix A). The "present" target mound heights shown in table 1 account for the change in site bathymetry that have occurred since the baseline condition.

Concern should arise only if the level of accumulation significantly exceeds the target height and/or the area of accumulation exceeding the target value becomes greater than 2,000 x 2,000 ft. Examination of wave amplification potential will be conducted only if dredged material accumulates to levels that substantially exceed the "target mound height" and/or covers an area larger that 2,000 x 2,000 feet. Should this occur, the STWAVE model [Smith 2001] will be used to assess whether the area of accumulation may potentially affect waves in or near the disposal site in question. Although RCPWAVE is considered an appropriate model for establishing conservative target mound heights, STWAVE is more accurate and considered to be better suited for predicting actual conditions.

Table 1. Target height of dredged material mounds, based on the RCPWAVE model. Values to be used for intermediate review of disposal site capacity.

Disposal Site	Target Mound Height (ft) with respect to Baseline	Target Mound Height (ft) with respect to **Present**	Drop Zone Area (acre)	Present Site Static Capacity Volume (CY)
SWS – East	5	**3**	190	**0.7 M**
SWS – West	5	**2**	100	**0.2 M**
NJ Site*	8	**2**	100	**0.1 M**
DWS – MCR	40	**20**	207	**5.0 M**
DWS – CRCI	40	**35**	330	**11 M**

SWS = designated under section 102 of MPRSA, 1 April 2005 (40CFR, Part 228), formally ODMDS E
DWS = designated under section 102 of MPRSA, 1 April 2005 (40CFR, Part 228)
* = The NJ is not subject to the same target mound geometry criteria as unprotected sites. For initial assessment of 2005 dredging-disposal season, capacity of Site NJ has been set at 0.20 MCY to minimize potential transport to areas near the MCR channel.
Baseline = 1997 for SWS, 1999 for NJ Site, 2004 for MCR-DWS, and 2000 CR-DWS

5. Decision Framework for Site Threshold Management

Based on the above site management criteria, there are 6 action levels that will be used for managing dredged material placement within disposal sites at MCR.

Level 1. **Normal Level** = Dredged material accumulation is not close to the accumulation target. ACTION: Proceed as planned.
Level 2. **Limited Capacity Level** = Dredged material accumulates to within 1-2 ft of the threshold mound height in some part of the drop zone. ACTION: Minimize placement in affected location.
Level 3. **Threshold Level** = Dredged material accumulates to (or marginally exceeds) the target mound height within localized extent (less than 500 x 500 ft). ACTION: Assess accumulation in surrounding cells and overall site capacity. Avoid or minimize placement in the affected location of accumulation. Continue to use adjacent areas within site appropriately.
Level 4. **Limited Management Level** = Dredged material exceeds target mound height by 1-2 ft over an area greater than 500 x 500 ft. ACTION: Assess accumulation in surrounding cells and overall site capacity. Avoid or minimize placement in the affected location of accumulation and in adjacent areas. Continue to use areas not affected; adopt early exit strategy for site.
Level 5. **Moderate Management Level** = Dredged material exceeds target mound height by more than 2 ft over an area greater than 1,000 x 1,000 ft. ACTION: Assess accumulation in surrounding cells and overall site capacity. Stop using the area of the site exhibiting accumulation, until natural erosion has reduced accumulation (restored site capacity).
Level 6. **General Management Level** = Dredged material exceeds target mound height by more than 2 ft over an area greater than 2,000 x 2,000 ft. ACTION: Assess accumulation in surrounding cells and overall site capacity. Stop using the area of the site exhibiting accumulation. Assess potential wave impacts using STWAVE and determine appropriate action based on results.

6. Disposal Site Management Strategy

The goal of managing MCR disposal sites, particularly the SWS and North Jetty Site, is to fully utilize each available site, while limiting the average vertical accumulation of placed dredged material so as to minimize the potential for adversely affecting wave conditions at or near the site. To successfully manage each site throughout the dredging season, the capacity of each site must be frequently assessed.

As a general rule, capacity assessment for an *active* disposal site (one that is being used) will occur based upon the frequency at which a given site's bathymetry is surveyed. The frequency of conducting surveys will be directly related to the rate at which dredged material is placed within a given site. In this regard, the frequency for assessing active disposal sites will be based on the rate of volume of dredged material placed within the site. The Portland District (OP-NW and EC-CR) will, on a daily basis, collect operational dredging/disposal data at MCR (specifically, dump tracklines and beginning-ending coordinates). The data will be transferred to EC-HY/HR for compilation and plotting. Figure 2 shows the flow diagram describing the procedure of processing monitoring data and using the processed data to manage disposal site capacity. Improvements to the disposal plan will be identified and initiated within 1-2 days as necessary.

Coordination meetings will be conducted among different Portland District offices and EPA to discuss dredging and disposal management. Periodically, Portland District (OP-NW) will prepare a report that summarizes the volume of dredged material placed, relate this data to the changes in capacity for active MCR disposal sites, and make recommendations for utilizing each site. Active dredged material disposal sites will be assessed according to the management thresholds listed in Section 5 “Decision Framework for Site Threshold Management” and coordinated with EPA-Region 10. Periodically during the dredging season updates will be furnished via email to EPA-Region 10 and the members of the MCR Update Distribution List maintained by the MCR Channel O&M project manager (OP-NW).

Use of an active disposal site (or portion thereof) may be temporarily discontinued based on management indicators that show the potential for exceeding the target accumulation within the site, the status or location of the dredges and hydrosurvey vessels, priority use of sites, or other site use constraints. Weekly recommendations may address revision of monitoring needs (i.e. site bathymetry surveys) or the collection of additional operational data to be used for the purpose of improving the assessment of disposal site capacity. Data required to monitor the progress of site utilization includes: bathymetry surveys; analysis of surveys (plotting, differencing, or other processing); tracking of disposal locations within each site; and other pertinent information provided by the dredge operators. See figure 2 for the flow diagram describing the work elements for monitoring and managing disposal site capacity.

Within the collective constraints of available MCR disposal sites, preference is given to using the Shallow Water Site (SWS) and the North Jetty (NJ) site. However, based on MCR surveys conducted during September/October 2005, the SWS and the NJ site do not have sufficient capacity to meet the requirements for dredged material disposal. The Deep Water Site (DWS) will be used to supplement disposal site capacity for MCR dredging requirement during 2006 (refer to Section 8, fourth paragraph). It is intended that the contract dredge place up to 1 MCY of MCR material in SWS, up to 0.1 MCY of MCR material in the NJ site, and up to 2 MCY of LCR material in the DWS (CR-06-DWS drop zone). The government dredge is expected to place up to 0.5 MCY of MCR material in the SWS and up to 3 MCY of MCR material in the DWS (MCR-06-DWS drop zone). Subsequent surveys of the SWS and NJ Site (during 2006) may show increased erosion within these areas, which may result in additional nearshore capacity for dredged material disposal. This would effectively reduce the volume of MCR dredged material that would be placed at the DWS (MCR-06-DWS) for the government dredge.

If the SWS is to be used by both the government and contract hopper dredges (at different times) for the disposal of MCR dredged material and does not have the capacity to allow both dredges to complete their respective MCR requirement, then both dredges may need to use the MCR-06-DWS concurrently. The MCR-06-DWS is not large enough to allow concurrent use by 2 dredges. A dredge scheduling “work-around” will need to be developed if the above situation arises.

It is noted that SWS requires focused attention during dredged material placement and monitoring to ensure that the site is fully utilized without exceeding the site’s management target. The SWS will be managed such that the site may be under-utilized, rather than attempting to achieve full utilization of the site at the risk of exceeding the site’s capacity constraints. During 2005, concurrent use of the NJ site, DWS, and SWS by the “gvt” hopper dredge during July; reduced the rate at which material was placed within the SWS, and allowed the site to fully disperse the material being placed within it. The cessation of SWS use during August 2005 gave the SWS a “holiday” to further disperse placed material (figure 16). More material was placed in the SWS throughout the ***2005*** season by not over-using the site during a short time period. Intermittent use of the SWS during 2005 had increased the dispersive capacity of the site (see Appendix B). Figures 3a-b show the flow diagram describing the procedure for assessing site capacity and directing the government and contractor dredges to specific MCR disposal sites.

7. Site Management and Monitoring – Routine and Special Studies

Monitoring of active ODMDSs at MCR is required based on the site designation statute of MPRSA. Both management and monitoring are described in the 2005 USEPA/USCOE Site Management/Monitoring Plan (SMMP) for the Mouth of the Columbia River. Monitoring as described in the SMMP includes routine monitoring and when triggered special studies. Typically routine annual monitoring consists of bathymetric surveys of both the SWS and DWS. The intensity of these surveys is greater for the SWS than the DWS. For the DWS these would consist of a pre and post disposal survey of those areas proposed for placement of dredged material as well those portions of the site used the previous year. Placement of >500,000 CY at the DWS would trigger sediment physical characterization.

Special studies are non-routine studies of specified duration that are intended to address specific questions or issues that are not covered by routine monitoring or that arise from questions or issues identified through routine monitoring. Designation of the SWS and DWS by EPA-Region 10 in 2005 and the placement of 1.7 MCY of dredged material from the MCR project within the MCR-103-DWS in 2004 had triggered various special studies. These included biological as well as physical special studies. Special studies for 2005 included sediment profile imaging, benthic infauna and physical sediment analysis, bottom trawls, detailed bathymetry surveys, modeling, and crab pot deployment. This information was collected in June and again in September 2005. Sampling protocols were similar to those applied in 2002 for the SWS Biological Baseline survey but focused on the area of the 2005 placement with suitable reference areas. Physical studies performed in 2005 consisted of a multi-beam survey of the DWS and SWS (including the

MCR project area and the South Jetty Research Site) and sediment sampling (profile imaging and grab samples obtained at the DWS and South Jetty Research Site). See Appendix B for a brief on the South Jetty Research Site. In addition, mathematical modeling of circulation/sediment transport at the MCR was conducted by ERDC and the USGS under contract to Portland District. The ARGUS system at North Head is now operational can is used to verify that wave action on Peacock Spit is not negatively affected by the SWS. Specific survey plans were developed to provide such detail as sampling stations and frequencies and submitted to EPA, Region 10 for review and approval. Results of the physical, biologic, and numerical modeling analyses conducted during 2005 are summarized in Appendix B.

Additional modeling activities for the SWS and DWS will be conducted during 2006, to build on and complement the work performed in 2005. Additional investigations will be performed for the South Jetty Research Site during 2006, in preparation for phase II of the Columbia Nearshore Demonstration Project. A sediment tracer study will be conducted at the SWS and possibly the South Jetty Research Site during 2006-2007. The scopes of work for the above activities will be reviewed by EPA before commencing work.

8. Survey Frequency for Monitoring Dredged Material Accumulation

Minimum site monitoring requirements are a pre- and post -disposal bathymetry survey for each active disposal site at MCR and a 2 x 2 mile area on Peacock Spit. Refer to figure 4 for survey coverage at MCR. The SWS and the NJ Site will be surveyed at least once a month during the 2006 MCR dredging season. The drop zones of the DWS used during 2006 will be surveyed at the end of the dredging/disposal season. For active disposal sites, the survey frequency may differ from the minimum requirements, as specified in Table 2.

For all sites that are actually being used, an alternative Frequency for Site Monitoring (FSM) will be based on: The <u>volumetric rate</u> (∀) at which dredged material is begin placed, the <u>area</u> (A) over which the dredged material is being placed, and the <u>vertical target</u> (H) for dredged material accumulation. It is noted that as a given site (or portion thereof) is “filled” with dredged material, H will change (become less with time). The FSM may need to increase as a site is being filled. FSM will be re-assessed each time an active site is surveyed. An entire disposal area need not be surveyed during each survey; only the parts of the site receiving dredged material and adjacent areas (within approximately 1,000 ft of disposal activity). If the FSM becomes too frequent, then the disposal area may be considered “filled” and not used until sufficient dredged material dispersion occurs (as determined by site monitoring).

Equation 1 was used to estimate survey frequency for each site. Note that FSM (equation 1) assumes: The survey will be conducted at the midpoint of a site’s total remaining capacity; dredged material is continuously placed at the site; and 20% of the site’s area is not used. Table 2 specifies the initial FSM for each site based on initial conditions for 2004 and other parameters as shown. Note that the FSMs in table 2 will require revision as the capacity (allowable accumulation height) of each site is reduced by dredged material disposal.

Frequency of Site Monitoring (FSM)
= (Target Height/2) x (Site Area*0.8/∀olume placed per day) [Equation 1]

Example: Initial FSM for the Eastern half of SWS drop zone (DZ) for contract dredge is:
= (3/2) x (190*43560*0.8 /45,000*27) = 16 days.
…this is halfway thru the total time expected to fill the site.

Table 2. Values used to estimate Initial Frequency of Site Monitoring (FSM) for 2004.

Disposal Site	Target Mound Height (H,ft)*	Area (A, acres)*	Volume of DM Placed (∀,CY/day)♣ Government		Volume of DM Placed (∀,CY/day)♣ Contractor	FSM** (days)
SWS – East DZ	3	190	55,000	or	45,000	7 or 8
SWS– West DZ	2	100	50,000	or	35,000	3 or 4
SWS DZ	2	290	52,000	or	40,000	7 or 10
NJ Site	2	100			40,000	4
DWS (MCR DZ)	20	207	37,000			72
DWS (CR DZ)	35	330			25,000	300

* = Based on present values; changes as a site is filled; may be redefined based on subsequent site surveys.
**= time interval between FIRST successive surveys, assuming site in continuously used AND that dredged material is placed evenly throughout available disposal area. Frequency for Site Monitoring
♣= based on recent average production rates – values will be changed if 2004 production rates are higher

As a given disposal site is "used", the interval between successive surveys will become smaller. Table 3 shows an estimated schedule for surveying MCR disposal sites during 2006 assuming that disposal occurs continuously in the site and that dredged material is placed uniformly within the available area. Note that the SWS and NJ site values shown in Table 1-3 are based on surveys obtained in October 2005. The values shown in () are the revised FSMs, following the initial value. An example of how to read table 3 is given for the SWS, and assumes that dredged material is continuously and evenly placed from day one using a government hopper dredge (production of 52,000 cy/day):

1) 10 days after commencement of the disposal operation, the site would be surveyed and remaining capacity assessed.
2) After 5 additional days, the site would be re-surveyed and re-assessed. The total time for disposal would be 15 days.
3) After 2 additional days, the site would be re-surveyed and re-assessed. The total time for disposal would be 17 days.
4) After 1 additional day, the site would filled. The total time for disposal would be 28 days.

Table 3. Estimated successive frequency of site monitoring, based on contract (C) dredge and government (G) dredge production rates.

Disposal Site	Initial FSM	2nd FSM	3rd FSM	4th FSM	5th FSM
	days, starting from when site is first used in 2005 (days from previous FSM)				
SWS (G)	10	15 (5)	17 (2)	18 (1)	Filled-1 MCY
NJ Site (C)	4	6 (2)	7 (1)	Filled--100KCY	
DWS (C)	>70	Survey DWS at Beginning and End of Dredging Season**			

Values indicate cumulative time for which site has been used during 2006.
Values in () indicate successive FSM; or the time that the site can be used been used between successive surveys. When the FSM becomes less than 3 days, use of the site may be temporarily halted while site capacity is evaluated.
** Post-Survey of DWS occurs only if the site has been used in 2006.

9. Utilization of Active Disposal Sites during Monitoring and Other Conditions

Under certain conditions, active disposal sites may be left alone and others will be used. This means that when the SWS is being surveyed to assess remaining site capacity, the government or contract dredge may use another disposal site until the SWS remaining capacity has been assessed. This will typically take 1-2 days. This may happen towards the end of the dredging season when the SWS is nearing its site capacity. During each site assessment period, the dredges may use the NJ site (if available) or the DWS. See figures 2 and 3a-b.

During periods of rough bar conditions, the SWS or the NJ Site may not be available for use; in which case the DWS may be used. At times during the 2006 dredging season, both contract and government dredges may relocate to other work areas.

10. Optimization of Site Capacity

During 1997-2005, SWS (formally ODMDS E) has been the principal disposal site for MCR project maintenance dredged material; 64% of all MCR dredged material (sand) was placed in the SWS. Approximately 85% of the material placed within the SWS drop zone during 1997-2005 has been dispersed by waves and currents, in a north-northwesterly direction onto Peacock Spit. Less than 10% of the dredged material placed at the SWS has been transported southward into the MCR navigation channel. Continued use of SWS as a primary disposal site is of strategic importance to the MCR federal project and environment [USACE 2003]. The western half of the SWS drop zone has been slowly accumulating dredged material, since its initial use in 1997; approximately 2 MCY. Management of the SWS has taken this into account by preferentially using the highly dispersive eastern half of the site, and minimizing the additional accumulation within the western half of the site. The net result is to achieve uniform accumulation throughout the site with respect to the baseline condition (1997) without exceeding the site's target height of accumulation; by placing dredged material accordingly to match the site's dispersive and depositional nature.

The level to which the SWS can be used for dredged material disposal is related to the capacity available within the site and the efficiency to which the site's capacity is used. Regardless of the capacity available within the site, full utilization of SWS capacity can be achieved by promoting even deposition of dredged material throughout the site's drop zone, with respect the baseline condition. This means that the dredged material would be placed though out the entire site, both in space and time, using a regimented procedure to produce a uniform continuous layer on the seabed, avoiding the formation of any localized mounding.

SWS and NJ Site. To promote even and controlled deposition of dredged material within SWS and NJ Site the sites were partitioned into a system of cells (83 cells @ 500 x 500 ft for the SWS and 40 cells @ 250 x 500 ft for the NJ Site) as shown in figure 1a. Initial dump assignments are made for each cell within a given site based on the target mound heights (elevations) for dredged material accumulation. The cell assignments (dumps per cell) are periodically refined as a given site is "filled". As areas of a site become filled; the filled cells are either minimally used or are restricted from use. To facilitate coordination of site assessment, the same placement grid will be used by the contractor and government dredges. Figures 5 and 6 show initial cell assignments for the SWS and NJ Site and constitute the initial (provisional) disposal plan for each site for 2006. It is noted here and elsewhere in theis AUP that these disposal plans must be updated using spring 2006 survey data, before commencement of the dredging-disposal season.

During 2006, placement of dredged material within either SWS or the NJ Site will be conducted according to the following specification. The SWS and NJ Site shall be filled uniformly with no more than one load difference between any two cells: All cells must be filled with one load before placing a second load in any cell; all cells designated for two loads must be filled before placing a third load in any cell, etc. When recording the placement location, material shall be credited to the cell in which the disposal operation is started regardless of the number of cells disposed in. Each load shall be distributed across no less than 2 cells. No more than 50% of a hopper dredge load shall be placed within any given grid cell. Additional measures may be exercised to maximize capacity within the eastern half of the SWS. In some cases, each load of dredged material may be required to be distributed across no less than 3 cells. The filling of cells may be preferentially weighted toward the eastern half of the site.

Deep Water Site. Dredged material placement within active drop zones of the DWS will be conducted in manner similar to the SWS. See figure 1 and 7 for DWS drop zones to be used during 2006. The intent is to confine the aerial dispersal of dredged material placed within each "drop zone" of the DWS without promoting excessive vertical accumulation of placed dredged material. The outcome will achieve pin-point dumping without negative effects. Appendix A describes how a cell-based assignment can be used for the DWS to effectively achieve a concentrated accumulation on the bottom. Figures 7a and 7b show initial cell assignments for the drop zones to be used within the DWS and constitute the initial disposal plan for each site for 2006. The present vertical limit for dredged material accumulation (on the seabed) within the MCR-DWS and CR-DWS is 20 ft and 35 ft, respectively. Deposition of dredged material placed within each drop zone during 2006 is not expected to exceed 10 ft of additional accumulation. Drop zones within the DWS shall be used uniformly with no more than 5 loads difference between any two cells. When recording the placement location within each drop zone, material shall be credited to the cell in which the disposal operation is started regardless of the number of cells disposed in. Each load shall be distributed across no less than 1 cell. It is noted that after 2006, dredged material accumulation with the MCR-06-DWS is expected to reach 30 ft with respect to the 2004 baseline elevation. A new MCR-DWS drop zone will likely be needed for 2008.

11. Data Reporting Requirements

Field Data to be Provided to NWP: Different Portland District will conduct an internal briefing every week, during the active MCR dredging-disposal season. The resident engineer office (EC-CR) will retrieve digital information describing the contract and government hopper dredge disposal operation (tracklines and beginning-ending dump coordinates). EC-CR will verify the integrity of the disposal data. The previous day's verified disposal data will be provided to NWP-OP-NW and EC-HY/HR digitally every day while the dredges are working at MCR. Weekly compilation of disposal tracklines (in digital form) will be provided to EC-HY/HR, OP-NW, and EPA-Region 10 weekly. Other data may be transferred to OP-NW and EC-HY/HR, as adaptive site management requirements dictate. EC-HY will review disposal data to verify that the active disposal sites are being used as intended and compare to hydrographic survey results. OP-NW should provide hydrographic survey information (MCR channel and all MCR disposal sites) to EC-HY in a timely format.

EC-HY will compile survey information, update disposal plans when needed, and disseminate value-added products according to the flow diagram in figure 2. These data will be coordinated with EPA.

Updates from NWP to Public: The Portland District (MCR project manager) will provide updates to collaborating agencies and interested stakeholders every Friday. Other data may be sent, as adaptive site management requirements dictate.

12. Coordination of Dredging Activities During the Dredging Season

Steps that are taken to increase awareness of dredge locations and disposal management throughout the dredging season include:

1. Public Coordination: The EPA- Region 10 approved Annual Use Plan is coordinated with State Agencies and the public via email and an informational meeting conducted in the local area (Ilwaco/Astoria) prior to start of dredging. The approved Annual Use Plan is also posted on the Corps' website. A press release is issued to newspapers and radio stations in the local area prior to start of dredging and disposal activities. Crab fisherman who fish in the area of the Shallow Water Site and the North Jetty Site are notified via telephone two weeks in advance of the dredge starting work in these sites.
2. The Coast Guard is informed of when the work will start and they include this information in their Notice to Mariners. As Dredge Orders are prepared for the Federal

dredges, a copy is furnished to the Coast Guard via email for posting in the Notice to Mariners.

3. During the season, when two dredges are scheduled to work in the project concurrently, a meeting is held between the Captains of each vessel to discuss communication and coordination.

4. Hopper dredges are required by the Coast Guard to employ an intermittent blast from the ship's horn during foggy and low visibility conditions.
Hopper dredges are also required by the Coast Guard to display the "ball-diamond-ball" pattern atop her bridge to symbolize her limited ability to maneuver within a navigation channel.

5. Hopper dredges are required by the Coast Guard to display of automated identification systems (AIS) information, which indicates the position, heading, speed, ship length, beam, and type.

6. Nighttime dredging operations require Coast Guard navigation lights mounted at each cardinal location of a dredge.

7. Local newspapers, radio, and media propel public awareness of dredging activity within the area.

APPENDIX A

Mouth of the Columbia River Navigation Project

The mouth of the Columbia River (MCR) is the ocean gateway for maritime navigation to/from the Columbia – Snake River navigation system. 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). The MCR navigation channel lies between Columbia River Mile (RM) –3 to +3. The federal navigation project at the MCR is authorized by Rivers and Harbors Act of 1884, 1905, 1954, and Public Law 98-63. The authorized project provides for a 2640-ft wide deep-draft navigation channel across the Columbia River bar. The northerly 2,000 ft of the channel is maintained at –55 ft MLLW (plus 5 ft for over dredging), and the southerly 640 ft of the channel is maintained at –48 ft MLLW (plus 5 ft for over dredging).

Each year, the Corps of Engineers-Portland District dredges 3-5 million cubic yards (MCY) of sand at MCR to maintain the 6-mile long deep draft navigation channel. Most of the dredging occurs between RM –2 and +2 and is executed during the summer season. The dredged material is fine-medium sand (0.19-0.25 mm) and fine-grained material content is less than 3%. Due to the exposed ocean conditions at MCR, only ocean-going hopper dredges can perform dredging and disposal at MCR; dredging is limited to summer when wave conditions are favorable for working on the bar. Two hopper dredges are normally used to perform maintenance dredging at MCR: A government operated dredge and a contractor operated dredge, each with different capacities and operating characteristics.

Columbia River and Lower Willamette River Navigation Project

Since 1962, the Columbia and Lower Willamette Rivers federal navigation channel has been maintained at a depth of 40 feet and width of 600 feet, from RM 3.0 to 106.5. This channel configuration was authorized by River and Harbor Act 1962, PL 87-874. Much of the sediment that was dredged from RM 3 to 29 has been placed within estuarine disposal sites. Due to projected capacity limitations of estuarine disposal sites to accept additional dredged material (sand), long-term plans have identified material as far upstream as RM 29.0 as potentially being placed in the ocean, at designated disposal sites [USCE 1998]. Annual maintenance quantities projected go to designated ocean disposal sites, beginning in 2010-2012, were estimated to average 0.4 MCY per year.

In December 1999, Congress authorized the deepening of the Columbia River segment of the Columbia and Lower Willamette Rivers federal navigation channel to 43 feet [Section 101(b)(13) of the Water Resource development Act of 1999]. The existing 600-foot-wide, 40-foot-deep navigation channel would be deepened to -43 feet Columbia River datum (CRD), from RM 3 to RM 106.5. The construction phase of the deepening including advanced maintenance dredging for over-width and over-depth in the reaches where this practice is currently performed in the present maintenance program. During the construction phase of the 3-foot channel deepening, an estimated 6 mcy (4 mcy new work; 2 mcy 40-foot O&M) from RM 3-29 would go to ocean disposal sites [USACE 1999]. Similar to long-term planning conducted for the 40-foot project (see above), future maintenance material from RM 3-29 is expected to go to the ocean, when disposal sites in the estuary reach capacity.

If the material dredged from RM 3-29 is to be placed in the ocean, the dredging could be accomplished using either a hopper dredge or a clamshell/barge disposal operation.

The Hopper Dredge

A hydraulic hopper dredge is a self-propelled seagoing ship with sections of its hull compartmented into one or more holds or "hoppers". It is normally configured with two drag arms, one on each side of the dredge. During dredging, bottom sediment is sucked into the drag arm by hydraulic pumps and deposited into the dredge's hoppers. The dredged material enters the hoppers in slurry form and settles to the bottom as excess water flows over the top of the hoppers. Once the hoppers are full, the drag arms are lifted, and the dredge transits to the disposal area where the dredged material is usually dumped thru doors located on the bottom of the ship (hoppers). In some cases, the hopper dredge can use its pump to discharge the dredged material directly overboard or thru a pipeline to a disposal site not reachable by the hopper dredge (i.e. beach, upland, or nearshore locations). The operating parameters for several dredges that have been used at MCR are shown below.

