DRAFT FINAL (90 PERCENT) DESIGN REPORT

SEDIMENT DREDGING, BEACH RENOURISHMENT, CONFINED AQUATIC DISPOSAL (CAD), AND CAPPING

PORT HUENEME, CALIFORNIA

Prepared for

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EXECUTIVE SUMMARY

This Draft Final (90 Percent) Design Report, presents the basis of design elements for the proposed dredging of chemically contaminated sediments within the Port of Hueneme, California (the Harbor), and their placement and confinement in a subaqueous confined aquatic disposal (CAD) facility.

The Oxnard Harbor District (OHD), the U.S. Navy, and the U.S. Army Corps of Engineers (USACE) are all responsible for maintaining authorized navigation depths in different parts of the Harbor. Dredging will be required as a maintenance action to achieve the authorized navigation depths. In addition, there are numerous areas of known contaminated sediments present throughout the Harbor. A goal of this project is to remove these contaminated sediments, which in many cases will require dredging deeper than the authorized depths. Altogether, approximately 239,800 cubic meters (m^3) of contaminated sediments will need to be dredged from the Harbor by the OHD, the U.S. Navy, and USACE in order to achieve the authorized navigational depths and to remove the contaminated sediments.

There are currently no cost-effective alternatives for contaminated sediment disposal in Southern California. The only available and permitted off-site disposal location is an upland landfill, since the contaminated sediments are not suitable for beach or open-ocean disposal. However, the costs of dredging, offloading, dewatering, rehandling, transport, and disposal of the dredged material at an upland landfill are excessive to the point where the costs to maintain the shipping channel nearly exceeds the economic benefit to the region. As such, under the upland landfill disposal scenario, federal funding for the U.S. Navy and USACE projects would likely never occur, and the costs for the OHD to complete its project individually would result in a significant economic burden for current and future operations.

This report presents the basis for designing and constructing a unique solution to this problem in which the resources of OHD, U.S. Navy, and USACE are combined into one larger project using an innovative disposal alternative (the CAD facility) that would be far more cost effective for all as it presents minimal transportation costs, no tipping fee, and no need for sediment rehandling. The CAD facility would be excavated in the USACE-maintained Turning Basin, with sufficient size and depth to hold the contaminated sediment volume from all three parties. Clean sand that is excavated from the CAD facility would be pumped onto Hueneme Beach, located immediately south of the Entrance Channel, to renourish the beach. Subsequently, contaminated sediments from the OHD, U.S. Navy, and USACE sites would be dredged using mechanical equipment and placed within the CAD facility by a bottom-dump barge. These sediments would then be covered with clean sediments dredged from the remainder of the Federal Channel as part of USACE's ongoing Operations and Maintenance (O&M) program.

In an effort to remove all contaminated sediments in the Harbor (thus taking maximum advantage of the CAD), it will be necessary to excavate some areas along the OHD and U.S. Navy wharves to depths below their current authorized design depths. In order to prevent destabilizing the existing wharf structures, it will be necessary to perform the dredging along wharf faces in a segmental fashion, and to place clean backfill along the wharf face after the dredging is completed, to return the subgrade to its authorized design elevation.

Dredging the OHD and U.S. Navy wharves, excavating the CAD facility, and placing the clean sediment on Hueneme Beach will be subject to review under the California Environmental Quality Act (CEQA), National Environmental Policy Act (NEPA), and Clean Water Act (CWA). The OHD is acting as the lead CEQA agency for the project. The U.S. Navy will evaluate the entirety of the project under NEPA, and the USACE and Regional Water Quality Control Board will issue permits for all in-water construction activities. In an effort to streamline the environmental review process, the U.S. Navy and OHD prepared a joint NEPA/CEQA document and acted as co-applicants when applying for the necessary environmental permits and participating in agency consultations.

Various design analyses were conducted to evaluate the physical containment and long-term isolation of contaminated sediments in the CAD, protecting it against erosion from physical forces (propeller wash) acting on the sediment cap, and the amount and duration of sediment consolidation within the CAD. These analyses have been developed further from those documented in the 30 percent level Basis of Design Report (Anchor 2007a) and support the design of the CAD system as a stable and environmentally protective feature, both in the short-term after construction and in the long term.

1 INTRODUCTION

1.1 Description of the Project

This document, the Draft Final (90 Percent) Design Report, presents the basis of development of design elements for the proposed dredging and confined disposal of chemically contaminated sediments within the Port of Hueneme (the Harbor) in the city of Port Hueneme, California (Figure 1-1). The proposed project involves creating a confined aquatic disposal (CAD) site in the Harbor as a regional solution for contaminated sediment disposal.

The OHD, U.S. Navy, and USACE are all responsible for maintaining authorized depths in different parts of the Harbor (Figure 1-2). Sediments in some of these areas are known to be contaminated, in that they are unsuitable for open-ocean or beach disposal, due in most cases to elevated concentrations of metals, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), dichloro-diphenyl-trichloroethane (DDT) and its breakdown products, and organotins such as tributyltin (TBT). The effects range low (ERL) and effects range medium (ERM) values of Buchman (1999) were used as the criteria to establish appropriate concentrations of metals and PAHs. Risk-based criteria for concentrations of PCBs and DDT and its breakdown products were taken from a focused ecological risk assessment with bioaccumulation modeling prepared for the USACE, Los Angeles District (Anchor 2003). The bioaccumulation trigger value for TBT was derived from Meador et al. (2002).

Table 1-1
Bioaccumulation Trigger, ERL, and ERM Used for Evaluation of Suitability

Chemicals of Concern	Units	Bioaccumulation Trigger Value (ppb)	Sediment Quality Guidelines	
			ERL	ERM
Chromium	mg/kg	–	81	370
Copper	mg/kg	–	34	270
Lead	mg/kg	–	46.7	218
Mercury	mg/kg	–	0.15	0.71
Nickel	mg/kg	–	20.9	51.6
Silver	mg/kg	–	1	3.7
Zinc	mg/kg	–	150	410
Total DDT	µg/kg	38.9	1.58	46.1
TBT	µg/kg	36.0	–	–
Total PCBs	µg/kg	89.6	22.7	180
Total PAHs	µg/kg	–	4,022	44,792

Notes:
– = no applicable value exists
mg/kg = milligrams per kilogram
µg/kg = micrograms per kilogram
ppb = parts per billion

Sediments determined to have concentrations of one or more of these chemicals of concern in excess of these risk-based criteria were considered unsuitable for open-ocean disposal or beach placement.

Initially, the goal for the project was to dispose the contaminated sediment from the Harbor at a nearshore fill site planned by the Port of Long Beach (Pier J South); however, the Pier J South project was indefinitely delayed due to regulatory concerns, leaving no other feasible options for the material except to truck it to a Class III landfill. Unfortunately, after combining the costs of dredging, offloading, de-watering, and re-handling the dredged material for disposal at an upland landfill, the net result is a scenario where none of the projects could likely be implemented in a cost-effective manner, and would likely continue to be unfunded. To solve this problem, OHD began working to develop an innovative solution for contaminated sediment disposal. The concept of creating a CAD facility resulted from this work by OHD in conjunction with USACE.

Specifically, the project involves excavating a CAD facility in the USACE-managed Turning Basin, of sufficient size and depth to hold the volume of contaminated sediments that will need to be dredged from the Harbor by OHD, U.S. Navy, and USACE as part of their routine maintenance programs. Clean sand that is excavated from the CAD facility would be pumped onto Hueneme Beach, located immediately south of the Entrance Channel to renourish the beach. Subsequently, contaminated sediments from the OHD, U.S. Navy, and USACE sites would be dredged using mechanical equipment and placed within the CAD facility by bottom-dump barge. These sediments would then be covered with clean sediments dredged from the remainder of the USACE Federal Channel as part of USACE's ongoing Operations and Maintenance (O&M) program.

From a project permitting perspective, dredging of the OHD and U.S. Navy wharves and the Federal Channel, and construction of the CAD facility, are subject to both CEQA and National Environmental Policy Act (NEPA) compliance. The OHD is acting as the lead CEQA agency, and the U.S. Navy is acting as the lead NEPA agency. As the lead federal agency, the U.S. Navy has assumed the lead role for the project in ensuring compliance with the Endangered Species Act (ESA), Magnuson-Stevens Fishery Conservation and Enhancement Act, and Section 106 of the National Historic Properties Act. The U.S. Navy and USACE acted as co-applicants in obtaining a federal consistency determination from the California Coastal Commission (CCC), which satisfies requirements of the Coastal Zone Management Act (CZMA). The USACE is also responsible for NEPA compliance for their O&M dredging component of the overall project and is preparing a supplement to their existing environmental assessment. The OHD and U.S. Navy are co-applicants for permits from both the USACE and the Regional Water Quality Control Board (RWQCB).

1.2 Purpose and Objective of This Report

Field studies and engineering analyses have been conducted by Anchor Environmental CA, L.P. (Anchor), acting as a technical design consultant to the OHD and the U.S. Navy, to evaluate the overall technical feasibility of this project, to investigate key technical details associated with the proposed work, to evaluate necessary design features and a feasible construction approach, and to develop and implement a permitting strategy for the various parties. Anchor has prepared this Design Report on behalf of OHD, and in close coordination with the U.S. Navy and USACE, Los Angeles District.

Key technical details that were investigated included the subsurface conditions and soil types in the Harbor, the required size of the CAD, the ability of the CAD to provide long-term isolation of contaminated sediments, the stability of the CAD excavation and adjacent features, the equipment types and estimated construction costs that would be associated with the project, and the overall permitting strategy. Furthermore, numeric modeling has been used to evaluate potential scour forces acting on the clean sediment cap in the CAD facility, including an assessment of wind waves, storm waves, vessel wakes, and propeller wash forces from vessels calling at OHD and U.S. Navy facilities. All analyses have purposefully been conducted using reasonably conservative assumptions and engineering judgment, in order to design the CAD facility to withstand conservative conditions.

This report documents these analyses and their results, along with draft final (90 percent) design plans and an outline of technical specifications for the proposed project.

1.3 Report Organization

Specifically, this Design Report summarizes the following aspects of the project:

- Section 2 – Overall site and sediment characteristics, including summary of pre-design studies that supported characterization of:
  - Sediment
  - Debris
- Section 3 – Review of the dredging requirements for the OHD, U.S. Navy, and USACE areas
- Section 4 – Review of the feasibility of various sediment disposal alternatives, establishing the basis for the CAD concept being used for this project
- Section 5 – Methods and equipment needs for sediment dredging and disposal, including:
  - Debris removal
  - Hydraulic dredging of the CAD facility and pumping onto Hueneme Beach
  - Mechanical dredging of contaminated sediments from OHD, U.S. Navy, and USACE hotspot areas, and their disposal within the CAD
- Section 6 – Technical basis for the design of the CAD excavation, filling, and overall protectiveness, including discussions of:
  - Placement of contaminated sediments and clean capping materials into the CAD

  - Ability of capping material to isolate chemicals in underlying sediments
  - Stability of capping material against erosive forces
  - Stability of CAD excavation and adjacent facilities
  - Consolidation of sediments in the CAD over time
  - Protection against bioturbation
- Section 7 – Evaluation of potential short-term water quality impacts from construction and sediment disposal
- Section 8 – Summary of permitting strategy for CEQA/NEPA compliance
- Section 9 – Expected construction sequence and general approach to project implementation and contracting
- Section 10 – References for in-text citations in this report

This report also includes supporting data and information in a series of appendices, as follows:

- Appendix A – Results of Sediment Coring and Geotechnical Explorations
- Appendix B – Results of Chemical Analysis of Sediments
- Appendix C – Summary of Hydrogeologic Conditions Under Port of Hueneme Harbor
- Appendix D – Results of Bathymetric Condition and Debris Surveys
- Appendix E – Weather and Sea Conditions
- Appendix F – Bioturbation and Its Potential Effects on Aquatic Capping in Port of Hueneme
- Appendix G – 90 Percent Design Plans
- Appendix H – 90 Percent Specifications

2 SITE CHARACTERISTICS

2.1 Site and Project Background

The Harbor is located approximately 60 miles northwest of Los Angeles along the California coast (Figure 1-1). It is the only deep-water harbor between Los Angeles and the San Francisco Bay area, and also serves as one of the few military ports on the West Coast (Naval Base Ventura County [NBVC]).

The Harbor is a constructed, landlocked harbor connected to the sea by a jetty-protected Entrance Channel. The outer part of the Entrance Channel terminates at the head of a submarine canyon, which offers an excellent deep-water approach to the Harbor. Figure 1-2 illustrates the overall layout of the Harbor and delineates the various areas of the Harbor that are administered by three parties: OHD, U.S. Navy, and USACE. The following sections provide additional detail on these organizations and their use of the site.

2.1.1 OHD Facilities

The OHD was created in 1937 under authority of an act of the State of California legislature that provides for the formation of harbor districts. OHD's portion of the Harbor is serviced by two wharves: OHD Wharf 1 (South Terminal) and OHD Wharf 2 (North Terminal), as shown on Figure 1-2. The portion of the USACE Federal Channel that splits OHD Wharves 1 and 2 is referred to as Slip A.

The OHD terminal area is made up of two wharves: OHD Wharf 1 (South Terminal) and OHD Wharf 2 (North Terminal). The South Terminal is a continuous 550-meter concrete piling supported wharf and provides three 183-meter berths (Berths 1, 2, and 3). These berths accommodate general cargo and fresh fruit operations. At the west end of this terminal and adjacent to the Entrance Channel, there is a 155-meter-long shallow-draft wharf supported by concrete piling.

The North Terminal is a continuous 442-meter wharf supported by concrete piling and provides two 221-meter berths (Berths 4 and 5). These berths accommodate Roll On/Roll Off operations and automobile vessels terminal operations. At the east end of Slip A, there are 18 small craft berths as well as a special mooring facility for the oil spill response vessel owned by Marina Spill Response Corporation.

2.1.2 U.S. Navy Facilities

First built as a temporary depot in the early days of World War II, the U.S. Navy base at the Harbor was officially established and began operating May 18, 1942, as the Advance Base Depot and was later renamed the Naval Construction Battalion Center in 1945. October 11, 2000, marked the establishment of NBVC.

The U.S. Navy area consists of five different areas: Wharves A and B, North Harbor Area, Wharf 3, Wharf 4, and Wharf 5, as shown in Figure 1-2.

- U.S. Navy Wharves A and B are in an enclosed area in the Northwest portion of the Harbor. The southern 84 meters of Wharf A is pile supported and the northern 54 meters is sheet pile constructed with tiebacks. Wharf B is a seawall with entirely sheet pile construction. Between Wharves A and B is the LST Ramp area.
- U.S. Navy North Harbor Area is an open area to the north of the Turning Basin. This area is flanked by Wharf C, the Surface Craft Berths, Wharf 6, and the northern portion of Wharf 4.
- U.S. Navy Wharf 3 is the berthing area to the east of the Turning Basin. The majority of the length of Wharf 3 (approximately 343 meters) is pile supported, with the exception of the northernmost 48 meters that connects to Wharf 5, which is precast panel construction.
- U.S. Navy Wharf 4 is the berthing area to the west of the Turning Basin. Wharf 4 is approximately 366 meters in length and is entirely pile supported.
- U.S. Navy Wharf 5 is the berthing area to the north of the Turning Basin. This wharf is entirely a pile-supported structure.

Along the northern part of the Harbor, a variety of U.S. Navy ancillary structures exist including boat launch facilities, bumper storage, and small craft berthing facilities, as follows:

- Boat launching structures area are located between Wharves A and B
- Between Wharves B and C, a shallow berth exists for storage of boat bumpers
- A six slip floating dock structure for small surface craft is located along the wharf between Wharves C and 6

2.1.3 USACE Federal Channel

USACE is responsible for maintaining safe navigable depths within Federal Channel portion of the Harbor (Figure 1-2). The USACE Federal Channel is comprised of the following areas:

- The Approach Channel is the main channel that enters the Harbor. The channel is 472 meters long and 183 meters wide with an authorized navigable depth of -12.2 meters mean lower low water (MLLW) with an over-dredge allowance of 0.5 meter. It is flanked by two rubble mound jetties (East and West Jetty) at the entrance to the Harbor.
- The Entrance Channel separates the Approach Channel and the Turning Basin. The channel is 400 meters long and 100 meters wide with an authorized navigable depth of -11 meters MLLW and an over-dredge allowance of 0.5 meter.
- The Turning Basin is 400 meters long and 330 meters wide with an authorized navigable depth of -10.7 meters MLLW and an over-dredge allowance of 0.5 meter. The USACE is considering deepening the Turning Basin to a depth of -12.2 meters MLLW; this possibility has been factored into the CAD design, as is discussed further in Section 6.
- Slip A is located southeast of the Turning Basin, splitting OHD Wharves 1 and 2 as shown in Figure 1-2. It is 360 meters long and 85 meters wide with an authorized navigable depth of -10.7 meters MLLW and an over-dredge allowance of 0.5 meter.

2.2 Characterization Events for Site Sediments

In evaluating the project's dredging requirements, data available as early as 1965 were compiled and summarized to provide an assessment of current information regarding the physical and chemical characteristics of Harbor sediments and the extent of sediment contamination within the Harbor. This section briefly summarizes the various sampling events that took place in the Harbor from 1965 onwards. A project-wide map of sampling locations is presented on Figure 2-1. More detailed information on the results of the sediment characterization is provided in appendices to this report. Appendix A contains detailed results from sediment coring, geotechnical explorations, and physical testing on sediments and site soils. Appendix B presents a tabulated collection of relevant results from chemistry analysis. The implications of the sampling and analysis results on dredging design are discussed in detail in Section 3.

2.2.1 USACE 1965 Sediment Sampling

USACE sampled along the eastern side of the Entrance Channel and indicated dense to very dense silty sands, with occasional layers of silt or clay, to elevations of -21.3 meters MLLW or deeper.

2.2.2 USACE 1983 Sediment Sampling

USACE collected sediment samples from 43 core locations scattered throughout the Harbor complex. The cores, which varied in depth from 1.2 to 4.3 meters, showed sands and silty sands with an occasional surface layer of soft black silt. No bedrock was encountered in any of the cores.

2.2.3 USACE 1996 and 2001 Sediment Sampling for Proposed Harbor Deepening

To characterize dredged materials for proposed Harbor deepening, 12 sediment cores were advanced by USACE in March 1996 and 25 additional test holes in 2001 in the Approach Channel, Entrance Channel, and Turning Basin. Sediment samples were obtained from the cores and analyzed for gradation and chemical characteristics.

2.2.4 USACE 2002 Sediment Sampling

To better characterize the spatial distribution of potentially contaminated dredged materials for the proposed Harbor deepening, seven sediment cores were collected by USACE in 2002 from the Turning Basin, Approach Channel, and Entrance Channel. Sediment samples were obtained from the cores and analyzed for gradation and chemical characteristics.

2.2.5 Anchor 2006 Sediment Sampling of Proposed Maintenance Dredging of OHD Wharves

To characterize dredged materials for OHD's planned maintenance dredging and possible berth deepening, nine sediment cores were obtained in September 2006 from locations distributed along the two wharves. Sediment samples were obtained from the cores and analyzed for gradation and chemical characteristics. Results of this sampling event are documented in Anchor's *Port Hueneme Wharves 1 and 2 Sediment Characterization Results Report* (2006a), and in Appendices A and B to this report.

2.2.6 Anchor 2007 Sediment Sampling of Proposed CAD Facility

To characterize the deep sediment layers in the area proposed for excavating the CAD facility, five cores were obtained in March and April of 2007 from representative locations within the footprint. Sediment samples were obtained from the cores and analyzed for gradation and chemical characteristics, including evaluation (and confirmation) of the excavated material's suitability for disposal at Hueneme Beach. Results of this sampling event are documented in Anchor's *Port Hueneme CAD Site Conceptual Design Plan* (2007b), and in Appendices A and B to this report. In coring locations near the eastern end of Wharf 1 (the South Terminal), maintenance-type sediments were found to extend deeper than the authorized navigational depth, indicating that dredging would be needed below the navigational elevation at these locations.

2.2.7 U.S. Navy 2007 Sampling of U.S. Navy Wharf Areas and USACE Hotspots

The U.S. Navy obtained a series of sediment cores from locations throughout their planned dredging area, as well as from USACE Hotspots 1 (in the Approach Channel) and 2 (adjacent to the U.S. Navy wharf dredging areas).

2.2.8 Anchor 2008 Supplementary Sampling of OHD Wharves and USACE Hotspot 3

In early 2008, Anchor returned to the OHD wharf area and conducted additional sampling near the eastern end of Wharf 1, in order to better define areas in which contaminated sediments extended below the design depth along the eastern end of Wharf 1. During this sampling event, two cores were also obtained from within the USACE Hotspot 3 to better define the depth of contaminants in that area.

2.3 Overall Summary of Site Sediment Characteristics

In general, the material to be removed from the Harbor is classified as black, silty sand with some shell hash and woody debris (i.e., maintenance-type material). The upper 1 to 2 meters consist of silty sand with more than 20 percent passing the No. 200 sieve while the materials below this surface layer consist of poorly graded sand with less than 5 percent passing the No. 200 sieve. Sediment sampling locations are shown in Figure 2-1. Corresponding boring logs and grain size distribution information for these sampling events are attached in Appendix A.

No bedrock was encountered in any explorations conducted in the Harbor, including the area and planned excavation depth of the CAD.

2.3.1 Nearsurface Harbor Sediments to Be Dredged

The majority of the sediments to be dredged from the Harbor are silty sand, dark greenish gray wet loose to medium dense, fine-grained sand, with an occasional surface layer of soft black silt. This is referred to as maintenance-type sediment since it consists of recently deposited, low-strength material.

Underlying the maintenance-type material is primarily clean, light-colored, dense to very dense silty sands, with occasional layers of silt or clay, with the appearance of native material.

Chemical testing on the maintenance-type material detected elevated concentrations of DDT, TBT, and PCBs at levels of concern above ER-M screening levels. The material is not considered to be hazardous waste, as defined by State of California Title 22 requirements. A summary of chemical analysis results is included in Appendix B.

2.3.2 Characteristics of Materials Excavated from CAD

Subsurface materials in the CAD excavation area largely consist of a fairly consistent sequence of dense, slightly silty to silty, medium to fine sand, with occasional thin (less than 1-foot-thick) clay layers. Occasional cobbles, trace gravels, and shell fragments are present. Laboratory testing of grain-size distribution on composite samples indicated a sand content of 92 to 93 percent by weight. Chemical analyses were not conducted on these material because they are expected to be free of contamination as they are native material and not subject to external forces that could cause contamination (e.g., groundwater upwelling). Blow counts have not been obtained for these materials, but geotechnical borings in adjacent upland areas indicate that it is in a dense to very dense condition.

2.3.3 Geotechnical Explorations of Adjacent Areas

Geotechnical borings on upland areas surrounding the project site were conducted in 2001 by Fugro West, Inc. (Fugro), near the OHD wharves and in 2002 by Geotechnics Inc., upland by U.S. Navy Wharf 4. Their locations are indicated on Figure 2-2. Boring logs and grain size distribution information for these sampling events are attached in Appendix A.

2.4 Characteristics of Underlying Soil Strata and Groundwater Aquifers

The area of the planned CAD excavation was evaluated for its proximity within and/or above significant groundwater sources and aquifers. The interpretation of the hydrogeology of the Harbor was based on previous studies conducted at NBVC, located adjacent to the Harbor, for their groundwater Remedial Investigation. These studies documented stratigraphic, water level, geochemical, and stable isotope data for the Harbor and the immediate surroundings. These on-site field results have been corroborated with information obtained from the California Department of Water Resources (DWR), United Conservation Water District, and U.S. Geological Society (USGS) collected from the immediate vicinity of the Harbor. A summary of the hydrogeologic conditions under Port of Hueneme Harbor and the immediate surrounding region was prepared by Anchor in a Technical Memorandum dated May 28, 2008. A copy of this technical memorandum is included as Appendix C. The following discussion summarizes the key points that are documented in this memorandum.

The upper three aquifers identified in the locality of the Harbor consist of predominantly undeformed late Pleistocene and Holocene alluvial floodplain sediments (Izbicki 1991). In ascending stratigraphic order, these Upper Aquifers are the Mugu, Oxnard, and Semi-perched Aquifers. The following discussion focuses on the Oxnard and Semi-perched Aquifers, as these are the two shallowest water-bearing layers, and thus the layers that are in closest proximity to the CAD. A low permeability layer, known as the Clay Cap Aquitard, separates these units.

2.4.1 Semi-perched Aquifer

According to DWR (1965), the Semi-perched Aquifer begins immediately below the ground surface, and at NBVC reaches depths of approximately 25 feet below ground surface (bgs) in the northern portion of the base, 75 feet bgs in the southern portion of the base, and more than 100 feet bgs under the Harbor. It consists of interbedded, laterally discontinuous sands, gravels, silts, and clays, with sand beds more predominant and continuous than the finer grained sediments. Throughout the area of NBVC moderate to high permeability sediments dominate the upper 25 feet of the subsurface, while lower permeability sediments are more prevalent below. This increase in low permeability sediments marks the transition to the underlying confining layer.

Groundwater quality in the Semi-perched Aquifer is low, and groundwater is not generally used for either domestic or agricultural purposes. Recharge to the Semi-perched Aquifer is from infiltration of precipitation; anthropogenic sources, such as leaking municipal water lines; and regional flow from inland areas. The upper portion of the Semi-perched Aquifer appears to discharge primarily to surface water bodies, namely the Pacific Ocean and to local drainage ditches.

2.4.2 Clay Cap Aquitard

The Semi-perched Aquifer is underlain by a Clay Cap Aquitard, which separates it hydraulically from the underlying Oxnard Aquifer. At NBVC, information about the Clay Cap Aquitard is limited to data from a few USGS and DWR well borings drilled in the western portion of the base, as well as some development wells and geotechnical borings conducted by the OHD as part of a wharf stabilization project. The Clay Cap Aquitard appears to consist of several layers of interbedded layers of clay, silt, and sand, with low permeability layers appearing with increasing frequency and thickness at depth, such that the lower portion of the Clay Cap Aquitard is dominated by continuous and extensive low permeability sediments.

The interbedded, gradual nature of the transition between the Clay Cap Aquitard and the aquifer units above and below make it difficult to define precisely the top and bottom of the Clay Cap Aquitard. The upper portion of the Clay Cap Aquitard lies directly below the Semi-perched Aquifer in the northern portion of the base at a depth of approximately 25 feet bgs. In the southern portion, the upper Clay Cap Aquitard lies directly below the deep Semi-perched Aquifer at a depth of approximately 75 feet bgs.

In the Harbor, the upper Clay Cap Aquitard is believed to start at approximately 75 to 100 feet bgs. The bottom of the lower portion of the Clay Cap Aquitard ranges from 150 to 200 feet bgs, thus suggesting that thickness ranges from 50 to 100 feet.

Geotechnical borings conducted by the OHD (Fugro 2001) indicated a continuous clay layer, approximately 15 to 20 feet in thickness, underlying the site at depths ranging from 70 to 100 feet bgs. This appears to represent the upper portion of the Clay Cap Aquitard. Additional borings by Anchor (Anchor 2007b) did not extend deep enough to encounter this clay layer, indicating that it lies below the planned depth of the CAD.

2.4.3 Oxnard Aquifer

The Oxnard Aquifer is a major groundwater source for the region and, other than in areas where seawater intrusion has occurred, contains high-quality groundwater. The Oxnard Aquifer is a lithologically diverse unit that contains multiple coarse-grained, high-permeability layers separated by clays and silts. The top of the Oxnard Aquifer is located at approximately 200 feet bgs in the northern portion of the base and 150 feet bgs in the southern portion of the base. According to the DWR (1965), the Oxnard Aquifer dips gently westward across NBVC and thins from about 80 feet thick in the east to 50 feet thick in the west. The base of the Oxnard Aquifer ranges from approximately 210 to 230 feet bgs across NBVC.

2.4.4 Localized Groundwater Flow Regime

High chloride levels have been extensively documented in the shallow aquifers underlying the Oxnard Plain and the Harbor area. These indicate a trend of seawater intrusion, and thus an overall direction of groundwater flow that is in the inland direction, away from shore. Evidence of seawater intrusion was first detected on the Oxnard Plain in the early 1930s (DWR 1971), as early monitoring programs indicated that there was a widespread area of elevated chloride concentrations in the region of the Harbor to Point Mugu areas. Subsequent work was done by the USGS, as part of their Regional Aquifer-system Analysis study, in cooperation with the United Water Conservation District. These studies indicated that the extent of seawater intrusion was not as widespread as previously believed but confirmed that over time, groundwater flow advanced in an inland direction, particularly during dry climactic periods (Izbicki 1992; Izbicki et al. 1995; USGS 1996).

2.5 Bathymetric Surveys

2.5.1 Fugro 2000 Survey

Single and multibeam surveys were performed by Fugro on November 14, 2000, for USACE Los Angeles District. Multibeam and single beam data were processed generating a bathymetric plan shown in Appendix D. Water depths will be used for design purposes relative to dredge equipment selection, dredge production, and dredge volume.

2.5.2 NOAA Baseline Survey

A baseline survey of the Harbor was conducted by National Oceanic and Atmospheric Administration (NOAA) in December 2005 as part of their standard coastal mapping program. This survey was used for initial design work on this project prior to the completion of the USACE conditional survey described in Section 2.5.3.

2.5.3 USACE Conditional Survey

USACE has performed annual conditional surveys starting in 2000 through the present. These conditional surveys were performed for the maintenance dredging of the Harbor as well as for the nearby Channel Islands Harbor.

The most recent of these conditional surveys was a multibeam survey performed in September 2007 by USACE. Bathymetric survey information for USACE annual conditional surveys is presented in Appendix D and has been used for initial CAD design as well as to calculate the dredged material volumes as presented in this Design Report. Water depths will be used for design purposes relative to dredge equipment selection, dredge production, and dredge volume.

2.6 Debris Survey

The existence of debris on the seafloor within the Harbor was evaluated using side-scan sonar and magnetometer surveys performed by Fugro on October 19 to 21, 2000, for USACE. The results of this survey event are documented in Appendix D. The side-scan sonar survey was performed utilizing an Edgetech Model 260 Seafloor Mapping System and a Chesapeake Technology Sonar Data Acquisition System. Magnetic anomaly data was collected with a Geometrics 881 marine cesium vapor magnetometer. side-scan sonar and Magnetometer data were processed generating a mosaic for debris analysis. Debris determinations will be used for design purposes relative to dredge equipment selection due to presence of debris, dredge production, and debris disposal requirements (based on size and type). Nine potential debris targets were identified as part of the debris survey within the CAD and OHD Wharves 1 and 2 areas. Details of the nine potential targets are described in the side-scan survey documentation.

2.7 Weather and Sea Conditions

Appendix E summarizes weather and sea conditions in the Harbor. This information was used in the analysis in Section 6.2 and will be of use to potential bidders on the project. It will be provided as part of the construction documents for bidder and contractor reference.

3 SEDIMENT DREDGING REQUIREMENTS

As was described in Section 1 and 2, the Harbor study area is currently divided into three areas (Figure 1-2), corresponding to either ownership or management responsibilities: the OHD project area, the U.S. Navy project area, and the USACE project area. Collectively, the contaminated sediments from all three areas (Figure 1-2) of the Harbor total approximately 239,800 m^3.

- OHD Berths – 27,500 m^3
- U.S. Navy Berths – 73,300 m^3
- USACE Hotspots – 139,000 m^3

This section provides details on the sediment dredging requirements for the various sites.

3.1 OHD Wharves

3.1.1 Site Dredging Requirements

Current authorized design depth for dredging both OHD wharves is -10.7 meters MLLW with an over-dredge allowance of 0.5 meter. Maintaining active operations for OHD requires ensuring the full use of the berth areas along the two wharves, which in turn requires maintenance dredging to remove sediments that accumulate over time. OHD's Berths 1 and 2 were last dredged more than 10 years ago and have since accumulated between 1 and 4 meters of sediment along the wharf faces. OHD's maintenance material was recently chemically characterized (Anchor 2006a) and found to be unsuitable for open-ocean or beach disposal due to elevated pesticides, TBT, and PCB concentrations.

3.1.2 Sediment Characteristics

As was discussed in Section 2.2, in 2006, Anchor sampled sediments from OHD Wharves 1 and 2 to analyze and characterize the dredged material in preparation for maintenance dredging activities (Anchor 2006b). This sampling event indicated that the majority of the sediments to be dredged from OHD Wharves 1 and 2 can be classified as homogeneous, black, silty sand with some shell hash and woody debris. This description is consistent with the concept of the dredged sediment being a recently deposited maintenance-type material, distinguishable from the underlying materials, which are presumed to be native (pre-existing) materials. The native sediments underlying the maintenance-type material were primarily coarse sand at Wharf 1, while a clayey layer was observed in the bottom of core tubes at Wharf 2. In both cases, the native sediments were sufficiently dense to refuse penetration by the sampling vibracore.

The sampling conducted in 2006 (Anchor 2006a) detected elevated concentrations of DDT, TBT, and PCBs at levels of concern above ERM screening levels. The material is not considered to be hazardous waste (as defined by State of California Title 22 requirements), but the material would not be suitable for unconfined ocean disposal, nor for beach placement.

Refer to Appendices A and B for further information on sediment characteristics.

3.1.3 Evaluation of Required Dredge Depths

Required dredging depths were determined by the results of recent sediment coring and sampling activities throughout the Harbor, which indicated the limits and depths of contaminated material. Contaminants of concern include metals, PAHs, PCBs, DDT and its breakdown products, and organotins such as TBT. The vertical "depth to clean" at each sample location was calculated by determining the deepest elevations at which concentrations of these contaminants of concern exceed relevant risk-based criteria. The ERL and ERM values of Buchman (1999) were used as the criteria to establish appropriate concentrations of metals and PAHs. Risk-based criteria for concentrations of PCBs and DDT and its breakdown products were taken from a focused ecological risk assessment with bioaccumulation modeling prepared for the USACE, Los Angeles District (Anchor 2003). The bioaccumulation trigger value for TBT was derived from Meador et al. (2002). Sediments determined to have concentrations of one or more of these chemicals of concern in excess of these risk-based criteria will be disposed of within the CAD facility.

While defining the required dredge plan layout, an additional 0.3 meter of depth was typically added below the established depth to clean so as to provide an additional factor of safety for removal of contaminant. Furthermore, an additional 0.5-meter allowable overdepth will be provided to the contractor below the design dredging elevations, which will provide an additional level of conservatism.

3.2 U.S. Navy Dredging Requirements

Current authorized dredging depth for all U.S. Navy areas is -10.5 meters MLLW with an allowable over-dredge of 0.5 meter. The U.S. Navy is experiencing issues similar to those OHD is facing, in terms of sedimentation along its berth faces. Significant accumulations of contaminated sediments have started to affect vessel operations. The contaminated sediments along the U.S. Navy's berths extend from the wharf face outward to the edge of the USACE Federal Channel. Sampling conducted in 2007 allowed the U.S. Navy to finalize the vertical extent of contamination within these areas.

As was discussed in Section 2.2, the U.S. Navy conducted sediment sampling along their wharves in 2006 (U.S. Navy 2006), which indicated the presence of contaminated sediments, but did not fully define their vertical extent. The U.S. Navy performed a supplementary sediment sampling program in 2007 to better define the depth of contaminants. Refer to Appendices B and C for further information on sediment characteristics in the U.S. Navy area.

The same approach and criteria described in Section 3.1.3 was used to determine the vertical limits of dredging specified for the U.S. Navy dredging areas.

3.3 USACE Federal Channel Dredging Requirements

Previous sediment investigations, summarized in Section 2.2, identified three areas of contaminated sediment ("Hotspots" 1, 2, and 3) located within the USACE Federal Channel, which are also depicted on Figure 1-2. Hotspot 1 is situated in the Approach and Entrance Channels, while Hotspots 2 and 3 are in the Turning Basin. Hotspot 2 is directly adjacent to the U.S. Navy's dredging areas for Wharf 4 and the North Harbor Area, and Hotspot 3 is located between OHD Wharves 1 and 2 at the eastern end of Slip A. The rest of the area requiring maintenance dredging is not contaminated and was determined by USACE to be suitable for disposal (renourishment) on the adjacent beaches.

The same approach and criteria described in Section 3.1.3 were used to determine the vertical limits of dredging specified for the USACE Federal Channels.

3.4 Dredging Restriction Areas

In certain areas along the OHD and U.S. Navy wharves, sediment analysis results indicated contaminated sediments are present below the proposed dredging depths. These areas have been identified as Dredging Restriction and Backfill Areas and are identified in Figure 3-1. In these areas, the contaminated sediments will be removed to reach the required depth to clean; however, it will be necessary to backfill the areas to prevent undermining and damage to the existing wharves and fendering systems.

In dredging restriction areas, special dredging procedures by the contractor will be required to follow. These include:

- Dredging shall occur in segments not more than 30 meters in length
- In areas of dredging below -12.5 meters, dredging shall occur in segments not more than 15 meters in length
- Backfilling operations in each segment shall be completed within 36 hours following completion of dredging.

3.5 Confirmatory Sampling and Residuals Management

Residual contamination is typically encountered in surface sediments following the completion of an initial remedial dredging pass. The presence of residual contaminants is inevitable to some degree when dredging contaminated sediments due to the inability of mechanical or hydraulic dredging equipment to completely and perfectly remove all sediment within a submerged dredge prism. Resuspension of sediment during bucket impact and retrieval, or disturbance during hydraulic excavation, results in fine-grained sediment becoming suspended and transported away from the immediate location of the dredge. Larger grain sizes, such as sand, settle out of the water column fairly rapidly while finer-grained sediment, such as silts and clays, can remain in suspension for longer periods of time (traveling farther distances before settling out).

Residuals can potentially result in a thin layer of recently deposited sediment in which post-remediation surface concentrations may be similar to pre-remediation levels. Experience with other environmental dredging projects indicates that approximately 5 percent of the dredged sediment mass can be expected to be left behind as a layer of residuals (Stern and Patmont 2006). Similar dredge residual amounts have been reported for mechanical and hydraulic dredging operations, both with or without the use of best management practices (BMPs), such as silt curtains.

After dredging of site areas, confirmatory samples will be obtained from the freshly dredged sediment surface and analyzed to determine if any contaminated sediments remain, which might in turn require additional dredging. Confirmatory samples will be obtained from a series of randomly distributed or grid-based locations. The samples will be subdivided into vertical sections so that the presence of a residuals layer can be distinguished from the underlying native sediment. This will enable the concentrations in the surficial residual layer to be compared to concentrations in the underlying material. The presence of elevated concentrations in the residual layer alone will not necessarily trigger a need for re-dredging, since the residual layer will be limited in thickness and may not be able to be fully removed by dredging.

4 SEDIMENT DISPOSAL ALTERNATIVES

The project originates from the need to identify a cost-effective solution for disposal of contaminated sediments in the Harbor. Typically, maintenance dredging in the area (primarily USACE O&M dredging of the nearby Channel Islands Harbor) has been accomplished by hydraulically dredging the accumulated sediment and beneficially reusing it on nearby beaches, which experience very high rates of erosion and thus are constantly in need of sand renourishment. This has proven to be a cost-effective solution for dredging and beneficial reuse of dredged material that benefits not only the dredged harbor areas but also the receiving beaches.

However, due to the levels of contamination within upper layers of sediment planned for removal from the Harbor, nearshore or beach placement of dredged material is not a viable option. As a result, the disposal alternatives below were evaluated for the project.

4.1 Upland Landfill

Two factors to consider in determining the suitability of a specific permitted landfill for disposal of dredged material are the concentration of contaminants in the material and the total quantity of material to be disposed. In addition, the dredged material disposed at a landfill typically needs to pass the "paint filter" test, which requires that the material must be dewatered after dredging to prevent drainage during transport and to minimize excess infiltration during disposal.

The concentration of contaminants in dredged material determines the type of landfill that can accept the material. In California, landfills are identified as Class I, II, or III:

- Class I landfills can accept materials that are classified as hazardous wastes. Material that exceeds the chemical criteria listed in Title 22 of the California Code of Requirements (CCR), Section 66261.24 is considered a hazardous waste and must be disposed in a Class I landfill.
- Class II landfills are similar in design to Class I landfills, but these landfills will accept only designated waste that has been determined to be below hazardous waste criteria concentrations.
- Class III landfills can accept material with some degree of contamination (typically low concentrations of contaminants) depending on the individual landfill design and

location. Each Class III site operator must maintain a certification with the California State Integrated Waste Management Board that specifies that facility's waste acceptance criteria and testing requirements, in accordance with applicable state and federal discharge regulations.

The dredged material from OHD Wharves 1 and 2 as well as the contaminated dredged material from U.S. Navy and USACE Hotspots meets the qualifications for disposal at a Class III Landfill. This alternative, however, is very expensive for several reasons. First, the material must be dewatered prior to transport, which must occur either actively using a mechanical dewatering device (e.g., belt presses, centrifugation, hydrocyclones, or via additives) or passively by constructing a large containment area to hold the material until the water evaporates or drains. Next, the material must be trucked or shipped via railcar to the landfill[1]. Lastly, because the regional landfills are not in need of inert material for use as alternative daily cover, the material would be subjected to a tipping similar to any other waste product that they receive. Preliminary estimates for dredging and landfill disposal of material from the Harbor would likely exceed \$60 to \$70 per m^3. Therefore, due to economic constraints and the large volume of dredged material for this project, landfill disposal is not considered a viable alternative.

4.2 Reuse

Promoting beneficial reuse of dredged material is considered a national goal of the resource agencies. Beach renourishment, frequently used by USACE in the Oxnard/Ventura area, is one example of sediment reuse, but other possibilities include the use of dredged material in the development or manufacturing of commercial, industrial, horticultural, agricultural, or other products.

[1] Note that while rail lines do exist near the Harbor, most of the regional Class III landfills are not equipped for receiving material via rail car, so additional facilities would need to be constructed.

Reuse of dredged material can be categorized into options presented in Table 4-1.

Table 4-1
Typical Options for Soil Reuse

Description	Example
Land-filling	Daily cover
Landscaping	Beach renourishment/topsoil
Agricultural	Amendment to farms
Reclamation	Mines/quarries/brownfields
Engineered fill	Parking lots/roads/embankment
Building materials	Bricks/blocks/light weight aggregate

There are also many processing technologies that can be utilized to increase the suitability of dredged material, particularly for materials that are chemically impacted to some degree:

- Sand separation (hydrocyclones)
- Composting (biosolids or cellulose)
- Solidification/stabilization (cement, lime, flyash, etc.)
- Soil washing (BioGenesis)
- High temperature thermal treatment (Ecomelt, lightweight aggregate, bricks, etc.)

All of these technologies require additives and/or treatment of the sediment, and at least one rehandling step as well as significant amounts of area for the processing equipment and sediment stockpiling. Typically, such approaches have proven not to be cost-effective for projects of this size because they require the construction of large treatment facilities on site to process the material.

4.3 Open-ocean Disposal

Open-ocean disposal is a cost-effective alternative that is widely utilized on the West Coast. Because ocean-disposed dredged material does not require a rehandling step, sediment can be dredged and placed directly into a bottom-dump barge, hauled to one of several U.S. Environmental Protection Agency (USEPA)-managed open-ocean disposal sites, and discharged. However, sediments must be shown to be sufficiently clean to qualify for an open-ocean disposal permit, and the known contaminated sediments at the Harbor will not qualify for this disposal alternative.

4.4 Confined Aquatic Disposal

CAD is a process where either an existing depression or a constructed CAD facility is used to contain contaminated material. The sediments placed in the CAD facility are typically subsequently isolated with a clean layer of overlying cap material. Unless an existing CAD facility and large source of capping material is present on site, CAD is typically not considered an economically viable alternative because of the construction costs required to excavate the CAD facility, transport and dispose of the excavated materials, and the cost to dredge and transport clean material to the site for capping. The Harbor offers a unique opportunity where the nearby beach is in need of renourishment, which provides a low-cost disposal alternative for the excavated sands. USACE has a plan for O&M maintenance dredging of clean material in the Harbor, which is suitable in volume and quality for capping, and there are three parties (OHD, U.S. Navy, and USACE) that can share the construction costs for excavating the CAD facility. This option also has the advantage of requiring no rehandling, as dredged sediments can be placed directly into a bottom-dump haul barge, moved over the CAD facility, and disposed, similar to the process that would be used for open-ocean disposal (and with a much smaller transportation distance).

4.5 Summary

In summary, the sediment disposal option that appears to have the greatest potential to be cost-effective is the CAD option, owing to the negligible transportation distance, the fact that no sediment pre-treatment is necessary, and the lack of tipping fees. While this disposal option does require a capital investment (i.e., excavation of the CAD facility), this process is facilitated by the sand content of the excavated material and the proximity of a receiver beach. By splitting this capital cost between the three parties, a cost-effective disposal option can be realized.

The next sections of this report provide further detail on the technical design and construction processes for a CAD disposal site in the Harbor.

5 DREDGING OF CONTAMINATED SEDIMENTS AND CAD FACILITY

This section discusses the project sequence and dredge plan for the various portions of the project.

For any dredging project, the fist step in developing the dredge plan is to define the sequence of construction operations. The second step is to select appropriate dredging equipment for these site conditions. The third step is to define the dredge template based on site conditions and equipment selection.

Contract documents for this project will include a requirement for a Dredging Work Plan (Work Plan) that is prepared by the selected dredging contractor to detail the specifics of equipment and various operations associated with the project. The Work Plan will provide specific data on the project schedule, equipment selection, on-site logistics, construction monitoring, health and safety issues, progress reporting requirements, and other information as appropriate.

5.1 Required Project Sequence

The project will likely be accomplished under a USACE contract, and will take place in several discrete dredging, disposal, and material placement events. These have been identified based on type, sediment disposal or placement, and owner of the areas in which dredging is performed (OHD, U.S. Navy, or USACE).

5.1.1 Dredging Event 1 – CAD Excavation

Clean sand will be excavated from the CAD facility and pumped onto Hueneme Beach, located immediately south of the Entrance Channel, to renourish the beach.

5.1.2 Dredging Event 2 – U.S. Navy Wharves and Hotspot 2 Dredging

Contaminated sediments along the U.S. Navy Wharves and the adjacent USACE Hotspot 2 area will be dredged using mechanical equipment, and placed within the CAD facility by bottom-dump barge. As was discussed in Section 3.4, certain areas along the U.S. Navy wharves are identified to be in a Dredging Restriction area, and dredging operations will be required in 30- or 15-meter segments to maintain stability and prevent undermining of the structures. After dredging to the required elevations, confirmatory samples will be collected to verify if contaminated sediments have been fully removed. See Section 3.5 for additional discussion of the confirmatory sampling process and the potential for re-dredging at the site.

5.1.3 Dredging Event 3 – OHD Wharves and Hotspot 3 Dredging

Contaminated sediments along OHD Wharves 1 and 2 and the adjacent USACE Hotspot 3 area will be dredged using mechanical equipment and placed within the CAD facility by bottom-dump barge. As was discussed in Section 3.4, certain areas along the OHD Wharves are identified to be in a Dredging Restriction area and dredging operations in 30-meter segments will be required to maintain stability and prevent undermining of the structures. After dredging to the required elevations, the same process will occur as described in Section 5.1.2 for backfilling and confirmatory testing.

5.1.4 Concurrent Backfilling along Wharf Faces

Concurrent with Dredging Events 2 and 3 along the U.S Navy and OHD wharves, approximately 17,000 m^3 of material will be removed from an identified area in the southern portion of the Turning Basin, and placed as a stabilizing backfill along the U.S. Navy and OHD wharf faces to maintain stability and prevent undermining of fender piles as a result of the dredging operations.

5.1.5 Dredging Event 4 – Hotspot 1 Dredging

Contaminated sediments will be dredged from USACE Hotspot 1 within the Entrance Channel and placed within the CAD facility by bottom-dump barge. After dredging to the required elevations, confirmatory samples will be collected to verify if contaminated sediments have been fully removed. See Section 3.5 for additional discussion of the confirmatory sampling process and the potential for re-dredging at the site.

5.1.6 Dredging Event 5 – Operations and Maintenance Material Dredging

The remaining O&M material in the Federal Channel will be dredged using mechanical equipment and placed within the CAD facility by bottom-dump barge. This material will serve as a cap that isolates the underlying contaminated sediments. Dredging will take place first from the Turning Basin, then from the Entrance Channel and Approach Channel.

5.1.7 Installation of Armor Rock

After the five required dredging and CAD filling events occur, a layer of armor rock will be placed over the southwest portion of the CAD facility to protect the cap from erosion and propeller wash forces.

The remainder of this section presents these individual work elements and other accompanying tasks in greater detail.

5.2 Debris Removal

Fugro identified and categorized surficial debris using side-scan sonar and magnetometer survey results collected from October 19 to 21, 2000. The results of these surveys are presented in Appendix D. Fugro evaluated the data within the Harbor and developed a table (Appendix D) showing the estimated locations (northings and eastings) and dimensions (length, width, and height) of the debris, and brief descriptions of the debris targets identified. By evaluating the dimensions and descriptions of each identified debris target, an estimated volume of surficial debris within the Harbor was estimated to be 15 m^3. This volume estimate is only an indicator as to what amount of debris may be encountered; given that the project site is an industrial/port area, it is possible that additional subsurface debris may be present that was not captured fully by the side-scan sonar and magnetometer surveys. The corresponding tonnage of the debris to be removed during dredging operations is estimated as approximately 100 tons.

Debris will be removed mechanically and placed onto a flat deck barge. Remnant timber piles will be required to be removed in their entirety, to the extent feasible. Debris will be transported to an on-site offloading facility and placed into trucks for final transport and disposal at a Class II landfill in Ventura County or other approved disposal site.

5.3 CAD Excavation

Approximately 533,400 m^3 of sand will be excavated from the prescribed area of the Turning Basin to form the CAD facility. The excavated sand will be placed on Hueneme Beach using the same disposal area as with previous dredging events for Port of Hueneme Harbor and Channel Islands Harbor. The required size of the CAD facility was determined by adding the amount of contaminated dredged material expected to be generated from the OHD, U.S.

Navy, and USACE areas, while leaving sufficient space for clean capping material (USACE maintenance dredging material). The design for the CAD is such that the final elevation for the surface of the cap will take into account the possible future deepening of the Harbor by the USACE. The selection of design dimensions and volume capacity of the CAD facility are discussed in detail in Section 6.6.

5.3.1 Equipment

Equipment necessary to excavate the CAD facility would need to have the ability to remove material to a depth of as much as -26 meters MLLW. The availability and types of dredge equipment within the industry were assessed. Both hydraulic and mechanical dredging equipment of the size and capability required for the CAD were determined to be available for this project.

An important aspect of the excavation of the CAD facility is the ability to transport dredged material economically to Hueneme Beach as beach renourishment. Typical beach renourishment projects utilize hydraulic cutterhead dredges with in-water pipelines to carry the dredged material slurry from the CAD facility to Hueneme Beach. Once the sand reaches Hueneme Beach, the pipe will be extended as necessary to spread out the sand placement, and earth-moving equipment (dozers) will be utilized to grade the sand and level off the crown area of the beach.

Dredged material can also be removed mechanically (crane utilizing a clamshell) and placed into a barge. The barge is transported to an on-site offloading area where the dredged material is hydraulically unloaded and transported via a pipeline onto Hueneme Beach. However, for this project, mechanical dredging is not recommended due to the fact that it will take longer and has higher costs.

5.3.2 Anticipated Production Rate

The dredging production rate (i.e., the volume of dredged materials removed per hour) was estimated for purposes of developing estimated dredging costs and schedule for CAD dredging. Factors that impact dredging productivity vary with equipment, site characteristics, and weather conditions. Production rates may be higher in some areas of the site and lower in others, depending on sediment type, water depths, and the presence of debris. Production rates may also be impacted by turbidity control requirements.

The following assumptions were made to estimate the dredge production rate:

- Size of hydraulic dredge = 0.66 meter (26 inches)
- Pump rate = 91,000 liters per minute (24,000 gallons per minute [gpm])
- Slurry velocity = 4.4 meters per second (m/s)
- Slurry specific gravity (SG) = 1.2
- Uptime (i.e., the time that the dredge is actually working, excluding routine maintenance, unexpected maintenance, dredge positioning, and encountering unexpected debris) = 70 percent

The assumptions listed above were based on engineering judgment, familiarity with Harbor conditions, and discussions with dredging contractors. It is further assumed that dredging operations would be conducted 7 days per week for 24 hours a day, yielding a production rate of 11,700 m^3 per day. This results in a total estimated dredging duration of approximately 46 days for the project for a total removal volume of 533,400 m^3. The total project schedule for dredging depends on the additional time required for mobilization and demobilization (including installation and removal of the turbidity barrier system, if required), and the number of dredges used, among other factors.

The anticipated hydraulic dredge estimated to perform the CAD hydraulic dredging has a ladder depth restriction of approximately 16 meters. In order to reach the desired depth of the CAD excavation, a ladder extension would be required to extend the hydraulic dredging depth to approximately 30 meters. The dredging production rate for the CAD will be determined not only by the overall depth of dredging but also the presence of vessel traffic within the Harbor and possible seafloor debris.

5.3.3 Dredging Limits and Volumes

The dredging limits for the CAD are defined by the target dredging surface and the horizontal limits of removal. Dredging limits were determined by the capacity necessary to contain all contaminated dredged material from OHD, U.S. Navy, and

USACE with an appropriate cap, as is discussed in Section 6.6. The horizontal dredging limit for the CAD is defined within the USACE Federal Channel Turning Basin, and the vertical dredging limit was limited to an elevation of -26 meters MLLW so as to stay well above the Clay Cap Aquitard that overlies the Oxnard groundwater aquifer. The dimensions of the CAD, at its base, are 140 meters long by 180 meters wide. The maximum design dredge depth is up to -26 meters MLLW with an over-dredge allowance of 0.5 meter.

Given these dimensions, approximately 533,400 m^3 of dredged material will be removed from the CAD.

5.3.4 Beach Renourishment

Geotechnical investigations by Anchor (2007b) indicated that the material removed from the CAD will be comprised of clean, mostly fine to medium sand that is physically and chemically suitable for placement on site beaches. The nearest candidate beach is Hueneme Beach, which starts at the East Jetty and extends approximately 0.8 kilometer (km) along the south edge of the OHD property, and then another 2 km of public beach beyond that. The beach has a variable width (about 15 to 90 meters) depending on season, tides, and degree of beach erosion. Sand that is dredged from the CAD will be hydraulically placed on Hueneme Beach starting along the East Jetty and filling eastward until all dredged material from the CAD has been placed. The width will vary along this placement area until it is merged with the existing Hueneme Beach. The total anticipated pipeline distance from the CAD to the beach placement area is 2 km.

5.4 OHD Dredging

Approximately 27,500 m^3 of dredged material will be removed from OHD Wharves 1 and 2 and placed directly into the excavated CAD. The OHD Wharves 1 and 2 volume estimates are based on a dredging template that includes dredging to the authorized depth of -10.7 meters MLLW with a 0.5 meter of over-dredging allowance. Additional contaminated material extends below the authorized depth of -10.7 meters MLLW near the eastern end of Wharf 1. Volume estimates used in this report, therefore, include the removal of contaminated material from that area, and an additional 0.5 meter of allowable over-dredging below the authorized depth throughout.

5.4.1 Equipment

The contractor that will be selected to construct the CAD will likely be the same contractor that conducts the OHD dredging. Dredging mechanically using a crane (or other suitable equipment) mounted on a flat deck barge has been selected as the preferred dredging method, based on an evaluation of OHD Wharves 1 and 2 conditions. The mechanical dredge will be equipped with a clamshell bucket or equivalent for soft material. The specific make and model of the bucket to be employed will be determined by the selected contractor based on the material types present and the dredging requirements, but due consideration will be given to the ability of the selected bucket and associated equipment to keep turbidity generation to within acceptable limits given the expected turbidity monitoring requirements at the Harbor and material characteristics.

Dredged material removed from the water will be placed into a split-hull material barge. Once filled to capacity, the split-hull material barge will transport the dredged material to the CAD facility, using a tender for power and maneuvering. Placement of dredged sediment within the CAD facility is discussed in Section 6.4.

5.4.2 Anticipated Production Rate

The dredging production rate (i.e., the volume of dredged materials removed per hour) was estimated for purposes of developing the dredging project schedule. Factors that impact dredging productivity vary with equipment, site characteristics, and weather conditions. Production rates may be higher in some areas of the site and lower in others, depending on sediment type, water depths, and the presence of debris. Production rates may also be impacted by turbidity control requirements.

The following assumptions were made to estimate the dredge production rate:

- Size of clamshell bucket = 5 m^3
- Cycle time (i.e., the time to close the bucket with dredged material, pull it out of the water, place the dredged material into the barge/offloading area, and return the bucket to the water for the next dredge cut) = 90 seconds per cycle
- Uptime (i.e., the time that the dredge is actually working, excluding routine maintenance, unexpected maintenance, dredge positioning, encountering

unexpected debris, and the need to periodically switch out the barges used to transport dredged material) = 70 percent

- Bucket load = 60 percent in situ sediment and 40 percent water by volume

The assumptions listed above were based on engineering judgment, familiarity with the Harbor conditions, and discussions with dredging contractors. It is further assumed that dredging operations would be conducted 7 days per week for 24 hours a day, yielding a production rate of 2,000 m^3 per day. This results in a total estimated dredging duration of approximately 14 days for the project for a total removal volume of 27,500 m^3. The total project schedule for dredging depends on the additional time required for mobilization and demobilization (including installation and removal of the turbidity barrier system, if required), and the number of dredges used, among other factors.

5.4.3 Dredging Limits

The dredging limits for OHD Wharves 1 and 2 are defined by the target dredging surface and the horizontal limits of removal. Dredging limits were determined from sediment thickness interpolation using AutoCAD© Land Development Desktop (version 2007) 3-D terrain modeling software developed by Autodesk, Inc. Dredging limits, which define the volume and current disposition of sediment material that must be removed, are defined by OHD Wharves 1 and 2. The development of the target dredging surface involved identifying the surface of the native material underlying the sediment material and specifying a cut back slope around the OHD Wharves 1 and 2 perimeter to minimize slumping of materials into the dredging area.

The horizontal dredging limit for OHD Wharf 1 is defined by USACE Federal Channel Slip A and the pier head of South Terminal. The dimensions of the dredging limits at OHD Wharf 1 are 550 meters long by 22.9 meters wide. The horizontal dredging limit for OHD Wharf 2 is defined by USACE Federal Channel Slip A and the pier head of North Terminal. The dimensions of the dredging limits at OHD Wharf 2 are 442 meters long by 15.3 meters wide.

5.4.4 Dredging Volume

Based on most recent surveys of the OHD area (conducted by the USACE in September 2007) and on recent sampling performed by Anchor (2006a), it is estimated that approximately 27,500 m^3 of dredged material will be removed from OHD Wharves 1 and 2. Near the eastern end of the southern wharf, the risk-based suitability criteria listed in Table 1-1 were used to determine depths to clean at the sampling and coring locations, below the authorized dredging depth. An additional 0.3-meter factor of safety was added to this dredging depth to increase the likelihood of full removal of contaminants. Furthermore, an additional 0.5-meter allowable overdepth will be provided to the contractor below the design dredging elevations, which will provide an additional level of conservatism.

Volumes for each of the OHD areas are presented in Table 5-1.

Table 5-1
Summary of Dredging Volumes – OHD Areas

Dredge Area	Total Volume of Dredged Material (m^3)
OHD Wharf 1	13,100
OHD Wharf 2	14,400
Total	**27,500**

These volumes assume that the two wharves are dredged to their authorized design depth (-10.7 meters MLLW with an over-dredge allowance of 0.5 meter), with an additional volume dredged in order to remove deeper contaminated sediments, as described above.

5.4.5 Maintaining Wharf Stability along Dredge Cuts

In certain areas along the OHD (and U.S. Navy) wharves, contaminated sediments extend deeper than the authorized, design dredging depths along the wharf structures. In order to fulfill the project goal of removing known contaminated sediments from the Harbor, it will be necessary to excavate these areas below the wharf design depths.

Such areas are identified to the contractor as Dredging Restriction and Backfill Areas (Figure 3-1). In these areas, dredging will occur in individual segments of limited lengths along the wharf structures, as to lessen the distance and period of time over which the temporarily dredged and deepened condition exists. After dredging depths in each segment are approved by the engineer, the dredged areas will be backfilled to the design grades within 36 hours following completion of dredging in that segment.

Dredging and backfilling in Dredge Restriction and Backfill Areas can be done in different segments concurrently, as long as no two immediately adjacent dredging segments are dredged at the same time. Dredging and backfilling must be completed for one segment before dredging can start in an immediately adjacent segment.

Dredging near the wharves removes material that provides restraining pressure acting against the wharves and the piles that support them. The wharf structures have been designed for a sediment surface at the -10.7 meter MLLW mark to keep the wharves stable with an acceptable factor of safety. When sediment is removed along the wharf face to a level deeper than -10.7 meter MLLW to remove contaminated sediments, this will not cause failure, but will place the structures in a situation where they have a lower factor of safety than desired due to lack of horizontal pressure at the toe. Replacing this pressure with a block of clean backfill material is necessary to return the wharves to their previous level of stability.

The sections and wharves listed in Table 5-2 will have clean sand material placed up to a certain elevation in front of the wharves to replace the passive pressure that was removed by dredging. The backfill will be placed to build the soil elevation to an elevation of -10.7 meters MLLW. The width of the replaced material was analyzed using an equivalent slope and Rankine's passive earth pressure method.

For this analysis, the passive earth pressure coefficients, K_P, were evaluated for the pre-existing support prior to dredging, and after dredging with replacement of backfill to widths of 30 meters and 15 meters out from the face of the wharf structure. The material that will be removed is assumed to be a clayey silty material ($\phi' = 20^\circ$). The clean material that will be put back in its place is assumed to be a medium to fine sand (ϕ' =

25˚) that is mined from previously dredging areas of the Turning Basin. An equivalent slope (β) was found by measuring the angle from the top of the undredged material against the wall to the toe of the backfill material. Thus, the equivalent slope is steeper for a thinner (15-meter) backfill wedge than it is for a thicker (30-meter) wedge. Friction between the wall and the soil was neglected and all walls were generalized to be vertical.

Earth pressure coefficients before dredging and after dredging and placement of backfill are compared in Table 5-2. It can be seen that for both backfill widths, the wedge of backfill provides a higher earth pressure coefficient than was present before the dredging. It is therefore concluded that placing backfill materials in a 15-meter-wide wedge (as measured perpendicular to the wharf face) along the wharf edge will be sufficient to replace the passive pressure that was temporarily removed by dredging.

Table 5-2
Earth Pressure Coefficients for Stability of Wharves

Wharf Number	Before Dredging (φ' = 20˚)		Backfill, 30-meter width (φ' = 25˚)		Backfill, 15-meter width (φ' = 25˚)	
	β	K_{p1}	β	K_{p2}	β	K_{p3}
4	0	2.040	-3.8	2.216	-5.6	2.104
4	0	2.040	-3.8	2.216	-5.7	2.100
4	0	2.040	-4.4	2.180	-6.3	2.062
4	0	2.040	-4.4	2.180	-6.3	2.062
4	0	2.040	-3.1	2.260	-4.9	2.149
6	0	2.040	-3.1	2.260	-3.8	2.216
6	0	2.040	-3.8	2.216	-4.6	2.169

5.5 U.S. Navy Dredging

Approximately 73,300 m^3 of dredged material will be removed from five U.S. Navy areas and placed directly into the excavated CAD. The U.S. Navy volume estimates are based on a dredging template that includes dredging of contaminated sediments to the design depth of -10.5 meters MLLW. This is a potentially conservative estimate that will be revisited after further evaluation of updated sediment characterization data from the U.S. Navy.

5.5.1 Equipment

The contractor that will be selected to perform the CAD excavation and the OHD dredging work will likely be the same contractor utilized under the USACE contract. The U.S. Navy areas fall under the USACE contract. Dredging equipment will be the same utilized for the OHD dredging as described in Section 5.4.1.

5.5.2 Anticipated Production Rate

The assumptions regarding the dredging production rate (i.e., the volume of dredged materials removed per hour) are the same as those utilized under the OHD as described in Section 5.4.2.

It is further assumed that dredging operations would be conducted 7 days per week for 24 hours a day, yielding a production rate of 2,000 m^3 per day. This results in a total estimated dredging duration of 37 days for the project for a total removal volume of 73,300 m^3. The total project schedule for dredging depends on the additional time required for mobilization and demobilization (including installation and removal of the turbidity barrier system), and the number of dredges used, among other factors.

5.5.3 Dredging Limits and Volume

The horizontal dredging limits for the various U.S. Navy areas are depicted on Figure 1-2. The maximum authorized design dredge depth is -10.5 meters MLLW with an over-dredge allowance of 0.5 meter. It is known, however, that contaminated sediments are present below the authorized elevation. The risk-based suitability criteria listed in Table 1-1 were used to determine depths to clean for each sampling and coring location, and were used to develop an overall plan of required dredging throughout the U.S. Navy areas. While defining the required dredge plan layout, an additional 0.3 meter of depth was typically added below the established depth to clean so as to provide an additional factor of safety for removal of contaminant. Furthermore, an additional 0.5-meter allowable overdepth will be provided to the contractor below the design dredging elevations, which will provide an additional level of conservatism. The resulting dredge volumes from the U.S. Navy areas are tabulated in Table 5-3 and include the full 0.5-meter allowable overdepth.

Table 5-3
Summary of Dredging Volumes – U.S. Navy Areas

Dredge Area	Total Volume of Dredged Material (m^3)
U.S. Navy North Harbor Area	47,300
U.S. Navy Wharves A and B	6,000
U.S. Navy Wharf 3	8,900
U.S. Navy Wharf 4	5,600
U.S. Navy Wharf 5	5,500
Total	**73,300**

5.5.4 Maintaining Wharf Stability along Dredge Cuts

Certain areas along the U.S. Navy wharves are identified as Dredging Restriction and Backfill Areas, similar to those that are identified for the OHD wharves, as discussed above in Section 5.4.5. Again, in these areas, dredging shall occur in segments not more than 30 meters in length as measured along (parallel to) the wharf face. In areas of deeper dredging, to below -12.5 meters as indicated on the Design Plans, dredging shall occur in segments not more than 15 meters in length as measured along (parallel to) the wharf face. Segmental dredging is only necessary within a distance of 20 meters measured outward from the wharf face.

Backfilling operations in each segment will be completed to the extents and top elevations shown on the Contract Plans, using a clamshell bucket to place the material, and shall be completed in each segment within 36 hours following completion of dredging in that segment. Backfill will be placed to a top elevation of -10.5 meters and to a width of 15 meters out from the wharf face. See Section 5.4.5 for a discussion of how this size of backfill wedge will provide sufficient passive support to the wharf faces.

5.6 USACE Hotspot Dredging

Approximately 139,000 m^3 of dredged material will be removed from USACE Hotspots 1, 2, and 3 and placed directly into the recently excavated CAD. USACE Hotspots 1, 2, and 3 volume estimates are based on a dredging template that includes dredging to the authorized depth including over-dredging allowance. In areas where existing cores indicate contaminated material below the authorized depths, the dredge template will be adjusted to contain the contaminated material.

5.6.1 Equipment

The contractor that will be selected to perform the CAD excavation and the OHD dredging work will likely be the same contractor utilized under the USACE contract. USACE hotspot areas fall under the USACE contract. Dredging equipment will be the same equipment utilized under the OHD as described in Section 5.4.1.

5.6.2 Production

The dredging production rate (i.e., the volume of dredged materials removed per hour) will be the same utilized under the OHD as described in Section 5.4.2. It is further assumed that dredging operations would be conducted 7 days per week for 24 hours a day, yielding a production rate of 2,000 m^3 per day. This results in a total estimated dredging duration of approximately 70 days for the project for a total removal volume of 139,000 m^3. The total project schedule for dredging depends on the additional time required for mobilization and demobilization (including installation and removal of the turbidity barrier system), and the number of dredges used, among other factors.

5.6.3 Dredging Volumes

The risk-based suitability criteria listed in Table 1-1 were used to determine depths to clean for each sampling and coring location, and were used to develop an overall plan of required dredging throughout the USACE hotspot areas. While defining the required dredge plan layout, an additional 0.3 typically added below the established depth to clean so as to provide an additional factor of safety for removal of contaminant. Furthermore, an additional 0.5-meter allowable overdepth will be provided to the contractor below the design dredging elevations, which will provide an additional level of conservatism.

Approximately 139,000 m^3 of dredged material will be removed from USACE Hotspots 1, 2, and 3. Volumes for each of the USACE hotspot areas are presented in Table 5-4, and include the full 0.5-meter allowable overdepth.

Table 5-4
Summary of Contaminated Dredging Volumes – USACE Areas

Dredge Area	Total Volume of Dredged Material (m^3)
USACE Hotspot 1	71,000
USACE Hotspot 2	36,200
USACE Hotspot 3	31,800
Total	**139,000**

5.6.4 Dredging Adjacent to U.S. Navy Area at Hotspot 1

A 3H:1V (3 horizontal:1 vertical) side slope will be cut here to minimize the potential for a side slope failure back into the federal channel. Contaminated materials may extend beyond the current dredge area on the U.S. Navy side of the federal channel line, but their potential management is outside of the scope of this project and will be addressed separately.

5.7 USACE Federal Channel Operations and Maintenance Material Dredging

After the contaminated USACE hotspot sediments have been removed and placed within the CAD, approximately 109,700 m^3 of remaining, non-contaminated dredged material will be removed by the USACE from the Approach Channel, Entrance Channel, and Turning Basin, so as to complete their O&M dredging process. The USACE Federal Channel's volume estimates are based on a dredging template that includes dredging to the authorized depth including over-dredging allowance. This material will potentially be removed using a mechanical dredge and placed directly into the excavated CAD by a barge, or by using a hydraulic dredge and pumped into the CAD facility using a submerged diffuser (or similar method). It is likely that the mechanical dredging approach will be used, since this method will already be in place from its use for the contaminated sediments; although, it is possible that this final portion of the project could be conducted in less time and at less cost using the hydraulic method.

5.7.1 Equipment

The contractor that will be selected to perform the CAD excavation and the OHD dredging work will likely be the same contractor utilized under the USACE contract.

The USACE hotspot areas fall under the USACE contract. Dredging equipment will be the same utilized under the OHD as described in Section 5.4.1.

5.7.2 Anticipated Production Rate

The dredging production rate (i.e., the volume of dredged materials removed per hour) will be the same utilized under the OHD Section 5.4.2. It is further assumed that dredging operations would be conducted 7 days per week for 24 hours a day, yielding a production rate of 2,000 m^3 per day. This results in a total estimated dredging duration of approximately 54 days for the project for a total removal volume of 109,700 m^3. The total project schedule for dredging depends on the additional time required for mobilization and demobilization (including installation and removal of the turbidity barrier system), and the number of dredges used, among other factors.

5.7.3 Dredging Limits

The horizontal dredging limit for the Approach Channel is 472 meters long by 183 meters wide with a maximum authorized depth of -12.2 meters MLLW with an over-dredge allowance of 0.5 meter. The horizontal dredging limit for the Entrance Channel is 400 meters long by 100 meters wide with a maximum authorized depth of -11 meters MLLW with an over-dredge allowance of 0.5 meter. The horizontal dredging limit for the USACE Turning Basin is 400 meters long by 330 meters wide with a maximum authorized depth of -10.7 meters MLLW with an over-dredge allowance of 0.5 meter.

6 DESIGN ELEMENTS FOR CAD FACILITY

This section describes the various engineering analyses that were conducted to evaluate the overall feasibility of physically containing and chemically isolating contaminated sediments within the proposed CAD. Section 6.1 describes modeling analyses conducted to predict the ability of surficial capping material (dredged from the USACE O&M dredging project) to chemically isolate the underlying contaminated sediments from burrowing organisms and biota residing in the overlying water column under long-term scenarios. This analysis leads to a required minimum cap thickness in order to maintain environmental protectiveness. Section 6.2 documents an engineering evaluation of potential erosive forces acting on the surface of the CAD, primarily imposed by movements of vessels in the Harbor, and describes how that potential is addressed in the design. Finally, Sections 6.3 and 6.4 discuss engineering analysis of CAD excavation and filling respectively. Section 6.5 discusses protection against bioturbation. Finally, Section 6.6 combines the results of these analyses, in conjunction with geotechnical considerations of the CAD and the sediments within it, to determine target dimensions and depths for the CAD, suitable to contain the required volume of sediment while maintaining a protective cap that can withstand the erosive forces that are present.

In combination, these analyses were used to ensure that the CAD is protective against chemical breakthrough and that its surficial, isolating cap is designed in general accordance with USACE cap design guidelines (Palermo et al. 1998a and 1998b).

6.1 Cap Design for Chemical Isolation

6.1.1 Chemical Isolation Modeling

The steady-state model of Reible et al. (2004), was used to estimate chemical concentrations in the biologically available nearsurface layer of the cap (the bioturbation layer) once steady-state (long-term equilibrium) conditions are achieved after capping of contaminated CAD sediments.

As the dissolved contaminants move upward through the cap, they are predicted to undergo biodegradation while at the same time partitioning onto the cap material. Bioturbation mixes the surface layer, further reducing concentrations. The model predicts steady-state concentrations of sediment or porewater in the surface layer by applying developed formulas to represent these various processes. The chemical isolation performance of the cap can then be evaluated by comparing the model-predicted steady-state surficial concentrations to selected toxicity guidelines or criteria.

Using the model developed by Reible et al. (2004), the chemical concentrations in the bioturbation layer are calculated as a balance between the flux from the underlying chemical isolation layer, the flux leaving the bioturbation layer (characterized by a mass transfer coefficient, k_{bio}), and the benthic boundary layer in the overlying water column (characterized by a mass transfer coefficient, k_{bl}). Considering that groundwater seepage and transport of contaminants may potentially occur independently of these processes, the predicted porewater concentration in the bioturbation layer (C_{bio}) is related to the flux out of the chemical isolation layer by the following equation:

$$C_{bio} = Flux\left[\frac{1}{k_{bio}R_f + U} + \frac{1}{k_{bl} + U}\right] \qquad \text{(Equation 6-1)}$$

where: R_f = retardation factor for the movement of chemicals through the cap
U = Darcy velocity of the groundwater

To calculate the overall fluxes noted above, the Reible et al. (2004), model also requires the input values defined in Table 6-1. Other input values to the model are chemical-specific and are listed in Table 6-2.

6.1.2 Model Inputs and Assumptions

Modeling was conducted using the input values listed in Tables 6-1 and 6-2. Conservative values were selected in all cases. Specific assumptions are described below.

Table 6-1
Summary of Physical Input Parameters for Cap Chemical Isolation Layer Modeling

Symbol	Value	Units	Comments
L_{eff}	100	cm	Effective cap thickness for isolation layer; for the purposes of this modeling, the cap for the Harbor CAD is assumed to be a minimum of approximately 1 meter thick
ε	0.4	unitless	Porosity of cap sediments; 0.4 is a typical value for sand based on past experience
SG	2.5	g/cm^3	Specific gravity of cap sediment particles; typical value for sediment was used
P_b	1.5	g/cm^3	Bulk sediment density of cap sediments calculated as $P_b = (1- \varepsilon)*SG$ (Palermo et al. 1998a)
K_{oc}	(Note 1)	L/kg-OC	Organic carbon partitioning coefficient
λ	(Note 1)	/year	First order decay constant for chemical biodegradation
f_{oc}	0.0038	fraction	Total Organic Carbon (TOC) content of cap material (representative of USACE maintenance material; based on sampling throughout the Harbor)
K_d	(Note 1)	L/kg	Cap adsorption distribution coefficient ($K_d = K_{oc}*f_{oc}$)
R_f	(Note 1)	unitless	Retardation factor ($R_f = ((P_b * K_d)/ \varepsilon)+1$)
U	120 to 12,000	cm/yr	Darcy velocity ($U = V*\varepsilon$)
V	0 to 1 (0 to 365)	cm/day (cm/yr)	Upward porewater seepage velocity; a neutral (zero) upward groundwater seepage velocity was used in the model
D_o	(Note 1)	cm^2/yr	Molecular diffusion of chemical in water (best fit relationship based on diffusion rates in the Risk Assessment Information System (RAIS)[2] database)
C_o	(Note 1)	mg/L	Porewater chemical concentration of underlying sediments (95 percent UCL)
$k_{bio\ (particle)}$	1	cm/yr	Bioturbation mixing mass transfer coefficient for particle (Verduin et al. 2005)
$k_{bio\ (water)}$	100	cm/yr	Bioturbation mixing mass transfer coefficient for water (Verduin et al. 2005)
k_{bl}	1	cm/hr	Benthic boundary layer mass transfer coefficient (Verduin et al. 2005)

Notes:
1 – Chemical specific parameter
2 – DOE 2007
cm – centimeter
cm/hr – centimeters per hour
cm^2/yr – squared centimeters per year
g/cm^3 – grams per cubic centimeter
L/kg – liters per kilogram
mg/L – milligrams per liter
UCL – Upper Confidence Limit

Table 6-2
Summary of Chemical-specific Input Parameters for Cap Chemical Isolation Layer Modeling

Chemical	$Log_{10}K_{oc}$[a]	Molecular Diffusion Coefficient (cm/year)[b]	Solubility Limit at 25°C (mg/L)[c]	Minimum Reported Anaerobic Biodegradation Rate (year)[d]
TBT	4.4	181	100	1.53
Benzo(a)anthracene	5.4	284	0.01	0.002
Benzo(a)pyrene	5.9	284	0.002	0.48
Benzo(b)fluoranthene	5.9	175	0.002	0.41
Chrysene	5.4	196	0.002	0.06
Heptachlor epoxide	3.7	133	0.2	–[e]
Total DDT	6.4	156	0.006	0.003
Total PCBs	4.7	252	0.277	0.001

Notes:
a – K_{oc} for TBT source: USACE (2005); Source for other chemicals: Risk Assessment Information System (RAIS; DOE 2007)
b – Molecular diffusion values were developed from a best fit relationship from values given from RAIS (DOE 2004)
c – Solubility also from RAIS (DOE 2004); for TBT, TBT oxide was used
d – Biodegradation rate values from the U.S. National Library of Medicine (2008)
e – Research has shown that heptachlor epoxide usually does not biodegrade significantly in sediments
cm/year = centimeters per year
mg/L = milligrams per year

6.1.2.1 Dissolved Chemical Concentrations Entering Cap

The chemical concentrations for sediment underlying the cap were obtained from the sampling results from four sediment sampling events (2001, 2002, 2006, and 2007). The chemicals of potential concern (COPCs) determined after evaluating the data are:

- TBT
- PAHs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, and chrysene)
- Heptachlor epoxide
- Total DDT
- Total PCBs

Since all COPCs are organic chemicals, the concentrations were normalized for the organic carbon content of the sediment (using the average TOC calculated from all data sets) to obtain concentrations in milligrams per kilogram of organic carbon (mg/kg OC). Where values were undetected for a particular COPC, a concentration equal to half the detection limit was assumed, and then organic carbon-normalized. The 95 percent upper confidence levels (UCL) of all available data were calculated for each COPC. These values were then converted into porewater concentrations assuming equilibrium partitioning conditions and using the organic carbon water partitioning coefficients from the Risk Assessment Information System (RAIS) database (DOE 2007). The resulting porewater concentrations were input into the model as C_0 values (as summarized in Table 6-3).

Table 6-3
Calculated Initial Porewater Concentrations (C_0) for Chemical Isolation Modeling

Chemical	95 Percent UCL of Underlying Bulk Sediment (mg/kg OC)	95 Percent UCL of Underlying Sediment Porewater (mg/L)
TBT	10.2	2.9E-04
Benzo(a)anthracene	36.1	1.5E-04
Benzo(a)pyrene	47.1	7.1E-05
Benzo(b)fluoranthene	64.1	9.2E-05
Chrysene	54.4	2.4E-04
Heptachlor epoxide	0.4	4.0E-05
Total DDT	4.1	1.5E-05
Total PCBs	17.3	2.1E-04

Note:
mg/kg – milligrams per kilogram
mg/L – milligrams per liter

6.1.2.2 Thickness of Cap

The thickness of the capping material was conservatively assumed to be approximately 1 meter. This is the minimum thickness that the cap is designed to maintain, recognizing the potential for erosive scour forces (Section 6.2) and possible deepening of the Harbor in the future. In actuality, the cap will be designed to be 3 meters thick, allowing an additional degree of conservatism in the design.

6.1.2.3 Infinite Source Assumption

The underlying sediment was conservatively assumed to maintain the maximum estimated porewater concentration at all times, without any degradation or depletion during its movement through the cap.

6.1.2.4 Mass Transfer Coefficients

Conservative estimates of benthic boundary layer mass transfer coefficients were assumed, per Reible et al. (2004).

6.1.2.5 Seepage Velocities

This is a key variable in cap modeling, as it directly influences the timespan over which chemical concentrations are expressed through the cap. The cap model used in this design evaluates the effects of upward groundwater flow through the cap, since that would be the driving force for breakthrough into surface waters. For the Harbor and adjacent area, regional studies (most notably, United Water Conservation District 2001) indicate that the Harbor is underlain by a shallow perched aquifer system, which extends to a depth of about 100 feet where very little to no long-term porewater movement is indicated. Under this condition, the predominant mode of contaminant transport through the cap would be by passive diffusion. Historic local well data (as documented in the United Water Conservation District's 2003 Coastal Saline Intrusion Report [2004]) indicates that there is, in fact, an overall neutral flow condition in the subsurface of the Harbor (at least at the depths that are contiguous with or in the near vicinity of the CAD). This means that net groundwater flow is effectively neither upward nor downward, and that the primary transportation mechanism for dissolved chemicals is not via groundwater flow but rather by molecular diffusion—a very slow process that accounts for the long predicted timespans before breakthrough is predicted.

In the long run, there is evidence that groundwater flow may undergo periodic fluctuations between flow in upward (i.e., toward the Harbor) and downward (i.e., toward the land) directions, in response to fluctuations in climatic conditions. In dry periods, groundwater migration might develop in the landward direction; whereas, during wet periods, the aquifers become recharged, which would prompt groundwater to flow in the reverse direction toward the coast—but over long time spans, these variations will tend to even out, such that there is a net neutral groundwater flow condition. This is the basic assumption used in the modeling.

In the absence of upward groundwater flow, the process of diffusion drives the migration of dissolved contaminants upward into and through the cap.

6.1.2.6 Biodegradation Rates

Biodegradation rates were obtained from the Hazardous Substances Database. To be conservative, the slowest biodegradation rate provided from this source was used as input to the model.

6.1.2.7 Partitioning Coefficients

Porewater concentrations have not been directly measured at this site; therefore, partition coefficients (K_{oc}) were used to calculate porewater concentrations from the bulk chemistry data. These K_{oc} values were obtained from the Risk Assessment Information System (RAIS) database (DOE 2007). The calculated porewater concentration was used as the initial concentration entering the cap (C_0; Table 6-3).

6.1.3 Model Results

The model was run using a neutral seepage scenario representing the neutral flow conditions (i.e., zero seepage velocity) within the Semi-perched Aquifer that is documented below the site.

Table 6-4 presents the chronic toxicity criteria for sediment porewater used to evaluate model results. For TBT, results were compared with national recommended water quality criterion (USEPA 2005). All other parameters were compared to Priority Toxic Pollutants in the State of California (USEPA 2000). These toxicity criteria were used to determine the performance of the cap by comparing them to C_{bio} (the output concentration of the model). The ratio of C_{bio} to the selected toxicity criteria was determined for each COPC and defined as a hazard quotient (HQ) of toxicity. Values greater than 1 indicate potential toxicity to benthic organisms in the cap bioturbation layer.

Table 6-4
Sediment and Water Quality Guidelines for the Harbor

Chemical	Chronic Water Quality Criteria (mg/L)[a]	Sediment Guidelines	
		ERM (mg/kg)[b]	ERL (mg/kg)[b]
TBT	4.2E-04	N/A	N/A
Benzo(a)anthracene	4.9E-05	1.6	0.261
Benzo(a)pyrene	4.9E-05	1.6	0.43
Benzo(b)fluoranthene	4.9E-05	N/A	N/A
Chrysene	4.9E-05	2.8	0.384
Heptachlor epoxide	1.1E-07	N/A	N/A
Total DDT	5.9E-07	0.0461	0.00158
Total PCBs	3.0E-05	0.180	0.0227

Notes:

a – For TBT, the USEPA National Recommended Water Quality Criteria (2005) was used.
For PAHs, DDT, and PCBs, the Criteria for Priority Toxic Pollutants in the State of California (USEPA 2000)was used.

b – Sediment guidelines are not available for TBT; sediment guidelines for other contaminants are ERM and ERL from Buchman 1999.

N/A – not applicable

Model results are summarized in Table 6-5. The predicted steady-state concentrations in the surficial cap layer (C_{bio} and W_{bio}, for porewater and sediment, respectively) were compared to sediment and water quality guidelines (Table 6-4), and the resulting comparisons to quality guidelines are expressed as an HQ. HQ values less than 1 indicate that the guideline is not predicted to be exceeded under steady-state conditions in the surficial bioturbation layer.

Table 6-5
Summary of Chemical Isolation Layer Modeling Results Under Nominal Seepage Velocity Scenario

Seepage Velocity[1]	Chemical	Porewater Concentration (C_{bio}) at Steady State (mg/L)	Sediment Concentration (W_{bio}) at Steady State (mg/kg)	Hazard Quotients			Time to Steady State (years)
				Porewater HQ	ERM Sediment HQ[b]	ERL Sediment HQ[b]	
0 centimeter per year	TBT	3.87E-10	1.45E-07	0.000001	N/A[a]	N/A[a]	8,400
	Benzo(a)anthracene	5.42E-08	1.86E-04	0.001	0.0001	0.001	49,000
	Benzo(a)pyrene	1.20E-09	1.41E-05	0.00002	0.00001	0.00003	168,000
	Benzo(b)fluoranthene	4.98E-10	5.95E-06	0.00001	N/A[a]	N/A[a]	277,000
	Chrysene	3.56E-08	1.25E-04	0.001	0.00004	0.0003	73,000
	Heptachlor Epoxide	6.67E-08	5.23E-06	0.61	N/A[a]	N/A[a]	2,400
	Total DDT	3.15E-09	1.03E-05	0.01	0.0002	0.01	85,000
	Total PCBs	2.48E-07	1.66E-04	0.01	0.001	0.01	10,700

Notes:
1 – See Table 6-2 for definitions
a – Sediment guidelines are not available for TBT
b – ERM and ERL are from Buchman 1999
mg/L – milligrams per liter
mg/kg – milligrams per kilogram
N/A – not applicable

It can be seen from Table 6-5 that predicted HQs are below 1 for all parameters. The estimated time to steady-state conditions ranges from approximately 2,400 to 277,000 years. Keeping in mind that these results assume a cap thickness of 3 feet when in reality the actual cap will be at least 10 feet thick, a better estimate of breakthrough potential is closer to 8,000 years for the most mobile of contaminants present at the site (heptachlor epoxide). The implications of these results are that the cap is predicted to be effective in isolating all contaminants for a period of over many thousands of years.

6.2 Physical Stability of Capping Material

This section presents the results of an analysis that evaluates the hydrodynamic conditions at the Harbor. The objective of the analysis is to evaluate the stability of the capping material for the proposed CAD facility within the Harbor and to determine if any additional protection (using coarser material) is necessary to maintain the cap's design thickness in the long-term.

As described below, the local waves at the project location are expected to be small; hence, the focus of the analysis was on the propeller-induced currents at the project site.

6.2.1 Waves

In a feasibility study for navigation-related dredging for the Harbor, USACE (1999a) conducted a wave analyses for the Harbor site. Their findings are summarized below.

USACE reviewed three databases to estimate the wave conditions within the eastern Santa Barbara Channel near the Harbor. Although they have pointed out that the Santa Barbara Channel location has a somewhat different wave exposure than the Harbor, they concluded that the wave conditions at the Santa Barbara Channel can still be considered representative of the wave conditions at the Harbor. USACE summarized the average wave conditions for the Santa Barbara Channel location in two tables—one for the significant wave height and one for the wave period. These two tables are reproduced here as Table 6-6 and Table 6-7.

Table 6-6
Average Annual Wave Frequency Distribution by Significant Wave Height

Significant Wave Height (feet)	Percentage (%)
1 to 2.9	58.48
3 to 5.9	27.82
6 to 8.9	6.35
9 to 11.9	0.92
12 to 14.9	0.36
15 to 17.9	0.04
18 to 20.9	0

Note:
Based on conditions in the Santa Barbara Channel

Table 6-7
Average Annual Wave Frequency Distribution by Wave Period

Wave Period (seconds)	Percentage (%)
Less than 7.9	22.16
8 to 9.9	27.18
10 to 11.9	24.05
12 to 13.9	11.80
14 to 15.9	6.96
Greater than 16	0.71

Note:
Based on conditions in the Santa Barbara Channel

Note that the wave conditions presented in these tables represent the wave conditions outside the Harbor. In general, the waves at the proposed CAD facility inside the Harbor could be smaller. Nevertheless, as shown in Table 6-6, most of the waves outside of the Harbor are smaller than 3 feet, and it is very rare to have waves larger than 9 feet. For a 9-foot wave with a period of 10 seconds, the wave-induced bottom velocity at the CAD facility would be about 3 ft/s. The wave-induced bottom velocity on top of the cap is small compared to the vessel-generated propeller wash currents as will be demonstrated in Section 6.2.3. The stability of the capping material at the CAD facility will hence be governed by vessel operations instead of the waves.

USACE also evaluated the extreme wave condition at the Harbor based on the data available for the nearby Channel Islands Harbor. The extreme wave heights for different return periods are summarized in Table 6-8.

Table 6-8
Significant Wave Heights for Various Return Periods

Return Period (years)	Significant Wave Height (feet)
100	18.3
50	13.2
25	10.5
10	8.8
5	6.0

Note:
Based on conditions in the Channel Islands Harbor

The wave conditions shown in the table represent the storm waves outside the Harbor. Actual waves at the proposed CAD facility will likely be smaller.

6.2.2 Water Levels

The water levels in the study area are influenced primary by the astronomical tides. The other factors that affect water levels include temperature variations (e.g., during El Niño Southern Oscillation), barometric pressure changes, wind setup (i.e., storm surge), and wave setup. These factors are secondary in magnitude and episodic in nature, hence their effects on the water levels are not considered in the analyses presented herein. The long-term representation of the water level at the project location is calculated based on astronomical tides alone.

NOAA monitors gauging stations around the United States to obtain ocean water level measurements. Tidal elevations at the Harbor are summarized in Table 6-9 based on NOAA's publication of tidal datum in the area, dated December 10, 1984 (NOAA 1984).

Table 6-9
Tides at the Harbor

Tidal Condition	Elevation (feet MLLW)
Extreme high observed (2/4/58)	7.7
Mean higher high water (MHHW)	5.5
Mean high water (MHW)	4.7
Mean tide level (MTL)	2.8
Mean low water (MLW)	0.98
Mean lower low water (MLLW)	0.0
Lowest observed water level (1/7/51)	-2.3

Source:
NOAA 1984

For a given vessel, the magnitude of the propeller-generated bottom currents depends on the water depths (i.e., tidal elevation). The tidal information provided in Table 6-9 is used for estimating propeller wash currents at the CAD facility.

