

**Final
Environmental Impact Statement
for Designation of an Ocean Dredged Material Disposal Site
Offshore of Guam**

MARCH 2010

*Prepared for:
United States Environmental Protection Agency*



ABSTRACT

This Environmental Impact Statement (EIS) covers the proposed designation of the Northwest Ocean Dredged Material Disposal Site (ODMDS) Alternative as a permanent site for the ocean disposal of dredged material. This ocean disposal site will be available as an alternative for placement of dredged material when no practicable upland placement or viable beneficial reuse options are available.

Use of the Northwest ODMDS Alternative is not anticipated to cause significant long-term adverse environmental impacts beyond the site boundaries. Temporary physical impacts to benthos are expected within the site by sediment disposal but the environmental effects are not anticipated to extend beyond the site boundaries. Water quality impacts will be localized, short-term and negligible. The few identified potentially adverse impacts are not anticipated to be irreversible or to involve any irretrievable commitment of resources. As part of the site designation process, the United States Army Corps of Engineers (USACE) and United States Environmental Protection Agency (USEPA) have developed a Site Monitoring and Management Plan (SMMP) included in an appendix to this EIS that will ensure that environmental impacts remain insignificant.

The alternatives considered in this EIS are: 1) No Action, 2) North ODMDS Alternative, and 3) Northwest ODMDS Alternative. The Preferred Alternative identified in this EIS is the Northwest ODMDS Alternative. This decision is based on the absence of significant long-term environmental impacts beyond the site boundaries, the greater potential for adverse environmental impacts (particularly air quality) associated with the other alternatives, and the demonstrated need for continued availability of an ocean disposal site for dredged material.

[This page intentionally left blank]

**ENVIRONMENTAL IMPACT STATEMENT
FOR DESIGNATION OF AN OCEAN DREDGED MATERIAL DISPOSAL SITE
OFFSHORE OF GUAM**

Table of Contents

ACRONYMS AND ABBREVIATIONS	ix
EXECUTIVE SUMMARY	ES-1
1.0 PURPOSE OF AND NEED FOR ACTION	1-1
1.1 Introduction	1-1
1.2 Purpose For Action	1-3
1.3 Need For Action.....	1-3
1.3.1 Beneficial Reuse	1-3
1.3.2 Dewatering Sites	1-5
1.4 NEPA Process	1-5
1.4.1 Public Involvement	1-5
1.4.2 Notice of Intent (NOI) and Scoping Period.....	1-5
1.4.3 DEIS Status Meeting	1-8
1.4.4 Draft EIS (DEIS) / Coastal Zone Management (CZM) Consistency Review	1-9
1.4.5 Final EIS (FEIS) / Proposed Rule	1-9
1.4.6 Final Rule / Site Designation.....	1-9
1.5 Scope of the EIS.....	1-9
1.6 Cooperating Agencies And Agency Consultation.....	1-10
1.7 Regulatory Framework	1-10
2.0 ALTERNATIVES.....	2-1
2.1 ODMDS Designation Process	2-1
2.2 Alternative Development	2-3
2.2.1 Zone of Siting Feasibility Methods	2-3
2.2.2 Economic Feasibility Distance	2-5
2.2.3 Zone of Siting Feasibility (ZSF) Conclusions	2-6
2.2.4 Identification of a Specific ODMDS Alternative Within Each ZSF Study Area.....	2-6
2.3 Alternatives Considered and Dismissed from Further Consideration	2-8
2.3.1 Mariana Trench	2-8
2.3.2 Off-island upland placement	2-8
2.3.3 Interim ODMDS	2-8
2.4 North Alternative ODMDS	2-8
2.4.1 Description of the North ODMDS	2-8
2.4.2 Fate of Dredged Material Discharged at the North ODMDS.....	2-9
2.5 Northwest Alternative ODMDS.....	2-9
2.5.1 Description of the Northwest ODMDS.....	2-9
2.5.2 Fate of Dredged Material Discharged at the Northwest ODMDS	2-11
2.6 No Action Alternative	2-12