Table A-1. Operating parameters for hopper dredges commonly used at MCR

DREDGE	OVERALL DIMENSIONS			CAPACITY	VESSEL	TIME TO PLACE	
	length (ft)	beam (ft)	draft(ft) loaded/empty	load-average (cy)	type	open water dump (minutes, per load)	pump-out (minutes, per load)
Newport*(Cntr)*	300	55	20/10	3,000	split-hull	4 to 8	N/A
Sugar Island*(Cntr)*	281	52	19/8	2,300	split-hull	4 to 8	80 to 100
Padre Island*(Cntr)*	281	52	19/8	2,700	split-hull	4 to 8	N/A
Essayons*(Gvt)*	350	68	27/15	5,400	bottom doors	6 to 15	120 to 140*****
Stuyvesant*(Cntr)*	372	72	29/17	6,800	bottom doors	6 to 15	130 to 160

*** will have pump-out capability in 2008**
During 2004, the *Essayons* and *Sugar Island* will be used to maintain the MCR bar

Hopper dredges are used mainly for dredging in wave exposed or high current areas where traffic and operating conditions preclude the use of more stationary dredges and their attendant pipeline or dump scows. Hopper dredges are effective working offshore and in entrances where sea and weather conditions preclude the use of extensive dredge pipe. Most hopper dredges are capable of operating in ocean swell 10 ft high and they are important for accessing disposal sites many miles from the dredging location. The government hopper dredge (*Essayons*) utilizes a series of "doors" located on the hull bottom to release each load of dredged material. The bottom doors are sequentially opened during disposal until the entire load of dredged material is released form the vessel resulting in a gradual release of dredged material from the vessel. Contractor hopper dredges typically employ a split-hull design. A split-hull hopper dredge releases its load of dredged material by opening (splitting) the entire hull of the vessel. The split-hull method of disposal is more rapid (time-efficient) than bottom-door hopper dredges. While the use of split-hull hopper dredges reduces the time required for material disposal, split-hull dredges reduce the horizontal dispersal of dumped dredged material on the seabed while increasing the vertical extent of accumulation per dump.

MCR Disposal Site Utilization: Procedures and Governing Constraints

Both the Shallow Water and Deep Water Sites were configured based on hopper dredge operating characteristics. The Deep Water Site is large enough that barge-disposal of material would not be a problem. At the Shallow Water Site, dredged material placed using a barge/scow would likely not erode and disperse as readily as material placed by a hopper dredge. Due to less control and maneuverings limitations of a barge and tow, placement of material in the SWS by this equipment may not be possible. *Before any non-hopper dredged material may be discharged at the Shallow Water Site, a specific evaluation (potentially including sophisticated modeling) must be completed and submitted for approval by the USEPA* [USACE 2005].

Disposal Site Terminology: The ***Placement Area*** of a disposal site defines the extent of sea bottom that will be occupied by disposed dredged material released at the water surface on an annual use basis, and/or over the anticipated life of the disposal site. A ***drop zone*** is a defined area at the water surface within the placement area and within which dredged material discharge may occur. The drop zone for the SWS and the DWS are shown in figure 1 (dashed black line). The Drop Zone may be further subdivided into “cells” for more specific placement control (i.e. areas MCR-06 and CR-06 within the DWS). A ***Buffer*** is that area of the sea bottom between the defined limit of the placement area and the disposal site boundary. Direct disposal into the buffer is prohibited. Consult the SMMP for additional information [USACE/USEPA 2005].

Shallow Water Site (formally ODMDS E): The entire SWS occupies a trapezoidal area of 3,100 to 5,600 ft wide x 11,500 ft long and lies within 2 miles offshore from MCR in a water depth of 45 ft to 75 ft (see figure 1 and 8). The SWS drop zone is 1,054 ft to 3,600 ft wide by 10,000 ft long (and is equivalent to the former Section 103 ODMDS E). The SWS was designated in 2005, under the Section 102 of the MPRSA as described in USEPA [2005]. Prior to 2006, approximately 23.2 MCY of MCR dredged sand had been placed within the SWS (during 1997-2005). As of October 2005 approximately 3.7 MCY of this material remain within the SWS drop zone, with respect to the site’s 1997 baseline condition (figure 9 and 10). Results obtained from extensive analysis of the SWS indicate that the site can accommodate 4 MCY of accumulation within the drop zone baseline bathymetry without creating hazardous wave conditions, provided that the dredged material deposition is uniform throughout the drop zone [USACE 2003]. The SWS is configured so that the site is large enough to allow for the temporary storage of placed dredged material as it is naturally dispersed into the littoral zone during the dredging season avoiding the creation of conditions that could interfere with navigation safety.

Figure 11 shows the *target contour elevations* for the SWS: These contours account for a 5-ft accumulation added onto the site's baseline (1997) bathymetry (compare to figure 9). As of 17 October 2005, the SWS present *static* target capacity is 1.0 MCY; this is the static volume that can be realistically placed within the SWS drop zone (figure 12). The static target capacity is what would be achieved if there were no dispersion of placed dredged material during the dredging season. The western half of the site is typically less dispersive than the eastern half of the site. Figure 12 shows the *contour heights* at which dredged material can accumulate within the SWS, without exceeding the site's management target (with respect to May 1997), based on the 17 October 2005 survey. As of 17 October, the average height of accumulation that can be achieved during 2006 without exceeding the target contour elevations for the eastern and western areas of SWS is 3 ft and 2 ft, respectively.

Note that as of 17 October 2005, the *effective* target capacity within the Shallow Water Site (SWS) for the 2006 dredging season was estimated to be 1.5 MCY. The effective target capacity assumes that dredged material accumulates to the present target level within the site's drop zone and accounts for the dredged material side slope and the dispersive potential of the SWS. Between 40-50% of the material placed within the SWS is dispersed out of site's drop zone during the dredging season (June-October), based on site monitoring during 1998-2005 (see Table A-2). Refer to Appendix B for additional information concerning dredged material deposition within the SWS. The effective target capacity within the SWS drop zone can increase or decrease, depending upon prevailing wave-current conditions. Active monitoring of the SWS bathymetry during the dredging season is conducted to evaluate the current capacity of the SWS.

To avoid exceeding the management target for dredged material accumulation within the SWS (with respect to the baseline condition- May 1997), dredged material will be placed such that it accumulates uniformly throughout the site, both in space and time. This means that the entire site will be utilized, to the maximum extent practicable.

<u>North Jetty Site (NJS)</u>: The NJS is located approximately 200 ft south of the MCR north jetty and occupies an area of 1,000 ft x 5,000 ft (figure 13). The average water depth within the NJ Site is 35 ft to 55 ft, below MLLW. The NJS overall site boundaries are coincident with the site's drop zone boundary and placement area boundary. The NJS was selected in 1999, under Section 404 of CWA, for the purpose of allowing the placement of MCR dredged material along the toe of the north jetty. Placing dredged material along the north jetty toe is needed to reduce severe undermining of the jetty by wave and current scour. Approximately 3.7 MCY were placed within the NJS during 1999-2005. As of September 2005, 1.3 MCY remained within the NJS. It is acknowledged that some of the dredged material placed at the NJS is transported toward the navigation channel. So long as the amount transported from the NJS to the channel per year is small (less than 30% of the amount placed), the value of reducing scour along the north jetty outweighs the cost of re-handling the dredged material placed at the NJS.

In consideration of the above, use of the NJS will be curtailed from previous levels (0.5 MCY/yr).

As of 28 September 2005, the *effective* target capacity of the NJS was estimated to be 0.1 MCY, assuming that 70% of the NJS is permitted to accumulate dredged material to a height of 8 ft (with respect to the site's baseline 1999 condition). Refer to figure 14. The present target capacity for the NJS does not account for any dispersion of dredged material placed within the site. Due to the relatively shallow water depths thru the NJS, care will be taken to place dredged material such that it accumulates evenly within the site and the entire site should be utilized, to the maximum extent practicable. It may be advantageous to first use the eastern half of the NJS, then fill in the western half so as not get "blocked" from using the eastern half of the site should accumulation within the western part of the site restrict dredged access due to keel clearance.

Deep Water Site: The entire DWS occupies an area of 17,000 x 23,000 ft and lies 6 miles offshore from MCR in a water depth of 190 ft to 300 ft (see figure 1). The DWS has a defined placement area, which is inscribed within the overall site boundary by a 3,000 ft buffer zone, separating the DWS boundary from the DWS placement area (see figure 7). The DWS placement area is 11,000 ft x 17,000 ft. The DWS was designated in 2005, under the Section 102 of the MPRSA as described in USEPA [2005], to provide sufficient capacity for the disposal of dredged materials to meet current and anticipated future ocean disposal needs at the MCR. Placement of dredged material within the DWS will be limited to specific drop zones, which will be inscribed within the DWS placement zone. The intent is to confine the aerial dispersal of dredged material placed within the "drop zone" of the DWS without promoting excessive vertical accumulation of placed dredged material. Use of the DWS is expected to occur ONLY when the nearshore disposal sites have been used to the maximum extent practicable or when inclement weather conditions or operational constraints temporarily preclude the safe use of the other disposal sites.

Two DWS drop zones are available for use during 2006. The MCR-06-DWS (2006) drop zone is 3,000 X 3,000 foot (207 acres) and resides in a water depth of 220-235 ft. The MCR-06-DWS drop zone can accommodate approximately 7.5 MCY total deposition with an overall target mound height of 40 ft. During 2006, only sediment dredged from the MCR will be placed within the MCR-06-DWS. Figure 7a shows the initial 2006 placement plan for the MCR-06-DWS. The CR-06-DWS drop zone is 3,800 X 3,800 foot (330 acres) and resides in a water depth of 260-280 ft. The CR-DWS drop zone can accommodate approximately 12 MCY total deposition with an overall target mound height of 40 ft. Figure 7b shows the initial 2006 placement plan for the CR-06-DWS. During 2006, only sediment dredged from the LCR will be placed within the CR-06-DWS.

In 2004, part of the DWS was used for the first time (as a Section 103 site) for the disposal of 1.7 MCY of sand dredged from the MCR channel. The DWS area used in 2005 was the same as the drop zone used in 2004 (figure 24) and will also be used in 2006. During the 2005, the government hopper dredge *Essayons* placed dredged sand using a cell-based plan very similar to what was used for the MCR-DWS in 2004. The resultant distribution of dumps through the MCR-05-DWS and CR-05-DWS was almost uniform (figure 24 and 26), while the deposition on the seabed was confined similar to a pin-point disposal operation (figure 25). As of August 2005, the maximum height of dredged material accumulation within MCR-06-DWS was 18 ft. Approximately 95% of the dredged material placed within the 3,000 X 3,000 foot drop zone of the MCR-DWS during 2004 and 2005 had deposited on the seabed. Refer to Appendix B for additional information concerning dredged material deposition within the DWS. Based on the results of the 2004-2005 disposal action with the MCR-DWS, it is assumed that a cell-based plan of disposal within DWS drop zones for 2006 will result in a confined (pin-point) accumulation of dredged material on the seabed allowed by the safety and operational constraints of a hopper dredge. Note that hopper dredges must remain moving during the disposal phase of the operation.

<u>Previously Used Disposal Sites</u>: The de-designation of ODMDSs previously used at MCR is described in USEPA [2005]. The MPRSA Section 103 part of ODMDSs A, B, and F (as expanded in 1993) expired in Fall 2002, leaving the original 1986 EPA-designated areas (Section 102) of ODMDSs A, B, and F. In April 2005, EPA de-designated the original ODMDSs A, B, E, and F (based on the Section 102 boundaries). EPA, Region 10's designation of the new SWS also voided the Corps' selected Section 103 ODMDS E.

APPENDIX B

Utilization of MCR Disposal Sites During 2005

During 2005, approximately 3.9 million cy of sand was dredged from 6-mile long MCR deep draft navigation channel. Approximately 2.6 million cy was placed within the SWS, 0.2 million cy was placed within the NJ Site, 1.0 million cy was placed within the MCR-05-DWS, and 34,000 cy was placed within the South Jetty Research Site. Approximately 1.3 million cy of LCR ("new work" sand dredged from the Channel Improvement project) was placed within the CR-05-DWS during 2005.

Figure 15 highlights the distribution of dredged material placed at MCR during 1956-2005, in terms of nearshore (north and south of the entrance) and deepwater (greater than 55 ft depth) locations. Note that during 1956-1996, most of the material dredged at MCR was placed in the nearshore, with equal distribution to the north and south of MCR. During 1997-2004, about 75 % of the sediment dredged at MCR was placed within the nearshore area north of the entrance. In an effort to investigate re-establishing the balance in nearshore placement at MCR (north and south distribution), 34,000 cy was placed within the South Jetty Research Site in 2005 (figures 1, 33, and 35).

Figure 16 shows the distribution and timing of MCR disposal site use during 2005. Note the times when the SWS was used (and not used). Non-use of the SWS during August allowed time for the material placed within the site during June-July 2005 to be dispersed out of the site (renewing site capacity), before the site was again used (heavily) during September 2005. Approximately 35% of the material placed within the SWS during 2005 was dispersed out of the site's drop zone during the 2005 dredging season. During 2006, opportunities will be sought to allow cessation of disposal within the SWS to achieve the dispersal of dredged material observed during the 2005 dredging season.

<u>SWS:</u> Utilization of the SWS during 2005 is illustrated in figures 10 and 15-23. Figure 18 shows the level of sediment accumulation within the SWS at the beginning of the 2005 dredging season (April 2005), with maximum accumulation of 4 ft with respect to 1997. Figure 10 shows the total accumulation of dredged material placed within the SWS at the end of the 2005 season, with respect to 1997. As of October 2005, maximum accumulation of sediment within the SWS had reached 6 ft with respect to 1997. By the end of the 2005 dredging season, the SWS was at a "level 4" status (acceptable) in terms of the site's Decision Framework for Site Management (see Section 5 of the AUP). Figure 17 shows the 9 dump plans that were used to manage dredged material placement (and accumulation) with the SWS during 2005. Note the instances (plans 4-5 and 8-9) when dredged material placement was restricted through much of the site to ensure that accumulation did not exceed management threshold (Section 5 of the AUP). Figures 19-23 show how dredged material accumulated within the SWS during 2005, in response to the contract dredge and government dredge use of the site. Figure 19 shows the total accumulation of dredged material placed within the SWS during 2005 (April to October). Figure 19 demonstrates the overall attempt to utilize available capacity within the SWS

during 2005, i.e. place dredged material where the accumulation during 2005 plus the existing condition will not exceed 5 ft of total accumulation with respect to the 1997 baseline condition (compare to figures 12 and 18). Figures 20-21 illustrate how effective the contract hopper dredge (*Sugar Island*) was at distributing dredged material within the SWS during 2005. Accumulation of dredged material placed within the SWS (by the *Sugar Island*) was 2-5 ft, with a concentration of deposited material confined to the eastern $1/5^{th}$ of the site. Figures 22-23 show the effectiveness of the government hopper dredge (*Essayons*) at dispersing dredged material throughout the SWS. Although both dredges were "effective" at distributing dredged material within the SWS during 2005; the *Essayons* had achieved better dispersal of dredged material.

<u>DWS:</u> Utilization of the DWS during 2005 is summarized in figure 24-26. The dredge *Essayons* used the MCR-05-DWS and the dredge Sugar Island used the CR-05-DWS. The disposal locations shown in figure 24 document the distribution of dredged material placed within the MCR-05-DWS during 2005. Figure 25 shows the accumulation of dredged material placed within the MCR-DWS since 2004. Although an attempt has been made to distribute dredged material placement within MCR-DWS, bottom accumulation of dredged material has been concentrated near the center of the site, due to the crossing of disposal tracks within he relatively small site. Figure 26 shows the distribution of dredged material disposal within the CR-05-DWS as performed by the dredged *Sugar Island* during 2005. Note that only LCR (new work) material was placed within the CR-05-DWS during 2005.

<u>NJ Site:</u> Utilization of the NJ Site during 2005 is summarized in figure 27. The dredge *Essayons* used the NJ Site during 2005 for a limited volume of dredged material placement (227, 000 cy). Appreciable accumulation of sediment (assumed to be dredged material) was observed to have occurred within the eastern half of the NJ Site during 2005 (see figures 13-14). Use of the NJ site during 2006 will be limited to 100,000 cy due to this recent accumulation.

Special Studies Conducted During 2005

Several studies were conducted during 2005 to assess the effects of dredged material placement within MCR disposal sites, as required by the SMMP and other regulatory frameworks. In summary, these studies included the ARGUS beach monitoring system (ABMS) at North Head, Multibeam bathymetry (collected at DWS, SWS, the South Jetty Research Site, and MCR), Circulation and Sediment Transport modeling at the SWS/DWS, and an initial phase of a pilot study to assess the littoral effects of nearshore dredged material south of the MCR south jetty. Results obtained from the 2005 special studies are summarized in figures 28-35. A biological special study was also conducted in 2005 but was not included as part of this AUP.

<u>ABMS at North Head:</u> Figure 28 highlights the utility of the ABMS to monitor in real time wave action along the southern extent of Peacock Spit (including the SWS). The bottom panel of figure 28 shows merged images from the 8 ABMS video cameras installed within the North Head lighthouse, view is to the south (7 Feb 2005). The SWS

boundary is shown as a yellow line element in each image (bottom panel). Note the breaking waves that appear to boarder the northern boundary of the SWS. The top panel of figure 28 shows the rectified imagery (planemetrically correct) obtained from the bottom panel. The blue line shown within the top panel is the SWS drop zone, view is to the east. Note the location of wave breaking shown in the top panel; the waves are breaking 1 km north of the SWS. The North Head ABMS system continually updates the video imagery of Benson Beach and Peacock Spit every hour; the imagery is available to the public and can be accessed at http://www.planetargus.com/north_head/. If wave breaking is observed within the SWS, the Portland District will assess the severity of the situation, potential causes, and inform EPA and stakeholders of the situation.

Mulitbeam Survey: Figures 29-33 summarize elements of the multibeam special study survey obtained for the DWS, SWS, and South Jetty Research Site during August-September 2005. The multibeam survey was conducted to observe the bedform activity and backscatter attributes of the seabed at MCR. It was anticipated that this data would enable one to assess dredged material deposition and post-disposal transport at surveyed areas.

DWS Multibeam Survey: Figure 29-30 are images showing the detailed bathymetry and backscatter attributes for the DWS. The seabed at the DWS is featureless (no rock outcrops, reefs, or other topographic features are visible). The uneven surface of dredged material deposition within the CR-05-DWS and MCR-05-DWS are visible in figure 29. There is approximately 18 ft of dredged material deposition within the MCR-05-DWS and 3-5 ft of deposition within the CR-05-DWS. Figure 30 shows the backscatter signature of the seabed surface (sediments) within the DWS during August 2005. Darker areas indicate more backscatter. Backscatter intensity indicates the acoustic reflection for a given sediment (a higher reflection can indicate a "harder", or more "compact", or more "reflective" sediment). Note the different backscatter attributes for the seabed surface within the MCR-DWS as compared to the CR-DWS. It is speculated that the dredged material deposited at the CR-DWS exhibits more backscatter because of: A) a slightly different composition (LCR channel improvement material), B) the LCR dredged material was transported over a longer distance than the MCR material (LCR material compacted more within the hopper dredge during transit), and C) the LCR hopper dredge (split-hull) can release it's load more efficiently than the MCR hopper dredge (allowing a more dense deposit to form on the seabed, per load placed). Also note the far-field difference in backscatter associated with both the MCR-DWS and the CR-DWS (a dark halo envelopes both sites, indicating a slight change in bottom sediment acoustic properties – higher backscatter). It is likely that as the dredged material is placed in both sites, a small % of material is stripped off of the descending plume. It is estimated that the dredged material being stripped from the descending plume (released load) is attributed to the fines content of the dredged material (less than 4% of a total hopper load by volume). This stripped material is advected away from the immediate location of placement by currents and is deposited on the bottom as indicated by the extent of backscatter signature.

SWS Multibeam Survey. Figures 31 and 32 are images showing the detailed bathymetry and backscatter attributes for the SWS. Bedforms within the SWS are evident. Significant bedform activity is associated with the dredged material placed within the SWS during 2005 (as indicated in figure 31). The active beds indicate a transport direction to the NW for sediment within the eastern half of the SWS and WNW for sediment within the western half of the site. Figure 32 shows the backscatter attributes for the seabed of the SWS. The bedforms noted in figure 31 are evident in figure 32. A preferential "shift" in backscatter appears along the migrating crest of the material being transported out of the SWS. Figures 31 and 32 conclusively show that material is being actively transported out of the SWS in a N-NW direction during the 2005 summer season.

South Jetty Research Site Multibeam Survey: Figure 33 shows backscatter aspects for the seabed within the South Jetty Research Site (SJRS, figure 1 and 35), after 34,000 cy of dredged material (MCR sand) was placed within the site during Sept 14-15. The multibeam survey for the SJRS was obtained during 14-16 Sept. The tracklines for each disposal SJRS event are noted by the red lines in figure 33. The height (or thickness) of dredged material deposition on the seabed within the SJRS could not be determined by either the multibeam survey or sediment profile imagery (SAIC 2005). However, the backscatter data appears to resolve some aspects of the dredged material deposition on the seabed. The deposition areas appear to be shown as diffuse areas of varying backscatter signature; some areas exhibit higher backscatter and others exhibit lower backscatter.

<u>Sediment Modeling:</u> Figure 34 (top panel) shows an estimate of sediment transport and morphology change within the SWS (USGS 2005). The estimate of sediment transport was obtained for the month of Feb 2004 using the Delft 3-D model as part of the special studies conducted in 2005. A blanket of dredged material was first "placed" on the seabed within the SWS. Sediment transport was then simulated using model estimates for waves and currents. Figure 34 (top panel) shows that the dredged material was "transported" out of the SWS (denoted by erosion within the SWS-red) toward the NW. The eroded material was then deposited on Peacock Spit and transported toward shore (denoted by deposition-red and orange hues beyond the SWS boundary). The bottom panel of figure 34 shows bathymetry change observed at the SWS and Peacock Spit over a long period of time. Arrows within figure 34-bottom panel indicate transport direction of material eroded from the SWS. The model and observed results agree rather well, at least qualitatively. Compare figure 34 with figures 31-32.

<u>South Jetty Research Site, Phase I Evaluation Figure:</u> Figure 35 shows results of modeling the short-term fate (deposition) of dredged material placed at the South Jetty Research Site (SJRS). The modeling objective summarized in figure 35 was to replicate the actual disposal operation and the SJRS environment during the 14-15 September 2005; for the purpose of estimating the deposition of dredged material placed at the site (middle left panel). Tides, waves, and currents were obtained from the Sept –Nov 2003 monitoring effort at the SJRS. The tidal sequence for 14-15 Sept 2005 was matched to the proper tidal and wave sequence in the observed data from 2003. Sediment profile

imaging and sediment sampling locations occupied by SAI during the 2005 test dumps are shown in the top panel. Model results are shown in the middle right and lower panels. Compare figures 33 and 35. Maximum deposition for dredged material placed within the SJRS was estimated to be 0.4 ft; which is below the detection threshold for bathymetry surveys.

Table A1. Summary of SWS ODMDS utilization and dispersive properties of site.

YEAR	VOLUME PLACED IN SWS ODMDS	SPECIFICIED PLACEMENT METHOD ^ C=contractor G=government	MAXIMUM MOUND HEIGHT @ END OF DREDGING SEASON *	EFFECTIVENESS OF USING ENTIRE SW SITE TO DISPERSE DREDGED MATERIAL	TRANSPORT DURING DREDGING SEASON (CY)**	TRANSPORT DURING WINTER (CY)**	NET ANNUAL TRANSPORT OF SEDIMENT OUT OF SW SITE (CY)**
1997	1.0 MCY	None (C)	**2-3 ft** peak = 5 ft	20% of the Site Was Used	-400,000 (40%)	+614,000 (60%)	**+214,000** (20% accumulated)
1998	3.5 MCY	Grid Cells (C) Uniformly (G)	**5-6 ft** peak = 6 ft	70% of the Site Was Used	-2,100,000 (60%)	-1,216,000 (35%)	**-3,315,000** (95% eroded)
1999	3.8 MCY	Grid Cells(C) Uniformly(G)	**6-7 ft** Peak = 7 ft	80% of the Site Was Used	-1,520,000 (40%)	-1,091,000 (30%)	**-2,611,000** (70% eroded)
2000	2.9 MCY	Grid Cells(C) Uniformly(G)	**6-8 ft** Peak = 8 ft	60% of the Site Was Used	-1,160,000 (40%)	-739,000 (25%)	**-1,899,000** (65% eroded)
2001	2.2 MCY	Disposal Lanes(C) Uniformly(G)	**6-7 ft** Peak = 9 ft	70% of the Site Was Used	-1,200,000 (50%)	-1,752,000 (73%)	**-2,952,000** (123% eroded)
2002	1.5 MCY	Disposal Lanes(C)	**6-7 ft** Peak = 8 ft	50% of the Site Was Used	-300,000 (20%)	-1,710,000 (113%)	**-2,010,000** (134% eroded)
2003	2.8 MCY	Grid Cells (C) Grid Cells (G)	**2-4 ft** Peak = 5 ft	>90% of the Site Was Used	-900,000 (32%)	-575,000 (21%)	**-1,475,000** (52% eroded)
2004	2.9 MCY	Grid Cells (C) Grid Cells (G)	**2-5 ft** Peak = 5 ft	>90% of the Site Was Used	-1,000,000 (34%)	-1,000,000 (34%)	**-2,000,000** (68% eroded)
2005	2.6 MCY	Grid Cells (C) Grid Cells (G)	**2-6 ft** Peak = 6 ft	>90% of the Site Was Used	-900,000 (35%)		
	2.6 MCY	**AVERAGE VALUES**	**5-6 ft** Peak = 8 ft	**65%**	**40%**	47%	86%

^ = method used to distribute dredged material within SWS ODMDS during seasonal placement. Grid cells enhance the uniform distribution of dredged material placed through out the site; the release point of each dump is assigned to a given grid cell, the end point of the dump lies 500-1,500 ft away from the release point. Each grid cell is assigned a finite number of dumps. Disposal lanes thru the SWS were assigned a limiting elevation, above which accumulation of placed dredged material was restricted. Use of Grid cells to minimize the vertical accumulation of dredged material placed with the SWS are considered superior to disposal lanes.
* = peak value for maximum vertical accumulation of dredged material (mound height) may have occurred before the end of the dredging season. Values reported based on accumulation with respect to baseline condition (May 1997)
** = percentage of dredged material transported (out of SWS ODMDS) is based on the volume "placed" during a given year. Transport greater than 100% indicates that the SWS experienced net erosion.