6.2.3 Propeller Wash

6.2.3.1 Propeller Wash Model

A propeller wash model based on the equations developed by Blaauw and van de Kaa (1978), Blaauw et al. (1984), and Verhey (1983) and calibrated with field measurements at San Diego Bay (Everest 2003) was used for this study to evaluate the propeller-generated currents at the CAD location. The model predicts the velocity field behind a propeller jet based on the momentum theory by assuming that the propeller thrust equals the change of the fluid momentum caused by the propeller. It also predicts the laws of free jet turbulence for submerged jets by assuming that flow is steady, uniform, and frictionless.

The propeller wash model calculates the velocity of the propeller jet at a distance, x, from the propeller and a radial distance, r, from the propeller axis as:

$$V_{x,r} = 9.72 * (P_d/D_p^2)^{1/3} * (1.4 * D_p/x)^{0.85} * \exp(-8 * r^2/x^2) \qquad \text{(Equation 6-2)}$$

where: $V_{x,r}$ = water velocity at a given distance, x, behind the propeller and radial distance, r, from the propeller axis (ft/s)

P_d = applied engine/propeller power (horse power [hp])

D_p = propeller diameter (feet)

Details about the propeller wash model calibrations can be found in documents by Everest (2003) or Anchor (2004).

6.2.3.2 *Vessel Activities and Characteristics at the Harbor*

As discussed above, the propeller wash model requires information about specific vessels to predict the propeller jet velocities. Vessel operations and activities that may affect the proposed CAD location at the Harbor were obtained by interviewing the Captain and Port Engineer of BRUSCO Tug and Barge, as well as the Port Pilot. In general, the vessels that would affect the CAD location include tug boats, automobile vessels, and U.S. Navy Destroyers. Properties of representative vessels operating in the Harbor are listed in Table 6-10.

Table 6-10
Typical Vessel Properties at the Harbor

Vessel Type	Vessel Draft (feet)	Number of Propellers	Propeller Diameter (feet)	Maximum Power (hp)
Tug boat	11.2	2	6.75	4,000
Automobile vessel	31	1	20	20,000
U.S. Navy Destroyer, Arleigh-Burke Class	28	2	14 to 20	80,000

The Port Pilot also commented that the automobile vessel will typically use only about half of the maximum power (i.e., 10,000 hp) when leaving the Harbor. Information provided by the U.S. Navy also indicated that the U.S. Navy Destroyer will use up to one-half of the maximum power (i.e., 40,000 hp).

6.2.3.3 Model Predicted Propeller Wash Currents

The propeller wash model described above was used to predict the vessel-generated velocities on the surface of the proposed CAD, assumed for the purposes of this modeling to be at an elevation of -12.7 meters MLLW (below the potential depth of future deepening in the Turning Basin). Figure 6-1 shows examples of the model predicted propeller wash currents at the seabed (i.e., on the surface of the cap covering the CAD) behind the vessels. The top panel of Figure 6-1 shows the bottom velocities behind the tug boat operating at three different water levels—mean higher high water (MHHW), MLLW, and lowest recorded water (LRW). The predicted maximum bottom velocities generated by the tug boat are between 2.4 and 2.9 ft/s, occurring at about 120 to 160 feet behind the boat. As expected, the highest velocity occurs at the shallowest water level (i.e., at LRW). The middle panel and bottom panel show the model predicted bottom velocities generated by the automobile vessel and the U.S. Navy Destroyer operating at half their maximum power levels, respectively. As shown in the figure, the automobile vessel can generate maximum bottom velocity between 5.7 to 7.7 ft/s, while the U.S. Navy Destroyer can generate maximum bottom velocity of between 9.1 and 12.5 ft/s. Table 6-11 below summarizes the maximum bottom velocities (i.e., on top of proposed cap) generated by the three vessel types operating at different tidal conditions.

Table 6-11
Maximum Bottom Velocities at the Proposed CAD Facility (at elevation -41.5 feet MLLW)

Vessel Types	Maximum Bottom Velocities (ft/s)		
	MHHW	MLLW	LRW
Tug boat	2.4	2.8	2.9
Automobile vessel	5.7	7.0	7.7
U.S. Navy Destroyer	9.1	11.2	12.5

As discussed in the next section, the maximum bottom velocities generated by the vessels in the Harbor are high enough to scour the capping material at the proposed CAD facility; hence, part of the proposed CAD surface needs to be protected with larger size material (e.g., cobbles). The spatial distribution of the vessel generated propeller wash velocities on top of the proposed CAD has been examined to determine where the larger size capping material will be needed. Since the U.S. Navy Destroyers will generate the highest propeller wash velocities on top of the CAD, they are used as the criteria for design.

The design team evaluated the typical range of positioning of the U.S. Navy Destroyer during its departure from the Harbor, using information provided by the U.S. Navy (2008). Figures 6-2 and 6-3 show the spatial distribution of the propeller wash velocities on top of the CAD with the U.S. Navy Destroyer at two different typical locations at the start of departure, assuming a tide level at MLLW. Figure 6-2 shows the U.S. Navy Destroyer at its most likely location when leaving the Harbor (90 percent of the time, per the U.S. Navy) while Figure 6-3 shows the U.S. Navy Destroyer at a location farther back within the Harbor that is estimated to occur only 10 percent of the time. As shown in the figures, the highest propeller wash velocity occurs at about 100 feet behind the vessel (shown in red) and starts to trail off farther behind the vessel. In addition, most high velocities are confined to within a short distance away from the centerline of the vessel resulting in the elongated oval shaped velocities patterns shown in the figure. This velocity patterns suggest the areas of the CAD where larger size material will be needed, which was taken into consideration in the proposed capping design.

6.2.3.4 Propeller Wash Induced Scouring

Whether the vessel-generated propeller wash currents calculated above will cause scouring of the capping material at the CAD facility will depend on the grain size of the capping material. Based on available core log data, the proposed capping material (USACE O&M dredged material) has an average median grain size, D_{50}, of 0.2 millimeter (mm). Figure 6-4 shows the Hjulstrom curve, which is commonly used to evaluate whether bed material of a given grain size will be eroded by the imposed flow velocity. This curve indicates that for a grain size of 0.2 mm (indicated as the dashed line on the figure), the critical current speed that would cause incipient particle motion is about 0.6 to 0.8 ft/s. The propeller wash currents (shown as colored lines) generated by the vessels in the Harbor are all much higher than this critical current speed and hence very likely to cause erosion of the capping material.

The potential extent of the scouring of the proposed CAD was calculated based on the empirical method developed by Ducker and Miller (1996). In this method, the potential depth of the scour hole is related to the size of the capping material "d" and a stability parameter "B," which in turn is a function of the maximum vessel-induced current on top of the CAD, as well as the size and density of the capping material.

$$\frac{h_{hole}}{d} = C_m \cdot 0.1 \cdot \left(\frac{B}{B_{crit}} \right)^{13} \quad for \quad 1.0 < \left(\frac{B}{B_{crit}} \right) < 1.4 \qquad \text{(Equation 6-3)}$$

$$\frac{h_{hole}}{d} = C_m \cdot 4.6 \cdot \left(\frac{B}{B_{crit}} \right)^{2.25} \quad for \quad 1.4 < \left(\frac{B}{B_{crit}} \right)$$

Where:

h_{hole} = depth of scour hole (m)

d = grain size (m)

C_m = constant: 0.3 for maneuvering ships and 1.0 for ships at rest

B = stability parameter = $\dfrac{U_{\max,bot}}{\sqrt{\dfrac{\rho_S - \rho}{\rho} \cdot g \cdot d}}$

B_{crit} = 1.25

Figure 6-5 shows potential scour depths due to propeller wash currents at the CAD facility calculated with the above equations for capping materials with sizes varying from 0.2 mm to 1,000 mm. The top panel of Figure 6-5 shows the potential scour depths behind the tug boat operating at three different water levels—MHHW, MLLW, and LRW. As expected, the predicted maximum scour depths generated by the tug boat decrease with the increase of the size of the capping material. For capping material with d_{50} of 0.2 mm, the predicted maximum scour depths are between 0.17 and 0.27 foot. As expected, the highest scour depth occurs at the shallowest water level (i.e., at LRW). The middle panel and bottom panel show the predicted scour depths generated by the automobile vessel and the U.S. Navy

Destroyer operating at half the maximum power, respectively. (Note that the vertical scales for the middle and bottom panels are different from the top panel.) As shown in the figure, the automobile vessel can generate maximum scour depths between 1.1 to 2.3 feet, while the U.S. Navy Destroyer can generate maximum scour depths between 3.5 and 7 feet for the capping material with d_{50} of 0.2 mm.

The scouring analyses indicate that propeller wash current by the U.S. Navy Destroyer has the potential of generating deep scour holes for the proposed capping material of 0.2 mm. Hence, cobbles with d_{50} of about 4 to 5 inches (100 to 125 mm) will be used to protect part of the CAD. As shown in Figure 6-5, with capping material of 4 to 5 inches in size, the potential maximum scour depths will be approximately 1 foot or less due to the propeller wash currents generated by the automobile vessels. For the U.S. Navy Destroyer, for the large majority of the time, the maximum scour depth will be less than 3 feet. Only under the rare occasion when the U.S. Navy Destroyer is leaving the Harbor at a time when the tide is at the lowest recorded level, the scour depth will be slightly over 3 feet.

Even when this predicted scour does occur, because of its short duration, it is expected that the individual, relatively heavy stones composing the cobble layer will move only a short distance before resettling. The CAD design also includes an additional degree of safety, as the top of the armor rock will be restricted to elevation -13.2 meters MLLW or below (as is discussed in Section 6.6.2), which is up to 0.5 meter deeper than the cap elevation of -12.7 meters that was used for the analysis described above. This will have the effect of further reducing the predicted velocities experienced at the top of the CAD armor layer, and therefore lessen the potential temporary scouring depth.

6.2.4 Design of Protective Armoring Layer

The area where the cobbles will be placed has been selected based on the spatial distribution of the U.S. Navy Destroyer-induced velocities over the CAD facility as shown in Figures 6-2 and 6-3. To protect the cap from propeller wash forces, approximately 33,900 tons of armor rock will be placed over the southwest portion of the CAD facility. The armor rock cap will be 1 meter thick and will be placed in the configuration shown in Figure 6-6. This configuration matches the expected areas of maximum scour from propeller forces.

The armor rock will be 12-inch maximum size rock and will have the following proportions by weight as shown in Table 6-12.

Table 6-12
Armor Rock Proportions by Weight

Sieve Sizes	Percent Passing (%)
No. 12	95 to 100
No. 9	70 to 100
No. 6	50 to 70
No. 3	30 to 40
No. 4	5 to 10

This armor rock is a standard specification used in many local projects by the Port of Long Beach and the Port of Los Angeles and is readably available from a local natural quarry located on Catalina Island. The material would therefore be transported to the site via barge.

6.3 Engineering Analysis of CAD Excavation

6.3.1 Side Slopes of CAD Excavation

A slope inclination analysis was conducted to determine the angle at which CAD side slopes can be temporarily excavated in the dense existing materials without significant sloughing. For the 30 percent design, a 3H:1V side slope inclination was initially selected for the temporary 15-meter-deep excavation of the CAD. The additional analysis conducted for the 90 percent design was intended to fine-tune this result and to determine if a steeper inclination would be possible. Excavating at a steeper slope angle would have the advantage of creating a smaller surface footprint for the CAD excavation without sacrificing sediment volume capacity.

Cores advanced by Anchor (2007) within the footprint of the proposed CAD excavation (AN-GT-1 through AN-GT-5) encountered a fairly consistent sequence of dense, slightly silty to silty, medium to fine sand with occasional thin (less than 1-foot-thick) clay layers. In Anchor's explorations, the sand materials appeared to be in a dense condition, although since blow counts were not conducted, the density was not quantified. These soil conditions are consistent with work conducted by Moffat & Nichol (1965) along the eastern side of the Harbor's Entrance Channel, where dense to very dense silty sands were encountered to elevations of -21.3 meters MLLW or deeper. They are also consistent with deep onshore borings conducted by others (Fugro 2001) for the OHD wharves, which showed blow counts ranging from 25 to 70 to depth using a Dames and Moore sampler. This material would therefore be defined as a dense to very dense sand, and was defined as "Holocene lower sands" geologic unit with a friction angle of 35 degrees. It is expected that these materials are the same geologic unit as was encountered within the CAD footprint by the Anchor (2007) explorations.

The stability of various slope inclinations was evaluated for two different assumed angles of internal friction for the native sand materials. The "infinite slope" assumption was used, with the factor of safety defined as the ratio of the slope inclination to the assumed soil friction angle.

Assuming an internal friction angle of 36 degrees and no cohesion, the following results:

- A slope inclined at 3H:1V (18 degrees) has a safety factor of 2.2
- A slope inclined at 2.5H:1V (22 degrees) has a safety factor of 1.8
- A slope inclined at 2H:1V (26.5 degrees) has a safety factor of 1.5

If the friction angle were more conservatively assumed to be 32 degrees instead of 36 degrees:

- A slope inclined at 3H:1V (18 degrees) has a safety factor of 1.92
- A slope inclined at 2.5H:1V (22 degrees) has a safety factor of 1.54
- A slope inclined at 2H:1V (26.5 degrees) has a safety factor of 1.25

Based on these results, a slope inclination angle of 2.5H:1V appears to be suitably stable, with a factor of safety larger than 1.5. This appears to be particularly adequate given the fact that the CAD excavation will be only temporary (open for a few months as it gets filled with sediment).

6.3.2 Constraints on Excavation Depth for Aquifer Protection

The CAD will be situated in an area with a known sequence of groundwater aquifers, as was presented in detail previously in Section 2. To review, the CAD excavation will take place in the Semi-perched Aquifer, which is characterized by low to neutral groundwater flow and poor overall quality (not used for domestic or agricultural purposes). Below this, at depths of up to 100 feet (30 meters), is the Clay Cap Aquitard, which separates the Semi-perched Aquifer from the underlying Oxnard Aquifer, which is a major groundwater source for the region. The top of the Oxnard Aquifer is known to range from approximately 150 to 200 feet below ground surface (elevations of approximately -45 to 60 meters MLLW). In order to ensure that the CAD and its confined sediments stay above the Clay Cap Aquitard and thus remain protective of the underlying Oxnard Aquifer, the CAD will be excavated no deeper than elevation -26 meters MLLW.

Using the same chemical diffusion modeling assumptions as were presented above in Section 6.1 for the CAD's overlying cap layer and assuming a downward flow gradient through the Semi-perched Aquifer instead of a neutral one, it can be concluded that more than 16,000 years would be needed for chemical diffusion to progress downward from the CAD and through to the confining clay layer. In actuality, the time span to reach the Oxnard Aquifer would be much longer because groundwater would have to pass through the low-permeability materials that comprise the Clay Cap Aquitard, which ranges in thickness between 50 and 100 feet (Appendix C).

6.3.3 Setback of CAD Excavation from Adjacent U.S. Navy Wharves

The overall stability of the adjacent U.S. Navy Wharves 3 and 5 structures was investigated with regards to the proximity of the CAD side slopes to these structures. Situating the CAD excavation too close to the wharves could decrease necessary passive horizontal pressure against the pilings and lessen their stability. The computer slope stability software SLIDE 5.0 by Rocscience, Inc., was therefore used to analyze the effects of various possible side slopes and CAD offset distances. The intention of this analysis was to select a reasonable offset distance of the CAD, which would allow the full needed volume capacity to be obtained, while not adversely impacting the overall stability of the piles and slopes that support the wharves.

A model was set up reflecting conditions that were found from geotechnical explorations by Anchor (2007) and Fugro (2001) in the area of the proposed CAD excavation and nearby wharves. These geotechnical results are summarized in Appendix A, and the geologic cross-sections presented in Fugro (2001) were used as generally representative of geological conditions for the existing wharves and Harbor area. Soil properties are summarized in Table 6-13, and a depiction of the input of the model and layer depths are shown on Figure 6-7. The subsurface profile of the model was comprised of three materials. A 10-meter-thick gravel layer started at the surface and ended at -8 meters MLLW. Below that, sand was modeled to the depth of a 3-meter-thick clay layer at -21 meters MLLW, and continued to the base of the soil sequence modeled. The 3-meter-thick clay layer was found at depths of -60 to -70 feet MLLW in borings from Wharves 1 and 2 compiled in a report done by Fugro 2001. The borings done in the area of the proposed CAD did not reach this depth; therefore, this layer may or may not exist and is put in the model to be conservative. The wharf piling were represented indirectly by the model by the inclusion of a horizontal stress near the toe of the slope to simulate the restraining force of the piles.

Table 6-13
Material Properties for Slope Stability Analysis

Properties	Material		
	Gravel	Sand	Clay
Unsaturated Unit Weight (kN/m^3)	20.43	17.29	17.293
Saturated Unit Weight (kN/m^3)	20.8	17.75	17.293
Cohesion (psf)	0	0/200	1,000
Friction Angle (degrees)	35	26/32	0

Notes:
Strength Type: Mohr-Coulomb
1kPa = 20.9 psf
kN/m^3 = kilonewtons per cubic meters

Different combinations of failure surfaces, soil properties, CAD locations, CAD slopes, and surface loadings were investigated in this study to indicate the critical factor of safety for each scenario. A depiction of most of these modeled parameters can be seen on Figure 6-7. The software used both circular and wedge-type failure surfaces to find the lowest factor of safety in each model. Since some of the sand in the CAD facility was described in explorations as a silty sand, the possibility of cohesion in this layer was investigated in some runs using a cohesion value of 200 pounds per square foot (psf) in the sand layer. Distances of 20, 30, and 66 meters from the edge of the CAD to the edge of the wharf were modeled. CAD side slopes of 3H:1V, 2.5H:1V, and 2H:1V were used, since steeper slopes would allow a smaller footprint for the CAD. Each wharf may have different loadings on the surface deck, depending on use, so deck loads of 200 and 600 psf were investigated. Different combinations of these parameters resulted in differently sized and located slip surfaces. In cases where circular slip surfaces were to be found, a grid search method was used to find the lowest factor of safety. In wedge-type cases, a line search method with optimization was used in an attempt to directly evaluate the tendency of the failure wedge to pass through the saturated weak clay layer. A representative summary of these combinations of parameters, and the resulting factor of safety, are summarized in Table 6-14.

Table 6-14
Slope Stability Analysis to Evaluate CAD Offset from Wharf Structures

Factor of Safety (Spencer)							
Model Properties	Failure Surface	Circular	Circular	Circular	Circular	Wedge	Wedge
	Clay Layer	No	No	Clay	Clay	Clay	Clay
	Sand Friction Angle	26	26	32	32	32	32
	Surface Load (psf)	600	200	600	200	600	200
	Sand Cohesion (psf)	200	200	0	0	0	0
	CAD Slope (H:V)	2:1	3:1	2.5:1	2.5:1	2.5:1	2.5:1
CAD Location from Edge of Wharf (m)	66	3.029	3.411	3.100	3.178	2.072	2.229
	30	2.092	2.395	2.119	2.168	1.554	1.716
	20	1.813	2.106	1.865	1.906	1.465	1.497

It can be seen from Table 6-14 that all factors of safety from this analysis are well above 1.3 and in most cases exceed 2.0. For an offset distance of 20 meters, the factor of safety ranged from 1.4 to 1.8. When the offset is increased to 30 meters, the factor of safety range increased to 1.6 to 2.4. This was considered to be an acceptable factor of safety range, since it was higher than 1.5 across the board, for a temporary (excavated) condition. For the larger 66-meter offset distance, the factor of safety was higher yet, ranging from 2.0 to 3.4, but this was considered to be more offset than necessary because it would restrict the overall size of the CAD and make it more difficult to achieve the needed volume capacity.

Based on this analysis, therefore, the top of the excavated CAD side slopes has been set back from the wharves' edges by a distance of 30 meters.

6.4 Engineering Analysis of CAD Filling

6.4.1 Cap Stability and Placement Methods

Rapid or irregular placement of capping materials over the contaminated sediment mass could potentially lead to instability of the cap and underlying materials. This can be controlled by limiting the rate or methods of cap placement. Project specifications will require the contractor to place sediments in the CAD in individual layers with a reasonably uniform thickness, free of large mounds. The contractor will be required to open the bottom-dump barge gradually and in a controlled manner to minimize mixing of freshly placed material with previously placed material. Material will be placed in individual lifts not more than 1 to 2 meters in thickness across the entire footprint of the CAD. Each lift is to have no more than a 0.5-meter variation in its surface elevation. Regular progress surveys will be conducted at the end of each lift and transmitted to the engineer for review.

6.4.2 Compression of Sediment after Confinement in CAD

Sediment will be likely placed in the CAD by releasing them from a bottom-dump barge. Although the sediment will undergo some degree of initial "bulking" during the dredging and dumping process, this increase in volume is expected to be short in duration as additional sediment is added to the CAD and compresses the previously placed materials.

During the placement of subsequent sediment and capping layers, the sediment is expected to undergo both an initial and long-term consolidation. An investigation was conducted to determine the overall consolidation amount and the time for 90 percent consolidation of this material. Laboratory consolidation testing on a representative reconstituted composite from the OHD and Hotspot 3 area, in conjunction with evaluation of sediment physical characteristics throughout the Harbor, indicate the compression ratio to be approximately 0.10.

For the consolidation analysis, a uniform layer of CAD fill with consistent height was assumed to represent sediment placement over 7-day periods, based on expected CAD dimensions and production rates as described elsewhere in this report. Each layer initially consolidates under its own self weight and drains before being loaded by subsequent layers, every 7 days.

The total amount of consolidation is predicted to be 1.9 meters, relative to the initial in situ volume of the sediment. The time period of this consolidation was also evaluated. The length of the drainage path is the most critical element in analyzing the time rate of consolidation, as it has a great effect on the speed at which ultimate consolidation occurs in each placed layer. To this end, the length of the drainage path was calculated two ways to give a conservative and optimistic estimate of CAD consolidation. A short drainage path was assumed to be half the thickness of each layer as it is getting compressed. The long drainage path was the distance from the middle of each layer to the top of the CAD material in place. A shorter drainage path leads to a quicker time of consolidation.

After placement of materials in the CAD, 0.9 to 1.7 meters of consolidation are predicted to occur. Respectively, for both assumptions of drainage paths, this is 48 and 91 percent of the ultimate consolidation of 1.9 meters. After construction is finished, 0.2 to 1.0 meter of additional consolidation is therefore predicted to take place.

6.5 Design for Bioturbation Protection

Consistent with Palermo et al. (1998a and 1998b), cap thickness design needs to include a component of thickness that is sufficient to prevent substantial bioturbation of sediments underlying the cap. In soft bottom marine substrates, bioturbation is the mixing and overturning of sediments caused by organisms residing in the sediments (called benthic organisms).

6.5.1 Typical Bioturbation Depths

In terms of relative abundance, diversity, and biomass, the vast majority of benthic organisms reside in the upper few centimeters of the surface sediments (Berner 1980).

Thus, in most situations, the vast majority of bioturbation takes place in the top 10 to 15 centimeters of sediment. This upper layer is commonly referred to as the mixed zone. Although virtually no mixing of the sediment layers below about 15 centimeters is common, in some situations, a small amount of mixing may occur at greater depths. This is because some organisms burrow in sediments deeper than 15 centimeters.

At the particular locations of these burrows or burrowing activities, some mixing or other interaction of surface and deeper layers may occur. For example, some researchers (e.g., Kozloff 1983) have noted that ghost shrimp (*Neotrypaea* genus in general) move sediment from their relatively deep burrows to the surface, where these sediments are apparent as "volcano-like" mounds around the burrow entrance.

Thus, bioturbation is often conceptualized as decreasing rapidly at depths below the mixed zone. At some depth, the bioturbation rate essentially approaches zero, and for all purposes, bioturbation is so sporadic or infrequent that it is inconsequential and immeasurable. A cap intending to isolate contaminated sediments should have a thickness greater than or equivalent to the depth where the future bioturbation rate is expected to be close to zero.

6.5.2 Cap Design for Bioturbation Protection

A common method of estimating the lower extent of bioturbation (to determine adequate cap design thickness) is to examine those organisms present or likely to be present at the site and identify the deepest burrowers. It is important to note that this is a conservative approach. Using the most extreme observation of burrowing depth available from any instance of any organism in any location may yield a very extreme estimate of bioturbation for a particular location or situation. For example, many organisms burrow in the sediment but are primarily suspension feeders that remove plankton from the water for food rather than mixing up or churning the sediment on a continual basis.

Observations of extreme burrowers may provide no indication of the actual amount of sediments that might be bioturbated and how this relates to the overall stratification of sediments as typically observed in soft bottom sediments. However, this approach can provide a conservative estimate of cap thickness needed to prevent bioturbation of underlying sediments. Ghost shrimp (*Neotrypaea californiensis*) and other shrimp of this genus are known to burrow to considerable depths in sediments. This genus occurs throughout Pacific coastal waters of North America from Alaska to Baja California (Posey 1986). Consequently, they have been extensively examined and discussed in the general literature and capping project reports throughout the west coast of the United States. Thus, the burrowing habits of this species have been used for this project to conservatively determine an acceptable cap thickness to protect against bioturbation.

A detailed literature review of the habits and preferred habitats of ghost shrimp has been prepared for this project (Appendix F). The remainder of this section summarizes the findings of that literature review, and based on these findings, makes recommendations about the cap thickness needed to protect against bioturbation.

6.5.3 Ghost Shrimp Bioturbation

The range of reported depths for adult ghost shrimp is from less than 40 centimeters to as much as 90 centimeters. It should not be assumed from these data that all adult ghost shrimp burrow to these depths. On the contrary, almost all of the researchers reviewed discuss burrows or burrow networks that are often much less than 40 centimeters deep at their deepest point. Further, it is well established that juvenile benthic shrimp (as opposed to the pelagic larval stage) utilize very shallow sediment depths given that they are initially only a few millimeters long and may not reach average adult size for approximately 2.5 years after settlement (Appendix F). The usual maximum limit of adult ghost shrimp burrowing below the sediment surface is most often reported in the 50 to 60 centimeters range.

A number of researchers report that ghost shrimp burrow deepest in high intertidal areas in order to stay submerged underwater within the burrow for longer periods during low tides. Thus, some of the more extreme observations of ghost shrimp burrowing depths (e.g., 90 centimeters) likely reflect a behavioral adaptation to intertidal habitats.

In addition, the preferred habitat for dense beds of ghost shrimp is sandy or muddy intertidal to extremely shallow subtidal estuarine bays. The proposed cap for the CAD facility will be at a depth of between -12 and -13 meters MLLW, well below the preferred depth range. Existing regional information collected during 5 years of monitoring a similar CAD facility in Long Beach indicates that a species of *Neotrypaea* is present, but only in very low densities (about 1 per square meter) and that their presence on the cap did not result in burrows deep enough to jeopardize the integrity of the cap. Because the Long Beach CAD facility conditions are similar to the Harbor, substantial bioturbation by ghost shrimp is not expected at the proposed cap.

6.5.4 Recommendations for Cap Thickness – Bioturbation

Substantial numbers of ghost shrimp are not expected at the elevation of the cap. However, the cap thickness to protect against bioturbation can be conservatively set at the usual reported lower limit of adult ghost shrimp burrowing, which is 60 centimeters. A cap thickness of 60 centimeters or greater should be more than protective of deep bioturbation with sporadic exceptions by a few individuals. The overall bioturbation rates at 60 centimeters below the cap surface are expected to be extremely close to zero (Appendix F). Consequently, a cap thickness greater than 60 centimeters should be extremely protective and is expected to be sufficient to essentially prevent all bioturbation of underlying sediment. The actual cap thickness that will be specified is 3 meters, significantly greater than the minimum cap thickness required per this analysis.

6.6 Selection of CAD Size, Excavated Depth, and Cap Elevation

Based on the analysis documented in this section, the CAD size and excavated elevation were selected so as to achieve the following goals:

1. Ensure that there is sufficient volume in the CAD excavation to hold the full volume of contaminated sediment.
2. Ensure that contaminated sediments within the CAD are capped by a suitable thickness of capping material to act as an isolation cap layer, even if the Harbor were to be deepened in the future.
3. Ensure that contaminated sediments within the CAD are protected against scour forces from vessels operating in the Harbor.

4. Ensure that the upper surface of the cap (and its protective armor layer) are below the elevation to which the Harbor may be deepened by the USACE in the future.
5. Ensure that the cap is designed in general accordance with USACE cap design guidelines (Palermo et al. 1998a and 1998b), incorporating the various aspects of protective cap design, as described above.

6.6.1 Establishing the CAD Volume Capacity

The primary element in designing the CAD excavation is to determine an appropriate volume capacity, sufficient to contain the necessary volume of sediment that will be deposited within it. The "baseline" volume of sediment that will be placed in the CAD from the OHD, U.S. Navy, and USACE hotspot areas was determined as the predicted dredging volume, plus the full allowable over-dredging amount (0.5 meter), and the volume of material from adjacent side slopes around the dredge prisms. This number was determined as shown in Table 6-15.

Table 6-15
Summary of Sediment Volumes Requiring Disposal in CAD

Areas Requiring Dredging	Volume (m^3)
OHD	27,500
USACE hotspots	139,000
U.S. Navy	73,300
Total to be disposed in CAD	**239,800**

Note:
All volumes include 3H:1V perimeter side slopes and full 0.5-meter over-dredging allowance

To properly configure the CAD, an additional "contingency" volume should be included. This additional potential volume could result from either contractor over-dredging or from re-dredging necessitated from post-dredge confirmatory sampling. The contractor over-dredging element is difficult to quantify, although it will be discouraged in the contract documents through the inclusion of a penalty payment clause for any material that is dredged below the allowable 0.5-meter overdredge limit.

The second variable is the possibility of needing to re-dredge areas if confirmatory sampling indicates that contamination remains below the original dredge limits. The potential volume that could be generated by such re-dredging is also difficult to quantify, but a general range can be estimated given the area of dredging, likely cut of re-dredging, and current sediment chemistry data. Re-dredging would be tightly controlled, and if needed, would be done to a nominal depth of 0.3 meter (with an additional 0.3-meter overdredge allowance) over the areas necessary. Table 6-16 presents a sensitivity analysis of the potential re-dredge volumes.

Table 6-16
Summary of Potential Volumes Generated by Re-dredging

Area	Dredge Volume if Entire Area Re-dredged[a] (m^3)	Dredge Volume if 50% of Area Re-dredged[a] (m^3)	Dredge Volume if 25% of Area Re-dredged[a] (m^3)
OHD Wharves	11,100	5,600	2,800
U.S. Navy North Area	4,400	2,200	1,100
U.S. Navy Wharf 3	3,100	1,600	800
U.S. Navy Wharf 4	3,300	1,700	900
U.S. Navy Wharf 5	1,700	900	500
U.S. Navy Wharf 6	22,600	11,300	5,700
Hotspot 1	19,000	9,500	4,800
Hotspot 2	12,100	6,100	3,100
Hotspot 3	6,800	3,400	1,700
Total	**84,100**	**42,300**	**21,400**

Notes:
a Assumes 0.6 meter total dredge cut (approximately 0.3 meter re-dredging required, plus an additional allowable 0.3 meter)
b Excludes area immediately adjacent to wharves that cannot be dredged deeper

As can be seen from Table 6-16, the potential additional volumes produced by re-dredging all of the dredged areas could be as much as 84,100 m^3, which would add 35 percent to the currently estimated volume (239,800 m^3). Similarly, if 50 percent of the dredged areas required a re-dredging pass, then 42,300 m^3 would be produced, adding approximately 18 percent to the currently estimated volume. Finally, if 25 percent of the dredged areas required a re-dredging pass, then 21,400 m^3 would be produced, adding approximately 9 percent to the currently estimated volume. Based on site conditions, the dredge plan, and the goals for future dredging events, it is likely that the need for re-dredging can be limited to no more than an area closer to 25 percent of the dredge surface or less. This information was used in determining an appropriate volume capacity for the CAD.

The design of the CAD excavation also needs to consider two inherently conservative assumptions:

- First, the available capacity of the CAD was determined using only the minimum required neatline excavation depths of the CAD (i.e., up to elevation -26 meters). This does not include any additional volume that would come from allowable over-dredging (0.5 meter) of the CAD excavation or its side slopes. This allowable over-dredging could contribute up to another 15,000 m^3 (an additional 6 percent) to the overall capacity.
- Second, the CAD was sized assuming in situ sediment volumes, consistent with the 239,800 m^3 quantity that has been calculated as the total dredge sediment volume. This assumption assumes that the in situ volume of dredge material will be at the same density once placed in the CAD. In actuality, as is discussed in more detail in Section 6.4.2, it is expected that the sediment contained in the CAD will compress over time as it is filled. A consolidation analysis indicates that the placed materials within the CAD will undergo a total of 1.9 meters of compression from their original volume. This amount of compression indicates that the immediately placed volume of sediment in the CAD essentially has a bulked volume that is 20 percent higher than it will be ultimately after compression has occurred. This amount of consolidation equates to another 50,000 m^3 of volumetric space to the CAD (another 20 percent to the estimated capacity). Note, however, that estimating total consolidation can be difficult given the variability of dredged materials, and actual amounts will vary both in magnitude and in time duration. Practically speaking, the volume occupied by sediment within the CAD facility will change over time, as it occupies a larger volume in its initially "bulked" state and then gradually consolidates to lesser volumes. As a result, the sediment within the CAD may appear to be artificially "high" after its placement, but subsequent settlement will be expected.

Two other options exist for increasing CAD capacity prior to, or during, construction. Excavating the CAD 1 meter deeper (to elevation -26 meters) would provide an approximate 24,000 m^3 for sediment storage (adding another 9 percent to the estimated sediment volume). This of course, would have to be done up-front, rather than used as a back-up option later in the project.

Similarly, thinning the cap by 0.3 meter, thus enabling the sediment fill to be placed 0.3 meter higher, would provide an added 12,000 m^3 for sediment storage (approximately 5 percent additional capacity). This could be done after materials are placed if the predicted compression was not as much as predicted.

6.6.2 Selection of CAD Dimensions

The CAD excavation needs to be sized to contain a minimum estimated volume of sediment that will be produced (239,800 m^3). As stated in the previous section, this volume would be conservative in several key respects, but at the same time would need to be able to accommodate possible contractor over-dredging and the possibility of needing to re-dredge areas in response to confirmatory sampling. In summary, while an additional 9 to 35 percent of volume could be generated by re-dredging, this would potentially be offset by the following factors:

- An additional 6 percent storage volume could be provided by the allowable over-dredging of the CAD
- An additional 20 percent storage volume increase could be incurred by consolidation
- An additional 5 percent storage volume could potentially be secured during construction by allowing an additional 0.3 meter of fill (reducing the cap by 0.3 meter)

Each of these numbers are estimates and subject to uncertainty—in both directions. Given these offsetting issues, the CAD design has specifically incorporated an additional **5 percent contingency volume**. In this event, the CAD would be sized sufficiently to hold:

$$\text{CAD design capacity} = 239{,}800\ m^3 \times (1.05\ \text{contingency factor})$$
$$= \mathbf{251{,}800}\ m^3$$

The following constraints control the dimensions of the CAD:

- CAD side slopes will be set at 2.5H:1V (see Section 6.3.1)
- Base excavation will reach no deeper than -26 meters MLLW to stay well above underlying aquifer zones (see Section 6.3.2)
- North and east sideslopes will daylight no closer than 30 meters from the adjacent U.S. Navy wharves to maintain their structural stability (see Section 6.3.3)
- The west sideslope must not overlap the adjoining USACE Hotspot No. 2, since the hotspot material needs to be disposed of within the CAD

Furthermore, the cap thickness and elevation impact the CAD storage capacity:

- The cap will be 3 meters (10 feet) thick, minimum, per regulatory expectations. Note that the cap design was done for a 3-foot thickness, per Section 6.1, so an inherent degree of conservatism has been incorporated into the design.
- A 1-meter (3-foot)-thick protective layer of coarse ("armor") material will be added atop the cap to resist erosive forces (see Section 6.2)
- There is a possibility that in the future, the Turning Basin could be deepened to elevation -12.2 meters MLLW plus 0.5 meter of allowable over-dredging (approximately -41.5 feet MLLW, including potential allowable over-dredging). It is desirable to maintain the top elevation of the armor stone material sufficiently below this elevation to avoid having the armor stone inadvertently dredged up (and sent to beach disposal) should the USACE conduct this deepening work in the future. Therefore, the highest extent of the armor material will be restricted to no higher than -13.2-meter elevation, which provides an extra 0.5 meter of clearance below the allowable over-dredging limit for possible deepening.

Combining these elevation requirements means that the 1-meter-thick layer of armor rock will extend from elevation -13.2 meters to -14.2 meters, and the 3-meter cap layer will extend from elevation -14.2 meters to -17.2 meters. Therefore, the highest final elevation of the contained sediment will be at -17.2 meters.

A geometric analysis of a trapezoidal-shaped CAD cell with a base footprint of 130 meters by 180 meters, 2.5H:1V side slopes, and an excavated base elevation of up to -26 meters MLLW will have about 240,000 m^3 of capacity below elevation -17.2 meters MLLW, which is sufficient to contain the required volume of sediment, incorporating a 5 percent contingency volume factor. This footprint size fits in the Harbor with enough offset (30 meters) of its excavation edges from adjacent waterside facilities and wharves to avoid impacting these structures.

7 SHORT-TERM WATER QUALITY IMPACTS FROM CONSTRUCTION

The potential for water quality impacts from contaminated sediment dredging and disposal has been estimated for this project using measured sediment characteristics as well as documented placement techniques. Known chemical concentrations in the site sediments were evaluated to estimate the potential for suspended sediments to contribute dissolved contaminants to the surrounding water column. In addition, the computer model DREDGE (developed by the USACE) was used to predict short-term water quality impacts at the point of dredging, and the computer model Short-term Fate of Dredged Material Disposal in Open Water Models (STFATE; also developed by USACE; Version 5.01; Johnson et al. 1994) was used to predict water quality impacts at the CAD fill site during sediment disposal by split-hull dump scows. The methods and results of each of these predictive modeling efforts are described below.

7.1 Effects of Resuspended Sediments Due to Dredging Impacts

In 2003, members of the Los Angeles Contaminated Sediments Task Force (CSTF) conducted a detailed review on the potential adverse impacts to biological organisms as a result of dredging-induced turbidity. The complete results of the study are presented in *Literature Review of Effects of Resuspended Sediments Due to Dredging Operations* (Anchor 2003). The results of this study indicated that by comparing the dredging-induced suspended sediment concentrations observed in the field along with the associated physical effects of such concentrations as reported in relevant project literature, most dredging projects are not expected to produce suspended solids concentrations in the range documented to cause significant adverse effects to sensitive aquatic biological organisms (Anchor 2003). The threshold at which total suspended solids (TSS) are predicted to produce acute lethal effects is 760 milligrams per liter (mg/L). Sub-lethal effects are not expected to occur at concentrations below 100 mg/L. To put these numbers into perspective, a review of previous monitoring data for mechanical dredging projects within the Los Angeles Region (Anchor 2003) shows that about 90 percent of all the monitoring data collected from water column sampling down current of dredging operations revealed TSS concentration below 100 mg/L.

Potential impacts from dredging of contaminated sediments are more difficult to assess (Anchor 2003). Most of the information concerning the effects of contaminated sediments on marine organisms deal with the impacts of settled sediments. Few studies have dealt with resuspended contaminated sediments. Organisms exposed to resuspended contaminated sediments can develop physiological problems due to direct exposure to dissolved contaminants or bioaccumulation of metals and organic chemicals. However, much of the data suggests that significant adverse impacts do not occur at resuspension levels and durations typically associated with dredging projects. In general, previous studies indicate that potential effects from dredging are transient and not significant. There are, however, exceptions where highly elevated concentrations of specific chemicals (e.g., mercury and PCBs) have been shown to cause significant bioaccumulation in organisms down current from dredging operations. It should be noted that these instances are not typical for dredging projects (Anchor 2003).

7.2 Comparison of Sediment Chemistry to Water Quality Criteria

As was described in Section 5, contaminated dredged material from the OHD, U.S. Navy, and USACE impacted areas will be placed into a split-hull barge for transport to the CAD facility. Water depths in the Harbor are sufficient to allow split-hull barges to be filled to capacity without grounding. Once filled to capacity, each split-hull material barge will transport the dredged material to the CAD facility, using a tender for power and maneuvering. Once inside the CAD footprint, as confirmed by real-time kinematics positioning and/or global positioning system (GPS) systems, the split-hull material barge will open its hull and deposit the dredged material into the CAD. Contract specifications will include a specified CAD disposal procedure that will need to be followed not only by OHD but also by U.S. Navy and USACE during their sediment disposal events as well.

When the sediment load is released from the split-hull barge, it will immediately fall through the water column, coming to rest on the bottom surface. Typically, mechanically dredged sediment can be expected to fall through the water column as a distinct (rather than diffuse) mass, although it will spread out to some degree during its descent. Contract documents will require the contractor to release the loads only from positions that are set back from the CAD edge to ensure that all the material falls within the CAD boundaries rather than around the edges of the CAD facility. The USACE STFATE model (Palermo et al. 1998b) will be used to evaluate the dispersion of dredged material during placement. This model simulates dredged material discharges in open water from hopper barges and defines the aerial extent of the mound or deposit for the contaminated material within the

CAD. These specifications and model runs will be further developed during subsequent design efforts.

As the dredged material falls through the water column, some of the chemicals that are contained in the bulk mass of the sediment, as well as those contained in the sediment porewater, will be released into the surrounding water column. Similarly, some of the fine particles contained in the sediment mass will also enter the surrounding water, forming a temporary cloud of turbidity. Both of these effects will temporarily affect water quality in the Harbor.

It is expected that the turbidity will dissipate over a period of 20 to 30 minutes, and thus the release of chemicals into the water column will be a transient effect. This effect was recently demonstrated at the Dredged Material Management Program (DMMP) Pilot Capping Project in Long Beach (USACE 2002). As a rough, very conservative approximation of potential chemical impacts from the sediment disposal process, Table 7-1 presents chronic water quality criteria for key chemical constituents in site sediments and compares these criteria to the concentrations of the various chemicals predicted to be released from the sediment particles into the porewater (as calculated using equilibrium partitioning coefficients applied to bulk chemical concentrations).

Table 7-1
Conservative Approximation of Short-term Water Quality Impacts at Point of Disposal

Chemical	Chronic Water Quality Criteria (mg/L)[a]	Calculated 95 Percent UCL in Underlying Sediment Porewater (mg/L)[b]	Ratio of Porewater/ Chronic Value for Underlying Sediments
TBT	4.2E-04	6.7E-04	1.60
Acenaphthylene	0.307	8.9E-04	0.0029
Anthracene	110	5.6E-04	0.0000
Fluorene	14	3.7E-04	0.0000
Fluoranthene	0.370	8.5E-04	0.0023
Benzo(a)anthracene	4.9E-05	1.4E-04	2.76
Benzo(a)pyrene	4.9E-05	5.4E-05	1.10
Chrysene	4.9E-05	2.0E-04	4.08
Dibenzo(a,h)anthracene	4.9E-05	3.6E-06	0.0738
Pyrene	11	1.8E-03	0.0002
Total DDT	5.9E-07	1.2E-06	2.08
Total PCBs	3.0E-05	4.2E-04	13.98

Notes:
a – See Table 6-4
b – See Table 6-3
UCL – Upper Confidence Limit

The final column of Table 7-1 presents the ratio of porewater concentration to the chronic water quality criteria. Numbers greater than one (as for six of the chemicals, most notably for PCBs) indicate that concentrations in porewater are predicted to be greater than the corresponding chronic criteria. The highest indicated ratio is 13.98 for total PCBs.

It is important to recognize that these ratios are highly conservative in two basic ways. First, the relatively small volume of porewater that escapes from the disposed sediment mass is several orders of magnitude smaller than the volume of surrounding water in the Harbor. Therefore, the porewater will quickly be mixed into and diluted by the surrounding waters, so any measurements made at a short distance from the falling sediment mass will detect far lower concentrations than those indicated by Table 7-1. Second, the presence of elevated chemical concentrations will be very short-lived as the turbidity and porewater mixes into surrounding waters; these concentrations are therefore not technically comparable to the listed criteria, which is applicable to chronic (i.e., 30 day) exposures. Exposures to the ratios listed in the table would likely only occur as an instantaneous exposure at the point of

kg/m^3 = kilograms per cubic meter
m = meters
m/sec = meters per second
sec = seconds

Diffusion coefficients and sediment characteristics were selected based on previous DREDGE analysis performed for the Los Angeles River Estuary Pilot Study (CSTF 2002). Existing water depth at the site is approximately 11 meters, while post-dredge depths will vary from approximately -10.5 to -12.5 meters. The existing water depths were used in the model to resemble the worst-case scenarios that can be expected during construction. In general, TSS concentrations generally increase with decreasing water depth.

7.3.2 DREDGE Model Results

Using the assumptions discussed above, the DREDGE model predicts the TSS concentrations associated with the dredging as a function of distance from the dredge. Results are presented graphically in Figures 7-1 and 7-2.

In the U.S. Navy and Hotspot 2, as depicted on Figure 7-1, TSS concentrations were predicted to be approximately 46 mg/L at a distance of 10 meters from the point of dredging, assuming a 5 m^3 bucket is used. A significantly lower TSS concentration is predicted for sediments at the OHD Wharves and Hotspot 3 (Figure 7-2), due to the fact that the average grain size in this area is larger; thus, the material settles out faster. In those areas, TSS concentrations 10 meters from the point of dredging are predicted to be no higher than 27 mg/L.

TSS concentrations were also predicted at a greater distance from the point of dredging. A distance of 90 meters was selected for analysis, since that distance has been used as a water quality monitoring point of compliance for other, similar projects in the past. While dredging in the U.S. Navy Wharves and Hotspot 2 areas, TSS concentrations are predicted to drop significantly to 5.3 mg/L. For dredging at the OHD Wharves and Hotspot 3 areas, suspended solids are expected to be very minimal at 0.4 mg/L at a distance of 90 meters from the point of dredge—again, attributable to the larger average grain size of sediments in these areas, and the resulting faster settling rates.

When compared against known thresholds for acute lethal and sub-lethal TSS impacts (Anchor 2003), the relatively low predicted TSS concentrations during dredging operations are expected to have negligible impacts to the aquatic environment.

It is important to note that the predicted TSS concentrations resulting from dredging activities would be in addition to any ambient suspended solids that may already be present in the water column.

7.3.3 Modeling of Water Quality Impacts from Disposal

The potential for short-term impacts to water quality in receiving waters was modeled using the computer model STFATE. STFATE simulates resuspension and "stripping" of particulates during descent from the split-hull dump scow and predicts the concentration of TSS remaining in suspension (in units of mg/L) at a particular time. Successive time steps can be used to predict the fate of the suspended material in waters of the Harbor. The results of the STFATE modeling were compared to the results of the CSTF literature study (Anchor 2003) to evaluate the potential impacts to the aquatic environment.

STFATE also allows prediction of the distribution of sediment mass on the bottom after dumping. The sediment mass is subdivided into three primary components with different properties and settling velocities: clumps, which settle to the bottom essentially instantly; sand, which settles at a slower rate; and fines, which are suspended in the water column as turbidity. Over time, each component builds up on the bottom surface in response to settling velocity, fall height, and ambient current velocity of surface waters, such that a mound of settled sediment is predicted. This can be compared to the geometry of the CAD facility and used as a guide for limiting the split-hull dump scow's positioning during dumping to ensure that sediment is not lost outside of the identified disposal area.

7.3.4 STFATE Model Input

Input parameters for the STFATE model included the following:

- Geometry of the sediment disposal area, including horizontal dimensions and water depth (defined according to a grid of points spanning the area of interest)
- Conditions of the ambient water column (i.e., density, salinity, and current velocity)
- Disposal operation data, including split-hull dump scow dimensions, split-hull dump scow draft, and disposal rate
- Dredged material physical properties (i.e., grain size, clumping fraction, etc.)

These input parameters represent anticipated site-specific conditions at the time of disposal, as well as the physical characteristics of dredged material as determined from sampling data, expected to be representative of the material being disposed of at the CAD facility. All areas have been modeled assuming that disposal occurs in open water over a depression (the CAD excavation) that measures 180 meters by 130 meters in footprint area, with water depths that vary based on the amount of sediment that has been placed within the CAD. The model was set up such that the barge was located over the base of the CAD facility and not over on any side slopes as depicted in Figure 7-3. Key input parameters to the model are summarized in Table 7-3.

The STFATE model was run for individual dump events from a bottom-dump barge. Each layer of placed sediments was therefore assumed to be approximately one load of sediment placed from a bottom-dump barge (917 m^3 or approximately 1,200 cubic yards).

Table 7-3
Key Input Parameters Used in STFATE Modeling

Parameter	Unit	U.S. Navy and Hotspot 2	OHD and Hotspot 3	Hotspot 1	USACE O&M
Site Description					
Number of grid points in Z-Dir		22	22	22	22
Number of grid points in X-Dir		25	25	25	25
Spacing between grid points	m	5.24	5.24	5.24	5.24
Density of water (constant with depth)	g/cm^3	1.023	1.023	1.023	1.023
Water depth in disposal area	m	11	11	11	11
Material Description					
Total volume of placed sediments	m^3	111,158	59,319	68,691	109,691
Volume of each layer of placed sediments	m^3	917	917	917	917
Number of solids fractions in material		3	3	3	3
Characteristics of Material that Falls in Clumps					
Specific gravity		1.6	1.6	1.6	1.6
Fall velocity	m/sec	0.9144	0.9144	0.9144	0.9144
Void ratio after deposition		0.4	0.4	0.4	0.4
Volumetric concentration of total solids	%	0.25	0.25	0.25	0.25
Characteristics of Material Sand Fraction					
Specific gravity		2.7	2.7	2.7	2.7
Fall velocity	m/sec	0.03	0.03	0.03	0.03
Void ratio after deposition		0.6	0.6	0.6	0.6
Volumetric concentration of total solids	%	0.15	0.13	0.21	0.20
Characteristics of Material Fines Fraction					
Specific gravity		2.65	2.65	2.65	2.65
Fall velocity	m/sec	0.003	0.003	0.003	0.003
Void ratio after deposition		4.5	4.5	4.5	4.5
Volumetric concentration of total solids	%	0.10	0.12	0.04	0.05
Length of disposal vessel (bottom-dump dump scow)	m	61	61	61	61
Width of disposal vessel (bottom-dump dump scow)	m	15.2	15.2	15.2	15.2
Pre-disposal draft of disposal vessel	m	5	5	5	5
Post-disposal draft of disposal vessel	m	2.4	2.4	2.4	2.4
Time needed to empty disposal vessel	sec	30	30	30	30
Dumping Over a Depression					
Length of depression in X-Dir	m	130	160	167.5	177.5
Length of depression in Z-Dir	m	180	200	207.5	217.5
Average depth	m	25	21	19.5	17.5

g/cm^3 = grams per cubic centimeter
m = meters
m/sec = meters per second
sec = seconds

7.3.5 STFATE Modeling Results

This section presents a summary of the interpreted results from STFATE. These results should be considered conservative estimates, as STFATE cannot precisely predict actual conditions during construction.

7.3.5.1 Predictions of Deposited Sediment Thickness

In each of the modeled scenarios, STFATE predicted that each dump event (with a volume of 917 m^3) would create a mound of deposited materials ranging in maximum thickness from 1.3 to 1.7 feet (0.4 to 0.5 meter) and extending about 150 to 200 feet from the center point of the dumping, as shown in Figures 7-4 through 7-7. This thickness is comprised of a combination of the clumps, sands, and fines. The predicted thickness can be used as a general guideline, indicating the extent over which sediment may be expected to land on the seafloor, and for planning purposes should be viewed as a minimum setback distance from the edge of the CAD during the dumping to ensure that no material is carried outside of the CAD facility. Recognizing, however, the inherent imprecision of the model, this setback distance can be adjusted in the field depending on observations during construction.

7.3.5.2 Predictions of Suspended Solids Concentrations

The TSS concentrations resulting from sediment release during release from a split-hull dump scow was predicted for sediments representing each of the dredging areas and for time periods of up to 20 minutes after dumping. Modeling was conducted for the four dredging areas that will be placed within the CAD facility, in the following order:

- U.S. Navy wharves and USACE Hotspot 2
- OHD Wharves 1 and 2 and USACE Hotspot 3
- USACE Hotspot 1
- O&M material from the Federal Channel (Turning Basin, Entrance Channel, and Approach Channel)

As is depicted on Figures 7-8 through 7-11, TSS concentrations at three water depths (1 meter [near the surface], 5.5 meters [mid-depth], and 11 meters [bottom] below the water surface) were analyzed to evaluate TSS plume dispersion with depth.

The following sections discuss the predicted water column TSS concentrations and lateral extent of sediments deposited on the seafloor, specifically for the four dredging areas. All results represent worst-case conditions predicted for within 20 minutes after the dump event.

7.3.5.2.1 Sediment from U.S. Navy Wharves and Hotspot 2 Areas

The results of this modeling scenario are depicted on Figure 7-8. At a depth of 1 meter below the water surface, a small TSS plume is predicted to extend over an area measuring approximately 60 meters across. The TSS concentration at the center of the turbidity plume is expected to be about 5.7 mg/L.

At a depth of 5.5 meters below the water surface, a slightly larger TSS plume is predicted to extend over an area measuring roughly 60 meters across with a worst-case predicted TSS concentration of about 18 mg/L at the center of the plume.

At a depth of 11 meters below the water surface, an even larger plume is predicted, which extends 70 meters across. A maximum TSS concentration of 131 mg/L is predicted to occur directly in the center of the plume.

7.3.5.2.2 Sediment from OHD Wharves 1 and 2 and Hotspot 3 Areas

The results of this modeling scenario are depicted on Figure 7-9. At a depth of 1 meter below the water surface, a relatively small TSS plume is predicted to extend over an area measuring approximately 60 meters across. The TSS concentration at the center of the turbidity plume is expected to be about 6.8 mg/L.

At a depth of 5.5 meters below the water surface, the same 60-meter-wide TSS plume is predicted but the worst-case predicted TSS concentration increases to 22 mg/L at the center of the plume.

At a depth of 11 meters below the water surface, the TSS plume increases to extend 70 meters across. A maximum TSS concentration of 185 mg/L is predicted to occur directly in the center of the plume.

7.3.5.2.3 Sediment from Hotspot 1 Area

The results of this modeling scenario are depicted on Figure 7-10. At a depth of 1 meter below the water surface, a rather large TSS plume is predicted to extend over an area measuring approximately 70 meters across. The TSS concentration in the turbidity plume are low with a TSS concentration of 2.6 mg/L expected at the center of the turbidity plume.

At a depth of 5.5 meters below the water surface, the TSS plume remains the same in size extending over an area measuring roughly 75 meters across with a worst-case predicted TSS concentration of about 8.3 mg/L at the center of the plume.

At a depth of 11 meters below the water surface, the TSS plume increases in size to extend over an area measuring approximately 80 meters across. A maximum TSS concentration of 46 mg/L is predicted to occur directly in the center of the plume.

In general, the width of the TSS plume generated for Hotspot 1 sediments is slightly larger than that predicted for the other sediments. This is attributed to the higher sand content of the Hotspot 1 area.

7.3.5.2.4 Sediment from USACE O&M Dredging Areas

The results of this modeling scenario are depicted on Figure 7-11. At a depth of 1 meter below the water surface, a relatively small TSS plume is predicted to extend over an area measuring approximately 50 meters across. The TSS concentration at the center of the turbidity plume is expected to be about 3.1 mg/L.

At a depth of 5.5 meters below the water surface, the TSS plume is predicted to be about 70 meters across, but the worst-case predicted TSS concentration increases to 10 mg/L at the center of the plume.

At a depth of 11 meters below the water surface, the TSS plume remains relatively the same size extending over an area measuring 70 meters across. A maximum TSS concentration of 57 mg/L is predicted to occur directly in the center of the plume.

7.3.6 Conclusions

In general, the STFATE model suggests that the plume of suspended sediments, which forms after the sediment is released, is wider and more extensive at depth than it is at the surface. At shallow depth (1 meter below the water surface), maximum TSS concentrations ranged from 2.6 to 6.8 mg/L. At mid-depth (5.5 meters below the water surface), maximum TSS concentrations ranged from 8.3 to 22 mg/L. At the greatest depth modeled (11 meters below the water surface), maximum TSS concentrations range from 46 to 185 mg/L.

The predicted turbidity plume extends a maximum distance of approximately 80 meters horizontally from the dumping point (i.e., the turbidity plume is 160 meters across). This condition was predicted for a depth of 11 meters during the disposal of sediment from Hotspot 1. The highest predicted TSS concentration was 185 mg/L, for dumping of sediments dredged from the OHD Wharves 1 and 2 and Hotspot 3 area, again at bottom depth (11 meters).

Under conditions modeled for the four disposal scenarios, after 20 minutes following the disposal event, predicted TSS concentrations are expected to reach zero at distances of no more than approximately 80 meters from the disposal point. When compared against known and documented thresholds for acute and sub-lethal impacts from TSS (Anchor 2003), the predicted TSS concentrations for the Harbor are predicted to have negligible impacts to the aquatic environment, except for brief periods near the bottom surface in the close vicinity of the dump event.

8 PERMITTING STRATEGY

Dredging of the OHD and U.S. Navy wharves and the Federal Channel and construction of the CAD facility are subject to both CEQA and NEPA review. The OHD is acting as the lead CEQA agency and the U.S. Navy is acting as the lead NEPA agency. As the lead federal agency, the U.S. Navy has assumed responsibility for coordinating with resource agencies such as the National Marine Fisheries Service and California Department of Fish and Game and ensuring compliance with requirements of statutes such as the ESA and the Magnuson-Stevens Fishery Conservation and Enhancement Act. In addition, the U.S. Navy assumed the lead role in addressing cultural and historic resource issues including requirements of Section 106 of the National Historic Properties Act. The process of obtaining project approvals and permits is complex, and the information presented below is intended only as a general summary of the permitting process for the project.

The initial step of the OHD's CEQA process and the U.S. Navy's NEPA process was to develop appropriate CEQA and NEPA documentation for the project. Based on the history of the project site and the characteristics of the proposed project, previous sampling of the CAD facility and Harbor, modeling of the proposed sediment cap's physical and chemical stability, and conservative modeling of potential effects to water quality during sediment disposal, no significant impacts or impacts that cannot be mitigated to less than significant were expected. The environmental analysis was carried out in the form of a CEQA Initial Study prepared as a joint document with the U.S. Navy's NEPA Environmental Assessment. Because no significant impacts were identified in the environmental analyses, it is anticipated that the OHD will complete the CEQA process by adopting a Mitigated Negative Declaration, while the U.S. Navy will complete the NEPA process by issuing a Finding of No Significant Impact (FONSI) to accompany a final Environmental Assessment. The USACE is also responsible for NEPA compliance for their O&M dredging component of the overall project and is preparing a supplement to their existing Environmental Assessment.

The U.S. Navy and USACE acted as co-applicants in obtaining a federal consistency determination for the entire project from the CCC, which satisfies requirements of the CZMA. The CCC unanimously approved the federal consistency determination on May 9, 2008.

The OHD and U.S. Navy also acted as co-applicants for the Clean Water Act (CWA; Section 404) and River and Harbor Act (Section 10) permits from the USACE and CWA (Section 401) water quality certification from the RWQCB. The USACE Regulatory Division is preparing a Standard Individual Permit with an associated Environmental Assessment/FONSI in support of their permit decision. Water quality certification would be addressed through the RWQCB's issuance of a CWA Section 401 Water Quality Certification and Waste Discharge Requirements under the Porter-Cologne Act.

9 CONSTRUCTION SEQUENCING AND ANTICIPATED SCHEDULE

This section describes the construction sequencing for dredging the Harbor as described in Section 5.1. The durations and construction sequence reflected here are representative of design conditions as depicted in the 90 percent design plans (Appendix G) and 90 percent specifications (Appendix H).

Construction and disposal activities along Hueneme Beach and within the CAD will be subject to environmental work windows from the resource agencies. Work can be conducted outside of these windows, but additional consultation and monitoring would likely be required. The following sequence of activities is listed in order of operation:

1. Mobilize construction equipment.
2. Excavate CAD facility utilizing a hydraulic dredge and pump the clean sand onto Hueneme Beach.
3. Mechanically dredge contaminated sediments from USACE Hotspot 2 and place dredged material within the CAD facility by split-hull barges.
4. Mechanically dredge contaminated sediments from U.S. Navy Wharf 4 and place dredged material within the CAD facility by split-hull barges. Backfill areas along wharf face with material excavated within the southern portion of the Turning Basin, after all contaminated material has been removed.
5. Mechanically dredge contaminated sediments from U.S. Navy Wharf 3 and place dredged material within the CAD facility by split-hull barges. Backfill areas along wharf face with material excavated within the southern portion of the Turning Basin, after all contaminated material has been removed.
6. Mechanically dredge contaminated sediments from U.S. Navy Wharf 5 and place dredged material within the CAD facility by split-hull barges. Backfill areas along wharf face with material excavated within the southern portion of the Turning Basin, after all contaminated material has been removed.
7. Mechanically dredge contaminated sediments from U.S. Navy North Harbor Area and place dredged material within the CAD facility by split-hull barges. Backfill areas along U.S. Navy Wharf 6 face with material excavated within the southern portion of the Turning Basin, after all contaminated material has been removed.
8. Mechanically dredge contaminated sediments from U.S. Navy Wharves A and B and place dredged material within the CAD facility by split-hull barges.

9. Mechanically dredge contaminated sediments from USACE Hotspot 1 and place dredged material within the CAD facility by split-hull barges.
10. Mechanically dredge contaminated sediments from USACE Hotspot 3 and place dredged material within the CAD facility by split-hull barges.
11. Mechanically dredge contaminated sediments from OHD Wharf 1 and place dredged material within the CAD facility by split-hull barges. Backfill areas along wharf face with material excavated within the southern portion of the Turning Basin, after all contaminated material has been removed.
12. Mechanically dredge contaminated sediments from OHD Wharf 2 and place dredged material within the CAD facility by split-hull barges.
13. Mechanically dredge O&M material from the USACE Federal Channels and place dredged material within the CAD facility by split-hull barges. O&M material could be completed by hydraulic dredge and pumped into the CAD facility using a submerged diffuser (or similar method). This material would be used as a cap of the CAD facility.
14. Mechanically dredge O&M material from USACE Entrance Channel and place dredged material within the CAD facility by split-hull barges. O&M material could be completed by hydraulic dredge and pumped into the CAD facility using a submerged diffuser (or similar method). This material would be used as a cap of the CAD facility.
15. Mechanically dredge O&M material from the USACE Approach Channel and place dredged material within the CAD facility by split-hull barges. O&M material could be completed by hydraulic dredge and pumped into the CAD facility using a submerged diffuser (or similar method). This material would be used as a cap of the CAD facility.
16. Mechanically place armor stone with in the identified area of the CAD. If additional cap material is needed in order to achieve the requisite 3-meter thickness, then it can be excavated from the southern portion of the Turning Basin.
17. Demobilize construction equipment.

A conceptual schedule of design, permitting, and construction activities is presented in Figure 9-1. This schedule was developed based on current design knowledge, professional judgment, and experience from other similar projects, and as such, may be modified as part of subsequent design development. Production rates for each of the areas are discussed in Section 5.

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discharge, as dilution would nearly instantly reduce the dissolved concentrations well below the criteria.

All told, these combined effects will lessen the likely chemical impacts of disposal by a considerable margin—possibly two or more orders of magnitude—such that the ratios shown in Table 7-1 are expected to be much lower.

7.3 Modeling of Water Quality Impacts at Point of Dredging

The computer model DREDGE, developed by USACE as part of its Automated Dredging and Disposal Alternatives Modeling System (ADDAMS) suite of modeling software, was used to predict the suspended sediment plume resulting from resuspension of dredged sediments caused by clamshell bucket dredging. The mechanisms by which clamshell dredging could cause resuspension of sediment particles include clamshell impact, closure, withdrawal, and lifting of sediment through and out of the water column. DREDGE uses an expected resuspension rate in conjunction with field parameters (e.g., water current, sediment settling velocities, etc.) to predict the total suspended sediment concentration released into the water column at the point of dredging and at points cross stream and downstream. These predicted resuspension concentrations were then evaluated to assess potential for adverse risks.

7.3.1 DREDGE Model Input

DREDGE models the transport of suspended sediment from dredging operations into two distinct areas: "near-field" and "far-field." The area in the immediate vicinity of the dredging operation (typically 10 to 20 meters downstream from the dredge) is the zone of the highest TSS. This area is termed the "near-field" and is dominated by mixing and currents induced by the dredging process. In the "far-field" zone, suspended sediment transport is controlled by advection, turbulent diffusion, and sedimentation. The DREDGE program utilizes a two-dimensional, vertically averaged transport model published by the USACE to analyze sediment transport in the "far-field" area (Hayes and Je 2000).

Table 7-2 presents key input parameters used in the DREDGE model for the prediction of TSS concentrations at selected distances from the point of dredge with an open clamshell bucket. Modeling was completed for a 5 m^3 bucket, a 10-meter water depth, and a 90-second cycling time. These parameters were selected based on project-specific conditions and needs, and on typical equipment and operating procedures used for similar projects performed in the Southern California region. The cycle time selected is considered conservative in terms of resuspension, as longer cycles in excess of 2 minutes are not uncommon during remedial dredging. In general, longer cycle times tend to decrease the resuspension of sediments, if other parameters relating to operations are held constant.

Table 7-2
Key DREDGE Model Input Parameters

Parameter	Unit	U.S. Navy and Hotspot 2	OHD and Hotspot 3
Bucket Size	m^3	5	5
Cycle Time	sec	90	90
Settling Velocity[a]	m/sec	0.013343	0.039969
Dry density	kg/m^3	700	700
Turbidity Generation Unit (TGU)[b]	g/m^3	89,400	89,400
Fraction of particles less than 74 µm[c]		0.42	0.54
Fraction of particles less than critical settling velocity		0.5	0.5
Dredge depth	m	10	10
Lateral diffusion coefficient	cm^2/sec	100,000	100,000
Vertical diffusion coefficient	cm^2/sec	5	5
Ambient water velocity[d]	m/sec	0.1	0.1
Mean particle size[c]	µm	130	225
Specific gravity		2.65	2.65

Notes:

a Value is calculated by the DREDGE program based on Stokes' Law, using mean grain size from each sediment source.

b Based on literature values applicable to the use of an 8-cubic-meter bucket, as presented in Nakai (1978).

c Determined using the results of sediment sampling and grain-size testing U.S. Navy Sampling Data from 2007 (Columbia Analytical Services – no formal report) and USACE sampling in 1996 (USACE 1999b).

d Assumed value for ambient current conditions due to intertidal exchange.

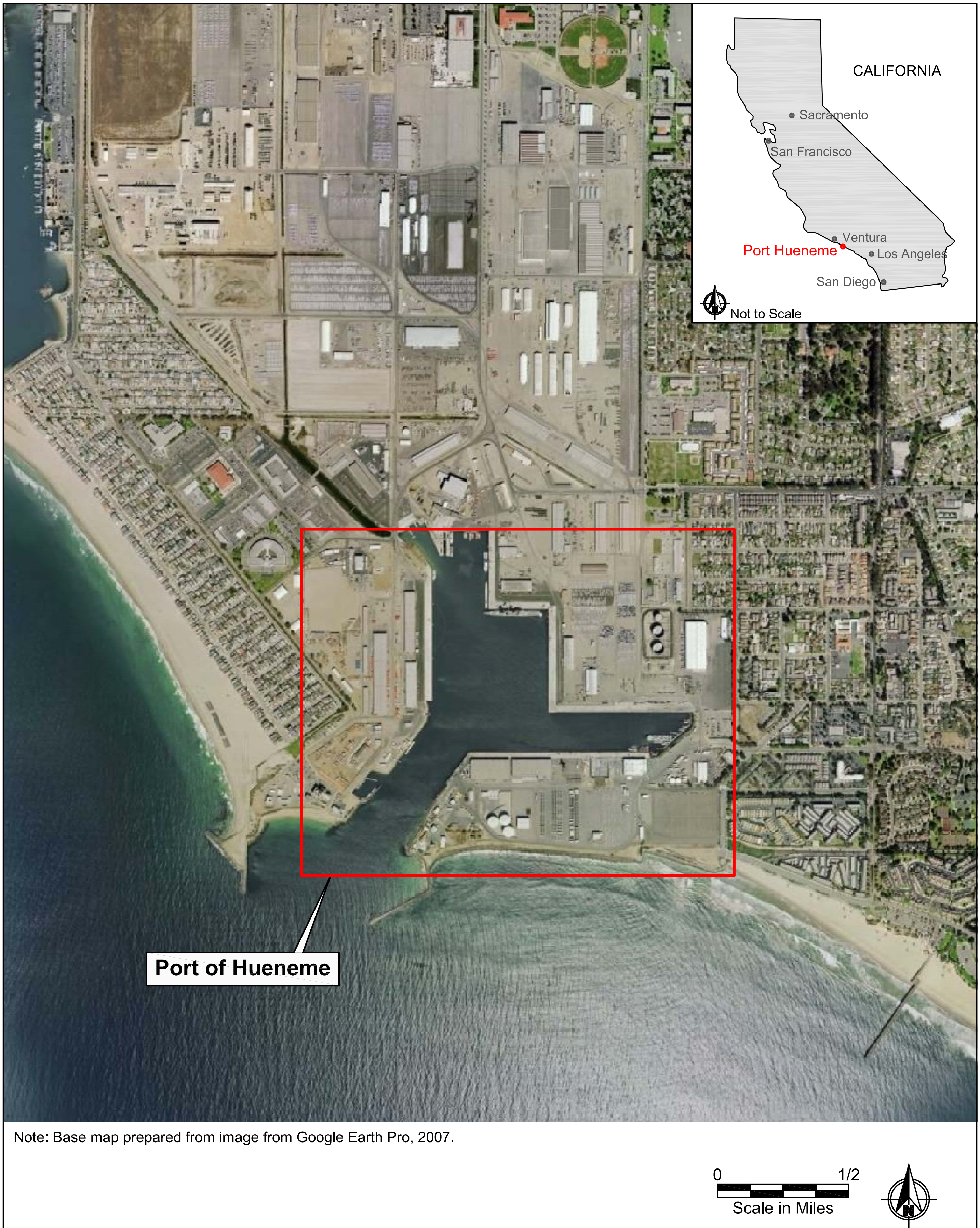
µm = micrometers

μm^3 = cubic micrometers

cm^2/sec = square centimeters per second

g/m^3 = grams per cubic meter

FIGURES



Jul 10, 2008 10:54am cdavidson K:\Jobs\070374-Port Hueneme\07037401-018.dwg Figure 1-1

Note: Base map prepared from image from Google Earth Pro, 2007.

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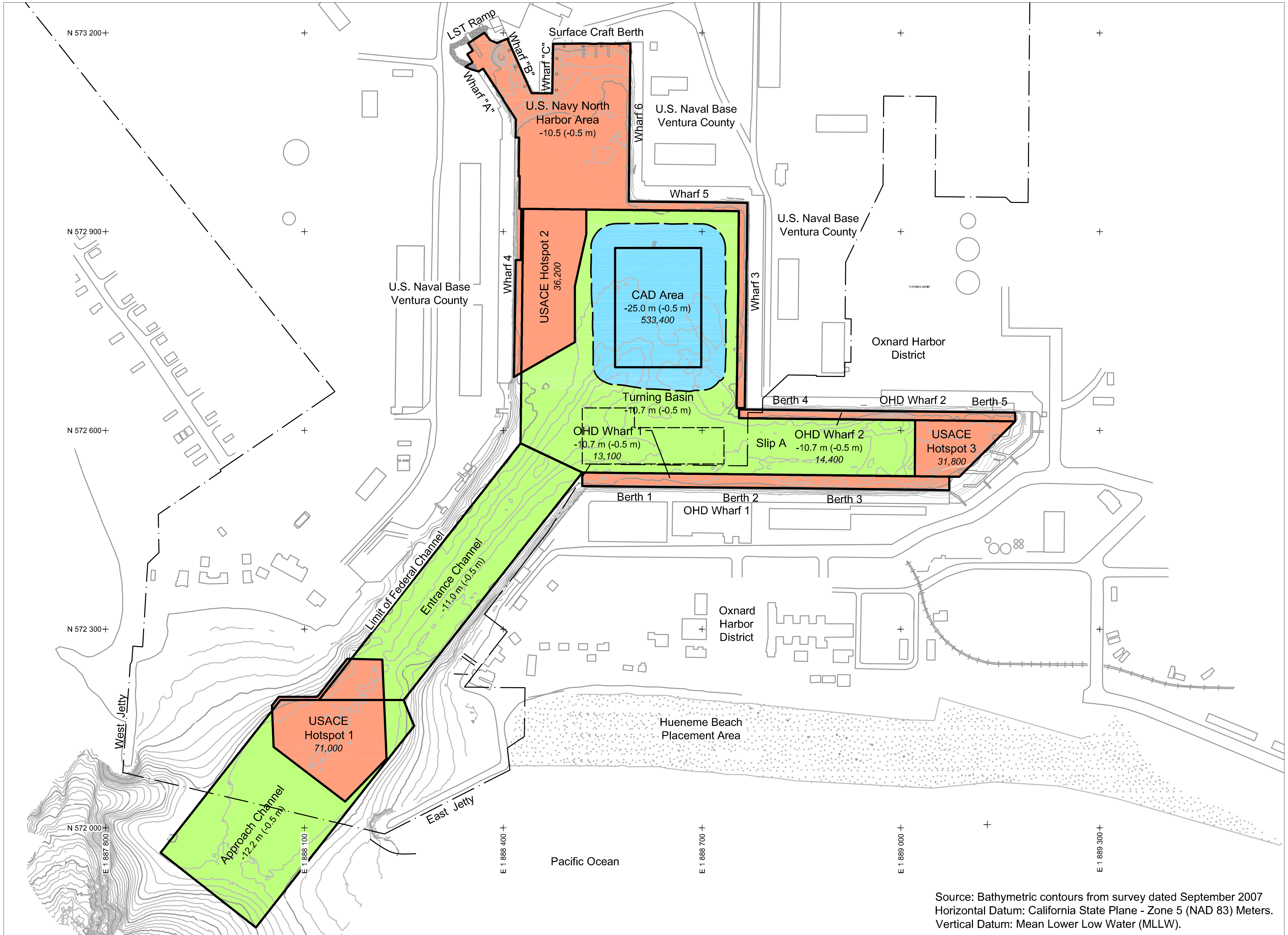
Figure 1-1
Site Location Map
Port of Hueneme



Legend:

- OHD/U.S. Navy Property Boundary (approximate)
- CAD Area to be Dredged and Placed on Hueneme Beach
- Area of Contaiminated Sediments to be Dredged and Placed in CAD
- Remaining USACE Operations and Maintenance Sediments to be Dredged and placed in CAD to Construct Cap

CAD Area — Dredge Area
-25.0 m (-0.5 m) — Target Depth (Allowable Overdepth)
533,400 — *Volume in Cubic Meters*

0 100
Scale in Meters

Summary of Estimated Contaminated Sediment Volumes (to be Contained in CAD)

Contaminated Sediment Location	Volume (m^3)
OHD Wharf 1	13,100
OHD Wharf 2	14,400
U.S. Navy Areas	73,300
USACE Hotspot 1	71,000
USACE Hotspot 2	36,200
USACE Hotspot 3	31,800
Approximate Total Contaminated Sediment Volume	239,800

Figure 1-2
Project Area Site Plan Including Key Structures
Port of Hueneme

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0 500
Scale in Feet

Figure 2-1
Surface and Subsurface
Sediment Sampling Locations
Port of Hueneme

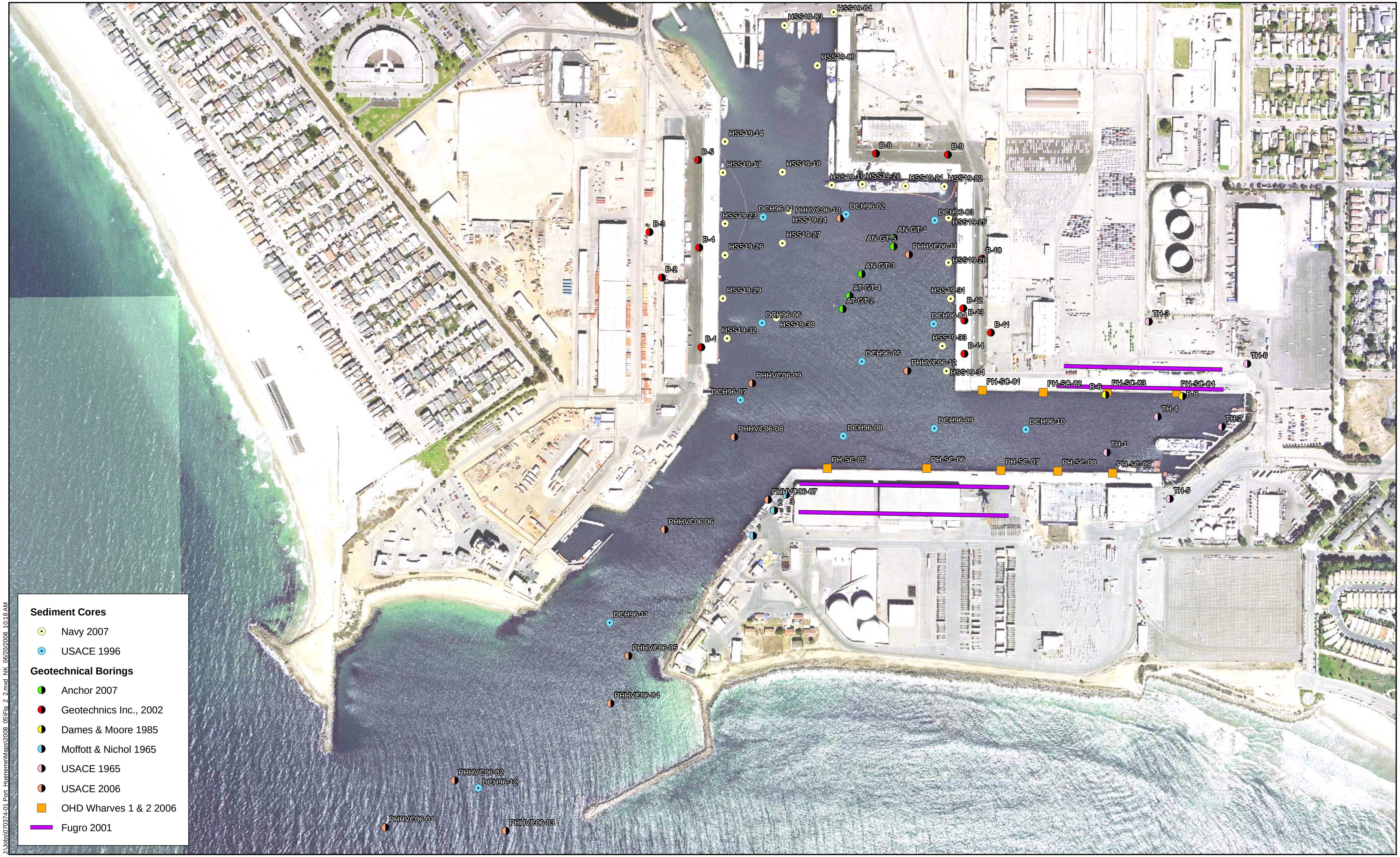

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Figure 2-2
Geotechnical Sampling Locations
Port of Hueneme

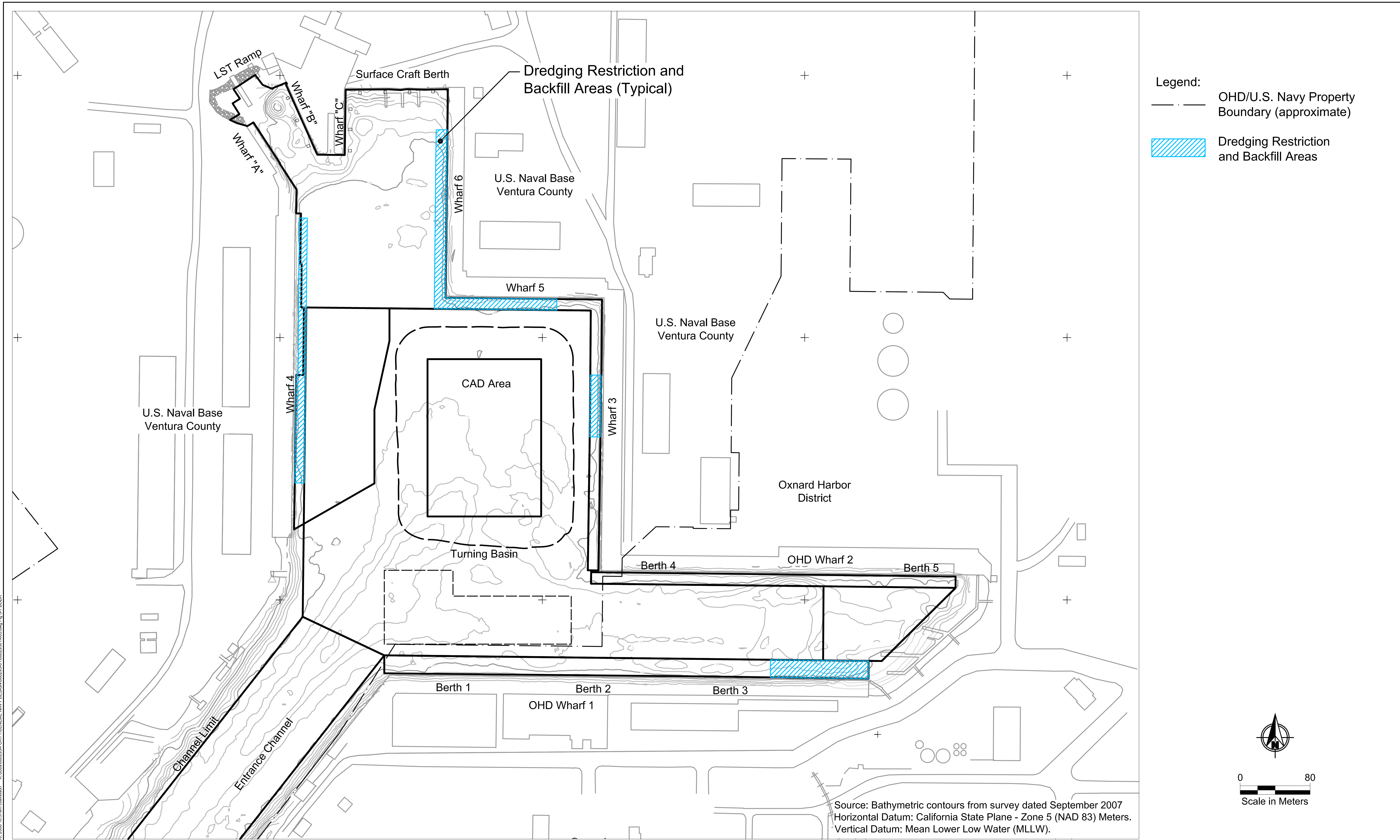

Figure 3-1
Dredging Restriction and Backfill Areas
Port of Hueneme

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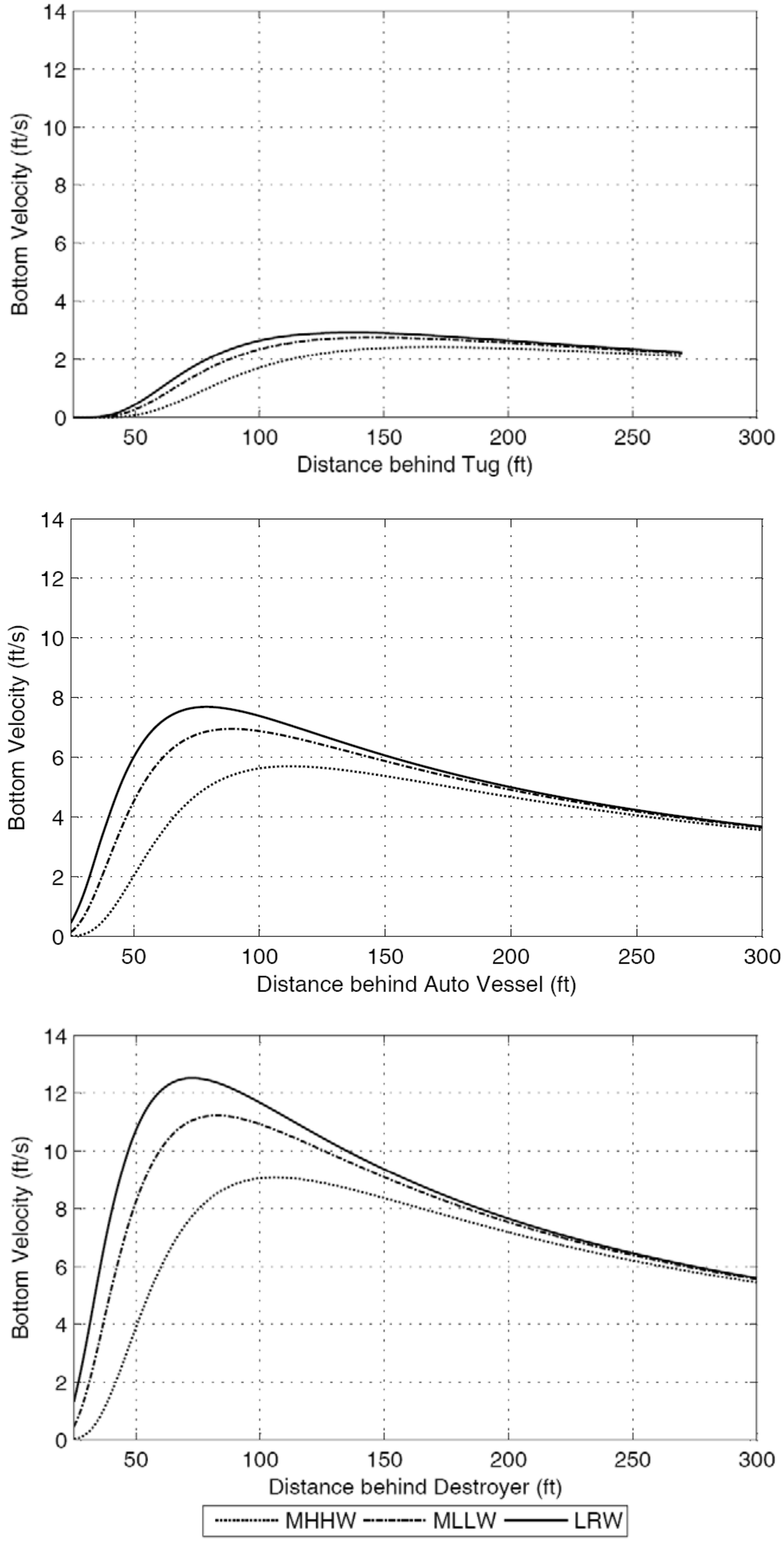

Figure 6-1
Predicted Bottom Velocities behind Vessels
Port of Hueneme

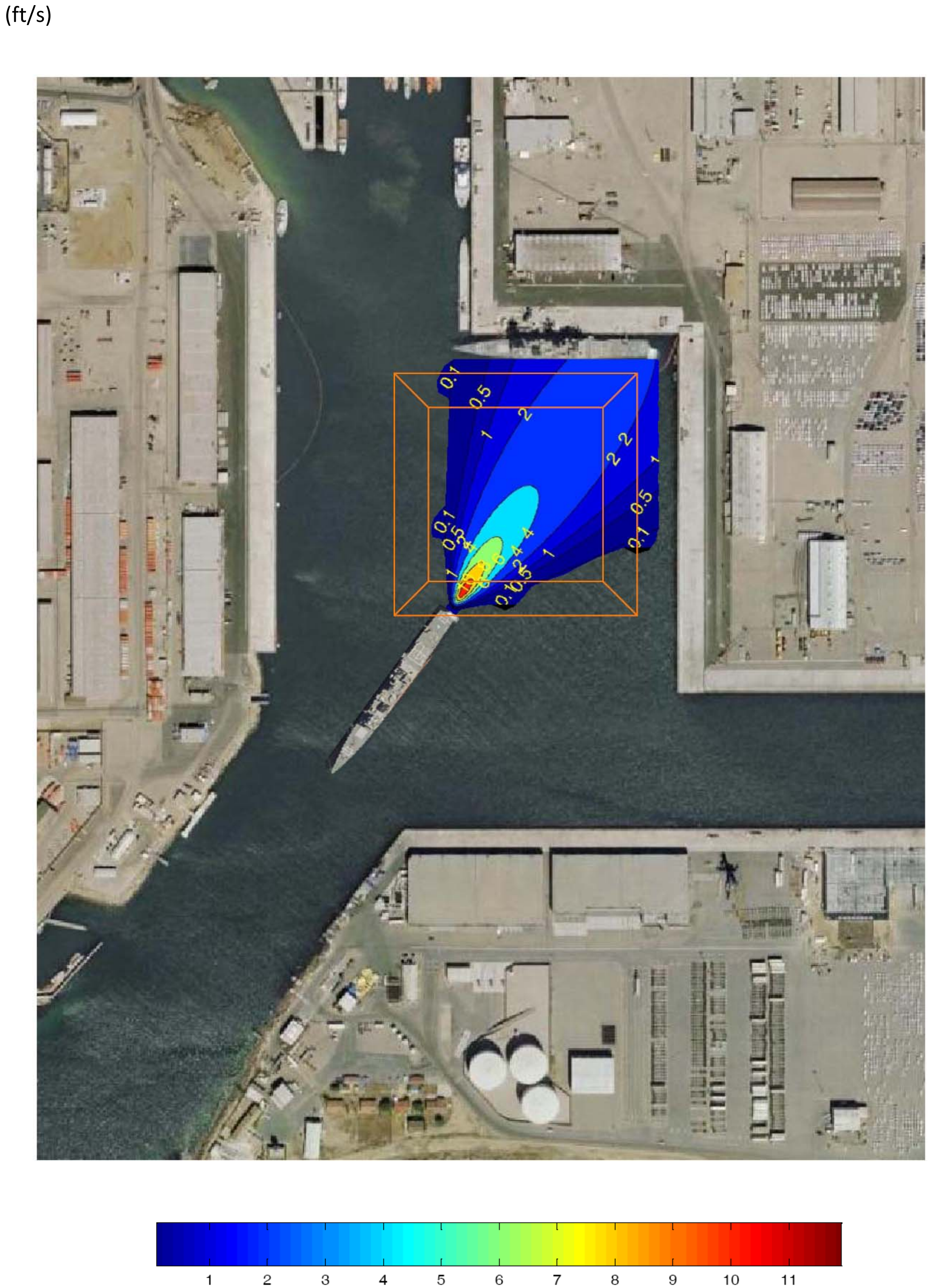

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Figure 6-2
Near Bed Velocities behind U.S. Navy Destroyer at Most Likely Location when Leaving Port of Hueneme
Port of Hueneme