2.7	Compliance with USEPA Criteria	2-12
2.7.1	General Criteria (40 CFR 228.5)	2-13
2.7.2	Specific Site Selection Criteria (40 CFR 228.6)	2-14
2.8	Comparison of Alternatives	2-16
2.9	Preferred Alternative.....	2-16
3.0	EXISTING ENVIRONMENT.....	3-1
3.1	Physical Environment	3-1
3.1.1	Climate and Air Quality	3-1
3.1.2	Physical Oceanography	3-4
3.1.3	Water Column Characteristics and Chemical Analysis.....	3-24
3.1.4	Water Column Chemical Analyses.....	3-32
3.1.5	Regional Geology.....	3-45
3.1.6	Sediment Characteristics	3-54
3.1.7	Mariana Trench Marine National Monument.....	3-68
3.2	Biological Environment	3-72
3.2.1	Plankton Communities	3-72
3.2.2	Invertebrate Communities	3-73
3.2.3	Fish Communities and Essential Fish Habitat (EFH).....	3-76
3.2.4	Marine Birds	3-84
3.2.5	Marine Mammals.....	3-93
3.2.6	Threatened, Endangered and Special Status Species	3-98
3.2.7	Marine Protected Areas (MPAs)	3-104
3.3	Socioeconomic Environment.....	3-108
3.3.1	Commercial Fishing and Mariculture.....	3-108
3.3.2	Military Use.....	3-109
3.3.3	Recreational Use.....	3-111
3.3.4	Commercial Shipping	3-112
3.3.5	Oil and Natural Gas Development	3-113
3.3.6	Archaeological, Historical, and Cultural Resources	3-113
3.3.7	Public Health and Welfare.....	3-114
4.0	ENVIRONMENTAL CONSEQUENCES	4-1
4.1	Physical Environment	4-1
4.1.1	Climate and Air Quality	4-1
4.1.2	Physical Oceanography	4-2
4.1.3	Water Column Characteristics and Chemical Analysis.....	4-6
4.1.4	Regional Geology.....	4-11
4.1.5	Sediment Characteristics and Chemical Constituents	4-29
4.2	Biological Environment	4-31
4.2.1	Significance Criteria	4-31
4.2.2	Impact Analysis	4-31
4.3	Socioeconomic Environment.....	4-42
4.3.1	Commercial Fishing and Mariculture.....	4-44
4.3.2	Military Use.....	4-44
4.3.3	Recreational Use.....	4-45

4.3.4	Commercial Shipping	4-46
4.3.5	Oil and Natural Gas Development	4-46
4.3.6	Archaeological, Historical, and Cultural Resources	4-46
4.3.7	Public Health and Welfare.....	4-47
4.4	Cumulative Impacts	4-48
4.4.1	Physical	4-48
4.4.2	Biological	4-49
4.4.3	Socioeconomic.....	4-49
4.5	Relationship Between Short-term and Long-term Resource Uses	4-50
4.6	Irreversible or Irretrievable Commitment of Resources.....	4-51
5.0	MANAGEMENT OF THE DISPOSAL SITE	5-1
5.1	Management of Disposal Sites.....	5-1
5.1.1	Ocean Disposal Permits.....	5-1
5.1.2	Site Management and Monitoring	5-3
5.2	Characteristics Common to Both ODMDS “Action” Alternatives	5-4
5.2.1	Physical Characteristics of ODMDS Use	5-4
5.3	ODMDS Management	5-6
5.3.1	Dredging Permits.....	5-6
5.3.2	ODMDS Management: Enforcement of Dredging Permit Conditions	5-7
5.3.3	ODMDS Management: Long-term	5-7
6.0	LIST OF PREPARERS	6-1
7.0	REFERENCES.....	7-1

APPENDICES

APPENDIX A: PUBLIC INVOLVEMENT

- NOTICE OF INTENT TO PREPARE EIS AND PUBLIC NOTICE OF SCOPING MEETING
- NOI SCOPING MEETING TRANSCRIPT
- AGENCY CORRESPONDENCE
- DEIS DISTRIBUTION LIST
- NOTICE OF AVAILABILITY OF EIS AND PUBLIC NOTICE OF SCOPING MEETING
- NOA SCOPING MEETING TRANSCRIPT
- AGENCY CORRESPONDENCE AND PUBLIC OFFICIALS
- PUBLIC COMMENTS AND USEPA RESPONSES
- EIS DISTRIBUTION LIST