References

Ebersol (1986). "Regional Coastal Processes Numerical Modeling System: RCPWAVE – A linear wave propagation model for engineering use", TR CERC-86-4, Waterways Experiment Station, USACE, Vicksburg, MS.

Smith, J.M., Sherlock, A.R., Resio, D.T. (2001) " STWAVE: Steady-State Spectral Wave Model User's Manual for STWAVE, Version 3.0". ERDC/CHL SR-01-1. U.S. Army Corps of Engineers - Engineer Research and Development Center. Vicksburg, MS.

USACE (1998). "Dredged Material Management Plan and Supplemental Environmental Impact Statement for the Columbia and Lower Willamette River Federal Navigation Channel". Portland District – US Army Corps of Engineers.

USACE/USEPA (1999). Integrated Feasibility Report for Channel Improvements and Environmental Impact Statement, Columbia and Lower Willamette River Federal Navigation Channel, US Army Corps of Engineers, Portland District, Portland, Oregon and US Environmental Protection Agency, Region 10, Seattle, Washington. (IFR/EIS, 1999)

USACE/USEPA (2001). Report of an Independent Federal Review Team on Management of Dredged Material Disposal Sites at the Mouth of the Columbia River, Oregon/Washington, October 19, 2001. Portland District – US Army Corps of Engineers

USACE (2003). Mouth of the Columbia River, Shallow Water Ocean Dredged Material Disposal Site: Supplemental Evaluation of Optimized Site Utilization and Assessment of Potential Wave-Related Impacts. (CENWP-EC-HY Final Report). Prepared by US Army Engineer District, Portland, OR, for US Environmental Protection Agency, Region 10, Seattle, WA.

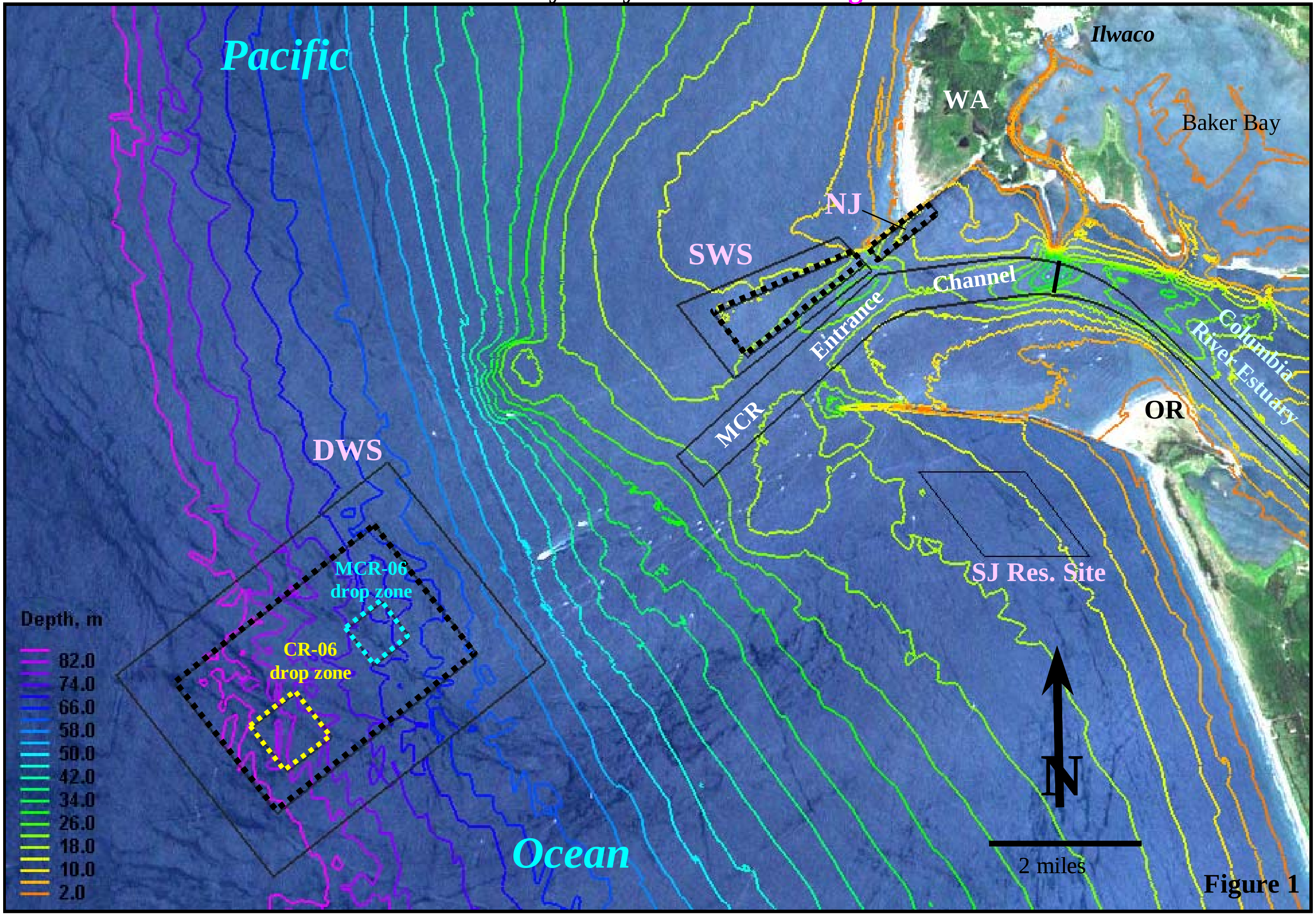
USACE/USEPA (2003). Final Supplemental Integrated Feasibility Report and Environmental Impact Statement, Columbia River Channel Improvement Project, US Army Corps of Engineers, Portland District, Portland, Oregon and US Environmental Protection Agency, Region 10, Seattle, Washington. (SEIS, 2003).

USACE (2004). "Utilization of existing MCR ODMDSs during 2003 and Recommendations for 2004". Portland District – US Army Corps of Engineers

USEPA (2005). 68 FR 11488. Ocean Dumping; De-designation of Ocean Dredged Material Disposal Sites and Proposed Designation of New Sites at the Mouth of the Columbia River, Oregon and Washington. Federal Register, volume 70, number 40, March 2, 2005, Final Rule.

USACE/USEPA (2005). Final Site Management/Monitoring Plan Mouth of the Columbia River , Shallow Water Site and Deep Water Site, Ocean Dredged USEPA Section 102 Material Disposasl Sites, Oregon/Washington, US Army Corps of Engineers, Portland District, Portland, Oregon and US Environmental Protection Agency, Region 10, Seattle, Washington.

Mouth of the Columbia River - Bathymetry and 2006 Dredged Material Placement Sites



DWS= Deep Water Site, 102 MPRSA NJ Site = North Jetty disposal site, 404 CWA
SWS= Shallow Water Site, 102 MPRSA (formally Site E, 103 MPRSA)

SJ Res. Site = South Jetty research site, restricted use by EPA permit

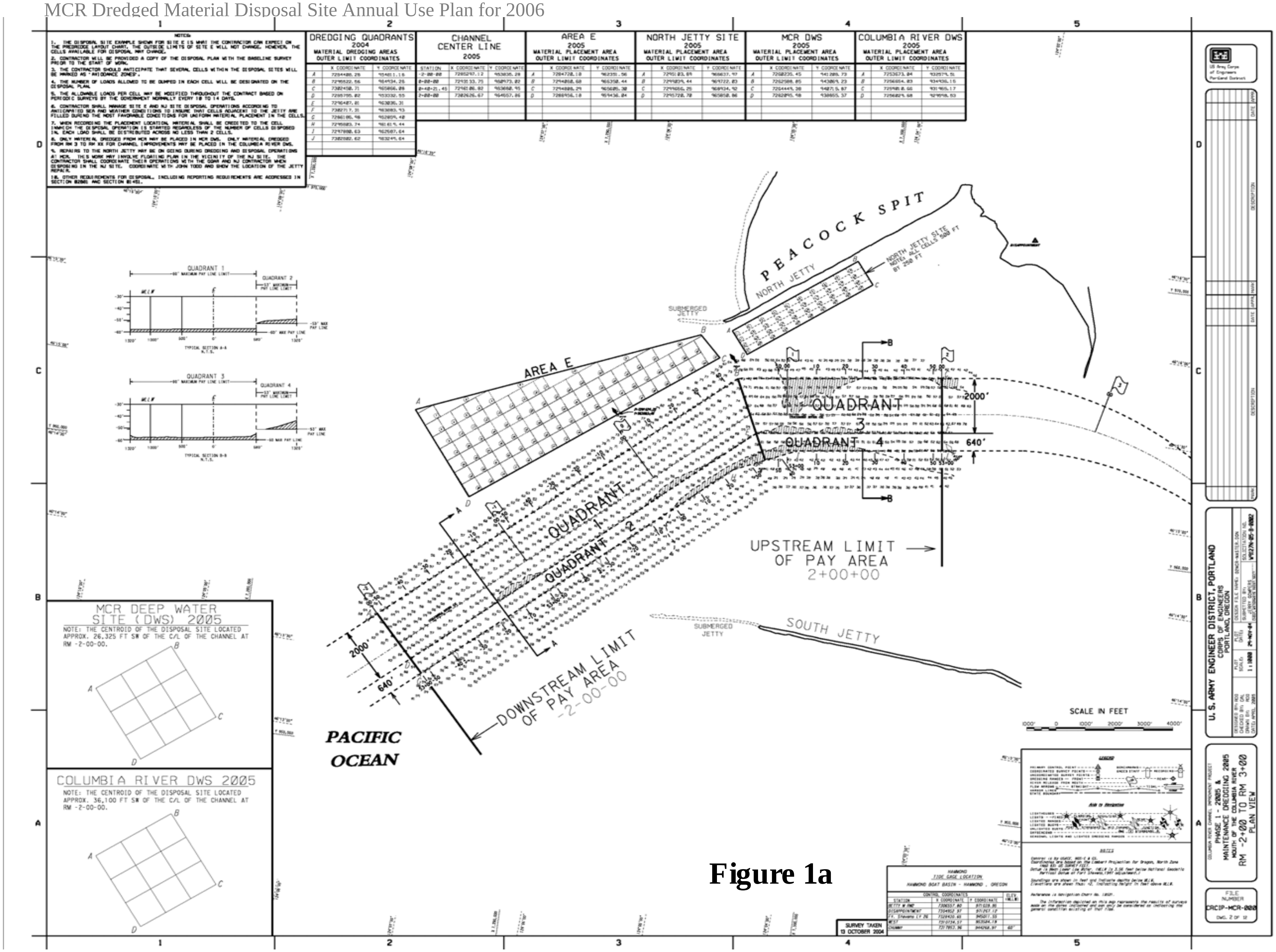

DREDGING QUADRANTS 2004
CHANNEL CENTER LINE 2005
AREA E 2005
NORTH JETTY SITE 2005
MCR DWS 2005
COLUMBIA RIVER DWS 2005
PEACOCK SPIT
NORTH JETTY
SUBMERGED JETTY
AREA E
QUADRANT 1
QUADRANT 2
QUADRANT 3
QUADRANT 4
2000'
640'
UPSTREAM LIMIT
OF PAY AREA
2+00+00
DOWNSTREAM LIMIT
OF PAY AREA
-2-00-00
SOUTH JETTY
PACIFIC OCEAN
MCR DEEP WATER SITE (DWS) 2005
NOTE: THE CENTROID OF THE DISPOSAL SITE LOCATED APPROX. 26,325 FT SW OF THE C/L OF THE CHANNEL AT RM -2-00-00.
COLUMBIA RIVER DWS 2005
NOTE: THE CENTROID OF THE DISPOSAL SITE LOCATED APPROX. 36,100 FT SW OF THE C/L OF THE CHANNEL AT RM -2-00-00.
SCALE IN FEET
U. S. ARMY ENGINEER DISTRICT, PORTLAND
CORPS OF ENGINEERS
PORTLAND, OREGON
PHASE 1 - 2005 &
MAINTENANCE DREDGING 2005
MOUTH OF THE COLUMBIA RIVER
RM -2+00 TO RM 3+00
PLAN VIEW
SURVEY TAKEN
13 OCTOBER 2004

Figure 1a

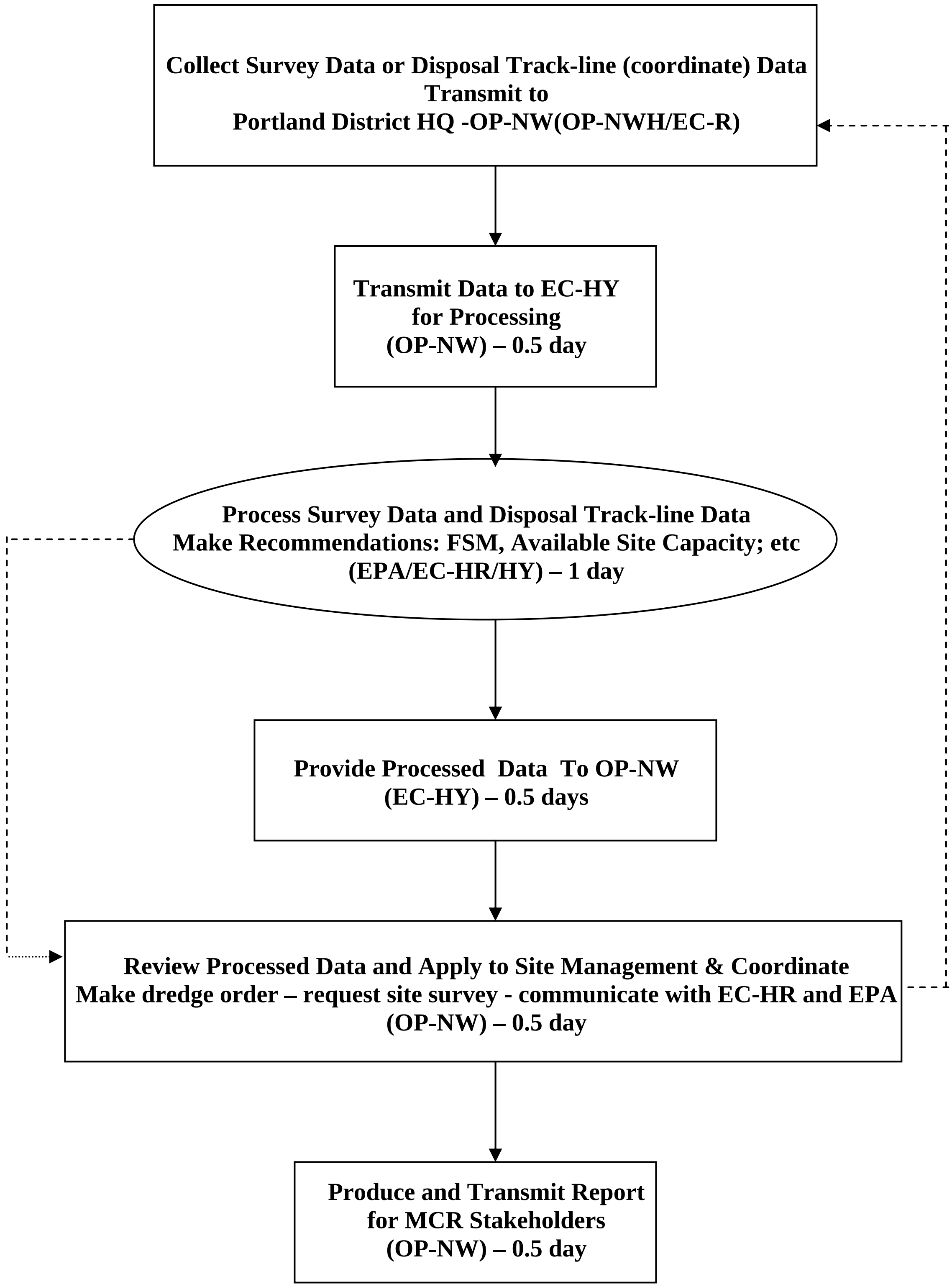


Figure 2. Flow diagram describing the procedure of processing monitoring data and using the processed data to manage disposal site capacity, at a frequency of 1 week or greater. Offices shown in () are assigned responsibility for task; expected duration of task is specified. FSM = Frequency for Site Monitoring.

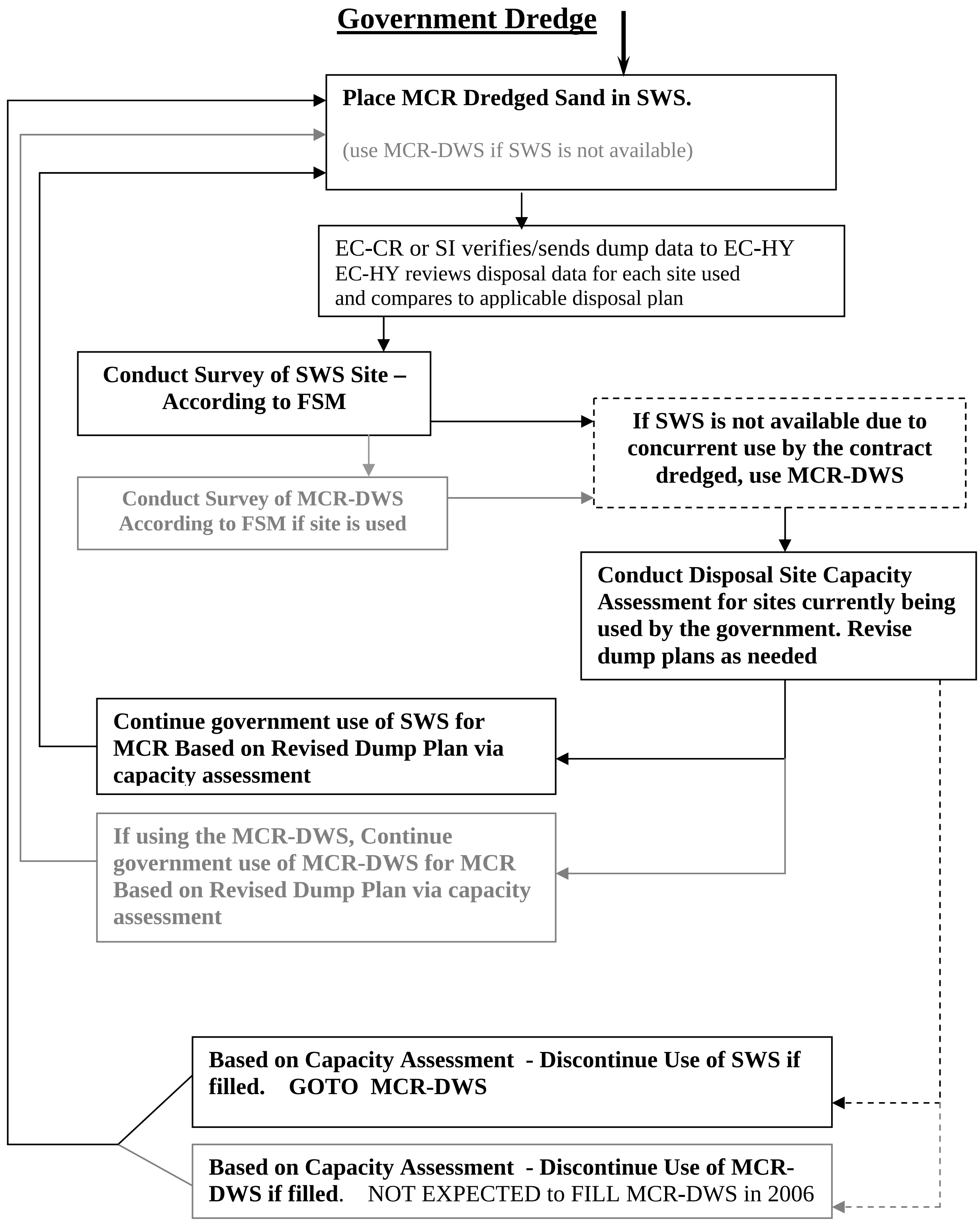


Figure 3a. Flow Diagram describing Action events for government dredge *Essayons* during dredging-disposal at MCR for 2006.

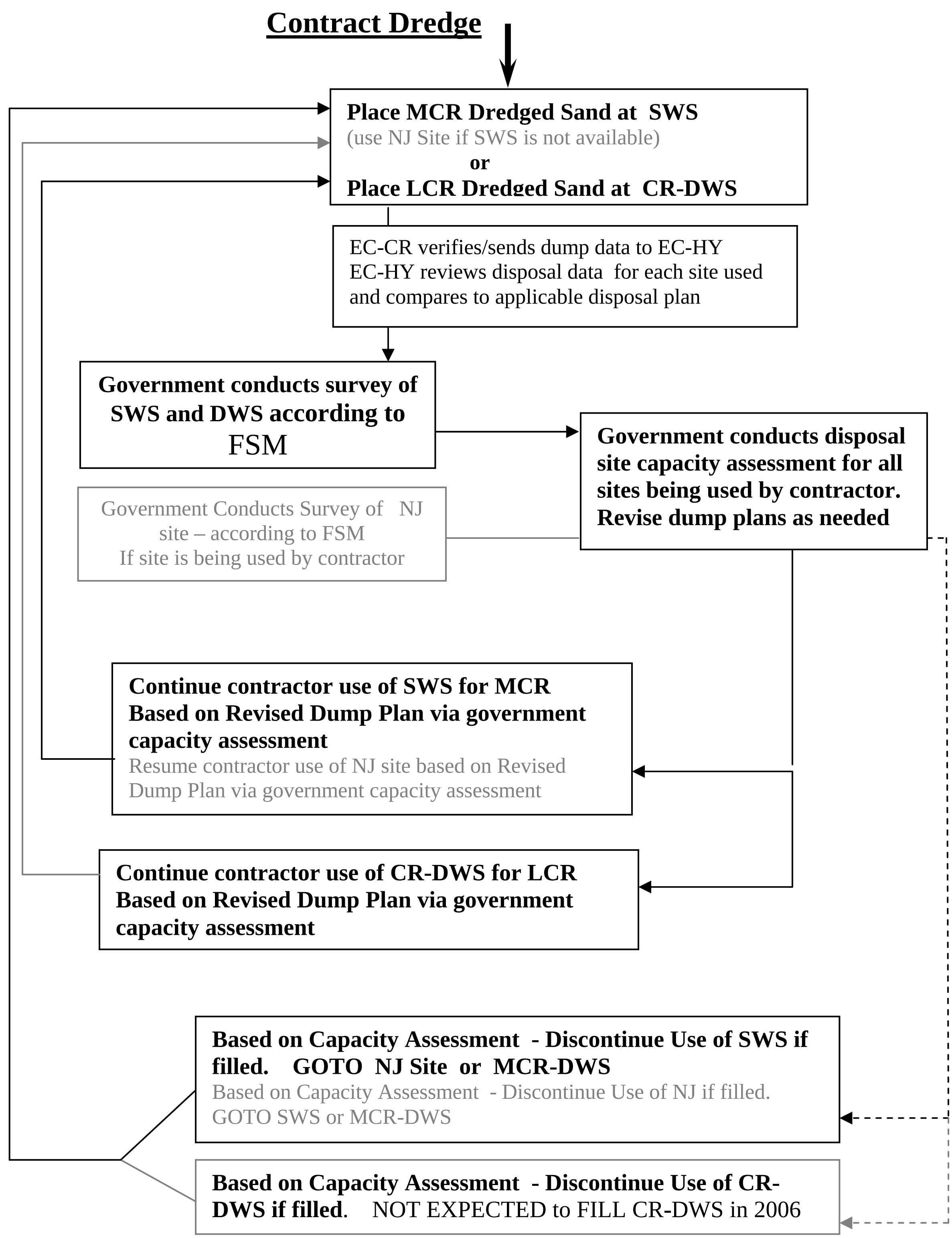
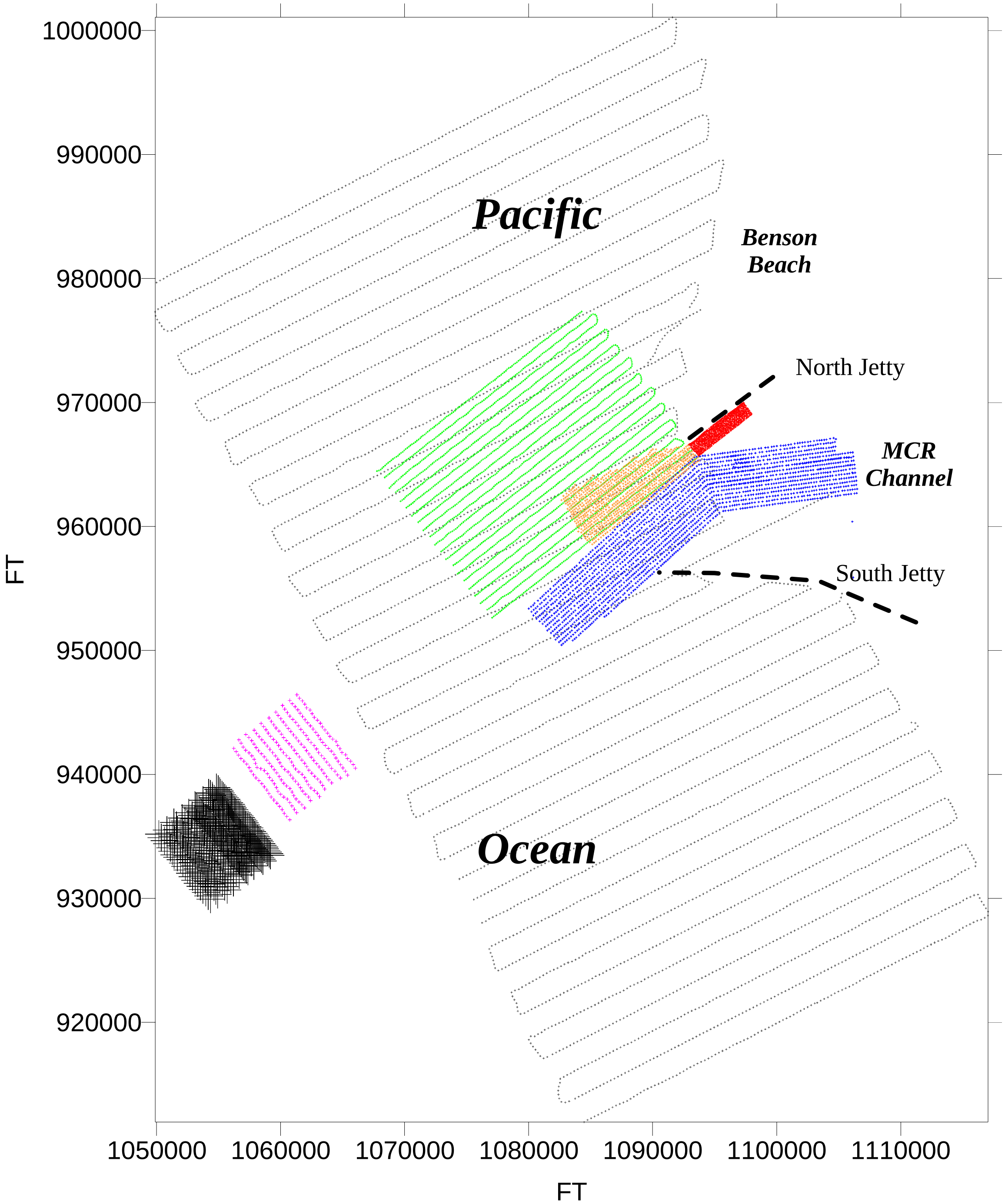


Figure 3b. Flow Diagram describing Action events for contract dredge during dredging-disposal at MCR for 2006.