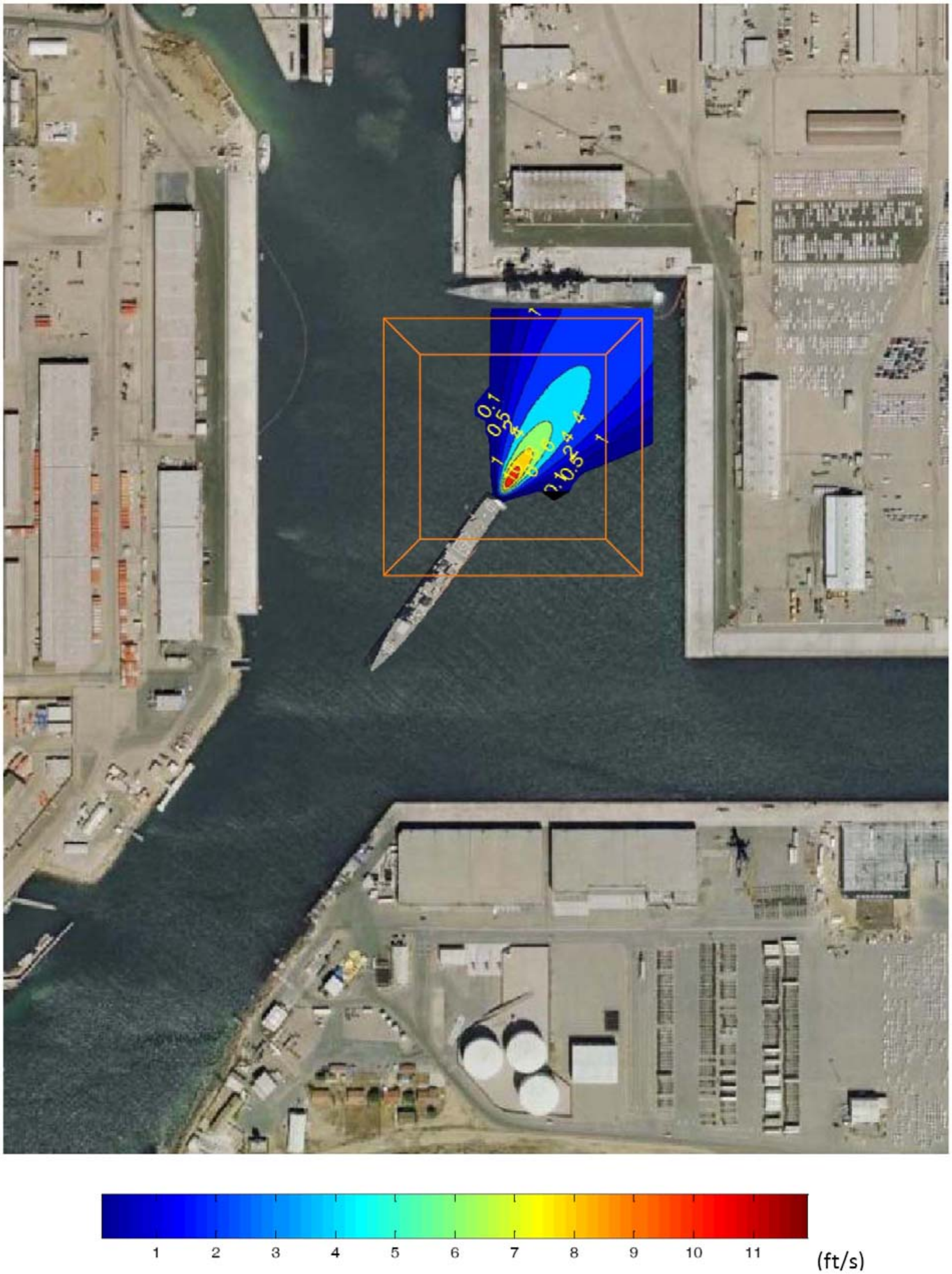


Figure 6-3
Near Bed Velocities behind U.S. Navy Destroyer at Less Likely Location when Leaving Port of Hueneme
Port of Hueneme

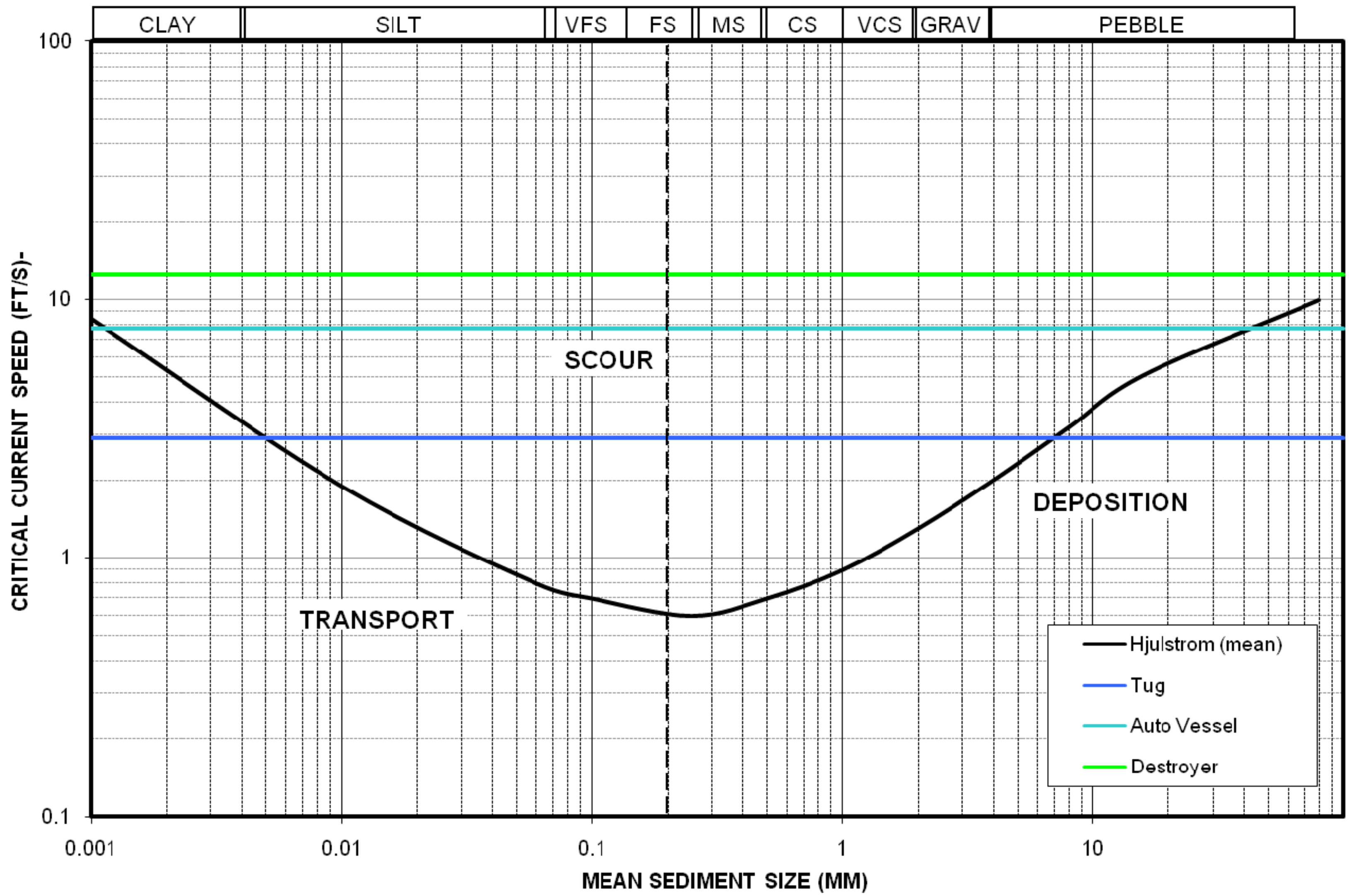


Figure 6-4
Critical Scouring Speed for Scouring of Capping Material
Port of Hueneme

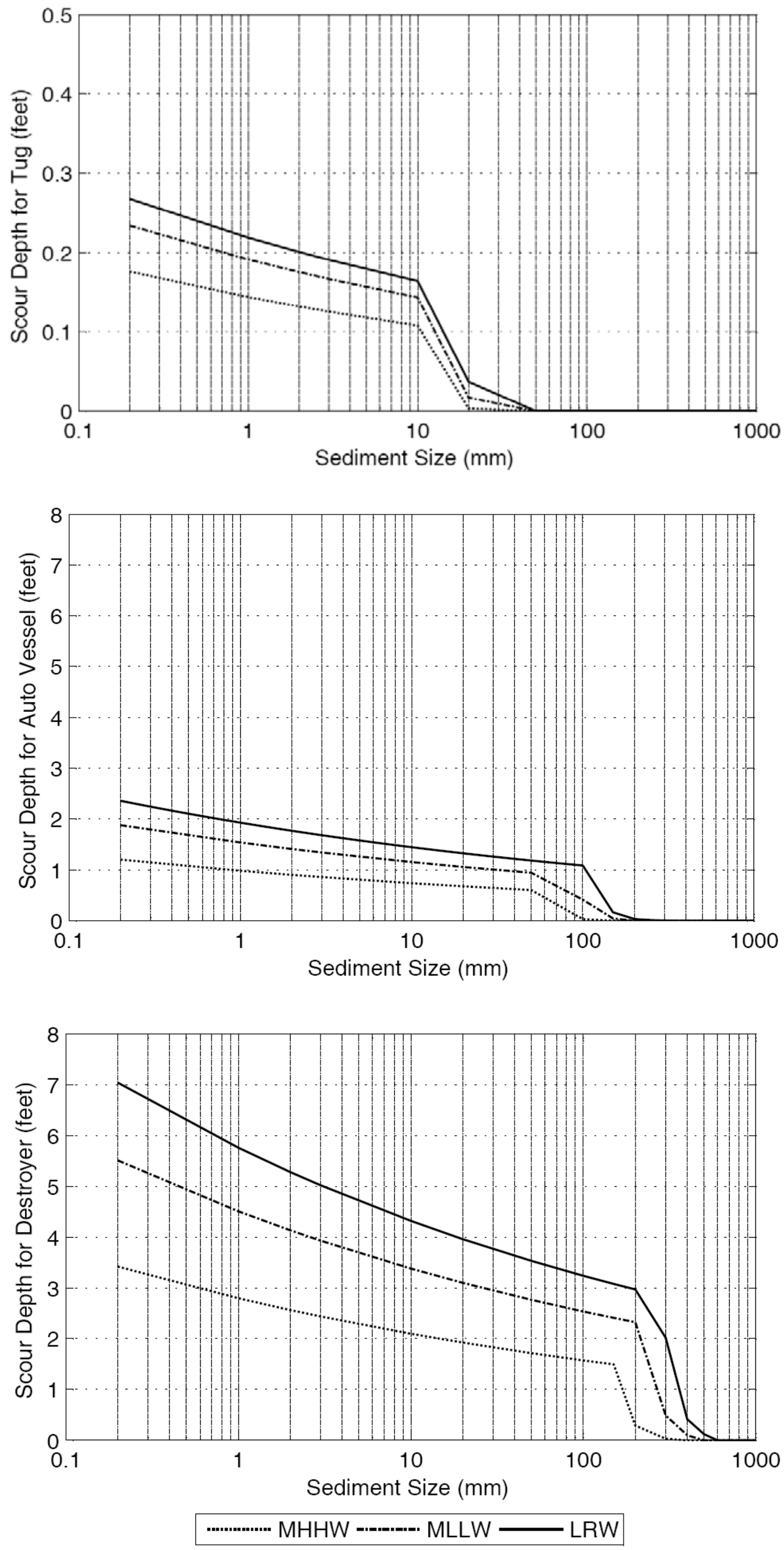
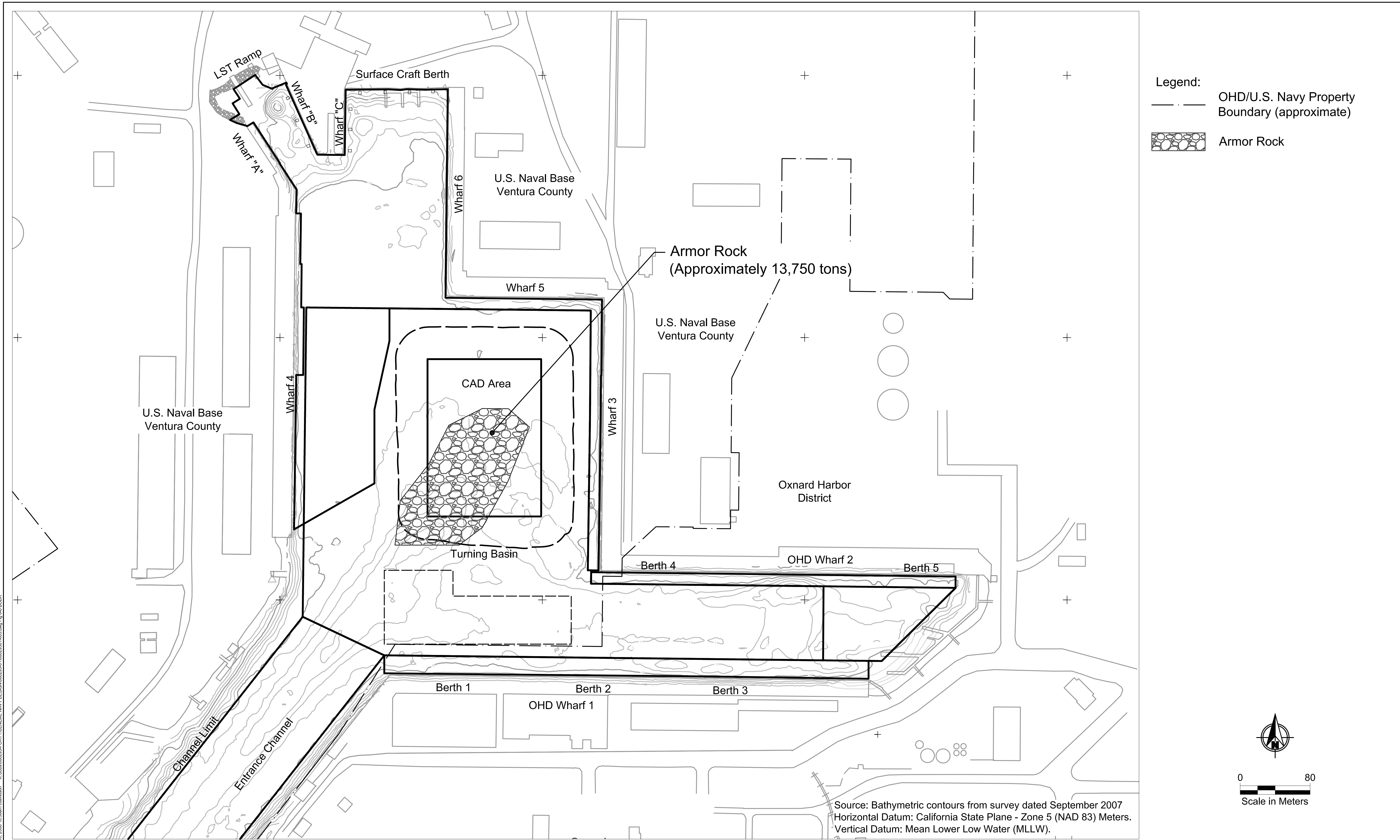
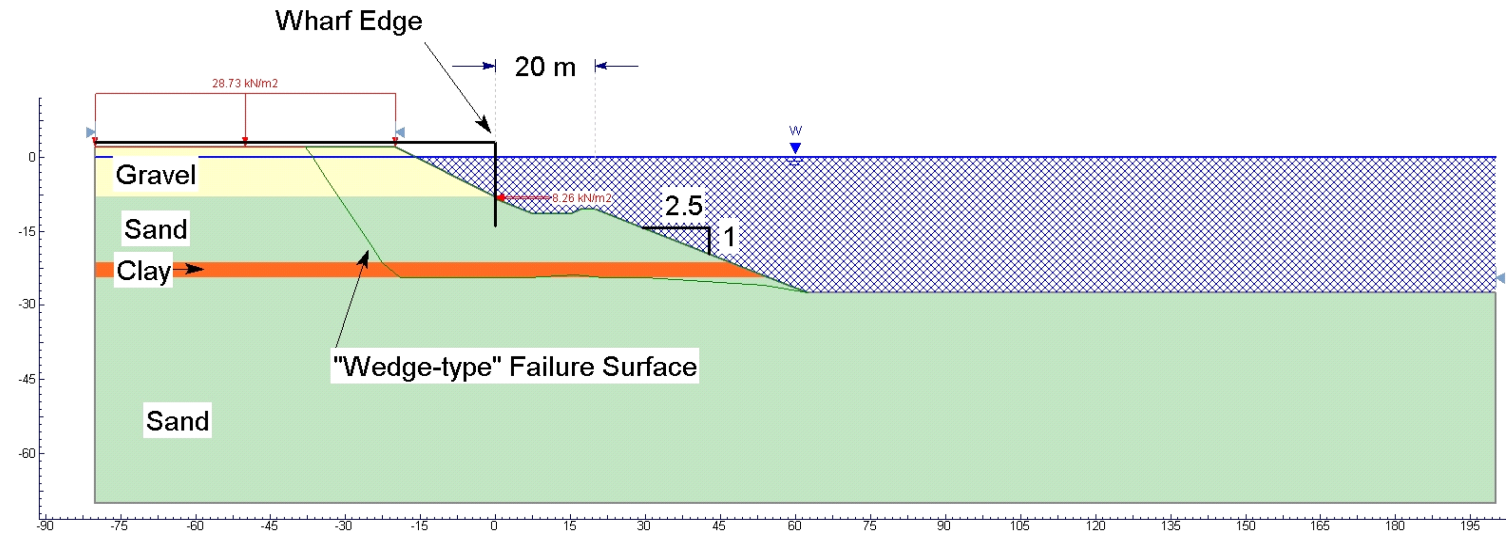


Figure 6-5
Predicted Scour Depth for Capping Material of Different Sizes
Port of Hueneme

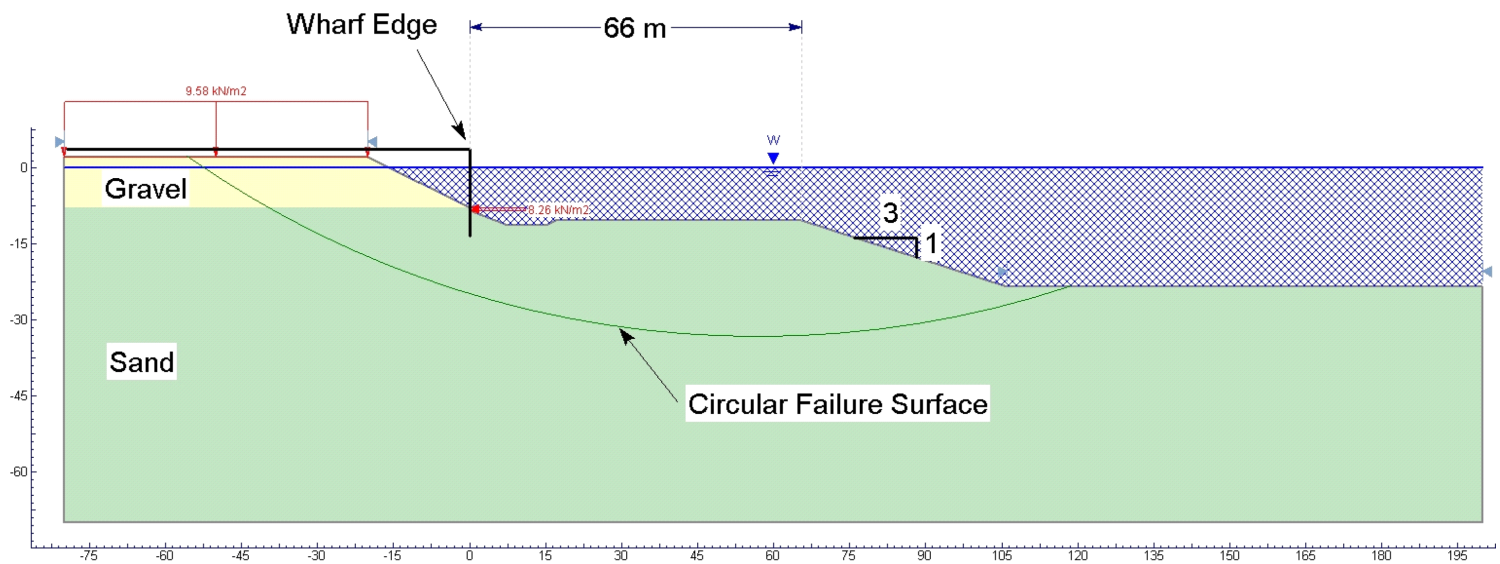


ANCHOR ENVIRONMENTAL, L.L.C.

Figure 6-6
Layout of Armor Rock over CAD Surface
Port of Hueneme



A) Wedge shaped failure of CAD 20 meters from wharf; 2.5:1 slope with clay layer



B) Circular shaped failure of CAD 66 meters from wharf; 3:1 slope without clay layer

Jul 11, 2008 3:11pm tgriga K:\Jobs\070374-Port Hueneme\07037401-021.dwg Fig 6-7

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 6-7
Stability of CAD Excavation and Adjacent Wharf Structures
Port of Hueneme

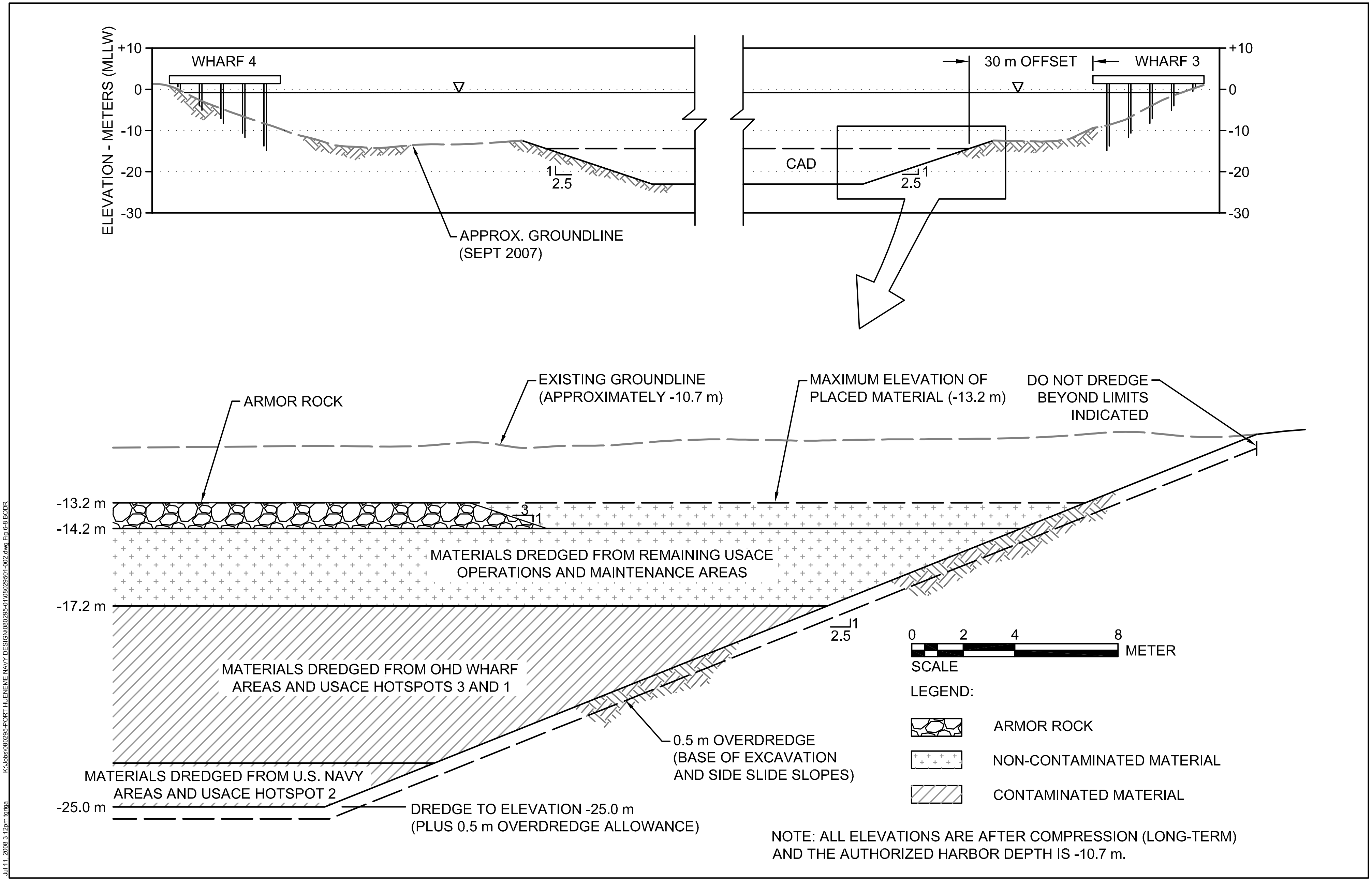
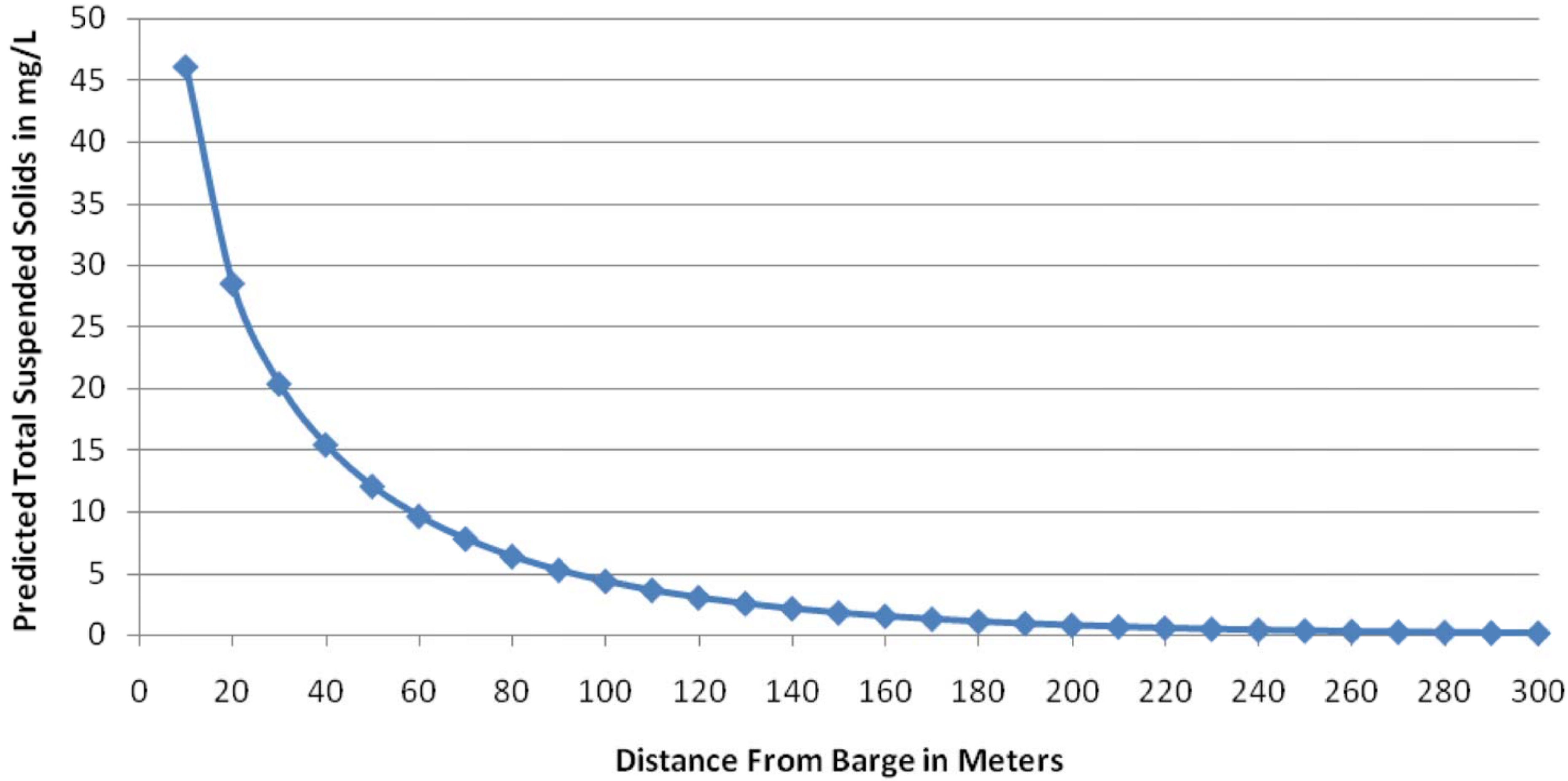


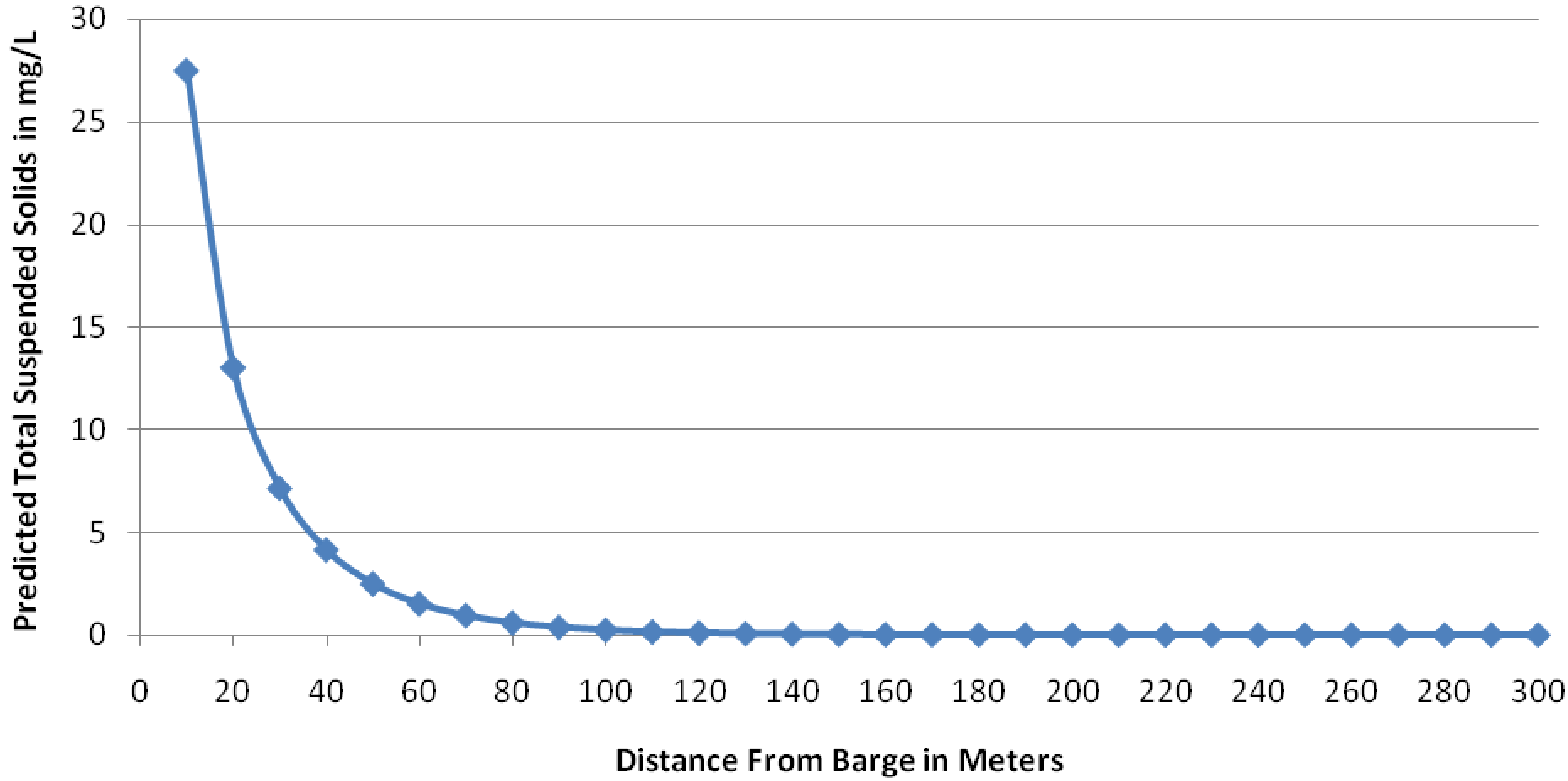
Figure 6-8
Typical Cross-section through CAD Facility
Port of Hueneme

ANCHOR
ENVIRONMENTAL, L.L.C.



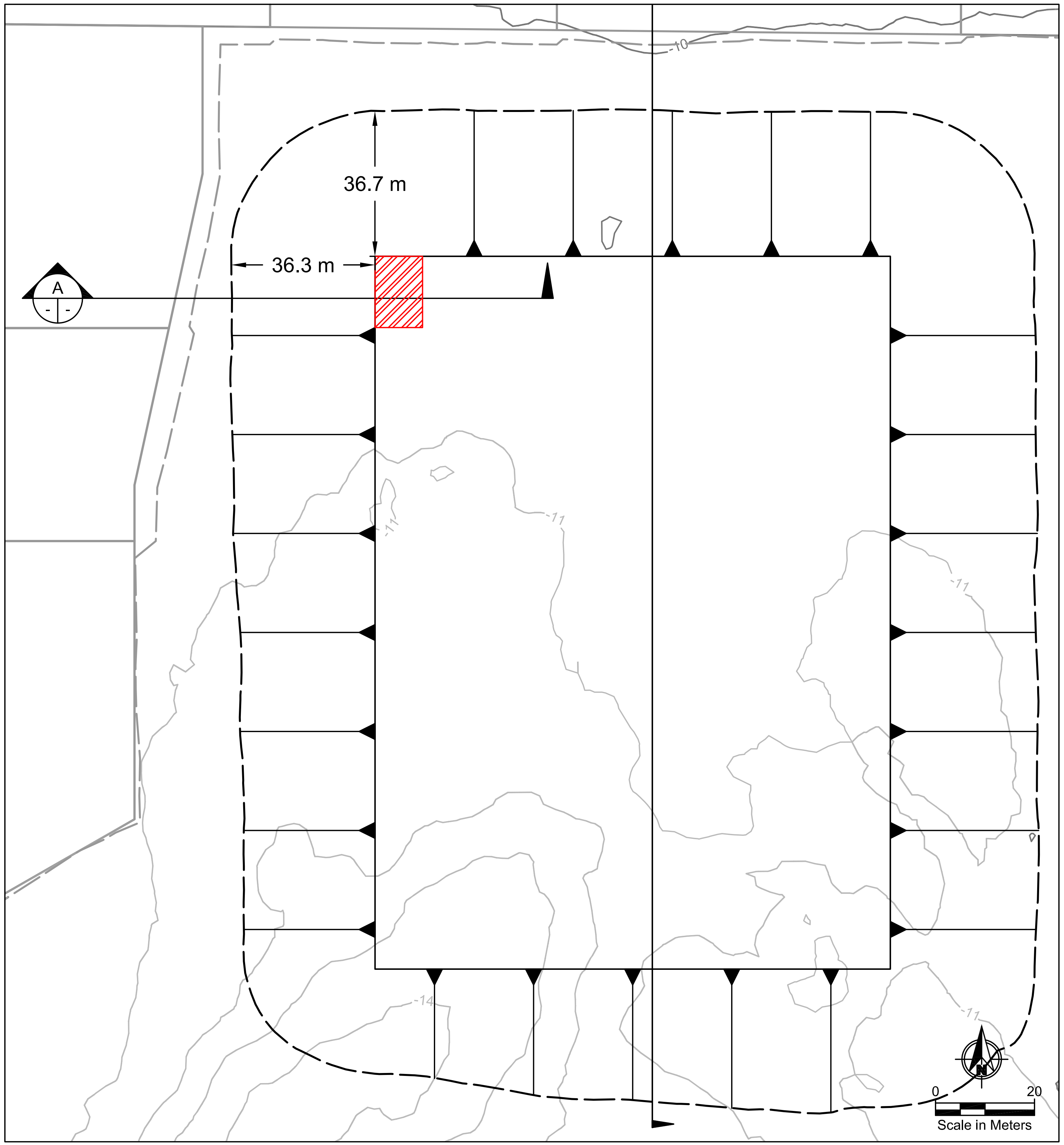
ANCHOR ENVIRONMENTAL, L.L.C.

Figure 7-1
U.S. Navy Wharves and Hotspot 2
Total Suspended Solids Predicted by DREDGE
Port of Hueneme

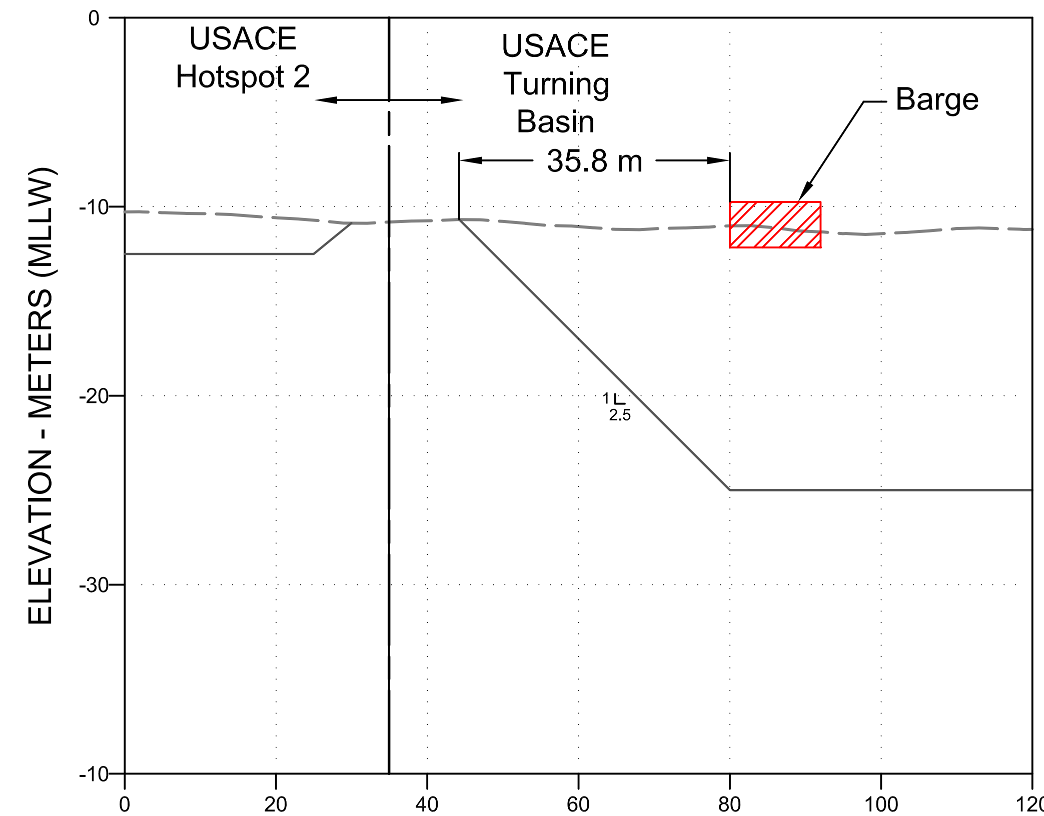


ANCHOR ENVIRONMENTAL, L.L.C.

Figure 7-2
OHD Wharves 1 and 2 and Hotspot 3
Total Suspended Solids Predicted by DREDGE
Port of Hueneme



Barge Location Plan



Barge Location Section A

Source: Bathymetric contours from survey dated September 2007
Horizontal Datum: California State Plane - Zone 5 (NAD 83) Meters.
Vertical Datum: Mean Lower Low Water (MLLW).

Figure 7-3
Assumed Barge Location over CAD Area during STFATE Modeling
Port of Hueneme

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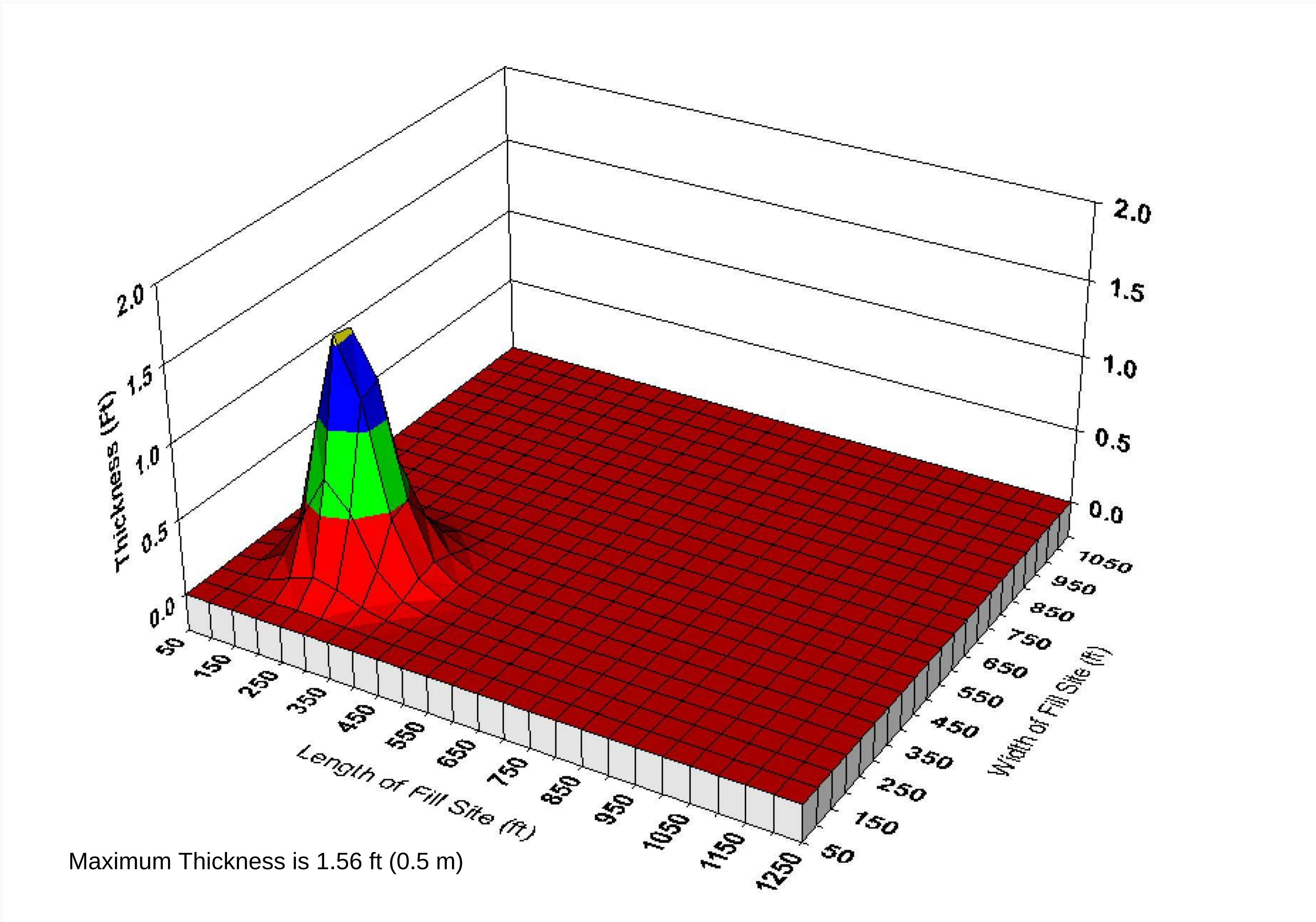

Jul 10, 2008 11:29am cdavidson K:\Jobs\070374-Port Hueneme\07037401-019.dwg Fig 7-4

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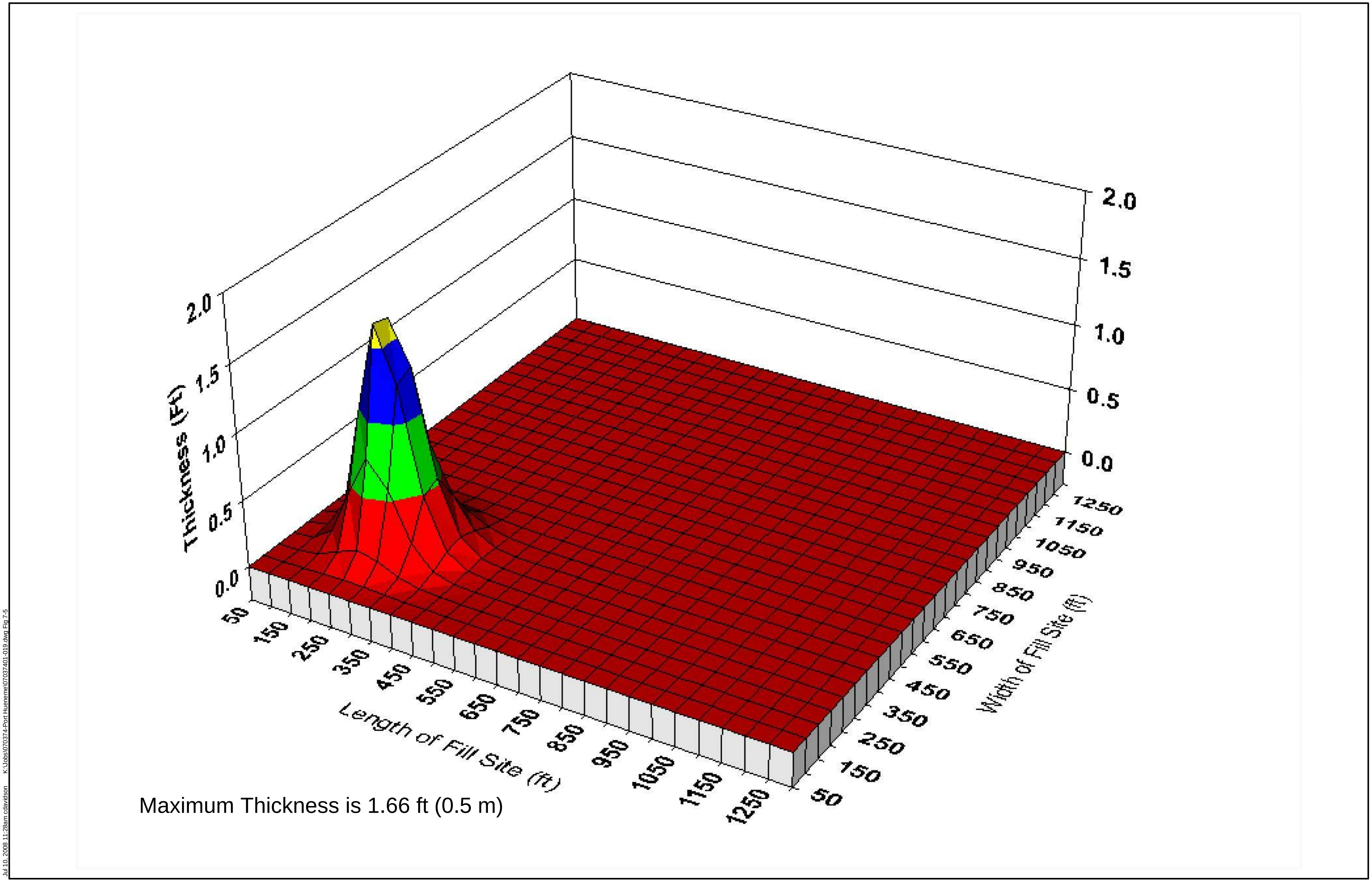
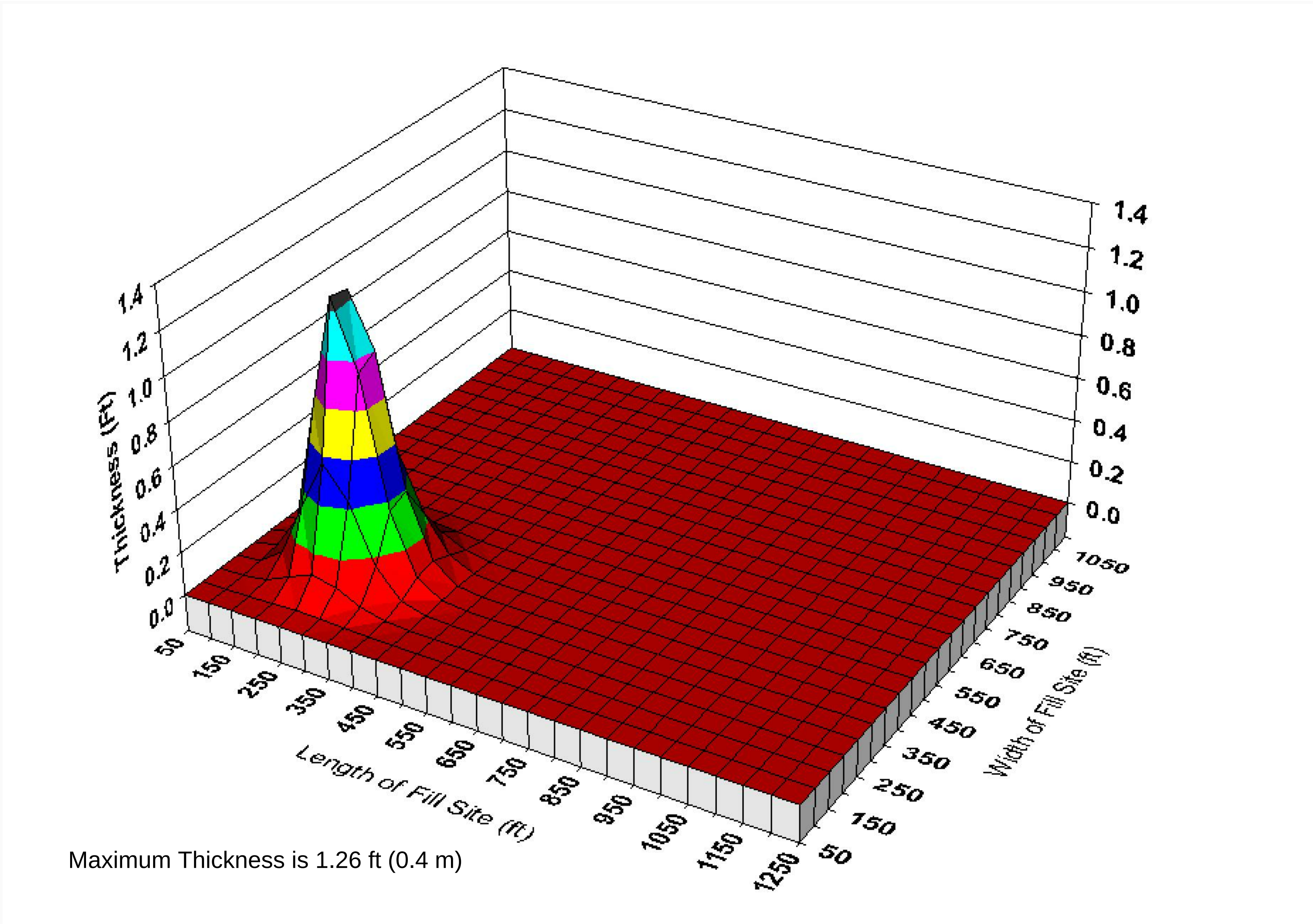
Figure 7-4
Total Deposited Material Thickness as a Function of Distance from Dump Location for U.S. Navy Wharves and Hotspot 2
Port of Hueneme



ANCHOR ENVIRONMENTAL, L.L.C.

Figure 7-5
Total Deposited Material Thickness as a Function of Distance from Dump Location for OHD Wharves 1 and 2 and Hotspot 3
Port of Hueneme



Jul 10, 2008 11:26am cdavidson K:\Jobs\070374-Port Hueneme\07037401-019.dwg Fig 7-6

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 7-6
Total Deposited Material Thickness as a Function of Distance from Dump Location for Hotspot 1
Port of Hueneme

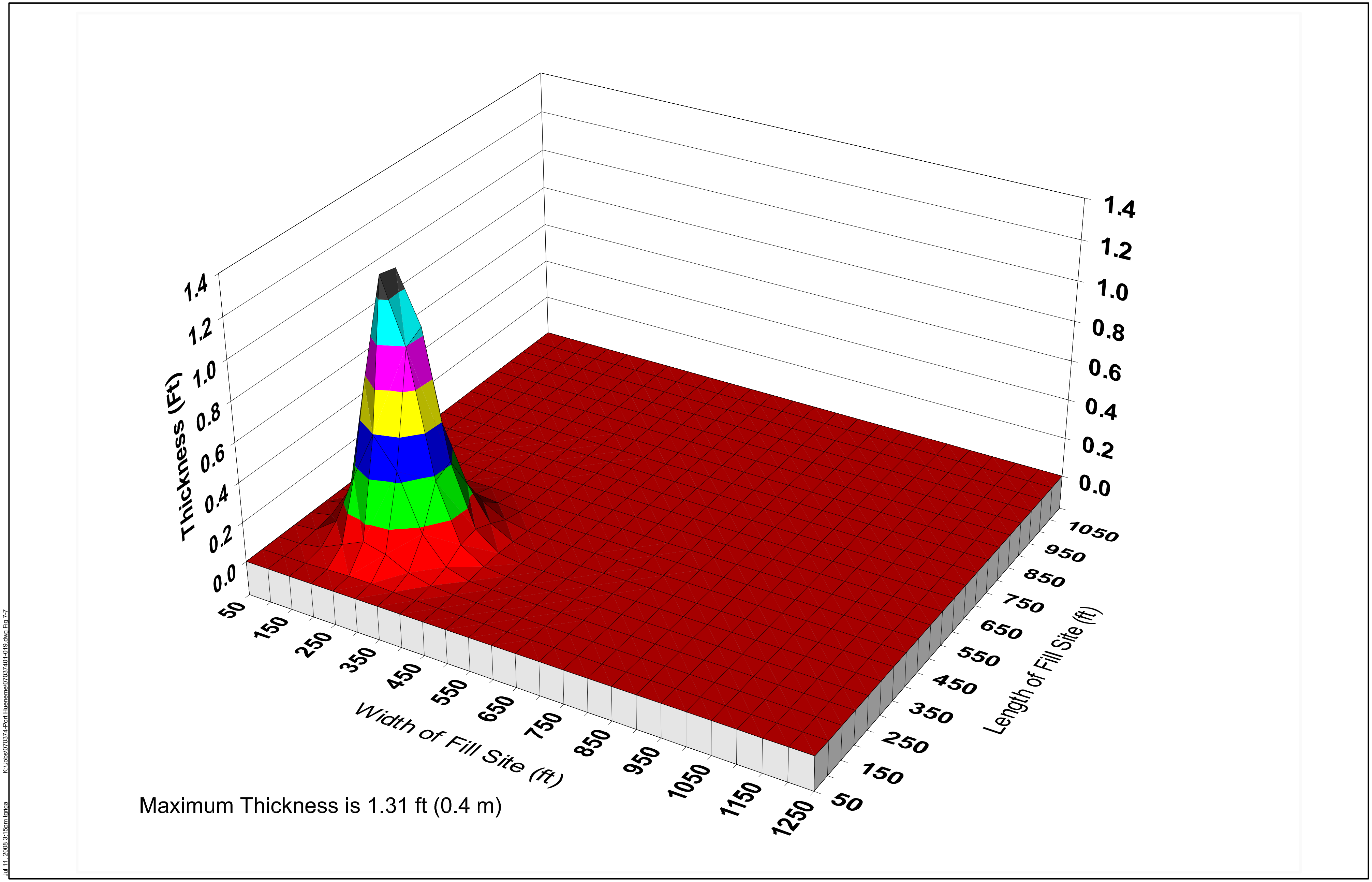


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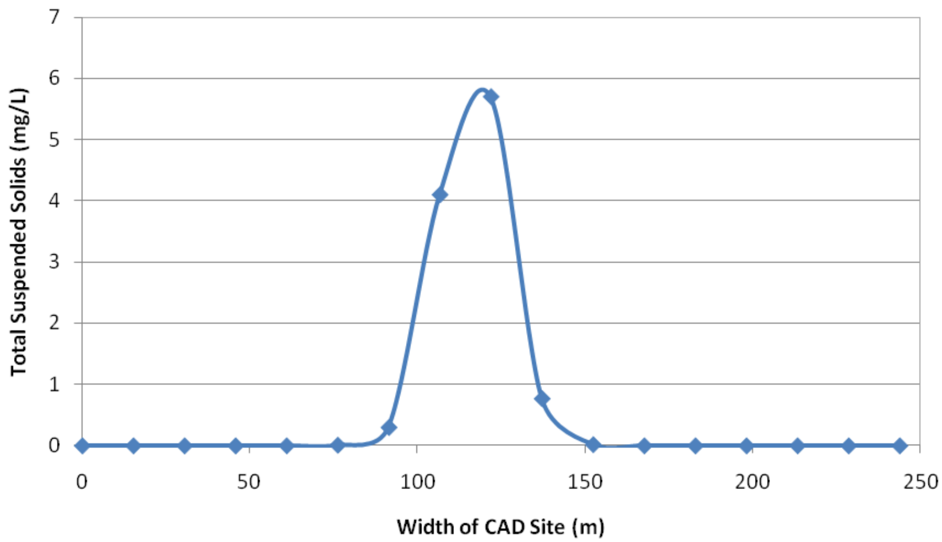
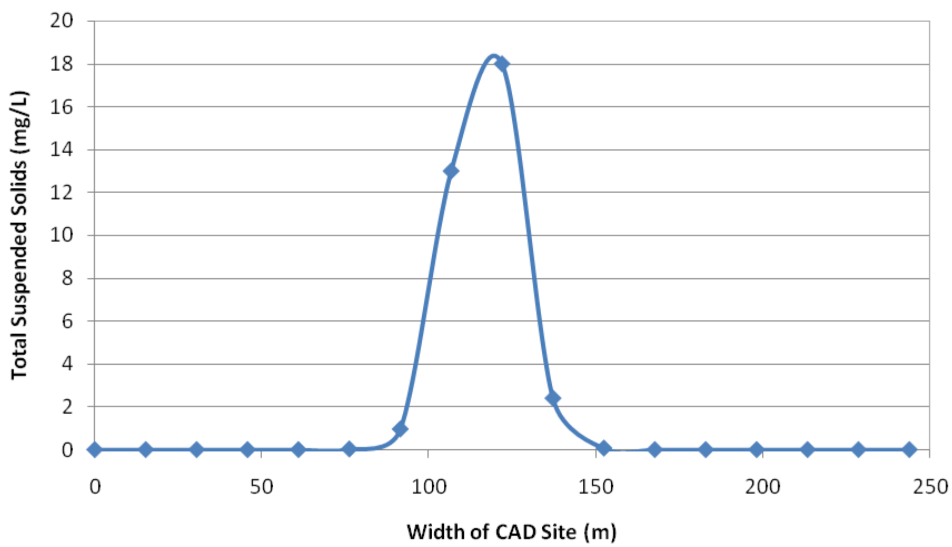
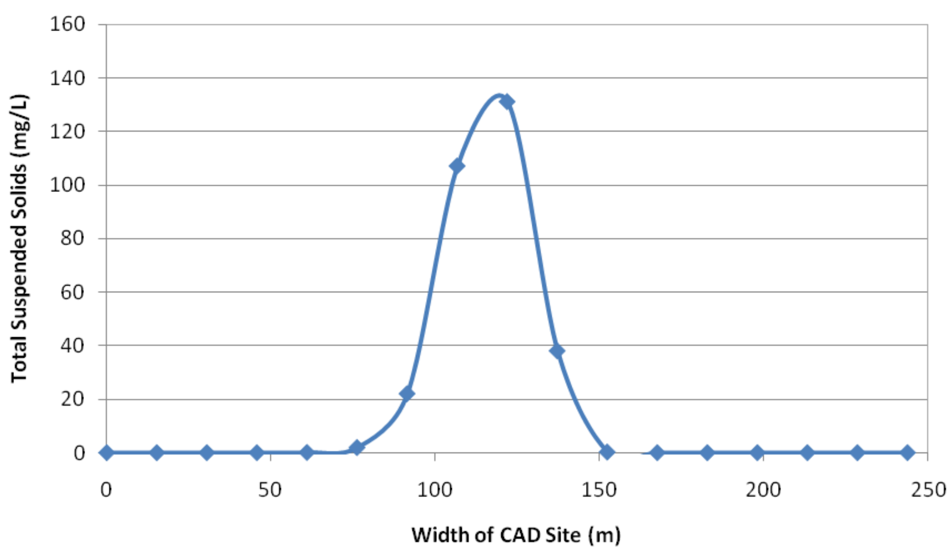
Figure 7-7
Total Deposited Material Thickness as a Function of Distance from Dump Location for USACE Operations and Maintenance Material
Port of Hueneme



A) At 1 Meter Below Water Depth



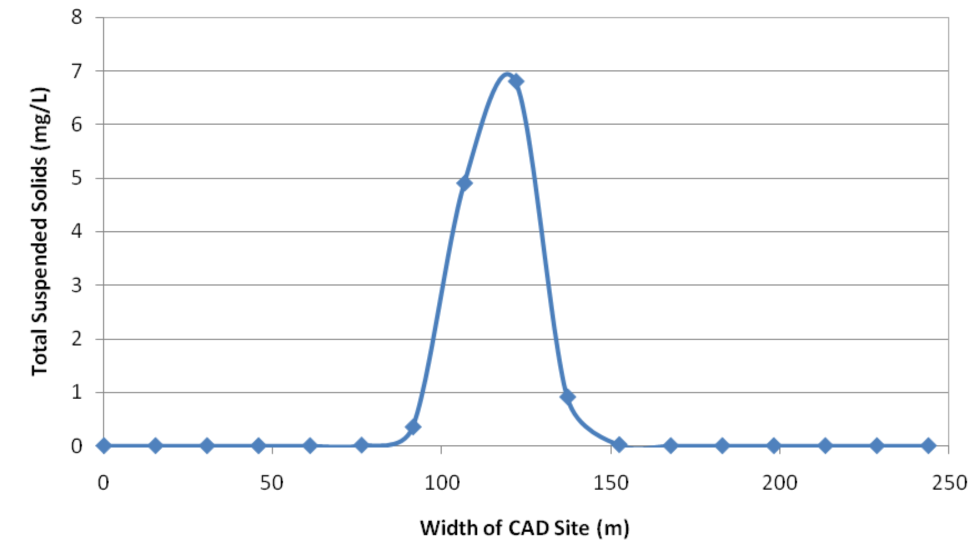
B) At 5.5 Meters Below Water Depth



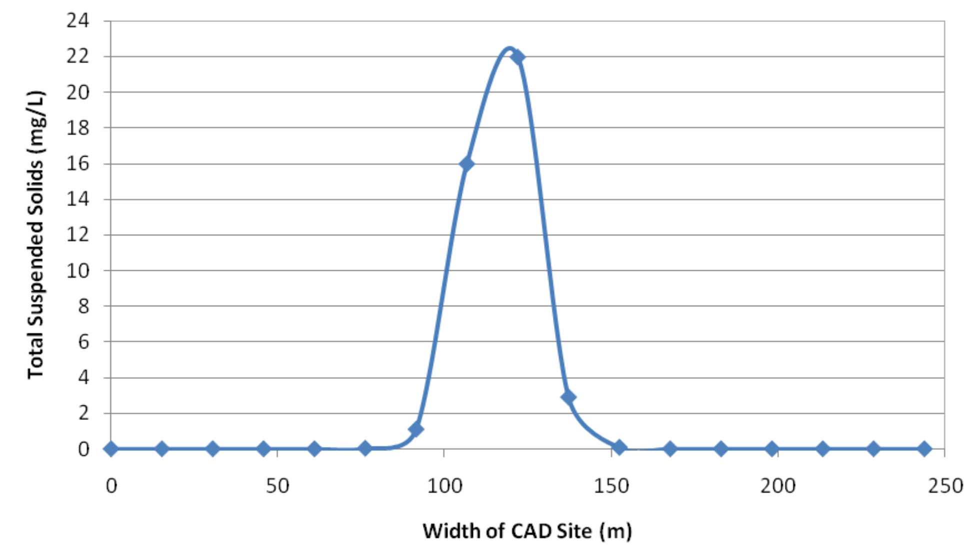
C) At 11 Meters Below Water Depth

ANCHOR ENVIRONMENTAL, L.L.C.

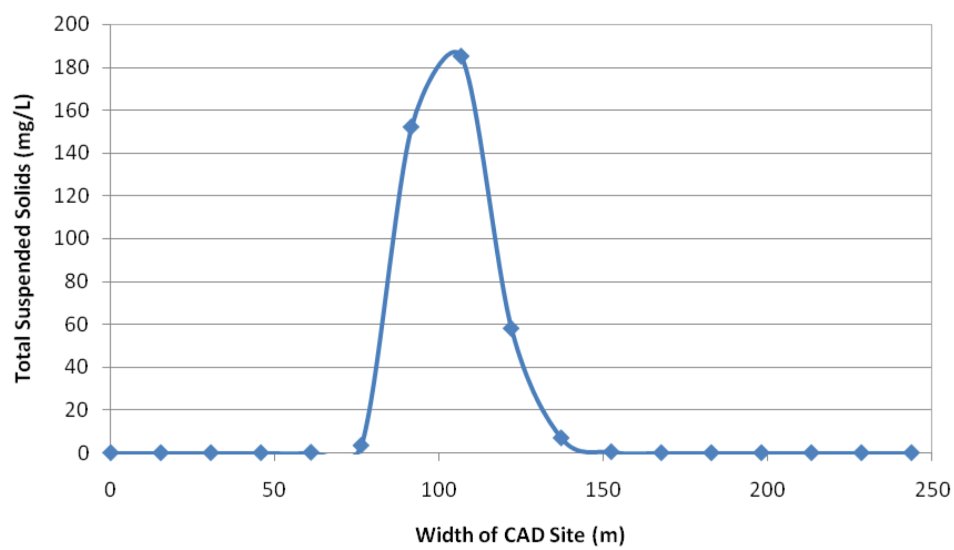
Figure 7-8
Concentrations of Suspended Solids as a Function from Dump Location for U.S. Navy Wharves and Hotspot 2
Port of Hueneme



A) At 1 Meter Below Water Depth



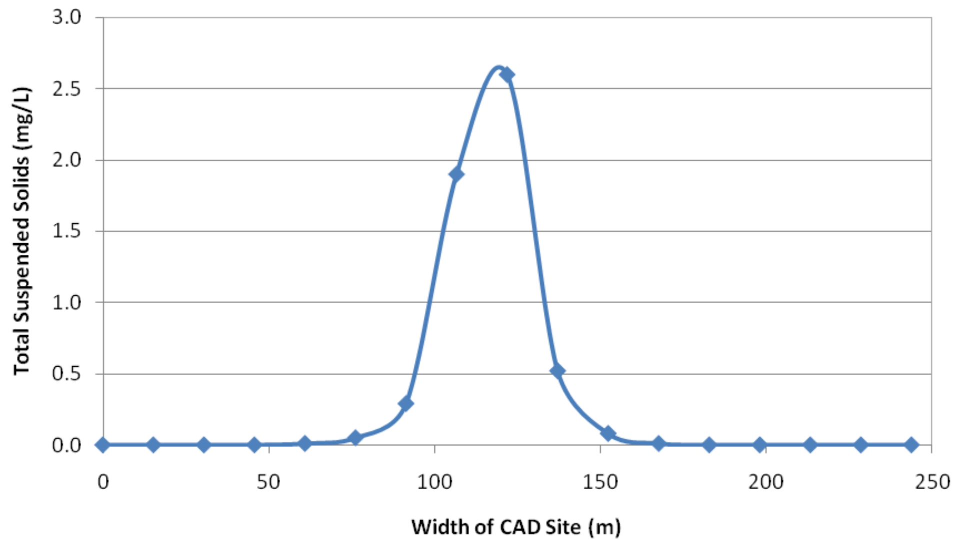
B) At 5.5 Meters Below Water Depth



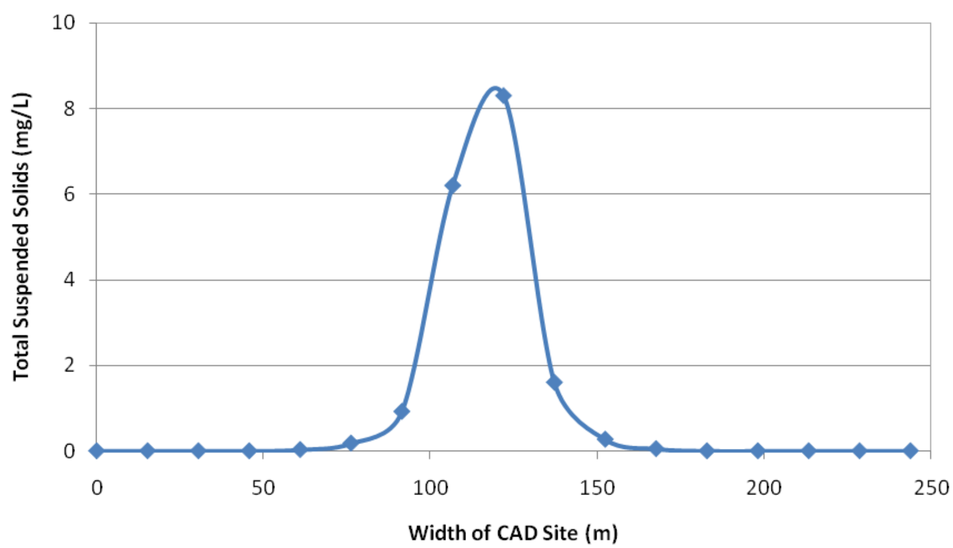
C) At 11 Meters Below Water Depth

Figure 7-9
Concentrations of Suspended Solids as a Function
from Dump Location for OHD Wharves 1 and 2 and Hotspot 3
Port of Hueneme

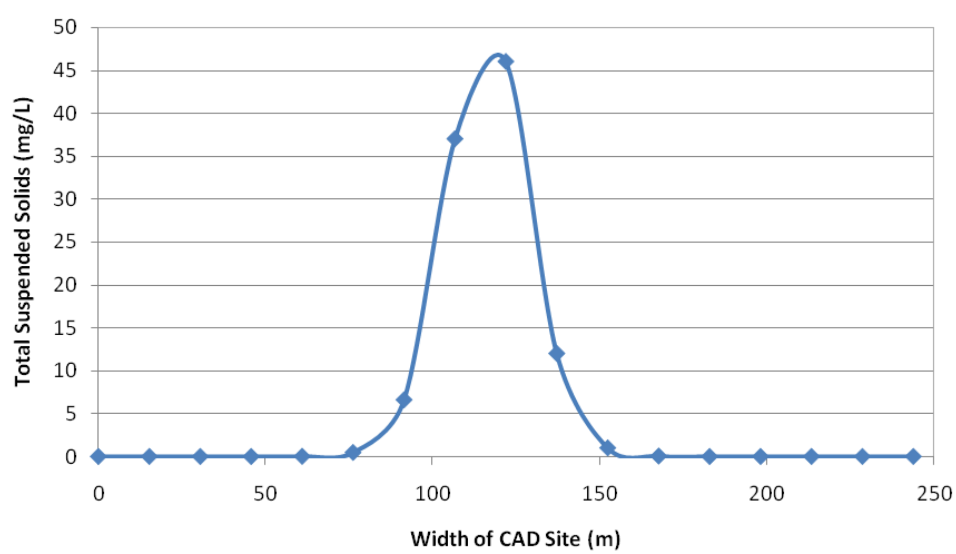
ANCHOR ENVIRONMENTAL, L.L.C.



A) At 1 Meter Below Water Depth



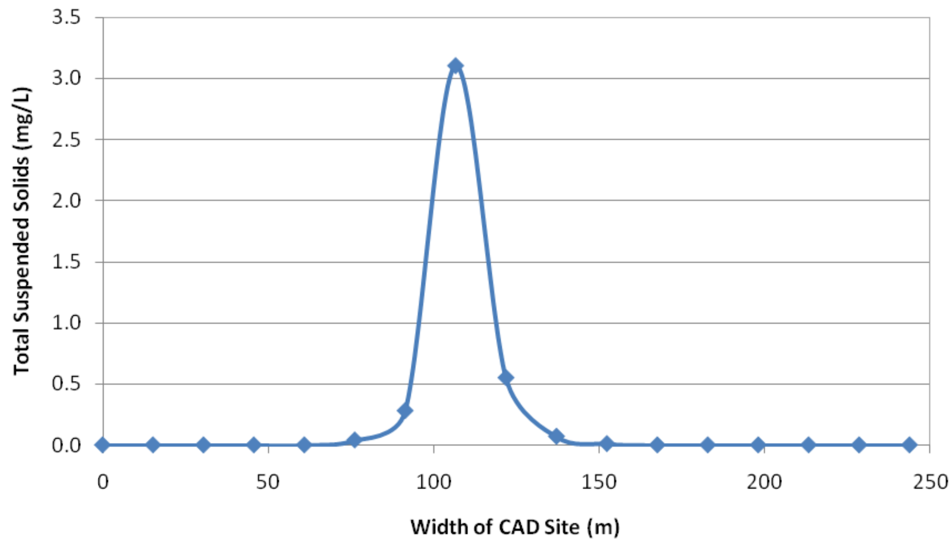
B) At 5.5 Meters Below Water Depth



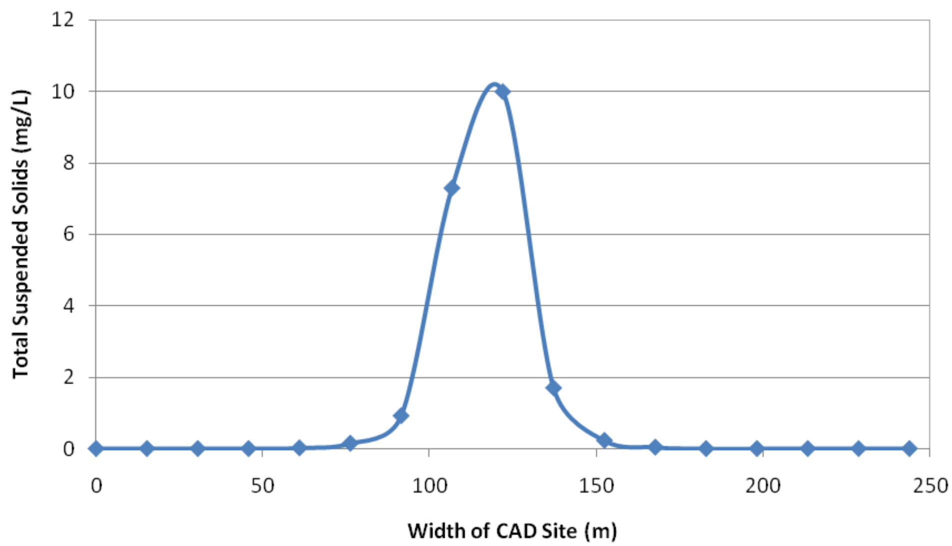
C) At 11 Meters Below Water Depth

ANCHOR ENVIRONMENTAL, L.L.C.

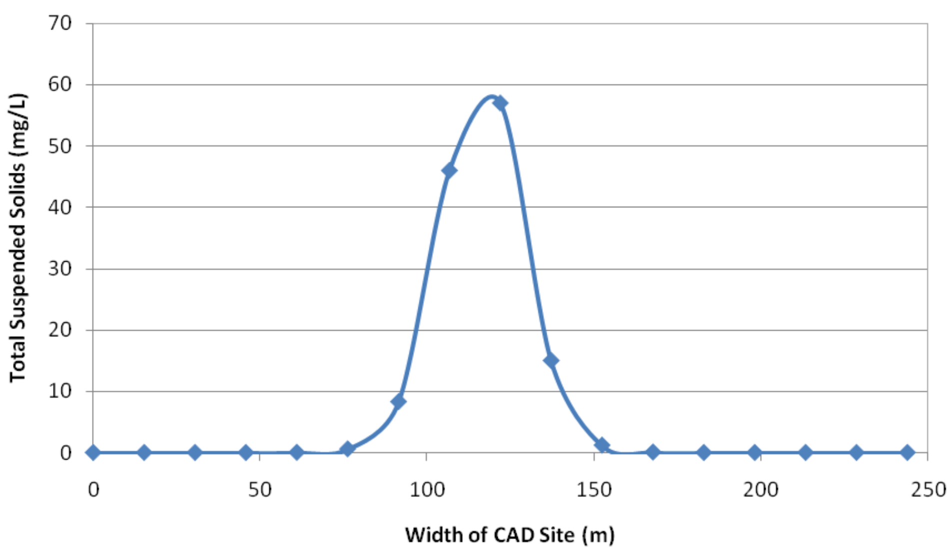
Figure 7-10
Concentrations of Suspended Solids as a Function from Dump Location Hotspot 1
Port of Hueneme



A) At 1 Meter Below Water Depth



B) At 5.5 Meters Below Water Depth



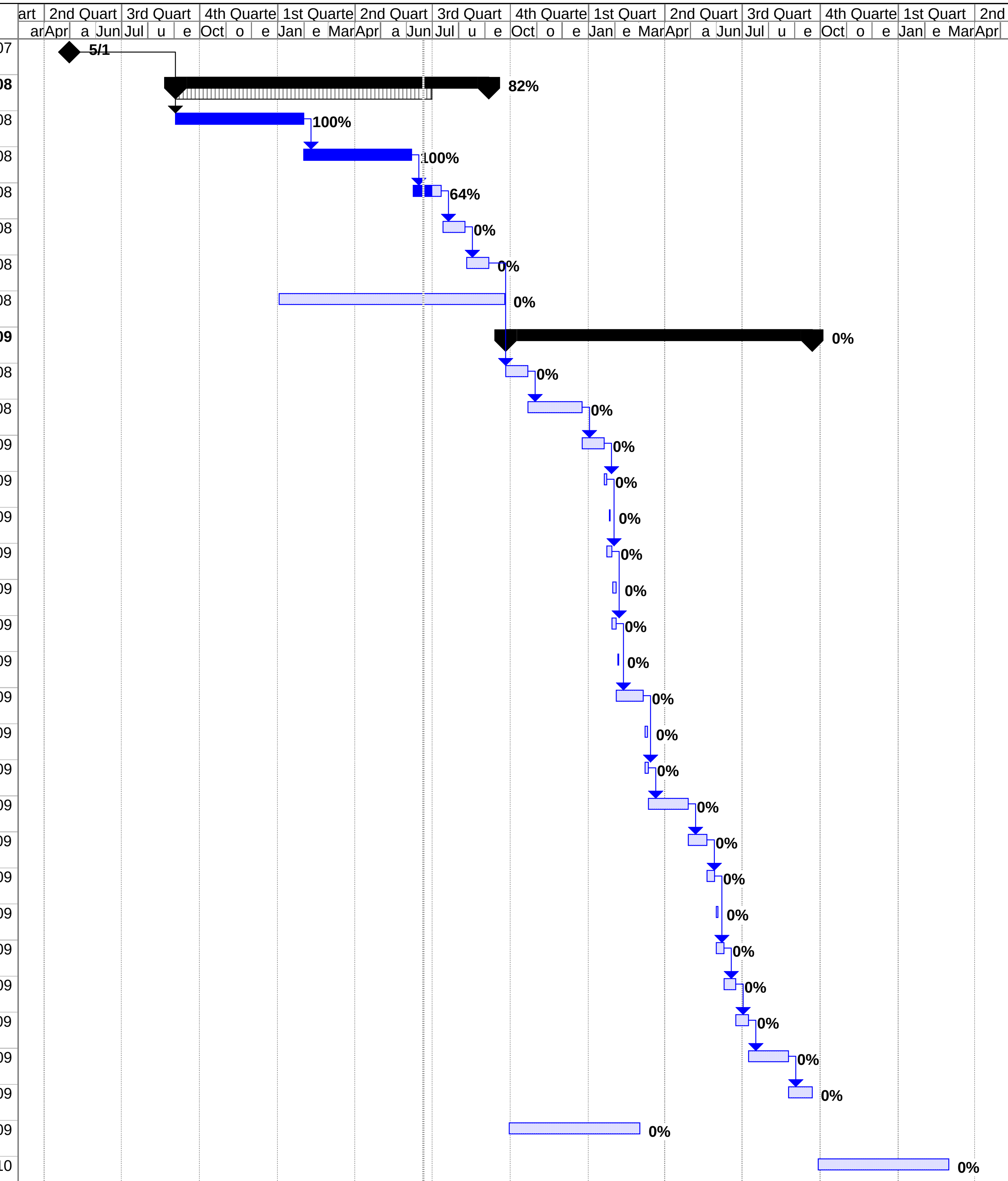
C) At 11 Meters Below Water Depth

ANCHOR ENVIRONMENTAL, L.L.C.

Figure 7-11
Concentrations of Suspended Solids as a Function from Dump Location for USACE Operations and Maintenance Material
Port of Hueneme

Figure 9-1
Conceptual Project Schedule

ID	Task Name	Duration	Start	Finish
1	**Stakeholder Decision to Move Forward**	1 day	Tue 5/1/07	Tue 5/1/07
2	**Engineering Design and Contracting**	**265 days**	**Mon 9/3/07**	**Fri 9/5/08**
3	30% Design	109 days	Mon 9/3/07	Thu 1/31/08
4	90% Design	91 days	Fri 2/1/08	Fri 6/6/08
5	100% Design	25 days	Mon 6/9/08	Fri 7/11/08
6	Contractor Bid Preparation	20 days	Mon 7/14/08	Fri 8/8/08
7	Contractor Award and Contract	20 days	Mon 8/11/08	Fri 9/5/08
8	**Agency Permitting**	190 days	Thu 1/3/08	Wed 9/24/08
9	**Construction Tasks**	**258 days**	**Fri 9/26/08**	**Mon 9/21/09**
10	Contractor Mobilization	18 days	Fri 9/26/08	Tue 10/21/08
11	Hydraulically Excavate CAD Cell (533,400 cm) and place onto Hueneme Beach	46 days	Wed 10/22/08	Wed 12/24/08
12	Mechanically Dredge USACE Hotspot 2 (35,800 cm) and place into CAD	18 days	Thu 12/25/08	Mon 1/19/09
13	Mechanically Dredge U.S. Navy Wharf 4 (5,500 cm) and place into CAD	3 days	Tue 1/20/09	Thu 1/22/09
14	Mechanically Backfill along U.S. Navy Wharf 4 (backfill material from area after Hotspot 2 was dredged)	1 day	Mon 1/26/09	Mon 1/26/09
15	Mechanically Dredge U.S. Navy Wharf 3 (9,000 cm) and place into CAD	4 days	Fri 1/23/09	Wed 1/28/09
16	Mechanically Backfill along U.S. Navy Wharf 3 (backfill material from area after Hotspot 2 was dredged)	2 days	Fri 1/30/09	Mon 2/2/09
17	Mechanically Dredge U.S. Navy Wharf 5 (5,500 cm) and place into CAD	3 days	Thu 1/29/09	Mon 2/2/09
18	Mechanically Backfill along U.S. Navy Wharf 5 (backfill material from area after Hotspot 2 was dredged)	1 day	Thu 2/5/09	Thu 2/5/09
19	Mechanically Dredge U.S. Navy North Harbor Area (48,500 cm) and place into CAD	24 days	Tue 2/3/09	Fri 3/6/09
20	Mechanically Backfill along U.S. Navy Wharf 6 (backfill material from area after Hotspot 2 was dredged)	3 days	Mon 3/9/09	Wed 3/11/09
21	Mechanically Dredge U.S. Navy Wharves A and B (7,000 cm) and place into CAD	4 days	Mon 3/9/09	Thu 3/12/09
22	Mechanically Dredge USACE Hotspot 1 (68,700 cm) and place into CAD	34 days	Fri 3/13/09	Tue 4/28/09
23	Mechanically Dredge USACE Hotspot 3 (31,800 cm) and place into CAD	16 days	Wed 4/29/09	Wed 5/20/09
24	Mechanically Dredge OHD Wharf 1 (13,200 cm) and place into CAD	7 days	Thu 5/21/09	Fri 5/29/09
25	Mechanically Backfill along OHD Wharf 1 (backfill material from area after Hotspot 2 was dredged)	2 days	Mon 6/1/09	Tue 6/2/09
26	Mechanically Dredge OHD Wharf 2 (14,400 cm) and place into CAD	7 days	Mon 6/1/09	Tue 6/9/09
27	Mechanically Dredge USACE Turning Basin (19,900 cm) and place into CAD	10 days	Wed 6/10/09	Tue 6/23/09
28	Mechanically Dredge USACE Entrance Channel (21,900 cm) and place into CAD	11 days	Wed 6/24/09	Wed 7/8/09
29	Mechanically Dredge USACE Approach Channel (67,900 cm) and place into CAD	33 days	Thu 7/9/09	Mon 8/24/09
30	Mechanically Place Armor Stone (33,900 tons) within the CAD area	20 days	Tue 8/25/09	Mon 9/21/09
31	Biological Work Windows 2008-2009	110 days	Tue 9/30/08	Mon 3/2/09
32	Biological Work Windows 2009-2010	110 days	Tue 9/29/09	Mon 3/1/10



Project: permit timeframes
Date: Fri 6/20/08

Critical		Task		Baseline		Milestone		Project Summary		Deadline	
Critical Split		Split		Baseline Split		Summary Progress		External Tasks			
Critical Progress		Task Progress		Baseline Milestone		Summary		External Milestone			

APPENDIX A

RESULTS OF SEDIMENT CORING AND GEOTECHNICAL EXPLORATIONS

ANCHOR
ENVIRONMENTAL, L.L.C.