APPENDIX B: COASTAL ZONE MANAGEMENT

APPENDIX C: SITE MANAGEMENT AND MONITORING PLAN

List of Figures

	<u>Page</u>
Figure ES-1. Location Map	ES-2
Figure ES-2. ODMDS Alternatives – Showing Deposition on the Seafloor Following 1,000,000 cy of Disposal	ES-4
Figure 1-1. Location Map	1-2
Figure 1-2. Dredged Material Management Options	1-4
Figure 1-3. Opportunities for Public Comment.....	1-6
Figure 2-1. Schematic Representation Zone of Siting Feasibility Process.....	2-4
Figure 2-2. Dredging Equipment.....	2-5
Figure 2-3. ZSF – Composite of Constraints	2-7
Figure 2-4. ODMDS Alternatives – Showing Deposition on the Seafloor Following 1,000,000 cy of Disposal	2-10
Figure 3-1. USEPA Designated Non-attainment Areas for Sulfur Dioxide Around the Piti and Tanguisson Power Plants.....	3-3
Figure 3-2. Vector Plots of Daily Averaged Current Velocities by Month for Each Location at 33 ft (10 m) Depth	3-6
Figure 3-3. Vector Plots of Daily Averaged Current Velocities by Month for Each Location at 1,300 ft (400 m) Depth	3-7
Figure 3-4. Vector Plots of Daily Averaged Current Velocities by Month for Each Location at 4,900 ft (1,500 m) Depth	3-8
Figure 3-5. Vector Plots of Daily Averaged Current Velocities by Month for Each Location at 8,200 ft (2,500 m) Depth	3-9
Figure 3-6. Locations of Deep Sea Current Meter Moorings.....	3-11
Figure 3-7. Vector Plots of Average Daily Current Direction in 303 m, 1005 m, 1,738 m, and 2,285 m Depths at CM1	3-12
Figure 3-8. Vector Plots of Average Daily Current Direction in 25 m, 50 m, 100 m, and 150 m Depths at CM2	3-15
Figure 3-9. Vector Plots of Average Daily Current Direction in 306 m, 988 m, 1716 m, and 2128 m Depths at CM2	3-16
Figure 3-10. Rose Diagram Plots of Daily Average Current Direction and Speed Over 1 Year Period, Comparing Modeled Navy Currents and <i>in situ</i> Currents at CM1	3-21
Figure 3-11. Rose Diagram Plots of Daily Average Current Direction and Speed Over 1 Year Period, Comparing Modeled Navy Currents and <i>in situ</i> Currents at CM2	3-26
Figure 3-12. Final Sampling Locations for CTD Casts and Water Samples.....	3-27
Figure 3-13. Comparison of Temperature Profiles between Representative Stations in the North Study Area, Northwest Study Area and Proposed Reference Site.....	3-33
Figure 3-14. Comparison of Salinity Profiles between Representative Stations in the North Study Area, Northwest Study Area and Proposed Reference Site.....	3-34
Figure 3-15. Comparison of Turbidity Profiles between Representative Stations in the North Study Area, Northwest Study Area and Proposed Reference Site.....	3-35
Figure 3-16. Comparison of Dissolved Oxygen Profiles between Representative Stations in the North Study Area, Northwest Study Area and Proposed Reference Site.....	3-36
Figure 3-17. Nutrient Concentrations with Depth in the North Study Area, Northwest Study Area, and Proposed Reference Site.....	3-37
Figure 3-18. Total Organic Carbon (TOC) Concentrations with Depth in the North Study Area, Northwest Study Area, and Proposed Reference Site	3-38
Figure 3-19. Dissolved Metals Concentrations with Depth in the North Study Area, Northwest Study Area and Proposed Reference Site	3-41