MCR SURVEY DATA - COVERAGE



Grey = Approach Survey
Green = Peacock Spit , 2 x 2 mile
Purple = MCR DWS(2005)
Black = CR-DWS(2005)
Blue = MCR Channel
Orange = Site E (SWS)
Red = North Jetty Site

Figure 4

Site Use Sequence = Atl 1:

Once the dredge has placed the specified number of dumps in a cell, that cell shall become a Limited Capacity Zone

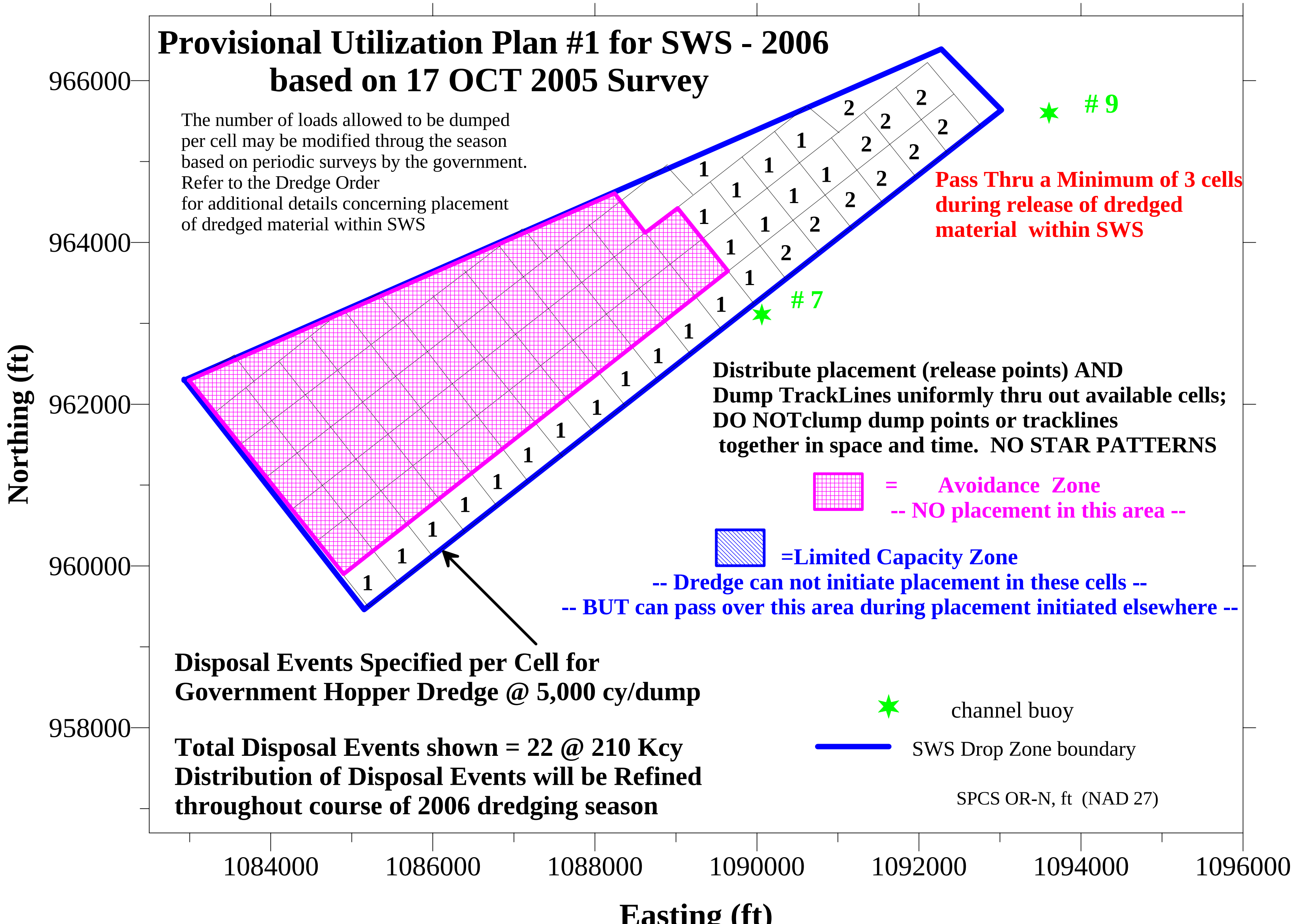


Figure 5

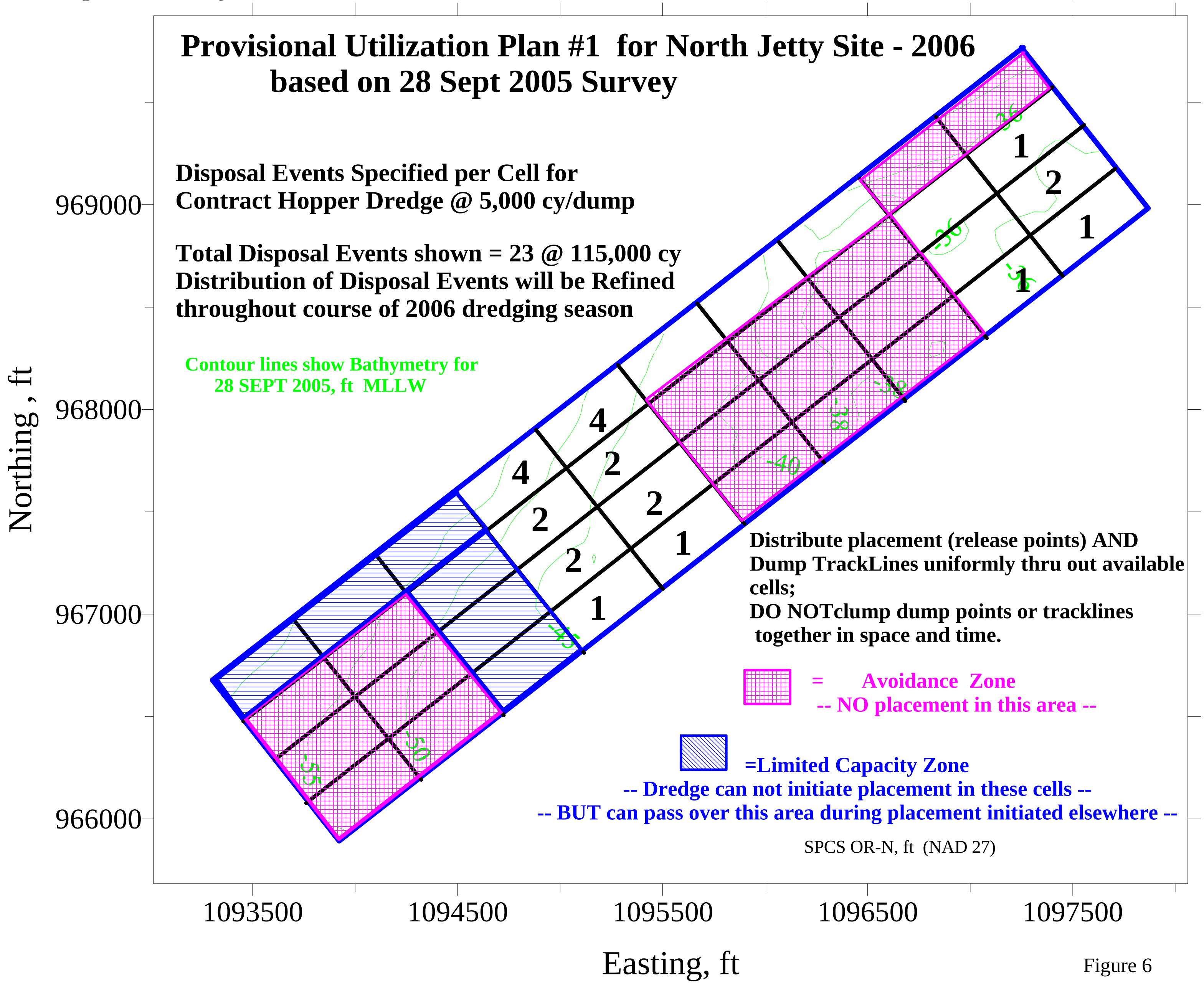

Provisional Utilization Plan #1 for North Jetty Site - 2006
based on 28 Sept 2005 Survey
Disposal Events Specified per Cell for
Contract Hopper Dredge @ 5,000 cy/dump
Total Disposal Events shown = 23 @ 115,000 cy
Distribution of Disposal Events will be Refined
throughout course of 2006 dredging season
Contour lines show Bathymetry for
28 SEPT 2005, ft MLLW
Distribute placement (release points) AND
Dump TrackLines uniformly thru out available
cells;
DO NOTclump dump points or tracklines
together in space and time.
= Avoidance Zone
-- NO placement in this area --
=Limited Capacity Zone
-- Dredge can not initiate placement in these cells --
-- BUT can pass over this area during placement initiated elsewhere --
SPCS OR-N, ft (NAD 27)
Northing , ft
969000
968000
967000
966000
1093500
1094500
1095500
1096500
1097500
Easting, ft

Figure 6

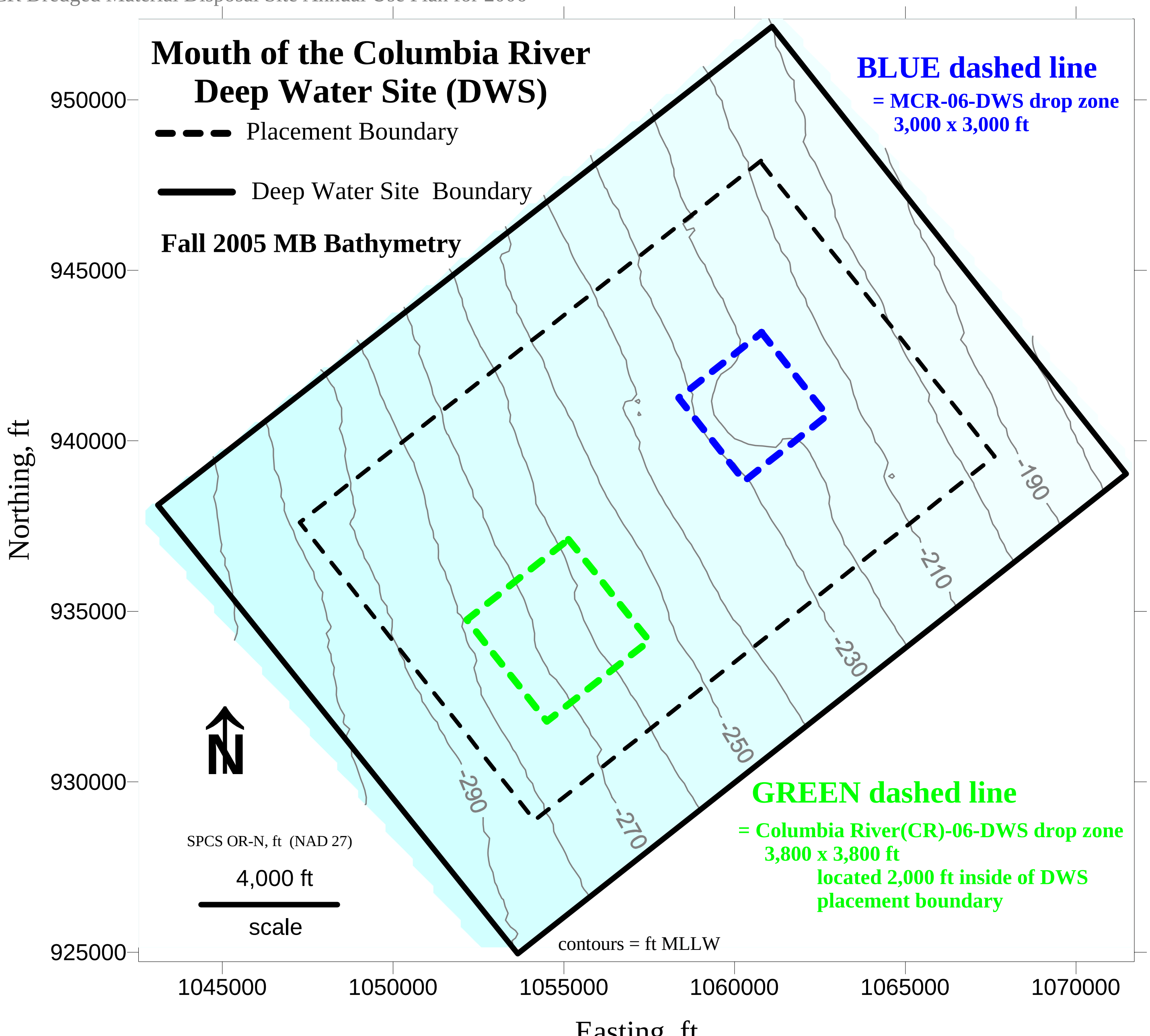
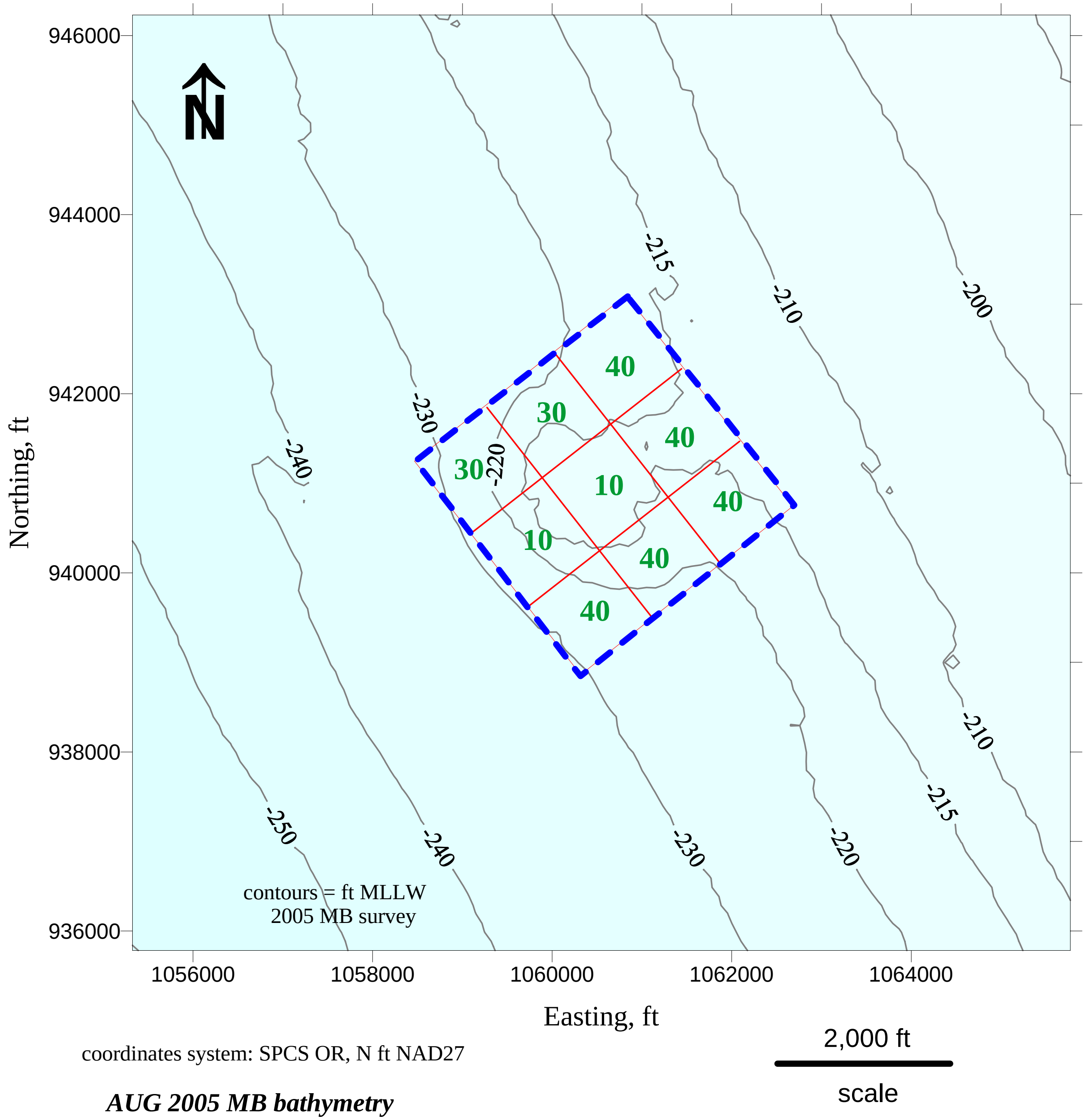

Mouth of the Columbia River
Deep Water Site (DWS)
Placement Boundary
Deep Water Site Boundary
Fall 2005 MB Bathymetry
BLUE dashed line
= MCR-06-DWS drop zone
3,000 x 3,000 ft
GREEN dashed line
= Columbia River(CR)-06-DWS drop zone
3,800 x 3,800 ft
located 2,000 ft inside of DWS
placement boundary
-190
-210
-230
-250
-270
-290
N
SPCS OR-N, ft (NAD 27)
4,000 ft
scale
contours = ft MLLW
Northing, ft
950000
945000
940000
935000
930000
925000
1045000
1050000
1055000
1060000
1065000
1070000
Easting, ft

Figure 7



coordinates system: SPCS OR, N ft NAD27

AUG 2005 MB bathymetry

Mouth of the Columbia River Deep Water Site (MCR-06-DWS)

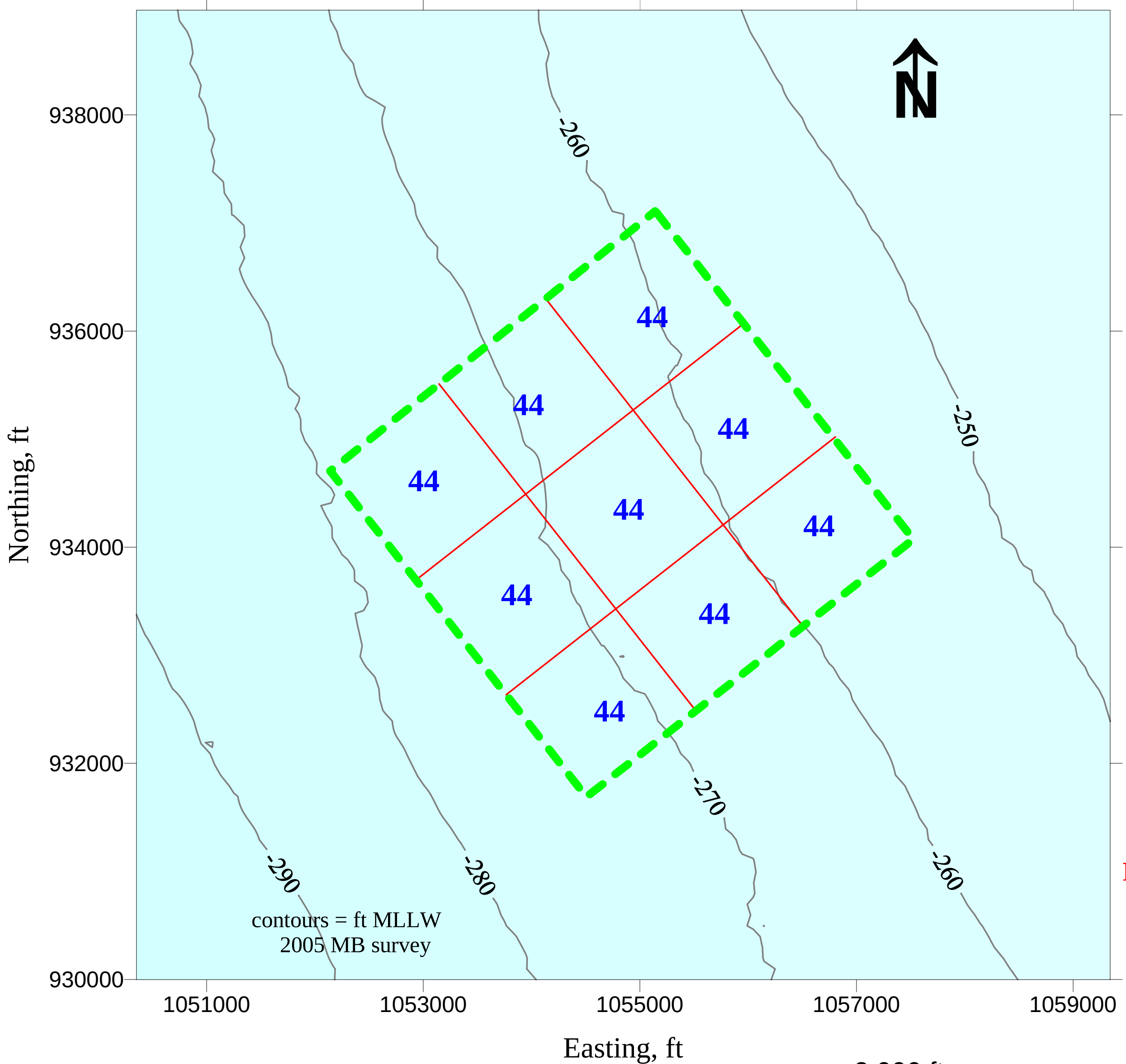
Utilization Plan #1 for MCR DWS: 2006

green cell assignments = GOVERNMENT dredge loads/cell at 5,000 cy/load = 1.5 MCY

Red Lines = grid (cells) used to control the placement of dredged material within the MCR DWS area - 1,000 x 1,000 ft ea.

dashed blue line = "MCR-06-DWS" Site drop zone is 3,000 x 3,000 ft

Figure 7a



coordinates system: SPCS OR, N ft NAD27

AUG 2005 bathymetry

Columbia River Deep Water Site (CR-06-DWS)

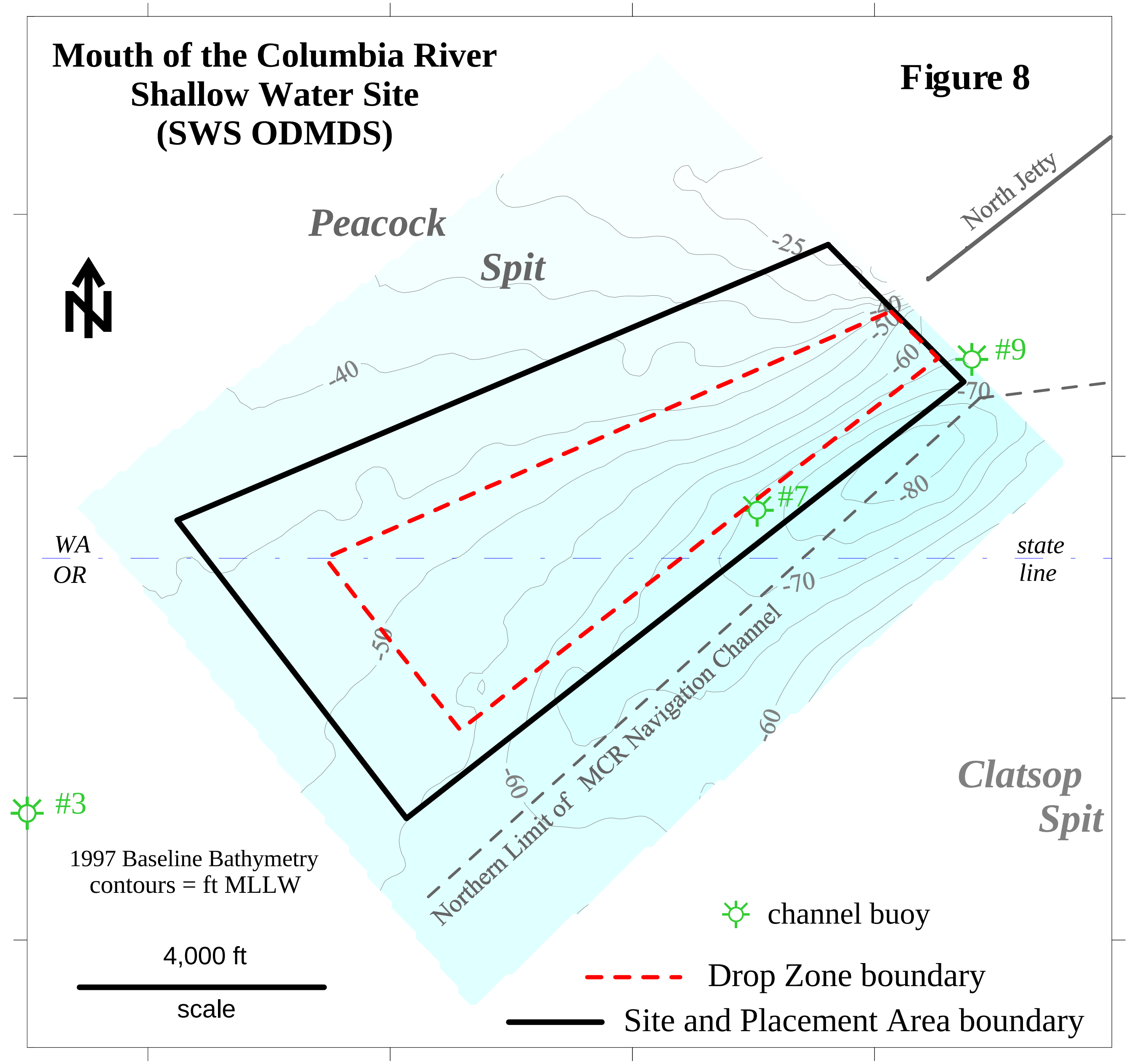
Utilization Plan #1 for CR DWS: 2006

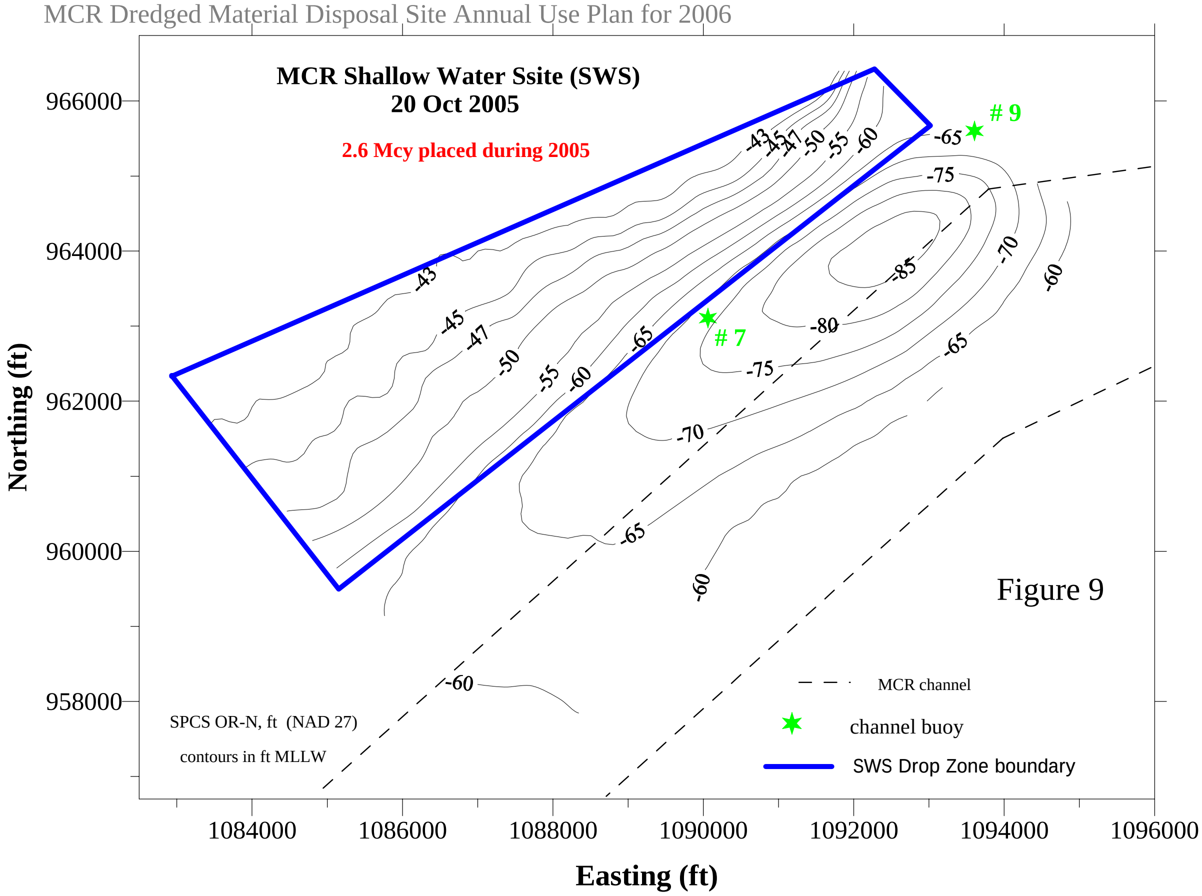
blue cell assignments = CONTRACT dredge loads/cell at 2,500 cy/load = 1 MCY