Figure A-1
Geotechnical Sampling Locations
Port of Hueneme

U.S. NAVY 2007

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706316
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/9/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-23-1
Lab Code: K0706316-001

Sand Fraction: Weight (Grams)	4.2892
Sand Fraction: Weight Recovered (Grams)	4.2754
Sand Fraction: Percent Recovery	99.7

Weight as received (Grams)	24.5114
Percent Solids	55.5
Weight Oven-Dried (Grams)	13.6038

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	1.2139	8.92
Gravel, Fine	2.00 mm	10	0.3028	2.23
Sand, Very Coarse	0.850 mm	20	0.2369	1.74
Sand, Coarse	0.425 mm	40	0.4217	3.10
Sand, Medium	0.250 mm	60	0.3835	2.82
Sand, Fine	0.106 mm	140	1.0304	7.57
Sand, Very Fine	0.075 mm	200	0.5799	4.26
Silt			8.1800	60.1
Clay			2.1500	15.8
		Total	14.4991	107

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706316
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/9/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-23-2
Lab Code: K0706316-002

Sand Fraction: Weight (Grams)	62.0365
Sand Fraction: Weight Recovered (Grams)	61.9446
Sand Fraction: Percent Recovery	99.9

Weight as received (Grams)	83.2536
Percent Solids	75.7
Weight Oven-Dried (Grams)	63.0230

Description	**Sieve Size**	**Sieve Number**	**Dry Weight (Grams)**	**Percent of Total Weight Recovered**
Gravel, Medium	4.75 mm	4	0.0000	0.00
Gravel, Fine	2.00 mm	10	0.9826	1.56
Sand, Very Coarse	0.850 mm	20	2.5043	3.97
Sand, Coarse	0.425 mm	40	16.9462	26.9
Sand, Medium	0.250 mm	60	25.5061	40.5
Sand, Fine	0.106 mm	140	14.0377	22.3
Sand, Very Fine	0.075 mm	200	1.7338	2.75
Silt			4.7050	7.47
Clay			1.6400	2.60
		Total	68.0557	108

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706316
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/9/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-23-~~2~~-3
Lab Code: K0706316-002DUP

Sand Fraction: Weight (Grams)	63.9083
Sand Fraction: Weight Recovered (Grams)	64.9101
Sand Fraction: Percent Recovery	102

Weight as received (Grams)	84.3545
Percent Solids	75.7
Weight Oven-Dried (Grams)	63.8564

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	1.3745	2.15
Gravel, Fine	2.00 mm	10	0.9982	1.56
Sand, Very Coarse	0.850 mm	20	2.7384	4.29
Sand, Coarse	0.425 mm	40	18.5477	29.0
Sand, Medium	0.250 mm	60	23.0049	36.0
Sand, Fine	0.106 mm	140	15.3972	24.1
Sand, Very Fine	0.075 mm	200	1.6222	2.54
Silt			4.4450	6.96
Clay			1.6350	2.56
		Total	69.7631	109

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706316
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/9/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-26-1
Lab Code: K0706316-004

Sand Fraction: Weight (Grams)	8.7320
Sand Fraction: Weight Recovered (Grams)	8.6966
Sand Fraction: Percent Recovery	99.6

Weight as received (Grams)	27.3493
Percent Solids	61.2
Weight Oven-Dried (Grams)	16.7378

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	4.1787	25.0
Gravel, Fine	2.00 mm	10	0.2875	1.72
Sand, Very Coarse	0.850 mm	20	0.3060	1.83
Sand, Coarse	0.425 mm	40	0.2776	1.66
Sand, Medium	0.250 mm	60	0.4805	2.87
Sand, Fine	0.106 mm	140	1.7634	10.5
Sand, Very Fine	0.075 mm	200	1.0730	6.41
Silt			7.0200	41.9
Clay			1.9050	11.4
		Total	17.2917	103

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706316
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/9/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-26-2
Lab Code: K0706316-005

Sand Fraction: Weight (Grams)	4.2588
Sand Fraction: Weight Recovered (Grams)	4.3547
Sand Fraction: Percent Recovery	102

Weight as received (Grams)	21.7756
Percent Solids	66.2
Weight Oven-Dried (Grams)	14.4154

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.2208	1.53
Gravel, Fine	2.00 mm	10	0.0141	0.10
Sand, Very Coarse	0.850 mm	20	0.0974	0.68
Sand, Coarse	0.425 mm	40	0.2880	2.00
Sand, Medium	0.250 mm	60	0.3277	2.27
Sand, Fine	0.106 mm	140	1.6321	11.3
Sand, Very Fine	0.075 mm	200	1.5431	10.7
Silt			7.5100	52.1
Clay			2.2100	15.3
		Total	13.8432	96.0

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706316
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/9/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-29-1
Lab Code: K0706316-006

Sand Fraction: Weight (Grams)	8.4496
Sand Fraction: Weight Recovered (Grams)	8.5985
Sand Fraction: Percent Recovery	102

Weight as received (Grams)	28.9766
Percent Solids	57.0
Weight Oven-Dried (Grams)	16.5167

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	3.5042	21.2
Gravel, Fine	2.00 mm	10	0.8313	5.03
Sand, Very Coarse	0.850 mm	20	0.3075	1.86
Sand, Coarse	0.425 mm	40	0.3067	1.86
Sand, Medium	0.250 mm	60	0.5155	3.12
Sand, Fine	0.106 mm	140	1.9719	11.9
Sand, Very Fine	0.075 mm	200	1.0395	6.29
Silt			7.9650	48.2
Clay			2.0650	12.5
		Total	18.5066	112

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Geofon, Incorporated
Project: Port Hueneme IRP Site 19/4-14105
Sample Matrix: Sediment

Service Request: K0706316
Date Collected: 7/17/2007
Date Received: 7/19/2007
Date Analyzed: 8/9/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-29-2
Lab Code: K0706316-007

Sand Fraction: Weight (Grams) 5.5277
Sand Fraction: Weight Recovered (Grams) 5.4544
Sand Fraction: Percent Recovery 98.7

Weight as received (Grams)	20.5393
Percent Solids	65.2
Weight Oven-Dried (Grams)	13.3916

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0000	0.00
Gravel, Fine	2.00 mm	10	0.0248	0.19
Sand, Very Coarse	0.850 mm	20	0.1041	0.78
Sand, Coarse	0.425 mm	40	0.3390	2.53
Sand, Medium	0.250 mm	60	1.1686	8.73
Sand, Fine	0.106 mm	140	2.6548	19.8
Sand, Very Fine	0.075 mm	200	1.0570	7.89
Silt			6.2750	46.9
Clay			1.9650	14.7
		Total	13.5883	101

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706316
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/9/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-32-1
Lab Code: K0706316-009

Sand Fraction: Weight (Grams)	7.0648
Sand Fraction: Weight Recovered (Grams)	7.0322
Sand Fraction: Percent Recovery	99.5

Weight as received (Grams)	21.2016
Percent Solids	68.2
Weight Oven-Dried (Grams)	14.4595

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0904	0.63
Gravel, Fine	2.00 mm	10	0.0909	0.63
Sand, Very Coarse	0.850 mm	20	0.0627	0.43
Sand, Coarse	0.425 mm	40	0.3620	2.50
Sand, Medium	0.250 mm	60	1.0642	7.36
Sand, Fine	0.106 mm	140	3.5256	24.4
Sand, Very Fine	0.075 mm	200	1.6270	11.3
Silt			5.9300	41.0
Clay			1.9800	13.7
		Total	14.7328	102

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706316
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/9/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-32-2
Lab Code: K0706316-010

Sand Fraction: Weight (Grams)	5.6657
Sand Fraction: Weight Recovered (Grams)	5.3016
Sand Fraction: Percent Recovery	93.6

Weight as received (Grams)	21.6155
Percent Solids	64.3
Weight Oven-Dried (Grams)	13.8988

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0723	0.52
Gravel, Fine	2.00 mm	10	0.1505	1.08
Sand, Very Coarse	0.850 mm	20	0.1961	1.41
Sand, Coarse	0.425 mm	40	0.3962	2.85
Sand, Medium	0.250 mm	60	0.7114	5.12
Sand, Fine	0.106 mm	140	2.4363	17.5
Sand, Very Fine	0.075 mm	200	1.1960	8.61
Silt			6.8750	49.5
Clay			2.4000	17.3
		Total	14.4338	104

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706316
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/9/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-34-1
Lab Code: K0706316-011

Sand Fraction: Weight (Grams)	18.9590
Sand Fraction: Weight Recovered (Grams)	19.0886
Sand Fraction: Percent Recovery	101

Weight as received (Grams)	34.1139
Percent Solids	70.8
Weight Oven-Dried (Grams)	24.1526

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.3048	1.26
Gravel, Fine	2.00 mm	10	0.1211	0.50
Sand, Very Coarse	0.850 mm	20	0.2114	0.88
Sand, Coarse	0.425 mm	40	1.7968	7.44
Sand, Medium	0.250 mm	60	4.8531	20.1
Sand, Fine	0.106 mm	140	9.2356	38.2
Sand, Very Fine	0.075 mm	200	2.4189	10.0
Silt			5.3700	22.2
Clay			1.8750	7.76
		Total	26.1867	108

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706316
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/9/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-34-2
Lab Code: K0706316-012

Sand Fraction: Weight (Grams)	54.4739
Sand Fraction: Weight Recovered (Grams)	54.8993
Sand Fraction: Percent Recovery	101

Weight as received (Grams)	80.6562
Percent Solids	81.1
Weight Oven-Dried (Grams)	65.4122

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.1969	0.30
Gravel, Fine	2.00 mm	10	0.4022	0.61
Sand, Very Coarse	0.850 mm	20	0.6899	1.05
Sand, Coarse	0.425 mm	40	7.9514	12.2
Sand, Medium	0.250 mm	60	16.8450	25.8
Sand, Fine	0.106 mm	140	23.8671	36.5
Sand, Very Fine	0.075 mm	200	4.4955	6.87
Silt			8.7500	13.4
Clay			1.7550	2.68
		Total	64.9530	99.3

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706316
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/9/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-19-1
Lab Code: K0706316-013

Sand Fraction: Weight (Grams)	7.8801
Sand Fraction: Weight Recovered (Grams)	7.9130
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	22.0708
Percent Solids	62.0
Weight Oven-Dried (Grams)	13.6839

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.3787	2.77
Gravel, Fine	2.00 mm	10	0.0161	0.12
Sand, Very Coarse	0.850 mm	20	0.0756	0.55
Sand, Coarse	0.425 mm	40	0.5437	3.97
Sand, Medium	0.250 mm	60	1.9617	14.3
Sand, Fine	0.106 mm	140	4.2467	31.0
Sand, Very Fine	0.075 mm	200	0.6477	4.73
Silt			4.9950	36.5
Clay			2.0150	14.7
		Total	14.8802	109

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706316
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/9/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-19-2
Lab Code: K0706316-014

Sand Fraction: Weight (Grams)	4.5743
Sand Fraction: Weight Recovered (Grams)	4.6914
Sand Fraction: Percent Recovery	103

Weight as received (Grams)	18.1245
Percent Solids	58.6
Weight Oven-Dried (Grams)	10.6210

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0000	0.00
Gravel, Fine	2.00 mm	10	0.0151	0.14
Sand, Very Coarse	0.850 mm	20	0.0529	0.50
Sand, Coarse	0.425 mm	40	0.2421	2.28
Sand, Medium	0.250 mm	60	0.7529	7.09
Sand, Fine	0.106 mm	140	2.4104	22.7
Sand, Very Fine	0.075 mm	200	1.0905	10.3
Silt			5.0700	47.7
Clay			1.9500	18.4
		Total	11.5839	109

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706316
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/9/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-14-1
Lab Code: K0706316-015

Sand Fraction: Weight (Grams)	1.7699
Sand Fraction: Weight Recovered (Grams)	1.7456
Sand Fraction: Percent Recovery	98.6

Weight as received (Grams)	20.4092
Percent Solids	54.0
Weight Oven-Dried (Grams)	11.0210

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0936	0.85
Gravel, Fine	2.00 mm	10	0.1473	1.34
Sand, Very Coarse	0.850 mm	20	0.0701	0.64
Sand, Coarse	0.425 mm	40	0.0694	0.63
Sand, Medium	0.250 mm	60	0.1232	1.12
Sand, Fine	0.106 mm	140	0.5289	4.80
Sand, Very Fine	0.075 mm	200	0.5071	4.60
Silt			7.4250	67.4
Clay			2.8450	25.8
		Total	11.8096	107

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706316
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/9/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-14-2
Lab Code: K0706316-016

Sand Fraction: Weight (Grams)	7.8730
Sand Fraction: Weight Recovered (Grams)	8.2404
Sand Fraction: Percent Recovery	105

Weight as received (Grams)	25.5249
Percent Solids	71.2
Weight Oven-Dried (Grams)	18.1737

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.8273	4.55
Gravel, Fine	2.00 mm	10	0.6368	3.50
Sand, Very Coarse	0.850 mm	20	0.6848	3.77
Sand, Coarse	0.425 mm	40	1.5286	8.41
Sand, Medium	0.250 mm	60	1.2002	6.60
Sand, Fine	0.106 mm	140	1.6837	9.26
Sand, Very Fine	0.075 mm	200	1.2937	7.12
Silt			8.7900	48.4
Clay			2.6250	14.4
		Total	19.2701	106

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706316
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/9/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-17-1
Lab Code: K0706316-019

Sand Fraction: Weight (Grams)	5.3297
Sand Fraction: Weight Recovered (Grams)	5.5817
Sand Fraction: Percent Recovery	105

Weight as received (Grams)	20.1680
Percent Solids	67.5
Weight Oven-Dried (Grams)	13.6134

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0000	0.00
Gravel, Fine	2.00 mm	10	0.0133	0.10
Sand, Very Coarse	0.850 mm	20	0.0299	0.22
Sand, Coarse	0.425 mm	40	0.1363	1.00
Sand, Medium	0.250 mm	60	0.4656	3.42
Sand, Fine	0.106 mm	140	2.8189	20.7
Sand, Very Fine	0.075 mm	200	1.8578	13.6
Silt			6.8900	50.6
Clay			1.7200	12.6
		Total	13.9318	102

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706316
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/9/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-17-2
Lab Code: K0706316-020

Sand Fraction: Weight (Grams)	3.0141
Sand Fraction: Weight Recovered (Grams)	3.1010
Sand Fraction: Percent Recovery	103

Weight as received (Grams)	20.9023
Percent Solids	52.6
Weight Oven-Dried (Grams)	10.9946

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.1565	1.42
Gravel, Fine	2.00 mm	10	0.2237	2.03
Sand, Very Coarse	0.850 mm	20	0.1866	1.70
Sand, Coarse	0.425 mm	40	0.1824	1.66
Sand, Medium	0.250 mm	60	0.2651	2.41
Sand, Fine	0.106 mm	140	0.9043	8.22
Sand, Very Fine	0.075 mm	200	1.0456	9.51
Silt			7.0200	63.8
Clay			2.1600	19.6
		Total	12.1442	110

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706258
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/16/2007
Sample Matrix:	Sediment	**Date Received:**	7/18/2007
		Date Analyzed:	8/7/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-6-2
Lab Code: K0706258-002

Sand Fraction: Weight (Grams)	62.5083
Sand Fraction: Weight Recovered (Grams)	62.4738
Sand Fraction: Percent Recovery	99.9

Weight as received (Grams)	82.1368
Percent Solids	82.0
Weight Oven-Dried (Grams)	67.3522

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	3.4716	5.15
Gravel, Fine	2.00 mm	10	0.8386	1.25
Sand, Very Coarse	0.850 mm	20	2.5439	3.78
Sand, Coarse	0.425 mm	40	18.3041	27.2
Sand, Medium	0.250 mm	60	22.9496	34.1
Sand, Fine	0.106 mm	140	13.0551	19.4
Sand, Very Fine	0.075 mm	200	1.1044	1.64
Silt			3.7900	5.63
Clay			2.0100	2.98
		Total	68.0673	101

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Geofon, Incorporated
Project: Port Hueneme IRP Site 19/4-14105
Sample Matrix: Sediment

Service Request: K0706258
Date Collected: 7/16/2007
Date Received: 7/18/2007
Date Analyzed: 8/7/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-20-1
Lab Code: K0706258-003

Sand Fraction: Weight (Grams)	24.5410
Sand Fraction: Weight Recovered (Grams)	24.5509
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	48.7909
Percent Solids	71.9
Weight Oven-Dried (Grams)	35.0807

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	5.6268	16.04
Gravel, Fine	2.00 mm	10	0.2782	0.79
Sand, Very Coarse	0.850 mm	20	0.4281	1.22
Sand, Coarse	0.425 mm	40	2.0828	5.94
Sand, Medium	0.250 mm	60	6.1108	17.4
Sand, Fine	0.106 mm	140	8.0228	22.9
Sand, Very Fine	0.075 mm	200	1.7212	4.91
Silt			8.2700	23.6
Clay			3.4400	9.81
		Total	35.9807	103

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Geofon, Incorporated
Project: Port Hueneme IRP Site 19/4-14105
Sample Matrix: Sediment

Service Request: K0706258
Date Collected: 7/16/2007
Date Received: 7/18/2007
Date Analyzed: 8/7/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-20-2
Lab Code: K0706258-004

Sand Fraction: Weight (Grams)	61.1141
Sand Fraction: Weight Recovered (Grams)	61.1467
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	82.0922
Percent Solids	79.3
Weight Oven-Dried (Grams)	65.0991

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0000	0.00
Gravel, Fine	2.00 mm	10	0.5252	0.81
Sand, Very Coarse	0.850 mm	20	3.0479	4.68
Sand, Coarse	0.425 mm	40	10.0319	15.4
Sand, Medium	0.250 mm	60	22.3733	34.4
Sand, Fine	0.106 mm	140	22.3724	34.4
Sand, Very Fine	0.075 mm	200	2.5067	3.85
Silt			3.9500	6.07
Clay			1.2600	1.94
		Total	66.0674	101

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706258
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/16/2007
Sample Matrix:	Sediment	**Date Received:**	7/18/2007
		Date Analyzed:	8/7/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-21-1
Lab Code: K0706258-006

Sand Fraction: Weight (Grams)	6.8263
Sand Fraction: Weight Recovered (Grams)	6.8643
Sand Fraction: Percent Recovery	101

Weight as received (Grams)	24.4527
Percent Solids	64.2
Weight Oven-Dried (Grams)	15.6986

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.2630	1.68
Gravel, Fine	2.00 mm	10	0.2634	1.68
Sand, Very Coarse	0.850 mm	20	0.2399	1.53
Sand, Coarse	0.425 mm	40	0.5647	3.60
Sand, Medium	0.250 mm	60	1.3698	8.73
Sand, Fine	0.106 mm	140	2.9223	18.6
Sand, Very Fine	0.075 mm	200	1.0199	6.50
Silt			6.9300	44.1
Clay			2.6050	16.6
		Total	16.1780	103

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706258
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/16/2007
Sample Matrix:	Sediment	**Date Received:**	7/18/2007
		Date Analyzed:	8/7/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-21-2
Lab Code: K0706258-007

Sand Fraction: Weight (Grams)	17.1647
Sand Fraction: Weight Recovered (Grams)	17.1501
Sand Fraction: Percent Recovery	99.9

Weight as received (Grams)	40.3577
Percent Solids	75.7
Weight Oven-Dried (Grams)	30.5508

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.5519	1.81
Gravel, Fine	2.00 mm	10	0.6904	2.26
Sand, Very Coarse	0.850 mm	20	2.5425	8.32
Sand, Coarse	0.425 mm	40	5.9868	19.6
Sand, Medium	0.250 mm	60	3.1063	10.2
Sand, Fine	0.106 mm	140	3.0030	9.83
Sand, Very Fine	0.075 mm	200	1.0822	3.54
Silt			8.3100	27.2
Clay			4.7150	15.4
		Total	29.9881	98.2

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706258
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/16/2007
Sample Matrix:	Sediment	**Date Received:**	7/18/2007
		Date Analyzed:	8/7/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-22-1
Lab Code: K0706258-008

Sand Fraction: Weight (Grams)	57.3654
Sand Fraction: Weight Recovered (Grams)	57.3643
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	83.8089
Percent Solids	78.3
Weight Oven-Dried (Grams)	65.6224

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	12.7152	19.4
Gravel, Fine	2.00 mm	10	2.8868	4.40
Sand, Very Coarse	0.850 mm	20	7.1417	10.9
Sand, Coarse	0.425 mm	40	16.0083	24.4
Sand, Medium	0.250 mm	60	11.6230	17.7
Sand, Fine	0.106 mm	140	5.7379	8.74
Sand, Very Fine	0.075 mm	200	1.1140	1.70
Silt			7.4850	11.4
Clay			3.6000	5.49
		Total	68.3119	104

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706258
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/16/2007
Sample Matrix:	Sediment	**Date Received:**	7/18/2007
		Date Analyzed:	8/7/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-22-2
Lab Code: K0706258-009

Sand Fraction: Weight (Grams)	58.4826
Sand Fraction: Weight Recovered (Grams)	58.4935
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	89.5222
Percent Solids	77.8
Weight Oven-Dried (Grams)	69.6483

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	8.0017	11.5
Gravel, Fine	2.00 mm	10	4.1342	5.94
Sand, Very Coarse	0.850 mm	20	10.2894	14.8
Sand, Coarse	0.425 mm	40	18.9174	27.2
Sand, Medium	0.250 mm	60	9.5120	13.7
Sand, Fine	0.106 mm	140	6.5648	9.43
Sand, Very Fine	0.075 mm	200	0.9588	1.38
Silt			8.0850	11.6
Clay			6.4350	9.24
		Total	72.8983	105

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706258
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/7/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-9-1
Lab Code: K0706258-012

Sand Fraction: Weight (Grams)	10.5609
Sand Fraction: Weight Recovered (Grams)	10.6079
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	40.582
Percent Solids	62.5
Weight Oven-Dried (Grams)	25.3638

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0881	0.35
Gravel, Fine	2.00 mm	10	0.0509	0.20
Sand, Very Coarse	0.850 mm	20	0.2805	1.11
Sand, Coarse	0.425 mm	40	1.1376	4.49
Sand, Medium	0.250 mm	60	2.4046	9.48
Sand, Fine	0.106 mm	140	5.0197	19.8
Sand, Very Fine	0.075 mm	200	1.3531	5.33
Silt			10.9400	43.1
Clay			4.7550	18.7
		Total	26.0295	103

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706258
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/7/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-9-2
Lab Code: K0706258-013

Sand Fraction: Weight (Grams)	70.3704
Sand Fraction: Weight Recovered (Grams)	70.4148
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	96.5644
Percent Solids	81.6
Weight Oven-Dried (Grams)	78.7966

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0893	0.11
Gravel, Fine	2.00 mm	10	0.6394	0.81
Sand, Very Coarse	0.850 mm	20	18.2347	23.1
Sand, Coarse	0.425 mm	40	33.3664	42.3
Sand, Medium	0.250 mm	60	7.7612	9.85
Sand, Fine	0.106 mm	140	9.2516	11.7
Sand, Very Fine	0.075 mm	200	1.0106	1.28
Silt			7.5800	9.62
Clay			3.3350	4.23
		Total	81.2682	103

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Geofon, Incorporated
Project: Port Hueneme IRP Site 19/4-14105
Sample Matrix: Sediment

Service Request: K0706258
Date Collected: 7/17/2007
Date Received: 7/19/2007
Date Analyzed: 8/7/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-4-1
Lab Code: K0706258-015

Sand Fraction: Weight (Grams)	78.6668
Sand Fraction: Weight Recovered (Grams)	78.3668
Sand Fraction: Percent Recovery	99.6

Weight as received (Grams)	100.5373
Percent Solids	79.6
Weight Oven-Dried (Grams)	80.0277

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	8.5228	10.6
Gravel, Fine	2.00 mm	10	2.2772	2.85
Sand, Very Coarse	0.850 mm	20	4.9532	6.19
Sand, Coarse	0.425 mm	40	17.3388	21.7
Sand, Medium	0.250 mm	60	23.4413	29.3
Sand, Fine	0.106 mm	140	19.8246	24.8
Sand, Very Fine	0.075 mm	200	1.7939	2.24
Silt			4.4500	5.56
Clay			1.5650	1.96
		Total	84.1668	105

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Geofon, Incorporated
Project: Port Hueneme IRP Site 19/4-14105
Sample Matrix: Sediment

Service Request: K0706258
Date Collected: 7/17/2007
Date Received: 7/19/2007
Date Analyzed: 8/7/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-4-2
Lab Code: K0706258-016

Sand Fraction: Weight (Grams)	84.5363
Sand Fraction: Weight Recovered (Grams)	84.4539
Sand Fraction: Percent Recovery	99.9

Weight as received (Grams)	103.1877
Percent Solids	82.9
Weight Oven-Dried (Grams)	85.5426

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	9.5331	11.1
Gravel, Fine	2.00 mm	10	4.1235	4.82
Sand, Very Coarse	0.850 mm	20	6.8083	7.96
Sand, Coarse	0.425 mm	40	15.2954	17.9
Sand, Medium	0.250 mm	60	26.3949	30.9
Sand, Fine	0.106 mm	140	20.5594	24.0
Sand, Very Fine	0.075 mm	200	1.5371	1.80
Silt			2.0300	2.37
Clay			0.9350	1.09
		Total	87.2167	102

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706258
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/7/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-3-1
Lab Code: K0706258-017

Sand Fraction: Weight (Grams)	75.9089
Sand Fraction: Weight Recovered (Grams)	75.6766
Sand Fraction: Percent Recovery	99.7

Weight as received (Grams)	95.4154
Percent Solids	80.8
Weight Oven-Dried (Grams)	77.0956

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	2.0241	2.63
Gravel, Fine	2.00 mm	10	2.7273	3.54
Sand, Very Coarse	0.850 mm	20	7.4201	9.62
Sand, Coarse	0.425 mm	40	23.9476	31.1
Sand, Medium	0.250 mm	60	21.8805	28.4
Sand, Fine	0.106 mm	140	15.6689	20.3
Sand, Very Fine	0.075 mm	200	1.8363	2.38
Silt			2.7850	3.61
Clay			1.6000	2.08
		Total	79.8898	104

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706258
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/7/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-3-1
Lab Code: K0706258-017DUP

Sand Fraction: Weight (Grams)	78.7421
Sand Fraction: Weight Recovered (Grams)	78.5949
Sand Fraction: Percent Recovery	99.8

Weight as received (Grams)	98.7837
Percent Solids	80.8
Weight Oven-Dried (Grams)	79.8172

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.2786	0.35
Gravel, Fine	2.00 mm	10	2.7527	3.45
Sand, Very Coarse	0.850 mm	20	8.5308	10.7
Sand, Coarse	0.425 mm	40	22.9408	28.7
Sand, Medium	0.250 mm	60	25.4741	31.9
Sand, Fine	0.106 mm	140	16.6145	20.8
Sand, Very Fine	0.075 mm	200	1.7426	2.18
Silt			2.5300	3.17
Clay			1.4550	1.82
		Total	82.3191	103

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706258
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/7/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-3-2
Lab Code: K0706258-018

Sand Fraction: Weight (Grams)	86.9958
Sand Fraction: Weight Recovered (Grams)	86.6338
Sand Fraction: Percent Recovery	99.6

Weight as received (Grams)	106.21
Percent Solids	80.7
Weight Oven-Dried (Grams)	85.7115

Description	**Sieve Size**	**Sieve Number**	**Dry Weight (Grams)**	**Percent of Total Weight Recovered**
Gravel, Medium	4.75 mm	4	5.0572	5.90
Gravel, Fine	2.00 mm	10	3.4236	3.99
Sand, Very Coarse	0.850 mm	20	8.0936	9.44
Sand, Coarse	0.425 mm	40	25.5305	29.8
Sand, Medium	0.250 mm	60	24.7056	28.8
Sand, Fine	0.106 mm	140	17.7606	20.7
Sand, Very Fine	0.075 mm	200	1.9074	2.23
Silt			1.9700	2.30
Clay			0.8600	1.00
		Total	89.3085	104

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706319
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/10/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-25-1
Lab Code: K0706319-001

Sand Fraction: Weight (Grams)	6.8538
Sand Fraction: Weight Recovered (Grams)	6.8057
Sand Fraction: Percent Recovery	99.3

Weight as received (Grams)	24.0265
Percent Solids	60.0
Weight Oven-Dried (Grams)	14.4159

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.7583	5.26
Gravel, Fine	2.00 mm	10	0.3342	2.32
Sand, Very Coarse	0.850 mm	20	0.3178	2.20
Sand, Coarse	0.425 mm	40	0.4650	3.23
Sand, Medium	0.250 mm	60	0.7382	5.12
Sand, Fine	0.106 mm	140	2.6973	18.7
Sand, Very Fine	0.075 mm	200	1.2897	8.95
Silt			6.3050	43.7
Clay			2.7400	19.0
		Total	15.6455	109

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706319
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/10/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-25-2
Lab Code: K0706319-002

Sand Fraction: Weight (Grams)	24.5590
Sand Fraction: Weight Recovered (Grams)	25.4671
Sand Fraction: Percent Recovery	104

Weight as received (Grams)	47.7366
Percent Solids	68.7
Weight Oven-Dried (Grams)	32.7950

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	1.2416	3.79
Gravel, Fine	2.00 mm	10	1.0501	3.20
Sand, Very Coarse	0.850 mm	20	2.2785	6.95
Sand, Coarse	0.425 mm	40	7.6661	23.4
Sand, Medium	0.250 mm	60	5.3415	16.3
Sand, Fine	0.106 mm	140	5.4633	16.7
Sand, Very Fine	0.075 mm	200	1.9591	5.97
Silt			8.3350	25.4
Clay			2.4600	7.50
		Total	35.7952	109

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706319
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/10/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-28-1
Lab Code: K0706319-003

Sand Fraction: Weight (Grams)	15.5508
Sand Fraction: Weight Recovered (Grams)	15.4284
Sand Fraction: Percent Recovery	99.2

Weight as received (Grams)	33.0063
Percent Solids	66.4
Weight Oven-Dried (Grams)	21.9162

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	1.1233	5.13
Gravel, Fine	2.00 mm	10	0.9703	4.43
Sand, Very Coarse	0.850 mm	20	0.7384	3.37
Sand, Coarse	0.425 mm	40	1.1803	5.39
Sand, Medium	0.250 mm	60	2.4769	11.3
Sand, Fine	0.106 mm	140	6.6532	30.4
Sand, Very Fine	0.075 mm	200	1.9149	8.74
Silt			5.9750	27.3
Clay			2.4950	11.4
		Total	23.5273	107

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706319
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/10/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-28-2
Lab Code: K0706319-004

Sand Fraction: Weight (Grams)	51.1595
Sand Fraction: Weight Recovered (Grams)	49.6661
Sand Fraction: Percent Recovery	97.1

Weight as received (Grams)	84.7150
Percent Solids	73.0
Weight Oven-Dried (Grams)	61.8420

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.1716	0.28
Gravel, Fine	2.00 mm	10	1.0149	1.64
Sand, Very Coarse	0.850 mm	20	1.4046	2.27
Sand, Coarse	0.425 mm	40	9.0780	14.7
Sand, Medium	0.250 mm	60	16.1665	26.1
Sand, Fine	0.106 mm	140	17.1622	27.8
Sand, Very Fine	0.075 mm	200	3.9740	6.43
Silt			13.9800	22.6
Clay			3.2950	5.33
		Total	66.2468	107

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706319
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/10/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-31-1
Lab Code: K0706319-006

Sand Fraction: Weight (Grams)	14.6656
Sand Fraction: Weight Recovered (Grams)	14.0430
Sand Fraction: Percent Recovery	95.8

Weight as received (Grams)	33.4897
Percent Solids	69.2
Weight Oven-Dried (Grams)	23.1749

Description	**Sieve Size**	**Sieve Number**	**Dry Weight (Grams)**	**Percent of Total Weight Recovered**
Gravel, Medium	4.75 mm	4	0.4419	1.91
Gravel, Fine	2.00 mm	10	0.2612	1.13
Sand, Very Coarse	0.850 mm	20	0.3466	1.50
Sand, Coarse	0.425 mm	40	0.7889	3.40
Sand, Medium	0.250 mm	60	2.3538	10.2
Sand, Fine	0.106 mm	140	6.9728	30.1
Sand, Very Fine	0.075 mm	200	2.4659	10.6
Silt			7.5800	32.7
Clay			3.0900	13.3
		Total	24.3011	105

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706319
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/10/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-31-2
Lab Code: K0706319-007

Sand Fraction: Weight (Grams)	22.8162
Sand Fraction: Weight Recovered (Grams)	22.6891
Sand Fraction: Percent Recovery	99.4

Weight as received (Grams)	54.4392
Percent Solids	72.3
Weight Oven-Dried (Grams)	39.3595

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	1.6340	4.15
Gravel, Fine	2.00 mm	10	0.5369	1.36
Sand, Very Coarse	0.850 mm	20	0.7725	1.96
Sand, Coarse	0.425 mm	40	1.6373	4.16
Sand, Medium	0.250 mm	60	2.9229	7.43
Sand, Fine	0.106 mm	140	8.2124	20.9
Sand, Very Fine	0.075 mm	200	4.7462	12.1
Silt			14.9600	38.0
Clay			4.7500	12.1
		Total	40.1722	102

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706319
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/10/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-33-1
Lab Code: K0706319-008

Sand Fraction: Weight (Grams)	17.2554
Sand Fraction: Weight Recovered (Grams)	17.4817
Sand Fraction: Percent Recovery	101

Weight as received (Grams)	40.9581
Percent Solids	69.0
Weight Oven-Dried (Grams)	28.2611

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.7680	2.72
Gravel, Fine	2.00 mm	10	0.5946	2.10
Sand, Very Coarse	0.850 mm	20	0.3035	1.07
Sand, Coarse	0.425 mm	40	1.4815	5.24
Sand, Medium	0.250 mm	60	3.4699	12.3
Sand, Fine	0.106 mm	140	8.2332	29.1
Sand, Very Fine	0.075 mm	200	2.2611	8.00
Silt			9.8400	34.8
Clay			3.6300	12.8
		Total	30.5818	108

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706319
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	8/10/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-33-2
Lab Code: K0706319-009

Sand Fraction: Weight (Grams)	46.9119
Sand Fraction: Weight Recovered (Grams)	46.646
Sand Fraction: Percent Recovery	99.4

Weight as received (Grams)	83.6173
Percent Solids	79.5
Weight Oven-Dried (Grams)	66.4758

Description	**Sieve Size**	**Sieve Number**	**Dry Weight (Grams)**	**Percent of Total Weight Recovered**
Gravel, Medium	4.75 mm	4	1.2693	1.91
Gravel, Fine	2.00 mm	10	0.6021	0.91
Sand, Very Coarse	0.850 mm	20	0.7938	1.19
Sand, Coarse	0.425 mm	40	3.3300	5.01
Sand, Medium	0.250 mm	60	13.9245	20.9
Sand, Fine	0.106 mm	140	19.8807	29.9
Sand, Very Fine	0.075 mm	200	5.6459	8.49
Silt			15.3550	23.1
Clay			4.0700	6.12
		Total	64.8713	97.6

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706319
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/18/2007
Sample Matrix:	Sediment	**Date Received:**	7/20/2007
		Date Analyzed:	8/10/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-30-1
Lab Code: K0706319-011

Sand Fraction: Weight (Grams)	54.5330
Sand Fraction: Weight Recovered (Grams)	54.4037
Sand Fraction: Percent Recovery	99.8

Weight as received (Grams)	85.4722
Percent Solids	75.7
Weight Oven-Dried (Grams)	64.7025

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.1801	0.28
Gravel, Fine	2.00 mm	10	0.5151	0.80
Sand, Very Coarse	0.850 mm	20	4.8907	7.56
Sand, Coarse	0.425 mm	40	18.8840	29.2
Sand, Medium	0.250 mm	60	14.7436	22.8
Sand, Fine	0.106 mm	140	11.5044	17.8
Sand, Very Fine	0.075 mm	200	3.1252	4.83
Silt			10.8500	16.8
Clay			4.4200	6.83
		Total	69.1131	107

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706319
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/18/2007
Sample Matrix:	Sediment	**Date Received:**	7/20/2007
		Date Analyzed:	8/10/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-30-2
Lab Code: K0706319-012

Sand Fraction: Weight (Grams)	44.8410
Sand Fraction: Weight Recovered (Grams)	44.7232
Sand Fraction: Percent Recovery	99.7

Weight as received (Grams)	80.7749
Percent Solids	73.5
Weight Oven-Dried (Grams)	59.3696

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.6922	1.17
Gravel, Fine	2.00 mm	10	0.6363	1.07
Sand, Very Coarse	0.850 mm	20	3.9645	6.68
Sand, Coarse	0.425 mm	40	16.3336	27.5
Sand, Medium	0.250 mm	60	10.2920	17.3
Sand, Fine	0.106 mm	140	10.3294	17.4
Sand, Very Fine	0.075 mm	200	1.9633	3.31
Silt			13.9500	23.5
Clay			5.7300	9.65
		Total	63.8913	108

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706319
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/18/2007
Sample Matrix:	Sediment	**Date Received:**	7/20/2007
		Date Analyzed:	8/10/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-27-1
Lab Code: K0706319-013

Sand Fraction: Weight (Grams)	20.1796
Sand Fraction: Weight Recovered (Grams)	19.9106
Sand Fraction: Percent Recovery	98.7

Weight as received (Grams)	43.4715
Percent Solids	74.7
Weight Oven-Dried (Grams)	32.4732

Description	**Sieve Size**	**Sieve Number**	**Dry Weight (Grams)**	**Percent of Total Weight Recovered**
Gravel, Medium	4.75 mm	4	0.0000	0.00
Gravel, Fine	2.00 mm	10	0.4531	1.40
Sand, Very Coarse	0.850 mm	20	1.2128	3.73
Sand, Coarse	0.425 mm	40	4.5440	14.0
Sand, Medium	0.250 mm	60	5.3891	16.6
Sand, Fine	0.106 mm	140	6.2657	19.3
Sand, Very Fine	0.075 mm	200	1.9685	6.06
Silt			8.6350	26.6
Clay			3.7550	11.6
		Total	32.2232	99.2

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706319
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/18/2007
Sample Matrix:	Sediment	**Date Received:**	7/20/2007
		Date Analyzed:	8/10/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-27-2
Lab Code: K0706319-014

Sand Fraction: Weight (Grams)	62.0519
Sand Fraction: Weight Recovered (Grams)	61.7919
Sand Fraction: Percent Recovery	99.6

Weight as received (Grams)	83.8573
Percent Solids	86.5
Weight Oven-Dried (Grams)	72.5366

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0000	0.00
Gravel, Fine	2.00 mm	10	0.2823	0.39
Sand, Very Coarse	0.850 mm	20	1.8740	2.58
Sand, Coarse	0.425 mm	40	13.9046	19.2
Sand, Medium	0.250 mm	60	20.6961	28.5
Sand, Fine	0.106 mm	140	21.3285	29.4
Sand, Very Fine	0.075 mm	200	3.1999	4.41
Silt			7.5550	10.4
Clay			2.9650	4.09
		Total	71.8054	99.0

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706319
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/18/2007
Sample Matrix:	Sediment	**Date Received:**	7/20/2007
		Date Analyzed:	8/10/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-24-1
Lab Code: K0706319-016

Sand Fraction: Weight (Grams)	11.4623
Sand Fraction: Weight Recovered (Grams)	11.4636
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	26.813
Percent Solids	73.6
Weight Oven-Dried (Grams)	19.7344

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0000	0.00
Gravel, Fine	2.00 mm	10	0.0192	0.10
Sand, Very Coarse	0.850 mm	20	0.1062	0.54
Sand, Coarse	0.425 mm	40	0.8744	4.43
Sand, Medium	0.250 mm	60	2.5491	12.9
Sand, Fine	0.106 mm	140	5.5599	28.2
Sand, Very Fine	0.075 mm	200	2.0414	10.3
Silt			6.1050	30.9
Clay			2.5100	12.7
		Total	19.7652	100

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706319
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/18/2007
Sample Matrix:	Sediment	**Date Received:**	7/20/2007
		Date Analyzed:	8/10/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-24-2
Lab Code: K0706319-017

Sand Fraction: Weight (Grams)	7.1425
Sand Fraction: Weight Recovered (Grams)	7.1038
Sand Fraction: Percent Recovery	99.5

Weight as received (Grams)	24.1214
Percent Solids	66.1
Weight Oven-Dried (Grams)	15.9442

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0000	0.00
Gravel, Fine	2.00 mm	10	0.0000	0.00
Sand, Very Coarse	0.850 mm	20	0.0147	0.09
Sand, Coarse	0.425 mm	40	0.2541	1.59
Sand, Medium	0.250 mm	60	0.5913	3.71
Sand, Fine	0.106 mm	140	3.6557	22.9
Sand, Very Fine	0.075 mm	200	2.1621	13.6
Silt			7.8850	49.5
Clay			2.7350	17.2
		Total	17.2979	108

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706319
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/18/2007
Sample Matrix:	Sediment	**Date Received:**	7/20/2007
		Date Analyzed:	8/10/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-18-1
Lab Code: K0706319-018

Sand Fraction: Weight (Grams)	7.4310
Sand Fraction: Weight Recovered (Grams)	7.4040
Sand Fraction: Percent Recovery	99.6

Weight as received (Grams)	24.6223
Percent Solids	68.7
Weight Oven-Dried (Grams)	16.9155

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0000	0.00
Gravel, Fine	2.00 mm	10	0.0000	0.00
Sand, Very Coarse	0.850 mm	20	0.0557	0.33
Sand, Coarse	0.425 mm	40	0.2144	1.27
Sand, Medium	0.250 mm	60	0.6767	4.00
Sand, Fine	0.106 mm	140	3.5210	20.8
Sand, Very Fine	0.075 mm	200	2.2683	13.4
Silt			8.0900	47.8
Clay			2.8600	16.9
		Total	17.6861	105

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706319
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/18/2007
Sample Matrix:	Sediment	**Date Received:**	7/20/2007
		Date Analyzed:	8/10/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-18-2
Lab Code: K0706319-019

Sand Fraction: Weight (Grams)	62.5971
Sand Fraction: Weight Recovered (Grams)	62.4759
Sand Fraction: Percent Recovery	99.8

Weight as received (Grams)	80.7943
Percent Solids	84.2
Weight Oven-Dried (Grams)	68.0288

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.5057	0.74
Gravel, Fine	2.00 mm	10	0.8286	1.22
Sand, Very Coarse	0.850 mm	20	4.6777	6.88
Sand, Coarse	0.425 mm	40	25.1466	37.0
Sand, Medium	0.250 mm	60	19.3016	28.4
Sand, Fine	0.106 mm	140	10.5761	15.5
Sand, Very Fine	0.075 mm	200	1.2455	1.83
Silt			4.0100	5.89
Clay			2.0500	3.01
		Total	68.3418	100

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Geofon, Incorporated
Project: Port Hueneme IRP Site 19/4-14105
Sample Matrix: Sediment

Service Request: K0706319
Date Collected: 7/17/2007
Date Received: 7/19/2007
Date Analyzed: 8/10/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-33-2
Lab Code: K0706319-009DUP

Sand Fraction: Weight (Grams)	48.3759
Sand Fraction: Weight Recovered (Grams)	48.2144
Sand Fraction: Percent Recovery	99.7

Weight as received (Grams)	84.6555
Percent Solids	79.5
Weight Oven-Dried (Grams)	67.3011

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	1.1695	1.74
Gravel, Fine	2.00 mm	10	0.3745	0.56
Sand, Very Coarse	0.850 mm	20	0.5554	0.83
Sand, Coarse	0.425 mm	40	4.3048	6.40
Sand, Medium	0.250 mm	60	13.3524	19.8
Sand, Fine	0.106 mm	140	21.4626	31.9
Sand, Very Fine	0.075 mm	200	5.6528	8.40
Silt			15.8000	23.5
Clay			4.1450	6.16
		Total	66.8170	99.3

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Geofon, Incorporated
Project: Port Hueneme IRP Site 19/4-14105
Sample Matrix: Sediment

Service Request: K0706319
Date Collected: 7/17/2007
Date Received: 7/19/2007
Date Analyzed: 9/7/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-28-3
Lab Code: K0706319-005

Sand Fraction: Weight (Grams)	54.4211
Sand Fraction: Weight Recovered (Grams)	54.4719
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	99.211
Percent Solids	72.8
Weight Oven-Dried (Grams)	72.2256

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	6.8480	9.48
Gravel, Fine	2.00 mm	10	3.7497	5.19
Sand, Very Coarse	0.850 mm	20	2.6059	3.61
Sand, Coarse	0.425 mm	40	8.9850	12.4
Sand, Medium	0.250 mm	60	12.7507	17.7
Sand, Fine	0.106 mm	140	13.8444	19.2
Sand, Very Fine	0.075 mm	200	4.3160	5.98
Silt			18.0800	25.0
Clay			5.3750	7.44
		Total	76.5547	106

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706319
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/17/2007
Sample Matrix:	Sediment	**Date Received:**	7/19/2007
		Date Analyzed:	9/7/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-33-3
Lab Code: K0706319-010

Sand Fraction: Weight (Grams)	76.2702
Sand Fraction: Weight Recovered (Grams)	76.283
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	102.3426
Percent Solids	73.2
Weight Oven-Dried (Grams)	74.9148

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.0000	0.00
Gravel, Fine	2.00 mm	10	0.1055	0.14
Sand, Very Coarse	0.850 mm	20	0.4315	0.58
Sand, Coarse	0.425 mm	40	1.8078	2.41
Sand, Medium	0.250 mm	60	4.1886	5.59
Sand, Fine	0.106 mm	140	0.2505	0.33
Sand, Very Fine	0.075 mm	200	68.6025	91.6
Silt			4.0050	5.35
Clay			1.8750	2.50
		Total	81.2664	108

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client: Geofon, Incorporated
Project: Port Hueneme IRP Site 19/4-14105
Sample Matrix: Sediment

Service Request: K0706319
Date Collected: 7/18/2007
Date Received: 7/20/2007
Date Analyzed: 9/7/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-27-3
Lab Code: K0706319-015

Sand Fraction: Weight (Grams)	44.7833
Sand Fraction: Weight Recovered (Grams)	44.7822
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	88.3224
Percent Solids	76.8
Weight Oven-Dried (Grams)	67.8316

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	0.7997	1.18
Gravel, Fine	2.00 mm	10	0.5817	0.86
Sand, Very Coarse	0.850 mm	20	2.6805	3.95
Sand, Coarse	0.425 mm	40	9.4974	14.0
Sand, Medium	0.250 mm	60	13.8695	20.4
Sand, Fine	0.106 mm	140	13.4426	19.8
Sand, Very Fine	0.075 mm	200	3.2653	4.81
Silt			16.7300	24.7
Clay			7.9550	11.7
		Total	68.8217	101

COLUMBIA ANALYTICAL SERVICES, INC.

Analytical Report

Client:	Geofon, Incorporated	**Service Request:**	K0706319
Project:	Port Hueneme IRP Site 19/4-14105	**Date Collected:**	7/18/2007
Sample Matrix:	Sediment	**Date Received:**	7/20/2007
		Date Analyzed:	9/7/2007

Particle Size Determination
ASTM Method D422 Modified

Sample Name: HSS19-18-3
Lab Code: K0706319-020

Sand Fraction: Weight (Grams)	80.4142
Sand Fraction: Weight Recovered (Grams)	80.2358
Sand Fraction: Percent Recovery	100

Weight as received (Grams)	100.8875
Percent Solids	79.4
Weight Oven-Dried (Grams)	80.1047

Description	Sieve Size	Sieve Number	Dry Weight (Grams)	Percent of Total Weight Recovered
Gravel, Medium	4.75 mm	4	6.4101	8.00
Gravel, Fine	2.00 mm	10	3.6480	4.55
Sand, Very Coarse	0.850 mm	20	3.4679	4.33
Sand, Coarse	0.425 mm	40	28.1412	35.1
Sand, Medium	0.250 mm	60	25.5844	31.9
Sand, Fine	0.106 mm	140	9.0994	11.4
Sand, Very Fine	0.075 mm	200	3.7183	4.64
Silt			2.5200	3.15
Clay			2.0600	2.57
		Total	84.6493	106

Columbia Analytical Services, Inc.

Analytical Report

Method: ASTM D422 Particle Size

Service Request #:	K0706319
Lab Code #:	K0706319-005
Sample Name:	HSS19-28-3

Client:	Geofon, Incorporated
Project:	Port Hueneme IRP Site 19/4-14105
Sample Matrix:	Sediment
Date Collected:	7/17/2007
Date Received:	7/19/2007
Date Analyzed:	9/7/2007

I. Sieving Operation

I. Sieving Operation	Sieve #	Weight (g)
Gravel 4.75 mm (g)	4	6.8480
Gravel 2.00 mm (g)	10	3.7497
Gravel 0.850 mm (g)	20	2.6059
Gravel 0.425 mm (g)	40	8.9850
Gravel 0.250 mm (g)	60	12.7507
Gravel 0.106 mm (g)	140	13.8444
Gravel 0.075 mm (g)	200	4.3160
S/C <0.075 mm (g)	Pan	1.3722
Total (g) Recov'd	54.4719	
Total (%) Recov'd	100.1	

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	158.1118
Grams Beaker (Tare)	103.6907
Grams Gravel/Sand	54.4211

I. Sample Preparation

Grams As Received Sample	99.2110
Percent (%) Solids	72.8
Grams Oven Dried Sample	72.2256

III. Determination of Silt/Clay Fraction

Temperature: 24 Time Start: 1300 Time Finish: 1451

	Silt/Clay Fraction	Clay Fraction
Total Volume of Sample (mls)	1000	1000
Amount of Dispersant	10	10
Volume of Aliquot (mls)	20	20
Grams Sample, Dispersant & Tare	41.6655	40.6399
Grams of Tare	41.1952	40.5312
Grams of Dispersant Correction	0.0012	0.0012
Grams of Sample	0.4691	0.1075
Total Grams Sample X 50	23.4550	5.3750

Analyst: AM/BB Date: 9/7/2007

Reviewed by: [signature] Date: 9/13/07

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Columbia Analytical Services, Inc.

Analytical Report

Method: ASTM D422 Particle Size

Service Request #: K0706319
Lab Code #: K0706319-010
Sample Name: HSS19-33-3

Client: Geofon, Incorporated
Project: Port Hueneme IRP Site 19/4-14105
Sample Matrix: Sediment

Date Collected: 7/17/2007
Date Received: 7/19/2007
Date Analyzed: 9/7/2007

I. Sieving Operation	Sieve #	Weight (g)
Gravel 4.75 mm (g)	4	0.0000
Gravel 2.00 mm (g)	10	0.1055
Gravel 0.850 mm (g)	20	0.4315
Gravel 0.425 mm (g)	40	1.8078
Gravel 0.250 mm (g)	60	4.1886
Gravel 0.106 mm (g)	140	0.2505
Gravel 0.075 mm (g)	200	68.6025
S/C <0.075 mm (g)	Pan	0.8966
Total (g) Recov'd	76.2830	
Total (%) Recov'd	100.0	

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	177.3694
Grams Beaker (Tare)	101.0992
Grams Gravel/Sand	76.2702

I. Sample Preparation

Grams As Received Sample	102.3426
Percent (%) Solids	73.2
Grams Oven Dried Sample	74.9148

III. Determination of Silt/Clay Fraction

Temperature: 24 Time Start: 1300 Time Finish: 1451

	Silt/Clay Fraction	Clay Fraction
Total Volume of Sample (mls)	1000	1000
Amount of Dispersant	10	10
Volume of Aliquot (mls)	20	20
Grams Sample, Dispersant & Tare	28.1072	39.3350
Grams of Tare	27.9884	39.2963
Grams of Dispersant Correction	0.0012	0.0012
Grams of Sample	0.1176	0.0375
Total Grams Sample X 50	5.8800	1.8750

Analyst: 0 AM/BB Date: 9/7/2007
Reviewed by: [signature] Date: 9/13/07

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Columbia Analytical Services, Inc.

Analytical Report

Method: ASTM D422 Particle Size

Service Request #: K0706319
Lab Code #: K0706319-015
Sample Name: HSS19-27-3

Client: Geofon, Incorporated
Project: Port Hueneme IRP Site 19/4-14105
Sample Matrix: Sediment

Date Collected: 7/18/2007
Date Received: 7/20/2007
Date Analyzed: 9/7/2007

I. Sieving Operation	Sieve #	Weight (g)
Gravel 4.75 mm (g)	4	0.7997
Gravel 2.00 mm (g)	10	0.5817
Gravel 0.850 mm (g)	20	2.6805
Gravel 0.425 mm (g)	40	9.4974
Gravel 0.250 mm (g)	60	13.8695
Gravel 0.106 mm (g)	140	13.4426
Gravel 0.075 mm (g)	200	3.2653
S/C <0.075 mm (g)	Pan	0.6455
Total (g) Recov'd	44.7822	
Total (%) Recov'd	100.0	

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	148.5082
Grams Beaker (Tare)	103.7249
Grams Gravel/Sand	44.7833

I. Sample Preparation

Grams As Received Sample	88.3224
Percent (%) Solids	76.8
Grams Oven Dried Sample	67.8316

III. Determination of Silt/Clay Fraction

Temperature: 24 Time Start: 1300 Time Finish: 1451

	Silt/Clay Fraction	Clay Fraction
Total Volume of Sample (mls)	1000	1000
Amount of Dispersant	10	10
Volume of Aliquot (mls)	20	20
Grams Sample, Dispersant & Tare	41.4948	40.6555
Grams of Tare	40.9999	40.4952
Grams of Dispersant Correction	0.0012	0.0012
Grams of Sample	0.4937	0.1591
Total Grams Sample X 50	24.6850	7.9550

Analyst: 0 AM/BB Date: 9/7/2007
Reviewed by: W Date: 9/13/07

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Columbia Analytical Services, Inc.

Analytical Report

Method: ASTM D422 Particle Size

Service Request #: K0706319
Lab Code #: K0706319-020
Sample Name: HSS19-18-3

Client: Geofon, Incorporated
Project: Port Hueneme IRP Site 19/4-14105
Sample Matrix: Sediment

Date Collected: 7/18/2007
Date Received: 7/20/2007
Date Analyzed: 9/7/2007

I. Sieving Operation	Sieve #	Weight (g)
Gravel 4.75 mm (g)	4	6.4101
Gravel 2.00 mm (g)	10	3.6480
Gravel 0.850 mm (g)	20	3.4679
Gravel 0.425 mm (g)	40	28.1412
Gravel 0.250 mm (g)	60	25.5844
Gravel 0.106 mm (g)	140	9.0994
Gravel 0.075 mm (g)	200	3.7183
S/C <0.075 mm (g)	Pan	0.1665
Total (g) Recov'd	80.2358	
Total (%) Recov'd	99.8	

II. Dry Sieving of Gravel/Sand

Grams Gravel/Sand & Beaker	186.6340
Grams Beaker (Tare)	106.2198
Grams Gravel/Sand	80.4142

I. Sample Preparation

Grams As Received Sample	100.8875
Percent (%) Solids	79.4
Grams Oven Dried Sample	80.1047

III. Determination of Silt/Clay Fraction

Temperature: 24 Time Start: 1300 Time Finish: 1451

	Silt/Clay Fraction	Clay Fraction
Total Volume of Sample (mls)	1000	1000
Amount of Dispersant	10	10
Volume of Aliquot (mls)	20	20
Grams Sample, Dispersant & Tare	40.2944	40.0794
Grams of Tare	40.2016	40.0370
Grams of Dispersant Correction	0.0012	0.0012
Grams of Sample	0.0916	0.0412
Total Grams Sample X 50	4.5800	2.0600

Analyst: 0 AM/BB Date: 9/7/2007
Reviewed by: [signature] Date: 9/13/07

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DCH96-1

ELEV. (m) -11	DEPTH (m) 0.0	SOIL CLASS	-2.25 / 4	-1.5 / 7	-1.0 / 10	-0.5 / 14	0.0 / 18	+0.5 / 25	+1.0 / 35	+1.5 / 45	+2.0 / 60	+2.5 / 80	+3.0 / 120	+3.5 / 170	+3.75 / 200	+4.0 / 230	LL	PI	DESCRIPTION
	0.6	SC-SM	100	98	97	95	91	88	78	69	58	44	34	28	25	24	27	8	SILTY CLAYEY SAND: black, loose, occasional gravel to 12.7mm, 127mm layer of silt starting at 0.3mm
	1.2	SP-SM				100	99	99	94	83	81	32	15	10	9	8	-	np	POORLY GRADED SAND with SILT: dark grey, medium dense to dense.
	2.0	SP			100	99	99	98	95	83	65	28	8	3	2	2	-	np	POORLY GRADED SAND: grey, occasional shells and shell fragments to 6.35mm, finer sand interval from 1.4m to 1.5m, occasional gravel to 6.35mm, dense.
-13.7	2.7	SP							100	96	88	40	10	2	2	2	-	np	

DCH96-2

ELEV. (m) -10.7	DEPTH (m) 0.0	SOIL CLASS	-2.25 / 4	-1.5 / 7	-1.0 / 10	-0.5 / 14	0.0 / 18	+0.5 / 25	+1.0 / 35	+1.5 / 45	+2.0 / 60	+2.5 / 80	+3.0 / 120	+3.5 / 170	+3.75 / 200	+4.0 / 230	LL	PI	DESCRIPTION
	0.3	CL-ML				100	99	93	95	91	83	74	65	56	52	49	23	7	SANDY SILT CLAY: black, very soft to soft, high water content.
	0.8	SP-SM		100	99	95	98	91	80	62	35	21	13	9	7	7	-	np	POORLY GRADED SAND with SILT: dark grey, medium dense.
	1.2	SP-SM	100	98	97	94	89	81	68	53	35	21	14	10	9	9	-	np	grey, medium dense to dense, 63.5mm thick intervals of silt.
	2.0	SP-SM	100	99	98	97	94	85	70	56	39	21	11	7	6	5	-	np	dense, occasional shell to 3.18mm, finer sand between 1.4m and 1.7m.
-13.4	2.7	SP-SM			100	99	95	79	51	32	20	12	8	6	5	5	-	np	occasional shell to 6.35mm.

DCH96-3

ELEV. (m) -10.7	DEPTH (m) 0.0	SOIL CLASS	-2.25 / 4	-1.5 / 7	-1.0 / 10	-0.5 / 14	0.0 / 18	+0.5 / 25	+1.0 / 35	+1.5 / 45	+2.0 / 60	+2.5 / 80	+3.0 / 120	+3.5 / 170	+3.75 / 200	+4.0 / 230	LL	PI	DESCRIPTION
	0.5	SM			100	99	95	92	79	61	41	29	22	17	15	13	-	np	SILTY SAND: black, very loose to medium dense, 152.4mm very soft layer at surface, few leaves, 25.4mm soft silty layer at 0.5m.
	0.9	SM		100	99	98	95	88	73	57	38	27	21	18	16	16	-	np	black to dark grey, medium dense, 25.4mm soft silty layers at 0.6m and 0.8m.
	1.4	SP-SM			100	99	97	90	74	55	34	18	12	9	8	6	-	np	POORLY GRADED SAND with SILT: grey, medium dense to dense.
	2.2	SP			100	95	94	81	58	38	20	10	6	4	4	4	-	np	POORLY GRADED SAND: grey, medium dense to dense.
-13.6	2.9	SP				100	97	88	65	49	25	12	7	5	4	4	-	np	

DCH96-4

ELEV. (m) -10.5	DEPTH (m) 0.0	SOIL CLASS	-2.25 / 4	-1.5 / 7	-1.0 / 10	-0.5 / 14	0.0 / 18	+0.5 / 25	+1.0 / 35	+1.5 / 45	+2.0 / 60	+2.5 / 80	+3.0 / 120	+3.5 / 170	+3.75 / 200	+4.0 / 230	LL	PI	DESCRIPTION
	0.3	SM				100	99	98	93	85	67	48	32	20	16	13	-	np	SILTY SAND: dark grey, medium dense.
	0.5	SM				100	99	98	94	90	75	55	31	22	14	9	-	np	
	1.2	SM					100	99	99	97	91	79	55	25	18	16	-	np	
	1.7	SP						100	98	91	85	31	13	6	3	2	-	np	POORLY GRADED SAND: dark grey, medium dense.
	2.7	SP					100	98	93	76	37	12	3	1	1	1	-	np	grey.
-13.3	2.8	ML						100	99	98	98	99	98	95	95	95	-	np	SILT: olive, hard.

UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS More than half of material is larger than no. 200 sieve size.	GRAVELS More than half of coarse fraction is larger than no. 4 sieve size.	Clean Gravels	GW	Well graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines.
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction is smaller than no. 4 sieve size.	Clean Sands	SW	Well graded sands, gravelly sands, little or no fines.
			SP	Poorly graded sands, gravelly sands, little or no fines.
		Sands with fines.	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS More than half of material is smaller than no. 200 sieve size.	SILTS AND CLAYS	Low liquid limit.	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts, with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
		High liquid limit.	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
Highly organic soils			Pt	Peat and other highly organic soils.

NOTES:

1. BOUNDRY CLASSIFICATION: SOILS POSSESSING CHARACTERISTICS OF TWO GROUPS ARE DESIGNATED BY COMBINATIONS OF GROUP SYMBOLS. FOR EXAMPLE, GW-GC, WELL GRADED GRAVEL-SAND MIXTURE WITH CLAY BINDER.
2. ALL SIEVE SIZES ON THE CHART ARE U.S. STANDARD.
3. THE TERMS "SILT" AND "CLAY" ARE USED RESPECTIVELY TO DISTINGUISH MATERIALS EXHIBITING LOWER PLASTICITY FROM THOSE WITH HIGHER PLASTICITY. THE MINUS NO. 200 SIEVE MATERIAL IS SILT IF THE LIQUID LIMIT AND PLASTICITY INDEX PLOT BELOW THE "A" LINE ON THE PLASTICITY CHART, AND IS CLAY IF THE LIQUID LIMIT AND PLASTICITY INDEX PLOT ABOVE THE "A" LINE ON THE CHART.
4. THE SOIL CLASSIFICATION SYSTEM IS BASED ON THE AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM).
   A. (ASTM) D2487 STANDARD TEST METHOD FOR CLASSIFICATION OF SOILS FOR ENGINEERING PURPOSES.
   B. (ASTM) D2488 STANDARD RECOMMENDED PRACTICE FOR DESCRIPTION OF SOILS (VISUAL MANUAL PROCEDURE).

LEGEND

DCH96-3 DIVER CORE HOLE, YEAR AND NUMBER

-1.5 -1.5 PHI SIZE.
7 NO. 7 SIEVE.
100 PERCENT OF MATERIAL, BY WEIGHT, PASSING NO. 7 SIEVE.

LL LIQUID LIMIT.
PI PLASTICITY INDEX (LIQUID LIMIT - PLASTIC LIMIT).
NP NONPLASTIC.

GENERAL NOTES

1. LOGS OF EXPLORATION INDICATE GEOTECHNICAL CONDITIONS AT THAT TIME AND LOCATION. CONDITIONS CAN CHANGE. STRATIFICATION LINES SHOWN ON LOGS REPRESENT APPROXIMATE BOUNDARY BETWEEN SOIL TYPES.
2. DIVER CORES WERE OBTAINED IN MARCH 1996 UTILIZING A DIVER OPERATED SLIDE HAMMER WITH FRAME TO DRIVE A 41mm ID BY 3m LEXAN TUBE INTO THE SEDIMENT.
3. ALL ELEVATIONS WERE DETERMINED BY LEAD-LINE AND TIDE TABLES AND ARE BASED ON MLLW.
4. ALL DEPTHS ARE BELOW OCEAN FLOOR.

NOTE:

1. SEE PLATE 1 FOR LOCATION OF DIVER CORE HOLES.

SYMBOL | DESCRIPTIONS | DATE | APPROVAL

REVISIONS

FEASIBILITY STUDY FOR DEEP DRAFT NAVIGATION
VENTURA COUNTY, CALIFORNIA

PORT HUENEME HARBOR

LOGS OF EXPLORATION

DESIGNED BY: GREG D.
DRAWN BY: ENRIQUE H.
CHECKED BY: JIM F.

FILE NAME: CPH97MLOGN

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

SUBMITTED BY: ABBAS T. ROODSARI
CHIEF, GEOTECHNICAL BRANCH

SPEC. NO. DACW09-97-B-0009

DISTRICT FILE NO.

SCALE:

SHEET OF SHEETS

PLATE 2

SAFETY PAYS

DCH96-5

ELEV. (m)	DEPTH (m)	SOIL CLASS	-2.25 4	-1.5 7	-1.0 10	-0.5 14	0.0 18	+0.5 25	+1.0 35	+1.5 45	+2.0 60	+2.5 80	+3.0 120	+3.5 170	+3.75 200	+4.0 230	LL	PI	DESCRIPTION
-10.9	0.0																		
	0.4	SM	100	99	98	97	95	90	81	69	54	42	32	25	22	21	-	np	SILTY SAND: black, loose to medium dense.
	1.3	SM	100	98	96	93	89	82	71	60	53	47	37	25	19	15	-	np	black for first 0.2m, remainder dark grey to grey, medium grained sand from 0.7m to 0.8m and 0.9m to 1m.
	2.1	SM							100	99	97	84	57	32	22	16	-	np	grey.
-13.6	2.7	SP-SM						100	99	95	95	87	66	23	10	6	-	np	POORLY GRADED SAND with SILT: grey, medium dense, occasional shell fragments.

DCH96-6

ELEV. (m)	DEPTH (m)	SOIL CLASS	-2.25 4	-1.5 7	-1.0 10	-0.5 14	0.0 18	+0.5 25	+1.0 35	+1.5 45	+2.0 60	+2.5 80	+3.0 120	+3.5 170	+3.75 200	+4.0 230	LL	PI	DESCRIPTION
-10.8	0.0																		
	0.5	SM	100	99	99	98	96	90	82	76	67	54	37	25	21	18	-	np	SILTY SAND: black to dark gray, loose.
	1.4	SP-SM	100	99	98	95	86	70	48	31	23	18	13	10	9	8	-	np	POORLY GRADED SAND with SILT: dark grey/olive, medium dense, occasional gravel to 19.1mm
	1.8	SP-SM	100	98	95	83	80	81	40	25	22	19	16	10	8	6	-	np	grey.
-13.1	2.3	SP-SM	100	99	99	99	98	97	94	85	67	54	36	17	10	7	-	np	

DCH96-7

ELEV. (m)	DEPTH (m)	SOIL CLASS	-2.25 4	-1.5 7	-1.0 10	-0.5 14	0.0 18	+0.5 25	+1.0 35	+1.5 45	+2.0 60	+2.5 80	+3.0 120	+3.5 170	+3.75 200	+4.0 230	LL	PI	DESCRIPTION
-11.1	0.0																		
	0.3	SM				100	99	98	95	91	84	75	60	44	38	34	-	np	SILTY SAND: black, loose to medium dense.
	1.1	SM				100	99	98	95	92	86	77	62	47	42	39	-	np	
	1.8	SP-SM		100	99	98	96	91	85	73	65	52	32	16	12	10	-	np	POORLY GRADED SAND with SILT: grey, medium dense, silt layer from 1.2m to 1.3m
	2.4	SP-SM	100	99	99	98	97	94	90	83	55	27	15	9	7	6	-	np	occasional shell fragments.
-13.7	2.6	SP-SM	100	99	99	99	99	99	95	96	90	81	68	27	11	6	-	np	

DCH96-8

ELEV. (m)	DEPTH (m)	SOIL CLASS	-2.25 4	-1.5 7	-1.0 10	-0.5 14	0.0 18	+0.5 25	+1.0 35	+1.5 45	+2.0 60	+2.5 80	+3.0 120	+3.5 170	+3.75 200	+4.0 230	LL	PI	DESCRIPTION
-11.4	0.0																		
	0.3	SM		100	99	98	96	91	83	73	60	47	35	19	14	12	-	np	SILTY SAND: black, loose to medium dense.
	0.9	SP-SM			100	99	99	95	89	73	52	39	27	10	6	4	-	np	POORLY GRADED SAND with SILT: dark gray, medium dense.
	1.7	SP-SM	100	99	99	97	93	88	75	59	43	35	28	10	5	4	-	np	brown, occasional shell fragments.
-13.8	2.4	SP-SM	100	99	98	97	94	85	78	62	29	18	12	7	5	4	-	np	brown to grey.

DCH96-9

ELEV. (m)	DEPTH (m)	SOIL CLASS	-2.25 4	-1.5 7	-1.0 10	-0.5 14	0.0 18	+0.5 25	+1.0 35	+1.5 45	+2.0 60	+2.5 80	+3.0 120	+3.5 170	+3.75 200	+4.0 230	LL	PI	DESCRIPTION
-11.1	0.0																		
	0.3	SM					100	99	98	93	82	64	39	20	15	12	-	np	SILTY SAND: dark grey, loose to medium dense, thin layer of silt at surface.
	1.1	SP-SM			100	99	98	95	88	74	59	45	27	13	8	7	-	np	POORLEY GRADED SAND with SILT: dark grey, medium dense.
	1.5	SP-SM	100	99	97	95	91	84	71	57	45	35	24	13	9	8	-	np	coarser grained with depth.
-13.4	2.3	ML					100	99	99	98	98	97	95	88	79	88	-	np	SILT with SAND: dark grey/olive, firm to very firm.

DCH96-10

ELEV. (m)	DEPTH (m)	SOIL CLASS	-2.25 4	-1.5 7	-1.0 10	-0.5 14	0.0 18	+0.5 25	+1.0 35	+1.5 45	+2.0 60	+2.5 80	+3.0 120	+3.5 170	+3.75 200	+4.0 230	LL	PI	DESCRIPTION
-10.7	0.0																		
	0.6	SM		100	99	98	97	92	82	65	45	34	27	22	19	17	-	np	SILTY SAND: dark grey to olive, loose to medium dense, 50.8mm very soft silty layer on surface.
	1.5	SP-SM	100	99	98	97	94	85	75	52	29	18	14	11	10	8	-	np	POORLY GRADED SAND with SILT: olive, medium dense.
-13.2	2.5	SM			100	99	97	96	90	88	82	79	71	51	38	28	-	np	SILTY SAND: olive, medium dense to dense.

DCH96-11

ELEV. (m)	DEPTH (m)	SOIL CLASS	-2.25 4	-1.5 7	-1.0 10	-0.5 14	0.0 18	+0.5 25	+1.0 35	+1.5 45	+2.0 60	+2.5 80	+3.0 120	+3.5 170	+3.75 200	+4.0 230	LL	PI	DESCRIPTION
-11.6	0.0																		
	0.6	SM								100	99	96	75	39	28	22	-	np	SILTY SAND: dark grey to grey, medium dense.
	0.9	SM								100	99	96	72	27	18	11	-	np	grey, medium dense.
	1.4	SM					100	99	99	98	97	92	69	33	22	15	-	np	
-14.2	2.8	SP	100	99	98	95	90	78	53	33	21	14	9	6	4	3	-	np	POORLY GRADED SAND: grey, medium dense to dense, shell fragments, gravel to 31.75mm.

DCH96-12

ELEV. (m)	DEPTH (m)	SOIL CLASS	-2.25 4	-1.5 7	-1.0 10	-0.5 14	0.0 18	+0.5 25	+1.0 35	+1.5 45	+2.0 60	+2.5 80	+3.0 120	+3.5 170	+3.75 200	+4.0 230	LL	PI	DESCRIPTION
-12.0	0.0																		
	0.8	SM			100	99	98	94	87	81	75	63	46	29	22	16		np	SILTY SAND: dark grey, medium dense to dense, 50.8mm soft layer at surface.
	1.7	SM								100	98	83	46	20	14	11		np	dark grey to grey.
-14.3	2.3	SP-SM								100	89	84	43	15	10	6		np	POORLY GRADED SAND with SILT: dark grey to grey, medium dense to dense.

NOTES:

1. SEE PLATE 1 FOR LOCATION OF DIVER CORE HOLES.
2. SEE PLATE 2 FOR CLASSIFICATION SYSTEM, LEGEND AND GENERAL NOTES.

SYMBOL	DESCRIPTIONS	DATE	APPROVAL

REVISIONS

FEASIBILITY STUDY FOR DEEP DRAFT NAVIGATION
VENTURA COUNTY, CALIFORNIA

PORT HUENEME HARBOR

LOGS OF EXPLORATION

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: GREG D.
DRAWN BY: ENRIQUE H.
CHECKED BY: JIM F.

SUBMITTED BY: ABBAS T. ROODSARI
CHIEF, GEOTECHNICAL BRANCH

SPEC. NO. DACW09-97-D-0009

FILE NAME:

DISTRICT FILE NO.

SCALE:

SHEET of SHEETS

PLATE 3

SAFETY PAYS

PEBBLES\COASTAL\HUENEME\DREDGING

ANCHOR 2007

Sample Description

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual–manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:
Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT, additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance.
Soil density/consistency in test pits is estimated based on visual observation and is presented parenthetically on the test pit logs.

SAND or GRAVEL Density	Standard Penetration Resistance (N) in Blows/Foot	SILT or CLAY Consistency	Standard Penetration Resistance (N) in Blows/Foot	Approximate Shear Strength in TSF
Very loose	0 – 4	Very soft	0 – 2	<0.125
Loose	4 – 10	Soft	2 – 4	0.125 – 0.25
Medium dense	10 – 30	Medium stiff	4 – 8	0.25 – 0.5
Dense	30 – 50	Stiff	8 – 15	0.5 – 1.0
Very dense	>50	Very stiff	15 – 30	1.0 – 2.0
		Hard	>30	>2.0

Moisture

Dry	Little perceptible moisture
Damp	Some perceptible moisture, probably below optimum
Moist	Probably near optimum moisture content
Wet	Much perceptible moisture, probably above optimum

Minor Constituents

	Estimated Percentage
Not identified in description	0 – 5
Slightly (clayey, silty, etc.)	5 – 12
Clayey, silty, sandy, gravelly	12 – 30
Very (clayey, silty, etc.)	30 – 50

Legends

Sampling Test Symbols

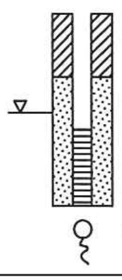
BORING SAMPLES

- Split Spoon
- Shelby Tube
- Cuttings
- Core Run
- * No Sample Recovery
- P Tube Pushed, Not Driven

TEST PIT SAMPLES

- Grab (Jar)
- Bag
- Shelby Tube

Groundwater Observations



Surface Seal

Groundwater Level on Date (ATD) At Time of Drilling

Observation Well Tip or Slotted Section

Groundwater Seepage (Test Pits)

Test Symbols

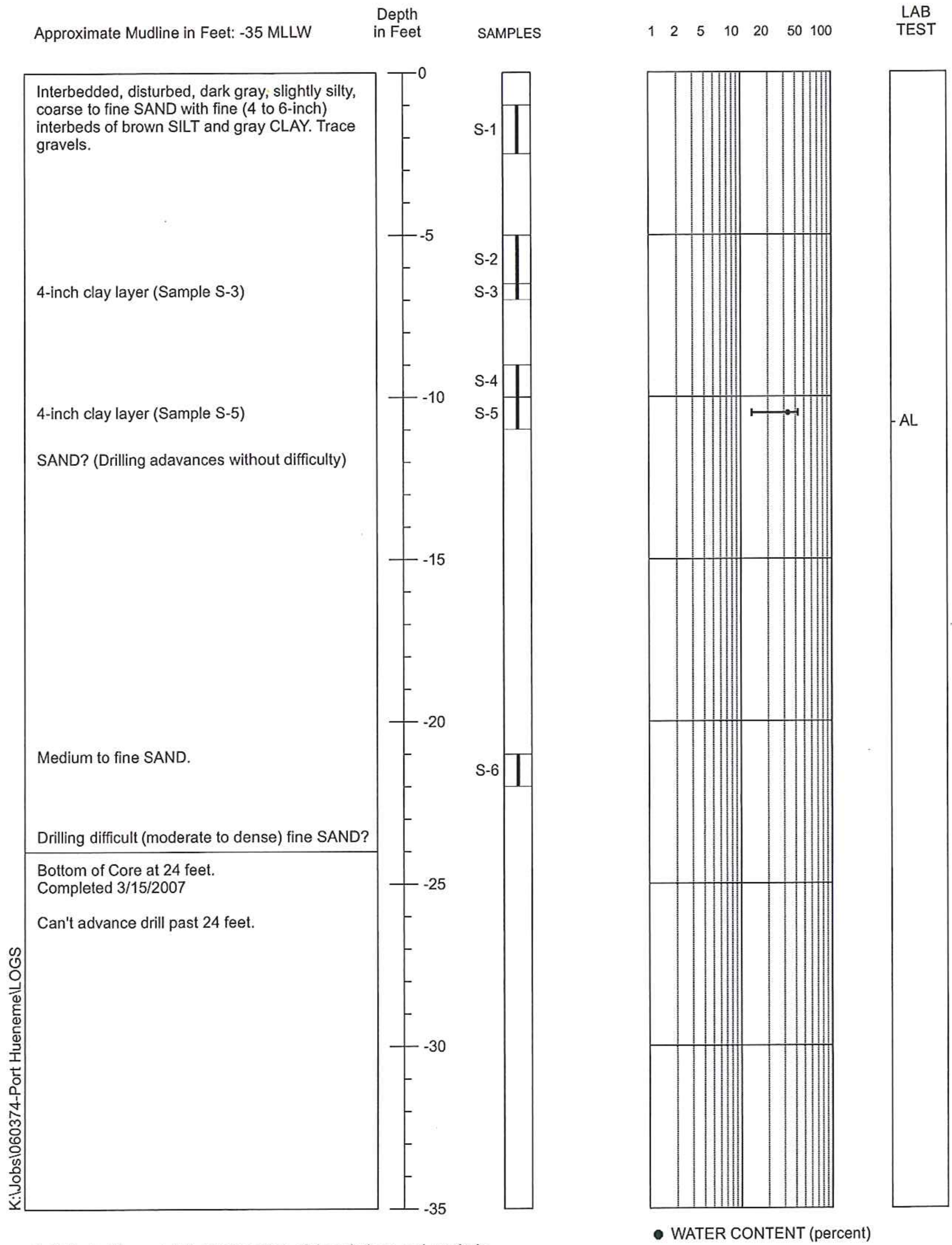
NS	No Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen
TCD	Triaxial Consolidated Drained
QU	Unconfined Compression
DS	Direct Shear
K	Permeability
PP	Pocket Penetrometer Approximate Compressive Strength in TSF
TV	Torvane Approximate Shear Strength in TSF
CBR	California Bearing Ratio
MD	Moisture Density Relationship
AL	Atterberg Limits
PID	Photoionization Detector Reading
CA	Chemical Analysis
DT	*In Situ* Density Test

Atterberg Limits: Water Content in Percent — Liquid Limit, Natural, Plastic Limit

ANCHOR ENVIRONMENTAL, L.L.C.

Figure A-1
Key to Exploration Logs
Port Hueneme

Boring: AN-GT-1



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive, and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling or at the time and date specified. Ground water level may vary with time.

ANCHOR ENVIRONMENTAL, L.L.C.

Figure A-2
Core Log AN-GT-1
Port Hueneme

Boring: AN-GT-2

Approximate Mudline in Feet: -38.4 MLLW

Description	Depth in Feet	Samples	Water Content (1 2 5 10 20 50 100)	Lab Test
11-inch-thick CLAY layer (Sample S-1)	0	S-1		
Slightly silty to silty, medium to fine SAND with thin CLAY layers.				
	-5	S-2		
8-inch-thick CLAY layer (Sample S-3)		S-3		
Drilling action becoming more difficult. Fine SAND, becoming medium dense to dense?	-10			
6-inch-thick CLAY layer (Sample S-4)		S-4		
(Dense), silty, fine SAND.		S-5	•	GS
Bottom of Core at 14 feet. Completed 3/16/2007	-15			
	-20			
	-25			
	-30			
	-35			

K:\Jobs\060374-Port Hueneme\LOGS

● WATER CONTENT (percent)

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive, and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling or at the time and date specified. Ground water level may vary with time.

ANCHOR ENVIRONMENTAL, L.L.C.

Figure A-3
Core Log AN-GT-2
Port Hueneme

Boring: AN-GT-3

Approximate Mudline in Feet: -34 MLLW

Depth in Feet	Description	SAMPLES	1 2 5 10 20 50 100	LAB TEST
0	Drill action indicates (loose) SAND with occasional cobbles.			
-5	(Loose) easy drilling.			
-10	10.5' - Drill hangs up. Medium dense, fine SAND.			
	Bottom of Core at 11 feet. Completed 3/16/2007. Can't advance drill past 11 feet.			
-15				
-20				
-25				
-30				
-35				

K:\Jobs\060374-Port Hueneme\LOGS

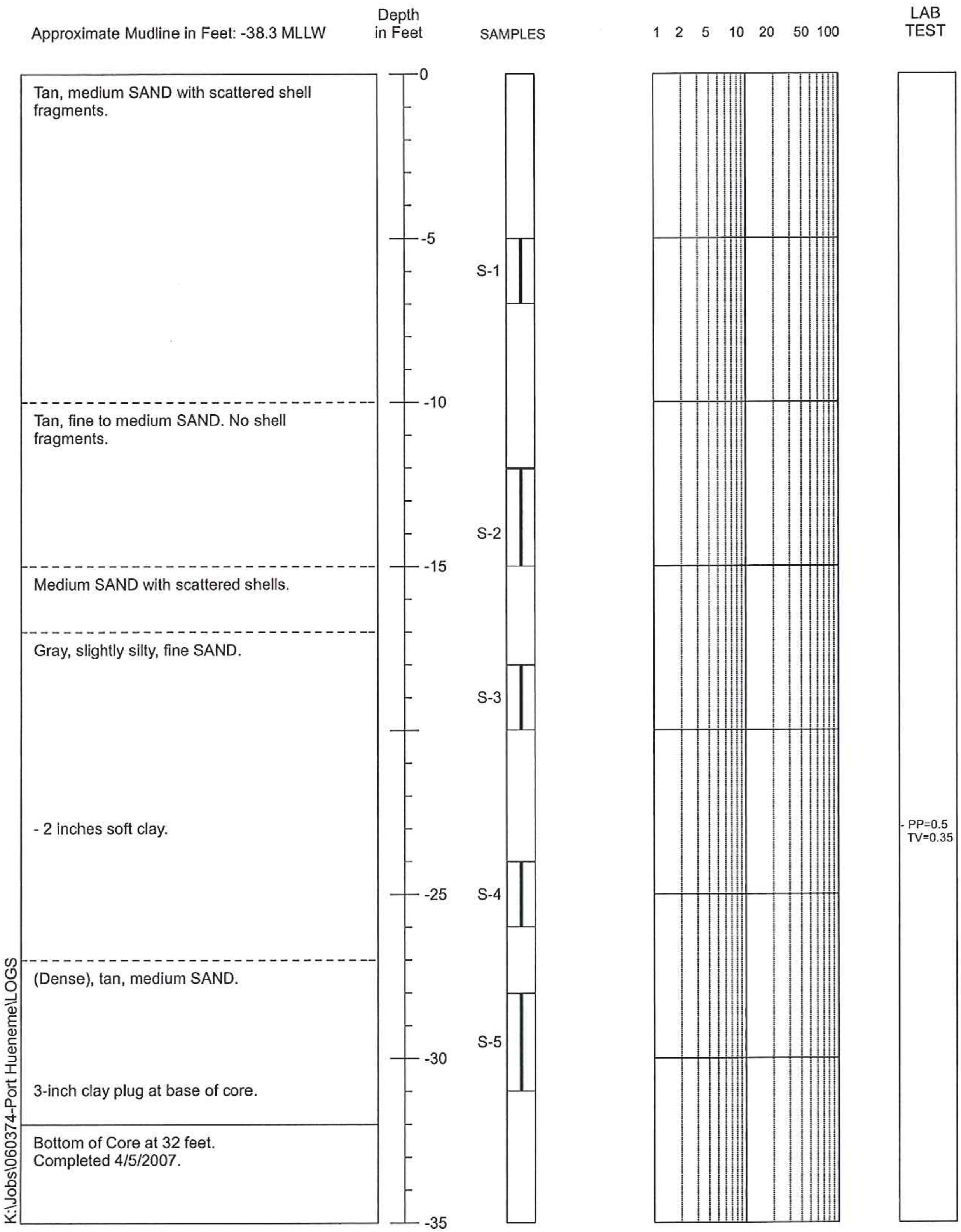
● WATER CONTENT (percent)

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive, and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling or at the time and date specified. Ground water level may vary with time.

ANCHOR ENVIRONMENTAL, L.L.C.

Figure A-4
Core Log AN-GT-3
Port Hueneme

Boring: AN-GT-4

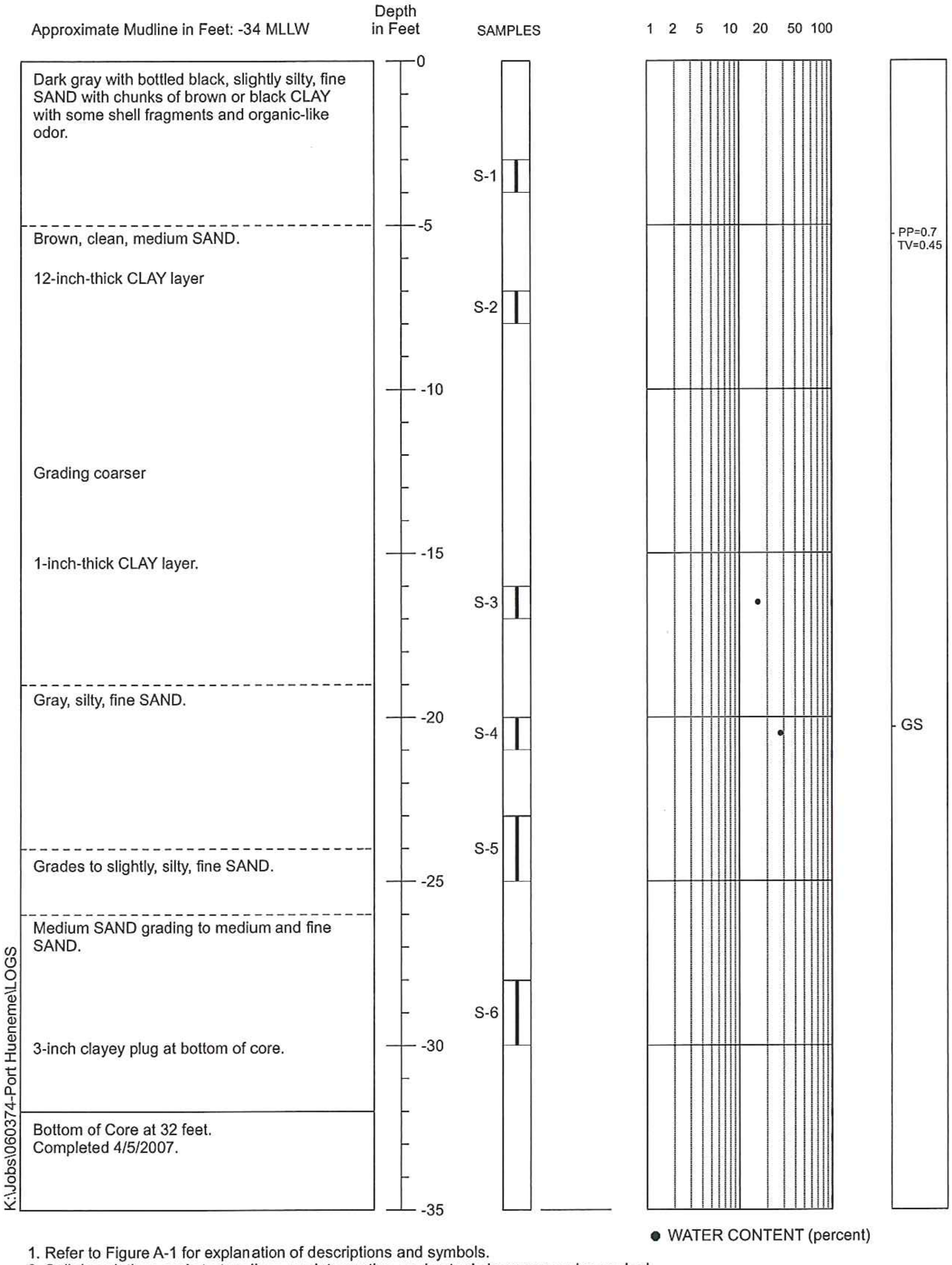


1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive, and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling or at the time and date specified. Ground water level may vary with time.

ANCHOR ENVIRONMENTAL, L.L.C.

Figure A-5
Core Log AN-GT-4
Port Hueneme

Boring: AN-GT-5



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive, and actual changes may be gradual.
3. Ground water level, if indicated, is at time of drilling or at the time and date specified. Ground water level may vary with time.

ANCHOR ENVIRONMENTAL, L.L.C.

Figure A-6
Core Log AN-GT-5
Port Hueneme

PTS File No: 37232
Client: Anchor Environmental, L.L.C..

MOISTURE CONTENT

(METHODOLOGY: ASTM D 2216))

PROJECT NAME: Port Hueneme
PROJECT NO: 060374-01

SAMPLE ID.	ANALYSES DATE	DEPTH, ft.	MATRIX	TARE WEIGHT, grams	WET SAMPLE + TARE WEIGHT, grams	DRY SAMPLE + TARE WEIGHT, grams	MOISTURE CONTENT, percent dry weight
AN-GT-1 S-5	03/30/07	N/A	SOIL	112.78	213.43	185.63	38.2
AN-GT-2 S-5	03/30/07	N/A	SOIL	116.79	222.53	201.82	24.4

PTS File No: 37232
Client: Anchor Environmental, L.L.C..

ATTERBERG LIMITS DATA - FINE FRACTION < No. 40 SIEVE

(METHODOLOGY: ASTM D4318)

PROJECT NAME: Port Hueneme
PROJECT NO: 060374-01

SAMPLE ID.	DEPTH, ft.	ATTERBERG LIMITS			USCS / PLASTICITY CHART SYMBOL (Fines: <#40 Sieve)
		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
AN-GT-1 S-5	N/A	42.3	15.3	27.0	CL

PTS Laboratories, Inc.

Anchor Environmental, L.L.C..
PTS File No: 37232

PARTICLE SIZE SUMMARY

(METHODOLOGY: ASTM D422/D4464M)

PROJECT NAME: Port Hueneme
PROJECT NO: 060374-01

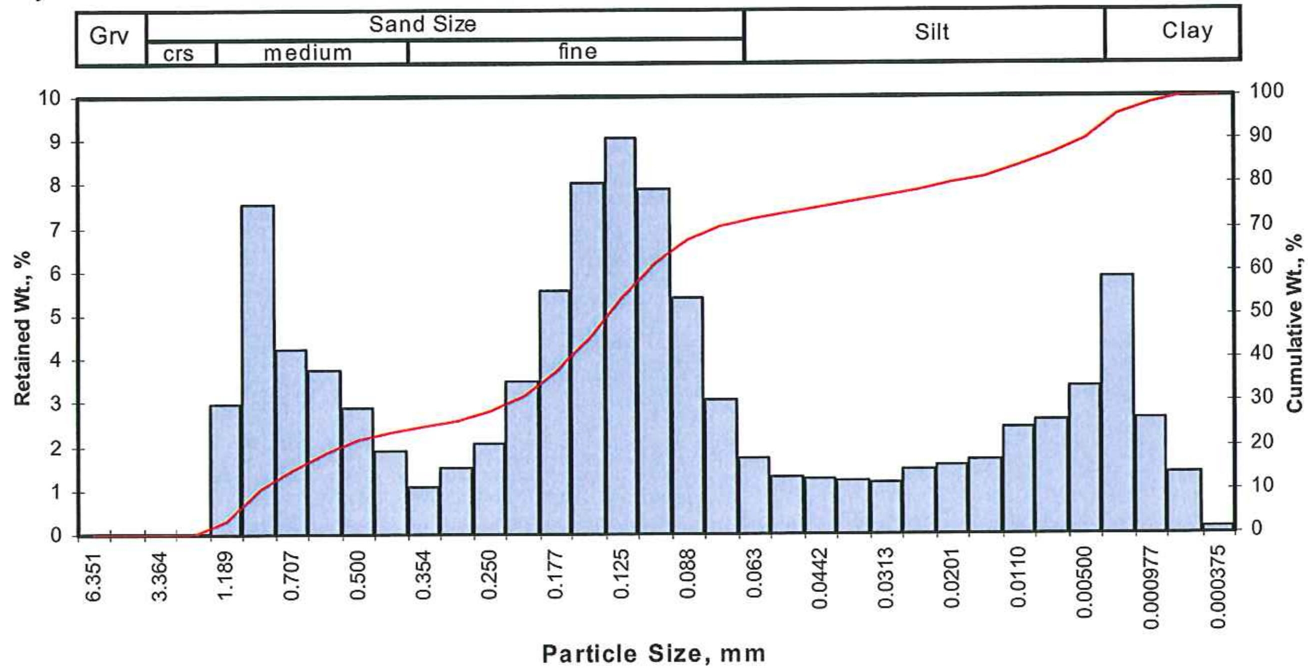
			Median	Particle Size Distribution, wt. percent						Silt
		Mean Grain Size	Grain Size		Sand Size					&
Sample ID	Depth, ft.	Description (1)	mm	Gravel	Coarse	Medium	Fine	Silt	Clay	Clay
AN-GT-2 S-5	N/A	Fine sand	0.135	0.00	0.00	23.30	47.08	19.62	10.01	29.63

(1) Based on Mean from Trask

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Anchor Environmental, L.L.C..	**PTS File No:**	37232
Project:	Port Hueneme	**Sample ID:**	AN-GT-2 S-5
Project No:	060374-01	**Depth, ft:**	N/A



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	2.98	2.98	2.98
0.0331	0.841	0.25	20	7.56	7.56	10.54
0.0278	0.707	0.50	25	4.23	4.23	14.77
0.0234	0.595	0.75	30	3.75	3.75	18.52
0.0197	0.500	1.00	35	2.89	2.89	21.41
0.0166	0.420	1.25	40	1.89	1.89	23.30
0.0139	0.354	1.50	45	1.07	1.07	24.37
0.0117	0.297	1.75	50	1.50	1.50	25.87
0.0098	0.250	2.00	60	2.06	2.06	27.93
0.0083	0.210	2.25	70	3.48	3.48	31.41
0.0070	0.177	2.50	80	5.57	5.57	36.98
0.0059	0.149	2.75	100	8.00	8.00	44.98
0.0049	0.125	3.00	120	9.04	9.04	54.01
0.0041	0.105	3.25	140	7.90	7.90	61.91
0.0035	0.088	3.50	170	5.40	5.40	67.31
0.0029	0.074	3.75	200	3.06	3.06	70.37
0.0025	0.063	4.00	230	1.73	1.73	72.10
0.0021	0.053	4.25	270	1.28	1.28	73.38
0.00174	0.0442	4.50	325	1.23	1.23	74.61
0.00146	0.0372	4.75	400	1.19	1.19	75.80
0.00123	0.0313	5.00	450	1.15	1.15	76.95
0.000986	0.0250	5.32	500	1.48	1.48	78.43
0.000790	0.0201	5.64	635	1.54	1.54	79.97
0.000615	0.0156	6.00		1.69	1.69	81.66
0.000435	0.0110	6.50		2.40	2.40	84.06
0.000308	0.00781	7.00		2.57	2.57	86.63
0.000197	0.00500	7.65		3.36	3.36	89.99
0.000077	0.00195	9.00		5.85	5.85	95.84
0.000038	0.000977	10.00		2.65	2.65	98.49
0.000019	0.000488	11.00		1.37	1.37	99.86
0.000015	0.000375	11.38		0.14	0.14	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	-0.12	0.0427	1.084
10	0.21	0.0339	0.862
16	0.58	0.0263	0.668
25	1.61	0.0129	0.329
40	2.59	0.0065	0.166
50	2.89	0.0053	0.135
60	3.19	0.0043	0.110
75	4.58	0.0016	0.042
84	6.49	0.0004	0.011
90	7.65	0.0002	0.005
95	8.81	0.0001	0.002

Measure	Trask	Inman	Folk-Ward
Median, phi	2.89	2.89	2.89
Median, in.	0.0053	0.0053	0.0053
Median, mm	0.135	0.135	0.135
Mean, phi	2.43	3.53	3.32
Mean, in.	0.0073	0.0034	0.0039
Mean, mm	0.185	0.086	0.100
Sorting	2.805	2.953	2.828
Skewness	0.868	0.219	0.272
Kurtosis	0.167	0.511	1.229
Grain Size Description (ASTM-USCS Scale)	Fine sand (based on Mean from Trask)		

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	23.30
Fine Sand	200	47.08
Silt	>0.005 mm	19.62
Clay	<0.005 mm	10.01
	Total	**100**

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PTS File No: 37285
Client: Anchor Environmental, L.L.C..