Figure 3-20. Mean and Standard Deviation of Selected Conventional Chemistry Constituents of Water Samples Collected Offshore of Guam, Showing Comparison of Study Areas (N and NW) to Each Other and Proposed Reference (I+R).....	3-46
Figure 3-21. Mean and Standard Deviation of Selected Metals Showing Comparison of Study Areas (N and NW) to Each Other, Proposed Reference (I+R) and CMC and CCC Values.....	3-47
Figure 3-22. Marine Geology Offshore of Guam and Surrounding Vicinity	3-48
Figure 3-23. Regional Bathymetry	3-50
Figure 3-24. North Study Area Bathymetry.....	3-51
Figure 3-25. Northwest Study Area Bathymetry	3-52
Figure 3-26. Plan and Profile Views of Upper Water Column Sediment Dispersion in the North and Northwest Study Areas During La Niña Conditions	3-53
Figure 3-27. Grain Size Distribution by Size Class (Gravel, Sand, Silt, Clay) of Seafloor Sediment Samples Collected in the Guam ODMDS Study Region, April 2008.....	3-55
Figure 3-28. Mean and Standard Deviation of Selected Conventional Chemistry Constituents Showing Comparison of Study Areas to Each Other and Proposed Reference	3-57
Figure 3-29. Mean and Standard Deviation of Selected Metals Showing Comparison of Study Areas to Each Other, Proposed Reference and ER-L and ER-M	3-59
Figure 3-30. Mariana Trench Marine National Monument.....	3-69
Figure 3-31. Mariana Trench Marine National Monument Trench and Islands Units.....	3-70
Figure 3-32. Mariana Trench Marine National Monument Volcanic Unit.....	3-71
Figure 3-33. Marine Protected Areas.....	3-105
Figure 3-34. Guam Prohibited Longline Fishing Area.....	3-109
Figure 3-35. Military Training Areas in the Vicinity of ODMDS Alternative Study Areas	3-110
Figure 4-1. Prospective View of Upper Water Column Sediment Dispersion in the North Study Area During La Niña Conditions	4-8
Figure 4-2. Prospective View of Upper Water Column Sediment Dispersion in the Northwest Study Area During La Niña Conditions	4-9
Figure 4-3. Isopachs Showing Deposit Thicknesses in the Northwest Study Area for the Disposal of 1,000,000 cy of Predominantly Fine-Grained Material Using <i>In Situ</i> Current Measurements from Station CM1	4-14
Figure 4-4. Isopachs Showing Deposit Thicknesses in the North Study Area for the Disposal of 1,000,000 cy of Predominantly Fine-Grained Material Using <i>In Situ</i> Current Measurements from Station CM1	4-15
Figure 4-5. Isopachs Showing Deposit Thicknesses in the Northwest Study Area for the Disposal of 1,000,000 cy of Predominantly Coarse-Grained Material Using <i>In Situ</i> Current Measurements from Station CM1	4-16
Figure 4-6. Isopachs Showing Deposit Thicknesses in the North Study Area for the Disposal of 1,000,000 cy of Predominantly Coarse-Grained Material Using <i>In Situ</i> Current Measurements from Station CM1	4-17
Figure 4-7. Isopachs Showing Deposit Thicknesses in the Northwest Study Area for the Disposal of 1,000,000 cy of Predominantly Fine-Grained Material Using <i>In Situ</i> Current Measurements from Station CM2	4-18
Figure 4-8. Isopachs Showing Deposit Thicknesses in the North Study Area for the Disposal of 1,000,000 cy of Predominantly Fine-Grained Material Using <i>In Situ</i> Current Measurements from Station CM2	4-19
Figure 4-9. Isopachs Showing Deposit Thicknesses in the Northwest Study Area for the Disposal of 1,000,000 cy of Predominantly Coarse-Grained Material Using <i>In Situ</i> Current Measurements from Station CM2	4-20
Figure 4-10. Isopachs Showing Deposit Thicknesses in the North Study Area for the Disposal of 1,000,000 cy of Predominantly Coarse-Grained Material Using <i>In Situ</i> Current Measurements from Station CM2	4-21