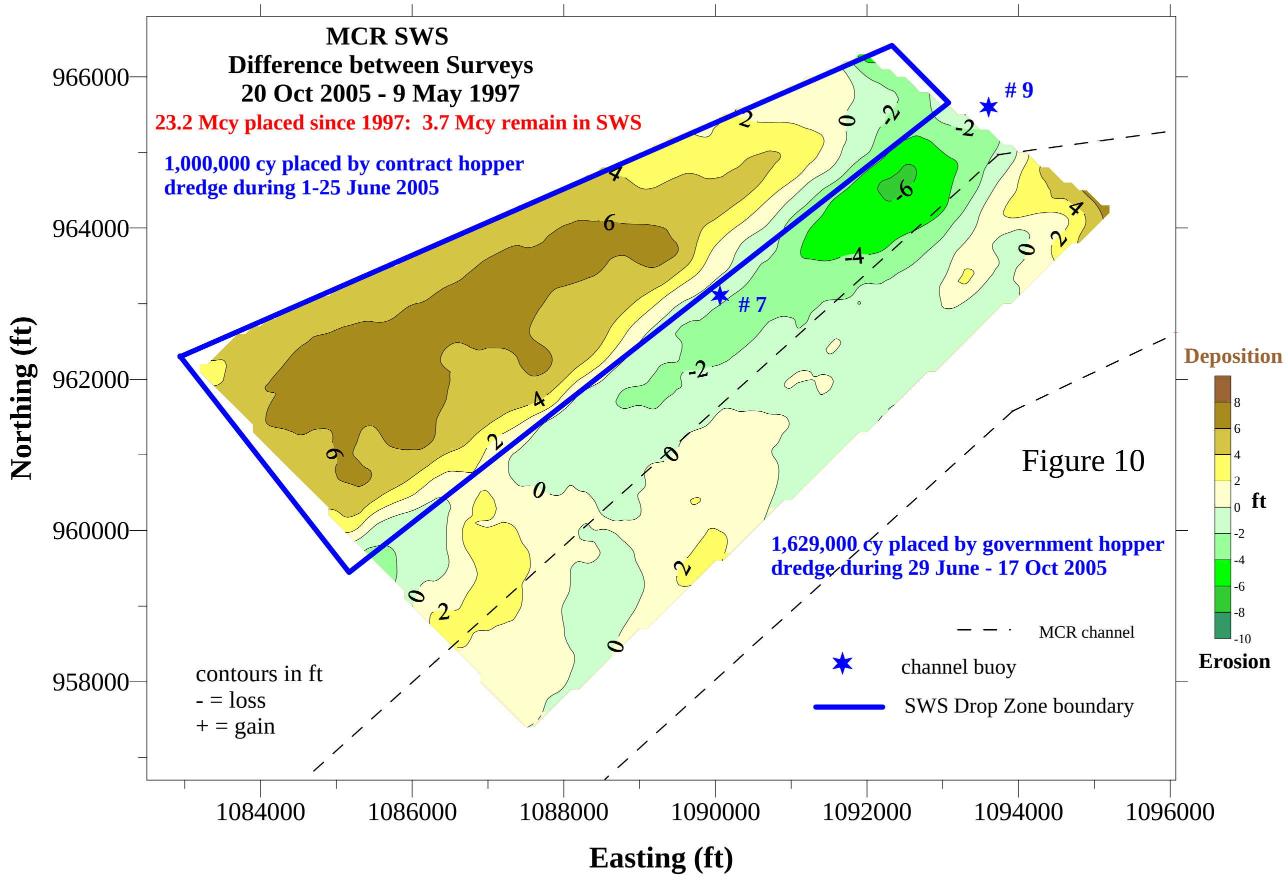
dashed GREEN line = Columbia River 2006 DWS drop zone 3,800 x 3,800 ft

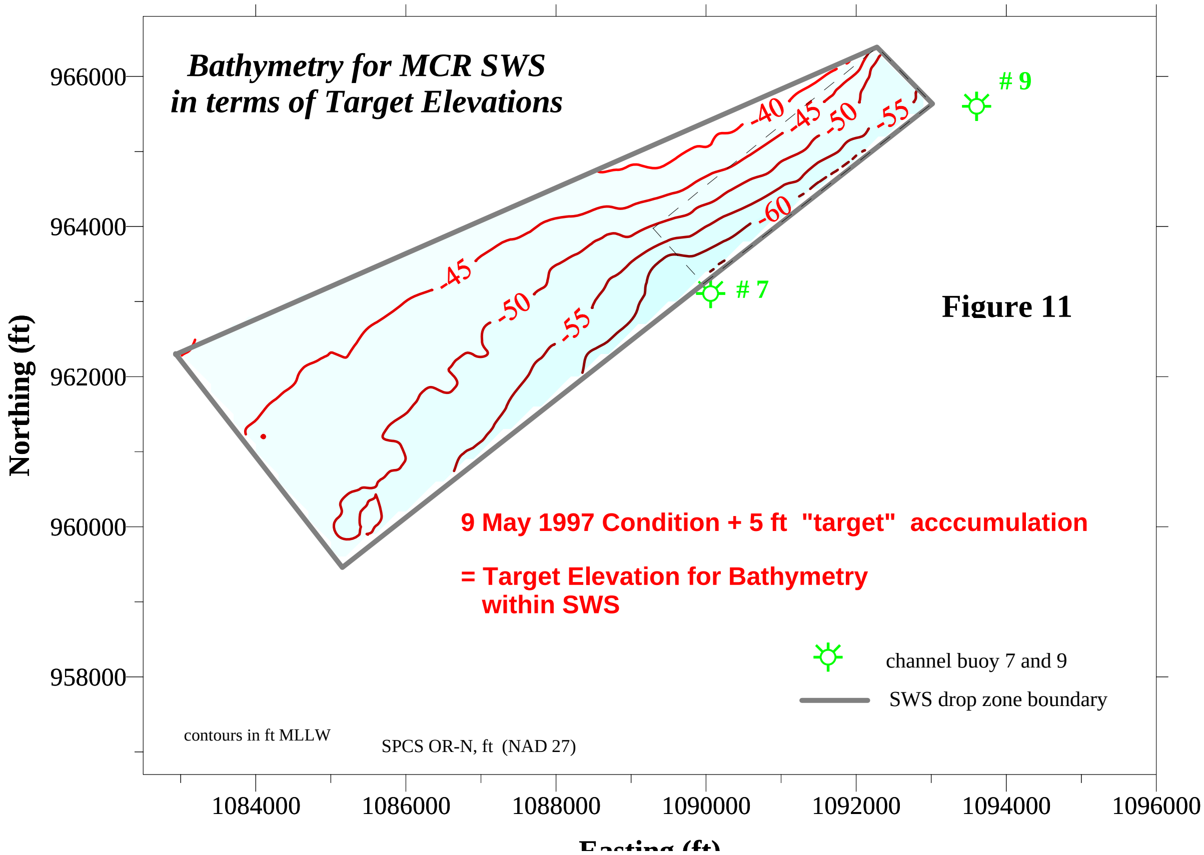
Red Lines = grid (cells) used to control the placement of dredged material within the CR-06-DWS placement area - 1,270 x 1,270 ft ea.

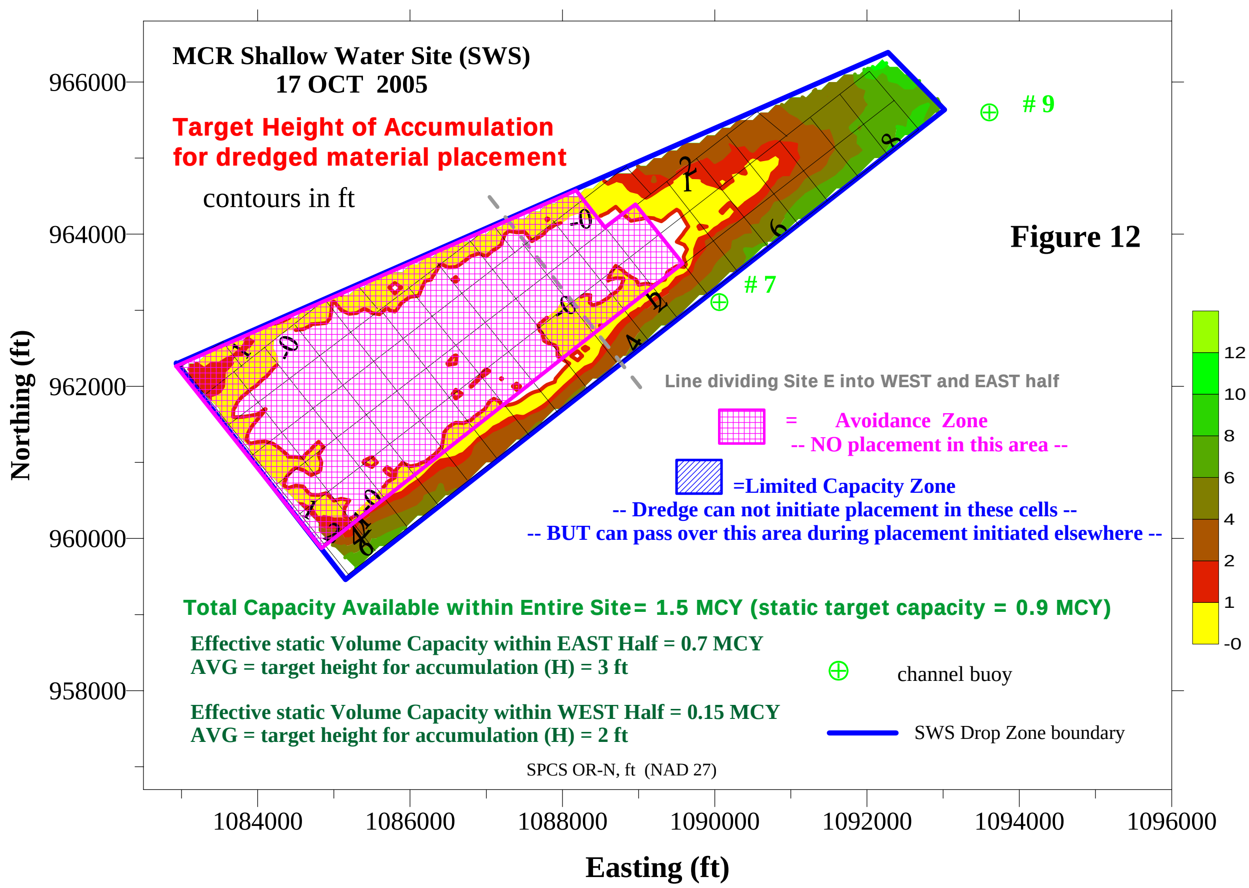
Figure 7b


Mouth of the Columbia River
Shallow Water Site
(SWS ODMDS)
Figure 8
Peacock
Spit
North Jetty
-25
-40
-50
-60
-70
-80
#9
#7
#3
WA
OR
state
line
Northern Limit of MCR Navigation Channel
Clatsop
Spit
1997 Baseline Bathymetry
contours = ft MLLW
4,000 ft
scale
channel buoy
Drop Zone boundary
Site and Placement Area boundary


MCR Shallow Water Ssite (SWS)
20 Oct 2005
2.6 Mcy placed during 2005
9
7
Figure 9
MCR channel
channel buoy
SWS Drop Zone boundary
SPCS OR-N, ft (NAD 27)
contours in ft MLLW
Northing (ft)
Easting (ft)


MCR SWS
Difference between Surveys
20 Oct 2005 - 9 May 1997
23.2 Mcy placed since 1997: 3.7 Mcy remain in SWS
1,000,000 cy placed by contract hopper dredge during 1-25 June 2005
9
7
Figure 10
1,629,000 cy placed by government hopper dredge during 29 June - 17 Oct 2005
MCR channel
channel buoy
SWS Drop Zone boundary
contours in ft
- = loss
+ = gain
Deposition
ft
Erosion
Northing (ft)
Easting (ft)


Bathymetry for MCR SWS
in terms of Target Elevations
Figure 11
9 May 1997 Condition + 5 ft "target" acccumulation
= Target Elevation for Bathymetry
within SWS
channel buoy 7 and 9
SWS drop zone boundary
contours in ft MLLW
SPCS OR-N, ft (NAD 27)
Northing (ft)
Easting (ft)
9
7
-40
-45
-50
-55
-60
966000
964000
962000
960000
958000
1084000
1086000
1088000
1090000
1092000
1094000
1096000


MCR Shallow Water Site (SWS)
17 OCT 2005
Target Height of Accumulation
for dredged material placement
contours in ft
Figure 12
Line dividing Site E into WEST and EAST half
= Avoidance Zone
-- NO placement in this area --
=Limited Capacity Zone
-- Dredge can not initiate placement in these cells --
-- BUT can pass over this area during placement initiated elsewhere --
Total Capacity Available within Entire Site= 1.5 MCY (static target capacity = 0.9 MCY)
Effective static Volume Capacity within EAST Half = 0.7 MCY
AVG = target height for accumulation (H) = 3 ft
Effective static Volume Capacity within WEST Half = 0.15 MCY
AVG = target height for accumulation (H) = 2 ft
channel buoy
SWS Drop Zone boundary
SPCS OR-N, ft (NAD 27)
Northing (ft)
Easting (ft)
9
7
12
10
8
6
4
2
1
-0
966000
964000
962000
960000
958000
1084000
1086000
1088000
1090000
1092000
1094000
1096000

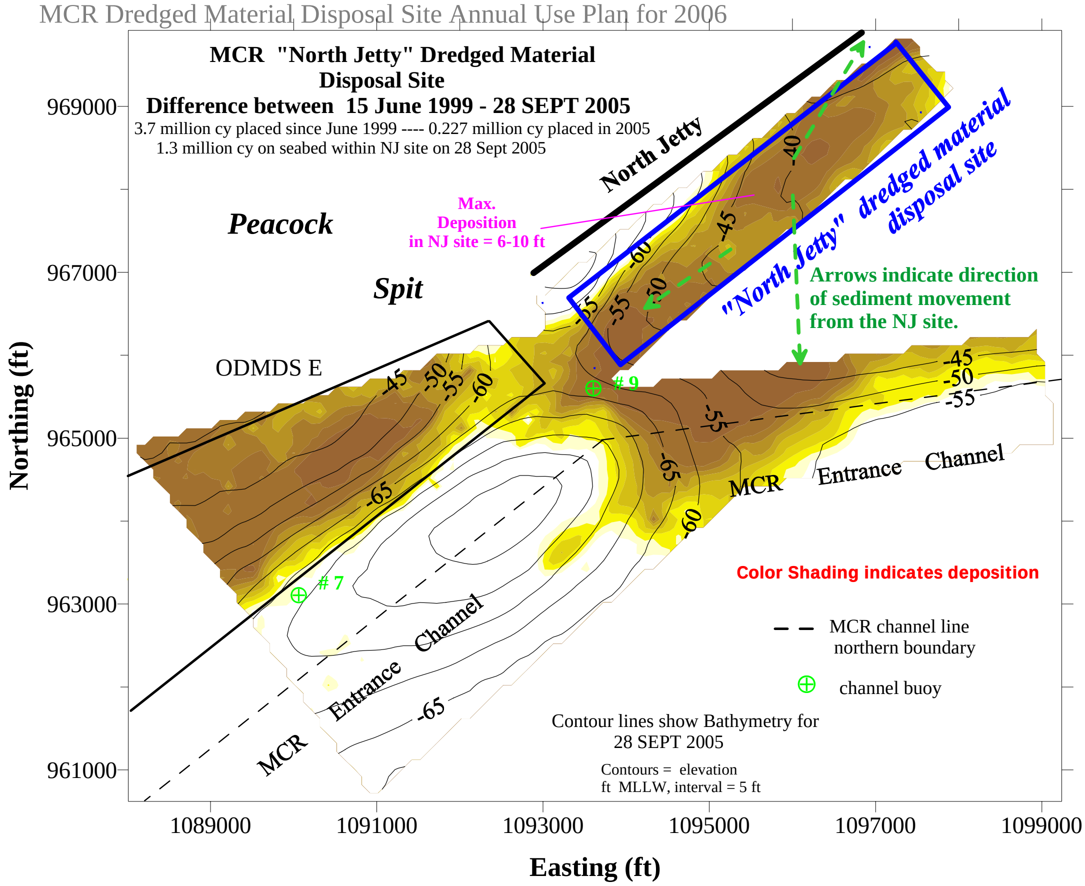


Figure 13

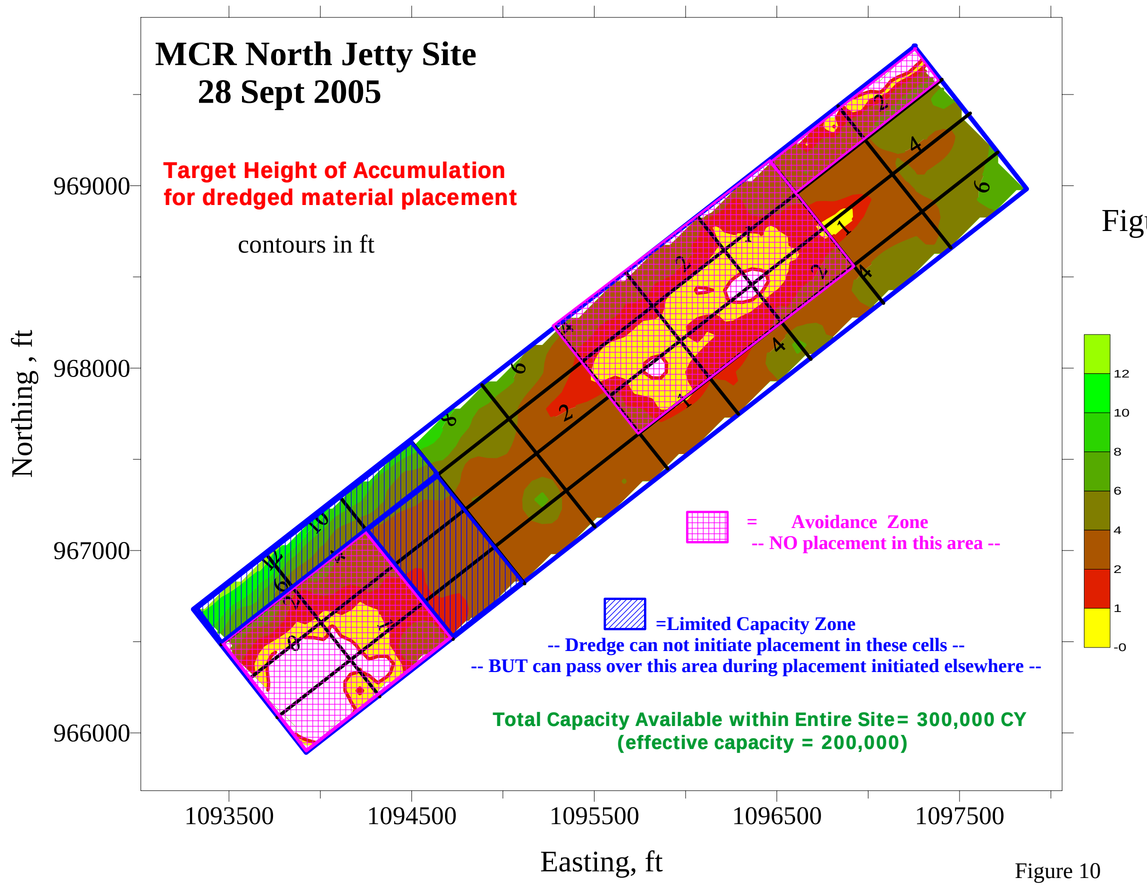


Figure 14

Figure 10

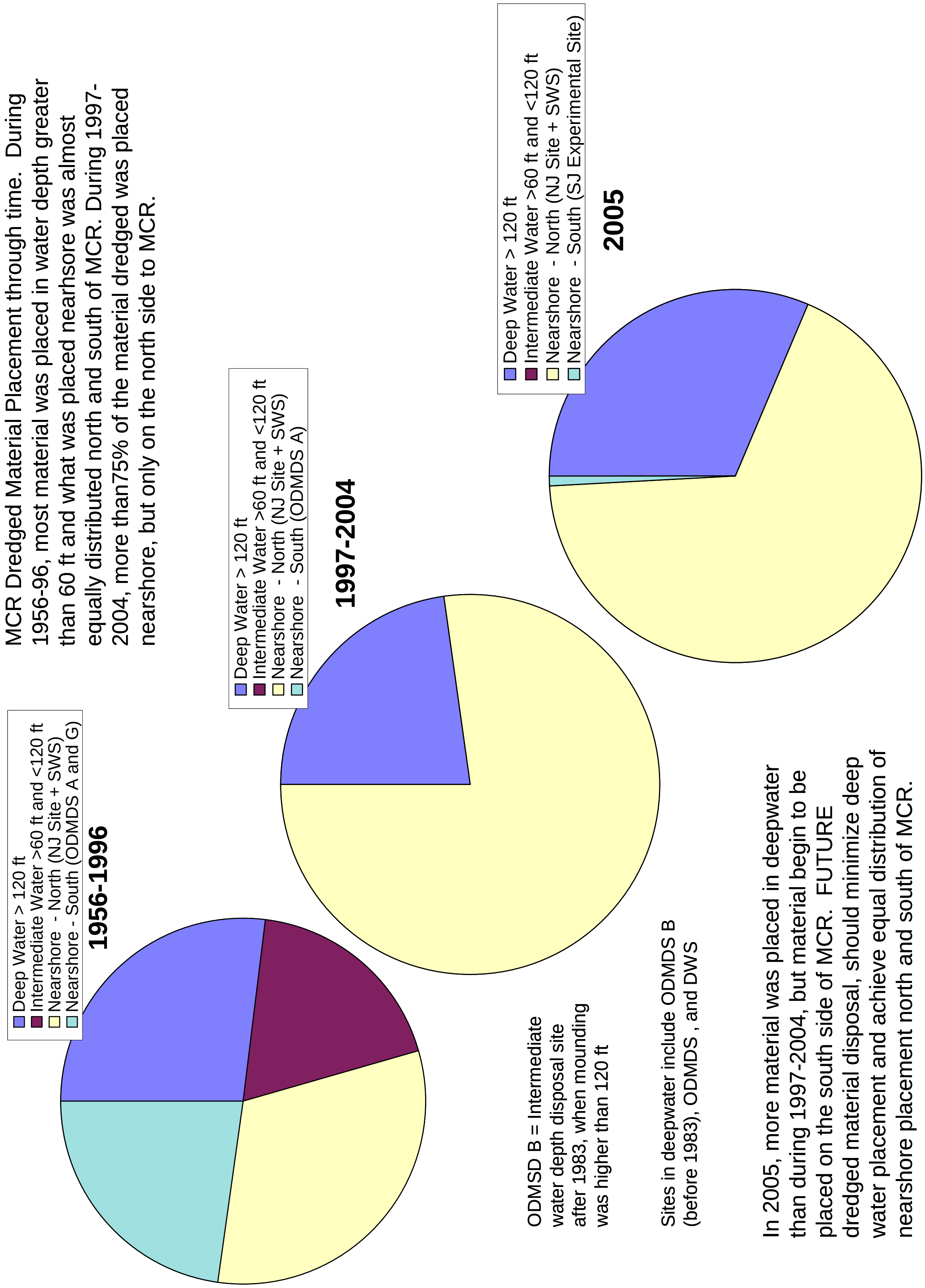
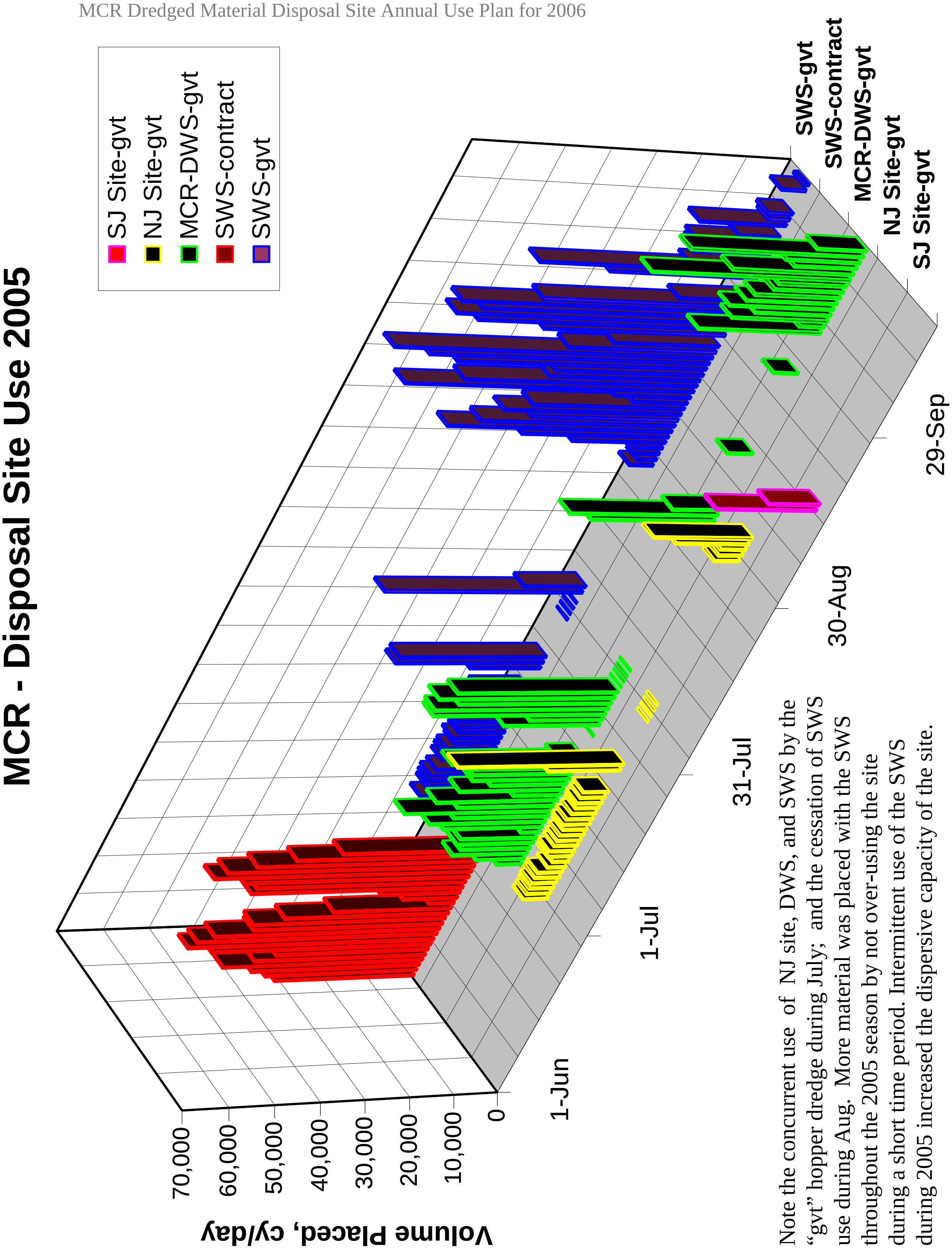