MOISTURE CONTENT

(METHODOLOGY: ASTM D 2216))

PROJECT NAME: Port Hueneme
PROJECT NO: 060374-01

SAMPLE ID.	ANALYSES DATE	DEPTH, ft.	MATRIX	TARE WEIGHT, grams	WET SAMPLE + TARE WEIGHT, grams	DRY SAMPLE + TARE WEIGHT, grams	MOISTURE CONTENT, percent dry weight
AN-GT-5 S3	04/10/07	N/A	SOIL	1.03	34.46	29.69	16.6
AN-GT-5 S4	04/10/07	N/A	SOIL	1.02	29.78	24.44	22.8
AN-GT-4 Comp	04/10/07	N/A	SOIL	1.01	35.33	30.16	17.7
AN-GT-5 Comp	04/10/07	N/A	SOIL	1.03	32.49	27.69	18.0

PTS Laboratories

PTS File No: 37285
Client: Anchor Environmental, L.L.C..

ATTERBERG LIMITS DATA - FINE FRACTION < No. 40 SIEVE

(METHODOLOGY: ASTM D4318)

PROJECT NAME: Port Hueneme
PROJECT NO: 060374-01

SAMPLE ID.	DEPTH, ft.	ATTERBERG LIMITS			USCS / PLASTICITY CHART SYMBOL (Fines: <#40 Sieve)
		LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	
AN-GT-5 S3	N/A	6.5	NON-PLASTIC		NP

PTS Laboratories, Inc.

Anchor Environmental, L.L.C.
PTS File No: 37285

PARTICLE SIZE SUMMARY

(METHODOLOGY: ASTM D422/D4464M)

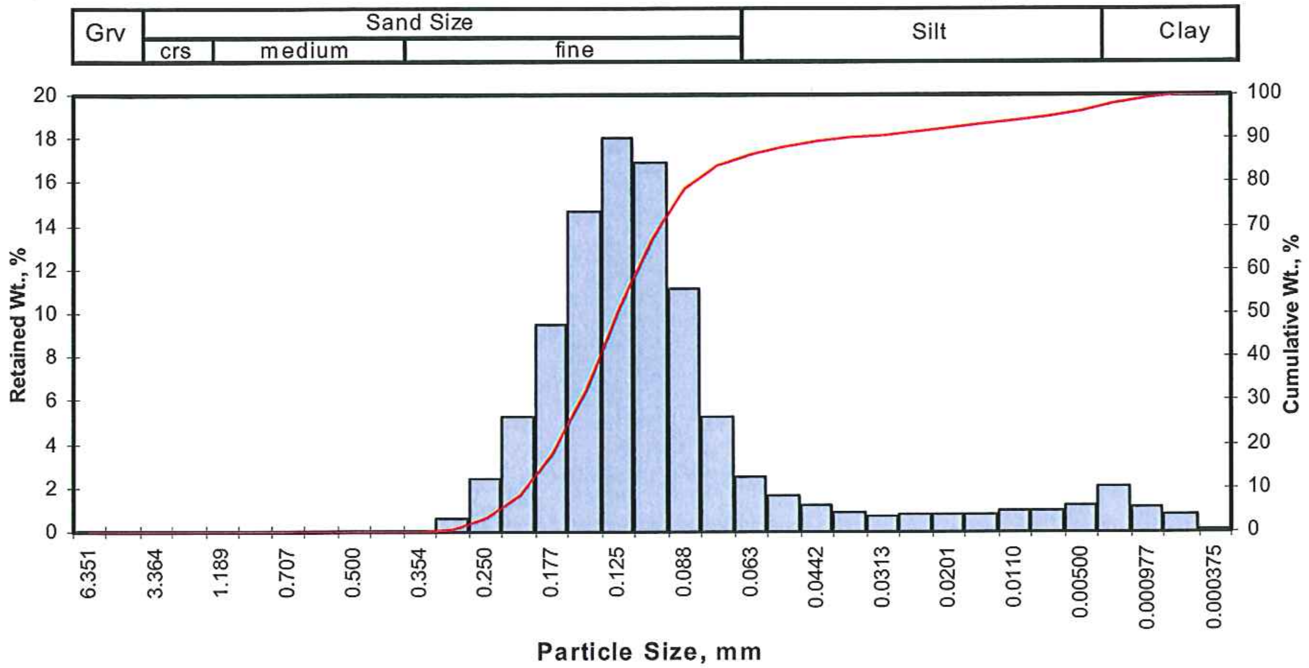
PROJECT NAME: Port Hueneme
PROJECT NO: 060374-01

Sample ID	Depth, ft.	Mean Grain Size Description (1)	Median Grain Size mm	Particle Size Distribution, wt. percent						Silt & Clay
				Gravel	Sand Size			Silt	Clay	
					Coarse	Medium	Fine			
AN-GT-5 S4	N/A	Fine sand	0.126	0.00	0.00	0.00	83.67	12.32	4.01	16.33
AN-GT-4 Comp	N/A	Fine sand	0.371	0.00	0.00	45.09	47.48	5.40	2.03	7.43
AN-GT-5 Comp	N/A	Fine sand	0.331	0.00	0.00	37.35	54.28	6.01	2.36	8.37

(1) Based on Mean from Trask

PTS Laboratories, Inc. — **Particle Size Analysis - ASTM D4464M**

Client:	Anchor Environmental, L.L.C.	**PTS File No:**	37285
Project:	Port Hueneme	**Sample ID:**	AN-GT-5 S4
Project No:	060374-01	**Depth, ft:**	N/A



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	0.00	0.00	0.00
0.0331	0.841	0.25	20	0.00	0.00	0.00
0.0278	0.707	0.50	25	0.00	0.00	0.00
0.0234	0.595	0.75	30	0.00	0.00	0.00
0.0197	0.500	1.00	35	0.00	0.00	0.00
0.0166	0.420	1.25	40	0.00	0.00	0.00
0.0139	0.354	1.50	45	0.01	0.01	0.01
0.0117	0.297	1.75	50	0.59	0.59	0.59
0.0098	0.250	2.00	60	2.43	2.43	3.02
0.0083	0.210	2.25	70	5.24	5.24	8.26
0.0070	0.177	2.50	80	9.48	9.48	17.74
0.0059	0.149	2.75	100	14.70	14.70	32.44
0.0049	0.125	3.00	120	18.00	17.99	50.43
0.0041	0.105	3.25	140	16.90	16.89	67.32
0.0035	0.088	3.50	170	11.10	11.10	78.42
0.0029	0.074	3.75	200	5.25	5.25	83.67
0.0025	0.063	4.00	230	2.53	2.53	86.20
0.0021	0.053	4.25	270	1.66	1.66	87.86
0.00174	0.0442	4.50	325	1.19	1.19	89.05
0.00146	0.0372	4.75	400	0.87	0.87	89.92
0.00123	0.0313	5.00	450	0.72	0.72	90.64
0.000986	0.0250	5.32	500	0.81	0.81	91.45
0.000790	0.0201	5.64	635	0.74	0.74	92.19
0.000615	0.0156	6.00		0.74	0.74	92.93
0.000435	0.0110	6.50		0.94	0.94	93.87
0.000308	0.00781	7.00		0.95	0.95	94.82
0.000197	0.00500	7.65		1.17	1.17	95.99
0.000077	0.00195	9.00		2.05	2.05	98.03
0.000038	0.000977	10.00		1.10	1.10	99.13
0.000019	0.000488	11.00		0.78	0.78	99.91
0.000015	0.000375	11.38		0.09	0.09	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	2.09	0.0092	0.234
10	2.30	0.0080	0.204
16	2.45	0.0072	0.182
25	2.62	0.0064	0.162
40	2.86	0.0054	0.138
50	2.99	0.0049	0.126
60	3.14	0.0045	0.113
75	3.42	0.0037	0.093
84	3.78	0.0029	0.073
90	4.78	0.0014	0.036
95	7.10	0.0003	0.007

Measure	Trask	Inman	Folk-Ward
Median, phi	2.99	2.99	2.99
Median, in.	0.0049	0.0049	0.0049
Median, mm	0.126	0.126	0.126
Mean, phi	2.97	3.12	3.08
Mean, in.	0.0050	0.0045	0.0047
Mean, mm	0.128	0.115	0.119
Sorting	1.319	0.664	1.091
Skewness	0.980	0.187	0.414
Kurtosis	0.206	2.769	2.567

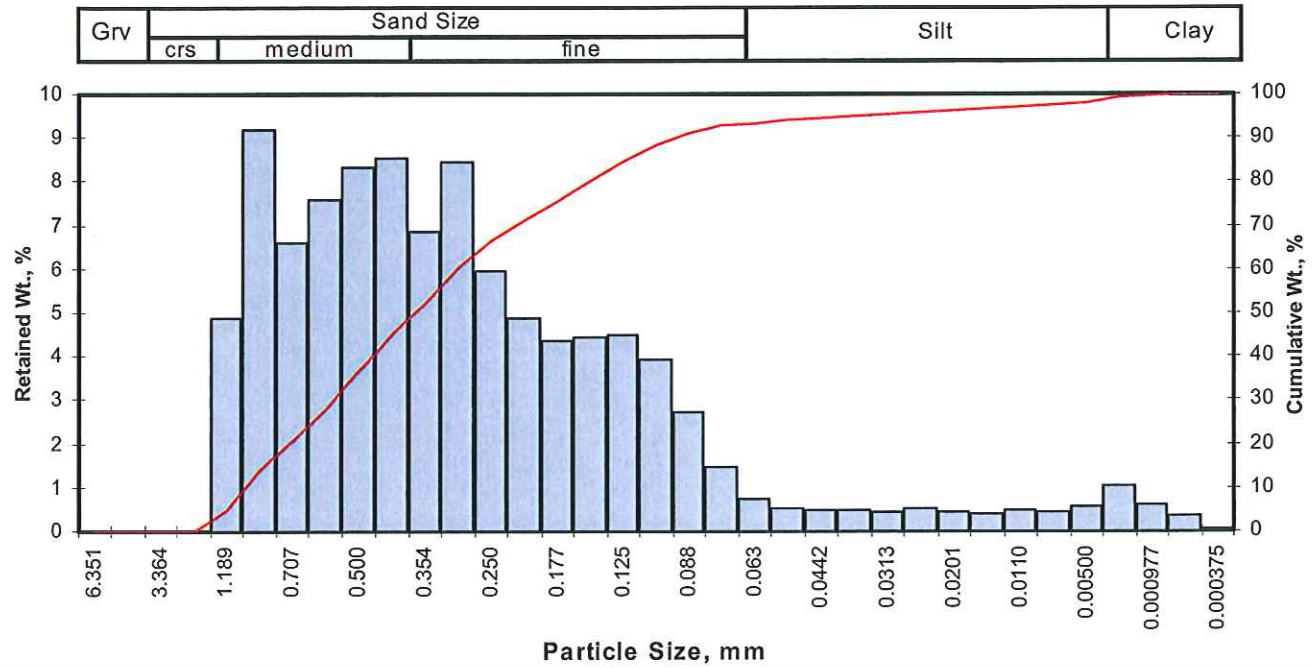
Grain Size Description (ASTM-USCS Scale)	Fine sand (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	0.00
Fine Sand	200	83.67
Silt	>0.005 mm	12.32
Clay	<0.005 mm	4.01
	Total	**100**

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Anchor Environmental, L.L.C.	**PTS File No:**	37285
Project:	Port Hueneme	**Sample ID:**	AN-GT-4 Comp
Project No:	060374-01	**Depth, ft:**	N/A



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	4.88	4.88	4.88
0.0331	0.841	0.25	20	9.19	9.19	14.07
0.0278	0.707	0.50	25	6.58	6.58	20.65
0.0234	0.595	0.75	30	7.57	7.57	28.22
0.0197	0.500	1.00	35	8.33	8.33	36.55
0.0166	0.420	1.25	40	8.54	8.54	45.09
0.0139	0.354	1.50	45	6.87	6.87	51.96
0.0117	0.297	1.75	50	8.44	8.44	60.40
0.0098	0.250	2.00	60	5.94	5.94	66.34
0.0083	0.210	2.25	70	4.87	4.87	71.21
0.0070	0.177	2.50	80	4.35	4.35	75.56
0.0059	0.149	2.75	100	4.43	4.43	79.99
0.0049	0.125	3.00	120	4.50	4.50	84.49
0.0041	0.105	3.25	140	3.91	3.91	88.40
0.0035	0.088	3.50	170	2.70	2.70	91.10
0.0029	0.074	3.75	200	1.47	1.47	92.57
0.0025	0.063	4.00	230	0.74	0.74	93.31
0.0021	0.053	4.25	270	0.50	0.50	93.81
0.00174	0.0442	4.50	325	0.49	0.49	94.30
0.00146	0.0372	4.75	400	0.49	0.49	94.79
0.00123	0.0313	5.00	450	0.45	0.45	95.24
0.000986	0.0250	5.32	500	0.50	0.50	95.74
0.000790	0.0201	5.64	635	0.41	0.41	96.15
0.000615	0.0156	6.00		0.38	0.38	96.53
0.000435	0.0110	6.50		0.46	0.46	96.99
0.000308	0.00781	7.00		0.44	0.44	97.43
0.000197	0.00500	7.65		0.54	0.54	97.97
0.000077	0.00195	9.00		1.04	1.04	99.01
0.000038	0.000977	10.00		0.61	0.61	99.62
0.000019	0.000488	11.00		0.35	0.35	99.97
0.000015	0.000375	11.38		0.04	0.03	100.00
TOTALS				**100.00**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	-0.24	0.0466	1.184
10	0.03	0.0386	0.980
16	0.32	0.0315	0.799
25	0.64	0.0252	0.640
40	1.10	0.0184	0.466
50	1.43	0.0146	0.371
60	1.74	0.0118	0.300
75	2.47	0.0071	0.181
84	2.97	0.0050	0.127
90	3.40	0.0037	0.095
95	4.87	0.0013	0.034

Measure	Trask	Inman	Folk-Ward
Median, phi	1.43	1.43	1.43
Median, in.	0.0146	0.0146	0.0146
Median, mm	0.371	0.371	0.371
Mean, phi	1.28	1.65	1.58
Mean, in.	0.0162	0.0126	0.0132
Mean, mm	0.410	0.319	0.336
Sorting	1.882	1.325	1.437
Skewness	0.916	0.166	0.256
Kurtosis	0.259	0.930	1.149
Grain Size Description (ASTM-USCS Scale)			Fine sand (based on Mean from Trask)

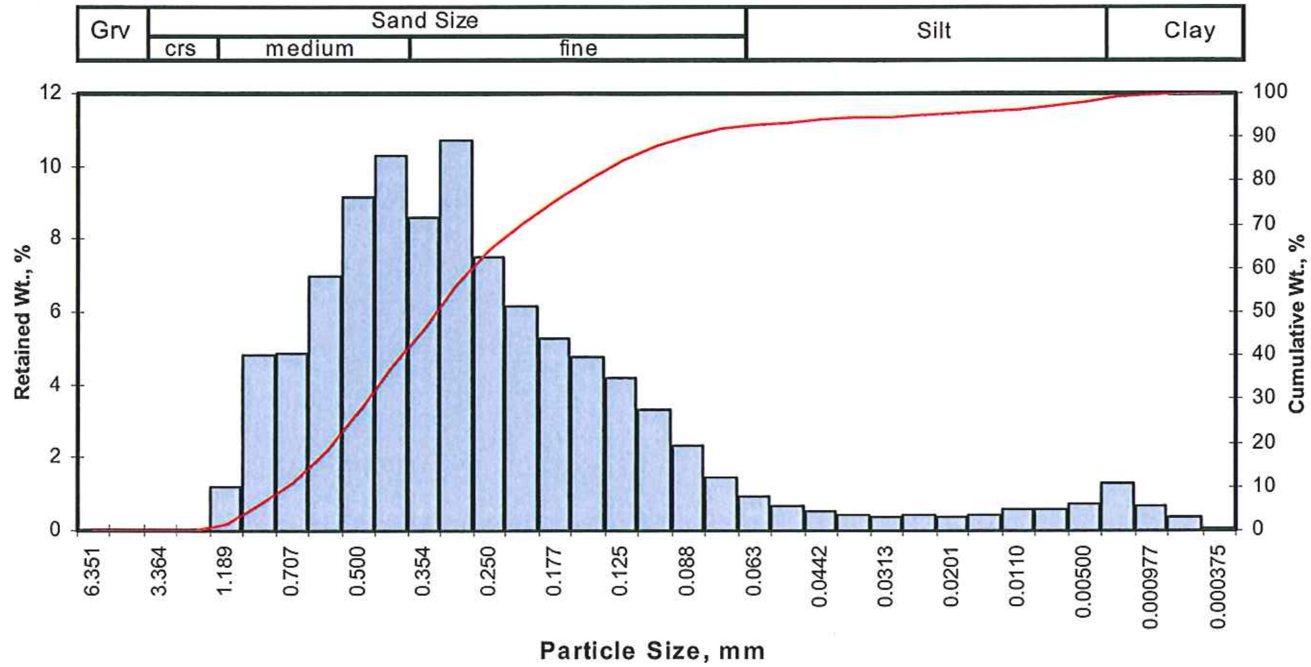
Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	45.09
Fine Sand	200	47.48
Silt	>0.005 mm	5.40
Clay	<0.005 mm	2.03
	Total	**100**

Phone: (562) 907-3607 Fax: (562) 907-3610

PTS Laboratories, Inc.

Particle Size Analysis - ASTM D4464M

Client:	Anchor Environmental, L.L.C.	**PTS File No:**	37285
Project:	Port Hueneme	**Sample ID:**	AN-GT-5 Comp
Project No:	060374-01	**Depth, ft:**	N/A



Opening Inches	Opening Millimeters	Phi of Screen	U.S. No.	Sample Weight, grams	Increment Weight, percent	Cumulative Weight, percent
0.2500	6.351	-2.67	1/4	0.00	0.00	0.00
0.1873	4.757	-2.25	4	0.00	0.00	0.00
0.1324	3.364	-1.75	6	0.00	0.00	0.00
0.0787	2.000	-1.00	10	0.00	0.00	0.00
0.0468	1.189	-0.25	16	1.20	1.20	1.20
0.0331	0.841	0.25	20	4.82	4.82	6.02
0.0278	0.707	0.50	25	4.89	4.89	10.90
0.0234	0.595	0.75	30	7.01	7.01	17.91
0.0197	0.500	1.00	35	9.15	9.14	27.06
0.0166	0.420	1.25	40	10.30	10.29	37.35
0.0139	0.354	1.50	45	8.59	8.59	45.93
0.0117	0.297	1.75	50	10.70	10.69	56.63
0.0098	0.250	2.00	60	7.51	7.51	64.13
0.0083	0.210	2.25	70	6.17	6.17	70.30
0.0070	0.177	2.50	80	5.28	5.28	75.58
0.0059	0.149	2.75	100	4.76	4.76	80.34
0.0049	0.125	3.00	120	4.20	4.20	84.53
0.0041	0.105	3.25	140	3.33	3.33	87.86
0.0035	0.088	3.50	170	2.31	2.31	90.17
0.0029	0.074	3.75	200	1.46	1.46	91.63
0.0025	0.063	4.00	230	0.94	0.94	92.57
0.0021	0.053	4.25	270	0.68	0.68	93.25
0.00174	0.0442	4.50	325	0.53	0.53	93.78
0.00146	0.0372	4.75	400	0.42	0.42	94.20
0.00123	0.0313	5.00	450	0.36	0.36	94.56
0.000986	0.0250	5.32	500	0.41	0.41	94.97
0.000790	0.0201	5.64	635	0.38	0.38	95.35
0.000615	0.0156	6.00		0.41	0.41	95.76
0.000435	0.0110	6.50		0.57	0.57	96.33
0.000308	0.00781	7.00		0.58	0.58	96.91
0.000197	0.00500	7.65		0.73	0.73	97.64
0.000077	0.00195	9.00		1.31	1.31	98.95
0.000038	0.000977	10.00		0.67	0.67	99.62
0.000019	0.000488	11.00		0.35	0.35	99.97
0.000015	0.000375	11.38		0.04	0.03	100.00
TOTALS				**100.10**	**100.00**	**100.00**

Cumulative Weight Percent greater than

Weight percent	Phi Value	Particle Size Inches	Particle Size Millimeters
5	0.14	0.0356	0.905
10	0.45	0.0287	0.730
16	0.68	0.0245	0.623
25	0.94	0.0205	0.520
40	1.33	0.0157	0.399
50	1.60	0.0130	0.331
60	1.86	0.0108	0.275
75	2.47	0.0071	0.180
84	2.97	0.0050	0.128
90	3.48	0.0035	0.090
95	5.35	0.0010	0.025

Measure	Trask	Inman	Folk-Ward
Median, phi	1.60	1.60	1.60
Median, in.	0.0130	0.0130	0.0130
Median, mm	0.331	0.331	0.331
Mean, phi	1.51	1.83	1.75
Mean, in.	0.0138	0.0111	0.0117
Mean, mm	0.350	0.282	0.298
Sorting	1.699	1.143	1.360
Skewness	0.925	0.201	0.322
Kurtosis	0.265	1.276	1.395

Grain Size Description (ASTM-USCS Scale)	Fine sand (based on Mean from Trask)

Description	Retained on Sieve #	Weight Percent
Gravel	4	0.00
Coarse Sand	10	0.00
Medium Sand	40	37.35
Fine Sand	200	54.28
Silt	>0.005 mm	6.01
Clay	<0.005 mm	2.36
	Total	**100**

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Sample Description

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual–manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:
Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT, additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance.
Soil density/consistency in test pits is estimated based on visual observation and is presented parenthetically on the test pit logs.

SAND or GRAVEL Density	Standard Penetration Resistance (N) in Blows/Foot	SILT or CLAY Consistency	Standard Penetration Resistance (N) in Blows/Foot	Approximate Shear Strength in TSF
Very loose	0 – 4	Very soft	0 – 2	<0.125
Loose	4 – 10	Soft	2 – 4	0.125 – 0.25
Medium dense	10 – 30	Medium stiff	4 – 8	0.25 – 0.5
Dense	30 – 50	Stiff	8 – 15	0.5 – 1.0
Very dense	>50	Very stiff	15 – 30	1.0 – 2.0
		Hard	>30	>2.0

Moisture

Dry	Little perceptible moisture
Damp	Some perceptible moisture, probably below optimum
Moist	Probably near optimum moisture content
Wet	Much perceptible moisture, probably above optimum

Minor Constituents

Minor Constituents	Estimated Percentage
Not identified in description	0 – 5
Slightly (clayey, silty, etc.)	5 – 12
Clayey, silty, sandy, gravelly	12 – 30
Very (clayey, silty, etc.)	30 – 50

Legends

Sampling Test Symbols

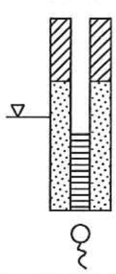
BORING SAMPLES

- Split Spoon
- Shelby Tube
- Cuttings
- Core Run
- * No Sample Recovery
- P Tube Pushed, Not Driven

TEST PIT SAMPLES

- Grab (Jar)
- Bag
- Shelby Tube

Groundwater Observations



Surface Seal

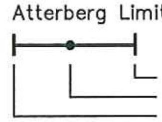
Groundwater Level on Date (ATD) At Time of Drilling

Observation Well Tip or Slotted Section

Groundwater Seepage (Test Pits)

Test Symbols

NS	No Sheen
SS	Slight Sheen
MS	Moderate Sheen
HS	Heavy Sheen
TCD	Triaxial Consolidated Drained
QU	Unconfined Compression
DS	Direct Shear
K	Permeability
PP	Pocket Penetrometer Approximate Compressive Strength in TSF
TV	Torvane Approximate Shear Strength in TSF
CBR	California Bearing Ratio
MD	Moisture Density Relationship
AL	Atterberg Limits



PID	Photoionization Detector Reading
CA	Chemical Analysis
DT	*In Situ* Density Test

ANCHOR ENVIRONMENTAL, L.L.C.

Figure A-1
Key to Exploration Logs
Port Hueneme

GEOTECHNICS INC 2002

100% SUBMITTAL

LOG OF EXPLORATION BORING NO. B-1

Logged by: MA — Date Drilled: 2/20/2002
Equipment Used: 8-inch Diameter Hollow Stem Auger — Elevation: 13' msl

DEPTH (FT)	BLOWS PER FT	DESCRIPTION	LAB TESTS
0–3	12	3-inches Asphaltic Concrete over 7" Crushed Aggregate Base. FILL: Silty sand (SM), red-brown to gray, moist, fine to medium, some gravel, loose to medium dense	(PID: ND)
3–6.5	8, 4	Poorly graded sand (SP), brown, moist, fine to medium, loose	(PID: ND) (PID: ND)

Total depth: 6-1/2 feet
Groundwater not encountered
Backfilled: 2/20/02

LOG OF EXPLORATION BORING NO. B-2

Logged by: MA — Date Drilled: 2/20/2002
Equipment Used: 8-inch Diameter Hollow Stem Auger — Elevation: 13' msl

DEPTH (FT)	BLOWS PER FT	DESCRIPTION	LAB TESTS
0–3	43	4-1/2-inches Asphaltic Concrete over 3" Crushed Aggregate Base. FILL: Silty sand (SM), red-brown to gray, moist, fine to medium, some gravel, rock in bottom of shoe, dense	(PID: ND)
3–6.5	17, 4	Poorly graded sand (SP), brown, moist, fine to medium, medium dense, some gravel; moist to wet, light brown, no gravel, loose	(PID: ND) (PID: ND)

Total depth: 6-1/2 feet
Groundwater not encountered
Backfilled: 2/20/02

PROJECT NO. 0730-001-00 — GEOTECHNICS INCORPORATED — FIGURE B-1

LOG OF EXPLORATION BORING NO. B-3

Logged by: MA — Date Drilled: 2/26/2002
Equipment Used: 8-inch Diameter Hollow Stem Auger — Elevation: 13' msl

DEPTH (FT)	BLOWS PER FT	DESCRIPTION	LAB TESTS
0–2		4-inches Asphaltic Concrete over 7" Crushed Aggregate Base. FILL: Silty sand (SM), red-brown to gray, moist, fine to medium, some gravel, dense	(PID: ND)
2–6.5	33, 14, 8	Poorly graded sand (SP), brown, dry to moist, fine to medium, loose to medium dense	Sulfate, pH, Resistivity, Chloride (PID: ND) (PID: ND)

Total depth: 6-1/2 feet
Groundwater not encountered
Backfilled: 2/26/02

LOG OF EXPLORATION BORING NO. B-4

Logged by: MA — Date Drilled: 2/26/2002
Equipment Used: 8-inch Diameter Hollow Stem Auger — Elevation: 13' msl

DEPTH (FT)	BLOWS PER FT	DESCRIPTION	LAB TESTS
0–4.5	12, 10	4-inches Asphaltic Concrete over 6" Crushed Aggregate Base. FILL: Silty sand (SM), brown, moist, fine to medium, trace to some gravel, loose to medium dense	(PID: 2.8) Sulfate, pH, Resistivity, Chloride, R-Value (Mix B-5) (PID: 1.7)

Total depth: 4-1/2 feet
Groundwater not encountered
Backfilled: 2/26/02

PROJECT NO. 0730-001-00 — GEOTECHNICS INCORPORATED — FIGURE B-2

LOG OF EXPLORATION BORING NO. B-5

Logged by: MA — Date Drilled: 2/26/2002
Equipment Used: 8-inch Diameter Hollow Stem Auger — Elevation: 13' msl

DEPTH (FT)	BLOWS PER FT	DESCRIPTION	LAB TESTS
0–2.5	17	4-1/2-inches Asphaltic Concrete over 4" Crushed Aggregate Base. FILL: Silty sand with gravel (SM), brown, moist, fine to medium, trace gravel, medium dense	(PID: ND)
2.5–4.5	10	Silty sand (SM), brown, moist, fine to medium, micaceous, loose	(PID: ND)

Total depth: 4-1/2 feet
Groundwater not encountered
Backfilled: 2/26/02

LOG OF EXPLORATION BORING NO. B-6

Logged by: MA — Date Drilled: 2/26/2002
Equipment Used: 8-inch Diameter Hollow Stem Auger — Elevation: 13' msl

DEPTH (FT)	BLOWS PER FT	DESCRIPTION	LAB TESTS
0–2.5	17	3-inches Asphaltic Concrete over 4" Crushed Aggregate base over 3-inches Asphaltic Concrete. FILL: Silty sand (SM), red-brown, moist, fine to medium, some gravel, dense	(PID: 1.1) Gradation
2.5–6.5	8, 1	Silty sand (SM), brown, moist, very fine to medium, trace gravel, loose; Brown to dark gray, very loose	(PID: 1.8) (PID: ND)

Total depth: 6-1/2 feet
Groundwater not encountered
Backfilled: 2/26/02

PROJECT NO. 0730-001-00 — GEOTECHNICS INCORPORATED — FIGURE B-3

LOG OF EXPLORATION BORING NO. B-7

Logged by: MA — Date Drilled: 2/26/2002
Equipment Used: 8-inch Diameter Hollow Stem Auger — Elevation: 13' msl

DEPTH (FT)	BLOWS PER FT	DESCRIPTION	LAB TESTS
0–4.5	13, 4	4-1/2 inches Asphaltic Concrete over 5" Crushed Aggregate Base. FILL: Poorly graded sand (SP), brown to gray, moist, fine to coarse, medium dense	(PID: ND) Sulfate, pH, Resistivity, Chloride, R-Value (Mix B-8, 9) (PID: ND)

Total depth: 4-1/2 feet
Groundwater not encountered
Backfilled: 2/26/02

LOG OF EXPLORATION BORING NO. B-8

Logged by: MA — Date Drilled: 2/26/2002
Equipment Used: 8-inch Diameter Hollow Stem Auger — Elevation: 13' msl

DEPTH (FT)	BLOWS PER FT	DESCRIPTION	LAB TESTS
0–6.5	21, 8, 4	3-inches Asphaltic Concrete over 5" Crushed Aggregate Base. FILL: Poorly graded sand (SP), brown to grey, moist, fine to medium, trace gravel, medium dense; fine to coarse, loose; very loose	(PID: 0.4) (PID: 0.4) (PID: ND)

Total depth: 6-1/2 feet
Groundwater not encountered
Backfilled: 2/26/02

PROJECT NO. 0730-001-00 — GEOTECHNICS INCORPORATED — FIGURE B-4

LOG OF EXPLORATION BORING NO. B-9

Logged by: MA — Date Drilled: 2/20/2002
Equipment Used: 8-inch Diameter Hollow Stem Auger — Elevation: 13' msl

DEPTH (FT)	BLOWS PER FT	DESCRIPTION	LAB TESTS
0–3	35	4-1/2 inches Asphaltic Concrete over 5" Crushed Aggregate Base. FILL: Silty sand (SM), grey-brown, moist, fine to medium, some gravel, dense	(PID: ND) Gradation
3–6.5	11, 5	Poorly graded sand (SP), brown, moist, fine to coarse, loose to medium dense, trace gravel; no gravel, loose	(PID: 0.6) (PID: ND)

Total depth: 6-1/2 feet
Groundwater not encountered
Backfilled: 2/20/02

LOG OF EXPLORATION BORING NO. B-10

Logged by: MA — Date Drilled: 2/20/2002
Equipment Used: 8-inch Diameter Hollow Stem Auger — Elevation: 13' msl

DEPTH (FT)	BLOWS PER FT	DESCRIPTION	LAB TESTS
0–4.5	15, 17	4-inches Asphaltic Concrete over 5" Crushed Aggregate Base. FILL: Silty sand (SM), brown, moist, fine to medium, trace fine gravel, medium dense; no gravel	(PID: ND) Sulfate, pH, Resistivity, Chloride, R-Value (Mix B-11) (PID: ND)

Total depth: 4-1/2 feet
Groundwater not encountered
Backfilled: 2/20/02

PROJECT NO. 0730-001-00 — GEOTECHNICS INCORPORATED — FIGURE B-5

LOG OF EXPLORATION BORING NO. B-11

Logged by: MA — Date Drilled: 2/20/2002
Equipment Used: 8-inch Diameter Hollow Stem Auger — Elevation: 13' msl

DEPTH (FT)	BLOWS PER FT	DESCRIPTION	LAB TESTS
0–3	18	5-inches Asphaltic Concrete over 5" Crushed Aggregate Base. FILL: Silty sand (SM), grey-brown, moist, fine to medium, some gravel, medium dense	(PID: ND) Max. Density (Mix B-2, 3) (Mix B-9, 11)
3–6.5	7, 6	Poorly graded sand (SP), brown, moist, fine to medium, loose, trace gravel	(PID: ND) (PID: ND)

Total depth: 6-1/2 feet
Groundwater not encountered
Backfilled: 2/20/02

LOG OF EXPLORATION BORING NO.

Logged by: — Date Drilled:
Equipment Used: — Elevation:

DEPTH (FT)	BLOWS PER FT	DRIVE SAMPLE	BULK SAMPLE	DENSITY (PCF)	MOISTURE (%)	DESCRIPTION	LAB TESTS

PROJECT NO. 0730-001-00 — GEOTECHNICS INCORPORATED — FIGURE B-6

REVISIONS				
SYMBOL	DESCRIPTION	PREP. BY	DATE	APPROVED
			4/12/02	

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST DIVISION
SAN DIEGO, CALIFORNIA

MCON P-532
PORT IMPROVEMENTS
BORING LOGS (1 OF 2)

WINZLER & KELLY — PH (707) 523-1010, FAX (707) 527-8679

DSGN MM | DR WC | CHK
SUBMITTED BY | DATE
PL | CM | FP
BRANCH MGR | DR

SATISFACTORY TO — DATE
APPROVED — DATE
SW DIV FOR COMMANDER NAVFAC

SIZE D
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT—SCALE REDUCED ACCORDINGLY
CODE IDENT. NO. 80091
PROJ. LOCATION NBVC PORT HUENEME
CONSTR. CONTR. NO. N68711-02-C-2013
SPEC. 11022013
NAVFAC DWG. NO. 8180793
SHEET 24 OF
GT-601

LOG OF EXPLORATION BORING NO. 12

Logged by: MA
Method of Drilling: 8-inch diameter hollow-stem auger
Date Drilled: 2/27/2002
Elevation: +/- 13' MSL

DEPTH (FT)	BLOWS PER FT	DRIVE SAMPLE	BULK SAMPLE	DENSITY (PCF)	MOISTURE (%)	DESCRIPTION	LAB TESTS
0						12" Reinforced Concrete Slab	
2	21	SPT	X			Fill: Crushed Aggregate Base (CAB), brown, fine to coarse, moist, medium dense	(PID: ND)
4	13	SPT	X			Poorly graded sand (SP), yellow to brown, fine to coarse, some gravel, moist, medium dense	(PID: ND)
6	7	SPT			▽	Wet at 6', loose	(PID: ND)
11	12	SPT				medium to coarse, loose to medium dense	Gradation (PID: ND)
16	26	SPT				Poorly graded gravel (GP), pink/purple, up to 3" diameter, angular some sand, wet, medium dense	Gradation (PID: ND)
21	14	SPT				medium dense	(PID: ND)
25	47	SPT				dense, refusal at 27 feet	(PID: ND)

Total depth: 27 feet
Groundwater at 6 feet
Backfilled: 2/27/02

PROJECT NO. 0730-001-00 GEOTECHNICS INCORPORATED FIGURE B-7

LOG OF EXPLORATION BORING NO. 13

Logged by: MA
Method of Drilling: 8-inch diameter hollow-stem auger
Date Drilled: 2/27/2002
Elevation: +/- 13' MSL

DEPTH (FT)	BLOWS PER FT	DRIVE SAMPLE	BULK SAMPLE	DENSITY (PCF)	MOISTURE (%)	DESCRIPTION	LAB TESTS
0						12" Reinforced Concrete Slab	
2	40	SPT				Fill: Crushed Aggregate Base (CAB), brown, fine to coarse, moist, dense	(PID: ND)
4	17	SPT				Poorly graded sand (SP), fine to coarse, trace gravel, moist, medium dense	(PID: ND)
6	11	SPT			▽	Wet at 6' loose to medium dense	(PID: ND)
11	11	SPT				loose to medium dense	(PID: ND)
16	15	SPT				Poorly graded gravel (GP), pink/purple, up to 2" diameter, angular some sand, medium dense	(PID: ND)
21	8	SPT				loose	(PID: ND)
25	9	SPT				loose, refusal at 27 feet	(PID: ND)

Total depth: 27 feet
Groundwater at 6 feet
Backfilled: 2/27/02

PROJECT NO. 0730-001-00 GEOTECHNICS INCORPORATED FIGURE B-8

LOG OF EXPLORATION BORING NO. 14

Logged by: MA
Method of Drilling: 8-inch diameter hollow-stem auger
Date Drilled: 2/27/2002
Elevation: +/- 13' MSL

DEPTH (FT)	BLOWS PER FT	DRIVE SAMPLE	BULK SAMPLE	DENSITY (PCF)	MOISTURE (%)	DESCRIPTION	LAB TESTS
0						12" Reinforced Concrete Slab	
2	23	SPT	X			Fill: Crushed Aggregate Base (CAB), brown, fine to coarse, moist, medium dense	(PID: ND)
4	17	SPT	X			Poorly graded sand (SP), brown, fine to coarse, moist, medium dense	(PID: ND)
6	9	SPT	X			loose, trace fine gravel	(PID: ND)
9	6	SPT			▽	loose, wet	Gradation (PID: ND)
13	20	SPT				Poorly graded gravel (GP), pink/purple, up to 2" diameter, angular, some sand, medium dense	Gradation (PID: ND)
16	18	SPT				medium dense	(PID: ND)
21	22	SPT				medium dense Refusal at 23 feet on cobble	(PID: ND)

Total depth: 2? feet
Groundwater at 8 feet
Backfilled: 2/27/02

PROJECT NO. 0730-001-00 GEOTECHNICS INCORPORATED FIGURE B-9

REVISIONS				
APPROVED	DATE	PREP. BY	DESCRIPTION	SYMBOL
	4/15/02			

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
SOUTHWEST DIVISION
SAN DIEGO, CALIFORNIA

WINZLER & KELLY
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FAX (707) 527-8679

DSGN MM | DR WC | CHK
SUBMITTED BY | DATE
PL | CM | FP
BRANCH MGR | DIR

SATISFACTORY TO ____ DATE
APPROVED ____ DATE
SW DIV FOR COMMANDER NAVFAC

MCON P-532
PORT IMPROVEMENTS
BORING LOGS (2 OF 2)

100% SUBMITTAL

SIZE D
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT– SCALE REDUCED ACCORDINGLY

CODE IDENT. NO. 80091
PROJ. LOCATION NBVC PORT HUENEME
CONSTR. CONTR. NO. N68711-02-C-2013
SPEC. 11022013
NAVFAC DWG. NO. 8180794
SHEET 25 OF
GT-602

DAMES & MOORE 1985

BORING B-6

SURFACE ELEVATION : +14 FEET

Depth in Feet	Tests Reported Elsewhere	Liquid Limit (%)	Plasticity Index (%)	Type of Test	Normal or Confining Pressure (PSF)	Shear Strength (PSF)	Deviator Stress (PSF)	Moisture Content (%)	Dry Density (PCF)	Blows/Ft.	Symbols	Description
0										14	SM	REDDISH-BROWN SILTY FINE-TO-MEDIUM SAND WITH A TRACE OF COARSE SAND AND WEATHERED GRAVEL (MEDIUM DENSE)
0–5	SA							26	98	20		GRADING TO BROWN
5–10	SA									3	ML	BROWN CLAYEY SILT WITH SOME FINE SAND (MEDIUM STIFF)
10–15	SA									8	SP	GREY FINE-TO-COARSE SAND (MEDIUM DENSE)
15–20	SA											GRADING TO (DENSE)
20–25	SA									23		
25–30	SA									28		GRADING WITH SOME FINE GRAVEL
30–35	SA									50	SM	DARK GREY SILTY FINE SAND WITH A TRACE OF MICA (DENSE)
35–40	SA							30	95	24		
40–45	SA									32		
45–50	SA			TX/CU	1500	226		44	77	9	ML	GREENISH-GREY FINE SANDY SILT WITH A TRACE OF MICA (LOOSE)
50–55				TV		720				6	SP	DARK GREY MEDIUM-TO-COARSE SAND WITH SOME FINE GRAVEL (LOOSE)
55–60								29	95	40	SC	DARK GREY CLAYEY FINE SAND WITH A TRACE OF MICA (DENSE)
60–65										42	SP	DARK GREY FINE SAND (DENSE)
65–70								38	85	46		GRADING WITH A TRACE OF SHELL FRAGMENTS
70–75										8	CL	DARK GREY TO BROWNISH-GREEN SILTY CLAY WITH A TRACE OF SAND (MEDIUM STIFF)
75–80				TV		1100				8		

LOG OF BORINGS

PORT HUENEME, CALIFORNIA

Dames & Moore

PLATE A-6a

BORING B-6 (CONT.)

DEPTH IN FEET	TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	STRENGTH TEST DATA: TYPE OF TEST	STRENGTH TEST DATA: NORMAL OR CONFINING PRESSURE (PSF)	STRENGTH TEST DATA: SHEAR STRENGTH (PSF)	STRENGTH TEST DATA: DEVIATOR STRESS (PSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	BLOWS/FT.	SAMPLE	SYMBOLS	DESCRIPTION
80										11	■	ML	DARK GREY FINE SANDY SILT WITH A TRACE OF CLAY (MEDIUM DENSE)
85										8	■		GRADING CLAYEY WITH LESS SAND
90										41	■	SP	DARK GREY MEDIUM-TO-COARSE SAND WITH A TRACE OF MICA (DENSE)
95													
100								30	98	60	■		
105													
110	C	62	26							10	■	MH	DARK GREENISH-GREY FINE CLAYEY SILT WITH A TRACE OF SAND AND MICA (MEDIUM STIFF)
115													
120										70	■	SP	GREY TO BROWN MEDIUM-TO-COARSE SAND (VERY DENSE)
125													
130	C	45	13							25	■	ML	DARK GREENISH-GREY SANDY CLAYEY SILT WITH A TRACE OF MICA (DENSE)
135													
140										32	■	SM	DARK GREY SILTY FINE-TO-MEDIUM SAND (DENSE)
145													

BORING COMPLETED AT A DEPTH OF 144½ FEET ON NOVEMBER 14, 1984
NO CAVING OBSERVED

LOG OF BORINGS

PORT HUENEME, CALIFORNIA

Dames & Moore

PLATE A-6b

BORING B-8

SURFACE ELEVATION : +15 FEET

LABORATORY TEST DATA

DEPTH IN FEET	TESTS REPORTED ELSEWHERE	ATTERBERG LIMITS: LIQUID LIMIT (%)	ATTERBERG LIMITS: PLASTICITY INDEX (%)	STRENGTH TEST DATA: TYPE OF TEST	STRENGTH TEST DATA: NORMAL OR CONFINING PRESSURE (PSF)	STRENGTH TEST DATA: SHEAR STRENGTH (PSF)	STRENGTH TEST DATA: DEVIATOR STRESS (PSF)	MOISTURE CONTENT (%)	DRY DENSITY (PCF)	BLOWS/FT.	SAMPLE
0	SA									36	■
5	SA									22	■
10	SA									14	■
15	SA			DS	1500 3000	1488 2496				22	■
20	SA									35	■
25	SA									36	■
30	SA							20	74	35	■
35	SA									21	■
40	SA							29	92	33	■
45	SA									30	■
50										42	■
55								32	90	23	■
60										75	■
65										39	■
70											
75										15	■
80											

SYMBOLS	DESCRIPTION
SP	BROWN FINE-TO-MEDIUM SAND WITH SOME SILT AND SOME CEMENTATION (DENSE)
ML	DARK BROWN SANDY SILT WITH A TRACE OF WOOD DEBRIS (DENSE)
SP	LIGHT BROWN FINE-TO-MEDIUM SAND (MEDIUM DENSE)
	GRADING TO GREY
	GRADING WITH COARSE SANDY GRAVEL AND TO (DENSE)
	GRADING WITHOUT SANDY GRAVEL
	GRADING WITH SOME COARSE SAND
	GRADING WITHOUT COARSE SAND
	GRADING WITH A TRACE OF SILT
ML	DARK GREENISH-GREY FINE SANDY SILT WITH A TRACE OF MICA (MEDIUM DENSE)
CL	DARK GREY SILTY CLAY (MEDIUM STIFF)

LOG OF BORINGS

PORT HUENEME, CALIFORNIA

Dames & Moore

PLATE A-8a

BORING B-8 (CONT.)

Depth in Feet	Tests Reported Elsewhere	Atterberg Limits: Liquid Limit [%]	Atterberg Limits: Plasticity Index [%]	Strength Test Data: Type of Test	Strength Test Data: Normal or Confining Pressure [PSF]	Strength Test Data: Shear Strength [PSF]	Strength Test Data: Deviator Stress [PSF]	Moisture Content [%]	Dry Density [PCF]	Blows/Ft.	Sample	Symbols	Description
80				TV		1400		46	80	6	■	CL	DARK GREY SILTY CLAY (MEDIUM DENSE)
85										30	■	SP	DARK GREY FINE SAND WITH A TRACE OF SILT (VERY DENSE)
90				DS	3000	2923				65	■		GRADING WITH INTERLAYERS OF GRAVEL AND COARSE SAND
95				DS	6000	6120				77	■		
100										80	■		BORING COMPLETED AT A DEPTH OF 101½ FEET ON NOVEMBER 15, 1984 NO CAVING OBSERVED
105													

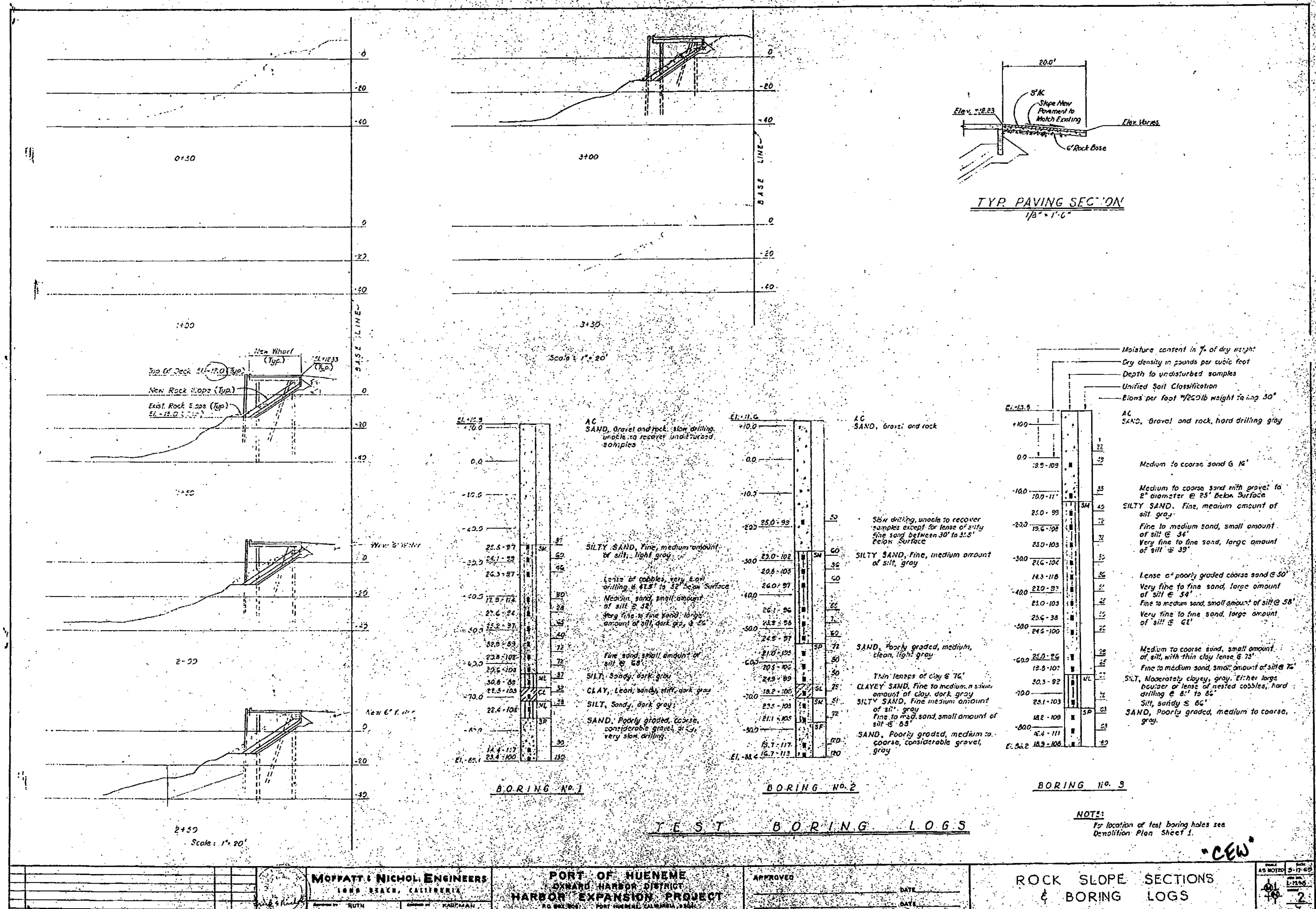
LOG OF BORINGS

PORT HUENEME, CALIFORNIA

Dames & Moore

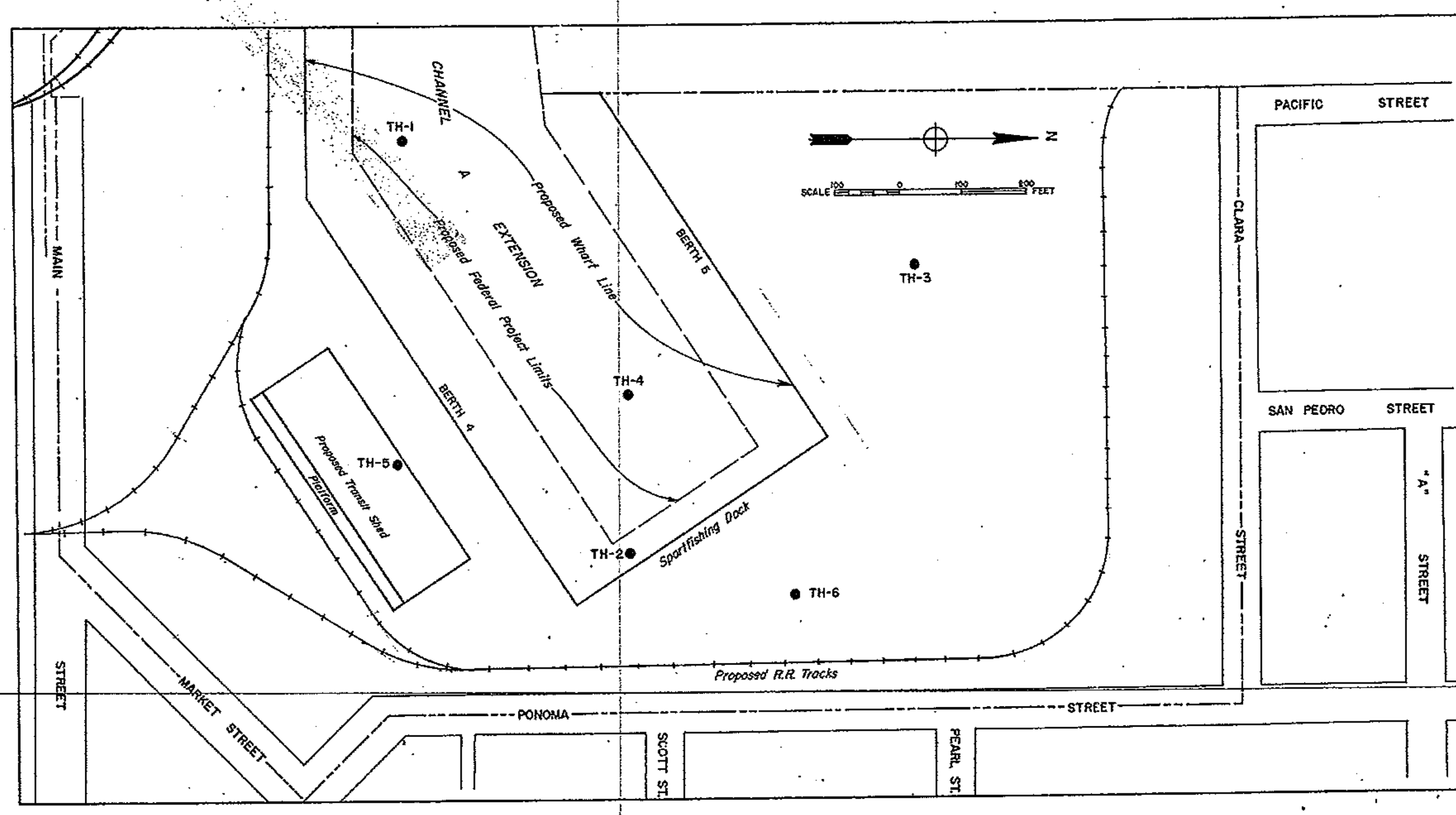
PLATE A-8b

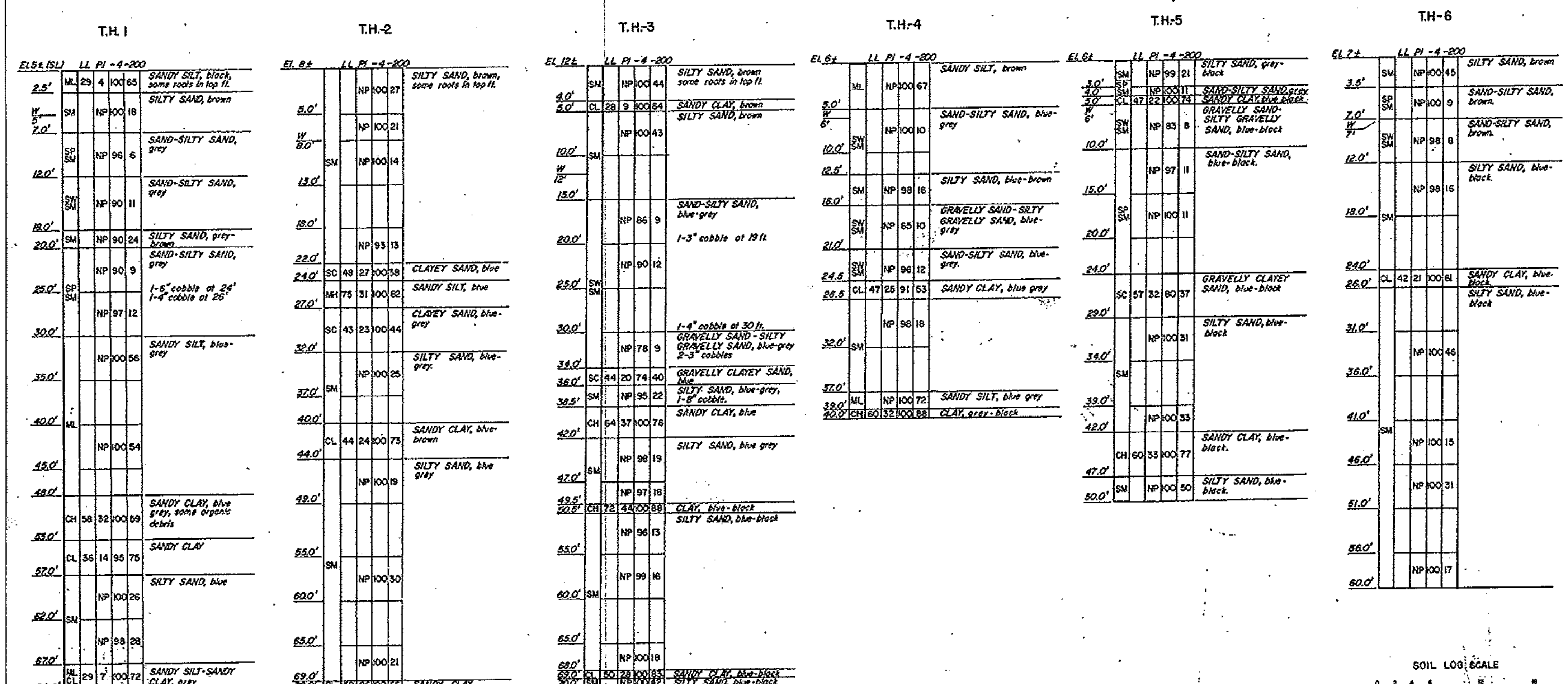
MOFFOTT & NICHOL 1965



0+50
1+00
1+50
2+00
2+50
Scale: 1" = 20'
3+00
3+50
Scale: 1" = 20'
BASE LINE
New Wharf (Typ.)
Top of Deck El. +12.0 (Typ.)
New Rock Slope (Typ.)
Exist. Rock Slope (Typ.)
TYP. PAVING SECTION
1/8" = 1'-0"
20.0'
Slope New Pavement to Match Existing
Elev. Varies
6" Rock Base
Moisture content in % of dry weight
Dry density in pounds per cubic foot
Depth to undisturbed samples
Unified Soil Classification
Blows per foot w/250 lb weight falling 30"
AC
SAND, Gravel and rock, slow drilling, unable to recover undisturbed samples
SILTY SAND, Fine, medium amount of silt, light gray
SILT, Sandy, dark gray
CLAY, Lean, sandy, stiff, dark gray
SAND, Poorly graded, coarse, considerable gravel, very slow drilling
BORING No. 1
AC
SAND, Gravel and rock
SILTY SAND, Fine, medium amount of silt, gray
SAND, Poorly graded, medium, clean, light gray
CLAYEY SAND, Fine to medium
SAND, Poorly graded, medium to coarse, considerable gravel, gray
BORING No. 2
AC
SAND, Gravel and rock, hard drilling gray
Medium to coarse sand @ 16'
SILTY SAND, Fine, medium amount of silt, gray
SILT, Moderately clayey, gray
SAND, Poorly graded, medium to coarse, gray
BORING No. 3
TEST BORING LOGS
NOTE:
For location of test boring holes see Demolition Plan Sheet 1.
"CEW"
MOFFATT & NICHOL ENGINEERS
LONG BEACH, CALIFORNIA
PORT OF HUENEME
OXNARD HARBOR DISTRICT
HARBOR EXPANSION PROJECT
APPROVED
DATE
ROCK SLOPE SECTIONS
& BORING LOGS
AS NOTED
2

USACE 1965





UNIFIED SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS More than half of material is larger than no. 200 sieve size.	GRAVELS More than half of coarse fraction is larger than no. 4 sieve size.	Clean gravels	GW	Well-graded gravels, gravel-sand mixtures, little or no fines.
			GP	Poorly-graded gravels, gravel-sand mixtures, little or no fines.
		Gravels with fines	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels, gravel-sand-clay mixtures.
	SANDS More than half of coarse fraction is smaller than no. 4 sieve size.	Clean sands	SW	Well-graded sands, gravelly sands, little or no fines.
			SP	Poorly-graded sands, gravelly sands, little or no fines.
		Sands with fines	SM	Silty sands, sand-silt mixtures.
			SC	Clayey sands, sand-clay mixtures.
FINE GRAINED SOILS More than half of material is smaller than no. 200 sieve size.	SILTS AND CLAYS	Low liquid limit.	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts, with slight plasticity.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and organic silty clays of low plasticity.
		High liquid limit.	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity, organic silts.
Highly organic soils			Pt	Peat and other highly organic soils.

NOTES:

1. Boundary Classification: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example, GW-GC, well-graded gravel-sand mixture with clay binder.

2. All sieve sizes on this chart are U. S. Standard.

3. The terms "silt" and "clay" are used respectively to distinguish materials exhibiting lower plasticity from those with higher plasticity. The minus no. 200 sieve material is silt if the liquid limit and plasticity index plot below the "A" line on the plasticity chart (Plate 2, Technical Memorandum No. 3-357), and is clay if the liquid limit and plasticity index plot above the "A" line on the chart.

4. For a complete description of the Unified Soil Classification System, see "Technical Memorandum No. 3-357," prepared for Office, Chief of Engineers by Waterways Experiment Station, Vicksburg, Mississippi, March 1953.

LEGEND

T.H.-1 ●	LOCATION AND NUMBER OF TEST HOLE.
W/D	DEPTH TO GROUND WATER.
LL	LIQUID LIMIT.
PI	PLASTICITY INDEX (LIQUID LIMIT MINUS PLASTIC LIMIT).
NP	NONPLASTIC
-4	PERCENT OF MATERIAL BY WEIGHT PASSING NO. 4 SIEVE.
-200	PERCENT OF MATERIAL BY WEIGHT PASSING NO. 200 SIEVE.

GENERAL NOTES

1. Test holes were drilled March 1965.

2. Test holes were drilled with a bucket type power auger similar to Calweld #100, manufactured by California Welding and Blacksmith Shop, Inc., Los Angeles. Bucket diameter was 16".

3. Drilling mud was used in all test holes.

4. For additional description of conditions encountered, see detailed logs on file in the Los Angeles District Office.

PORT HUENEME HARBOR, CALIFORNIA
REVIEW OF REPORTS

FOUNDATION EXPLORATIONS

U.S. ARMY ENGINEER DISTRICT, LOS ANGELES, CALIF.

SUBMITTED:	RECOMMENDED:	APPROVED:
CHIEF, FDN. & MAT'LS. BRANCH	CHIEF, ENGINEERING DIVISION	COLONEL, C.E., DISTRICT ENGINEER

DRAWN	TRACED	CHECKED	TO ACCOMPANY REPORT	FILE NO. (D.O. SERIES)
DGS	B.C.M.	G.O.W.	DATED: APRIL 1, 1968	F-2406

USACE 2006

Mudline

LOCATION: N 1887912 E 571980	ELEVATION AND DATUM (meters):MLLW -10.7
LATITUDE: 34° 08' 34.1"	LONGITUDE: 119° 12' 55.4"
EQUIPMENT: KLI Vibrocore ~~Water depth~~ 12.2	SAMPLING METHOD: Vibrocore ~~Tidal~~ +1.85
RECOVERED SAMPLE LENGTH (meters): 4.3	PENETRATION (meters): 4.4
DATE: 10/7/6	DRIVE SAMPLER DIAMETER (centimeters) ID: OD: 10cm
OPERATOR: Kinnetic Labs, Inc.	LOGGED BY: JL CHECKED BY:

Elevation (meter-MLLW)	Depth (meter)	Sampler	Symbol	Penetration (minutes/meter)	Field Unc. Comp. Str. (tsf)	Tests	DESCRIPTION	Lab Sample Type/Depth (m)	Recovery (meter/meter)	Sample Condition	Time	PID- sample/ [Background]	Other
-10.7							Silty Sand (SM); dark greenish gray / greenish gray, wet, loose to medium dense, fine-grained sand.	① -10.7 ~ -11.7			11:15		
	0.5												
	1		1.0					② -11.7 ~ -12.2			11:20		
Top 1.5m)	1.5		1.5					③ -12.2 ~ -13.2			11:25		
	2												
	2.5		2.5					④ -13.2 ~ -14.7			11:30		
	3						interbedded silt (ML) layer (1cm); black, medium plasticity, firm @3.15m						
Bottom 3.5m)	3.5		3.5					⑤ -14.7 ~ -15.2			11:35		
	4												
	4.5		4.5										

LOG OF VIBRACORE PHHVC06-01

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Port Hueneme
Project No. 2006-029.~~02~~ 03

PLATE
1

Template: VCO2-FIELD; Prj ID: 2006-023.02.GPJ

Mudline

LOCATION: N 1887992 E 572061	ELEVATION AND DATUM (meters):MLLW -11.5
LATITUDE: 34° 08' 36.4"	LONGITUDE: 119° 12' 51.7"
EQUIPMENT: KLI Vibrocore Water depth 12.5	SAMPLING METHOD: Vibrocore Tidal 4.1.0
RECOVERED SAMPLE LENGTH (meters): 2.82	PENETRATION (meters): 2.88
DATE: 10/7/6	DRIVE SAMPLER DIAMETER (centimeters) ID: OD: 10cm
OPERATOR: Kinnetic Labs, Inc.	LOGGED BY: JL CHECKED BY:

Elevation (meter-MLLW)	Depth (meter)	Sampler	Symbol	Penetration (minutes/meter)	Field Unc. Comp. Str. (tsf)	Tests	DESCRIPTION	Lab Sample Type/Depth (m)	Recovery (meter/meter)	Sample Condition	Time	PID- sample/ [Background]	Other
11.5							Silty Sand (SM); dark greenish gray wet, loose to medium dense, fine-grained sand	① -11.5 ~ -12.2			16:00		
Top (0.7m)	0.5	*	0.7					② -12.2 ~ -13.2			16:05		
	1												
	1.5	*	1.7										
	2							③ -13.2 ~ -14.2			16:10		
	2.5						trace coarse-grained sand (1.5mm) @2.5m						
Bottom (2.7m)		*	2.7										
		*	2.82					④ -14.2 ~ -14.3			16:15		
	3												
	4												

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Port Hueneme

Project No. 2006-029.~~02~~ 03

PLATE

2

Template: VCO2-FIELD; Prj ID: 2006-023.02.GPJ

Mudline

LOCATION: N 1888093 E 571961	ELEVATION AND DATUM (meters):MLLW -11.7
LATITUDE: 34° 08' 34"	LONGITUDE: 119° 12' 48.3"
EQUIPMENT: KLI Vibrocore Water depth 13.5	SAMPLING METHOD: Vibrocore Tidal +1.8
RECOVERED SAMPLE LENGTH (meters): 4.55	PENETRATION (meters): 4.84
DATE: 10/7/6	DRIVE SAMPLER DIAMETER (centimeters) ID: OD: 10 cm
OPERATOR: Kinnetic Labs, Inc.	LOGGED BY: JL CHECKED BY:

Elevation (meter-MLLW)	Depth (meter)	Sampler	Symbol	Penetration (minutes/meter)	Field Unc. Comp. Str. (tsf)	Tests	DESCRIPTION	Lab Sample Type/Depth (m)	Recovery (meter/meter)	Sample Condition	Time	PID- sample/ [Background]	Other
-11.7							Sandy Silt (ML); dark gray, wet soft to firm, low plasticity, fine-grained sand, trace wood pieces	① -11.7 ~ -12.2			13:35		
Top (0.5m)	0.5	*	0.5				interbedded organic layer (2 cm); black @ 0.37m	② -12.2 ~ -13.2			13:40		
	1						interbedded organic layer (2cm); black @ 0.65m						
	1.5	*	1.5				dark greenish gray	③ -13.2 ~ -13.4			13:45		
		*	1.7				Silty Sand (SM); dark greenish gray, wet, loose to medium dense, fine-grained sand	④ -13.4 ~ -14.2			13:50		
	2						interbedded sandy silt (ML) layer (5cm); dark greenish gray, hard @2.22 ~2.27m						
Bottom (2.5m)	2.5	*	2.5					⑤ -14.2 ~ -15.2			13:55		
	3												
	3.5	*	3.5					⑥ -15.2 ~ -16.25			14:00		
	4						Interbedded sandy silt (ML) layer (5cm); dark gray, hard, low plasticity, fine-grained sand						
	4.5	*	4.55										

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Project No. 2006-029.03

PLATE

3

Template: VCO2-FIELD; Prj ID: 2006-023.02.GPJ

Mudline

LOCATION: N 1888233 E 572161	ELEVATION AND DATUM (meters):MLLW -11.45
LATITUDE: 34° 08' 40.2"	LONGITUDE: 119° 12' 42.8"
EQUIPMENT: KLI Vibrocore ~~Water depth~~ 11.7	SAMPLING METHOD: Vibrocore Tidal +0.25
RECOVERED SAMPLE LENGTH (meters): 2.7	PENETRATION (meters): 3.3
DATE: 10/7/6	DRIVE SAMPLER DIAMETER (centimeters) ID: OD: 10cm
OPERATOR: Kinnetic Labs, Inc.	LOGGED BY: JL CHECKED BY:

Elevation (meter-MLLW)	Depth (meter)	Sampler	Symbol	Penetration (minutes/meter)	Field Unc. Comp. Str. (tsf)	Tests	DESCRIPTION	Lab Sample Type/Depth (m)	Recovery (meter/meter)	Sample Condition	Time	PID-sample/ [Background]	Other
-11.45					0		Silt (ML); dark gray, wet, very soft, medium plasticity, trace seashell (1.5cm) interbedded organic layer (5cm); black @ 0.5m	① -11.45 ~ -12.05			16:45		
	0.5		0.6										
Top (0.75m)			0.75				Sandy Silt (ML); dark greenish gray, wet, soft, nonplastic, fine-grained sand	② -12.05 ~ -12.2			16:50		
	1						Silty Sand (SM); dark greenish gray, wet, loose to medium dense, fine-grained sand interbedded silt (ML) layer; dark gray, firm, medium plasticity (5 cm) @ 1.05 ~ 1.1 m	③ -12.2 ~ -13.2			16:55		
	1.5		1.75										
	2							④ -13.2 ~ -14.15			17:00		
	2.5		2.7										
	4												

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PLATE

4

Template: VCO2-FIELD; Prj ID: 2006-023.02.GPJ

Mudline

LOCATION: N 1888311 E 572281	ELEVATION AND DATUM (meters):MLLW -9.55
LATITUDE: 34' 08' 42.5"	LONGITUDE: 119° 12' 41.9"
EQUIPMENT: KLI Vibrocore Water depth 9.4	SAMPLING METHOD: Vibrocore Tidal -0.15
RECOVERED SAMPLE LENGTH (meters): 3.75	PENETRATION (meters): 4.24
DATE: 10/7/6	DRIVE SAMPLER DIAMETER (centimeters) ID: OD: 10cm
OPERATOR: Kinnetic Labs, Inc.	LOGGED BY: JL CHECKED BY:

Elevation (meter-MLLW)	Depth (meter)	Sampler	Symbol	Penetration (minutes/meter)	Field Unc. Comp. Str. (tsf)	Tests	DESCRIPTION	Lab Sample Type/Depth (m)	Recovery (meter/meter)	Sample Condition	Time	PID- sample/ [Background]	Other
-9.55							Silty Sand (SM); dark greenish gray, wet, loose to medium dense, fine-grained sand, trace wood pieces	① -9.55 ~ -10.55			17:45		
	0.5												
	1	1.0						② -10.55 ~ -11			17:50		
Top (1.45m)	1.5	1.45						③ -11 ~ -12			17:55		
	2												
	2.5	2.45						④ -12 ~ -12.15			18:00		
		2.6					Poorly graded sand with silt (SP-SM); dark greenish gray, wet, medium dense, fine- to coarse-grained sand (max. 1.5mm), trace fine to coarse gravel (max. 2cm)	⑤ -12.15 ~ -13			18:05		
	3												
Bottom (3.45m)	3.5	3.45					Silty Sand (SM); dark greenish gray, wet medium dense, fine-grained sand	⑥ -13 ~ -13.3			18:10		
		3.75											
	4												

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PLATE 5

LOCATION: N 1888313 E 572421		ELEVATION AND DATUM (meters):MLLW -10.38	
LATITUDE: 34° 08' 48.6"	Water depth 10.3	LONGITUDE: 119° 12' 39.9"	Tidal -0.08
EQUIPMENT: KLI Vibrocore		SAMPLING METHOD: Vibrocore	
RECOVERED SAMPLE LENGTH (meters): 2.46		PENETRATION (meters): 3.48	
DATE: 10/7/6		DRIVE SAMPLER DIAMETER (centimeters) ID: OD: 10cm	
OPERATOR: Kinnetic Labs, Inc.		LOGGED BY: JL	CHECKED BY:

10.38

Top (0.62m)

Elevation (meter-MLLW)	Depth (meter)	Sampler	Symbol	Penetration (minutes/meter)	Field Unc. Comp. Str. (tsf)	Tests	DESCRIPTION	Lab Sample Type/Depth (m)	Recovery (meter/meter)	Sample Condition	Time	PID- sample/ [Background]	Other
	0.5		.062			0	Elastic silt (MH); dark gray, wet very soft, medium plasticity,	① -10.38 ~ -11			18:55		
	1						Silty Sand (SM); dark greenish gray, loose to medium dense, fine-grained sand	② -11 ~ -12.03			19:00		
	1.5		1.65			0	Silt w/ sand (ML); dark gray, wet, soft, medium plasticity, fine- to medium-grained sand	③ -12.03 ~ -12.18			19:05		
	2		1.8				Poorly graded sand with silt (SP-SM); dark greenish gray, medium dense, fine- to medium-grained sand	④ -12.18 ~ -12.34			19:10		
	2.5		2.46										
	4												

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PLATE

6

Mudline

LOCATION: N 1888495 E 572521	ELEVATION AND DATUM (meters):MLLW -10.68
LATITUDE: 34° 08' 50.1" ~~Water depth~~	LONGITUDE: 119° 12' 33.9" ~~Tidal stage~~
EQUIPMENT: KLI Vibrocore 12.2 m	SAMPLING METHOD: Vibrocore +1.52m
RECOVERED SAMPLE LENGTH (meters): 3.71	PENETRATION (meters): 3.93
DATE: 10/8/6	DRIVE SAMPLER DIAMETER (centimeters) ID: OD: 10 cm
OPERATOR: Kinnetic Labs, Inc.	LOGGED BY: JL CHECKED BY:

10.68 Top (0.32m)

Bottom (2.32m)

Elevation (meter-MLLW)	Depth (meter)	Sampler	Symbol	Penetration (minutes/meter)	Field Unc. Comp. Str. (tsf)	Tests	DESCRIPTION	Lab Sample Type/Depth (m)	Recovery (meter/meter)	Sample Condition	Time	PID-sample/ [Background]	Other
			0.32		0		Elastic silt (MH); black, very soft, wet, medium plasticity, trace seashell fragments (3 cm), strong organic odor	① -10.68 ~ -11			9:20		
	0.5				0		interbedded organic layer (5 cm); black, fish scale @ 1.0m	② -11 ~ -11.88			9:30		
	1		1.2		0		Organic layer with sand; black, soft, mostly fish scale, trace seashell frag, fine-grained sand, few plastic trash (6cm x 12cm), strong organic odor	③ -11.88 ~ -12.21			9:40		
	1.5		1.53 / 1.77				Well graded sand with silt (SW-SM); greenish gray, loose to medium dense, fine- to coarse-grained sand trace seashell fragment (0.3cm)	④ -12.21 ~ -12.45			9:50		
	2 / 2.5		2.32				Silty Sand (SM); dark greenish gray, medium dense, fine-grained sand	⑤ -12.45 ~ -13			10:00		
	3							⑥ -13 ~ -13.98			10:10		
	3.5		3.3 / 3.6 / 3.71				Well graded sand with silt (SW-SM); dark greenish gray, loose to medium dense, fine- to coarse grained sand (max. 1mm), trace seashell fragment (max. 1cm)	⑦ -13.98 ~ -14.28			10:20		
	4						Well graded sand with silt and seashell fragment (SW-SM); dark greenish gray, medium dense, fine- to coarse-grained sand (max. 2mm) seashell frag. (max 1 ~ 1.5cm), trace coarse gravel (4cm), interbedded silt (ML) layer (3cm), dark greenish gray, medium plasticity	⑧ -14.28 ~ -14.39			10:30		

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PLATE 7

Template: VCO2-FIELD; Prj ID: 2006-023.02.GPJ

LOCATION: N 1888417 E 572561	ELEVATION AND DATUM (meters):MLLW Mudline -10.41
LATITUDE: 34° 08' 53.1"	LONGITUDE: 119° 12' 35.9"
EQUIPMENT: KLI Vibrocore Water depth 12.25	SAMPLING METHOD: Vibrocore Tidal +1.84
RECOVERED SAMPLE LENGTH (meters): 3.84	PENETRATION (meters): 4.09
DATE: 10/8/6	DRIVE SAMPLER DIAMETER (centimeters) ID: OD: 10cm
OPERATOR: Kinnetic Labs, Inc.	LOGGED BY: JL CHECKED BY:

Elevation (meter-MLLW)	Depth (meter)	Sampler	Symbol	Penetration (minutes/meter)	Field Unc. Comp. Str. (tsf)	Tests	DESCRIPTION	Lab Sample Type/Depth (m)	Recovery (meter/meter)	Sample Condition	Time	PID- sample/ [Background]	Other
10.41					0		Elastic silt (MH); black, wet, very soft, medium plasticity, trace wood pieces	① -10.41 ~ -11			11:55		
Top (0.59m)	0.5	0.59						② -11 ~ -11.56			12:00		
	1	1.15					Silty Sand (SM) and interbedded silt (ML); dark gray, loose / soft, fine-grained sand, medium plasticity	③ -11.56 ~ -12.17			12:05		
	1.5												
		1.76			0		Lean clay (CL); dark greenish gray, soft, medium plasticity	④ -12.17 ~ -12.39			12:10		
	2	1.98					Poorly graded sand with silt (SP-SM) and interbedded silt (ML); dark greenish gray, loose to medium dense / firm, fine- to medium-grained sand, medium plasticity, few seashell fragments (max. 2cm)	⑤ -12.39 ~ -13			12:15		
Bottom (2.59m)	2.5	2.59						⑥ -13 ~ -13.16			12:20		
		2.75											
	3	3.0					Poorly graded sand (SP), dark greenish gray, medium dense, fine- to medium grained sand	⑦ -13.16 ~ -13.41			12:25		
	3.5						Silty Sand (SM) and interbedded silt (ML); dark greenish gray, medium dense, fine-grained sand, medium plasticity	⑧ -13.41 ~ -14.25			12:30		
		3.84											
	4												

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PLATE

8

Template: VCO2-FIELD; Prj ID: 2006-023.02.GPJ

Mudline

LOCATION: N 1888452 E 572640		ELEVATION AND DATUM (meters):MLLW	-10.37m
LATITUDE: 34° 08' 55.7"		LONGITUDE: 119° 12' 34.3"	
EQUIPMENT: KLI Vibrocore	Water depth 12.35	SAMPLING METHOD: Vibrocore	Tidal stage +1.98
RECOVERED SAMPLE LENGTH (meters): 2.0		PENETRATION (meters): 2.73	
DATE: 10/8/6		DRIVE SAMPLER DIAMETER (centimeters) ID:	OD: 10cm
OPERATOR: Kinnetic Labs, Inc.		LOGGED BY: JL	CHECKED BY:

Margin notes: -10.37; Top (0.33m); Bottom (1.33m)

Elevation (meter-MLLW)	Depth (meter)	Sampler	Symbol	Penetration (minutes/meter)	Field Unc. Comp. Str. (tsf)	Tests	DESCRIPTION	Lab Sample Type/Depth (m)	Recovery (meter/meter)	Sample Condition	Time	PID-sample/ [Background]	Other
		0.33					Sandy Silt (ML); dark gray, wet, very soft, low plasticity, fine-grained sand	① -10.37 ~ -10.7			1:20		
	0.5							② -10.7 ~ -11.17			1:25		
	1	0.8					Silty Sand (SM); dark gray, loose, fine-grained sand interbedded silt (ML) layer (3cm) @ 1.06m	③ -11.17 ~ -11.62			1:30		
		1.25			0								
	1.5	1.33			1		Silt with sand (ML); olive/dark gray, soft, low plasticity, fine-grained sand, trace wood pieces (max 5cm)	④ -11.62 ~ -11.7			1:35		
		1.72						⑤ -11.7 ~ -12.09			1:40		
	2	2.0					Silty Sand (SM); dark greenish gray, loose to medium dense, fine-grained sand	⑥ -12.09 ~ -12.37			1:45		
	4							4					

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Port Hueneme

Project No. 2006-029.~~02~~ 03

PLATE

9

Template: VCO2-FIELD; Prj ID: 2006-023.02.GPJ

LOCATION: N 1888592 E 572901	ELEVATION AND DATUM (meters):MLLW Mudline -10.4
LATITUDE: 34°09'03.7"	LONGITUDE: 119°12'29.5"
EQUIPMENT: KLI Vibrocore Water depth 11.7	SAMPLING METHOD: Vibrocore Tidal stage +1.3
RECOVERED SAMPLE LENGTH (meters): 2.31	PENETRATION (meters): 2.75
DATE: 10/8/6	DRIVE SAMPLER DIAMETER (centimeters) ID: OD: 10 cm
OPERATOR: Kinnetic Labs, Inc.	LOGGED BY: JL CHECKED BY:

Elevation (meter-MLLW)	Depth (meter)	Sampler	Symbol	Penetration (minutes/meter)	Field Unc. Comp. Str. (tsf)	Tests	DESCRIPTION	Lab Sample Type/Depth (m)	Recovery (meter/meter)	Sample Condition	Time	PID- sample/ [Background]	Other
-10.4							Sandy Silt (ML); dark gray, very soft, medium plasticity, fine-grained sand trace coarse gravel (3cm)	① -10.4 ~ -10.7			15:05		
Top (0.3m)	0.5		0.3					② -10.7 ~ -11.35			15:45		
	1		0.95				Poorly graded sand with silt (SP-SM); dark gray / dark greenish gray, loose to medium dense, fine- to medium-grained sand trace seashell frag.	③ -11.35 ~ -11.7			15:10		
Bottom (1.3m)	1.5		1.3					④ -11.7 ~ -12.71			15:15		
	2						interbedded silt (ML) layer (4cm) @ 2.2m; olive						
			2.31										
	4												

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PLATE
10

Template: VC02-FIELD; Prj ID: 2006-023.02.GPJ

Mudline

LOCATION: N 1888712 E 572819	ELEVATION AND DATUM (meters):MLLW -10.5
LATITUDE: 34° 09' 02 "	LONGITUDE: 119° 12' 25.8 "
EQUIPMENT: KLI Vibrocore ~~Water depth~~ 12.2	SAMPLING METHOD: Vibrocore ~~Tidal stage~~ +1.7
RECOVERED SAMPLE LENGTH (meters): 2.6	PENETRATION (meters): 2.72
DATE: 10/8/6	DRIVE SAMPLER DIAMETER (centimeters) ID: OD: 10 cm
OPERATOR: Kinnetic Labs, Inc.	LOGGED BY: JL CHECKED BY:

Elevation (meter-MLLW)	Depth (meter)	Sampler	Symbol	Penetration (minutes/meter)	Field Unc. Comp. Str. (tsf)	Tests	DESCRIPTION	Lab Sample Type/Depth (m)	Recovery (meter/meter)	Sample Condition	Time	PID-sample/ [Background]	Other
10.5 Top (0.2m)			0.2				Silt w/ sand (ML); dark gray, wet very loose, medium plasticity, fine-grained sand	① -10.5 ~ -10.7			14:15		
	0.5		0.65					② -10.7 ~ -11.15			14:20		
bottom (1.2m)	1		1.2				Silty Sand (SM); dark gray, loose, fine- to medium-grained sand, trace coarse-grained sand (max. 2mm), trace fine gravel (1 cm)	③ -11.15 ~ -11.7			14:25		
	1.5		1.35		0		Well graded sand with silt (SW-SM); dark greenish gray, loose, fine- to coarse-grained sand (max. 2mm), few coarse gravel (max. 3cm)	④ -11.7 ~ -11.85			14:30		
	2		1.77				Silt (ML); olive/dark greenish gray, soft medium plasticity, trace fine-grained sand	⑤ -11.85 ~ -12.27			14:35		
	2.5		2.6				Silty Sand (SM); dark greenish gray, loose to medium dense, fine-grained sand	⑥ -12.27 ~ -13.1			14:40		
	4												

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PLATE
11

Template: VCO2-FIELD; Prj ID: 2006-023.02.GPJ

LOCATION: N 1888752 E 572620	ELEVATION AND DATUM (meters):MLLW Mudline -10.43
LATITUDE: 34° 08' 56.4"	LONGITUDE: 119° 02' 25.8"
EQUIPMENT: KLI Vibrocore Water depth 12.3	SAMPLING METHOD: Vibrocore Tidal stage +1.87
RECOVERED SAMPLE LENGTH (meters): 2.54	PENETRATION (meters): 2.88
DATE: 10/8/6	DRIVE SAMPLER DIAMETER (centimeters) ID: OD: 10cm
OPERATOR: Kinnetic Labs, Inc.	LOGGED BY: JL CHECKED BY:

Elevation (meter-MLLW)	Depth (meter)	Sampler	Symbol	Penetration (minutes/meter)	Field Unc. Comp. Str. (tsf)	Tests	DESCRIPTION	Lab Sample Type/Depth (m)	Recovery (meter/meter)	Sample Condition	Time	PID- sample/ [Background]	Other
10.43 Top 0.27m)	0.5		0.27 0.56				Poorly graded sand with silt (SP-SM); dark greenish gray, wet, loose to medium dense, fine- to coarse-grained sand (2mm), trace coarse gravel (2cm) trace seashell frag.	① -10.43 ~ -10.7 ② -10.7 ~ -10.99			15:40 15:45		
bottom 1.27m)	1 1.5		1.27				Silty Sand (SM) and interbedded silt (ML); dark gray, loose to medium dense/firm, fine-grained sand, medium plasticity	③ -10.99 ~ -11.7			15:50		
	2 2.5		1.8 2.5				Sandy silt (ML); dark greenish gray, hard to very hard, nonplastic, fine-grained sand dark olive brown (1.8 ~ 2.54m)	④ -11.7 ~ -12.23 ⑤ -12.23 ~ -12.93			15:55 16:00		
	4												

LOG OF VIBRACORE PHHVC06-12

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PLATE
12

OHD WHARVES 1 AND 2 2006

ANCHOR ENVIRONMENTAL, L.L.C.

Sediment Core Collection Form

Station ID:	PH-CS-01-06	**Date:**	9-14-06
Project Name:	Port Hueneme	**Project Number:**	060374-01
Coordinates: Lat/Northing	34 08.925	Long/Easting:	119 12.344
Vertical Datum	MLLW	MLW	Other:
Depth Measurement	Sounder	Leadline	34.5
Project Depth	40'	**Overdredge**	2'

	Attempt 1	Attempt 2	Attempt 3
Time:	1:00pm		
(A) Measured Water Depth	34.5		
(B) Tide Height	4.4		
(C) Mudline Elevation	30.1		
(-A+B = C include sign of tide height as reported)			
Estimated Penetration	10'		
Description of Core Drive			
Refusal Encountered?	Yes		
Total Core Length	9'		

Core Characteristics

Sediment Type	cobble, gravel, sand C M F , silt clay, organic matter	cobble, gravel, sand C M F , silt clay, organic matter	cobble, gravel, sand C M F , silt clay, organic matter
Sediment Color	gray, black, brown brown surface, olivine	gray, black, brown brown surface, olivine	gray, black, brown brown surface, olivine
Sediment Odor	None, slight, mod, strong H_2S, petroleum, septic	None, slight, mod, strong H_2S, petroleum, septic	None, slight, mod, strong H_2S, petroleum, septic
Any Layering Homogeneous			

Comments:

Target 40'

Heavy clay at ~ 39'

Recorded by: JLB

Visual Classification of Subsurface Core

ANCHOR ENVIRONMENTAL, L.L.C.

Job	Port Hueneme	Date 9-14-06	
Job No.		Core Pushed By	TEG
Exploration No.		Core Logged By	JLB
Core No.	PH-CS-01-06	Type of Core	☐ Shelby ☐ Piston Core ☐ Other
Water Depth/Elevation of Core	30	Diameter of Core (inches)	
Cored Length (feet; from log)	10'	Core Quality	☐ Good ☐ Fair ☐ Poor ☐ Disturbed
Core Recovery (feet)	9'	Average % Compaction =	

Core Sections: Theoretical / Depth in ( ) / Actual	Sample Interval	Sample Analytes	Classification and Remarks (Color, Consistency, Moisture, Grain Size, Sheen, Odor)
30'			Black silty sand Large shell/rock debris No odor, oil
32'			Clay/silt layer Black
34'			Black silty Large shelly rock Same as 30'-32'
36'			Coarse sand, light color
38'			Clay? Layer - strong elastic Very dense
39'			

ANCHOR ENVIRONMENTAL, L.L.C.

Sediment Core Collection Form

Station ID:	PH-CS-02-06	**Date:**	9-14-06
Project Name:	Port Hueneme	**Project Number:**	060374-01
Coordinates: Lat/Northing	34 08.924	Long/Easting:	119 12.285
Vertical Datum	MLLW	MLW	Other:
Depth Measurement	Sounder	Leadline	35.1

Project Depth 40' **Overdredge** 2'

	Attempt 1	**Attempt 2**	**Attempt 3**
Time:	1:50pm	**Repositioned angle of cutter**	2:15pm
(A) Measured Water Depth	35.1		35.1
(B) Tide Height	4.6		4.8
(C) Mudline Elevation	30.5'		30.3
(-A+B = C include sign of tide height as reported)			
Estimated Penetration	9.9'		10'
Description of Core Drive			
Refusal Encountered?	Yes		Yes
Total Core Length	4'		5'6"

Core Characteristics

Sediment Type	cobble, gravel, sand C M F , silt clay, organic matter	cobble, gravel, sand C M F , silt clay, organic matter	cobble, gravel, sand C M F , silt clay, organic matter
Sediment Color	gray, black, brown brown surface, olivine	gray, black, brown brown surface, olivine	gray, black, brown brown surface, olivine
Sediment Odor	None, slight, mod, strong H_2S, petroleum, septic	None, slight, mod, strong H_2S, petroleum, septic	None, slight, mod, strong H_2S, petroleum, septic
Any Layering Homogeneous			

Comments: Target 40'

Attempt #1 – Failed – Only 4' actual recovery – shell hash in cutter

Attempt #2 – Failed – " " – pulled up/repositioned cutter angle mid-drill for #3

Attempt #3 – Impenetrable below ~ 5'6"

Recorded by: JLB

Visual Classification of Subsurface Core

ANCHOR ENVIRONMENTAL, L.L.C.

Job	Port Hueneme	Date 9-14-06	
Job No.		Core Pushed By	TEG
Exploration No.		Core Logged By	JLB
Core No.	PH-CS-02-06	Type of Core	☐ Shelby ☐ Piston Core ☐ Other
Water Depth/Elevation of Core	30.3'	Diameter of Core (inches)	
Cored Length (feet; from log)	9'	Core Quality	☐ Good ☐ Fair ☐ Poor ☐ Disturbed
Core Recovery (feet)	5'6"	Average % Compaction =	

Core Sections: Theoretical / Depth in ( ) / Actual	Sample Interval	Sample Analytes	Classification and Remarks (Color, Consistency, Moisture, Grain Size, Sheen, Odor)
0		30'3"	Black, silty sand No odor Lots of shell hash
		2'	
			Black relatively homogenous silty clay Very sticky/elastic Interspersed sand pockets
5'6"		35'9"	

ANCHOR ENVIRONMENTAL, L.L.C.