Figure 4-11. Extent of 1 mcy (764,556 m ³) of Predominantly Coarse-Grained Material After 4 Hours Assuming Normal Surface Current Direction at 4x Speed (La Niña Conditions)	4-25
Figure 4-12. Extent of 1 mcy (764,556 m ³) of Predominantly Coarse-Grained Material After 4 Hours Assuming Reversed Surface Current Direction at 4x Speed (El Niño Conditions)	4-26
Figure 4-13. Extent of 1 mcy (764,556 m ³) of Predominantly Fine-Grained Material After 4 Hours Assuming Normal Surface Current Direction at 4x Speed (La Niña Conditions)	4-27
Figure 4-14. Extent of 1 mcy (764,556 m ³) of Predominantly Fine-Grained Material After 4 Hours Assuming Reversed Surface Current Direction at 4x Speed (El Niño Conditions)	4-28
Figure 4-15. Overview Map of Potential Dewatering Facilities and Beneficial Use Alternatives, Apra Harbor Naval Complex, Guam.....	4-43
Figure 5-1. Short-term Fate of Dredged Material Disposal.....	5-5

List of Tables

	<u>Page</u>
Table ES-1. Compliance with General Criteria (40 CFR 228.5)	ES-9
Table ES-2. ODMDS Alternatives and USEPA Specific Site Selection Criteria	ES-10
Table ES-3. ODMDS Alternatives, Summary of Impacts.....	ES-12
Table 1-1. Summary of Excess Dredged Material	1-5
Table 2-1. Five General and Eleven Specific ODMDS Selection Criteria	2-2
Table 2-2. Compliance with General Criteria (40 CFR 228.5)	2-13
Table 2-3. ODMDS Alternatives and USEPA Specific Site Selection Criteria.....	2-14
Table 2-4. ODMDS Alternatives, Summary of Impacts	2-16
Table 3-1. Summary of Meteorological Conditions for Guam.....	3-2
Table 3-2. Relative Frequencies for Modeled Current Direction at Navy Site 1	3-19
Table 3-3. Relative Frequencies for <i>In Situ</i> Current Direction at CM1	3-19
Table 3-4. Modeled Current Speeds at Navy Site 1	3-20
Table 3-5. Measured Current Speeds at CM1	3-20
Table 3-6. Relative Frequencies for Modeled Current Direction at Navy Site 2	3-23
Table 3-7. Relative Frequencies for <i>In Situ</i> Current Direction at CM2	3-23
Table 3-8. Modeled Current Speeds at Navy Site 2	3-25
Table 3-9. Measured Current Speeds at CM2	3-25
Table 3-10. Upper and Lower Trace Metal Concentration Values at the North Study Area.....	3-40
Table 3-11. Upper and Lower Trace Metal Concentration Values at the Northwest Study Area	3-42
Table 3-12. Upper and Lower Trace Metal Concentration Values at the Proposed Reference Site	3-43
Table 3-13. Simultaneously Extracted Metals/Acid Volatile Sulfides Results and Σ SEM:AVS for Seafloor Sediment Samples Collected in the Guam ODMDS Study Region, April 2008	3-62
Table 3-14. Calculated Sum Total Dioxins (CDD) and Furans (CDF) for Sediment Samples Collected Offshore of Guam	3-66
Table 3-15. Macroinfauna Community Composition in the North Study Area	3-74
Table 3-16. Macroinfauna Community Composition in the Northwest Study Area.....	3-75
Table 3-17. Macroinfauna Community Composition at the Inshore and Proposed Reference Sites	3-75
Table 3-18. Birds Associated with Marine Habitats on Guam	3-85
Table 3-19. List of Threatened, Endangered and Special Status Marine Mammal Species	3-101
Table 3-20. Vessel Calls by Type to Apra Harbor for FY2000 to FY2007	3-113
Table 3-21. Containers Handled at Apra Harbor FY2000 to FY2007	3-113
Table 4-1. Emission Estimates for Guam ODMDS Alternate Sites	4-3
Table 4-2. Ambient Air Quality Impacts at Maximum Impact Location	4-4