MCR Dredged Material Placement through time. During 1956-96, most material was placed in water depth greater than 60 ft and what was placed nearhsore was almost equally distributed north and south of MCR. During 1997-2004, more than75% of the material dredged was placed nearshore, but only on the north side to MCR.
1956-1996
Deep Water > 120 ft
Intermediate Water >60 ft and <120 ft
Nearshore - North (NJ Site + SWS)
Nearshore - South (ODMDS A and G)
1997-2004
Deep Water > 120 ft
Intermediate Water >60 ft and <120 ft
Nearshore - North (NJ Site + SWS)
Nearshore - South (ODMDS A)
2005
Deep Water > 120 ft
Intermediate Water >60 ft and <120 ft
Nearshore - North (NJ Site + SWS)
Nearshore - South (SJ Experimental Site)
ODMSD B = Intermediate water depth disposal site after 1983, when mounding was higher than 120 ft
Sites in deepwater include ODMDS B (before 1983), ODMDS , and DWS
In 2005, more material was placed in deepwater than during 1997-2004, but material begin to be placed on the south side of MCR. FUTURE dredged material disposal, should minimize deep water placement and achieve equal distribution of nearshore placement north and south of MCR.

Figure 15



Note the concurrent use of NJ site, DWS, and SWS by the "gvt" hopper dredge during July; and the cessation of SWS use during Aug. More material was placed with the SWS throughout the 2005 season by not over-using the site during a short time period. Intermittent use of the SWS during 2005 increased the dispersive capacity of the site.

Figure 16

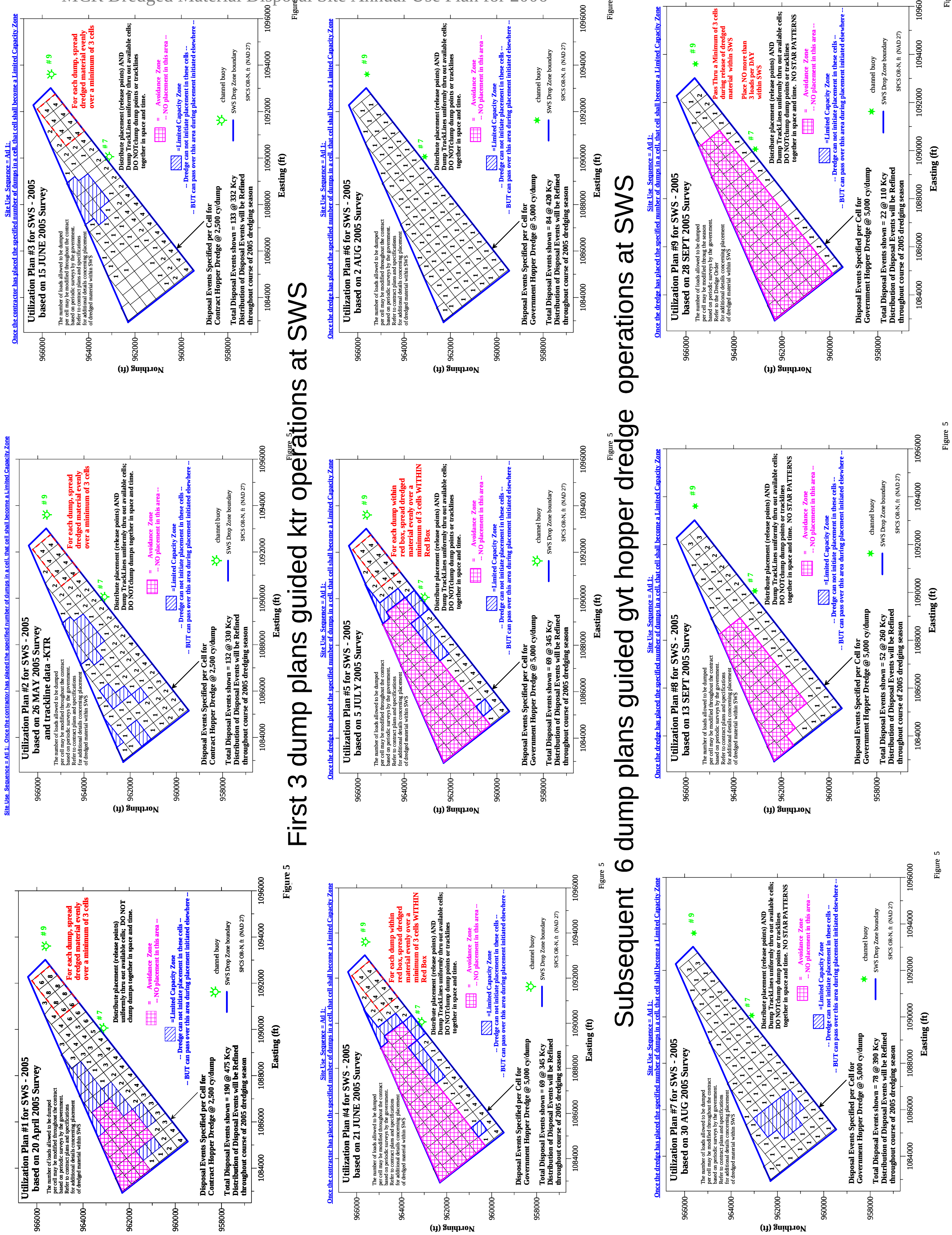

First 3 dump plans guided ktr operations at SWS
Subsequent 6 dump plans guided gvt hopper dredge operations at SWS
Utilization Plan #1 for SWS - 2005 based on 20 April 2005 Survey
Utilization Plan #2 for SWS - 2005 based on 26 MAY 2005 Survey and trackline data -KTR
Utilization Plan #3 for SWS - 2005 based on 15 JUNE 2005 Survey
Utilization Plan #4 for SWS - 2005 based on 21 JUNE 2005 Survey
Utilization Plan #5 for SWS - 2005 based on 5 JULY 2005 Survey
Utilization Plan #6 for SWS - 2005 based on 2 AUG 2005 Survey
Utilization Plan #7 for SWS - 2005 based on 30 AUG 2005 Survey
Utilization Plan #8 for SWS - 2005 based on 13 SEPT 2005 Survey
Utilization Plan #9 for SWS - 2005 based on 28 SEPT 2005 Survey
Easting (ft)
Northing (ft)

Figure 17

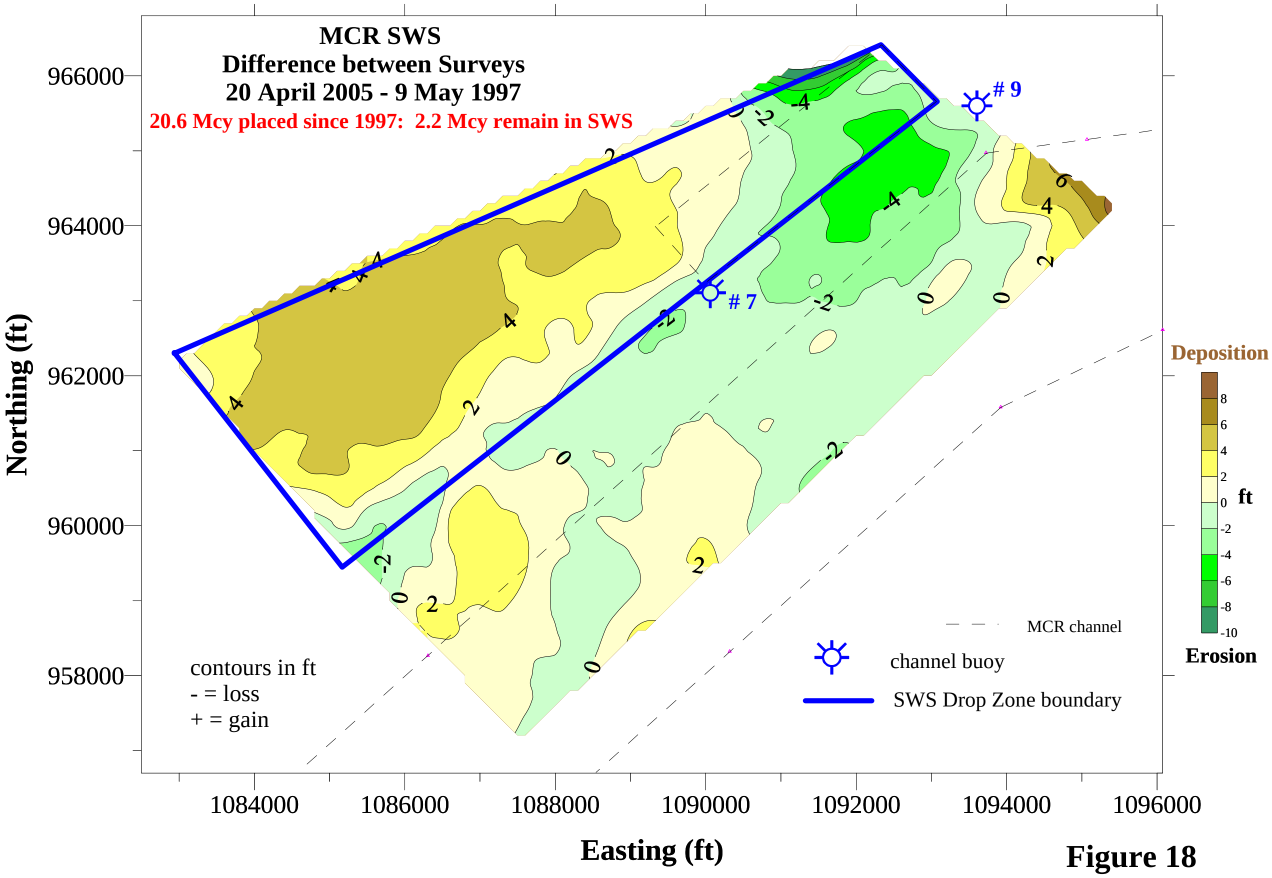


Figure 18

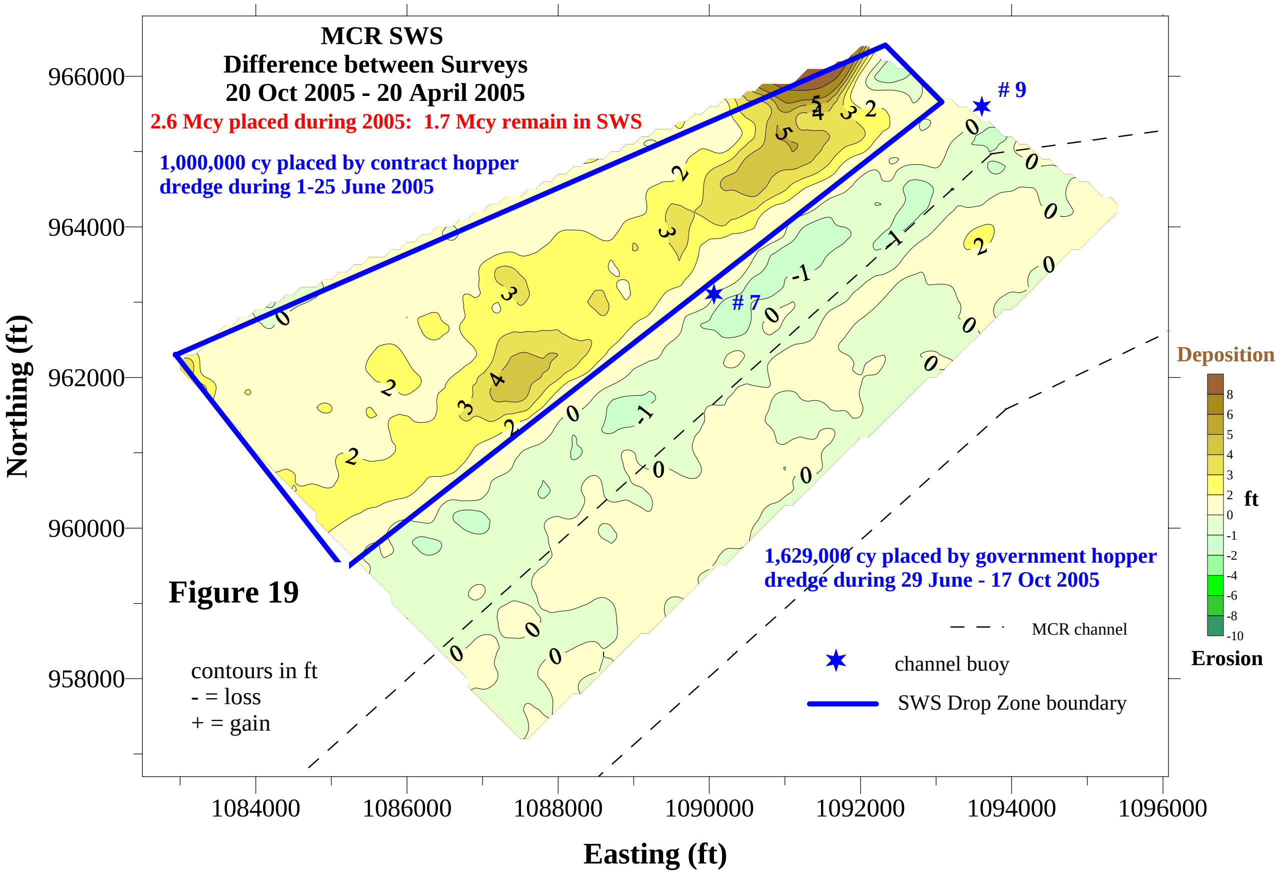


Figure 19

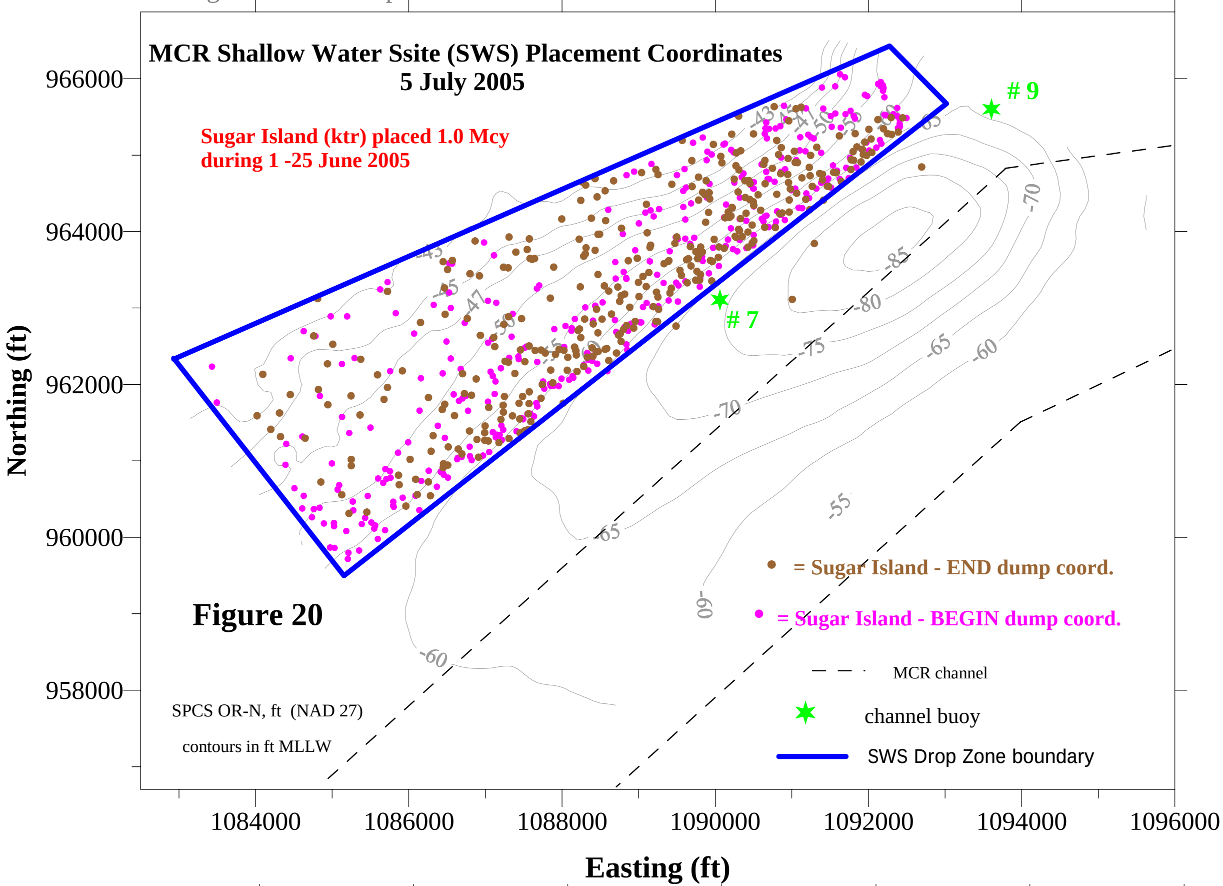


Figure 20

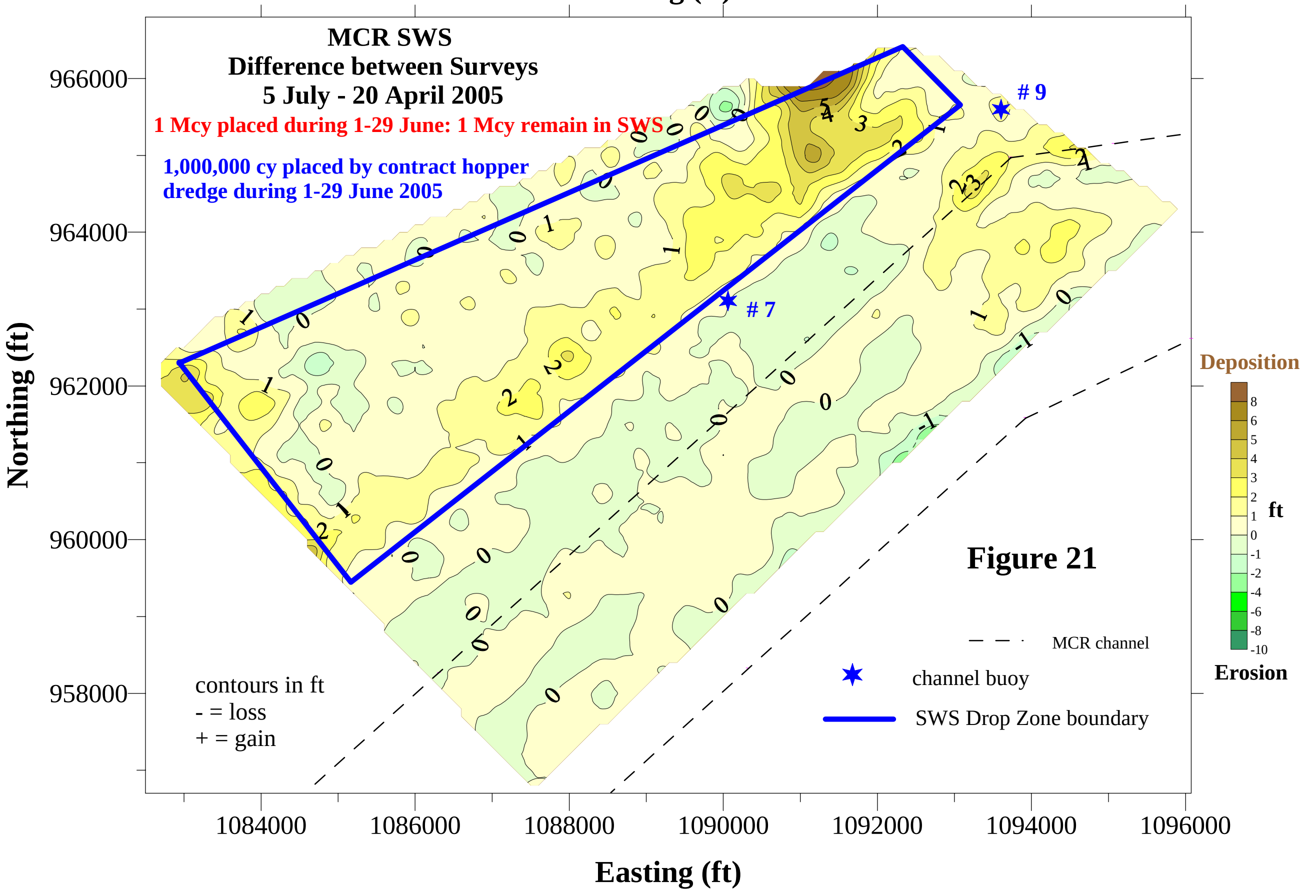
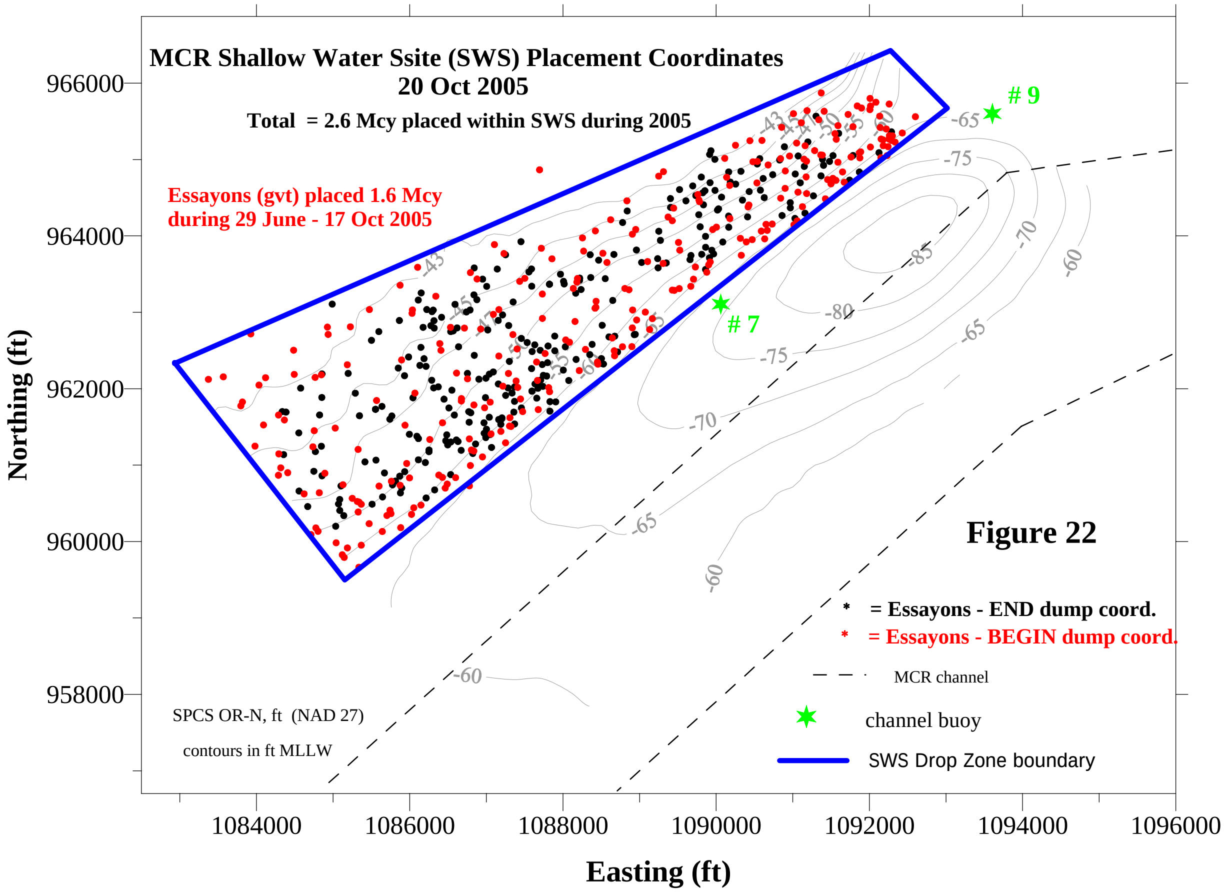
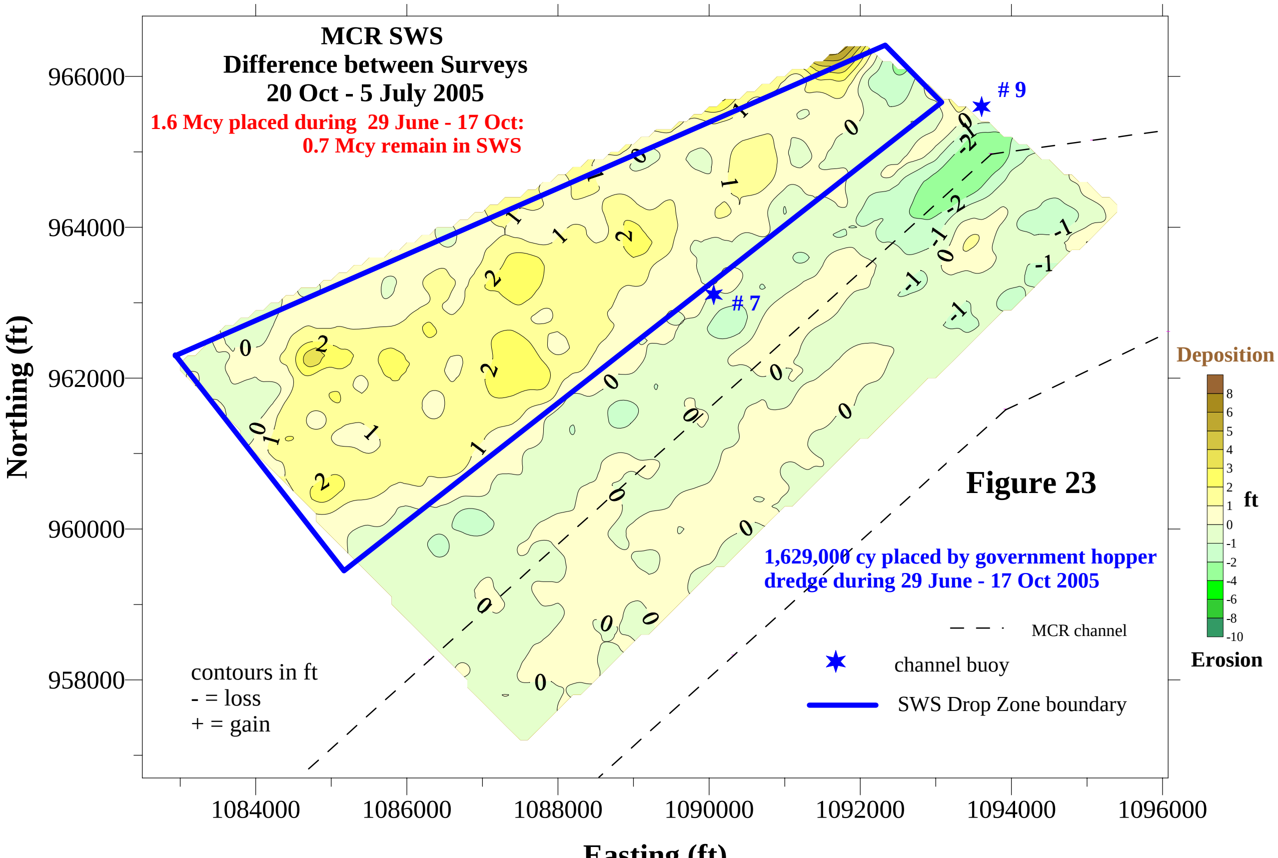
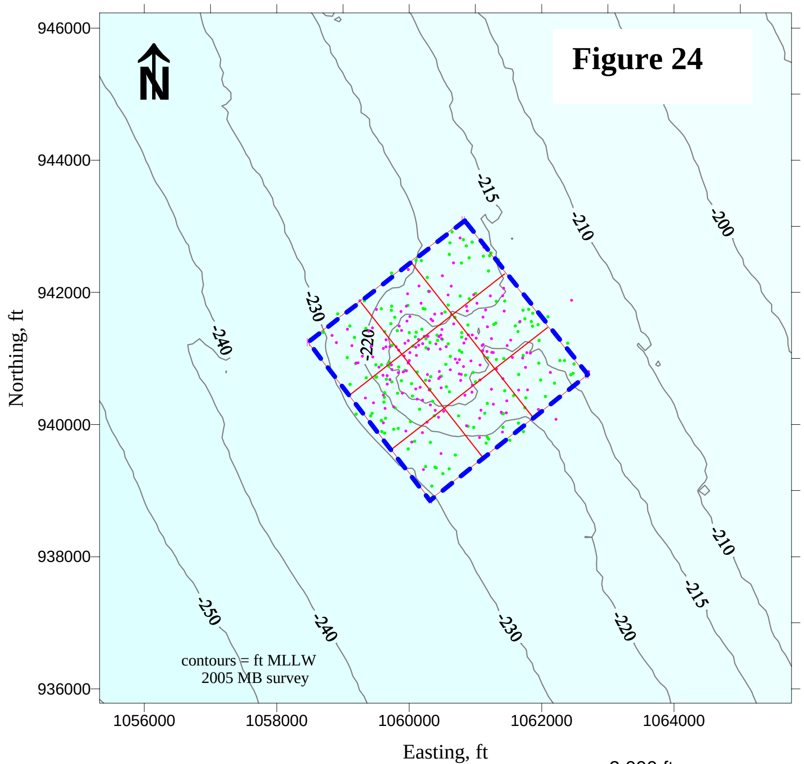