Sediment Core Collection Form

Station ID:	PH-CS-03-06	**Date:**	9-14-06
Project Name:	Port Hueneme	**Project Number:**	060374-01
Coordinates: Lat/Northing	34 08.925	Long/Easting:	119 12.223
Vertical Datum	MLLW	MLW	Other:
Depth Measurement	Sounder	Leadline	41.4

Project Depth 40' **Overdredge** 2'

	Attempt 1	Attempt 2	Attempt 3
Time:	2:45pm		
(A) Measured Water Depth	41.4		
(B) Tide Height	5.1		
(C) Mudline Elevation	36.3		
(-A+B = C include sign of tide height as reported)			
Estimated Penetration	10'		
Description of Core Drive			
Refusal Encountered?	Yes		
Total Core Length	6'		

Core Characteristics

Sediment Type	cobble, gravel, sand C M F, silt clay, organic matter	cobble, gravel, sand C M F, silt clay, organic matter	cobble, gravel, sand C M F, silt clay, organic matter
Sediment Color	gray, black, brown brown surface, olivine	gray, black, brown brown surface, olivine	gray, black, brown brown surface, olivine
Sediment Odor	None, slight, mod, strong H_2S, petroleum, septic	None, slight, mod, strong H_2S, petroleum, septic	None, slight, mod, strong H_2S, petroleum, septic
Any Layering Homogeneous			

Comments: Target 40'

Mudline ~ authorized depth therefore Lower only!

Recorded by: JLB

Visual Classification of Subsurface Core

ANCHOR ENVIRONMENTAL, L.L.C.

Job Port Hueneme	Date 9-14-06
Job No.	Core Pushed By TEG
Exploration No.	Core Logged By JLB
Core No. PH-CS-03-06	Type of Core ☐ Shelby ☐ Piston Core ☐ Other
Water Depth/Elevation of Core 36	Diameter of Core (inches)
Cored Length (feet; from log) 10'	Core Quality ☐ Good ☐ Fair ☐ Poor ☐ Disturbed
Core Recovery (feet) 6'	Average % Compaction =

Core Sections: Theoretical / Depth in ( ) / Actual	Sample Interval	Sample Analytes	Classification and Remarks (Color, Consistency, Moisture, Grain Size, Sheen, Odor)
36'3" – 40'			4' of clean, light sand Very coarse
40' – 42'3"			2' of hard pack, light color clay Probably native material

ANCHOR ENVIRONMENTAL, L.L.C.

Sediment Core Collection Form

Station ID:	PH-CS-04-06	**Date:**	9-14-06
Project Name:	Port Hueneme	**Project Number:**	060374-01
Coordinates: Lat/Northing	34 08.925	Long/Easting:	119 12.156
Vertical Datum	MLLW	MLW	Other:
Depth Measurement	Sounder	Leadline	37.7
Project Depth	40'	**Overdredge**	2'

	Attempt 1	Attempt 2	Attempt 3
Time:	3:15pm		
(A) Measured Water Depth	37.7		
(B) Tide Height	5.1		
(C) Mudline Elevation	32.6		
(-A+B = C include sign of tide height as reported)			
Estimated Penetration	9.4		
Description of Core Drive			
Refusal Encountered?	Yes		
Total Core Length	8'6"		

Core Characteristics

Sediment Type	cobble, gravel, sand C M F , silt clay, organic matter	cobble, gravel, sand C M F , silt clay, organic matter	cobble, gravel, sand C M F , silt clay, organic matter
Sediment Color	gray, black, brown brown surface, olivine	gray, black, brown brown surface, olivine	gray, black, brown brown surface, olivine
Sediment Odor	None, slight, mod, strong H_2S, petroleum, septic	None, slight, mod, strong H_2S, petroleum, septic	None, slight, mod, strong H_2S, petroleum, septic
Any Layering Homogeneous			

Comments:

Recorded by: JLB

Visual Classification of Subsurface Core

ANCHOR ENVIRONMENTAL, L.L.C.

Job	Port Hueneme	Date 9-14-06	
Job No.		Core Pushed By	TEG
Exploration No.		Core Logged By	JLB
Core No.	PH-CS-04-06	Type of Core	☐ Shelby ☐ Piston Core ☐ Other
Water Depth/Elevation of Core	33	Diameter of Core (inches)	
Cored Length (feet; from log)	9'4"	Core Quality	☐ Good ☐ Fair ☐ Poor ☐ Disturbed
Core Recovery (feet)	8'6"	Average % Compaction =	

Core Sections — Theoretical Depth in ( )	Actual	Sample Interval	Sample Analytes	Classification and Remarks (Color, Consistency, Moisture, Grain Size, Sheen, Odor)
32'6"				
				Black, homogenous silty sa
37'			4'6"	
				mixed layer silty sand
37'6"			5'	
				Coarse, lite sand
40'			7'6"	
				Clay
41'			8'6"	

ANCHOR ENVIRONMENTAL, L.L.C.

Sediment Core Collection Form

Station ID:	PH-CS-05-06	**Date:**	9-14-06
Project Name:	Port Hueneme	**Project Number:**	060374-01
Coordinates: Lat/Northing	34 08.861	Long/Easting:	119 12.493
Vertical Datum	MLLW	MLW	Other:
Depth Measurement	Sounder	Leadline	33.9

Project Depth 40' **Overdredge** 2'

	Attempt 1	Attempt 2	Attempt 3
Time:	12:15pm		
(A) Measured Water Depth	33.9		
(B) Tide Height	4.0		
(C) Mudline Elevation	29.9		
(-A+B = C include sign of tide height as reported)			
Estimated Penetration	9'		
Description of Core Drive			
Refusal Encountered?	Yes		
Total Core Length	9'		

Core Characteristics

Sediment Type	cobble, gravel, sand C M F , silt clay, organic matter	cobble, gravel, sand C M F , silt clay, organic matter	cobble, gravel, sand C M F , silt clay, organic matter
Sediment Color	gray, black, brown brown surface, olivine	gray, black, brown brown surface, olivine	gray, black, brown brown surface, olivine
Sediment Odor	None, slight, mod, strong H_2S, petroleum, septic	None, slight, mod, strong H_2S, petroleum, septic	None, slight, mod, strong H_2S, petroleum, septic
Any Layering Homogeneous			

Comments:

Shooting MW for 40'

Recorded by: JLB

Visual Classification of Subsurface Core

ANCHOR ENVIRONMENTAL, L.L.C.

Job	Port Hueneme	Date 9-14-06	
Job No.		Core Pushed By	TEG
Exploration No.		Core Logged By	JLB
Core No.	PH-CS-05-06	Type of Core	☐ Shelby ☐ Piston Core ☐ Other
Water Depth/Elevation of Core	30	Diameter of Core (inches)	
Cored Length (feet; from log)	9'	Core Quality	☐ Good ☐ Fair ☐ Poor ☐ Disturbed
Core Recovery (feet)	9'	Average % Compaction =	

Theoretical Depth in ( ) Actual — Core Sections	Sample Interval	Sample Analytes	Classification and Remarks (Color, Consistency, Moisture, Grain Size, Sheen, Odor)
30'			
31'			
32'			Homogenus silty sand
			Black
			No odor, oil, grease
33'			Some shell:woody debris
34'			
35'			
36'			
			Sandy/clay interface
37'			
			Coarse sand, light color
38'			
38'9"			

ANCHOR ENVIRONMENTAL, L.L.C.

Sediment Core Collection Form

Station ID: PH-CS-06-06 **Date:** 9-14-06

Project Name: Port Hueneme **Project Number:** 060374-01

Coordinates:
Lat/Northing 34 08.862 Long/Easting: 119 12.397

Vertical Datum MLLW MLW Other:

Depth Measurement Sounder Leadline 33.6 A1 / 34.4 A2

Project Depth 40 **Overdredge** 2'

	Attempt 1	Attempt 2	Attempt 3
Time:	10:30am	11:20am	
(A) Measured Water Depth	33.6	34.4	
(B) Tide Height	3.5	3.3	
(C) Mudline Elevation	30.1	30.6	
(-A+B = C include sign of tide height as reported)			
Estimated Penetration	7.5'	12'	
Description of Core Drive	Retried, failed	Bent tube	
Refusal Encountered?	Yes	No	
Total Core Length	FAILED – hit 12'	9'	

Core Characteristics

Sediment Type	cobble, gravel, sand C M F , silt clay, organic matter	cobble, gravel, sand C M F , silt clay, organic matter	cobble, gravel, sand C M F , silt clay, organic matter
Sediment Color	gray, black, brown brown surface, olivine	gray, black, brown brown surface, olivine	gray, black, brown brown surface, olivine
Sediment Odor	None, slight, mod, strong H_2S, petroleum, septic	None, slight, mod, strong H_2S, petroleum, septic	None, slight, mod, strong H_2S, petroleum, septic
Any Layering Homogeneous			

Comments:
Attempt #1 – Failed – apparently hit debris, black mucky material

Attempt #2 – Tube bent; oil & grease in water that spilled off.

Recorded by: JLB

Visual Classification of Subsurface Core

ANCHOR ENVIRONMENTAL, L.L.C.

Job	Port Hueneme	Date 9-14-06	
Job No.		Core Pushed By	TEG
Exploration No.		Core Logged By	JLB
Core No.	PH-CS-06-06	Type of Core	☐ Shelby ☐ Piston Core ☐ Other
Water Depth/Elevation of Core	31	Diameter of Core (inches)	
Cored Length (feet; from log)	12'	Core Quality	☐ Good ☐ Fair ☐ Poor ☐ Disturbed
Core Recovery (feet)	9'	Average % Compaction =	

Depth in ( ) Core Sections (Theoretical / Actual)	Sample Interval	Sample Analytes	Classification and Remarks (Color, Consistency, Moisture, Grain Size, Sheen, Odor)
30' – 36'			Iniform black silty sand Some odor (hydrocarbon) Some shell debris Noticeable oil/grease in water - spillege
36' – 39'			Black, sand/clay Some sticky clay texture No odor No debris
39' – 39'6"			

ANCHOR ENVIRONMENTAL, L.L.C.

Sediment Core Collection Form

Station ID: PH-CS-07-06 **Date:** 9-14-06

Project Name: Port Hueneme **Project Number:** 060374-01

Coordinates: Lat/Northing 34 08.861 Long/Easting: 119 12.325

Vertical Datum MLLW MLW Other:

Depth Measurement Sounder Leadline 36.3

Project Depth ______ **Overdredge** ______

	Attempt 1	Attempt 2	Attempt 3
Time:	9:40am		
(A) Measured Water Depth	36.3		
(B) Tide Height	3.4		
(C) Mudline Elevation	32.9		
(-A+B = C include sign of tide height as reported)			
Estimated Penetration	8'		
Description of Core Drive			
Refusal Encountered?	Yes		
Total Core Length	8'		

Core Characteristics

Sediment Type	cobble, gravel, sand C M F , silt clay, organic matter	cobble, gravel, sand C M F , silt clay, organic matter	cobble, gravel, sand C M F , silt clay, organic matter
Sediment Color	gray, black, brown brown surface, olivine	gray, black, brown brown surface, olivine	gray, black, brown brown surface, olivine
Sediment Odor	None, slight, mod, strong H_2S, petroleum, septic	None, slight, mod, strong H_2S, petroleum, septic	None, slight, mod, strong H_2S, petroleum, septic
Any Layering Homogeneous			

Comments:
Refused at 40' – Did not achieve 42'

Recorded by: JLB

Visual Classification of Subsurface Core

ANCHOR ENVIRONMENTAL, L.L.C.

Job	Port Hueneme	Date	9-14-06
Job No.	060374-01	Core Pushed By	TEG
Exploration No.		Core Logged By	JLB
Core No.	PH-CS-07-06	Type of Core	☐ Shelby ☐ Piston Core ☐ Other
Water Depth/Elevation of Core	33	Diameter of Core (inches)	
Cored Length (feet; from log)	8'	Core Quality	☐ Good ☐ Fair ☐ Poor ☐ Disturbed
Core Recovery (feet)	8'	Average % Compaction =	

Depth in ( ) Theoretical / Actual — Core Sections	Sample Interval	Sample Analytes	Classification and Remarks (Color, Consistency, Moisture, Grain Size, Sheen, Odor)
33'			Sandy Material
			Shell hash mixture
34'10'			Little woody debris/rocks
			Coarse sand
36'			Silty black sand
37'			
38'			Transistional layer
39'			
			Sand plug
40'			
40'9"			Refussal

ANCHOR ENVIRONMENTAL, L.L.C.

Sediment Core Collection Form

Station ID:	PH-CS-08-06	**Date:**	9-14-06
Project Name:	Port Hueneme	**Project Number:**	060374-01
Coordinates: Lat/Northing	34 08.861	Long/Easting:	119 12.270
Vertical Datum	MLLW	MLW	Other:
Depth Measurement	34.8 Sounder	Leadline	

Project Depth 40 **Overdredge** 2

	Attempt 1	Attempt 2	Attempt 3
Time:	9am		
(A) Measured Water Depth	36		
(B) Tide Height	+2.1 – 3.1		
(C) Mudline Elevation	34.8		
(-A+B = C include sign of tide height as reported)			
Estimated Penetration	7'10"		
Description of Core Drive			
Refusal Encountered?	Yes		
Total Core Length	7'10"		

Core Characteristics

Sediment Type	cobble, gravel, sand C M F , silt clay, organic matter	cobble, gravel, sand C M F , silt clay, organic matter	cobble, gravel, sand C M F , silt clay, organic matter
Sediment Color	gray, black, brown brown surface, olivine	gray, black, brown brown surface, olivine	gray, black, brown brown surface, olivine
Sediment Odor	None, slight, mod, strong H_2S, petroleum, septic	None, slight, mod, strong H_2S, petroleum, septic	None, slight, mod, strong H_2S, petroleum, septic
Any Layering Homogeneous			

Comments:
Tube bent

Recorded by: JLB

Visual Classification of Subsurface Core

ANCHOR ENVIRONMENTAL, L.L.C.

Job	Port Hueneme	Date 9-14-06	
Job No.	060374-01	Core Pushed By	TEG
Exploration No.		Core Logged By	JLB
Core No.	PH-CS-08-06	Type of Core	☐ Shelby ☐ Piston Core ☐ Other
Water Depth/Elevation of Core	35	Diameter of Core (inches)	
Cored Length (feet; from log)	7'10"	Core Quality	☐ Good ☐ Fair ☐ Poor ☐ Disturbed
Core Recovery (feet)	7'10"	Average % Compaction =	

Depth in ( ) Core Sections (Theoretical / Actual)	Sample Interval	Sample Analytes	Classification and Remarks (Color, Consistency, Moisture, Grain Size, Sheen, Odor)
35'			
			Black silt/siltysand
			Odorless
38'			Clay/sand mixed layer
39'			
			Sand Plug
42'			
42'10'			

ANCHOR ENVIRONMENTAL, L.L.C.

Sediment Core Collection Form

Station ID:	PH-CS-09-06	**Date:**	9-14-06
Project Name:	Port Hueneme	**Project Number:**	060374-01
Coordinates: Lat/Northing	34 08.860	Long/Easting:	119 12.217
Vertical Datum	MLLW	MLW	Other:
Depth Measurement	31.9 Sounder	Leadline	

Project Depth 40' **Overdredge** 2'

	Attempt 1	Attempt 2	Attempt 3
Time:	8:30am		
(A) Measured Water Depth	33.1		
(B) Tide Height	+2.1 – 3.1		
(C) Mudline Elevation	31.9		
(-A+B = C include sign of tide height as reported)			
Estimated Penetration	10'8"		
Description of Core Drive			
Refusal Encountered?	Yes		
Total Core Length	10'8"		

Core Characteristics

Sediment Type	cobble, gravel, sand C M F , silt clay, organic matter	cobble, gravel, sand C M F , silt clay, organic matter	cobble, gravel, sand C M F , silt clay, organic matter
Sediment Color	gray, black, brown brown surface, olivine	gray, black, brown brown surface, olivine	gray, black, brown brown surface, olivine
Sediment Odor	None, slight, mod, strong H_2S, petroleum, septic	None, slight, mod, strong H_2S, petroleum, septic	None, slight, mod, strong H_2S, petroleum, septic
Any Layering Homogeneous			

Comments:

Sand plug at bottom

Recorded by: **JLB**

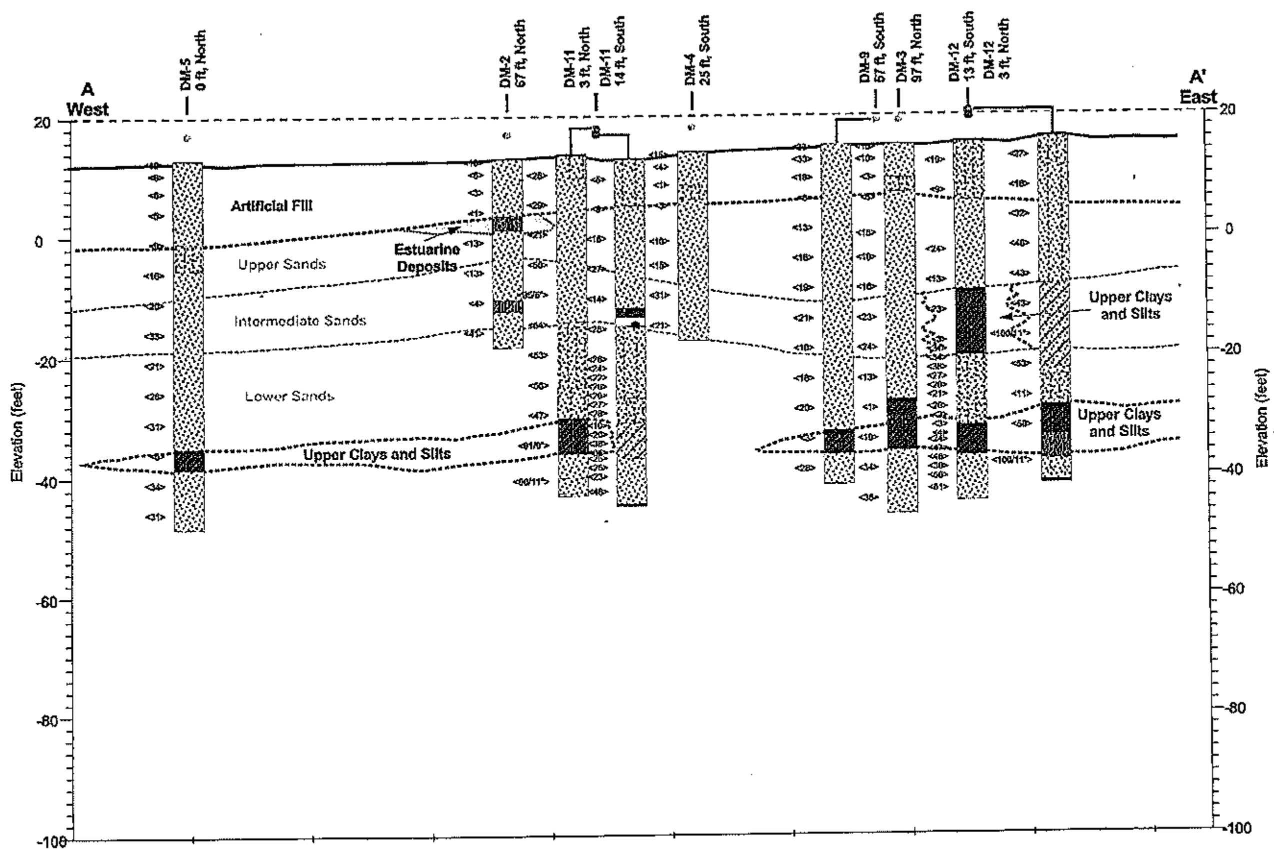
Visual Classification of Subsurface Core

ANCHOR ENVIRONMENTAL, L.L.C.

Job	Port Hueneme	Date	9-14-06
Job No.	060374-01	Core Pushed By	TEG
Exploration No.		Core Logged By	JLB
Core No.	PH-CS-09-06	Type of Core	☐ Shelby ☐ Piston Core ☐ Other
Water Depth/Elevation of Core	32	Diameter of Core (inches)	
Cored Length (feet; from log)	10'8"	Core Quality	☐ Good ☐ Fair ☐ Poor ☐ Disturbed
Core Recovery (feet)	10'8"	Average % Compaction =	

Depth in ( ) Theoretical / Actual — Core Sections	Sample Interval	Sample Analytes	Classification and Remarks (Color, Consistency, Moisture, Grain Size, Sheen, Odor)
32'			Homogenized silty sand Black Odorless Some cobble
39'			Sandy, clay mix - light brown
41'			Sand Plug
42'7"			

FURGO 2001



GENERAL NOTES:

1. Stratigraphic boundaries have been interpreted from boring logs and CPT profiles for the purposes of engineering analysis of the wharf stability. As such, they should be treated as approximate and intended to present a geologic framework for discussion. Actual conditions will vary along and perpendicular to the section line.

2. SPT "N" values are shown adjacent to the borings at their respective depths. Values in parenthesis <> indicate Dames & Moore sampler blow counts.

3. Refer to Key to Cross Sections Plate 8 for descriptions of boring and CPT data shown above and color coding.

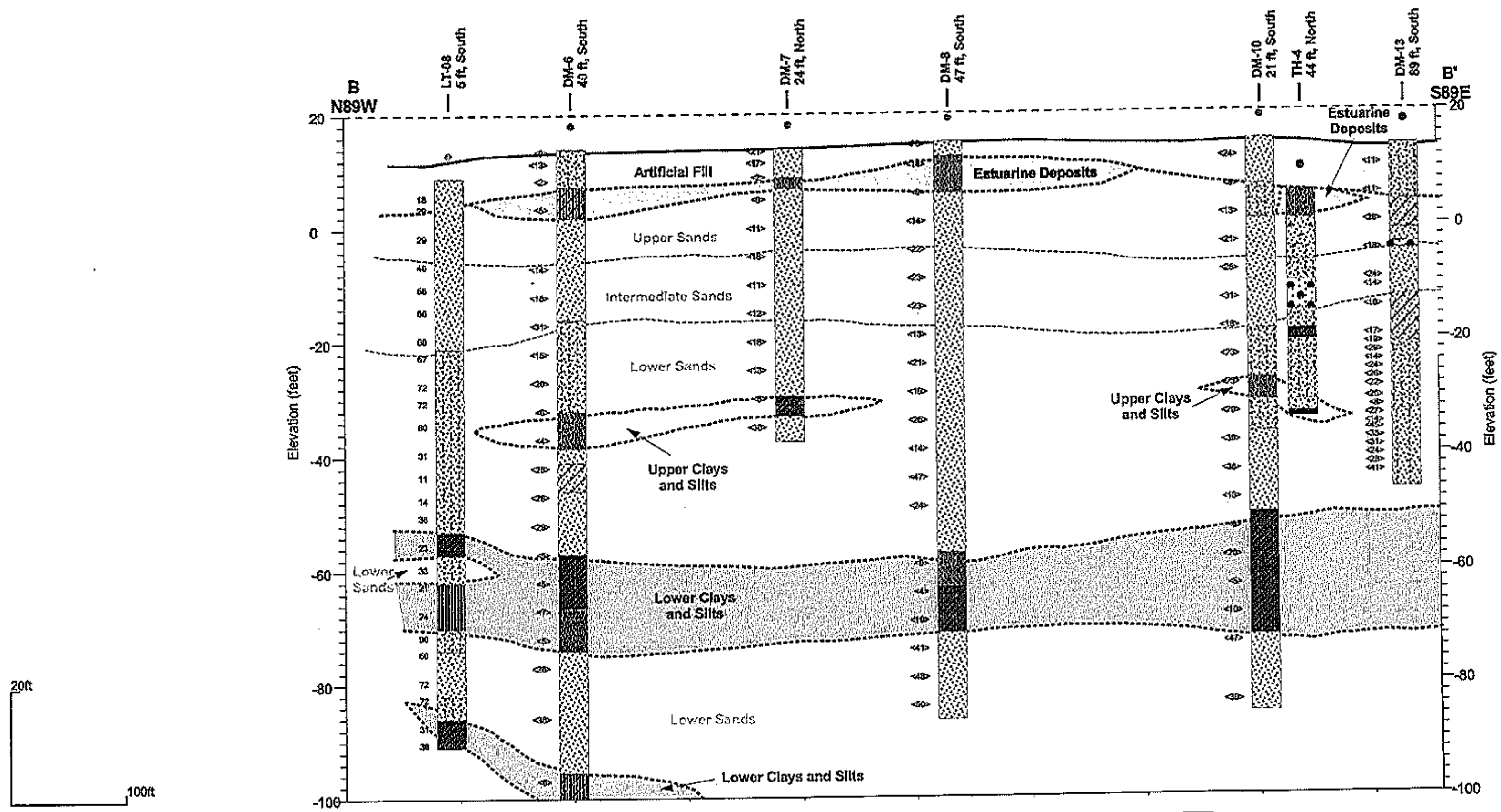
KEY TO GEOLOGIC UNITS

Unit 1	Artificial Fill
Unit 2	Estuarine Deposits
Unit 3a	Upper Sands
Unit 3b	Intermediate Sands
Unit 3c	Lower Sands
Unit 4a	Upper Clays and Silts

Subsurface Cross Section A-A'

DEEP DRAFT NAVIGATION PROJECT
PORT HUENEME, CALIFORNIA

PLATE 7



GENERAL NOTES:

1. Stratigraphic boundaries have been interpreted from boring logs and CPT profiles for the purposes of engineering analysis of the wharf stability. As such, they should be treated as approximate and intended to present a geologic framework for discussion. Actual conditions will vary along and perpendicular to the section line.

2. SPT "N" values are shown adjacent to the borings at their respective depths. Values in parenthesis <> indicate Dames & Moore sampler blow counts.

3. Refer to Key to Cross Sections Plate 8 for descriptions of boring and CPT data shown above and color coding.

KEY TO GEOLOGIC UNITS

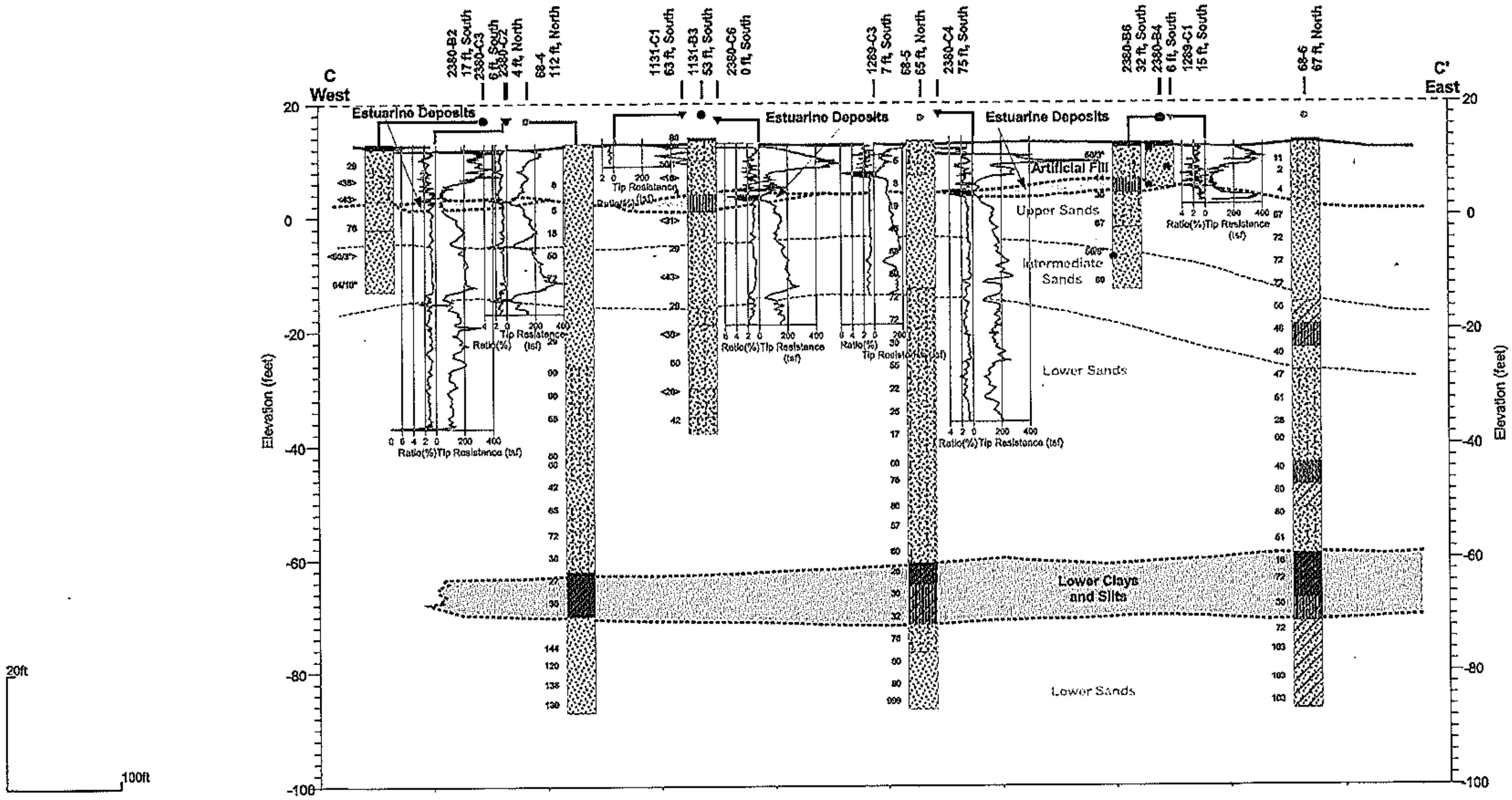
Unit 1	Artificial Fill
Unit 2	Estuarine Deposits
Unit 3a	Upper Sands
Unit 3b	Intermediate Sands
Unit 3c	Lower Sands
Unit 4a	Upper Clays and Silts
Unit 4b	Lower Clays and Silts

FUGRO

Subsurface Cross Section B-B'

DEEP DRAFT NAVIGATION PROJECT
PORT HUENEME, CALIFORNIA

PLATE 8



GENERAL NOTES:

1. Stratigraphic boundaries have been interpreted from boring logs and CPT profiles for the purposes of engineering analysis of the wharf stability. As such, they should be treated as approximate and intended to present a geologic framework for discussion. Actual conditions will vary along and perpendicular to the section line.

2. SPT "N" values are shown adjacent to the borings at their respective depths. Values in parenthesis <> indicate Dames & Moore sampler blow counts.

3. Refer to Key to Cross Sections Plate 8 for descriptions of boring and CPT data shown above and color coding.

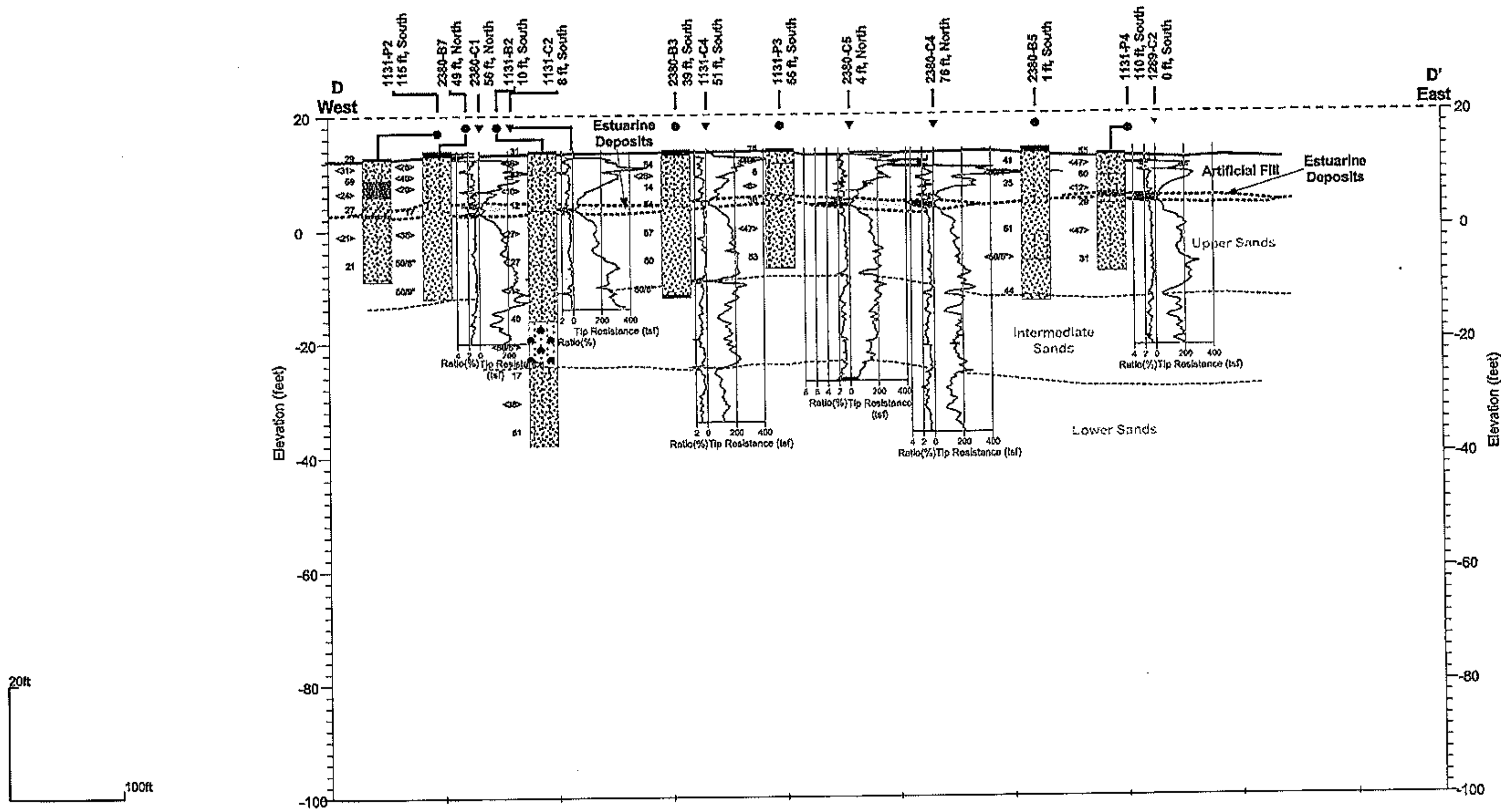
KEY TO GEOLOGIC UNITS

Unit 1	Artificial Fill
Unit 2	Estuarine Deposits
Unit 3a	Upper Sands
Unit 3b	Intermediate Sands
Unit 3c	Lower Sands
Unit 4b	Lower Clays and Silts

Subsurface Cross Section C-C'

DEEP DRAFT NAVIGATION PROJECT
PORT HUENEME, CALIFORNIA

PLATE 9



GENERAL NOTES:

1. Stratigraphic boundaries have been interpreted from boring logs and CPT profiles for the purposes of engineering analysis of the wharf stability. As such, they should be treated as approximate and intended to present a geologic framework for discussion. Actual conditions will vary along and perpendicular to the section line.

2. SPT "N" values are shown adjacent to the borings at their respective depths. Values in parenthesis <> indicate Dames & Moore sampler blow counts.

3. Refer to Key to Cross Sections Plate 8 for descriptions of boring and CPT data shown above and color coding.

KEY TO GEOLOGIC UNITS

Unit 1	Artificial Fill
Unit 2	Estuarine Deposits
Unit 3a	Upper Sands
Unit 3b	Intermediate Sands
Unit 3c	Lower Sands

Subsurface Cross Section D-D'

DEEP DRAFT NAVIGATION PROJECT
PORT HUENEME, CALIFORNIA

PLATE 10

APPENDIX B

RESULTS OF CHEMICAL ANALYSIS OF SEDIMENT

(PROVIDED ON CD)

APPENDIX C

SUMMARY OF HYDROGEOLOGIC CONDITIONS UNDER PORT OF HUENEME HARBOR

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Technical Memorandum

To: Port Hueneme Document Reviewers

From: Steve Cappellino and Michael Whelan, P.E., Anchor Environmental CA, L.P.

Date: May 28, 2008

Re: Summary of Hydrogeologic Conditions Under Port of Hueneme Harbor

The following technical memorandum was prepared to support the assumptions and models conducted during engineering design and planning for the Port of Hueneme Contaminated Sediments Dredging and CAD Cell Construction Project proposed for the Port of Hueneme Harbor (Harbor) in late 2008. The majority of this information has been obtained from the recently completed *Final Basewide Groundwater Investigation, Volume I (Text, Tables, and Figures*), dated January 2006 and prepared by Tetra Tech EM Inc.

1 PROJECT SUMMARY

The proposed project includes excavating a Confined Aquatic Disposal (CAD) cell to a depth of approximately -80 feet mean lower low water (MLLW) in the Harbor for the purpose of disposing contaminated sediments from the adjacent wharves. After excavation, a layer of contaminated sediments, approximately 25 feet thick, will be placed into the CAD cell and then covered with a 10-foot-thick clean sand cap to isolate the material. The planning and engineering documents for this project have described the subsurface conditions (where the CAD cell will be placed) as a groundwater confining zone, which is not subject to significant groundwater flow, and is not connected to regional groundwater sources used for drinking water or agricultural irrigation. The information provided below supports these assumptions by documenting the location of the CAD cell within the Semi-Perched Aquifer and the presence of a 50 to 100 foot confining clay layer between the groundwater confining zone and the underlying aquifer.

2 SITE HYDROGEOLOGY

The interpretation of the hydrogeology of Port of Hueneme is based on previous studies conducted at U.S. Naval Base Ventura County (NBVC), located adjacent to the Harbor, and for their groundwater remedial investigation (RI). These studies documented stratigraphic, water level, geochemical, and stable isotope data for the Harbor and its immediate surroundings. These on-site field results have been corroborated with information obtained from the Department of Water Resources (DWR), United Conservation Water District (UWCD), and U.S. Geological Society (USGS), whose data was collected from the immediate vicinity of the Harbor.

Six aquifers have been identified within the upper 1,000 feet of sediments in the Oxnard Plain. The lower three of these aquifers are present in early Pleistocene marine formations that have been slightly folded and partially removed by erosion (DWR 1965, Izbicki 1991). In ascending stratigraphic order, these aquifers are the Grimes, Fox Canyon, and Hueneme Aquifers.

The upper three aquifers are present in predominantly undeformed late Pleistocene and Holocene alluvial floodplain sediments (Izbicki 1991). In ascending stratigraphic order, these upper aquifers are the Mugu, Oxnard, and Semi-Perched Aquifers. The following discussion focuses on the two shallowest water-bearing layers and thus the layers that are in closest proximity to the CAD, Semi-Perched Aquifer and Oxnard Aquifer (see attached Figure 2-6 from Tetra Tech 2006). There is a low permeability layer separating these units, known as the clay cap aquitard, also discussed below.

2.1 Semi-Perched Aquifer

The DWR (1965) interprets the Semi-Perched Aquifer to be immediately below the soil horizon at an average depth of 20 to 50 feet below ground surface (bgs). The Semi-Perched Aquifer at NBVC Port of Hueneme is present from the water table (about 2 to 23 feet bgs) to approximately 25 feet bgs in the northern portion of the base, 75 feet bgs in the southern portion of the base, and more than 100 feet under the Harbor.

The Semi-Perched Aquifer consists of interbedded, laterally discontinuous sands, gravels, silts, and clays with sand beds more predominant and continuous than the finer grained sediments. Regionally, the lithology of the Semi-Perched Aquifer is highly variable but generally consists of fine to medium sands and gravels with lesser clays and silts.

Observations of the lithology of the Semi-Perched Aquifer at NBVC Port of Hueneme are consistent with regional interpretations made by others. Beneath NBVC Port of Hueneme, the Semi-Perched Aquifer consists predominantly of sands with variable amounts of silt and clay and minor gravel. Throughout the base, moderate to high permeability sediments dominate the upper 25 feet of the subsurface; however, in some areas low permeability sediments are found just below the ground surface. Low permeability sediments are more prevalent from 25 feet bgs in the northern portion of the base to 75 feet bgs in the southern portion. The increase in low permeability sediments marks the transition to the underlying confining layer.

Groundwater quality in the Semi-Perched Aquifer is low, and groundwater is not generally used for either domestic or agricultural purposes. Recharge to the Semi-Perched Aquifer is from infiltration of precipitation, anthropogenic sources (such as leaking municipal water lines), and regional flow from inland areas.

2.2 Clay Cap Aquitard

The Oxnard Aquifer is separated from the Semi-Perched Aquifer by the clay cap aquitard. At NBVC Port of Hueneme, information about the clay cap is limited to data from a few USGS and DWR well borings drilled in the western portion of the base as well as some development wells and geotechnical borings conducted by the Oxnard Harbor District as part of a wharf stabilization project. The clay cap appears to consist of several layers of interbedded high and low permeability materials including clay, silt, and sand. These interbeds make it difficult to precisely locate the top and bottom of the clay cap. According to the definition of the top of the Oxnard Aquifer and geologic cross sections provided by the DWR, the base of the clay cap varies from approximately 165 to 200 feet bgs across NBVC Port of Hueneme.

For the purposes of discussion, the clay cap has been divided into an upper and lower portion, as indicated by hydrostratigraphic observations. The upper portion of the clay cap has a higher proportion of moderate to high permeability sediments relative to the lower portion of the clay cap (see attached Figure 4-1 from Tetra Tech 2006). The upper portion of the clay cap is differentiated from the overlying Semi-Perched Aquifer based on differences in groundwater geochemistry and stable isotopes. The lower portion of the clay cap is dominated by continuous and extensive low permeability sediments.

The upper portion of the clay cap lies directly below the Semi-Perched Aquifer in the northern portion of the base at a depth of approximately 25 feet bgs. In the southern portion, the upper clay cap lies directly below the deep Semi-Perched Aquifer at a depth of approximately 75 feet bgs. In the Harbor, the upper clay cap is believed to start at approximately 75 to 100 feet bgs. The bottom of the lower portion of the clay cap ranges from 150 to 200 feet bgs and thus, suggesting that thickness ranges from 50 to 100 feet.

Geotechnical borings conducted by the Oxnard Harbor District (Fugro West 2001) indicated a continuous clay layer, approximately 15 to 20 feet in thickness, underlying the site at depths ranging from 70 to 100 feet bgs. This appears to represent the upper portion of the clay cap aquitard. Additional borings by Anchor Environmental CA, L.P. (Anchor 2007), did not extend deep enough to encounter this clay layer, indicating that it lies below the planned depth of the CAD.

2.3 Oxnard Aquifer

The Oxnard Aquifer is a major groundwater source for the region and, other than in areas where seawater intrusion has occurred, contains high-quality groundwater. The Oxnard Aquifer is a lithologically diverse unit that contains multiple coarse-grained beds separated by clays and silts. The silt and clay beds that separate the coarser-grained beds are commonly laterally extensive and may create hydrogeologic isolation between coarser-grained beds within the Oxnard Aquifer.

At Port of Hueneme, the Oxnard Aquifer was observed to be composed of sand, silty sand, gravel, and gravelly sand, with interbeds of clay and silt. According to the DWR (1965), the Oxnard Aquifer dips gently westward across NBVC Port of Hueneme and thins from about 80 feet thick in the east to 50 feet thick in the west. The top of the Oxnard Aquifer is located at approximately 200 feet bgs in the northern portion of the base and 150 feet bgs in the southern portion of the base. The base of the Oxnard Aquifer ranges from approximately 210 to 230 feet bgs across NBVC Port of Hueneme.

3 REGIONAL SEAWATER INTRUSION

High chloride levels were first detected on the Oxnard Plain in the vicinity of the Hueneme and Mugu submarine canyons in the early 1930s (California Department of Water Resources 1971) and became a serious concern in the 1950s. Early monitoring programs used only existing production wells and abandoned wells as monitoring points. Sampling of these wells indicated that there was a widespread area of elevated chloride concentrations in the Hueneme to Mugu areas. In 1989, the USGS initiated their Regional Aquifer-System Analysis (RASA) study and cooperative studies with United Water Conservation District on the Santa Clara-Calleguas groundwater basin. As part of those studies, a series of 14 nested well sites, with two or more wells installed at each site, were drilled and completed at specific depths in the Oxnard Plain basin (Dens more 1996).

Figure 2-3 from the UWCD's 2003 Coastal Saline Report (2004) is attached and shows the locations of the RASA well sites on the Oxnard Plain. Prior to the RASA study, it was believed that an area extending from approximately 3 miles north of Port of Hueneme to well SCE and south to Point Mugu was intruded by seawater.

The installation of a dedicated monitoring network and detailed chemical analysis of water samples from the new wells and other wells yielded new interpretations on the extent of seawater intrusion on the Oxnard Plain. It is now known that some areas of the southern Oxnard Plain are not intruded by seawater, and that high chloride readings from older production wells were the result of perched water leaking down failed well casings and contaminating the aquifer (Izbicki 1992; Izbicki et al 1995; USGS 1996).

4 RELATIONSHIP TO CAP MODELING CONDUCTED FOR PORT HUENEME CAD PROJECT

The cap model, presented in the engineering design documents, was designed to evaluate the effects of upward groundwater flow through the cap because that would be the driving force for breakthrough into surface waters. Here, our evaluation of historic local well data (as documented in the UWCD's 2003 Coastal Saline Intrusion Report) indicates that there is, in fact, an overall 'neutral' flow condition in the subsurface of the Harbor (at least at the depths that are contiguous with or in the near vicinity of the CAD). This means that net groundwater flow is effectively neither upward nor downward and that the primary transportation mechanism for dissolved chemicals is not via groundwater flow but rather by molecular diffusion—a very slow process that accounts for the long predicted timespans before breakthrough is predicted.

In the long run, there is evidence that groundwater flow may undergo periodic fluctuations between flow in upward (i.e., toward the harbor) and downward (i.e., toward the land) directions, in response to fluctuations in climatic conditions. In dry periods, groundwater migration might develop in the landward direction whereas during wet periods the aquifers become recharged, which would prompt groundwater to flow in the reverse direction (i.e., toward the coast). But over the long time spans that are being dealt with, again our interpretation is that these variations will tend to even out, such that we are basically dealing with a net 'neutral' groundwater flow condition. This is the basic assumption that we used in our modeling.

Estimated chemical diffusion breakthrough times for upward movement is in the order of 8,000 years or more, assuming a 10-foot-thick cap layer. Data presented in this technical memorandum suggest that the sand layer below the bottom of the CAD cell will be approximately 20 feet thick before the upper portions of the clay aquitard is reached. Using the same chemical diffusion modeling assumptions as presented in the project environmental documents, and assuming a downward gradient instead of an upward gradient, one could assume that it would require more than 16,000 years for breakthrough to the confining clay layer to occur. In actuality, the time span to reach the Oxnard Aquifer would be much longer because groundwater would have to pass through the clay cap aquitard, which ranges in thickness between 50 and 100 feet.

Further studies at Naval Base Ventura County by Tetra Tech (2006) indicate that the groundwater flow regime at the site will further reduce the ability of porewater-bound contaminants to move downward through the Clay Cap Aquifer and toward the underlying groundwater system. While evidence of neutral groundwater flow and saltwater intrusion have been noted for the Semi-Perched Aquifer (in which the CAD is excavated), Tetra Tech (2006) indicates that an upward hydraulic gradient exists through the Clay Cap Aquitard, between the overlying Semi-Perched Aquifer and the underlying Oxnard Aquifer. This upward hydraulic gradient is listed as a set of positive (i.e. upward) values in Table 5-6 (attached) for well screens 20M5 and 20M6, located near the Harbor area.

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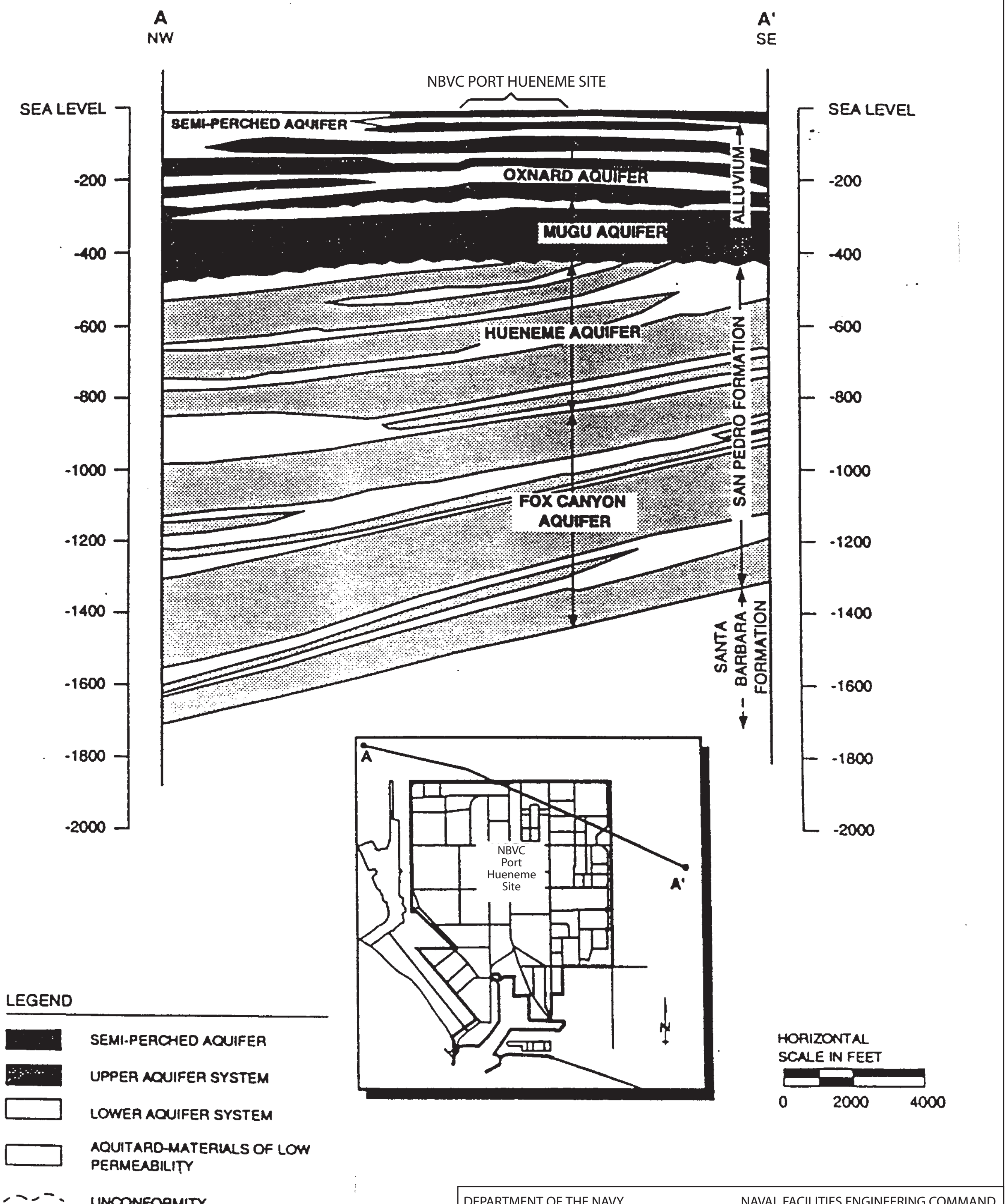
FIGURES



DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND

SOUTHWEST DIVISION

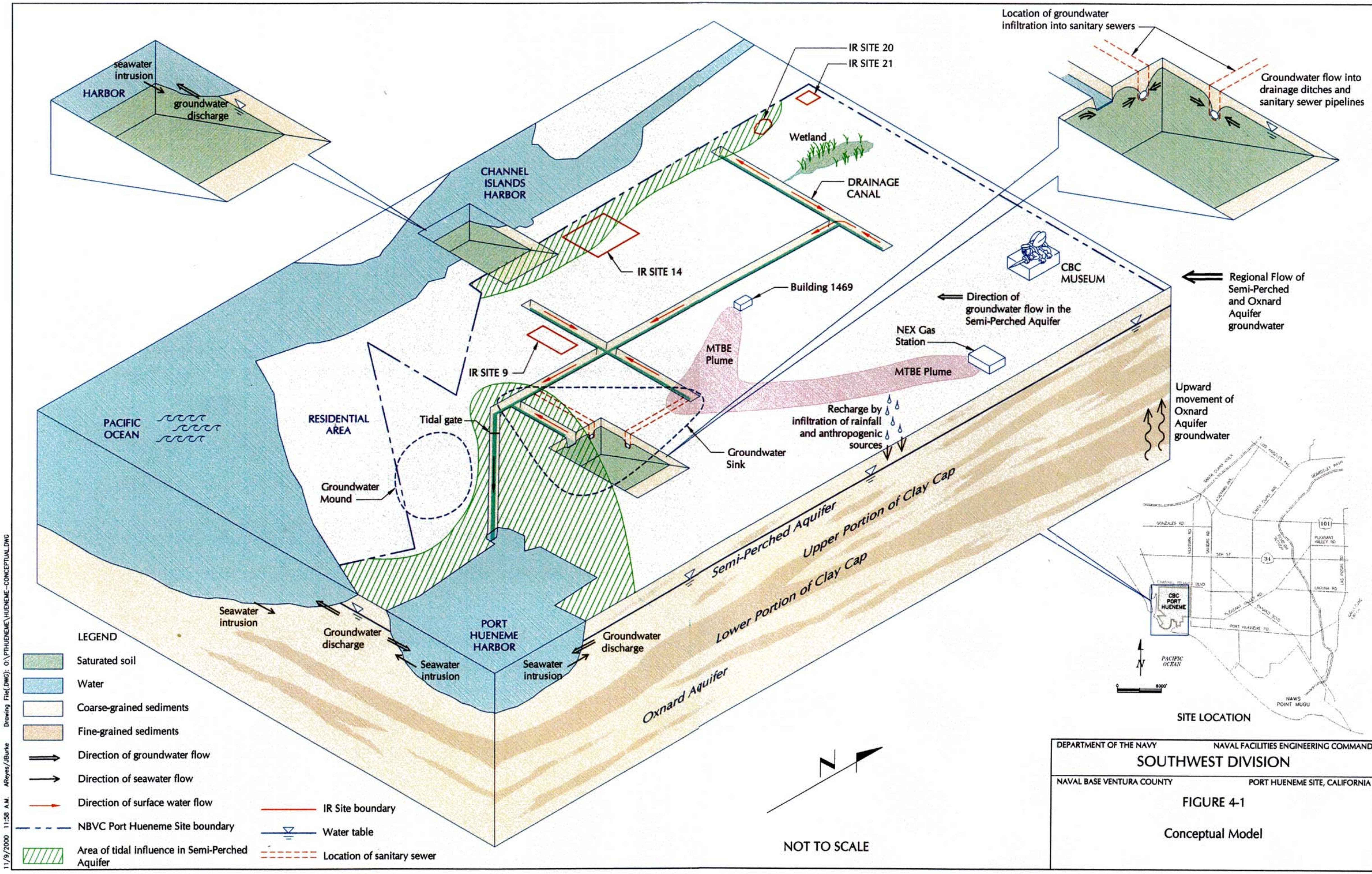
NAVAL BASE VENTURA COUNTY
PORT HUENEME SITE, CALIFORNIA

FIGURE 2-6

GENERALIZED HYDROGEOLOGIC CROSS SECTION

SOURCE:
PRC ENVIRONMENTAL MANAGEMENT, INC., JULY 1995

5305-HYDROGEO-X.CDR 102000



DEPARTMENT OF THE NAVY NAVAL FACILITIES ENGINEERING COMMAND

SOUTHWEST DIVISION

NAVAL BASE VENTURA COUNTY PORT HUENEME SITE, CALIFORNIA

FIGURE 4-1

Conceptual Model

11/9/2000 11:58 A.M. AReyes/JBurke Drawing File(.DWG): O:\PTHUENEME\HUENEME-CONCEPTUAL.DWG

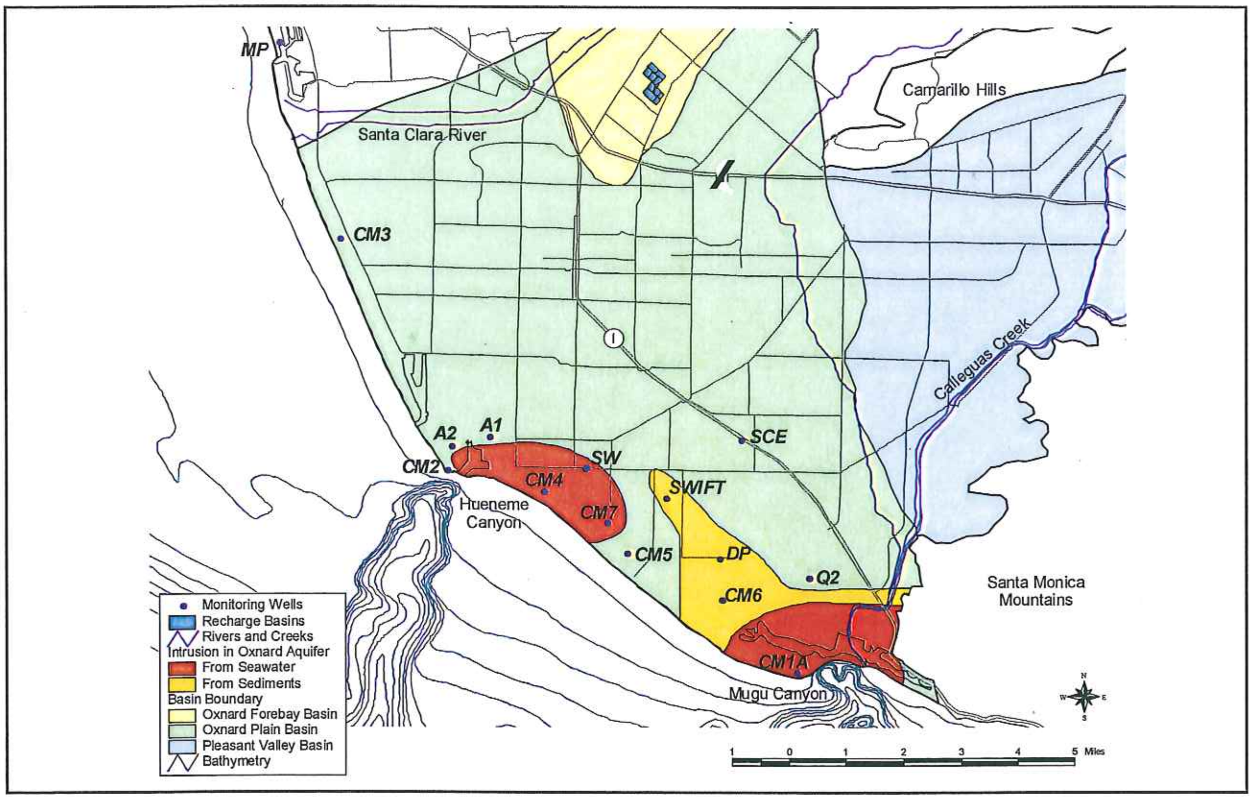


Figure 2-3. Location of RASA monitoring wells and saline intrusion in the Oxnard Aquifer, southern Oxnard Plain

TABLE 5-6

SUMMARY OF VERTICAL GRADIENTS IN THE SEMI-PERCHED AQUIFER
NBVC PORT HUENEME

Well Pair	Aquifer Screened	Screened Interval (feet)	First Round (May 1997)	Second Round (October 1997)	Third Round (January 1998)	Fourth Round (March 1998)	Tidal Study (April 1998)
GWIMW01A GWIMW01B	Shallow SPA Upper Clay Cap	5-15 50-60	--	-0.098	-0.003	upward (1)	-0.116
GWIMW09A GWIMW09B	Shallow SPA Upper Clay Cap	7-17 44-54	--	0.011	0.017	0.031	--
GWIMW10A GWIMW10B	Shallow SPA Upper Clay Cap	4-14 40-50	--	-0.004	-0.001	-0.003	-0.002
GWIMW11A GWIMW11B	Shallow SPA Upper Clay Cap	5-15 36-46	--	-0.100	-0.102	-0.097	-0.098
GWIMW17A GWIMW17B	Shallow SPA Deep SPA	5-15 40-50	--	-0.007	0.014	0.002	0.002
S14MW11 S14MW12	Shallow SPA Shallow SPA	11-21 23-31	--	-0.024	-0.027	0.017	--
S14MW14 S14MW15	Shallow SPA Shallow SPA	4.5-14.5 17-23	-0.033	-0.050	-0.026	-0.036	--
GWIMW18 20M6	Shallow SPA Deep SPA	9-19 50-70	**--**	**0.005**	**0.017**	**0.039**	--
GWIMW18 20M5	Shallow SPA Oxnard	9-19 150-170	**--**	**-0.037**	**-0.067**	**upward**	--
20M6 20M5	Deep SPA Oxnard	50-70 150-170	**-0.130**	**-0.055**	**-0.104**	**upward (1)**	--
20M5 20M4	Oxnard Mugu	150-170 300-320	**0.001**	**-0.002**	**-0.001**	**(2)**	--

TABLE 5-6

SUMMARY OF VERTICAL GRADIENTS IN THE SEMI-PERCHED AQUIFER
NBVC PORT HUENEME

Well Pair	Aquifer Screened	Screened Interval (feet)	First Round (May 1997)	Second Round (October 1997)	Third Round (January 1998)	Fourth Round (March 1998)	Tidal Study (April 1998)
20J8 20J7	Oxnard Mugu	155-195 280-320	**0.005**	**0.010**	**-0.002**	**(2)**	--
20J7 20J6	Mugu Mugu	280-320 385-425	**0.017**	**-0.005**	**0.034**	**downward** [1]	--

Notes:

Positive (+) vertical gradient values indicate downward movement of groundwater.

Negative (-) vertical gradient values indicate upward movement of groundwater.

Boldface indicates vertical gradient calculated with at least one pre-sampling water level, rather than during synoptic event.

Calculations are shown in Appendix J.

(1) Flowing artesian conditions exist in one of the wells, and a vertical gradient value cannot be calculated. However, the direction of groundwater movement can be determined and is denoted as either upward or downward.

(2) Flowing artesian conditions exist in both wells. Direction of groundwater movement cannot be determined.

-- = Water level data does not exist for one or both wells.

SPA = Semi-Perched Aquifer

APPENDIX D

RESULTS OF BATHYMETRIC CONDITIONS AND DEBRIS SURVEYS

(PROVIDED ON CD)

APPENDIX E

WEATHER AND SEA CONDITIONS

This appendix summarizes weather and sea conditions in the Port of Hueneme Harbor. The following information will be of use to potential bidders on the project and will be provided as part of the construction documents for bidder and contractor reference.

PRECIPITATION

Table 1 presents average historical monthly precipitation, days with precipitation, days with thunderstorms, record monthly maximum precipitation, and record monthly minimum precipitation for Port of Hueneme.

Table E-1
Precipitation Information for Port Hueneme, California

	Jan	Feb	March	April	May	June	July	Aug	Sep	Oct	Nov	Dec
Historical monthly precipitation (in)	2.7	2.4	1.9	0.8	0.1	N/A	N/A	0.1	0.3	0.2	1.5	1.7
Days with precipitation	6	5	6	3	1	1	N/A	N/A	1	2	4	5
Days with thunderstorms	1	1	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Record monthly maximum (in)	11.6	13.8	7.3	4.2	1.0	0.3	0.2	1.2	5.0	2.2	6.4	5.3
Record monthly minimum (in)	0.0	0.0	0.0	0.0	N/A	0.0	0.0	0.0	0.0	N/A	0.0	0.0

Notes:
Reporting Location: Point Mugu – Naval Air Warfare Center, California
Source: www.myforecast.com
in – inches
N/A – not applicable

WATER CONDITIONS

National Oceanic and Atmospheric Administration's (NOAA) National Data Buoy Center provides information for water located nearshore at Port Hueneme, California. The Waverider Buoy (Station 46234 – Port Hueneme Nearshore, California [141]) is located at 34°06'00" N 119°10'03" W, which is located 4 miles south southeast of Port of Hueneme, and is owned and maintained by Scripps Institution of Oceanography. Information provided by Waverider Buoy includes:

- Wave height – Significant wave height (meters) is calculated as the average of the highest one-third of all of the wave heights during the 20-minute sampling period
- Wave period – Dominant wave period (seconds) is the period with the maximum wave energy

- Water temperature – Sea surface temperature (Celsius)

WIND CONDITIONS

NOAA's National Data Buoy Center provides information for wind speed and direction located at the Santa Monica Basin. The 3-meter discus buoy (Station 46025 – Santa Monica Basin, California) is located at 33°44'42" N 119°05'02" W, which is located 29 miles south southeast of Port of Hueneme, and is owned and maintained by National Data Buoy Center. Information provided by the buoy includes:

- Wind direction – The direction the wind is coming from in degrees clockwise from true north
- Wind speed – Averaged over an 8-minute period for buoys (minutes/second [m/s])
- Wind gust – Peak 5- or 8-second gust speed (m/s) measured during the 8-minute period
- Air temperature – Air temperature at buoy (Celsius)

Meteorological data collected from the buoy spans 24 years from 1982 through 2006. Figure 1 contains a wind rose of the 8-minute averaged wind speed from that timeframe.

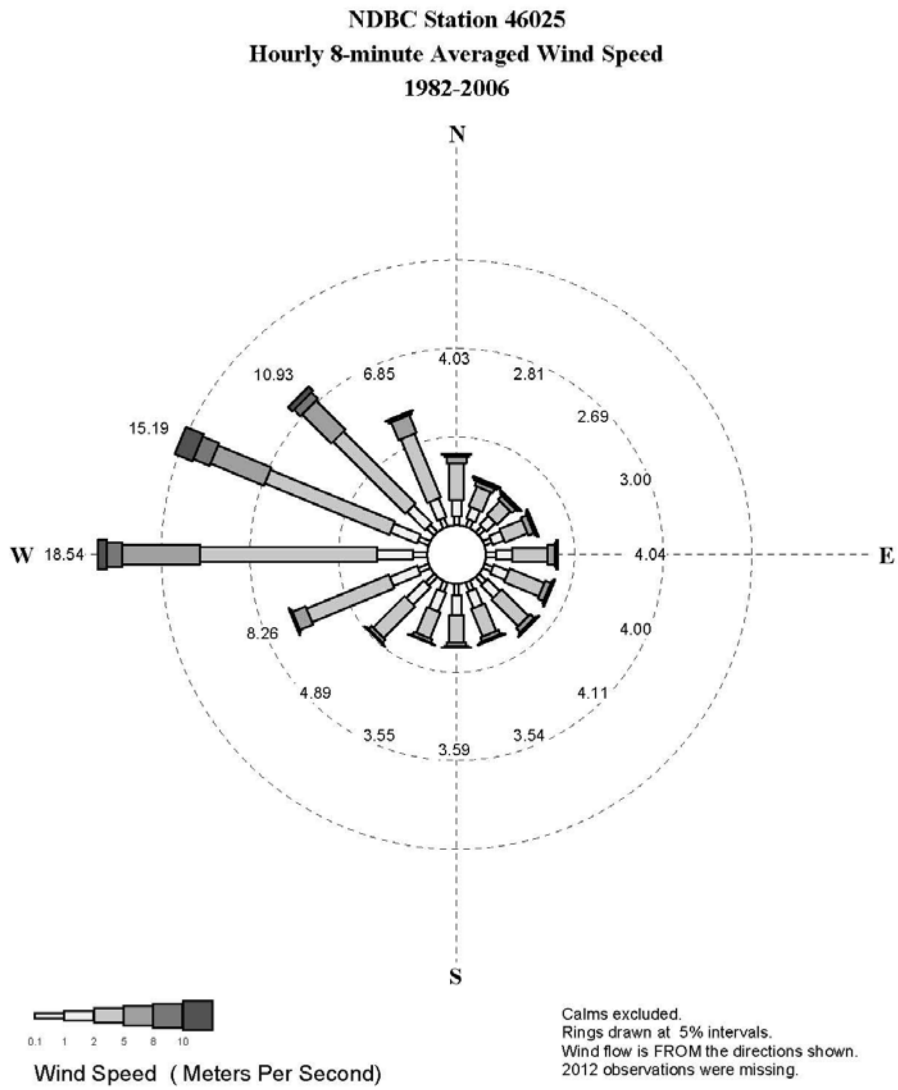


Figure 1
Hourly 8-minute Averaged Wind Speed

TIDAL DATUMS

NOAA's National Ocean Service provides information for tidal datums at Port of Hueneme, California. The tidal bench mark (Station 9411065 – Port Hueneme, California) is located at 34°8.9' N 119°12.2' W. Information provided by the tidal bench mark includes:

Table E-2
Tidal Datums at Port of Hueneme

Length of series	19 years
Time period	1941 to 1959
Tidal epoch	1960 to 1978
Control tide station	9410660 Los Angeles

Table E-3
Elevations of Tidal Datums Referred to MLLW

Tidal Condition	Elevation (feet)
Highest observed water level (02/04/1958)	7.67
Mean higher high water (MHHW)	5.47
Mean high water (MHW)	4.70
National Geodetic Vertical Datum-1929 (NGVD)[1]	2.88
Mean tide level (MTL)	2.84
Mean low water (MLW)	0.98
MLLW	0.00
Lowest observed water level (01/07/1951)	-2.33

Note:
1 – NGVD reference is based on adjustment of 1973 and NOS levels of 1940.

Table E-4
Tidal Bench Mark Information

Bench Mark Stamping or Designation	In Feet Above	
	MLLW	MHW
6 RESET 1970	14.84	10.14
BM 3 1932	14.02	9.32
NO 8 1949	18.97	14.27
NO 9 1949	12.47	7.77
8 LA	8.60	3.90
JAD RE 224	10.36	5.66
LIGHT 1921	11.01	6.31
N 5579.94 MON 11 E 6903.07	9.67	4.97

APPENDIX F

BIOTURBATION AND ITS POTENTIAL EFFECTS ON AQUATIC CAPPING IN PORT OF HUENEME

BIOTURBATION AND ITS POTENTIAL EFFECTS ON AQUATIC CAPPING IN PORT HUENEME

Prepared for

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November 2007

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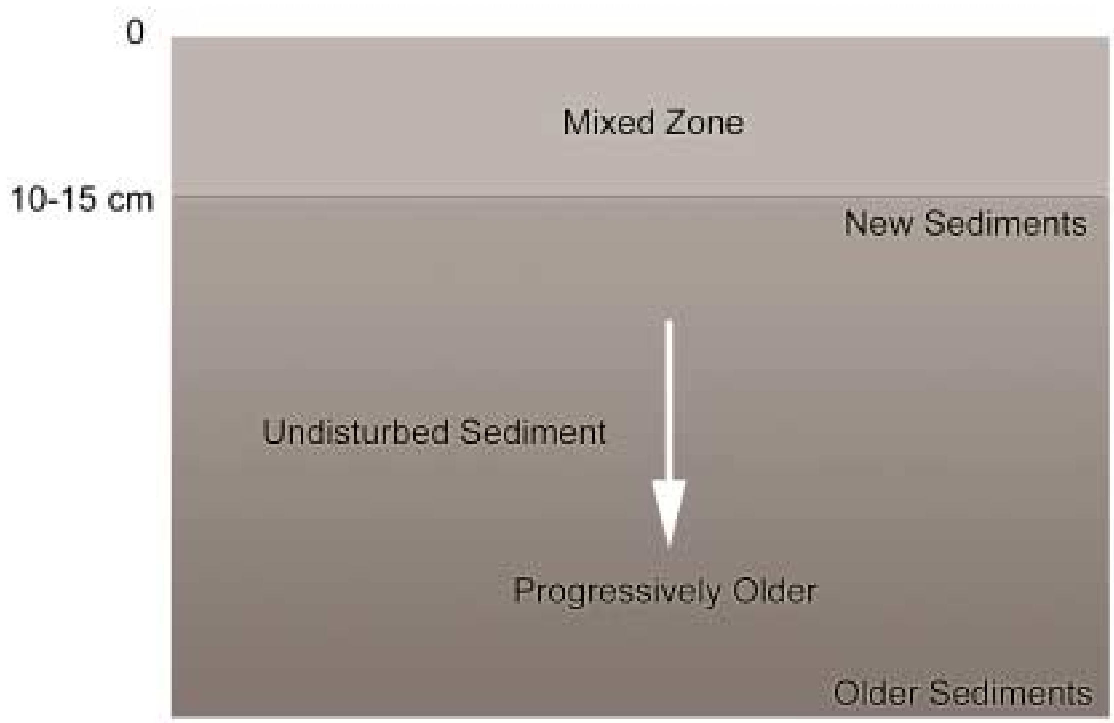
1 BACKGROUND ON MARINE SEDIMENTATION AND BIOTURBATION

In soft bottom marine substrates, bioturbation is the mixing and overturning of sediments caused by organisms residing in the sediments (called benthic organisms). Many benthic organisms burrow in, filter, consume, and generally disturb sediments as a part of their life processes. In terms of relative abundance, diversity, and biomass, the vast majority of benthic organisms reside in the upper few centimeters of the surface sediments (Berner 1980). Consequently, the upper few centimeters of most any unconsolidated marine sediments is extremely well mixed and is sometimes referred to as the "mixed zone." The exact depth of the mixed zone in any one location is variable and dependent upon the types of biological communities present, physical characteristics of the sediments, and characteristics of prevailing and storm-generated currents, which can also cause mixing of this upper layer. In many cases, the mixed zone in subtidal bay environments on the west coast of the United States is between 5 and 15 centimeters (cm) deep. For this reason, surface sediment sampling protocols for chemistry and benthos typically target the top 10 cm of sediment (SCBPP 1995 and Ecology 1991) (Figure 1).

Although isolation of the sediment layers below about 15 cm is common, in some situations, it may not be an absolute isolation and/or the mixed layer may be considerably deeper. This is because some organisms burrow in sediments deeper than 15 cm. At the particular locations of these burrows or burrowing activities, some mixing or other interaction of surface and deeper layers may occur. For example, some researchers (e.g., Kozloff 1983) have noted that ghost shrimp (*Neotrypaea* genus in general) move material from their relatively deep burrows to the surface, where these sediments are apparent as "volcano-like" mounds around the burrow entrance.

Thus, bioturbation is often conceptualized as decreasing with depth in a relationship illustrated in Figure 2 (Palmero et al. 1998). Under this concept, bioturbation is not assumed to stop suddenly at the mixed zone, but rather decrease at some rate through progressively deeper sediment layers. At some depth, the bioturbation rate essentially approaches zero; and for all purposes, bioturbation is so sporadic or infrequent that it is inconsequential and immeasurable.



ANCHOR ENVIRONMENTAL, L.L.C.
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Figure 1
Typical Unconsolidated Marine Sediment Profile

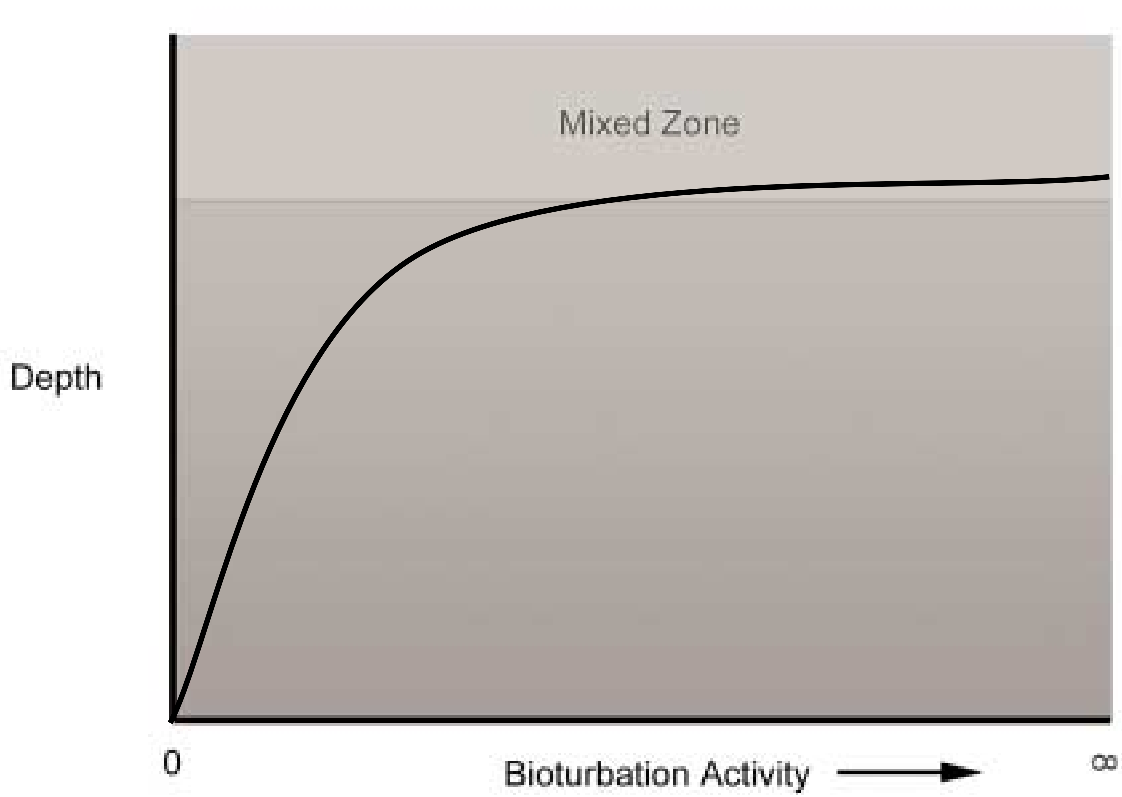

Figure 2
Conceptual Model of Bioturbation with Depth

2 CAP DESIGN AND BIOTURBATION

A critical issue for any aquatic capping project is estimating the overall shape and depth of the bioturbation curve (similar to the one shown in Figure 2) that will be present after the cap is constructed and recolonized by benthic organisms. Clearly, a cap intending to isolate contaminated sediments should have a thickness equivalent to the depth where the future bioturbation rate is expected to be close to zero.

A common method of estimating the lower extent of bioturbation is to examine those organisms present or likely to be present at the site and identify the deepest burrowers. It is important to note that this is a conservative approach. That is, using the most extreme observation of burrowing depth available from any instance of any organism in any location may yield a very extreme estimate of bioturbation for a particular location or situation. For example, many organisms burrow in the sediment but are primarily suspension feeders that remove plankton from the water for food rather than mixing up or churning the sediment on a continual basis. Observations of extreme burrowers may provide no indication of the actual amount of sediments that might be bioturbated and how this relates to the overall stratification of sediments as typically observed in soft bottom sediments. However, this approach can provide a starting point as a worst-case estimate of potential depths where bioturbation may be significant.

Neotrypaea californiensis and other shrimp of this genus are known to burrow to considerable depths in sediments. This genus occurs throughout Pacific coastal waters of North America from Alaska to Baja California (Posey 1986). Consequently, they have been extensively examined and discussed in the general literature and capping project reports throughout the west coast of the United States. This is also the reason that they have often been discussed in the context of this specific project and are the focus of this document.

3 GHOST SHRIMP HABITAT CHARACTERISTICS

This discussion is confined primarily to *N. californiensis* because it is the most often studied shrimp of this genus present in Southern California waters and is known to be a deep burrower. According to Hornig et al. (1989) only *N. gigas* is similar in distribution, habitat, and (most importantly) habits such as depth of burrowing. However, Johnson and Gonor (1983) indicate that *N. gigas* is rare compared to N. *californiensis* and thus would not be expected to contribute substantially to overall bioturbation rates as compared to the widespread and more common *N. californiensis*. Thus, *N. gigas* is not included in this discussion.

3.1 Burrowing Depths

Ghost shrimp burrows take the form of relatively simple U- or Y-shaped burrows, or alternatively, more elaborate tiered galleries (Griffis and Suchanek 1991). The depths of these burrows can vary considerably depending on a number of factors including:

- Size of shrimp (i.e., juveniles or adults)(Feldman et al. 1997 and Dumbauld et al. 1996)
- Sediment type (e.g., mud, sand, etc.)(Griffis and Chavez 1988 and Griffis and Suchanek 1991)
- Presence of interfering structures (e.g., polychaete tubes, sea grass roots, and/or shells) (Griffis and Suchanek 1991, Posey 1986, and Feldman et al. 1997)
- Tidal height (Griffis and Chavez 1988, Griffis and Suchanek 1991, and Posey 1986)

Table 1 summarizes some reported burrowing depths. This table does not contain an exhaustive review of the literature. However, because many of the values shown are based on other's reviews of the wider literature, Table 1 shows the overall range of burrowing depths generally attributed to *N. californiensis*.

Table 1
Reported Burrowing Depths for *N. californiensis*

Source	Maximum Depth (cm)	Usual Adult Depth (cm)	Location	Comments
Dumbauld et al. 1996	90	Less than 60	Washington	
Feldman et al. 1997	NR	50	Various	Synthesis of many studies
Griffis and Chavez 1988	45	Less than 40	Baja California	
Griffis and Suchanek 1991	NR	50	Various	Synthesis of many studies
Hornig et al. 1989	75	NR	Oregon	Synthesis of many studies
Personal communication, Lees 2001	90	75	Various	Synthesis of many studies; usual depth from MacGinitie (1934)
Peterson 1977	NR	50	Southern California	

NR – not reported in article

The range of reported depths for adult *N. californiensis* is from less than 40 cm to as much as 90 cm. It should not be assumed from these data that all adult ghost shrimp burrow to these depths. On the contrary, almost all of these researchers report or discuss burrows or burrow networks that are often much less than 40 cm deep at their deepest point. Further, it is well established that juvenile benthic shrimp (as opposed to the pelagic larval stage) utilize very shallow sediment depths given that they are initially only a few millimeters long and may not reach average adult size for approximately 2.5 years after settlement (Feldman et al. 1997 and Dumbauld et al. 1996).

A number of researchers report that ghost shrimp burrow deepest in high intertidal areas in order to stay submerged underwater within the burrow for longer periods during low tides (Griffis and Suchanek 1991, Griffis and Chavez 1988, and Posey 1986). Thus, some of the more extreme observations of ghost shrimp burrowing depths likely reflect a behavioral adaptation to intertidal habitats.

3.2 Bioturbation Rates

Estimates and reports of material volumes moved or mixed by ghost shrimp vary enormously. Sediment core dating in areas where ghost shrimp are known to occur often show no evidence of significant mixing below a relatively shallow mixed zone of 5 to 15 cm (Tetra Tech 1986 and Parametrix 1995). Conversely, some researchers report extensive mixing of sediments to considerable depths where dense "beds" of ghost shrimp occur (Hornig et al. 1989, Griffis and Suchanek 1991, Rowden and Jones 1993, and Berkenbusch and Rowden 1999).

Rowden and Jones (1993) reviewed bioturbation rate estimates (often termed "turnover") from a number of researchers and found a wide range of reported values. More importantly, the methods used to arrive at these estimates were highly variable and were often measuring different variables (e.g., volume turnover, mass movement, dry weight mass, wet weight mass, mass per burrow, mass per shrimp, etc.). Also, all of these methods focused on measurements of material excavated to the surface and provided no information on the depth from which the material originated.

MacGinitie (1934) reported a complete annual turnover of sediments to 75 cm in one location, but no method for this estimate is provided (as pointed out by Rowden and Jones 1993). Griffis and Suchanek (1991) present an estimate of 2.7 liters per square meter (m^2) per day (wet material). This would equate to complete turnover of the sediments in about 220 days using Dumbauld's et al. (1996) reported burrowing depth of 60 cm. Rowden and Jones reviewed estimates for unidentified species of *Neotrypaea* that range from 0.056 to 0.8 liter per m^2 per day (wet material), which is considerably less than Griffis and Suchanek's (1991) information. (Rowden and Jones also present many other estimates that cannot be resolved to consistent terms given the information provided in the article.) Regardless of the exact value, all of these estimates were made for dense beds of ghost shrimp (discussed more in Section 4.3). Overall, turnover rate is directly related to the number of shrimp per square meter (or density). Thus, shrimp density is an important factor in estimating a total turnover rate for a particular location.

3.3 Habitat Preferences and Density

Ghost shrimp can occur in dense beds where they are often the most abundant (or dominant) species present (Hornig et al. 1989). Conversely, they can also occur in much lower densities within relatively diverse communities of other species (Posey 1986, Feldman et al. 1997, Parametrix 1992 to 1999, Chambers 1996, and USACE 2007). Ghost shrimp prefer intertidal to shallow subtidal locations within estuarine bays, and this is where "dense" beds of ghost shrimp occur (Hornig et al. 1989, Dumbauld et al. 1996, Kozloff 1983, Griffis and Chavez 1988, Griffis and Suchanek 1991, Posey 1986, Rowden and Jones 1993, Peterson 1977, MacGinitie 1934, Feldman et al. 1997, and Johnson and Gonor 1983).

Table 2 summarizes some estimates of ghost shrimp densities in these types of shallow water habitats. In most cases, the values shown are from areas of particularly high ghost shrimp densities that were purposely selected for the study. Posey (1986) discusses the fact that ghost shrimp beds can be quite dense but extremely localized, with densities dropping to just 3 shrimp per m^2 a few meters from the edge of a bed. The beds observed by Posey (1986) were often restricted to certain tidal heights (all intertidal). Feldman et al. (1997) also report such localized beds in intertidal areas, with very few ghost shrimp in the intervening areas.

There is also considerable discussion in the literature about ghost shrimp substrate preferences (e.g., sand versus mud). Ghost shrimp have been observed to inhabit a range of substrate types but are usually characterized as preferring "muddy sand" (Hornig et al. 1989 and MacGinitie 1934). Griffis and Chavez (1988) indicate ghost shrimp prefer sandier sites but measured relatively high densities in some muddier sites as well. Peterson (1977) also indicates that ghost shrimp prefer relatively sandy habitats in Southern California. As noted above, the presence of interfering structures (polychaete tubes, sea grass roots, and/or shells) (Griffis and Suchanek 1991, Posey 1986, and Feldman et al. 1997) appears to retard burrowing and may preclude ghost shrimp (at least in high densities) in areas where these structures occur. Lees (personal communication 2001) showed in laboratory tests that a relatively thin gravel layer (less than 30 cm thick) would prevent ghost shrimp colonization of underlying sediments.

3.4 Commensal Species

Ghost shrimp burrows are inhabited by several species that are specifically adapted to these burrows (and are referred to as "commensal" species). Because these commensal species rarely occur outside ghost shrimp burrows, they provide an indirect indication of ghost shrimp presence. Notable ghost shrimp commensal species are a scaleworm (*Hesperonoe complanata*) and a small clam (*Cryptomya californica*) whose siphon opens to the shrimp burrow instead of the sediment surface (Kozloff 1983).

Table 2
Estimates of *N. californiensis* Densities in Various Locations

Source	Low Range Density (number per m^2)	High Range Density (number per m^2)	Location	Habitat	Comments
Hornig et al. 1989*	700	1,400	Oregon	Estuarine bay	No particulars given
Hornig et al. 1989*	420	770	Oregon	Estuarine bay	High density areas in particular
Hornig et al. 1989*	Less than 300	s.c.	Oregon	Coastal areas	General observation
Dumbauld 1996	230	450	Washington	Intertidal estuarine bay	Purposely selected highest density areas
Griffis and Chavez 1988	50	100	Baja California	Intertidal estuarine bays	
Griffis and Suchanek 1991*	100	180	British Columbia	Estuarine bay	No particulars given
Griffis and Suchanek 1991*	78	170	Unspecified	Unspecified	
Posey 1986	3	100	Oregon	Intertidal estuarine bay	Low value just 2 meters outside a dense bed
Peterson 1977	67	133	Southern California	Intertidal estuarine bay	
Feldman et al. 1997	s.c.	Greater than 100	Washington	Intertidal estuarine bay	General observation of dense beds

*Review of other articles
s.c. - see comment

4 PRESENCE OF GHOST SHRIMP IN PORT HUENEME

Other than conducting pilot studies of the proposed confined aquatic disposal (CAD) area, there is no way to predict exactly the potential presence and density of ghost shrimp on an aquatic cap before it has been built. However, observations from other, similar harbors within Southern California (Chambers 1996 and USACE 2007) have yielded information that can provide estimates of the potential for future ghost shrimp colonization of the cap. These estimates can be based on comparing the proposed cap material substrate and final design elevation to known information on ghost shrimp preferences, as well as previous surveys conducted in the region.

The design depth for the Turning Basin at Port Hueneme is currently approximately -11 meters mean lower low water (MLLW) while the surface of the cap is expected to be -12 to -13 meters MLLW. The present substrate in the area targeted for the Port Hueneme CAD site is predominantly fine to medium grade sand. Existing information indicates that the cap source material from the Federal Channel is comprised mostly of sand to silty sand. As noted in Section 4.3, dense ghost shrimp beds are usually found in intertidal to very shallow subtidal elevations in sandy or muddy (silty) substrates. No actual surveys have been conducted within Port Hueneme to target the presence of ghost shrimp, but similar studies have been conducted in other areas (USACE 2007), which provide useful information.

5 IMPLICATIONS FOR CAP DESIGN

The preferred habitat for dense beds of ghost shrimp is sandy or muddy intertidal to extremely shallow subtidal estuarine bays. The proposed Port Hueneme aquatic cap will be at a depth of approximately –12 to -13 meters MLLW, well below the preferred depth range. Existing information on regional benthos populations indicates that a species of *Neotrypaea* is likely present but only in very low densities. This finding is consistent with the existing (and proposed) water depths.

Both the existing Port Hueneme substrate and the proposed cap material are already in the range of sediment grain sizes colonized by ghost shrimp. Therefore, a large increase in ghost shrimp densities after capping due to changes in surface sediment grain size is not expected, particularly at these water depths. From this information, it appears most likely that some ghost shrimp will be present in the future aquatic cap but at very low densities.

Because ghost shrimp densities are expected to be low, the overall bioturbation rate (on an area basis) would also be expected to be very low as compared to estimates provided by other researchers investigating dense beds of ghost shrimp. Rowden and Jones (1993) reviewed an individual ghost shrimp bioturbation rate of 18 milliliters per individual per day (wet material). If ghost shrimp are assumed to be present in the future cap at densities equivalent to those measured at other, similar locations, this would equate to a turnover rate that is 150 times less than those reported by Griffis and Suchanek (1991).

As discussed in Section 4.1, the deepest commonly reported burrowing depth for ghost shrimp is about 90 cm (Table 1), and only a small fraction of the shrimp in any bed are expected to reach these depths. Given the above bioturbation rates, cap thicknesses less than 60 cm would appear to be protective. Currently, the proposed design for the cap is a thickness of approximately 300 cm. This thickness should be protective of even the deepest burrowing individuals; therefore, this thickness will result in essentially zero bioturbation of contaminated sediments underlying the cap. Based on the information presented above, a conceptual model of the expected bioturbation curve for this cap is shown in Figure 3.