Table 4-3. Ambient Air Quality Impacts at Downwind Distance Below Guam Ambient Air Quality Standards.....	4-4
Table 4-4. Modeled Thickness and Area of Deposits for Disposal of 1,000,000 cy of Fine or Coarse-Grained Dredged Material.....	4-22
Table 4-5. Modeled Coarse- and Fine-Grained Material Accumulations Greater Than 0.4 in (1 cm), 3.9 in (10 cm), and 7.9 in (20 cm) Under Stronger Than Normal Tradewinds (La Niña) and Stronger Than Normal Reversed Tradewinds (El Niño)	4-24

[This page intentionally left blank]

ACRONYMS AND ABBREVIATIONS

°C	Celcius
°F	Farenheit
µg/L	micrograms per liter
Ag	Silver
AVS	acid volatile sulfide
BSP	Bureau of Statistics and Plans
CAA	Clean Air Act
CCC	Criterion Continuous Concentration
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CNMI	Commonwealth of the Northern Mariana Islands
cm	centimeter
CMC	Criterion Maximum Concentration
CTD	conductivity/temperature/depth
CWA	Clean Water Act
cy	cubic yards
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
DAWR	Division of Aquatic and Wildlife Services
DDT	Dichlorodiphenyltrichloroethane
DEIS	Draft Environmental Impact Statement
DoD	U.S. Department of Defense
DON	Department of the Navy
E	East
EDL	Estimated Detection Limit
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EO	Executive Order
ERA	Ecological Reserve Area
ESA	Endangered Species Act
FAD	Fish Aggregation Device
FeS	Iron Sulfide
FMP	Fishery Management Plan
FR	Federal Register
ft	feet
FY	Fiscal Year
G	gram
GEPA	Guam Environmental Protection Agency
GFCA	Guam Fisherman's Cooperative Association
GIS	Geographic Information Systems
GOVGUAM	Government of Guam
GPS	Global Positioning System
Guam	Territory of Guam
GVB	Guam Visitors Bureau
GWA	Guam Waterworks Authority
In	inch
IUCN	International Union for the Conservation of Nature
IWC	International Whaling Commission
kg	kilogram
km	kilometers
km ²	square kilometers
kph	kilometers per hour
kt	knots
LPC	limiting permissible concentration
m	meters
mi	miles
mi ²	square miles

m ²	square meters
m ³	cubic meters
MBTA	Migratory Bird Treaty Act
mcy	million cubic yards
MDL	method detection limit
mg	milligrams
mg/L	milligrams per liter
MISTCS	Mariana Islands Sea Turtle and Cetacean Survey
MLLW	Mean Lower Low Water
MMPA	Marine Mammal Protection Act
MODAS	Modular Ocean Data Assimilation System
MPA	Marine Protected Area
mph	miles per hour
MPRSA	Marine Protection Research and Sanctuaries Act
MSFCMA	Magnuson-Stevens Fisheries Conservation and Management Act
N	North
NAAQS	National Ambient Air Quality Standards
NAVFAC PAC	Naval Facilities Engineering Command Pacific
NAVO	Naval Oceanographic Office
NCOM	Naval Coastal Ocean Model
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NLOM	Navy Layered Ocean Model
nm	nautical miles
NMFS	National Marine Fisheries Service
NO _x	Nitrogen Dioxide
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPDW	North Pacific Deep Water
NPEC	North Pacific Equatorial Current
NRHP	National Register of Historic Places
NTU	Nephelometric Turbidity Units
NWS	National Weather Service
ODMDS	Ocean Dredged Material Disposal Site
PAG	Port Authority of Guam
PAH	polycyclic aromatic hydrocarbons
PCB	polychlorinated biphenyls
pg/g	picrograms per gram
ROI	region of influence
SAP	sampling and analysis Plan
SEM	Simultaneously Extracted Metals
SHPO	State Historic Preservation Officer
SMMP	Site Management and Monitoring Plan
SO ₂	Sulfur Dioxide
SST	sea surface temperature
TBT	tributyltin
TIAS	Treaties and Other International Act Series
TKN	Total Kjeldahl Nitrogen
TOC	total organic carbon
TON	Total Organic Nitrogen
U.S.	United States of America
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WAPA	War in the Pacific National Historic Park
WPRFMC	Western Pacific Regional Fishery Management Council
WQC	Water Quality Criteria
ZSF	Zone of Siting Feasibility