Figure 21


MCR Shallow Water Ssite (SWS) Placement Coordinates
20 Oct 2005
Total = 2.6 Mcy placed within SWS during 2005
Essayons (gvt) placed 1.6 Mcy
during 29 June - 17 Oct 2005
9
7
Figure 22
* = Essayons - END dump coord.
* = Essayons - BEGIN dump coord.
MCR channel
channel buoy
SWS Drop Zone boundary
SPCS OR-N, ft (NAD 27)
contours in ft MLLW
Northing (ft)
Easting (ft)
966000
964000
962000
960000
958000
1084000
1086000
1088000
1090000
1092000
1094000
1096000


MCR SWS
Difference between Surveys
20 Oct - 5 July 2005
1.6 Mcy placed during 29 June - 17 Oct:
0.7 Mcy remain in SWS
9
7
Figure 23
1,629,000 cy placed by government hopper
dredge during 29 June - 17 Oct 2005
MCR channel
channel buoy
SWS Drop Zone boundary
contours in ft
- = loss
+ = gain
Deposition
Erosion
ft
Northing (ft)
Easting (ft)
966000
964000
962000
960000
958000
1084000
1086000
1088000
1090000
1092000
1094000
1096000



coordinates system: SPCS OR, N ft NAD27

2,000 ft
scale

Mouth of the Columbia River
Deep Water Site
(MCR-05-DWS)

August 2005

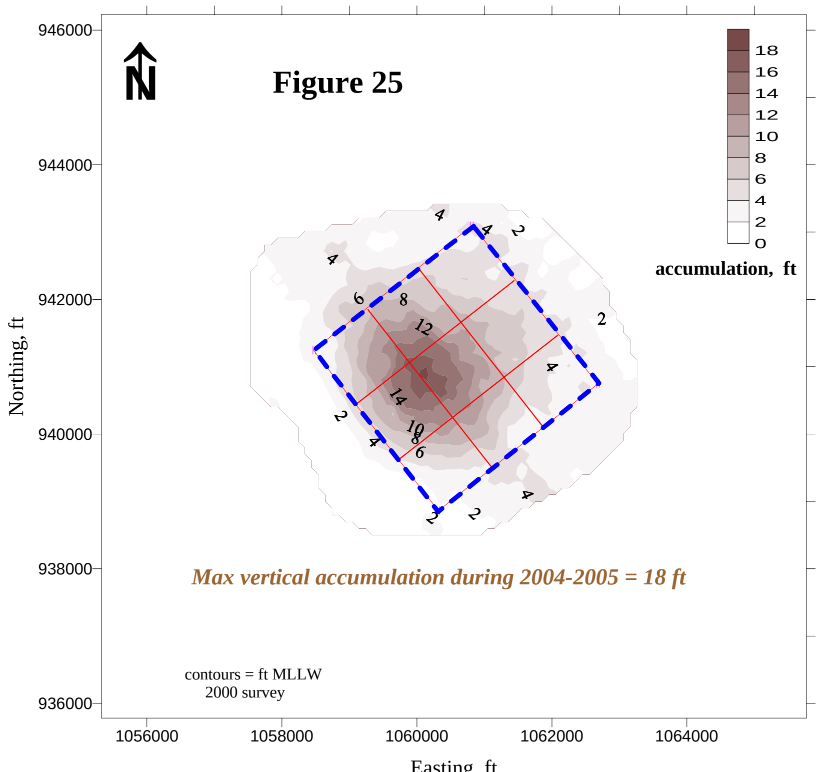
Volume of MCR dredged material placed during July - Oct 05 = 1.04 million cy

dashed blue line = "MCR-05-DWS" Site drop zone is 3,000 x 3,000 ft

Red Lines = grid (cells) used to control the placement of dredged material within the MCR DWS area - 1,000 x 1,000 ft ea.

• = Beginning dump coord. - Essaysons

• = Ending dump coord. - Essaysons



coordinates system: SPCS OR, N ft NAD27

2,000 ft
scale

Mouth of the Columbia River
Deep Water Site
(MCR-05-DWS)

Difference Between Suveys
29 June 2004 - 1 Sept 2005

Volume of dredged material placed during July - Nov 04 = 1.7 million cy

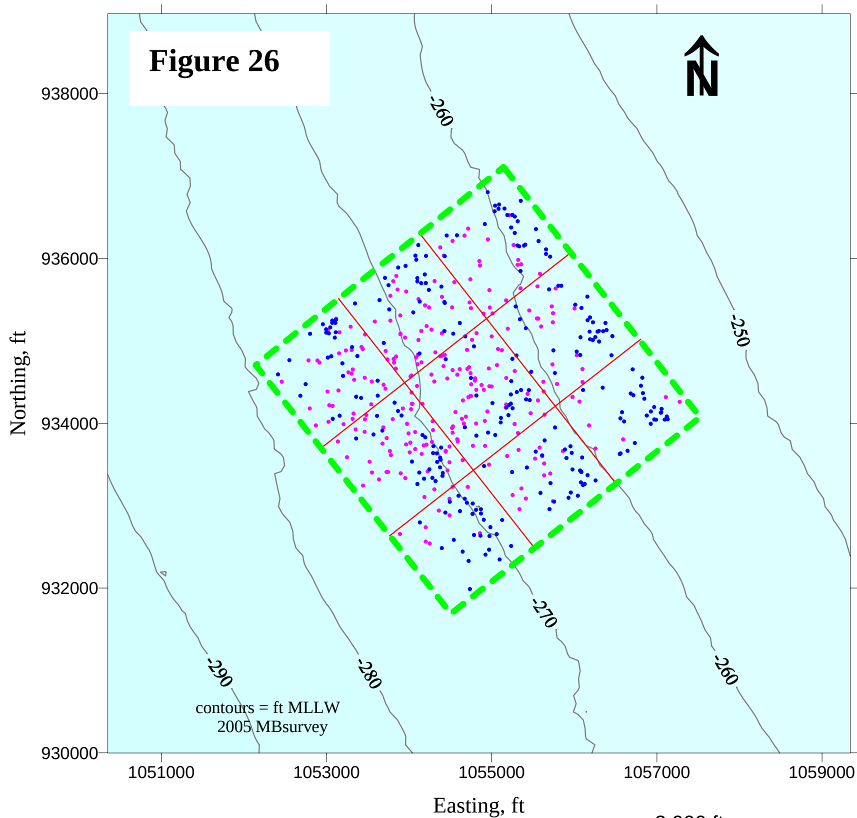
Volume of dredged material placed during July - Sept 05 = 0.7 million cy

Volume of deposition = 2.8 million cy

Red Lines = grid (cells) used to control the placement of dredged material within the DWS 103 area - 1,000 x 1,000 ft ea.

dashed blue line = "MCR-05-DWS" Site drop zone is 3,000 x 3,000 ft

Figure 26



Columbia River Deep Water Site (CR-05-DWS)

August 2005

Volume of CRCI dredged material placed during July - Oct 05 = 1.32 million cy

dashed GREEN line = Columbia River 2005 DWS drop zone 3,800 x 3,800 ft

Red Lines = grid (cells) used to control the placement of dredged material within the CR-05-DWS placement area - 1,270 x 1,270 ft ea.

coordinates system: SPCS OR, N ft NAD27

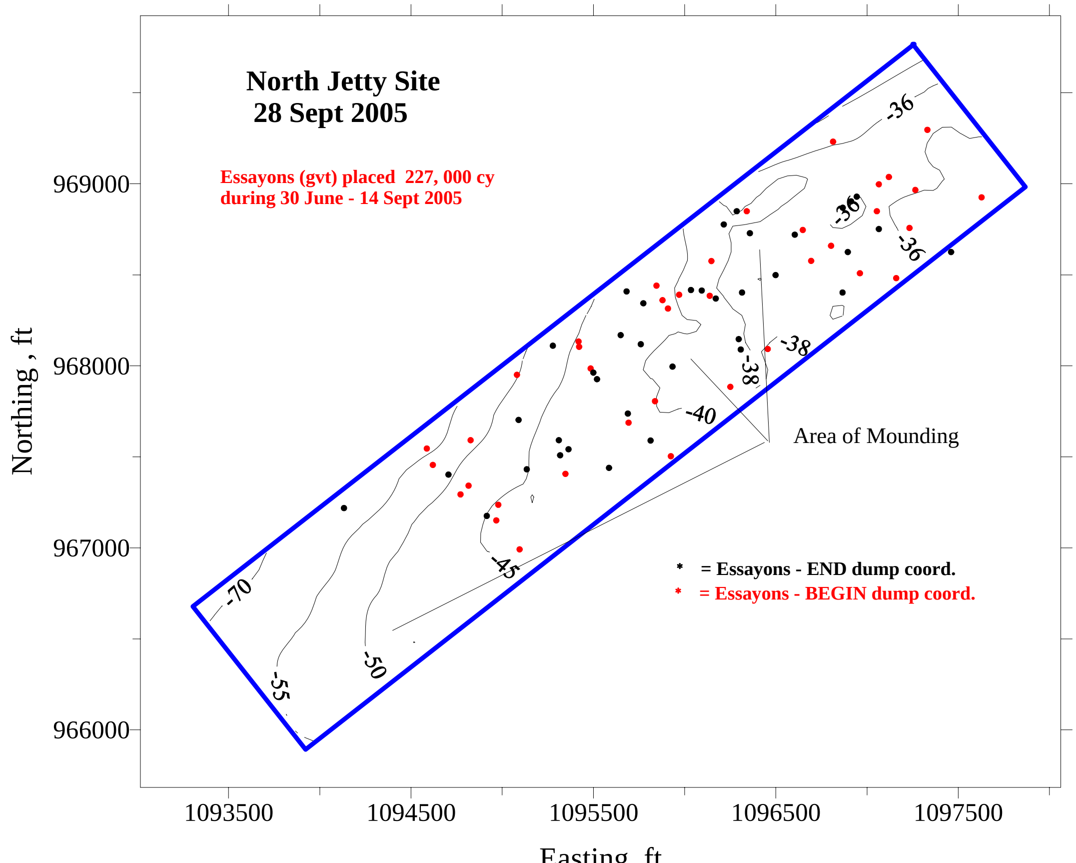
AUG 2005 bathymetry

2,000 ft
scale

• = Beginning dump coord. - Sugar Island (ktr)

• = Ending dump coord. - Sugar Island (ktr)

Figure 27



North Jetty Site
28 Sept 2005

Essayons (gvt) placed 227, 000 cy during 30 June - 14 Sept 2005

*** = Essayons - END dump coord.**
*** = Essayons - BEGIN dump coord.**

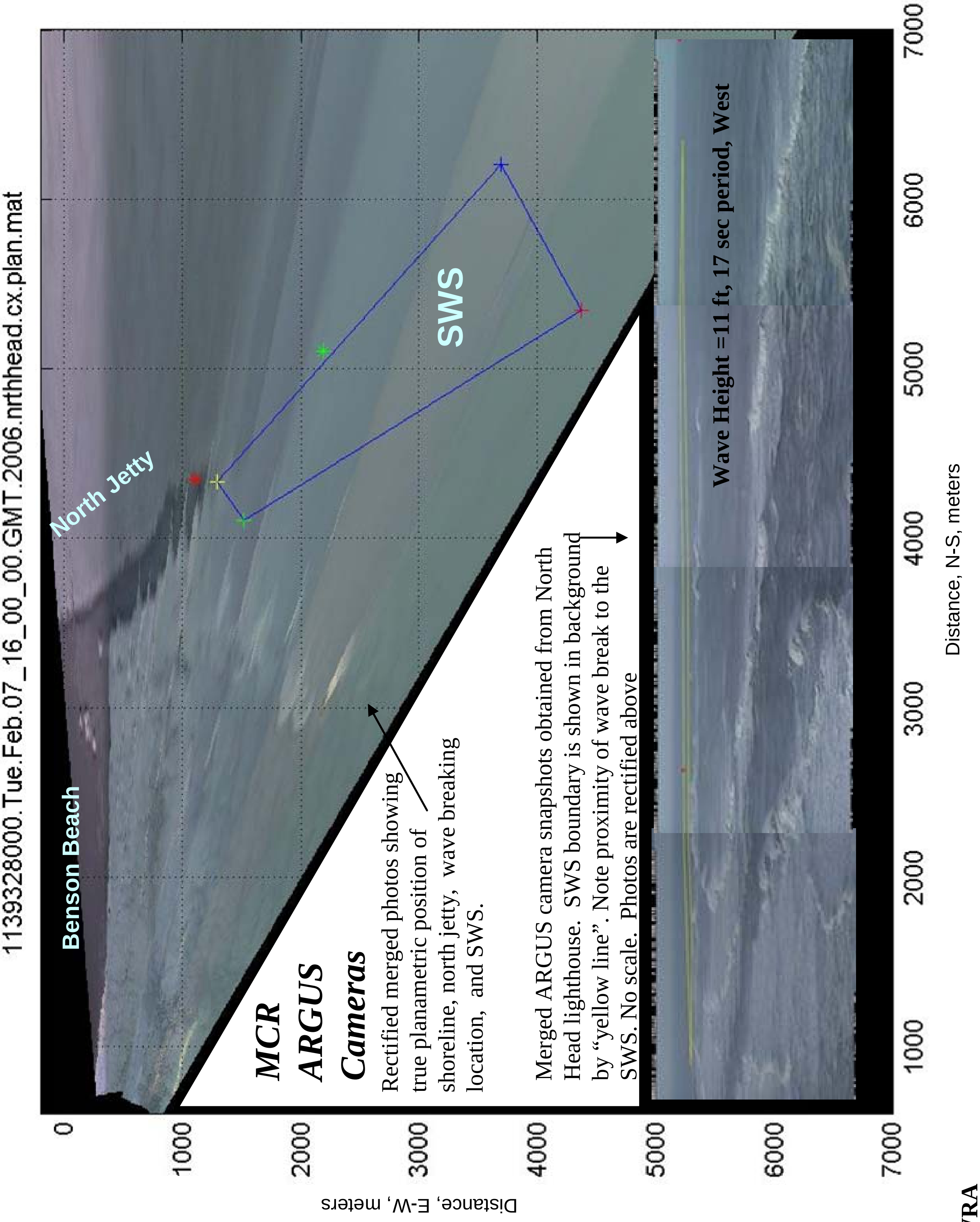

1139328000.Tue.Feb.07_16_00_00.GMT.2006.nrthhead.cx.plan.mat
Benson Beach
North Jetty
SWS
MCR
ARGUS
Cameras
Rectified merged photos showing true planametric position of shoreline, north jetty, wave breaking location, and SWS.
Merged ARGUS camera snapshots obtained from North Head lighthouse. SWS boundary is shown in background by "yellow line". Note proximity of wave break to the SWS. No scale. Photos are rectified above
Wave Height =11 ft, 17 sec period, West
Distance, N-S, meters
Distance, E-W, meters
1000
2000
3000
4000
5000
6000
7000
0
NWRA

Figure 28

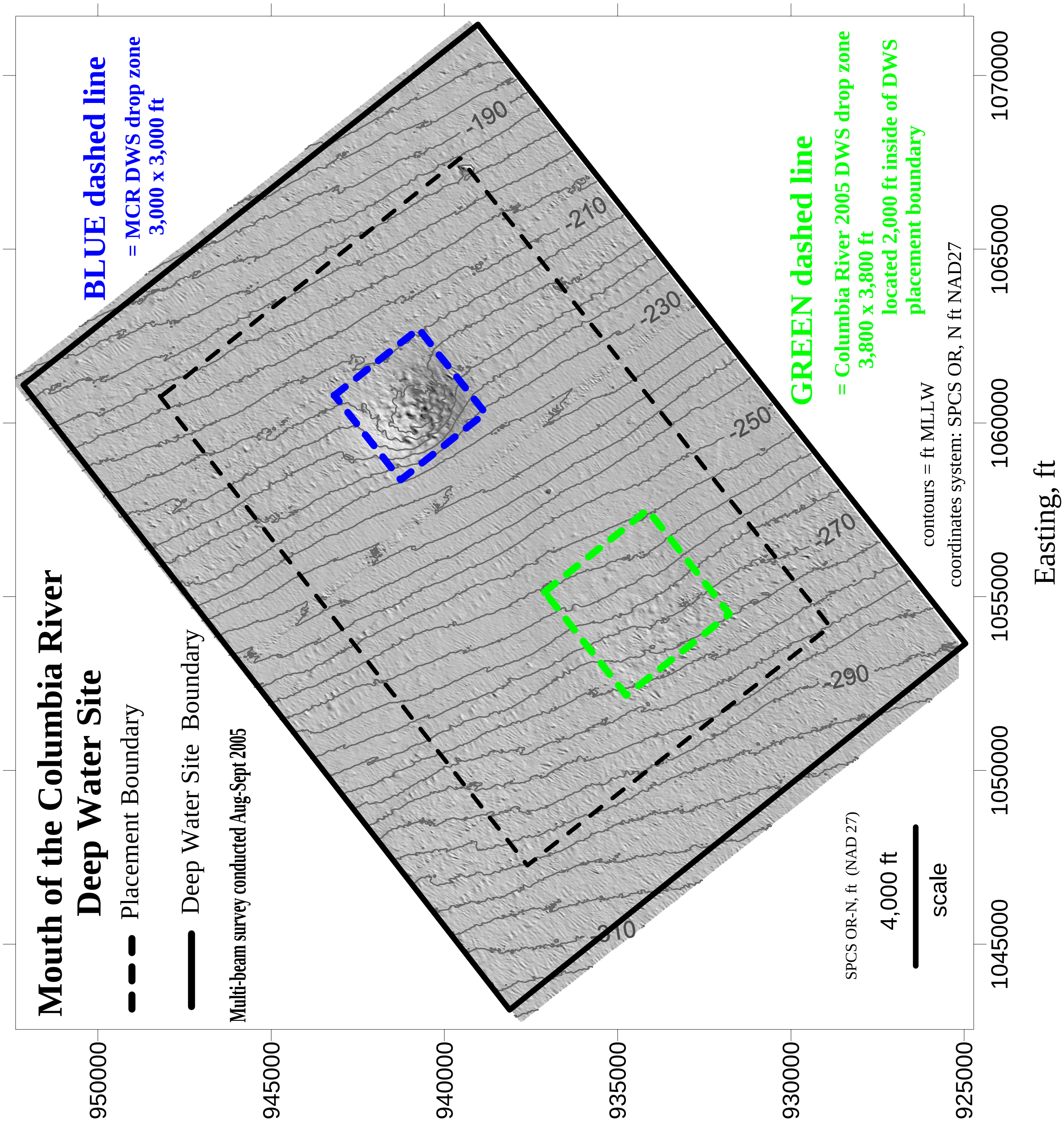
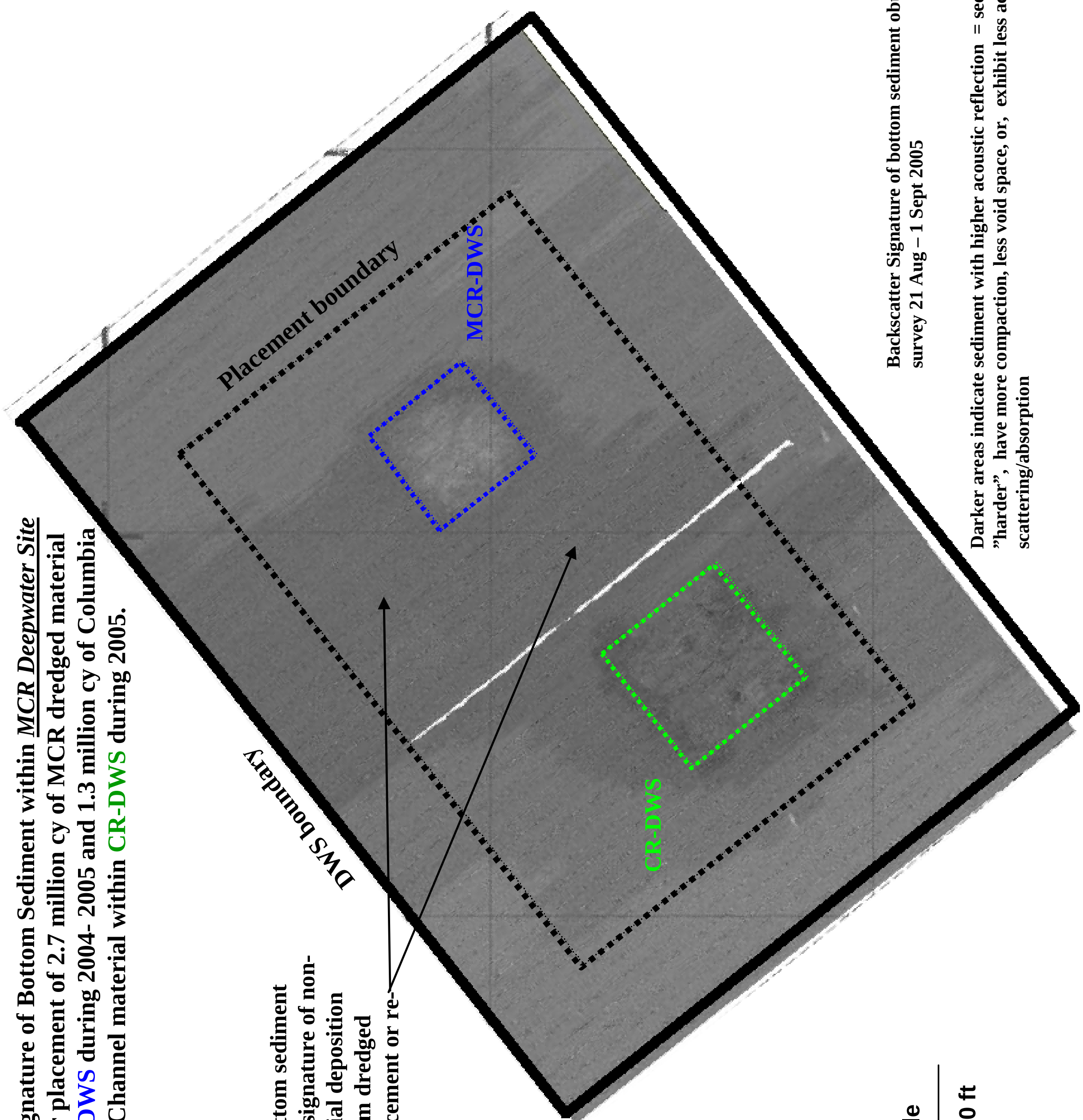

Mouth of the Columbia River
Deep Water Site
Placement Boundary
Deep Water Site Boundary
Multi-beam survey conducted Aug-Sept 2005
BLUE dashed line
= MCR DWS drop zone
3,000 x 3,000 ft
GREEN dashed line
= Columbia River 2005 DWS drop zone
3,800 x 3,800 ft
located 2,000 ft inside of DWS
placement boundary
contours = ft MLLW
coordinates system: SPCS OR, N ft NAD27
SPCS OR-N, ft (NAD 27)
4,000 ft
scale
-190
-210
-230
-250
-270
-290
-310
Easting, ft
1045000
1050000
1055000
1060000
1065000
1070000
Northing, ft
950000
945000
940000
935000
930000
925000

Figure 29

Backscatter Signature of Bottom Sediment within *MCR Deepwater Site (DWS)*. After placement of 2.7 million cy of MCR dredged material within MCR-DWS during 2004- 2005 and 1.3 million cy of Columbia River Channel material within CR-DWS during 2005.