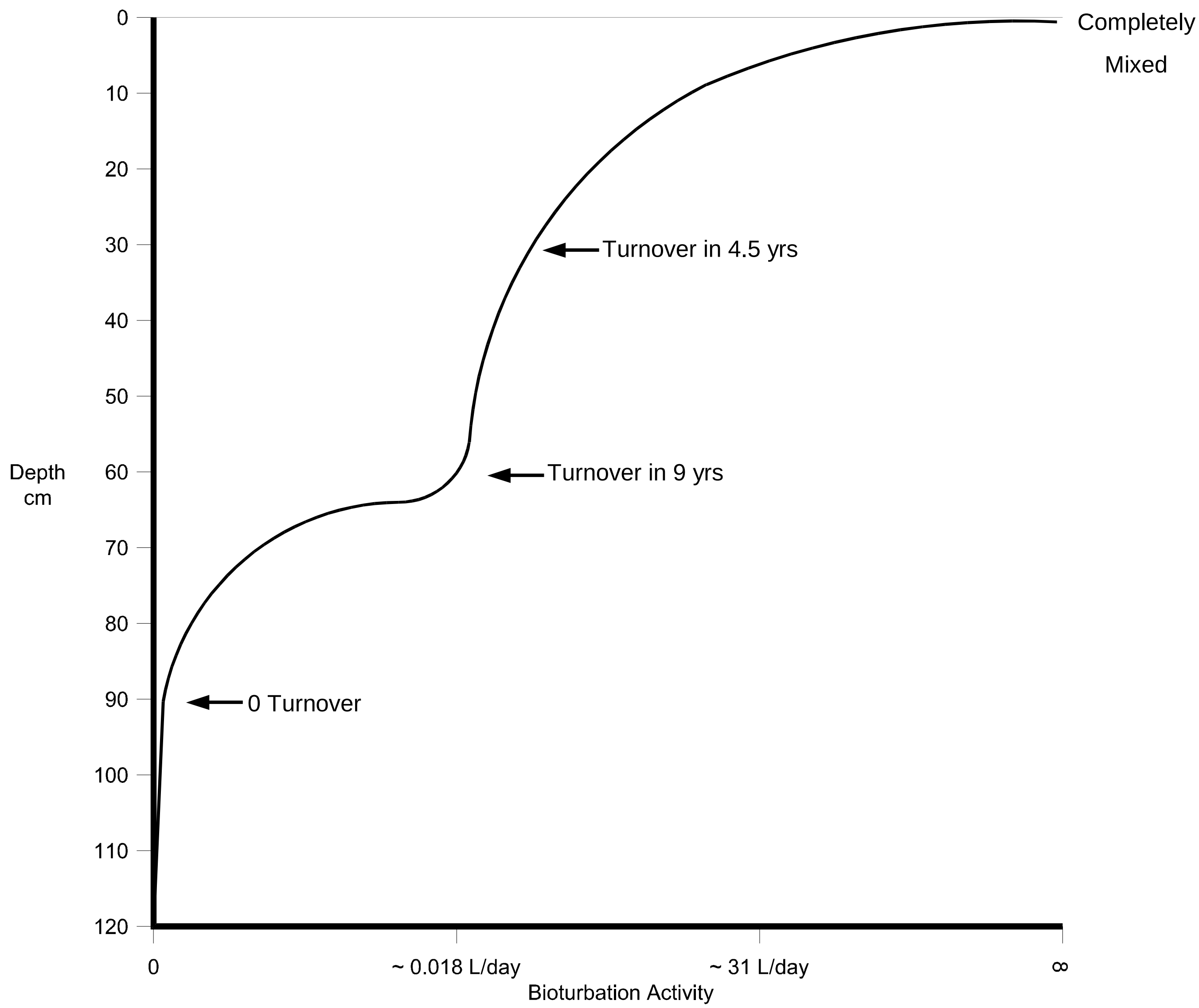

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Figure 3
Expected Bioturbation Curve
at Port Hueneme Aquatic Capping Site

6 UNCERTAINTY ASSOCIATED WITH GHOST SHRIMP OBSERVATIONS

One common criticism of standard benthic sampling techniques is that they sample only the upper sediment layers and do not penetrate to deeper layers where ghost shrimp may be residing in their burrows.

The work conducted by Dumbauld et al. (1996) and Feldman et al. (1997) investigated the larval settlement and subsequent growth of ghost shrimp. This research shows that:

1. Juvenile benthic shrimp are of sizes (typically a few millimeters in size) that would be retained on standard 1 millimeters (mm) or 0.5 mm screens.
2. Juvenile shrimp remain small for the first 6 months after settlement and do not reach median adult size (about 20 mm in one study) for about 2.5 years.

These juvenile shrimp do not burrow as deeply as adults and are observable in the upper few centimeters of sediment.

For many benthic organisms, the attrition rate from juvenile to adult stages is very high, even in environments that are ideal to the propagation of the species. Consequently, it would be very unusual to find an area with very low densities of ghost shrimp in the upper sediment layers and very high densities of large deep burrowing adults at the same site. This has been corroborated through 10 years of benthic sampling at the St. Paul Waterway Cap in Tacoma, Washington (Parametrix 1992 to 1999). At this capping site, cap material cores were taken to depths of 6 meters, and ghost shrimp were occasionally found as deep as 45 cm below the cap surface. Ghost shrimp were also observable in the top 10 cm of sediment throughout the 10-year sampling program. (It is worth noting that this cap has been approved by U.S. Environmental Protection Agency (EPA) as an effective remediation, and the site has since been removed from the federal Superfund list). Similarly, deep sediment samples (approximately 2 meters) collected at the Dredged Material Management Program (DMMP) Pilot Capping Study showed that ghost shrimp densities in deeper depths were similar to upper layers.

7 IMPLICATIONS FOR CAP MONITORING

It appears that a 120 cm cap would be more than effective to protect against ghost shrimp bioturbation of contaminated sediments underlying the cap. The proposed project will include a 300 cm cap, which should provide an additional layer of protection. Monitoring the cap over the long term to confirm these predictions is recommended and will be conducted.

A hypothetical monitoring plan would likely include the following elements:

- Benthic surveys of surface sediments (top 10 cm)
- Observations of deep cores through the entire cap for the presence of ghost shrimp and their burrows
- Chemical analysis of deep cores and cap surface sediments to detect any vertical movement of contaminated material to the surface

If high densities of ghost shrimp were colonizing the cap after construction, it would be observable in one or both of the biological survey methods. Further, the chemistry monitoring could confirm whether these shrimp were moving contaminated sediments to the surface of the cap.

If ghost shrimp were found in high numbers, more detailed monitoring would be considered at that time (such as radioisotope cores to determine bioturbation rates and depths). Although not anticipated, diver or remote camera surveys of the sediment surface could also be conducted and counts made of ghost shrimp or ghost shrimp-like burrow entrances. This would provide a third method of estimating the relative densities of adult ghost shrimp present.

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APPENDIX G

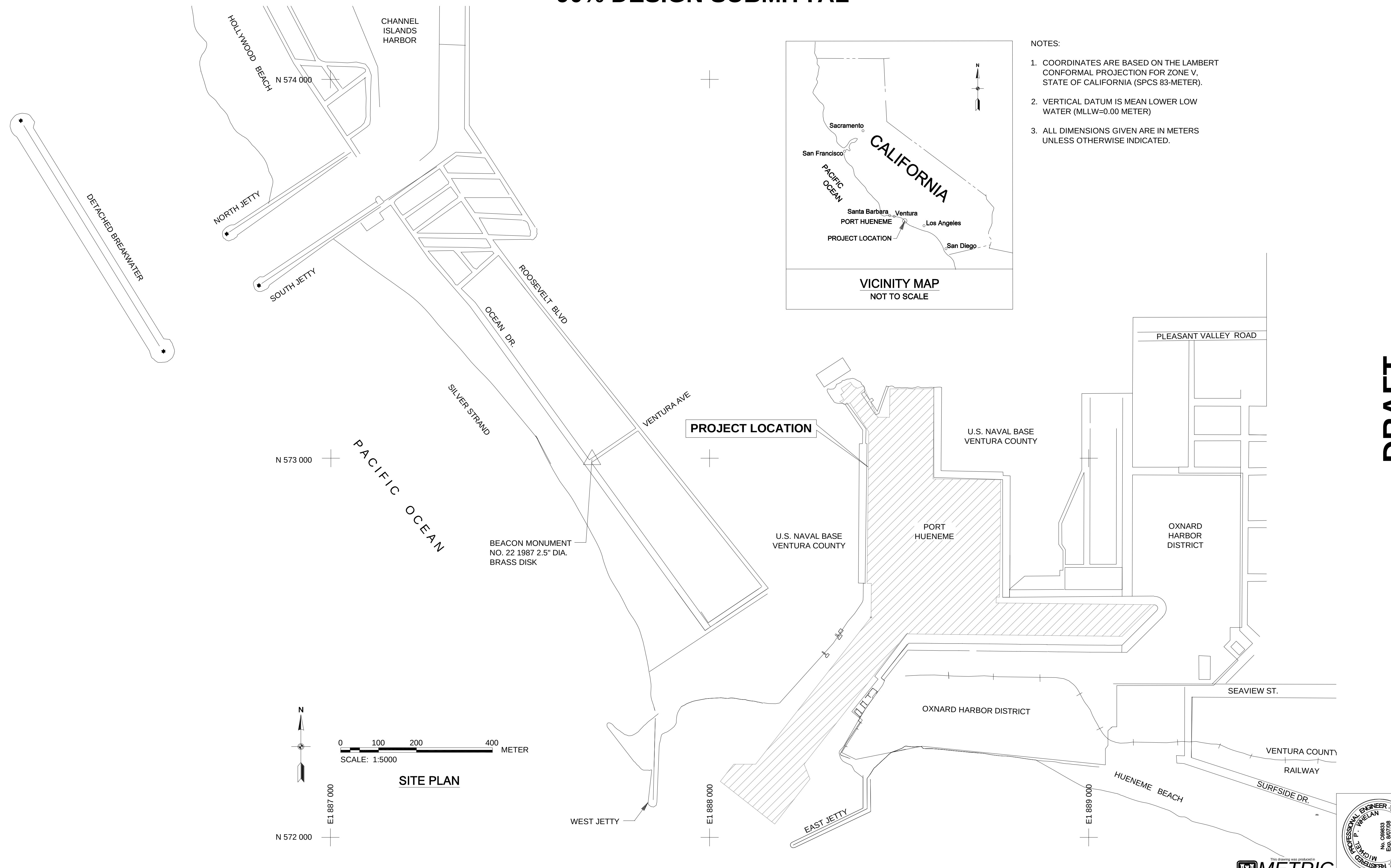
90 PERCENT DESIGN PLANS

VALUE ENGINEERING PAYS

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL

PORT HUENEME, CALIFORNIA

90% DESIGN SUBMITTAL



SITE PLAN

VICINITY MAP

NOT TO SCALE

NOTES:

1. COORDINATES ARE BASED ON THE LAMBERT CONFORMAL PROJECTION FOR ZONE V, STATE OF CALIFORNIA (SPCS 83-METER).
2. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW=0.00 METER)
3. ALL DIMENSIONS GIVEN ARE IN METERS UNLESS OTHERWISE INDICATED.

SYMBOL	DESCRIPTIONS	DATE	APPROVAL

REVISIONS

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

COVER SHEET, VICINITY MAP

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 080295-C-CS-IN.DWG

SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

DATE: JUNE 2008

DISTRICT FILE NO. #####

SCALE: 1:5000

SHEET 1 OF 38 SHEETS

REGISTERED PROFESSIONAL ENGINEER
MICHAEL P. WHELAN
No. C56833
Exp. 6/07/08
CIVIL
STATE OF CALIFORNIA

This drawing was produced in METRIC

SAFETY PAYS

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INDEX TO CONTRACT DRAWINGS

PROJECT NOTES:

1. BENCH MARK VE-6 IS AT THE SW END OF THE BOAT HOIST STRUCTURE ADJACENT TO THE LOADING AREA ON THE WHARF. THIS STATION IS A 3-1/2 INCH BRASS DISC SET IN A CONCRETE PILLAR. ELEVATION IS 3.725 METERS (MLLW).
2. BATHYMETRIC CONTOURS FROM SURVEY DATED SEPTEMBER, 2007.
3. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
4. ALL DIMENSIONS GIVEN ARE IN METERS UNLESS OTHERWISE INDICATED

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SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

INDEX TO CONTRACT DRAWINGS

SYMBOL | DESCRIPTIONS | DATE | APPROVAL
REVISIONS

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DRAWN BY: TPG
CHECKED BY: MPW

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

FILE NAME: 080295-C-CS-IN.DWG
SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

DATE: JUNE 2008
DISTRICT FILE NO. #####

SCALE: N/A
SHEET 2 OF 38 SHEETS

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C56833 Exp. 6/07/08 CIVIL STATE OF CALIFORNIA

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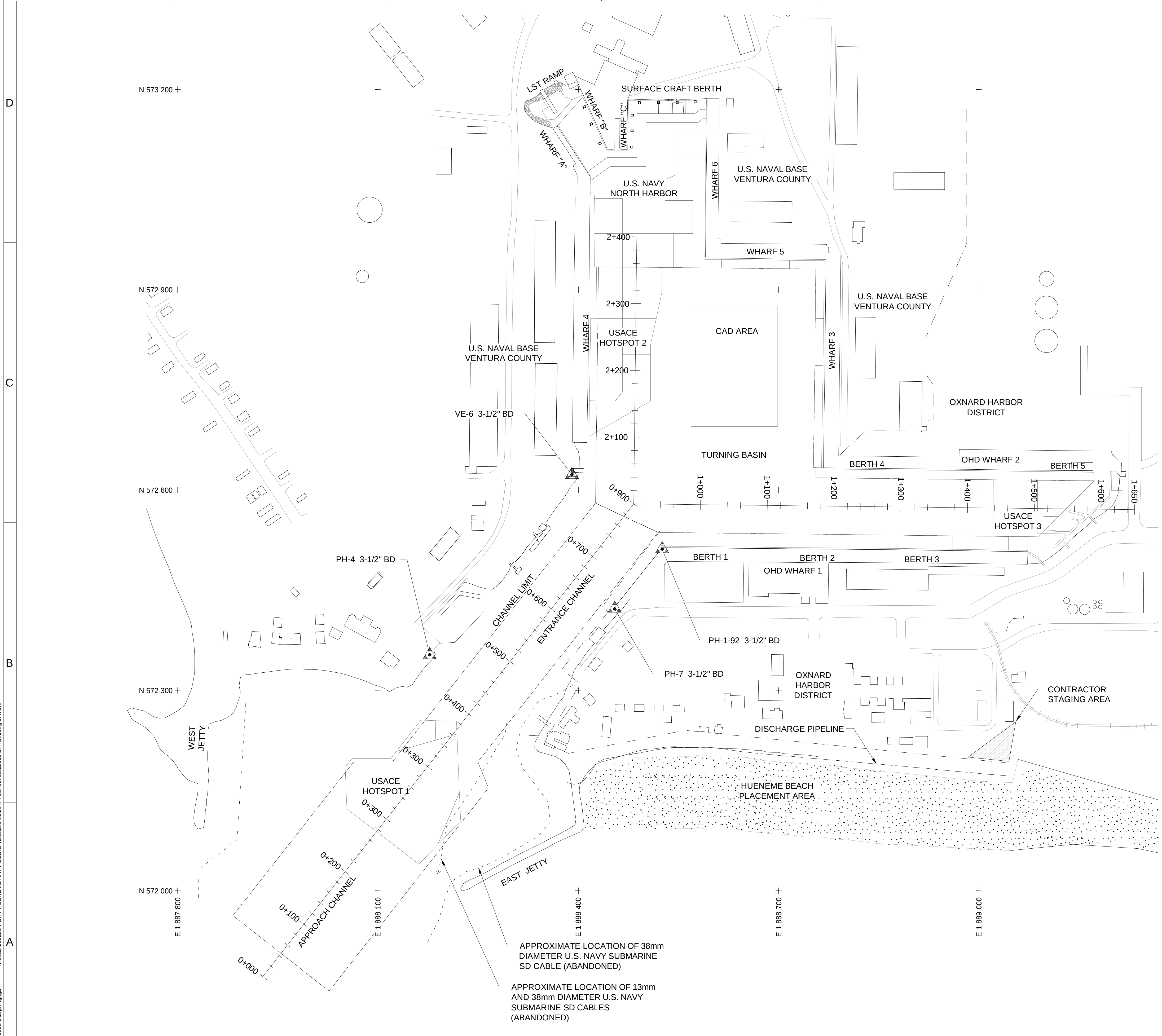

LEGEND:

- SURVEY MONUMENT
- PROPERTY LINE
- ABANDONED U.S. NAVY SUBMARINE SD CABLES

CONTROL STATIONS TABLE

STA.	EASTING	NORTHING	ELEV.
VE 6	1888390.456	572622.909	3.725
PH 7	1888454.418	572422.592	3.571
PH 4	1888177.433	572353.236	3.652
PHI-92	1888525.524	572511.569	3.808

NOTES:

1. BENCH MARK VE-6 IS AT THE SW END OF THE BOAT HOIST STRUCTURE ADJACENT TO THE LOADING AREA ON THE WHARF. THIS STATION IS A 3-1/2 INCH BRASS DISC SET IN A CONCRETE PILLAR. ELEV. 3.725 METERS (MLLW).
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4. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW).

DRAFT
SUBJECT TO REVISION

SYMBOL	DESCRIPTIONS	DATE	APPROVAL

REVISIONS

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

PROJECT DATUM

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 08029501-DATUM.DWG

SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

DATE: JUNE 2008

DISTRICT FILE NO. #####

SCALE: 1:3000

SHEET 3 OF 38 SHEETS

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C56833 Exp. 9/07/08 CIVIL STATE OF CALIFORNIA

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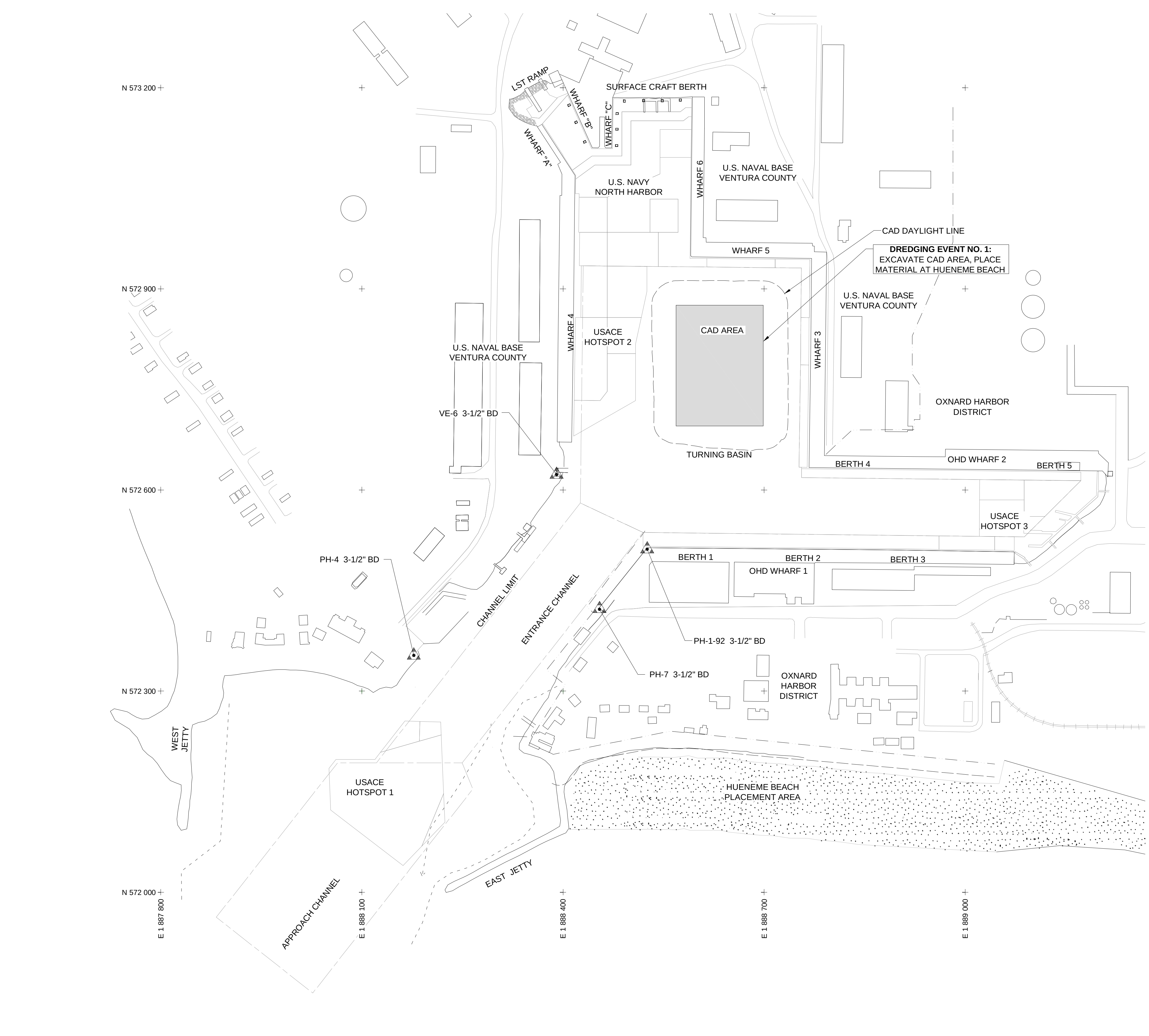
VALUE ENGINEERING PAYS



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LEGEND:

- SURVEY MONUMENT
- PROPERTY LINE
- ABANDONED U.S. NAVY SUBMARINE SD CABLES
- HYDRAULICALLY DREDGED CAD AREA

NOTES:

1. BENCH MARK VE-6 IS AT THE SW END OF THE BOAT HOIST STRUCTURE ADJACENT TO THE LOADING AREA ON THE WHARF. THIS STATION IS A 3-1/2 INCH BRASS DISC SET IN A CONCRETE PILLAR. ELEV. 3.725 METERS (MLLW).
2. BATHYMETRIC CONTOURS FROM SURVEY DATED SEPTEMBER, 2007.
3. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
4. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW)

LEGEND:

- DISCHARGE PIPELINE (THIS CONTRACT)
- SURVEY MONUMENT
- PROPERTY LINE
- ABANDONED U.S. NAVY SUBMARINE SD CABLES

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGE ORDER - CAD AREA

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 080295-01-DATUM.DWG

SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

DATE: JUNE 2008

DISTRICT FILE NO. #####

SCALE: 1:3000

SHEET 4 OF 38 SHEETS

REGISTERED PROFESSIONAL ENGINEER
MITCHELL P. WHELAN
No. C58833
Exp. 9/07/08
CIVIL
STATE OF CALIFORNIA

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SAFETY PAYS

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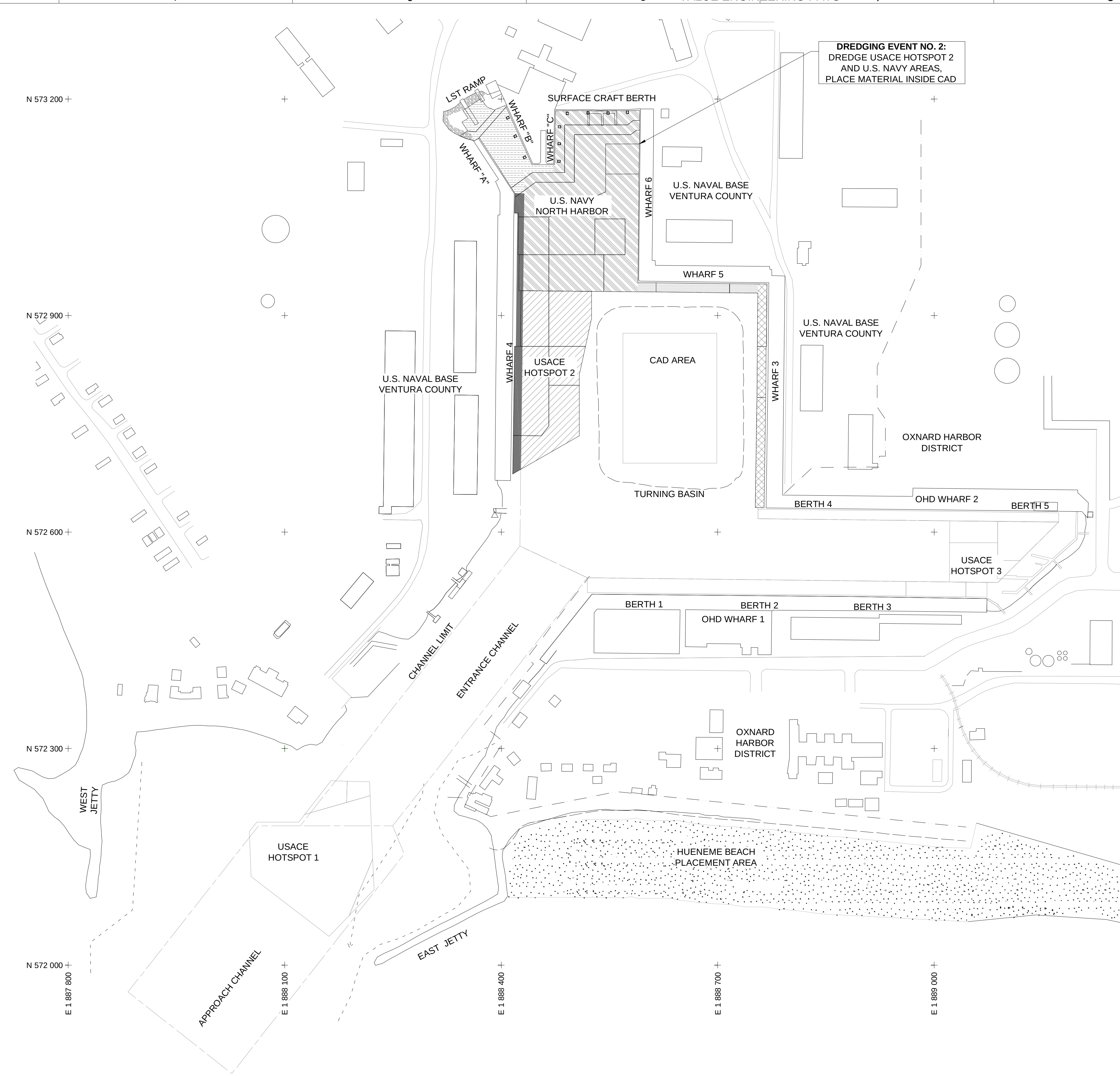
VALUE ENGINEERING PAYS



LEGEND:

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- PROPERTY LINE
- ABANDONED U.S. NAVY SUBMARINE SD CABLES

NOTES:

1. BENCH MARK VE-6 IS AT THE SW END OF THE BOAT HOIST STRUCTURE ADJACENT TO THE LOADING AREA ON THE WHARF. THIS STATION IS A 3-1/2 INCH BRASS DISC SET IN A CONCRETE PILLAR. ELEV. 3.725 METERS (MLLW).
2. BATHYMETRIC CONTOURS FROM SURVEY DATED SEPTEMBER, 2007.
3. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
4. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW)
5. DREDGE USACE HOTSPOT 2 BEFORE DREDGING U.S. NAVY AREAS.

DREDGE ORDER:

1. DREDGE USACE HOTSPOT 2
2. DREDGE U.S. NAVY WHARF 3
3. DREDGE U.S. NAVY WHARF 5
4. DREDGE U.S. NAVY NORTH HARBOR AREA
5. DREDGE U.S. NAVY WHARVES A & B
6. DREDGE U.S. NAVY WHARF 4

This drawing was produced in METRIC

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGE ORDER - U.S. NAVY WHARVES & USACE HS2

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 080295-01-DATUM.DWG

SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

DATE: JUNE 2008

DISTRICT FILE NO. #####

SCALE: 1:3000

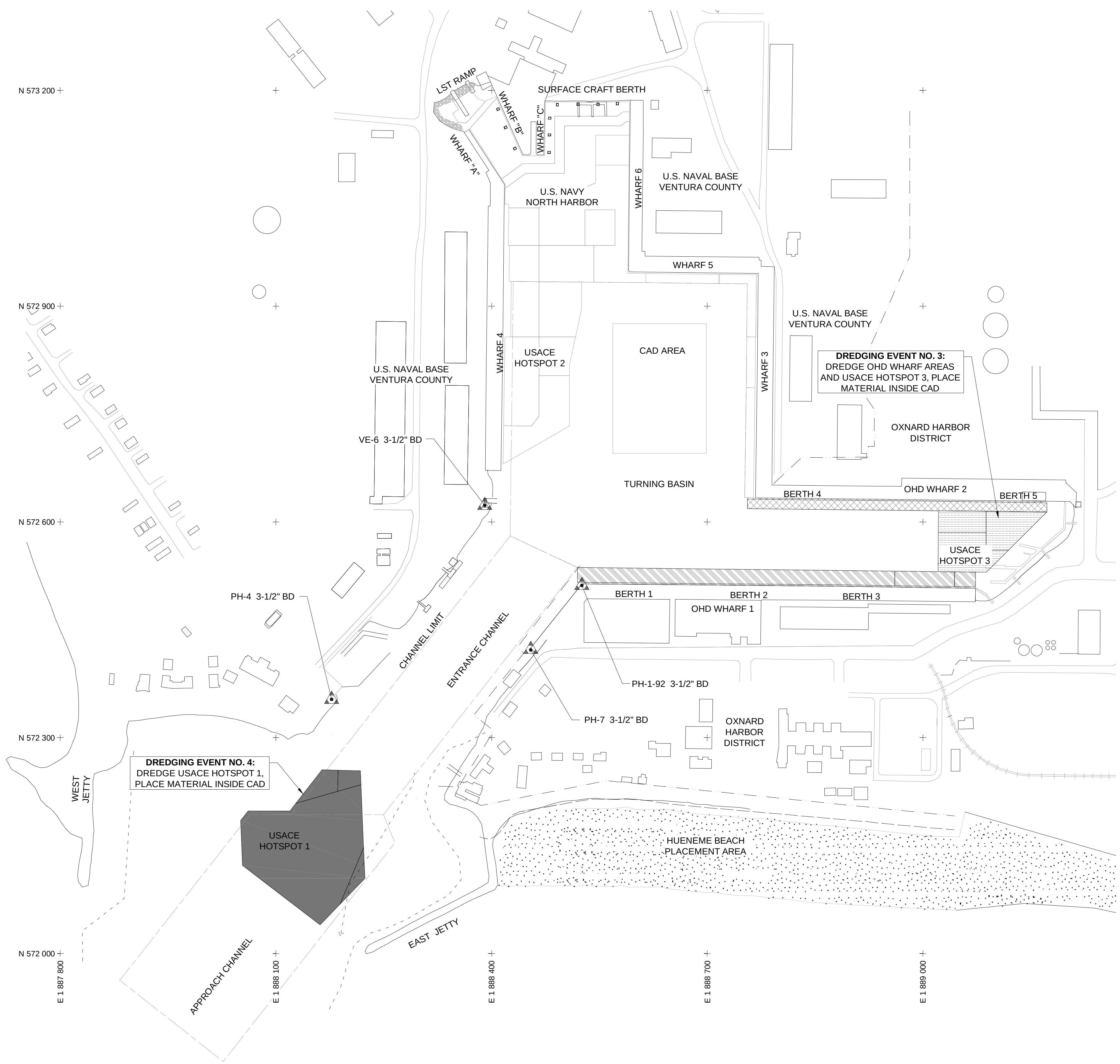
SHEET 5 OF 38 SHEETS

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C58833 Exp. 9/07/08 CIVIL STATE OF CALIFORNIA

Jun 25, 2008 2:19pm tgriga K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\080295-01-DATUM.dwg NAVY

SAFETY PAYS

VALUE ENGINEERING PAYS



0 40 80 160 METER
SCALE: 1:3000

N

LEGEND:

- SURVEY MONUMENT
- PROPERTY LINE
- ABANDONED U.S. NAVY SUBMARINE SD CABLES

NOTES:

1. BENCH MARK VE-6 IS AT THE SW END OF THE BOAT HOIST STRUCTURE ADJACENT TO THE LOADING AREA ON THE WHARF. THIS STATION IS A 3-1/2 INCH BRASS DISC SET IN A CONCRETE PILLAR. ELEV. 3.725 METERS (MLLW).
2. BATHYMETRIC CONTOURS FROM SURVEY DATED SEPTEMBER, 2007.
3. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
4. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW)

DREDGE ORDER:

1. DREDGE USACE HOTSPOT 3
2. DREDGE OHD WHARF 1
3. DREDGE OHD WHARF 2
4. DREDGE USACE HOTSPOT 1

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGE ORDER - OHD WHARVES 1, 2 AND USACE HS1 & HS3

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 080295-01-DATUM.DWG

SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

DATE: JUNE 2008

DISTRICT FILE NO. #####

SCALE: 1:3000

SHEET 6 OF 38 SHEETS

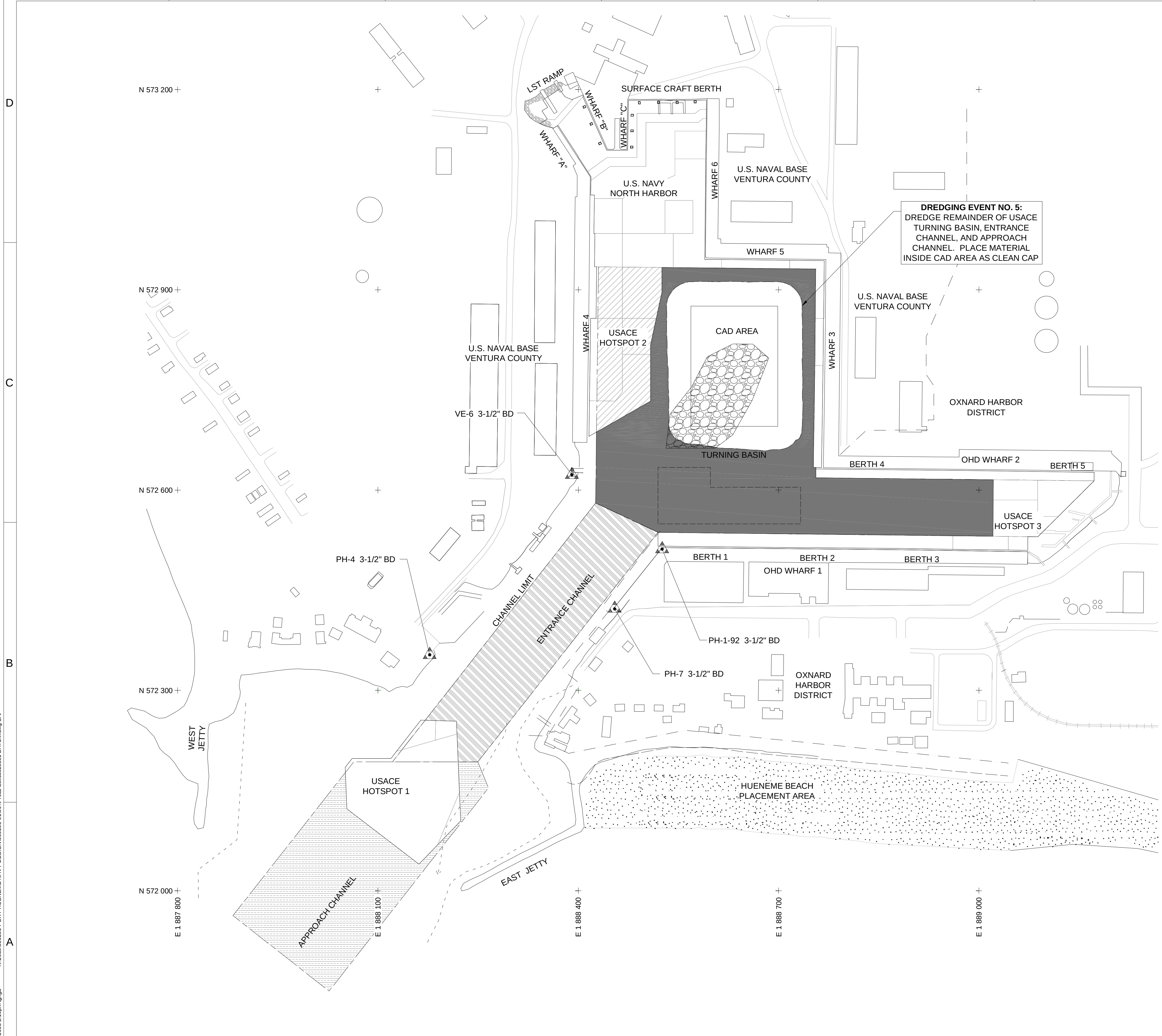
REGISTERED PROFESSIONAL ENGINEER
MICHAEL P. WHELAN
No. C56833
Exp. 6/07/08
CIVIL
STATE OF CALIFORNIA

This drawing was produced in METRIC

SAFETY PAYS

K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\080295-01-DATUM.dwg OHD
Jun 25, 2008 2:19pm tpriga

VALUE ENGINEERING PAYS



LEGEND:

- SURVEY MONUMENT
- PROPERTY LINE
- ABANDONED U.S. NAVY SUBMARINE BLACK SD CABLES

NOTES:

1. BENCH MARK VE-6 IS AT THE SW END OF THE BOAT HOIST STRUCTURE ADJACENT TO THE LOADING AREA ON THE WHARF. THIS STATION IS A 3-1/2 INCH BRASS DISC SET IN A CONCRETE PILLAR. ELEV. 3.725 METERS (MLLW).
2. BATHYMETRIC CONTOURS FROM SURVEY DATED SEPTEMBER, 2007.
3. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
4. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW)
5. AFTER USACE TURNING BASIN IS DREDGED, USACE ENTRANCE CHANNEL OR USACE APPROACH CAN BE DREDGED IN ANY ORDER CONVENIENT FOR THE CONTRACTOR.

DREDGE ORDER:

- DREDGE USACE TURNING BASIN - PLACE MATERIAL IN CAD AREA
- DREDGE USACE ENTRANCE CHANNEL - PLACE MATERIAL IN CAD AREA
- DREDGE USACE APPROACH CHANNEL - PLACE MATERIAL IN CAD AREA
- AVAILABLE EXCAVATION AREA FOR ADDITIONAL CAP MATERIAL (IF REQUIRED)
- PLACE ARMOR ROCK IN CAD AREA

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGE ORDER - FINAL

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 08029501-DATUM.DWG

SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

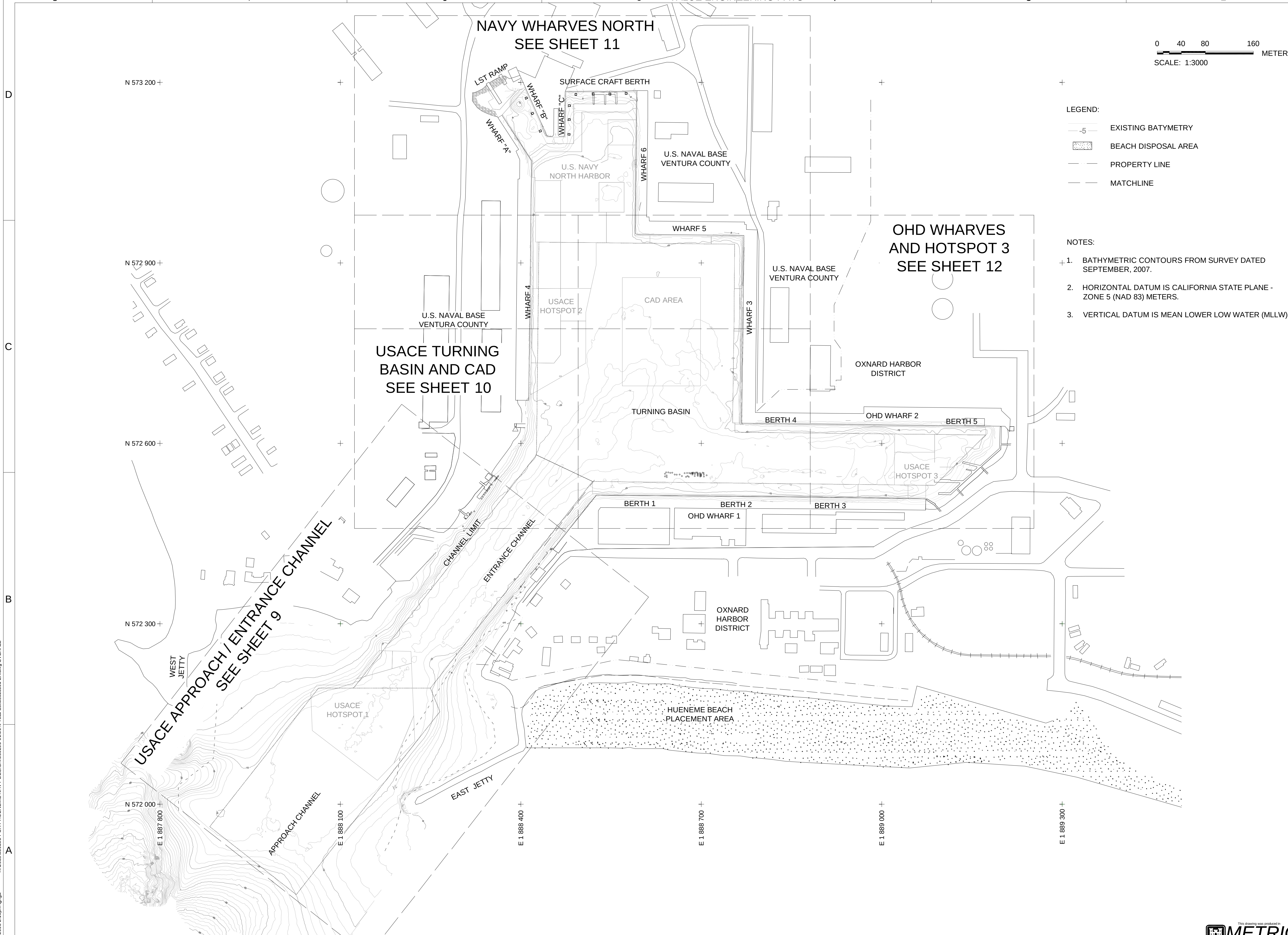
SCALE: 1:3000
DATE: JUNE 2008
DISTRICT FILE NO. #####
SHEET 7 OF 38 SHEETS

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C56833 CIVIL STATE OF CALIFORNIA

This drawing was produced in METRIC

Jun 25, 2008 2:19pm tgriga K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\08029501-DATUM.dwg CAP

SAFETY PAYS



LEGEND:

- -5- EXISTING BATYMETRY
- BEACH DISPOSAL AREA
- PROPERTY LINE
- MATCHLINE

NOTES:

1. BATHYMETRIC CONTOURS FROM SURVEY DATED SEPTEMBER, 2007.
2. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
3. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW)

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

EXISTING CONDITIONS - OVERALL

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 08029501-EX.DWG
SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

DATE: JUNE 2008
DISTRICT FILE NO. #####

SCALE: 1:3000
SHEET 8 OF 38 SHEETS

This drawing was produced in METRIC

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C56833 Exp. 6/07/08 CIVIL STATE OF CALIFORNIA

K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\08029501-EX.dwg OVERALL
Jun 25, 2008 2:19pm tgriga

NOTES:

1. BATHYMETRIC CONTOURS FROM SURVEY DATED SEPTEMBER, 2007.
2. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
3. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW).
4. DEBRIS IDENTIFIED FROM FUGRO WEST MULTIBEAM HYDROGRAPHIC SIDE SENSORS AND MAGNETOMETER SURVEYS, NOVEMBER 2000 FOR USACE LOS ANGELES.

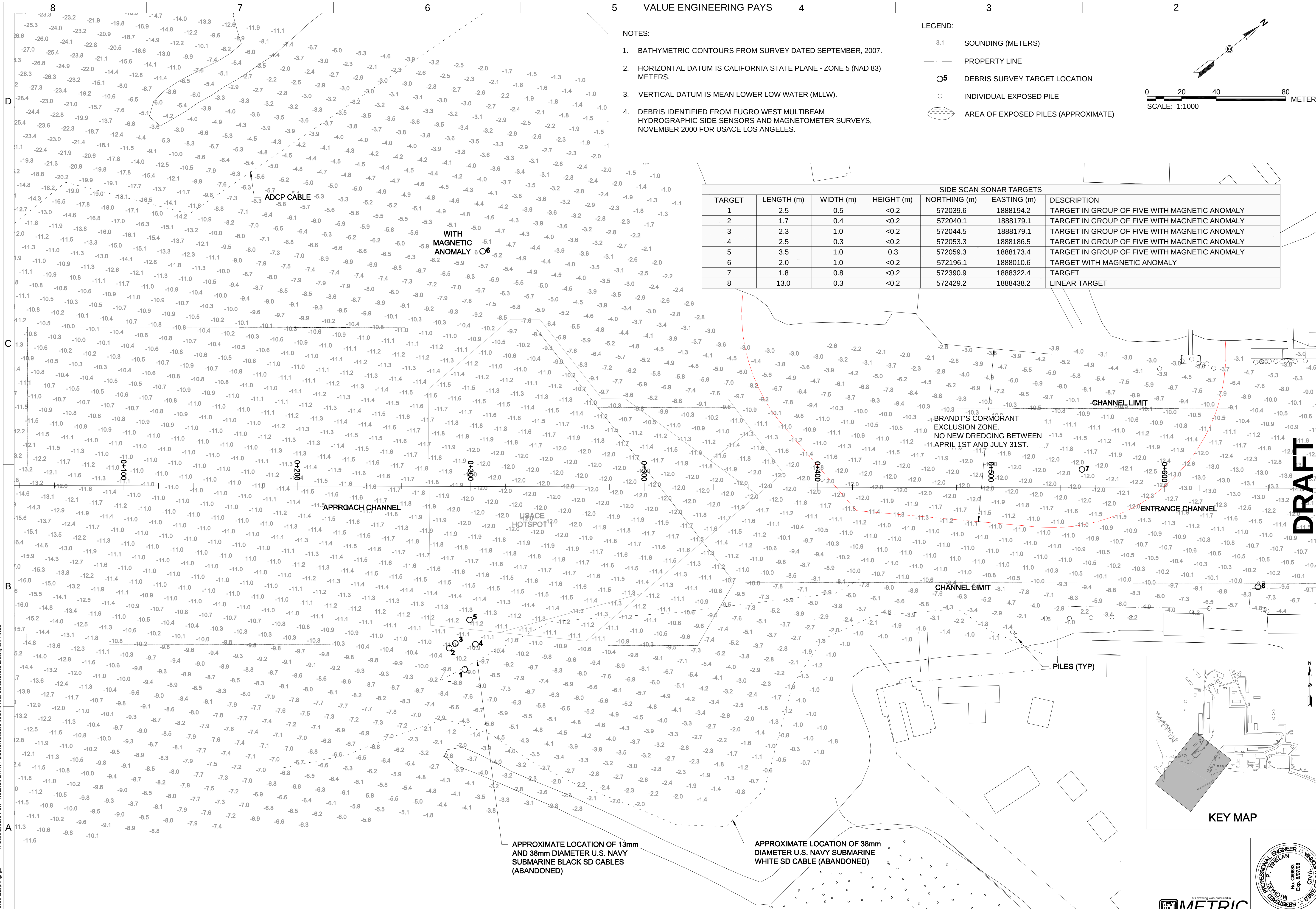
LEGEND:

- -3.1 SOUNDING (METERS)
- PROPERTY LINE
- ○5 DEBRIS SURVEY TARGET LOCATION
- ○ INDIVIDUAL EXPOSED PILE
- AREA OF EXPOSED PILES (APPROXIMATE)

SCALE: 1:1000 (0, 20, 40, 80 METER)

SIDE SCAN SONAR TARGETS

TARGET	LENGTH (m)	WIDTH (m)	HEIGHT (m)	NORTHING (m)	EASTING (m)	DESCRIPTION
1	2.5	0.5	<0.2	572039.6	1888194.2	TARGET IN GROUP OF FIVE WITH MAGNETIC ANOMALY
2	1.7	0.4	<0.2	572040.1	1888179.1	TARGET IN GROUP OF FIVE WITH MAGNETIC ANOMALY
3	2.3	1.0	<0.2	572044.5	1888179.1	TARGET IN GROUP OF FIVE WITH MAGNETIC ANOMALY
4	2.5	0.3	<0.2	572053.3	1888186.5	TARGET IN GROUP OF FIVE WITH MAGNETIC ANOMALY
5	3.5	1.0	0.3	572059.3	1888173.4	TARGET IN GROUP OF FIVE WITH MAGNETIC ANOMALY
6	2.0	1.0	<0.2	572196.1	1888010.6	TARGET WITH MAGNETIC ANOMALY
7	1.8	0.8	<0.2	572390.9	1888322.4	TARGET
8	13.0	0.3	<0.2	572429.2	1888438.2	LINEAR TARGET



DRAFT SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

EXIST. CONDITIONS - USACE APPROACH/ENTRANCE CHANNEL

U.S. ARMY ENGINEER DISTRICT LOS ANGELES CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 08029501-EX.DWG
SPEC. NO. W912PL-07-C-0002
DATE: JUNE 2008
DISTRICT FILE NO. #####
SCALE: 1:1000
SHEET 9 OF 38 SHEETS

ANCHOR ENVIRONMENTAL, L.L.C.

REGISTERED PROFESSIONAL ENGINEER MITCHELL P. WHELAN No. C58633 Exp. 3/07/08 CIVIL STATE OF CALIFORNIA

This drawing was produced in METRIC

K:\Jobs\080295-PORT HUENEME NAVY DESIGN\08029501\90% Total Set\08029501-EX.dwg CHANNEL
Jun 25, 2008 2:19pm tgriga

VALUE ENGINEERING PAYS

NOTES:

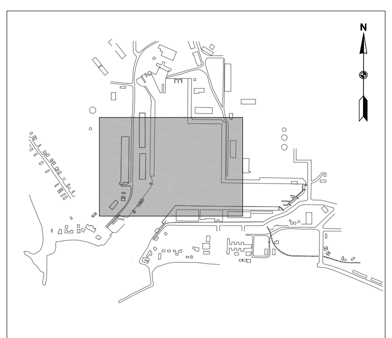
1. BATHYMETRIC CONTOURS FROM SURVEY DATED SEPTEMBER, 2007.
2. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
3. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW).
4. DEBRIS IDENTIFIED FROM FUGRO WEST MULTIBEAM HYDROGRAPHIC SIDE SENSORS AND MAGNETOMETER SURVEYS, NOVEMBER 2000 FOR USACE LOS ANGELES.

LEGEND:

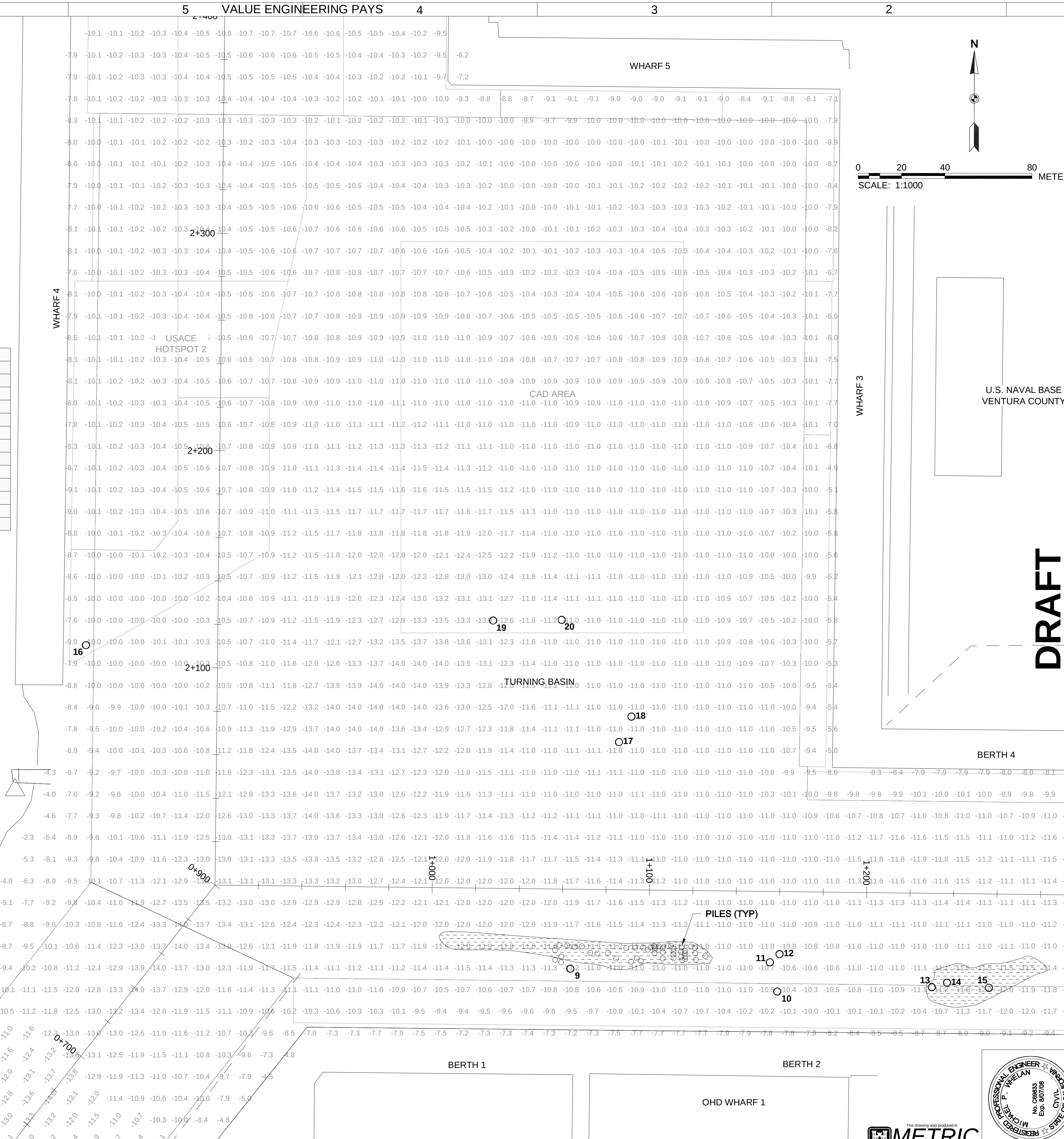
- -3.1 SOUNDING (METERS)
- — — PROPERTY LINE
- ○5 DEBRIS SURVEY TARGET LOCATION
- ○ INDIVIDUAL EXPOSED PILE
- AREA OF EXPOSED PILES (APPROXIMATE)

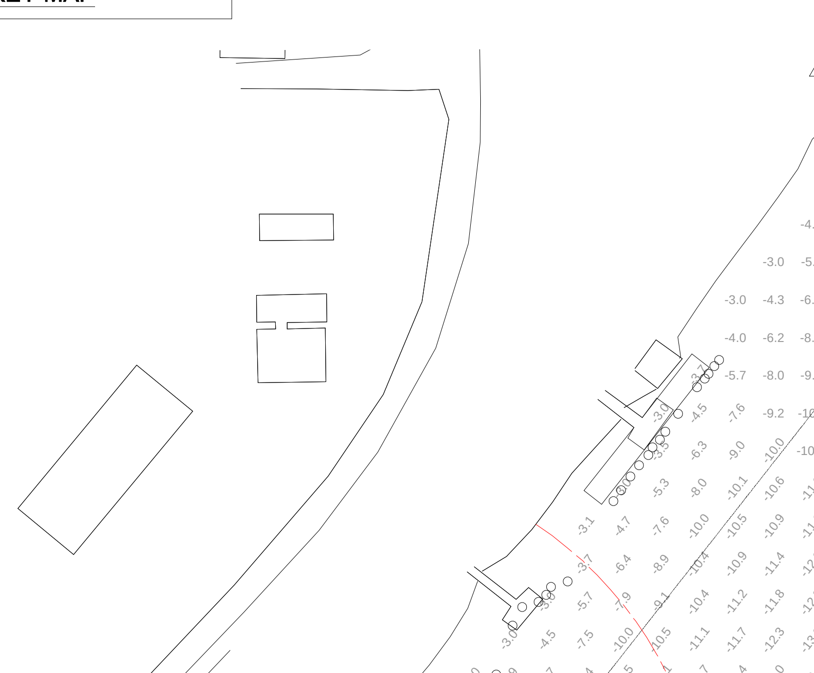
SIDE SCAN SONAR TARGETS

TARGET	LENGTH (m)	WIDTH (m)	HEIGHT (m)	NORTHING (m)	EASTING (m)	DESCRIPTION
9	2.0	0.3	<0.2	572540.8	1888647.2	TARGET
10	7.8	0.3	0.2	572530.3	1888742.5	LINEAR TARGET
11	1.0	1.0	<0.2	572543.7	1888739.1	SQUARE SHAPED TARGET
12	1.0	0.5	<0.2	572547.5	1888743.5	TARGET
13	2.4	0.3	0.2	572532.3	1888813.6	LINEAR TARGET
14	2.5	0.2	<0.2	572534.4	1888820.0	LINEAR TARGET
15	3.7	0.2	<0.2	572532.0	1888839.9	LINEAR TARGET
16	1.5	1.5	0.3	572689.7	1888424.3	SQUARE SHAPED TARGET
17	6.8	0.4	<0.2	572645.1	1888669.6	LINEAR TARGET
18	3.4	1.0	0.3	572656.8	1888675.3	TARGET
19	6.0	0.4	<0.2	572701.0	1888611.7	LINEAR TARGET
20	2.2	1.0	<0.2	572701.3	1888643.2	TARGET



KEY MAP





SAFETY PAYS

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

EXISTING CONDITIONS - USACE TURNING BASIN & CAD

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

FILE NAME: 08029501-EX.DWG

SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

DATE: JUNE 2008

DISTRICT FILE NO. #####

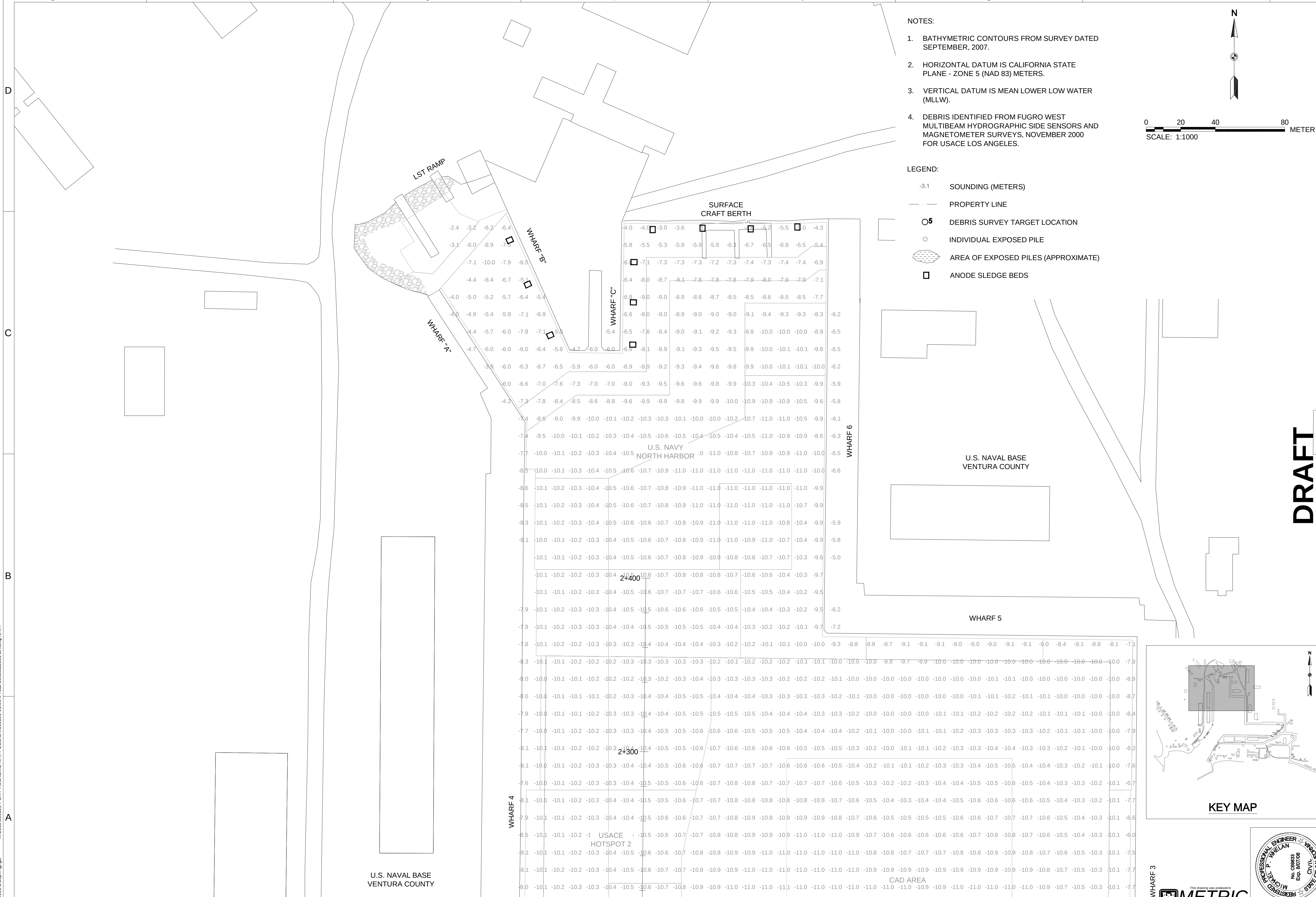
SCALE: 1:1000

SHEET 10 OF 38 SHEETS

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C56833 Exp. 6/07/08 CIVIL STATE OF CALIFORNIA

This drawing was produced in METRIC

K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\0802950 1-EX.dwg CAD
Jun 25, 2008 2:19pm tgriga



NOTES:

1. BATHYMETRIC CONTOURS FROM SURVEY DATED SEPTEMBER, 2007.
2. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
3. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW).
4. DEBRIS IDENTIFIED FROM FUGRO WEST MULTIBEAM HYDROGRAPHIC SIDE SENSORS AND MAGNETOMETER SURVEYS, NOVEMBER 2000 FOR USACE LOS ANGELES.

LEGEND:

- -3.1 SOUNDING (METERS)
- PROPERTY LINE
- 5 DEBRIS SURVEY TARGET LOCATION
- INDIVIDUAL EXPOSED PILE
- AREA OF EXPOSED PILES (APPROXIMATE)
- ANODE SLEDGE BEDS

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

EXISTING CONDTIONS - NAVY WHARVES

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

FILE NAME: 08029501-EX.DWG

SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

DATE: JUNE 2008

DISTRICT FILE NO. #####

SCALE: 1:1000

SHEET 11 OF 38 SHEETS

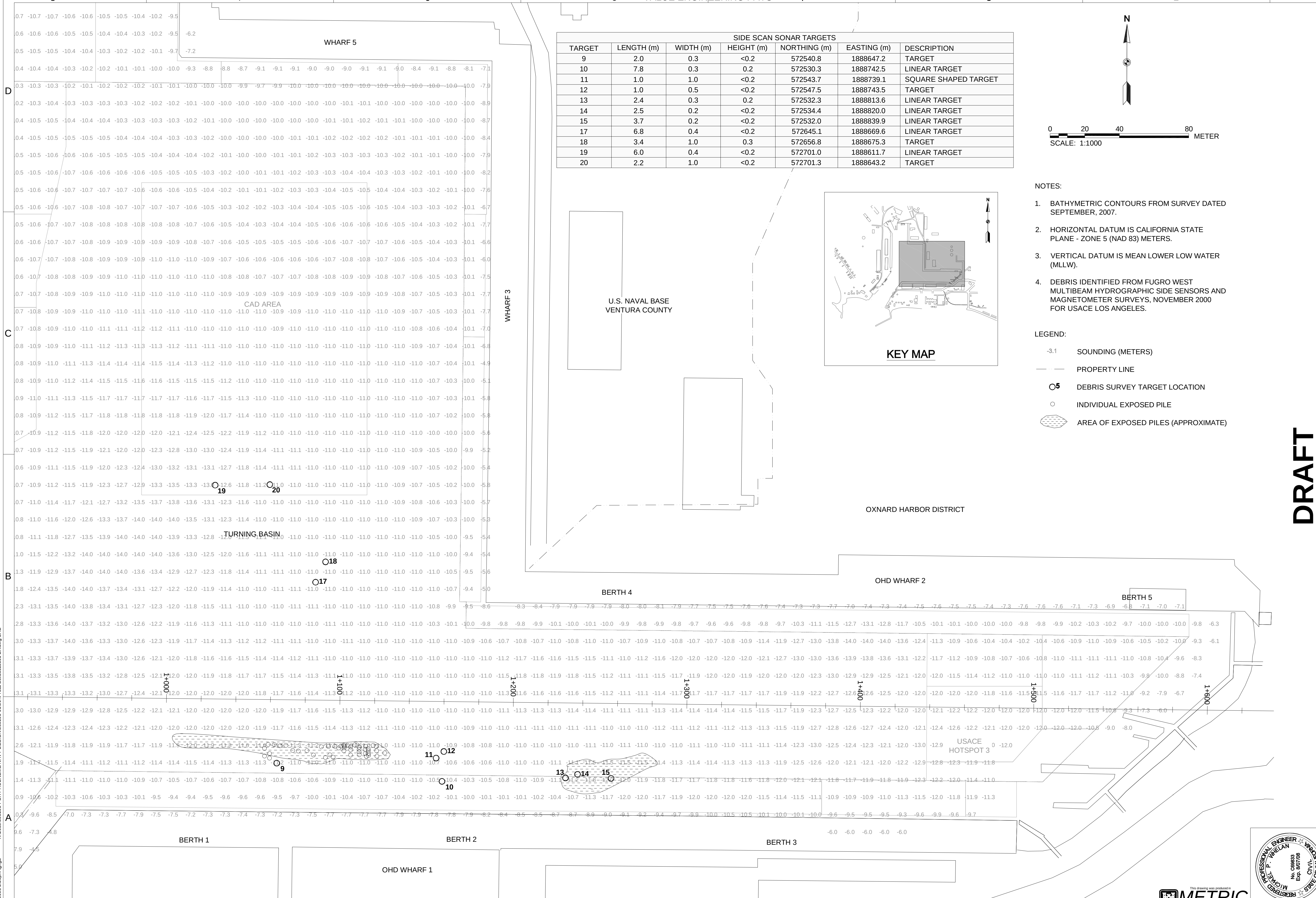
REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C56833 Exp. 6/07/08 CIVIL STATE OF CALIFORNIA

This drawing was produced in METRIC

K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\08029501-EX.dwg NAVY

Jun 25, 2008 2:19pm tgriga

VALUE ENGINEERING PAYS



SIDE SCAN SONAR TARGETS						
TARGET	LENGTH (m)	WIDTH (m)	HEIGHT (m)	NORTHING (m)	EASTING (m)	DESCRIPTION
9	2.0	0.3	<0.2	572540.8	1888647.2	TARGET
10	7.8	0.3	0.2	572530.3	1888742.5	LINEAR TARGET
11	1.0	1.0	<0.2	572543.7	1888739.1	SQUARE SHAPED TARGET
12	1.0	0.5	<0.2	572547.5	1888743.5	TARGET
13	2.4	0.3	0.2	572532.3	1888813.6	LINEAR TARGET
14	2.5	0.2	<0.2	572534.4	1888820.0	LINEAR TARGET
15	3.7	0.2	<0.2	572532.0	1888839.9	LINEAR TARGET
17	6.8	0.4	<0.2	572645.1	1888669.6	LINEAR TARGET
18	3.4	1.0	0.3	572656.8	1888675.3	TARGET
19	6.0	0.4	<0.2	572701.0	1888611.7	LINEAR TARGET
20	2.2	1.0	<0.2	572701.3	1888643.2	TARGET

NOTES:

1. BATHYMETRIC CONTOURS FROM SURVEY DATED SEPTEMBER, 2007.
2. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
3. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW).
4. DEBRIS IDENTIFIED FROM FUGRO WEST MULTIBEAM HYDROGRAPHIC SIDE SENSORS AND MAGNETOMETER SURVEYS, NOVEMBER 2000 FOR USACE LOS ANGELES.

LEGEND:

- -3.1 SOUNDING (METERS)
- PROPERTY LINE
- ○5 DEBRIS SURVEY TARGET LOCATION
- ○ INDIVIDUAL EXPOSED PILE
- AREA OF EXPOSED PILES (APPROXIMATE)

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

EXISTING CONDITIONS - OHD WHARVES 1, 2, & HOTSPOT 3

SYMBOL | DESCRIPTIONS | DATE | APPROVAL
REVISIONS

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

ANCHOR ENVIRONMENTAL, L.L.C.

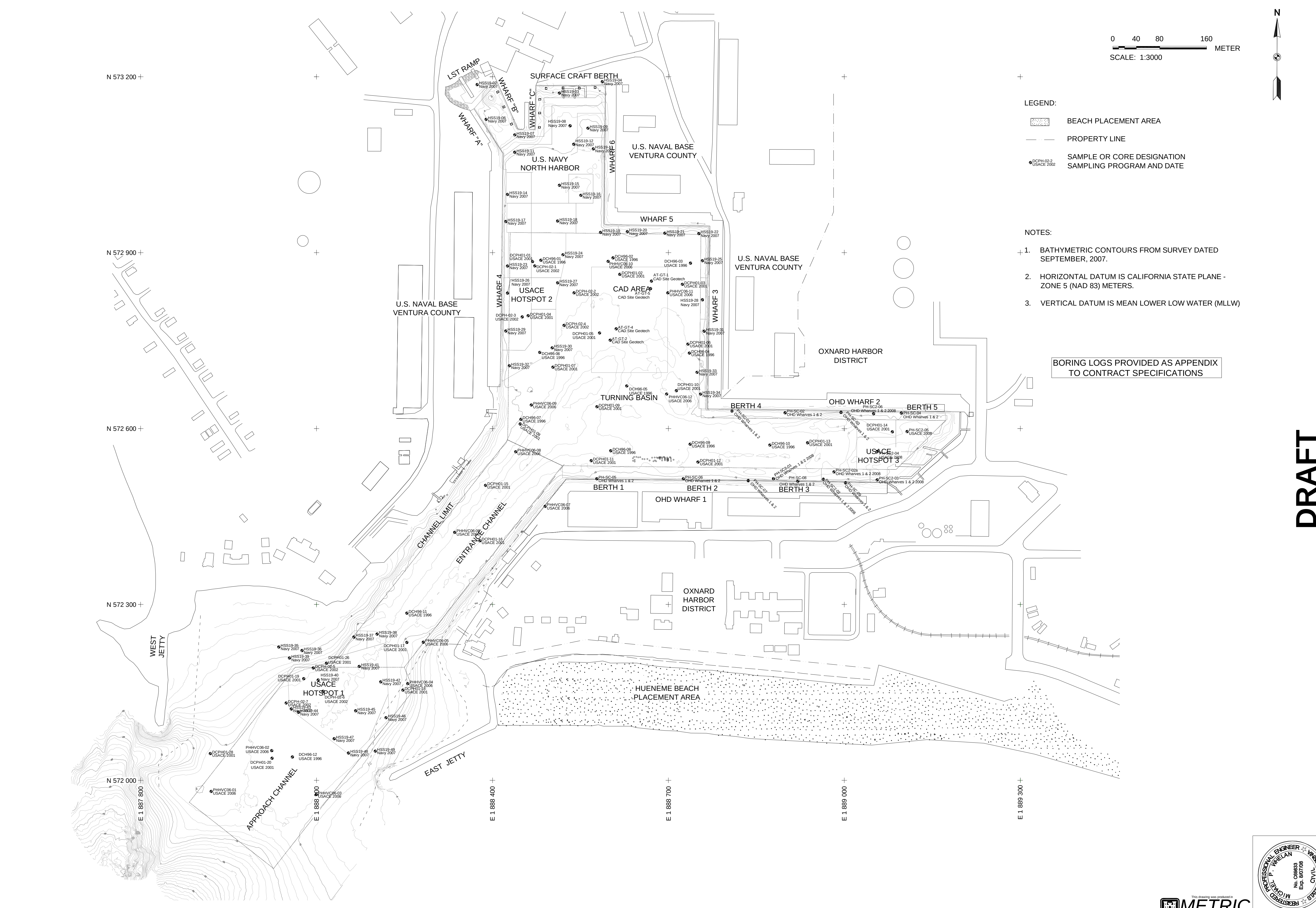
SCALE: 1:1000
DATE: JUNE 2008
SPEC. NO. W912PL-07-C-0002
DISTRICT FILE NO. #####
FILE NAME: 080295-01-EX.DWG
SHEET 12 OF 38 SHEETS

REGISTERED PROFESSIONAL ENGINEER
MICHAEL P. WHELAN
No. C58833
Exp. 9/07/08
CIVIL
STATE OF CALIFORNIA

This drawing was produced in METRIC

K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\080295-01-EX.dwg OHD
Jun 25, 2008 2:20pm tgriga

SAFETY PAYS



LEGEND:

- BEACH PLACEMENT AREA
- PROPERTY LINE
- DCPH-02-2 USACE 2002 — SAMPLE OR CORE DESIGNATION SAMPLING PROGRAM AND DATE

NOTES:

1. BATHYMETRIC CONTOURS FROM SURVEY DATED SEPTEMBER, 2007.
2. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
3. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW)

BORING LOGS PROVIDED AS APPENDIX TO CONTRACT SPECIFICATIONS

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

EXISTING SEDIMENT SAMPLING PLAN

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 08029501-EX.DWG
SPEC. NO. W912PL-07-C-0002
DATE: JUNE 2008
DISTRICT FILE NO. #####
SCALE: 1:3000
SHEET 13 OF 38 SHEETS

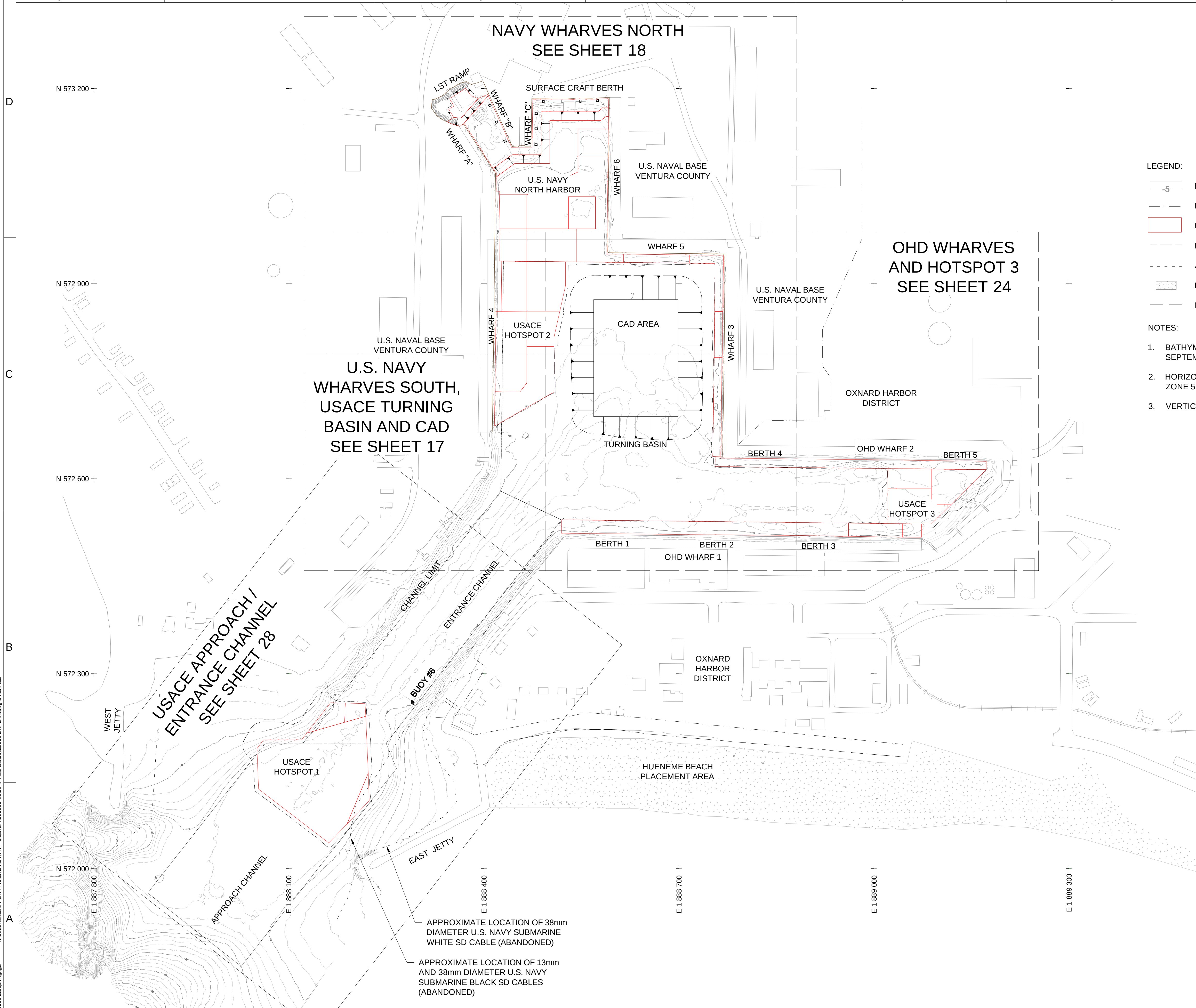
ANCHOR ENVIRONMENTAL, L.L.C.

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C56833 Exp. 6/07/08 CIVIL STATE OF CALIFORNIA

This drawing was produced in METRIC

K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\08029501-EX.dwg SAMPLE
Jun 25, 2008 2:20pm tgriga

VALUE ENGINEERING PAYS



LEGEND:

- -5 EXISTING BATHYMETRY (METERS)
- PROPERTY LINE
- PROPOSED DREDGE ELEVATION
- PROPOSED DAYLIGHT LINE
- ABANDONED U.S. NAVY SUBMARINE SD CABLES
- BEACH PLACEMENT AREA
- MATCHLINE

NOTES:

1. BATHYMETRIC CONTOURS FROM SURVEY DATED SEPTEMBER, 2007.
2. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
3. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW).

SYMBOL	DESCRIPTIONS	DATE	APPROVAL

REVISIONS

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGING PLAN - OVERALL

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

FILE NAME: 080295-01-DRPLAN.DWG

SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

DATE: JUNE 2008

DISTRICT FILE NO. #####

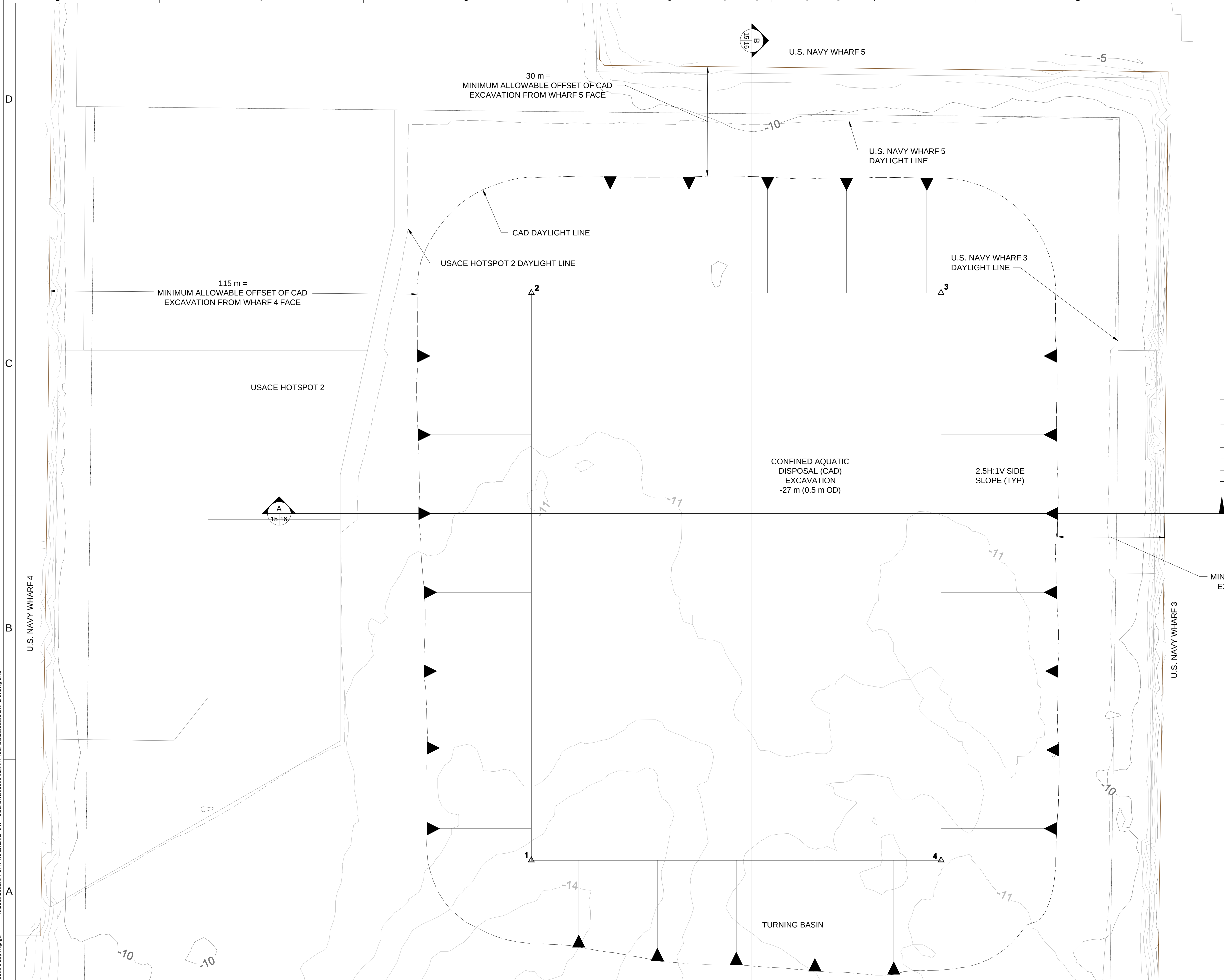
SCALE: 1:3000

SHEET 14 OF 38 SHEETS

METRIC

SAFETY PAYS

VALUE ENGINEERING PAYS



SCALE: 1:600 (0, 10, 20, 40 METER)

NOTES:

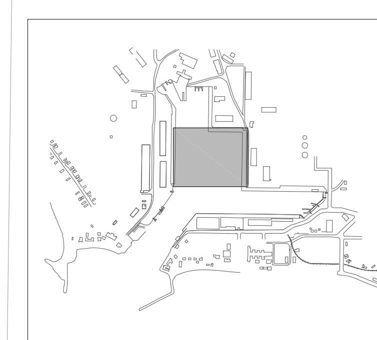
1. BATHYMETRIC CONTOURS FROM SURVEY DATED SEPTEMBER, 2007.
2. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
3. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW).

LEGEND:

- -5 EXISTING BATHYMETRY (METERS)
- 10△ CONTROL POINT

CAD - CONTROL POINT TABLE

POINT	EASTING	NORTHING
1	1888568.678	572695.393
2	1888568.678	572875.393
3	1888698.678	572875.393
4	1888698.678	572695.393



KEY MAP

This drawing was produced in METRIC

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGING PLAN - CAD AREA

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 08029501-DRPLAN.DWG

SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

DATE: JUNE 2008

DISTRICT FILE NO. #####

SCALE: 1:1000

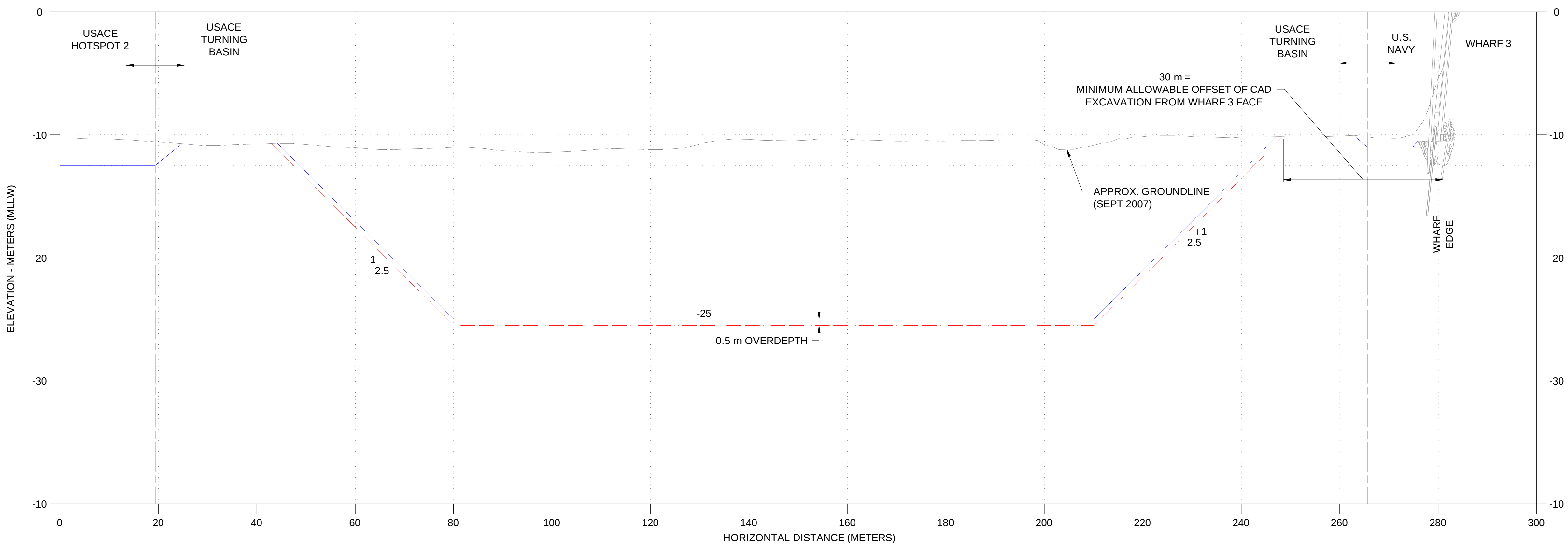
SHEET 15 OF 38 SHEETS

REVISIONS: SYMBOL | DESCRIPTIONS | DATE | APPROVAL

REGISTERED PROFESSIONAL ENGINEER MITCHELL P. WHELAN No. C56833 Exp. 9/07/08 CIVIL STATE OF CALIFORNIA

SAFETY PAYS

VALUE ENGINEERING PAYS

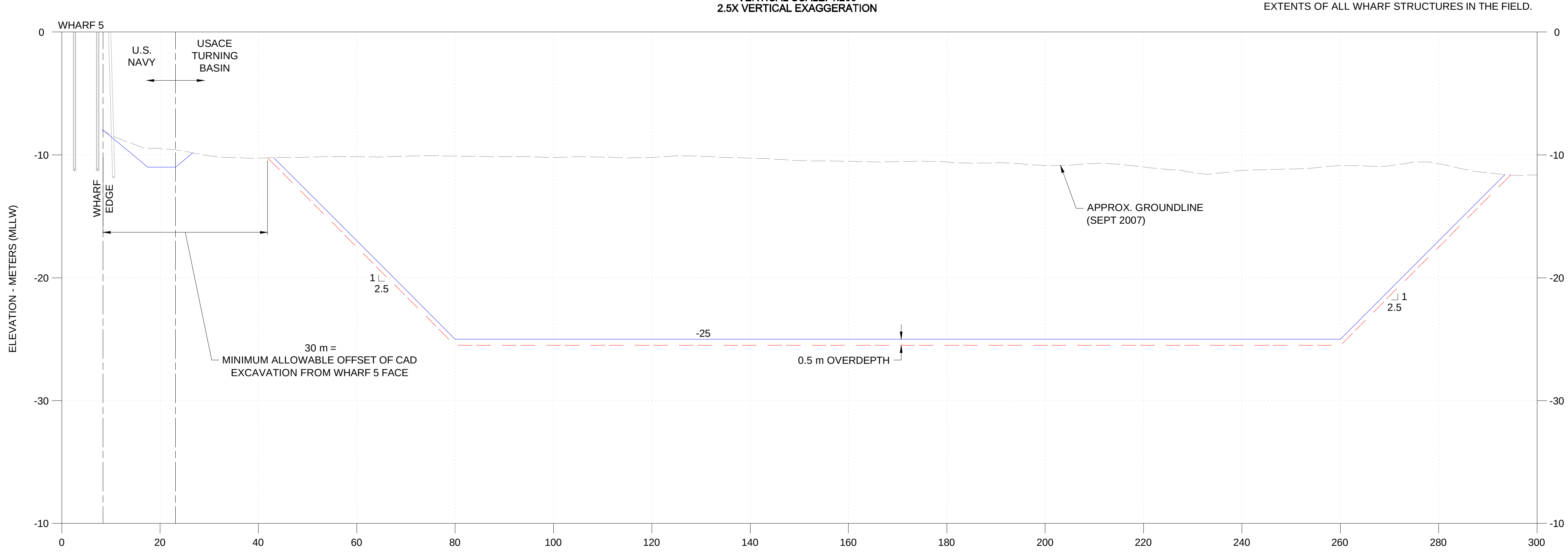


SECTION A
CAD 24|26

HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

NOTE:

1. ALL CROSS-SECTIONAL REPRESENTATIONS OF U.S. NAVY AND OXNARD HARBOR DISTRICT WHARVES ARE BASED ON DESIGN DRAWINGS PROVIDED BY THE NAVY AND OHD, RESPECTIVELY. CONTRACTOR SHALL CONFIRM CONDITION, LAYOUT, AND EXTENTS OF ALL WHARF STRUCTURES IN THE FIELD.