Backscatter Signature of bottom sediment obtained Multi-beam survey 21 Aug – 1 Sept 2005

Darker areas indicate sediment with higher acoustic reflection = sediment may be "harder", have more compaction, less void space, or, exhibit less acoustic scattering/absorption



Potential bottom sediment backscatter signature of non-insitu material deposition resulting from dredged material placement or re-suspension

Scale
3,000 ft

Figure 30

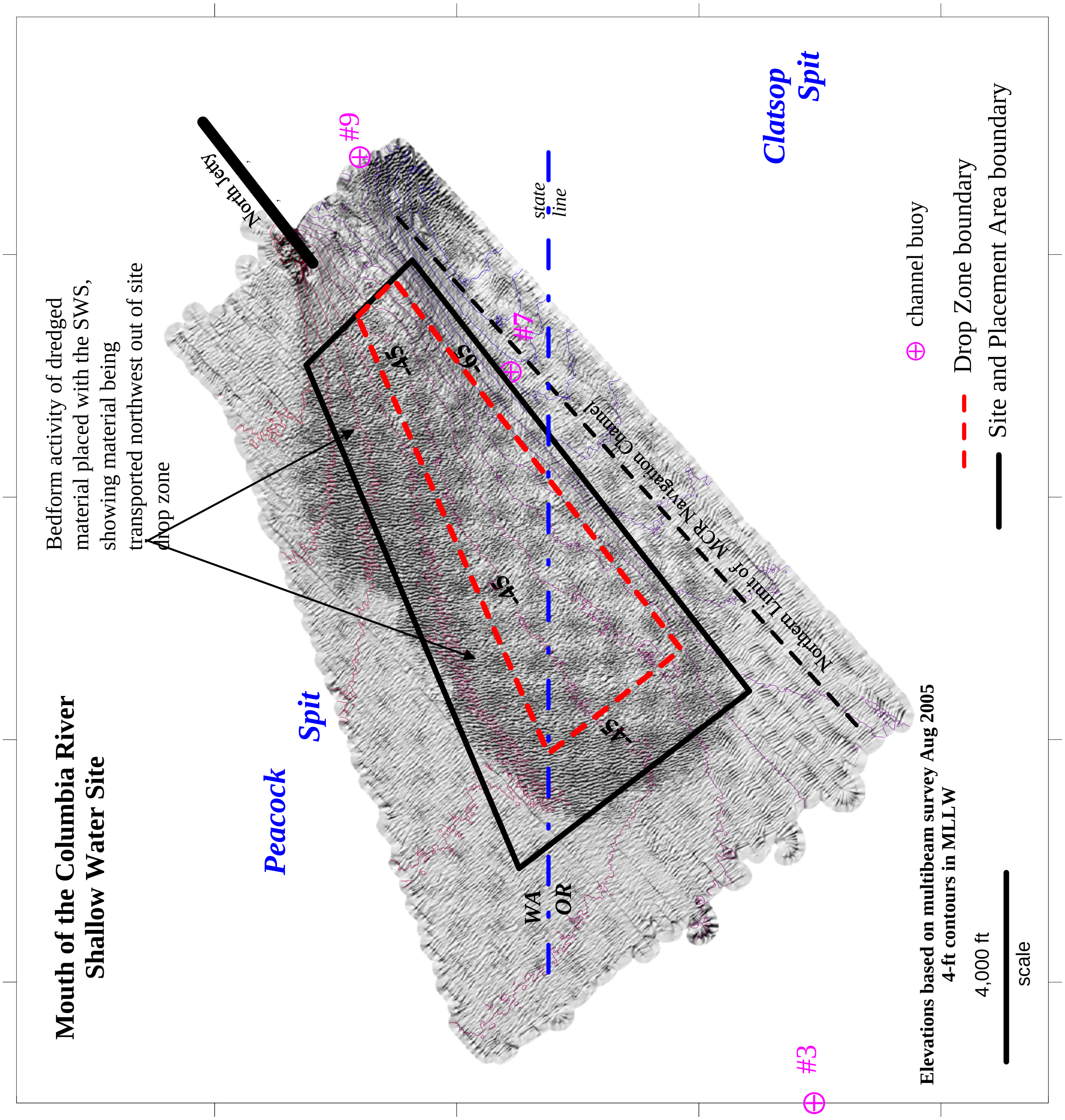

Mouth of the Columbia River
Shallow Water Site
Bedform activity of dredged material placed with the SWS, showing material being transported northwest out of site drop zone
Peacock
Spit
Clatsop
Spit
North Jetty
#9
#7
#3
state
line
WA
OR
MCR Navigation Channel
Northern Limit of
-45
-65
-45
-45
channel buoy
Drop Zone boundary
Site and Placement Area boundary
Elevations based on multibeam survey Aug 2005
4-ft contours in MLLW
4,000 ft
scale

Figure 31

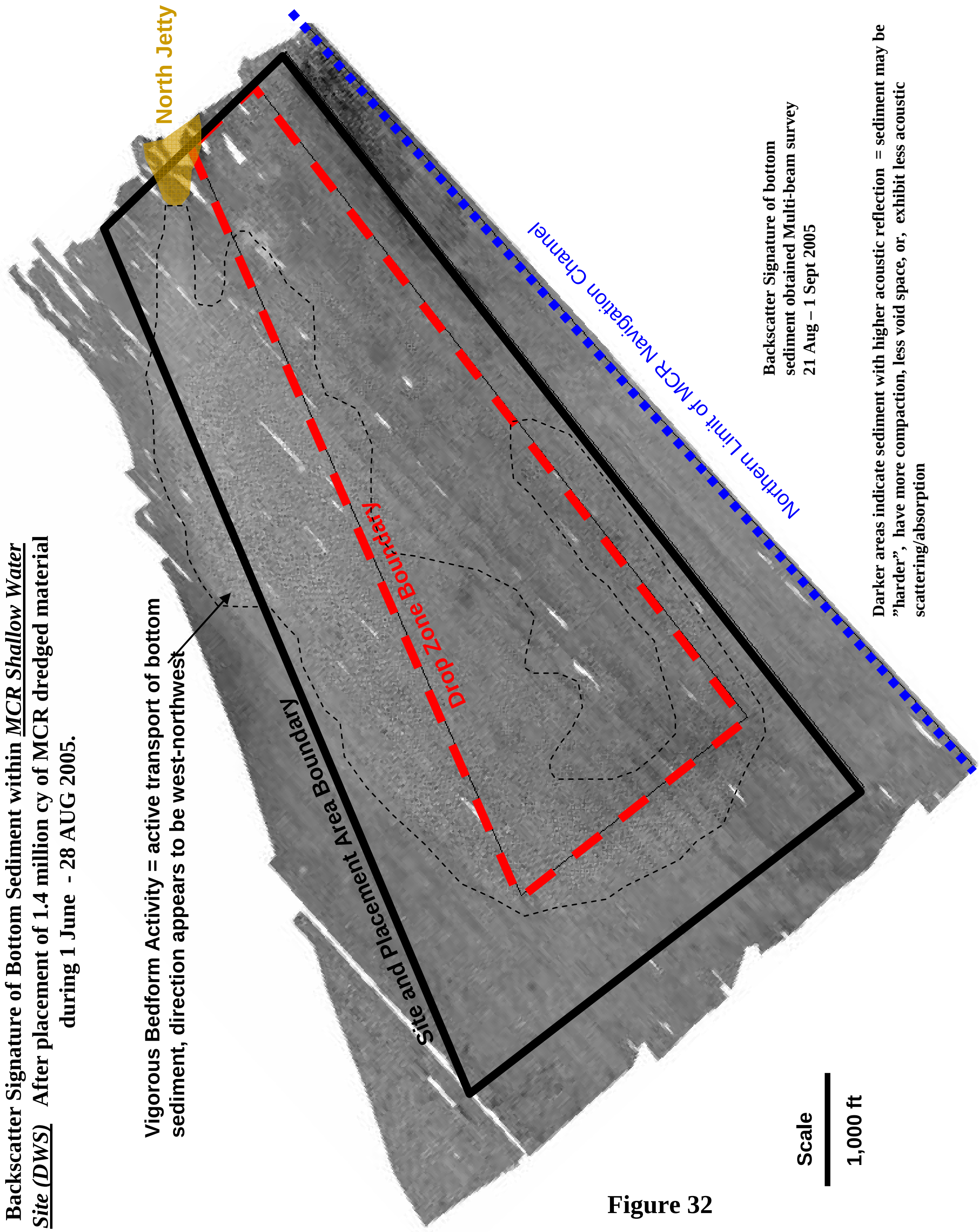

Backscatter Signature of Bottom Sediment within MCR Shallow Water Site (DWS) After placement of 1.4 million cy of MCR dredged material during 1 June - 28 AUG 2005.
Vigorous Bedform Activity = active transport of bottom sediment, direction appears to be west-northwest
North Jetty
Northern Limit of MCR Navigation Channel
Drop Zone Boundary
Site and Placement Area Boundary
Backscatter Signature of bottom sediment obtained Multi-beam survey 21 Aug – 1 Sept 2005
Darker areas indicate sediment with higher acoustic reflection = sediment may be "harder", have more compaction, less void space, or, exhibit less acoustic scattering/absorption
Scale
1,000 ft

Figure 32

Backscatter Signature of Bottom Sediment within *MCR South Jetty Research Site*
After placement of 6 loads of MCR dredged material during 14-15 Sept 2005.

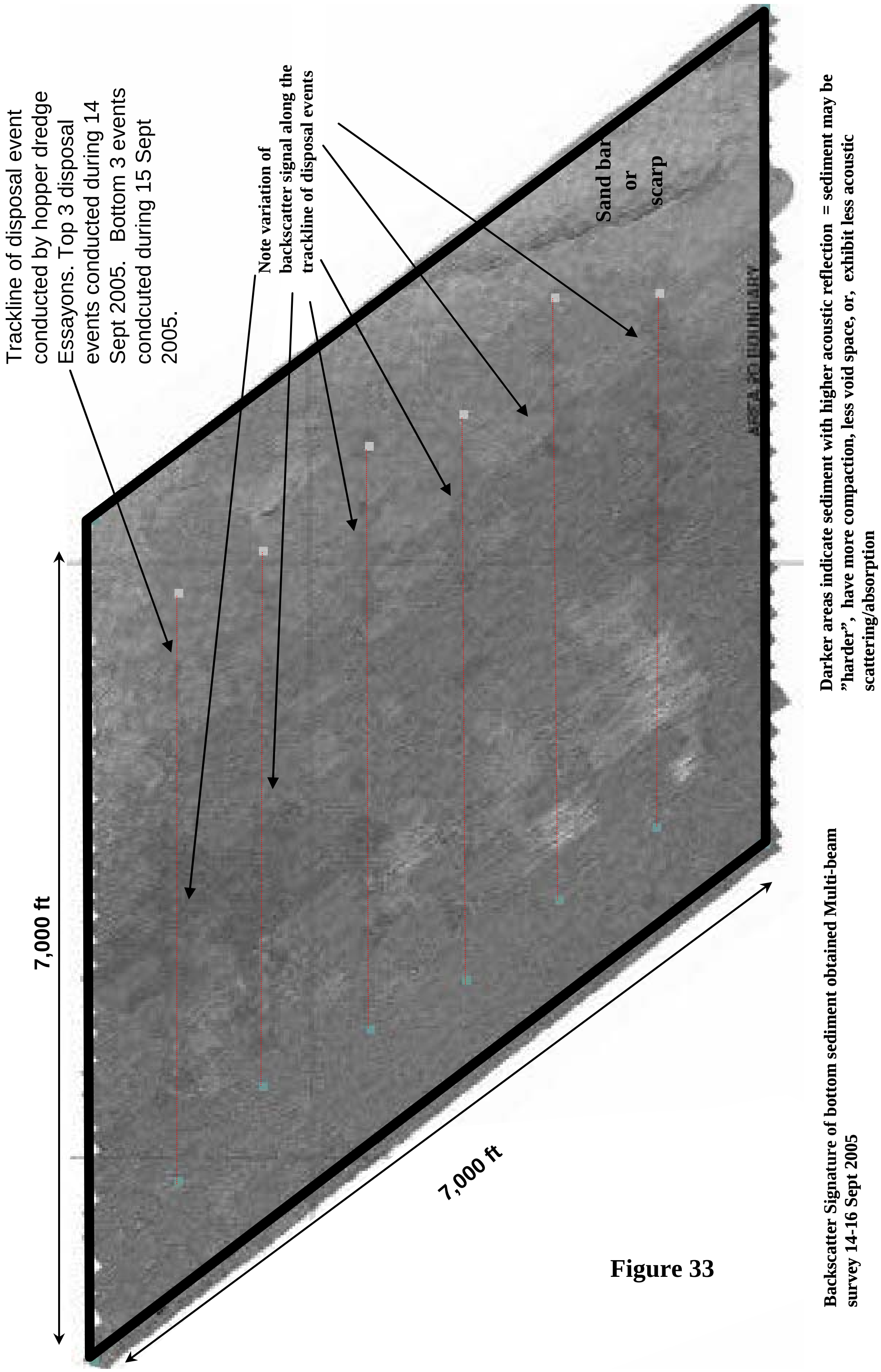
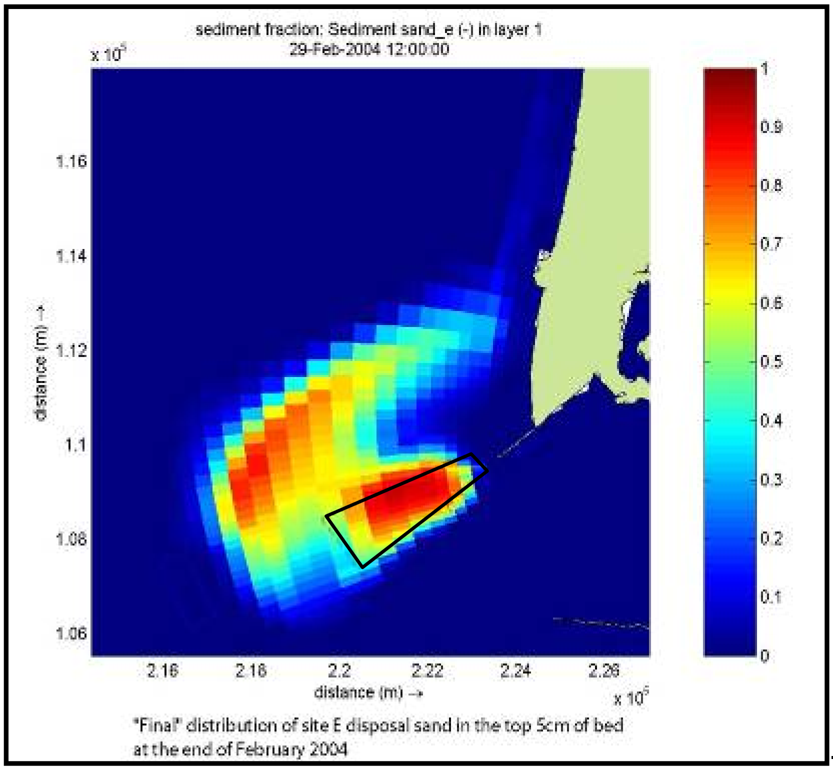
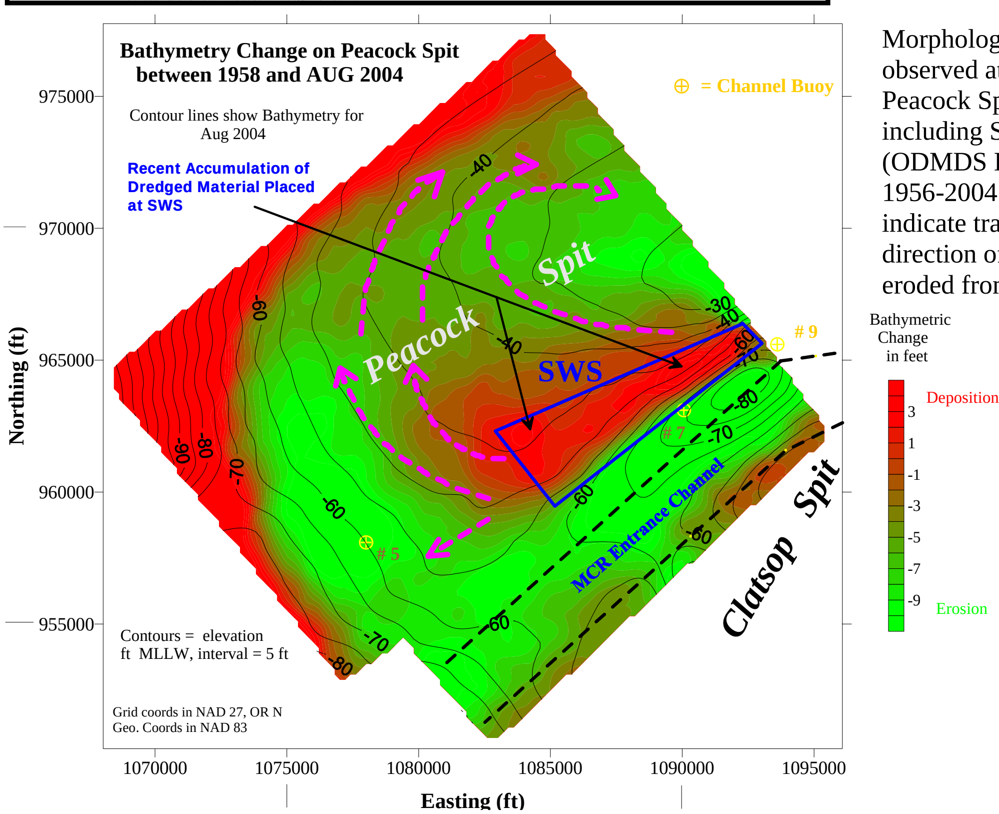


Figure 33

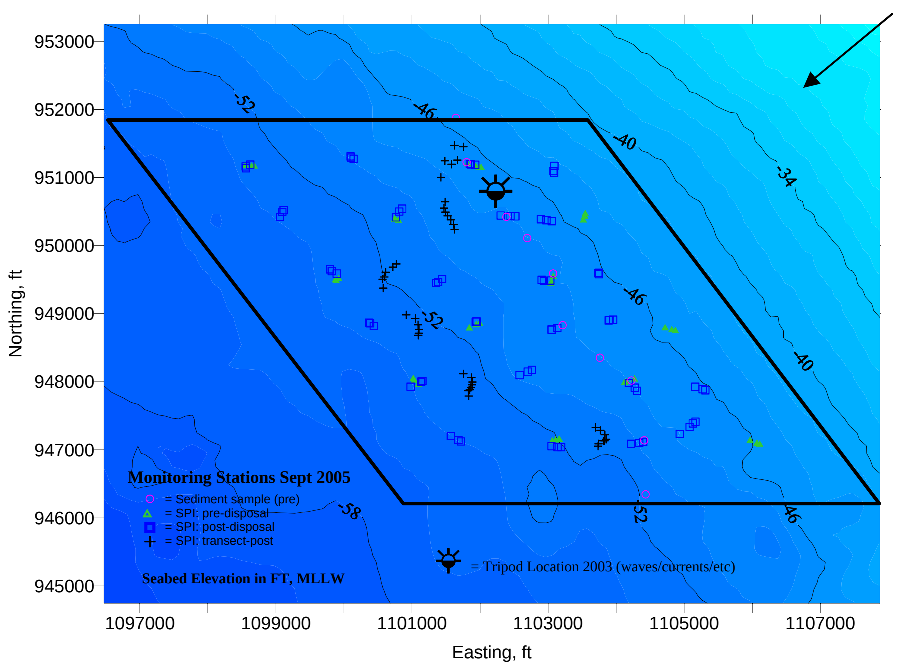


Delft-3D: Numerical model predicted sediment transport at the SWS during Feb 2004. Red areas within SWS indicate fraction of placed material eroded out of SWS.. Red areas outside of SWS indicate fraction of material deposited that had been eroded from SWS. Model results reported in USGS report 2005.



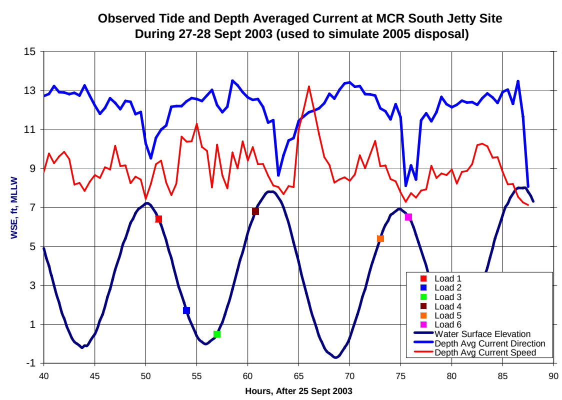
Morphology change observed at MCR Peacock Spit, including SWS (ODMDS E) during 1956-2004. Arrows indicate transport direction of material eroded from SWS.

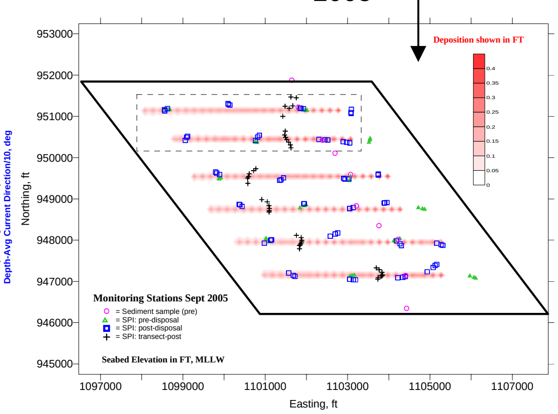
Figure 34. Qualitative comparison between observed seabed change and modeled seabed change for dredged material placed at the SWS. Although the time-scale for each scenario is different, the trends for sediment transport at the SWS are similar.

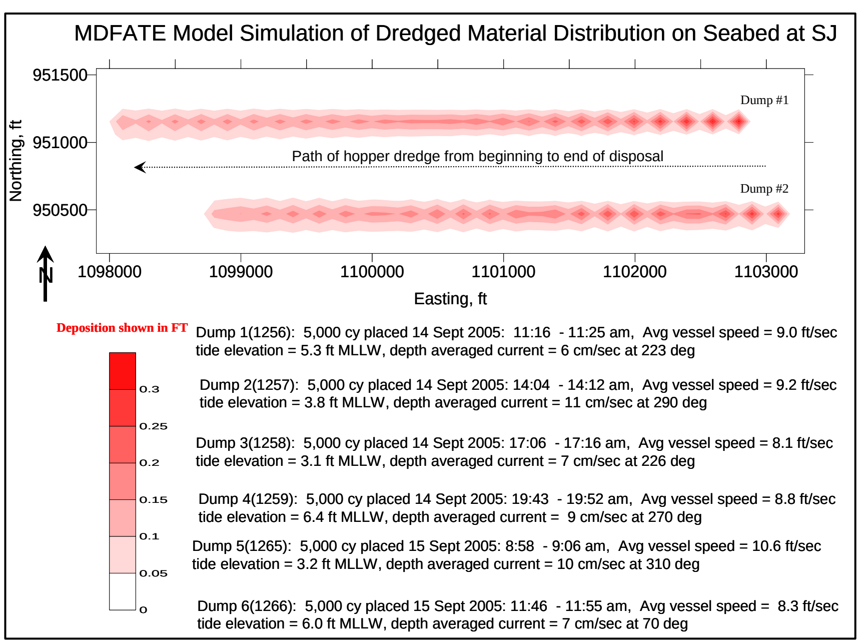


South Jetty Research Site boundary and bathymetry showing monitoring used stations to assess dredged material disposal accumulation per load placed; 6 loads placed during 14-25 Sept 2005, 5,000 cy per load. See figure 33

MDFATE Model Simulation of Dredged Material Distribution on Seabed at SJRS for 6 disposal events Conducted by hopper dredge Essayons during 14-15 Sept 2005







Cloes-up view shown for SJRS MDFATE Model Simulation. Maximum depth of accumulation was estimated to be 0.4 ft at initial point of dredged material placement. Accumulation reduced to 0,.15 ft at end of disposal run.

Figure 35