SECTION B
CAD 24|26

HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

LEGEND:

EXISTING BATHYMETRY	(grey dashed line)
PROJECT DREDGE NEATLINE	(blue line)
0.5 m OVERDEPTH	(red dashed line)

SAFETY PAYS

This drawing was produced in METRIC

REVISIONS: SYMBOL | DESCRIPTIONS | DATE | APPROVAL

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGING CROSS SECTIONS - CAD AREA

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW
DATE:
SUBMITTED BY:
APPROVED:
DATE:
CHIEF, DESIGN BRANCH
CHIEF, ENGINEERING DIVISION
FILE NAME: 080295-01-SEC2.DWG
SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C56833 Exp. 9/07/08 CIVIL STATE OF CALIFORNIA

SCALE: 1:500
SHEET 16 OF 38 SHEETS
DATE: JUNE 2008
DISTRICT FILE NO. #####

Jun 25, 2008 2:20pm tgriga K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\080295-01-SEC2.dwg CAD-CS-1

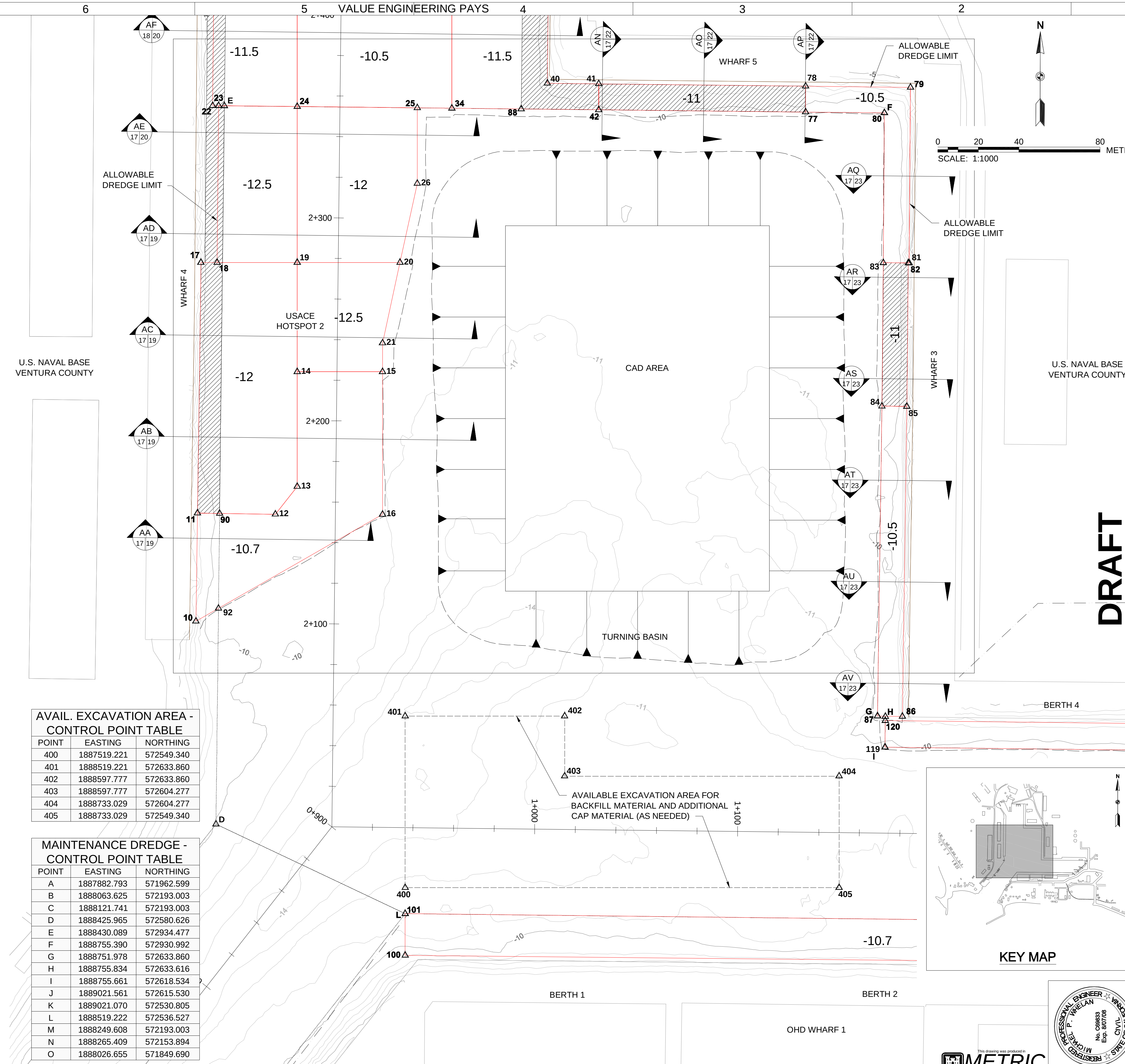
VALUE ENGINEERING PAYS

NOTES:

1. BATHYMETRIC CONTOURS FROM SURVEY DATED SEPTEMBER, 2007.
2. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
3. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW).
4. AREAS ALONG U.S. NAVY WHARVES THAT ARE TO BE DREDGED DEEPER THAN -10.5 METERS ARE CONSIDERED "DREDGING RESTRICTION AND BACKFILL AREAS" AND SHALL BE DREDGED IN SECTIONS NO LONGER THAN 30 METERS LONG. THE AREAS SHALL BE SURVEYED, ACCEPTED BY THE ENGINEER, AND THEN BACKFILLED BEFORE ADJACENT AREAS ARE DREDGED.

LEGEND:

- -5 EXISTING BATHYMETRY (METERS)
- -12 PROPOSED DREDGE ELEVATION
- PROPOSED DAYLIGHT LINE
- 10△ CONTROL POINT
- DREDGING RESTRICTION AND BACKFILL AREA (SEE NOTE 4)



U.S. NAVY & HOTSPOT 2 - CONTROL POINT TABLE

POINT	EASTING	NORTHING	POINT	EASTING	NORTHING
10	1888416.062	572680.558	50	1888418.511	573069.901
11	1888416.852	572733.860	51	1888414.033	573077.051
12	1888455.230	572733.303	52	1888443.057	573098.153
13	1888466.015	572746.911	53	1888487.747	573098.153
14	1888466.015	572803.469	54	1888487.747	573164.135
15	1888508.009	572803.469	55	1888574.984	573164.135
16	1888508.009	572733.215	56	1888582.845	573170.289
17	1888418.531	572857.253	57	1888591.593	573170.289
18	1888426.532	572857.255	58	1888399.556	573099.301
19	1888466.015	572857.255	59	1888399.975	573099.574
20	1888516.673	572857.255	60	1888369.639	573146.195
21	1888508.009	572817.597	61	1888342.778	573149.026
22	1888424.290	572934.539	62	1888353.542	573155.635
23	1888427.290	572934.510	63	1888364.754	573154.486
24	1888466.015	572934.092	64	1888391.180	573184.548
25	1888525.183	572933.458	65	1888407.337	573191.788
26	1888525.183	572896.203	66	1888407.942	573190.439
27	1888423.274	572984.192	67	1888406.853	573189.200
28	1888424.778	572984.192	68	1888345.746	573167.939
29	1888466.015	572984.192	69	1888354.151	573173.213
30	1888529.928	572984.192	70	1888346.995	573184.237
31	1888529.928	573033.748	71	1888371.622	573200.479
32	1888571.640	573033.748	72	1888380.174	573189.146
32	1888424.018	573041.966	73	1888442.713	573109.173
32	1888418.519	573042.042	74	1888474.034	573108.889
33	1888571.640	572984.192	75	1888475.132	573183.584
34	1888542.204	572933.276	76	1888591.845	573184.247
35	1888423.927	573036.768	77	1888716.526	572931.409
36	1888466.015	573036.768	78	1888716.526	572944.151
37	1888544.683	573071.501	79	1888768.225	572943.570
37	1888544.683	573137.750	80	1888767.573	572857.070
38	1888544.683	573095.932	81	1888755.390	572930.992
38	1888591.240	573137.750	82	1888767.073	572857.074
39	1888590.887	573095.932	83	1888754.834	572857.166
40	1888589.256	572945.582	84	1888754.163	572786.551
41	1888614.565	572945.298	85	1888766.402	572786.376
42	1888614.565	572932.501	86	1888764.216	572633.686
43	1888418.904	573063.901	87	1888751.978	572633.860
44	1888447.446	573084.653	88	1888576.378	572932.910
45	1888501.247	573084.653	89	1888578.599	573137.750
46	1888501.247	573150.635	90	1888427.749	572733.702
47	1888579.640	573150.635	91	1888431.281	573036.768
48	1888587.501	573156.789	92	1888427.204	572686.938
49	1888591.547	573156.789			

AVAIL. EXCAVATION AREA - CONTROL POINT TABLE

POINT	EASTING	NORTHING
400	1887519.221	572549.340
401	1888519.221	572633.860
402	1888597.777	572633.860
403	1888597.777	572604.277
404	1888733.029	572604.277
405	1888733.029	572549.340

MAINTENANCE DREDGE - CONTROL POINT TABLE

POINT	EASTING	NORTHING
A	1887882.793	571962.599
B	1888063.625	572193.003
C	1888121.741	572193.003
D	1888425.965	572580.626
E	1888430.089	572934.477
F	1888755.390	572930.992
G	1888751.978	572633.860
H	1888755.834	572633.616
I	1888755.661	572618.534
J	1889021.561	572615.530
K	1889021.070	572530.805
L	1888519.222	572536.527
M	1888249.608	572193.003
N	1888265.409	572153.894
O	1888026.655	571849.690

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGING PLAN - SOUTH NAVY WHARVES

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 080295-01-DRPLAN.DWG

SPEC. NO. W912PL-07-C-0002

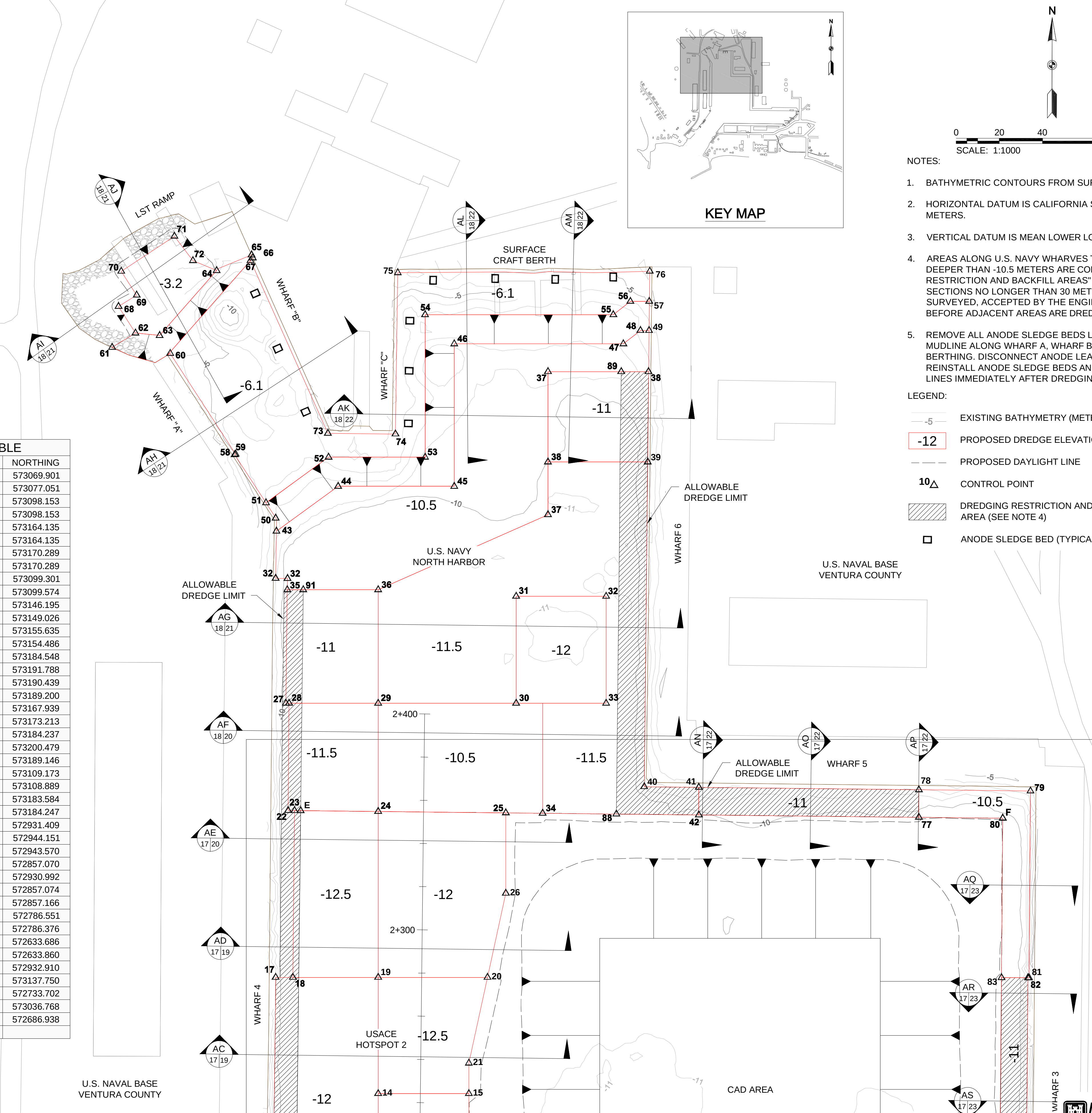
ANCHOR ENVIRONMENTAL, L.L.C.

SCALE: 1:1000
DATE: JUNE 2008
DISTRICT FILE NO. #####
SHEET 17 OF 38 SHEETS

SYMBOL | DESCRIPTIONS | DATE | APPROVAL
REVISIONS

METRIC

SAFETY PAYS



MAINTENANCE DREDGE - CONTROL POINT TABLE

POINT	EASTING	NORTHING
A	1887882.793	571962.599
B	1888063.625	572193.003
C	1888121.741	572193.003
D	1888425.965	572580.626
E	1888430.089	572934.477
F	1888755.390	572930.992
G	1888751.978	572633.860
H	1888755.834	572633.616
I	1888755.661	572618.534
J	1889021.561	572615.530
K	1889021.070	572530.805
L	1888519.222	572536.527
M	1888249.608	572193.003
N	1888265.409	572153.894
O	1888026.655	571849.690

U.S. NAVY & HOTSPOT 2 - CONTROL POINT TABLE

POINT	EASTING	NORTHING	POINT	EASTING	NORTHING
10	1888416.062	572680.558	50	1888418.511	573069.901
11	1888416.852	572733.860	51	1888414.033	573077.051
12	1888455.230	572733.303	52	1888443.057	573098.153
13	1888466.015	572746.911	53	1888487.747	573098.153
14	1888466.015	572803.469	54	1888487.747	573164.135
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23	1888427.290	572934.510	63	1888364.754	573154.486
24	1888466.015	572934.092	64	1888391.180	573184.548
25	1888525.183	572933.458	65	1888407.337	573191.788
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31	1888529.928	573033.748	71	1888371.622	573200.479
32	1888571.640	573033.748	72	1888380.174	573189.146
32	1888424.018	573041.966	73	1888442.713	573109.173
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37	1888544.683	573071.501	79	1888768.225	572943.570
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47	1888579.640	573150.635	91	1888431.281	573036.768
48	1888587.501	573156.789	92	1888427.204	572686.938
49	1888591.547	573156.789			

NOTES:

1. BATHYMETRIC CONTOURS FROM SURVEY DATED SEPTEMBER, 2007.
2. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
3. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW).
4. AREAS ALONG U.S. NAVY WHARVES THAT ARE TO BE DREDGED DEEPER THAN -10.5 METERS ARE CONSIDERED "DREDGING RESTRICTION AND BACKFILL AREAS" AND SHALL BE DREDGED IN SECTIONS NO LONGER THAN 30 METERS LONG. THE AREAS SHALL BE SURVEYED, ACCEPTED BY THE ENGINEER, AND THEN BACKFILLED BEFORE ADJACENT AREAS ARE DREDGED.
5. REMOVE ALL ANODE SLEDGE BEDS LINED UP AND RESTING ON MUDLINE ALONG WHARF A, WHARF B, AND SURFACE CRAFT BERTHING. DISCONNECT ANODE LEAD LINES ABOVE THE WATERLINE. REINSTALL ANODE SLEDGE BEDS AND RECONNECT ANODE LEAD LINES IMMEDIATELY AFTER DREDGING IS COMPLETE IN EACH WHARF.

LEGEND:

- -5 EXISTING BATHYMETRY (METERS)
- -12 PROPOSED DREDGE ELEVATION
- PROPOSED DAYLIGHT LINE
- 10 CONTROL POINT
- DREDGING RESTRICTION AND BACKFILL AREA (SEE NOTE 4)
- ANODE SLEDGE BED (TYPICAL, SEE NOTE 5)

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGING PLAN - NORTH NAVY WHARVES

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 080295-01-DRPLAN.DWG
SPEC. NO. W912PL-07-C-0002
DATE: JUNE 2008
DISTRICT FILE NO. #####
SCALE: 1:1000
SHEET 18 OF 38 SHEETS

ANCHOR ENVIRONMENTAL, L.L.C.

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C56833 CIVIL STATE OF CALIFORNIA

This drawing was produced in METRIC

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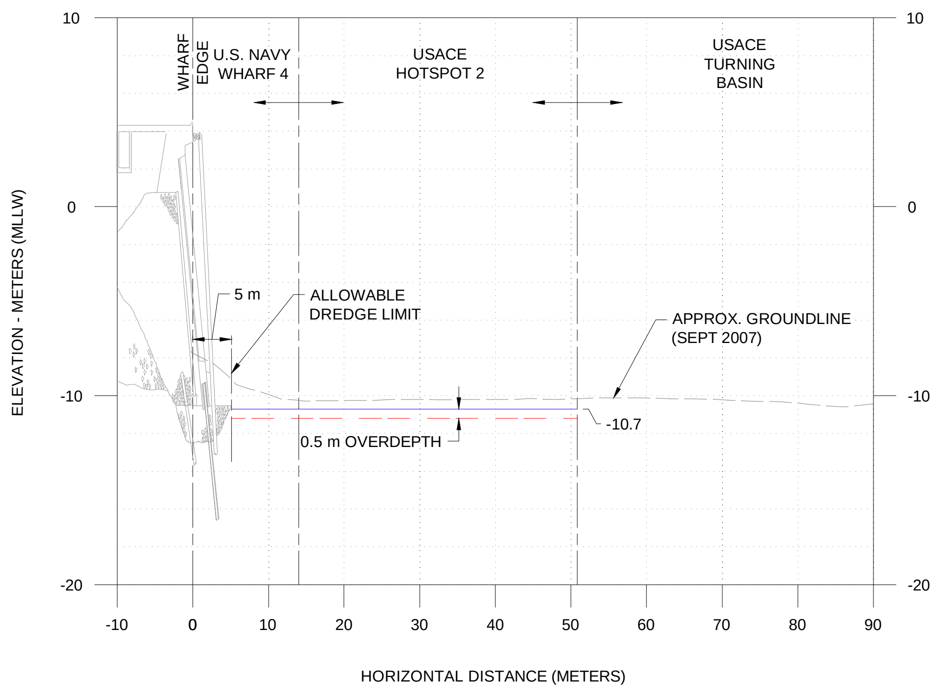
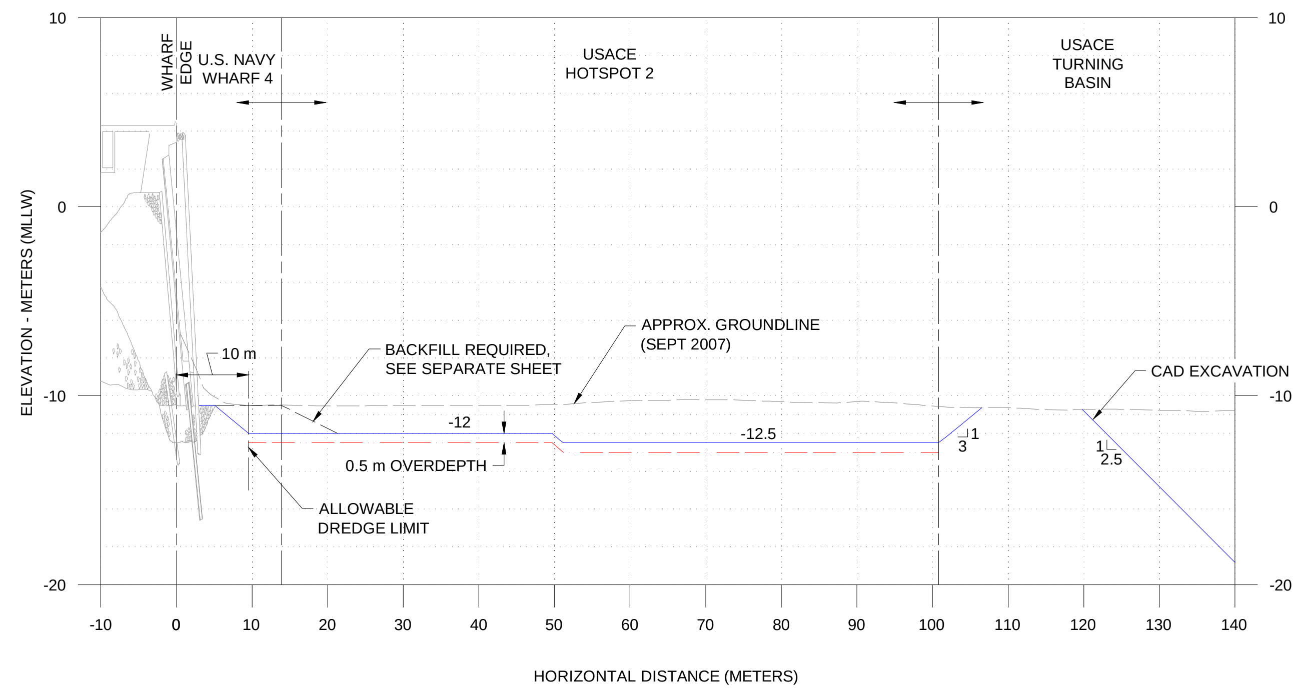
Jun 25, 2008 2:20pm tpriga



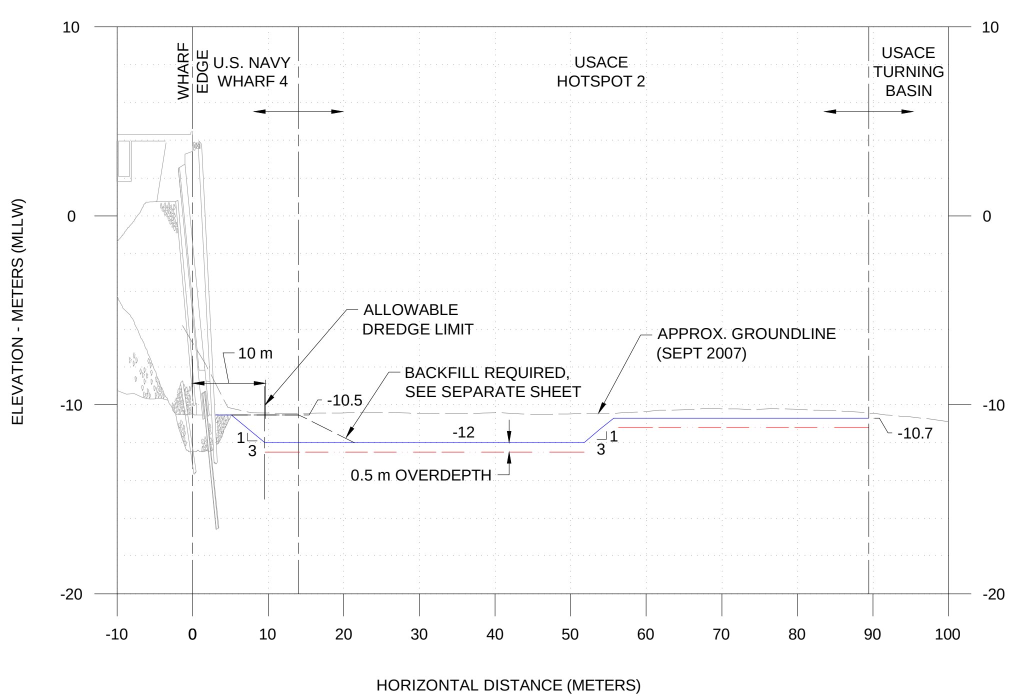
SECTION AA 17|19
WHARF 4
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION AC 17|19
WHARF 4
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

NOTES:

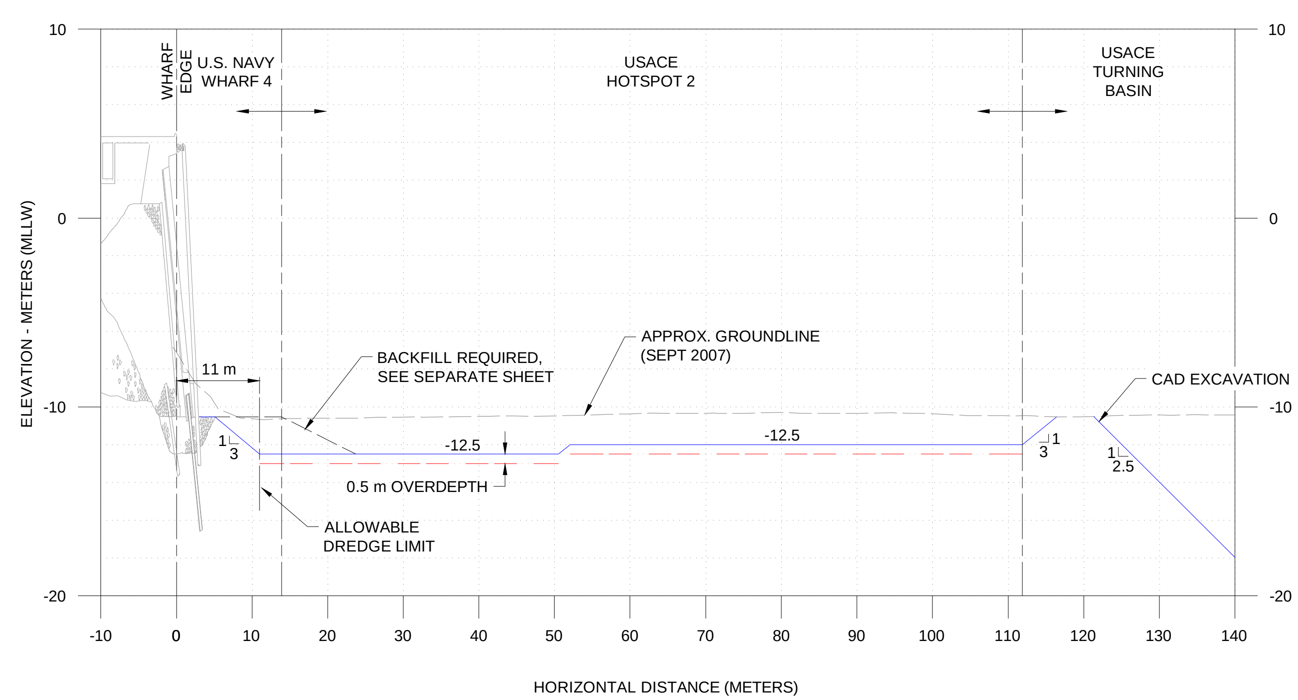
1. ALL CROSS-SECTIONAL REPRESENTATIONS OF U.S. NAVY AND OXNARD HARBOR DISTRICT WHARVES ARE BASED ON DESIGN DRAWINGS PROVIDED BY THE NAVY AND OHD, RESPECTIVELY. CONTRACTOR SHALL CONFIRM CONDITION, LAYOUT, AND EXTENTS OF ALL WHARF STRUCTURES IN THE FIELD.
2. MAINTAIN DREDGING OFFSET NO CLOSER THAN THE DEPICTED ALLOWABLE DREDGING LIMITFROM WHARF FACES. DREDGING SHALL NOT ENCROACH INSIDE (WHARF-WARD) OF THE INDICATED ALLOWABLE DREDGE LIMITS.
3. THE 3H:1V SIDE SLOPE INCLINATIONS IS AN ESTIMATE ONLY. ACTUAL SLOPE INCLINATION WILL BE DETERMINED BY THE NATURAL SLOUGHING OF THE SEDIMENT. IT IS NOT NECESSARY TO DREDGE SIDE SLOPES; AS A RESULT NO ALLOWABLE OVERDREDGE IS PROVIDED FOR SIDE SLOPES IN THE AREAS DEPICTED.
4. AREAS DENOTED AS "DREDGING RESTRICTION AND BACKFILL AREAS" ARE SUBJECT TO SPECIAL CONSTRAINTS ON DREDGING (PER SPECIFICATIONS) AND REQUIRE SUBSEQUENT BACKFILLING, AS IS DEPICTED ON SEPARATE SHEETS IN THIS PLANS SET.



SECTION AB 17|19
WHARF 4
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

LEGEND:

EXISTING BATHYMETRY	dashed grey line
PROJECT DREDGE NEATLINE	solid blue line
0.5 m OVERDEPTH	dashed red line



SECTION AD 17|19
WHARF 4
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGING CROSS SECTIONS A THRU D - NAVY WHARVES

SYMBOL | DESCRIPTIONS | DATE | APPROVAL
REVISIONS

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 080295-01-SEC1.DWG
SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

SCALE: 1:500
SHEET 19 OF 38 SHEETS
DATE: JUNE 2008
DISTRICT FILE NO. #####

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C56833 Exp. 6/07/08 CIVIL STATE OF CALIFORNIA

This drawing was produced in METRIC

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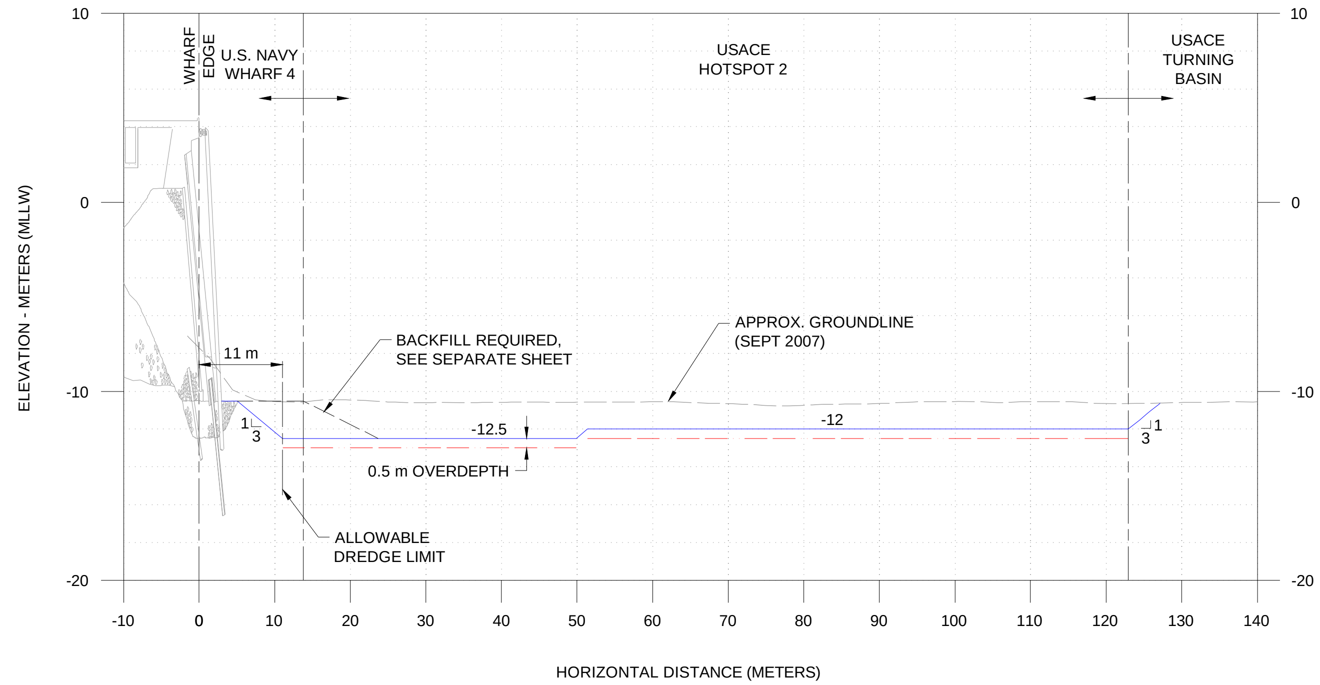
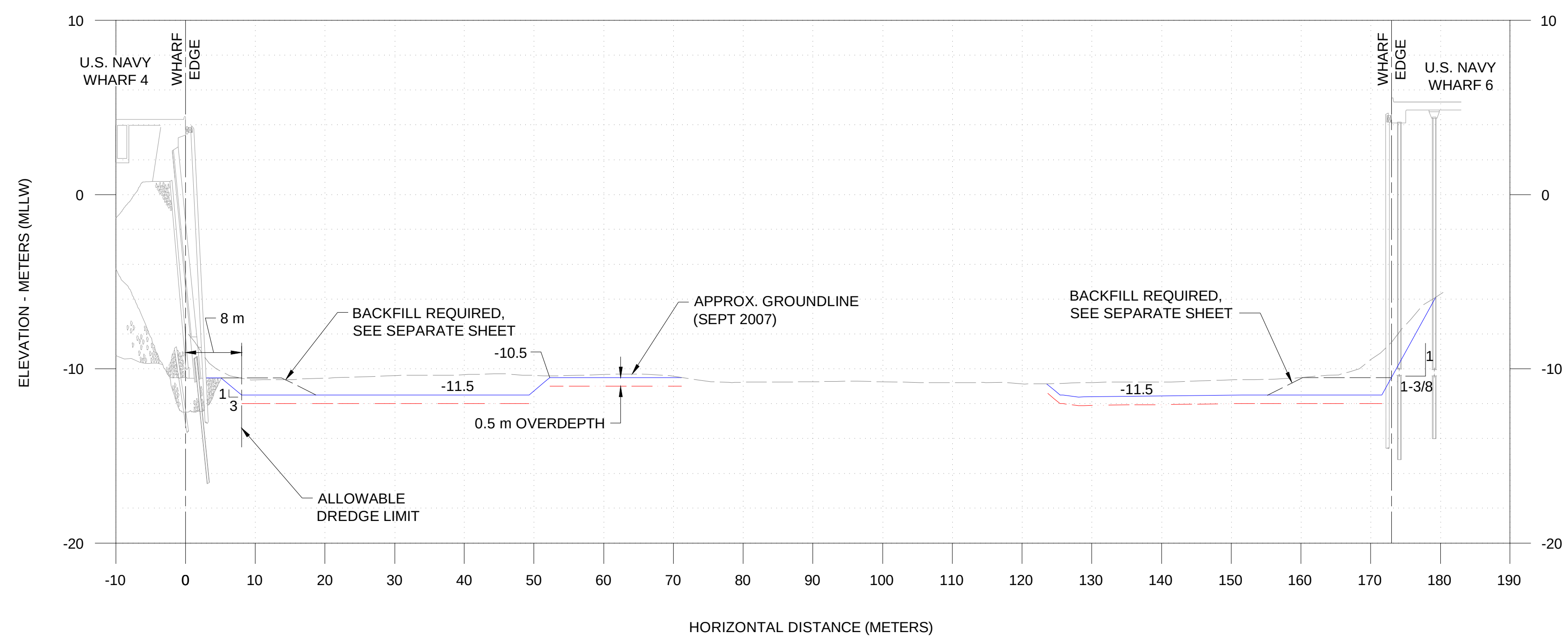
Jun 25, 2008 2:21pm tpriga



SECTION AE 17 20
WHARF 4
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION AF 18 20
WHARF 4 / WHARF 6
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

NOTES:

1. ALL CROSS-SECTIONAL REPRESENTATIONS OF U.S. NAVY AND OXNARD HARBOR DISTRICT WHARVES ARE BASED ON DESIGN DRAWINGS PROVIDED BY THE NAVY AND OHD, RESPECTIVELY. CONTRACTOR SHALL CONFIRM CONDITION, LAYOUT, AND EXTENTS OF ALL WHARF STRUCTURES IN THE FIELD.
2. MAINTAIN DREDGING OFFSET NO CLOSER THAN THE DEPICTED ALLOWABLE DREDGING LIMITFROM WHARF FACES. DREDGING SHALL NOT ENCROACH INSIDE (WHARF-WARD) OF THE INDICATED ALLOWABLE DREDGE LIMITS.
3. THE 3H:1V SIDE SLOPE INCLINATIONS IS AN ESTIMATE ONLY. ACTUAL SLOPE INCLINATION WILL BE DETERMINED BY THE NATURAL SLOUGHING OF THE SEDIMENT. IT IS NOT NECESSARY TO DREDGE SIDE SLOPES; AS A RESULT NO ALLOWABLE OVERDREDGE IS PROVIDED FOR SIDE SLOPES IN THE AREAS DEPICTED.
4. AREAS DENOTED AS "DREDGING RESTRICTION AND BACKFILL AREAS" ARE SUBJECT TO SPECIAL CONSTRAINTS ON DREDGING (PER SPECIFICATIONS) AND REQUIRE SUBSEQUENT BACKFILLING, AS IS DEPICTED ON SEPARATE SHEETS IN THIS PLANS SET.

LEGEND:

EXISTING BATHYMETRY	(grey dashed line)
PROJECT DREDGE NEATLINE	(blue line)
0.5 m OVERDEPTH	(red dashed line)

DRAFT
SUBJECT TO REVISION

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
REVISIONS			

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGING CROSS SECTIONS E & F - NAVY WHARVES

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 080295-01-SEC1.DWG
SPEC. NO. W912PL-07-C-0002

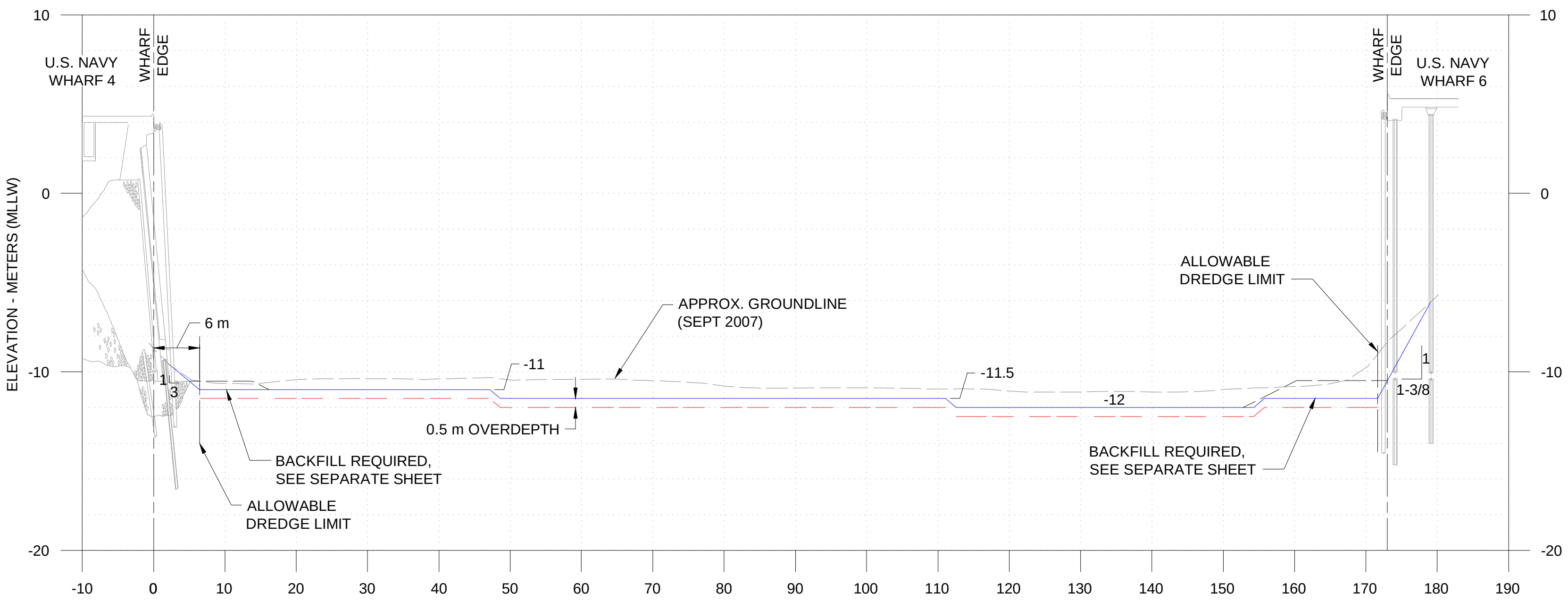
ANCHOR ENVIRONMENTAL, L.L.C.

DATE: JUNE 2008
DISTRICT FILE NO. #####
SCALE: 1:500
SHEET 20 OF 38 SHEETS

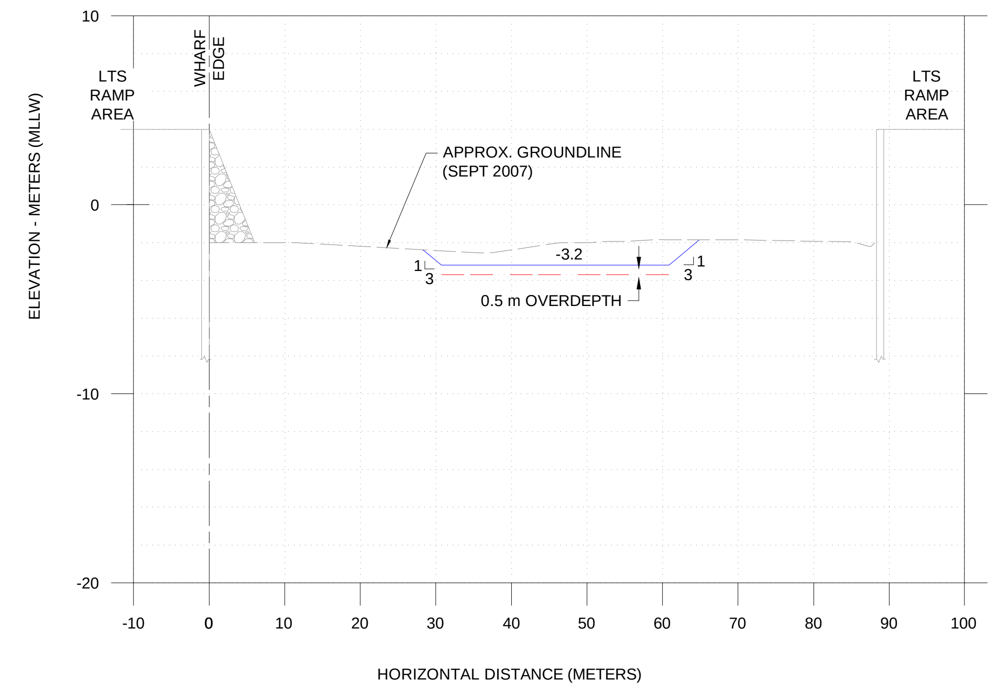
REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C58833 Exp. 6/07/08 CIVIL STATE OF CALIFORNIA

This drawing was produced in METRIC

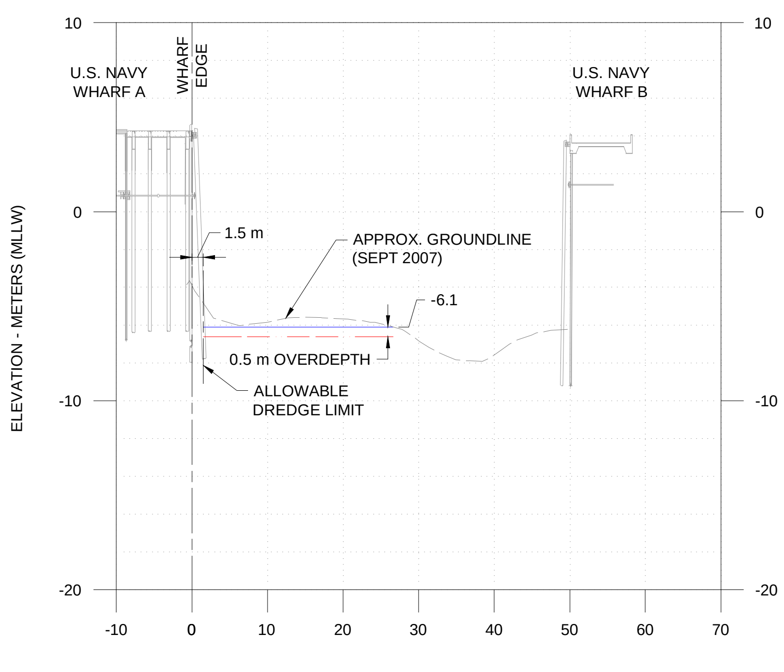
K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\080295-01-SEC1.dwg N-CS-2
Jun 25, 2008 2:21pm tpriga



SECTION AG 1821
WHARF 4 / WHARF 6
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION AI 1821
LTS RAMP
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



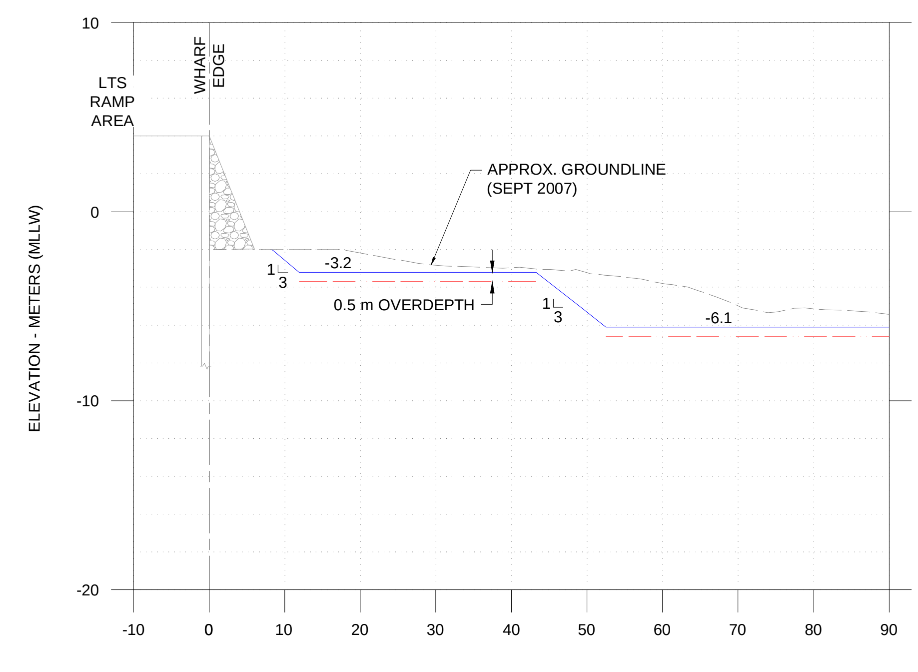
SECTION AH 1821
WHARF A - NORTH / WHARF B
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

LEGEND:

EXISTING BATHYMETRY	— — — (grey dashed)
PROJECT DREDGE NEATLINE	—— (blue)
0.5 m OVERDEPTH	— — — (red dashed)

NOTES:

1. ALL CROSS-SECTIONAL REPRESENTATIONS OF U.S. NAVY AND OXNARD HARBOR DISTRICT WHARVES ARE BASED ON DESIGN DRAWINGS PROVIDED BY THE NAVY AND OHD, RESPECTIVELY. CONTRACTOR SHALL CONFIRM CONDITION, LAYOUT, AND EXTENTS OF ALL WHARF STRUCTURES IN THE FIELD.
2. MAINTAIN DREDGING OFFSET NO CLOSER THAN THE DEPICTED ALLOWABLE DREDGING LIMITFROM WHARF FACES. DREDGING SHALL NOT ENCROACH INSIDE (WHARF-WARD) OF THE INDICATED ALLOWABLE DREDGE LIMITS.
3. THE 3H:1V SIDE SLOPE INCLINATIONS IS AN ESTIMATE ONLY. ACTUAL SLOPE INCLINATION WILL BE DETERMINED BY THE NATURAL SLOUGHING OF THE SEDIMENT. IT IS NOT NECESSARY TO DREDGE SIDE SLOPES; AS A RESULT NO ALLOWABLE OVERDREDGE IS PROVIDED FOR SIDE SLOPES IN THE AREAS DEPICTED.
4. AREAS DENOTED AS "DREDGING RESTRICTION AND BACKFILL AREAS" ARE SUBJECT TO SPECIAL CONSTRAINTS ON DREDGING (PER SPECIFICATIONS) AND REQUIRE SUBSEQUENT BACKFILLING, AS IS DEPICTED ON SEPARATE SHEETS IN THIS PLANS SET.



SECTION AJ 1821
LST RAMP
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGING CROSS SECTIONS G TO J - NAVY WHARVES

SYMBOL | DESCRIPTIONS | DATE | APPROVAL
REVISIONS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

FILE NAME: 08029501-SEC1.DWG
SPEC. NO. W912PL-07-C-0002

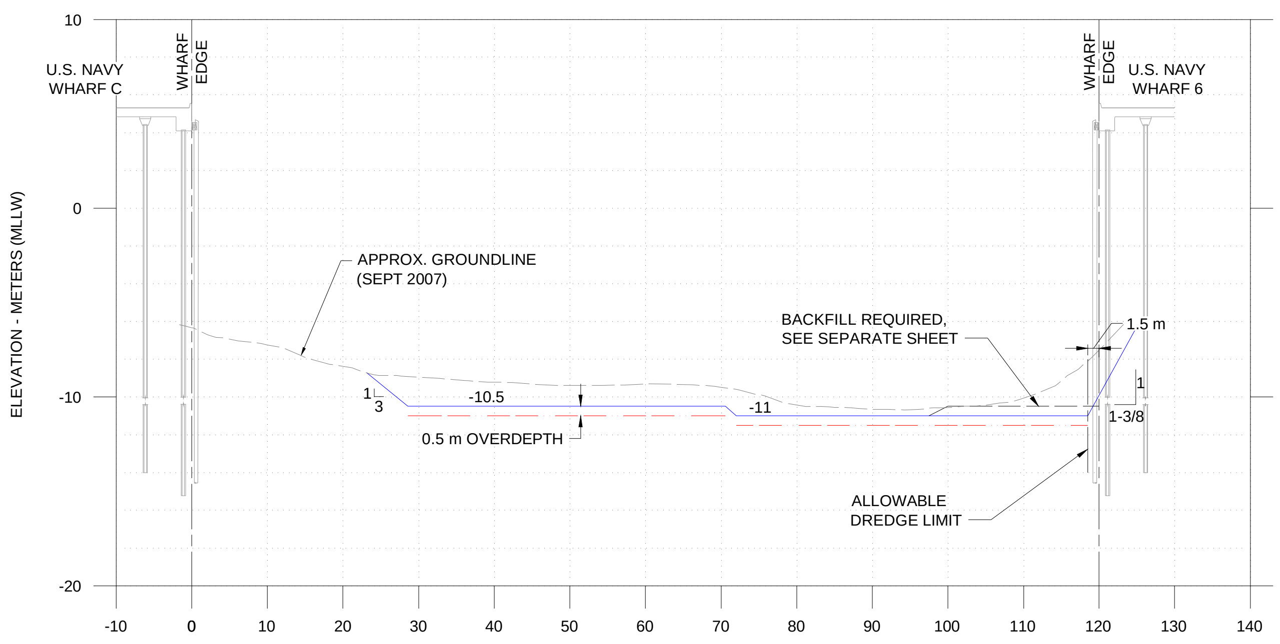
ANCHOR ENVIRONMENTAL, L.L.C.

DATE: JUNE 2008
DISTRICT FILE NO. #####
SCALE: 1:500
SHEET 21 OF 38 SHEETS

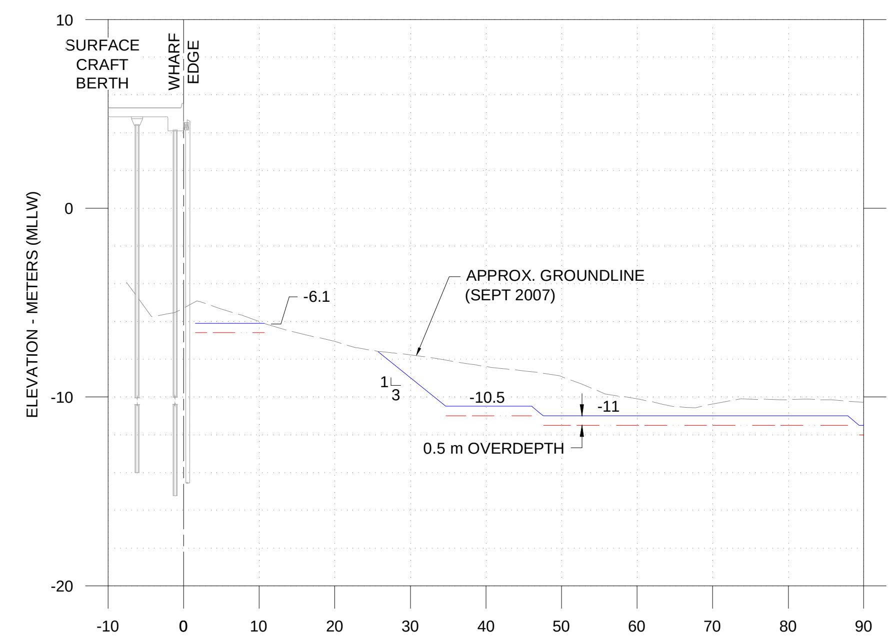
REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C58633 Exp. 6/30/08 CIVIL STATE OF CALIFORNIA

This drawing was produced in METRIC

K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\08029501-SEC1.dwg N-CS-3
Jun 25, 2008 2:21pm tgriga



SECTION AK
WHARF C / WHARF 6 18|22
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION AM
SURFACE CRAFT BERTH 18|22
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

NOTES:

1. ALL CROSS-SECTIONAL REPRESENTATIONS OF U.S. NAVY AND OXNARD HARBOR DISTRICT WHARVES ARE BASED ON DESIGN DRAWINGS PROVIDED BY THE NAVY AND OHD, RESPECTIVELY. CONTRACTOR SHALL CONFIRM CONDITION, LAYOUT, AND EXTENTS OF ALL WHARF STRUCTURES IN THE FIELD.
2. MAINTAIN DREDGING OFFSET NO CLOSER THAN THE DEPICTED ALLOWABLE DREDGING LIMITFROM WHARF FACES. DREDGING SHALL NOT ENCROACH INSIDE (WHARF-WARD) OF THE INDICATED ALLOWABLE DREDGE LIMITS.
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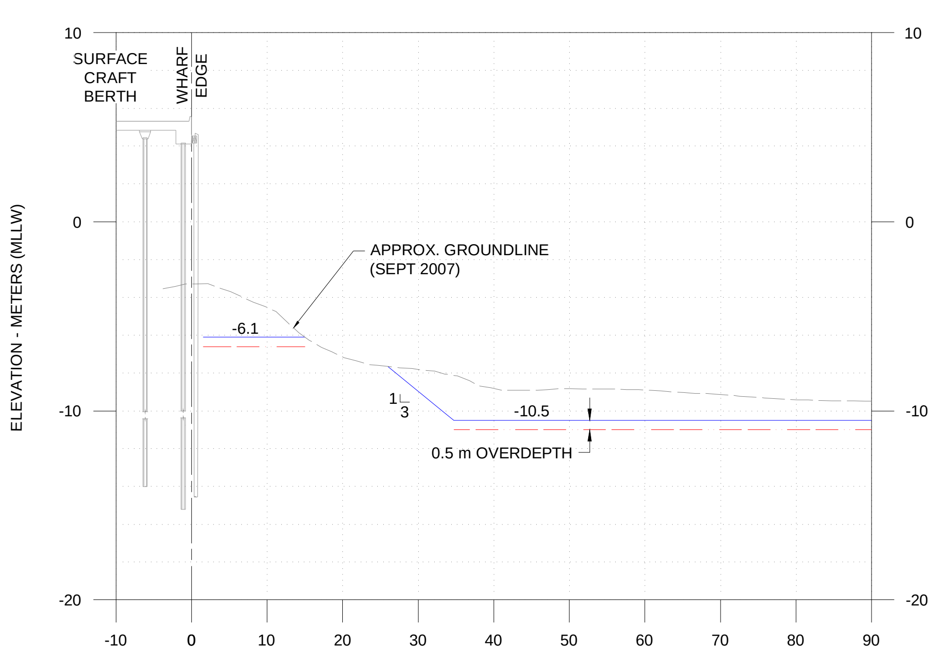
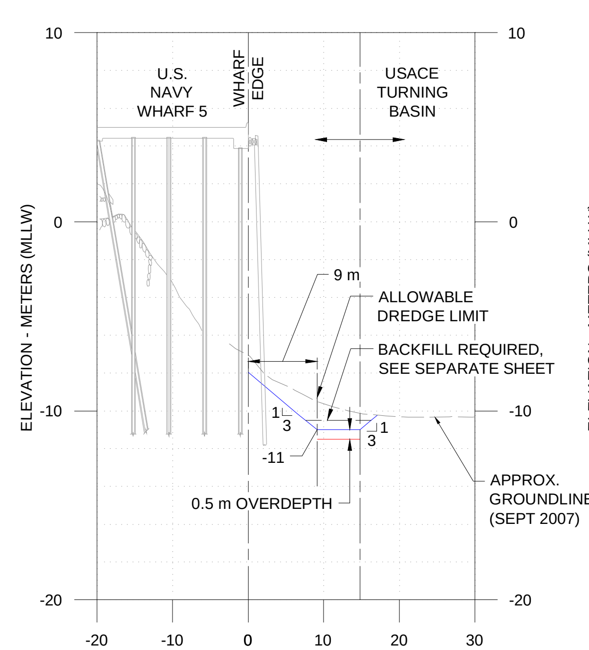
4. AREAS DENOTED AS "DREDGING RESTRICTION AND BACKFILL AREAS" ARE SUBJECT TO SPECIAL CONSTRAINTS ON DREDGING (PER SPECIFICATIONS) AND REQUIRE SUBSEQUENT BACKFILLING, AS IS DEPICTED ON SEPARATE SHEETS IN THIS PLANS SET.

LEGEND:

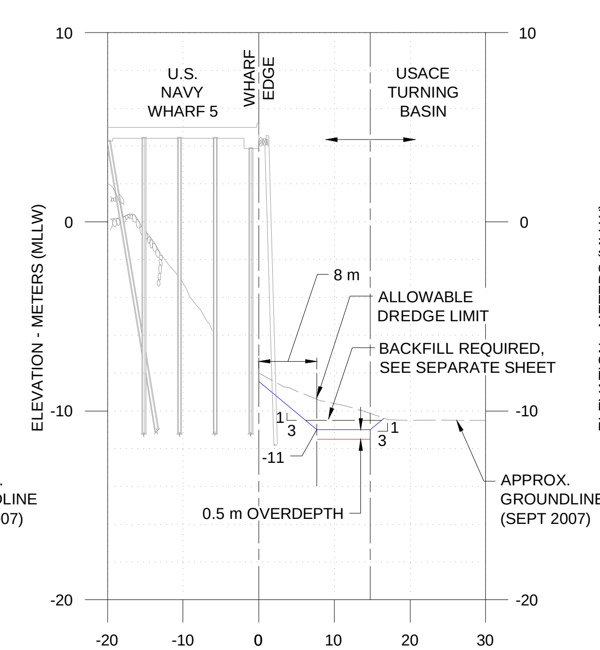
- EXISTING BATHYMETRY
- PROJECT DREDGE NEATLINE
- 0.5 m OVERDEPTH



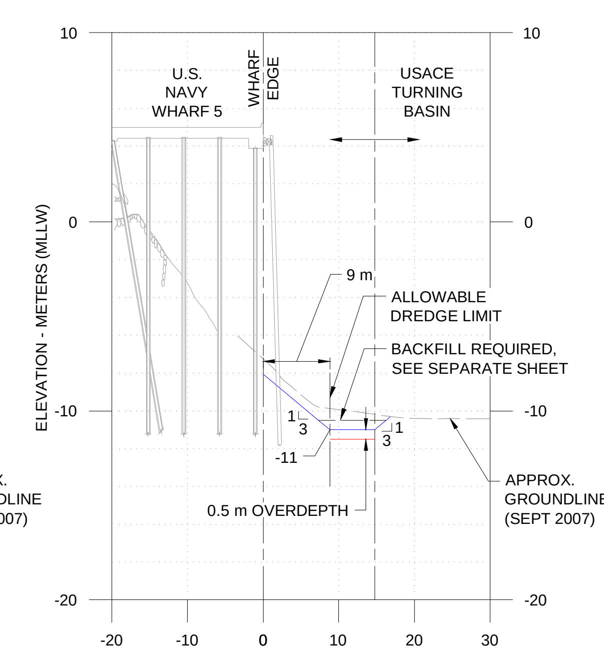
SECTION AL
SURFACE CRAFT BERTH 18|22
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION AN
WHARF 5 17|22
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION AO
WHARF 5 17|22
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION AP
WHARF 5 17|22
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGING CROSS SECTIONS AK TO AP - NAVY WHARVES

REVISIONS
SYMBOL | DESCRIPTIONS | DATE | APPROVAL

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

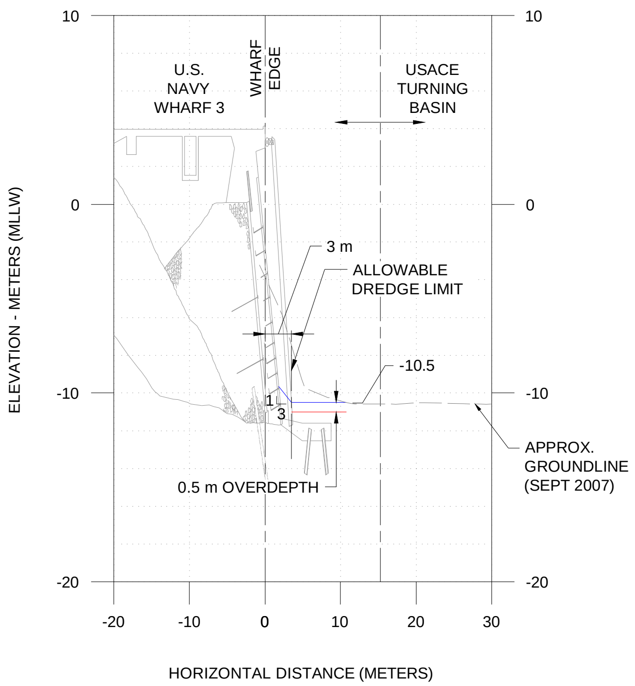
DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 08029501-SEC1.DWG
SPEC. NO. W912PL-07-C-0002
DISTRICT FILE NO. #####
DATE: JUNE 2008
SCALE: 1:500
SHEET 22 OF 38 SHEETS

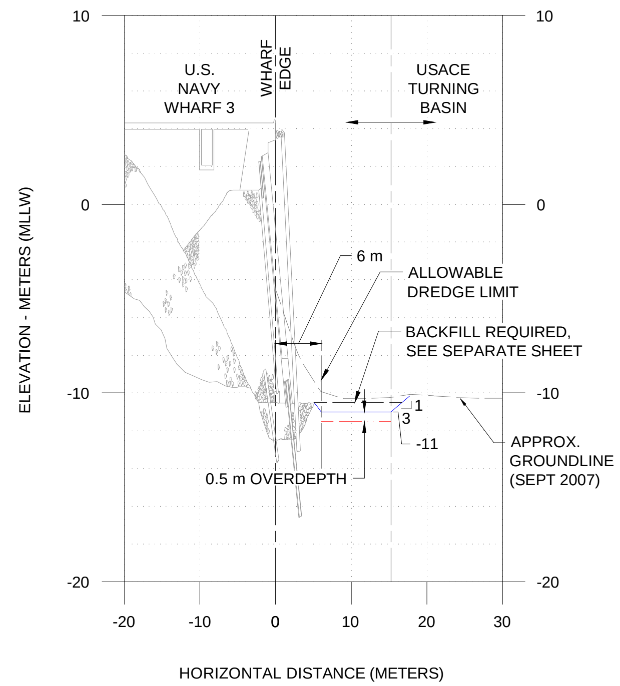
ANCHOR ENVIRONMENTAL, L.L.C.

This drawing was produced in METRIC

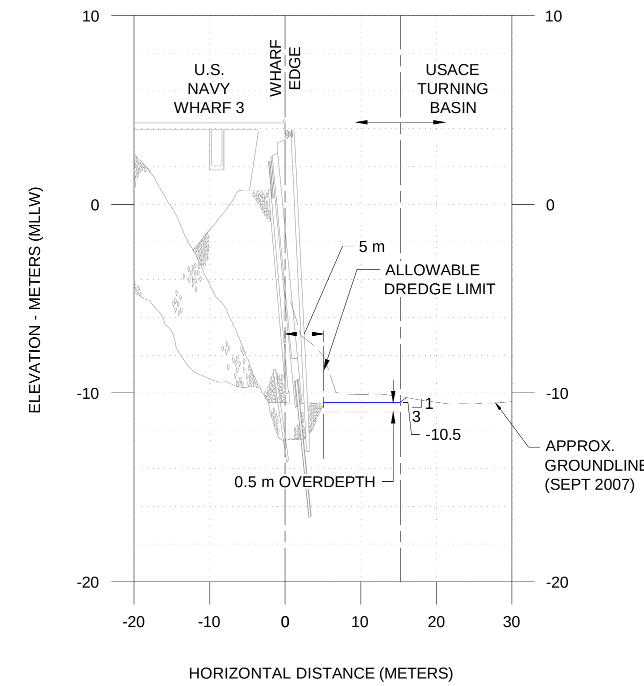
K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\08029501-SEC1.dwg N-CS-4
Jun 25, 2008 2:21pm tgriga



SECTION AQ
WHARF 3 17|23
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION AS
WHARF 3 17|23
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION AU
WHARF 3 17|23
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

NOTES:

1. ALL CROSS-SECTIONAL REPRESENTATIONS OF U.S. NAVY AND OXNARD HARBOR DISTRICT WHARVES ARE BASED ON DESIGN DRAWINGS PROVIDED BY THE NAVY AND OHD, RESPECTIVELY. CONTRACTOR SHALL CONFIRM CONDITION, LAYOUT, AND EXTENTS OF ALL WHARF STRUCTURES IN THE FIELD.
2. MAINTAIN DREDGING OFFSET NO CLOSER THAN THE DEPICTED ALLOWABLE DREDGING LIMITFROM WHARF FACES. DREDGING SHALL NOT ENCROACH INSIDE (WHARF-WARD) OF THE INDICATED ALLOWABLE DREDGE LIMITS.
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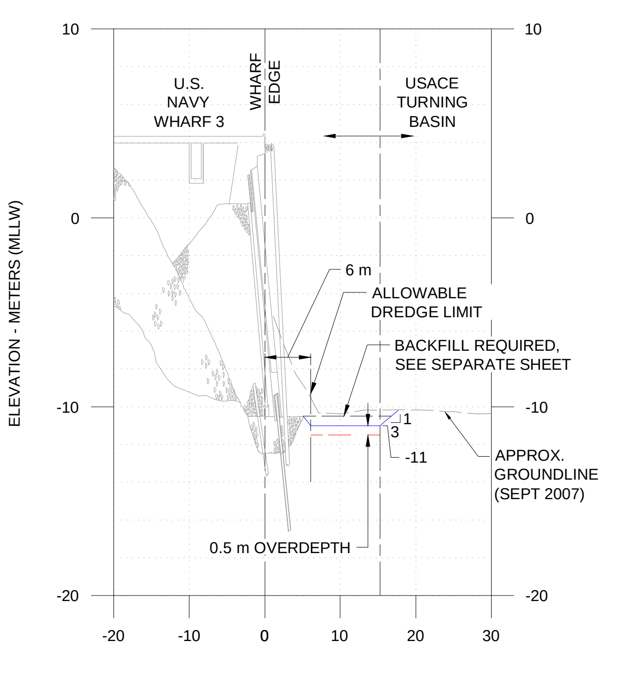
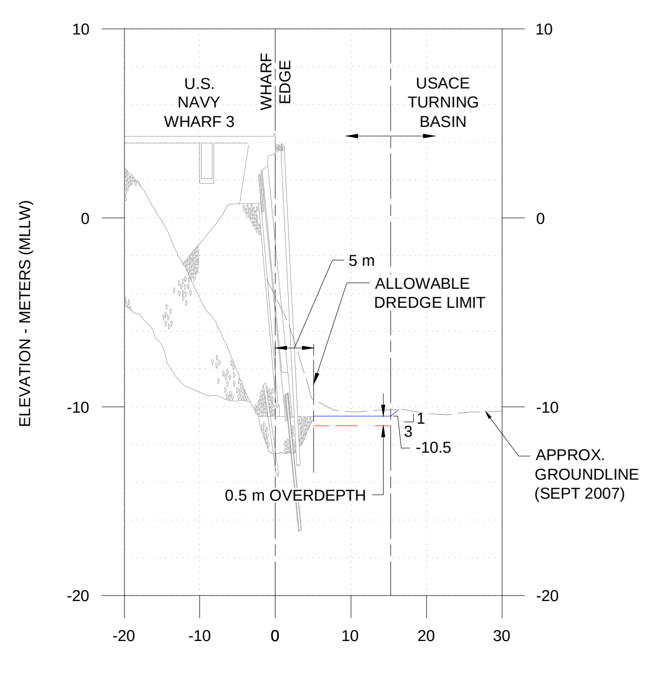
4. AREAS DENOTED AS "DREDGING RESTRICTION AND BACKFILL AREAS" ARE SUBJECT TO SPECIAL CONSTRAINTS ON DREDGING (PER SPECIFICATIONS) AND REQUIRE SUBSEQUENT BACKFILLING, AS IS DEPICTED ON SEPARATE SHEETS IN THIS PLANS SET.

LEGEND:

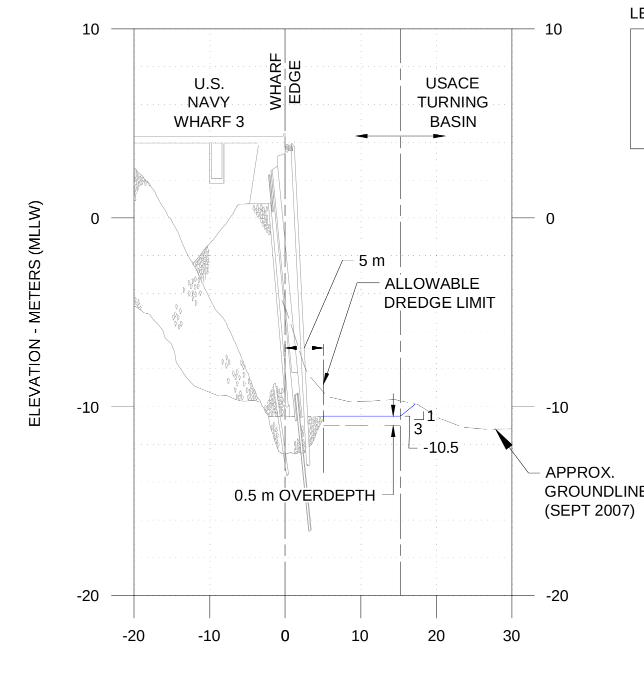
EXISTING BATHYMETRY	— — — (grey dashed)
PROJECT DREDGE NEATLINE	——— (blue)
0.5 m OVERDEPTH	— — (red dashed)



SECTION AR
WHARF 3 17|23
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION AT
WHARF 3 17|23
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION AV
WHARF 3 17|23
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGING CROSS SECTIONS AQ TO V - NAVY WHARVES

SYMBOL | DESCRIPTIONS | DATE | APPROVAL
REVISIONS

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 08029501-SEC1.DWG
SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

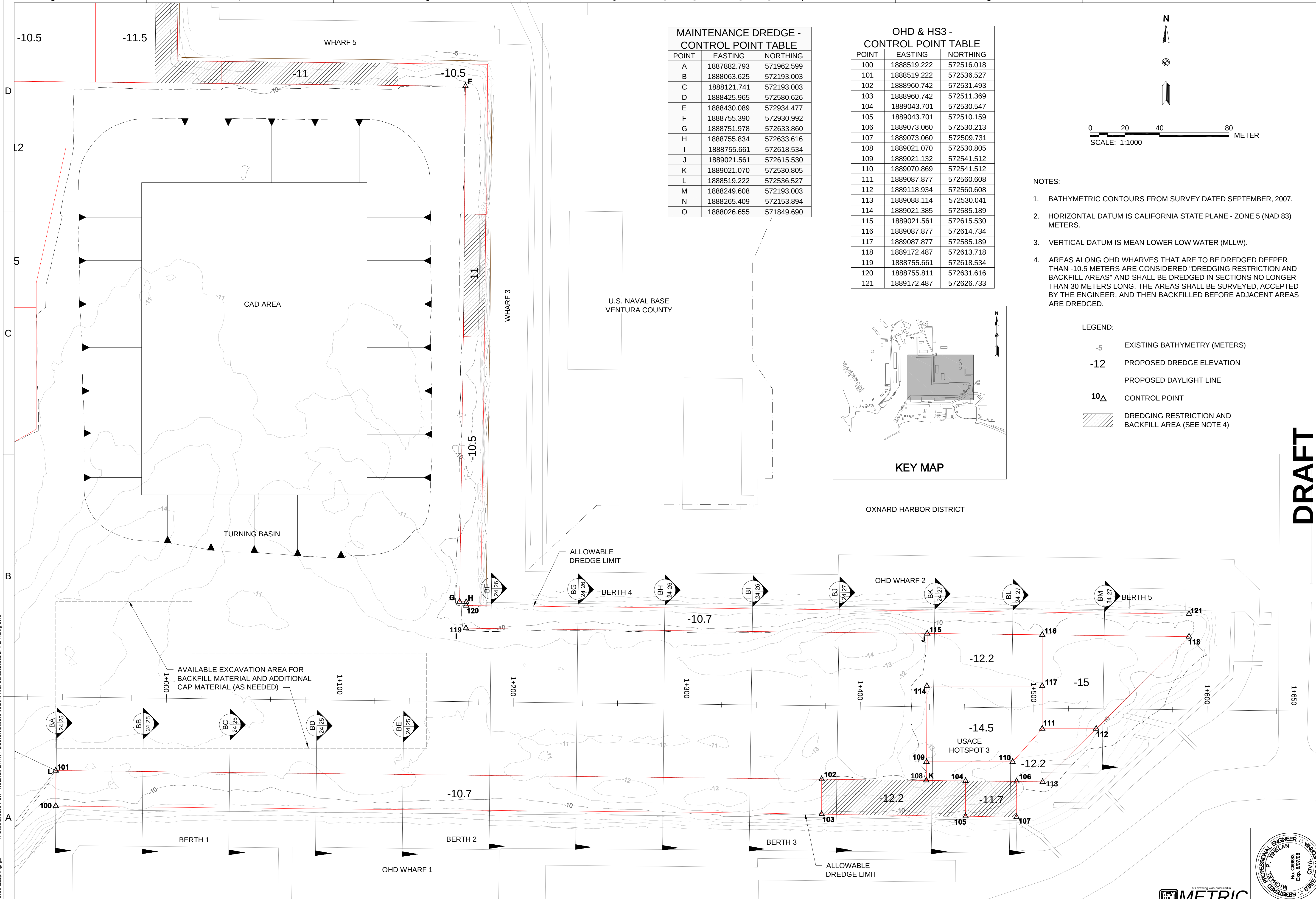
DATE: JUNE 2008
DISTRICT FILE NO. #####

SCALE: 1:500
SHEET 23 OF 38 SHEETS

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C56833 Exp. 6/07/08 CIVIL STATE OF CALIFORNIA

This drawing was produced in METRIC

K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\08029501-SEC1.dwg N-CS-5
Jun 25, 2008 2:21pm tgriga



MAINTENANCE DREDGE - CONTROL POINT TABLE

POINT	EASTING	NORTHING
A	1887882.793	571962.599
B	1888063.625	572193.003
C	1888121.741	572193.003
D	1888425.965	572580.626
E	1888430.089	572934.477
F	1888755.390	572930.992
G	1888751.978	572633.860
H	1888755.834	572633.616
I	1888755.661	572618.534
J	1889021.561	572615.530
K	1889021.070	572530.805
L	1888519.222	572536.527
M	1888249.608	572193.003
N	1888265.409	572153.894
O	1888026.655	571849.690

OHD & HS3 - CONTROL POINT TABLE

POINT	EASTING	NORTHING
100	1888519.222	572516.018
101	1888519.222	572536.527
102	1888960.742	572531.493
103	1888960.742	572511.369
104	1889043.701	572530.547
105	1889043.701	572510.159
106	1889073.060	572530.213
107	1889073.060	572509.731
108	1889021.070	572530.805
109	1889021.132	572541.512
110	1889070.869	572541.512
111	1889087.877	572560.608
112	1889118.934	572560.608
113	1889088.114	572530.041
114	1889021.385	572585.189
115	1889021.561	572615.530
116	1889087.877	572614.734
117	1889087.877	572585.189
118	1889172.487	572613.718
119	1888755.661	572618.534
120	1888755.811	572631.616
121	1889172.487	572626.733

SCALE: 1:1000 (0 20 40 80 METER)

NOTES:

1. BATHYMETRIC CONTOURS FROM SURVEY DATED SEPTEMBER, 2007.
2. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
3. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW).
4. AREAS ALONG OHD WHARVES THAT ARE TO BE DREDGED DEEPER THAN -10.5 METERS ARE CONSIDERED "DREDGING RESTRICTION AND BACKFILL AREAS" AND SHALL BE DREDGED IN SECTIONS NO LONGER THAN 30 METERS LONG. THE AREAS SHALL BE SURVEYED, ACCEPTED BY THE ENGINEER, AND THEN BACKFILLED BEFORE ADJACENT AREAS ARE DREDGED.

LEGEND:

- -5 EXISTING BATHYMETRY (METERS)
- -12 PROPOSED DREDGE ELEVATION
- PROPOSED DAYLIGHT LINE
- 10△ CONTROL POINT
- DREDGING RESTRICTION AND BACKFILL AREA (SEE NOTE 4)

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGING PLAN - OHD WHARVES 1, 2, & HOTSPOT 3

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

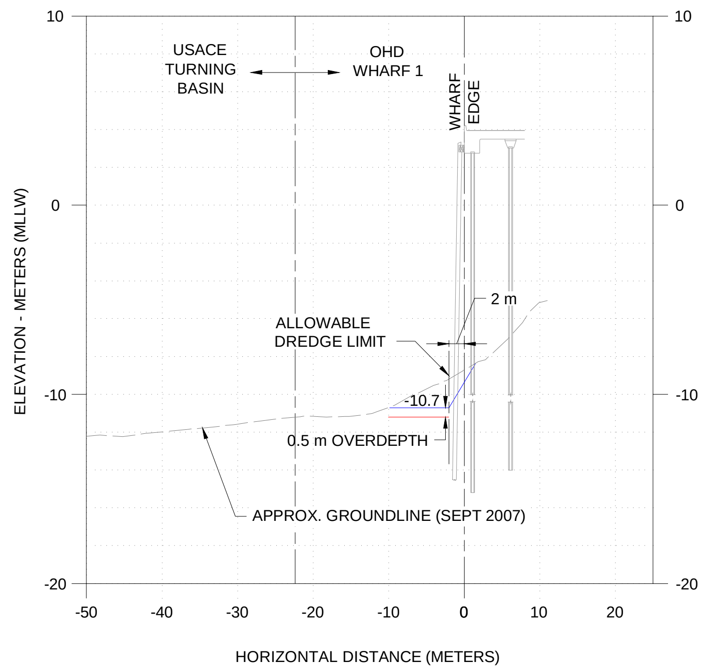
FILE NAME: 08029501-DRPLAN.DWG
SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

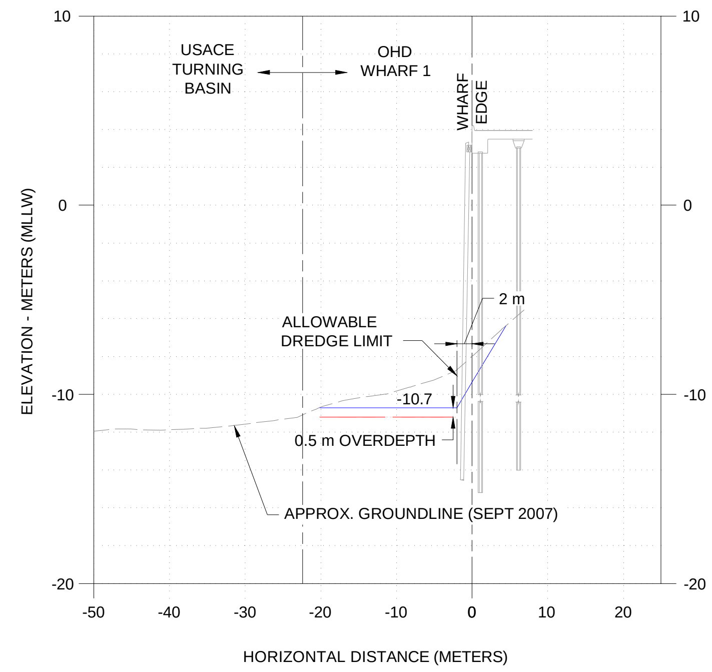
SCALE: 1:1000
SHEET 24 OF 38 SHEETS
DATE: JUNE 2008
DISTRICT FILE NO. #####

REGISTERED PROFESSIONAL ENGINEER MITCHELL P. WHELAN No. C56833 Exp. 9/07/08 CIVIL STATE OF CALIFORNIA

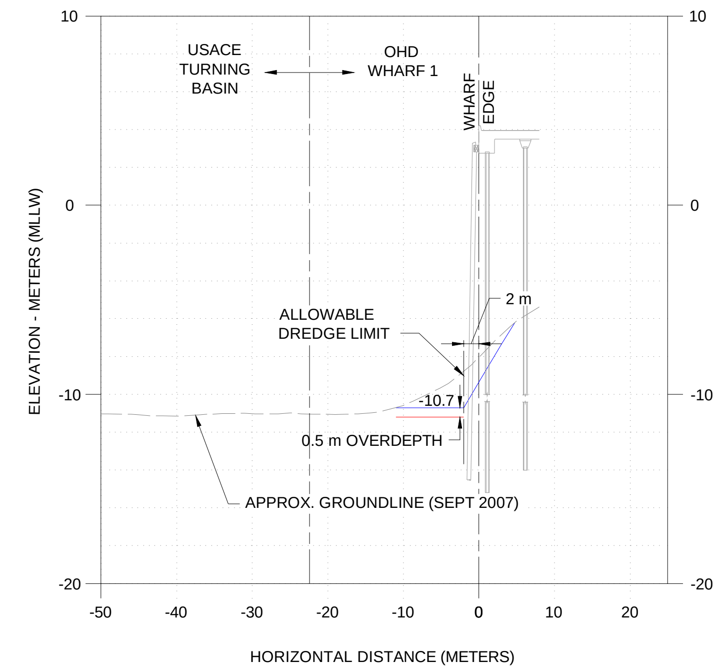
This drawing was produced in METRIC



SECTION BA 17|25
OHD WHARF 1
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION BC 17|25
OHD WHARF 1
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION BE 17|25
OHD WHARF 1
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

NOTES:

1. ALL CROSS-SECTIONAL REPRESENTATIONS OF U.S. NAVY AND OXNARD HARBOR DISTRICT WHARVES ARE BASED ON DESIGN DRAWINGS PROVIDED BY THE NAVY AND OHD, RESPECTIVELY. CONTRACTOR SHALL CONFIRM CONDITION, LAYOUT, AND EXTENTS OF ALL WHARF STRUCTURES IN THE FIELD.
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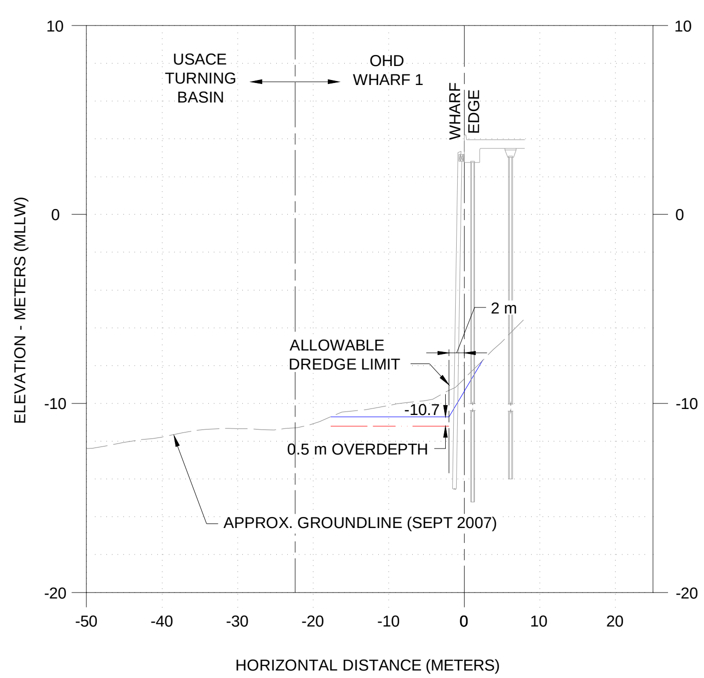
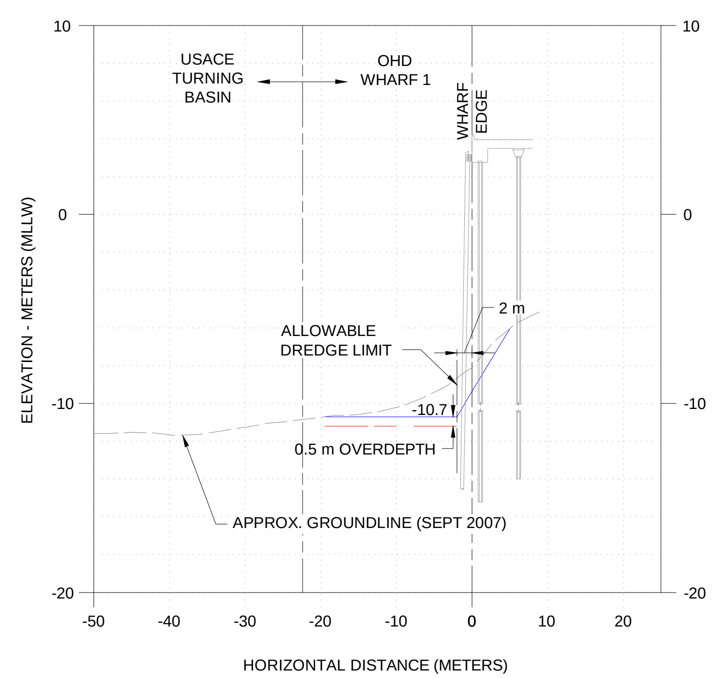


SECTION BB 17|25
OHD WHARF 1
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION BD 17|25
OHD WHARF 1
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

LEGEND:

- EXISTING BATHYMETRY
- PROJECT DREDGE NEATLINE
- 0.5 m OVERDEPTH

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGING CROSS SECTIONS BA TO BE - OHD WHARF 1

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

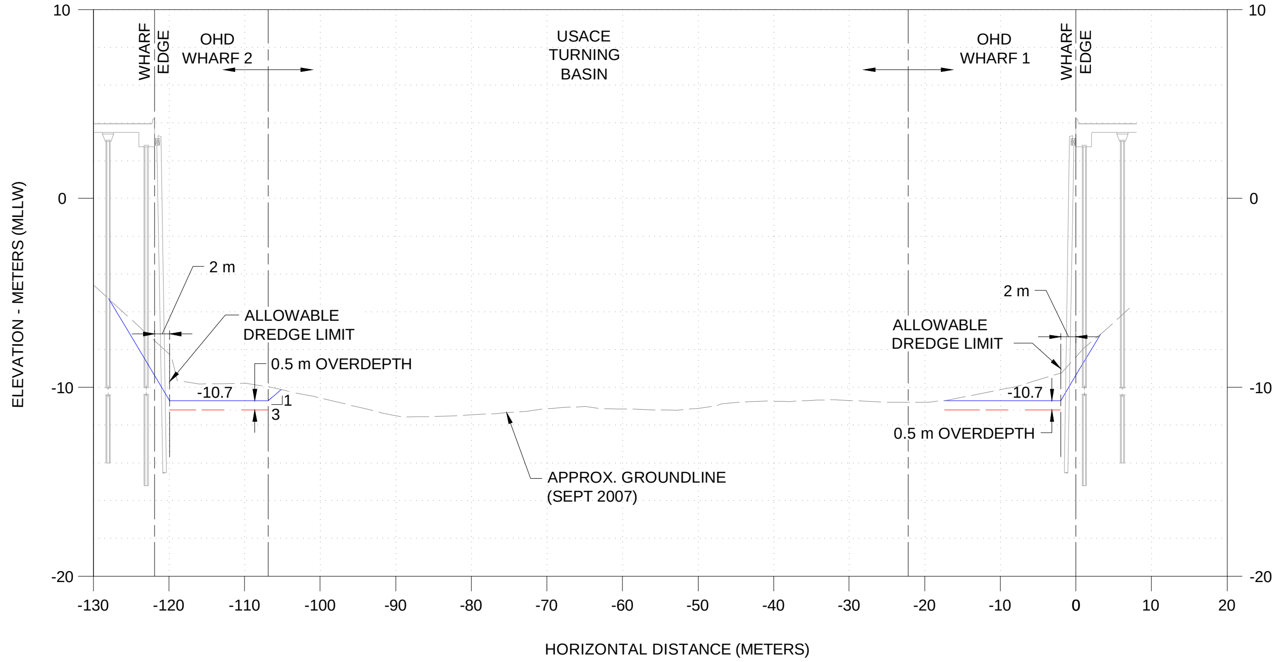
U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW
DATE:
SUBMITTED BY: DATE: CHIEF, DESIGN BRANCH
APPROVED: CHIEF, ENGINEERING DIVISION
SPEC. NO. W912PL-07-C-0002
FILE NAME: 08029501-SEC2.DWG

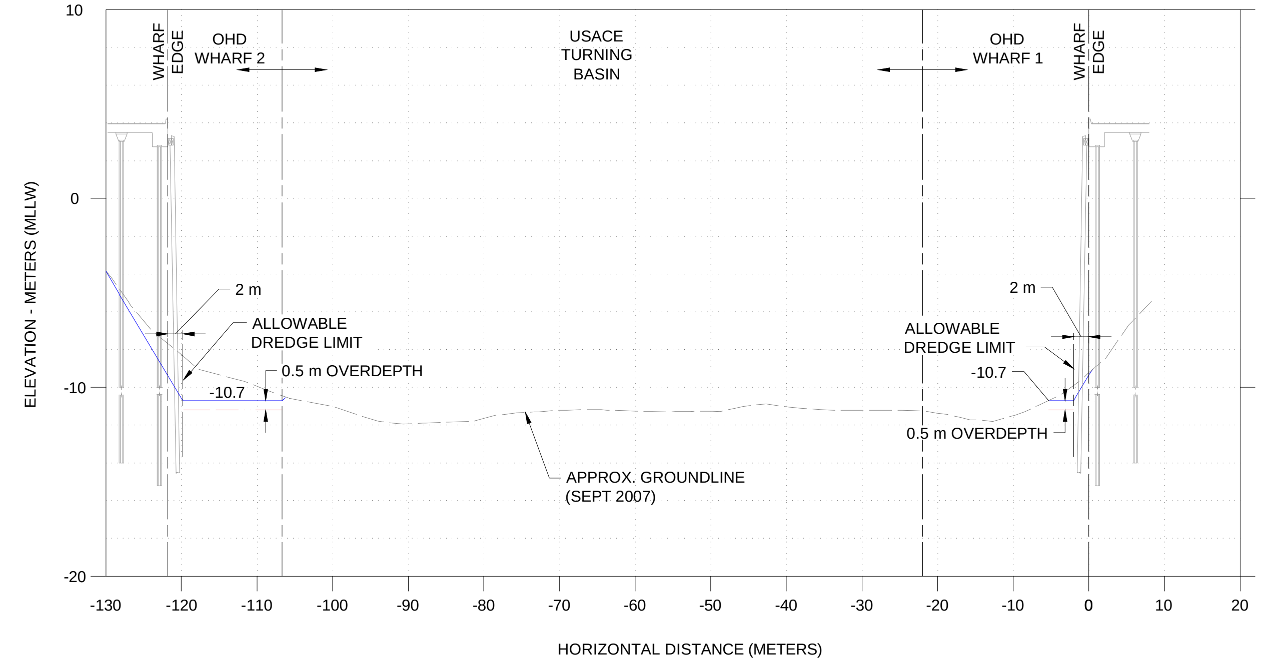
ANCHOR ENVIRONMENTAL, L.L.C.

SCALE: 1:500
SHEET 25 OF 38 SHEETS
DATE: JUNE 2008
DISTRICT FILE NO. #####

This drawing was produced in METRIC



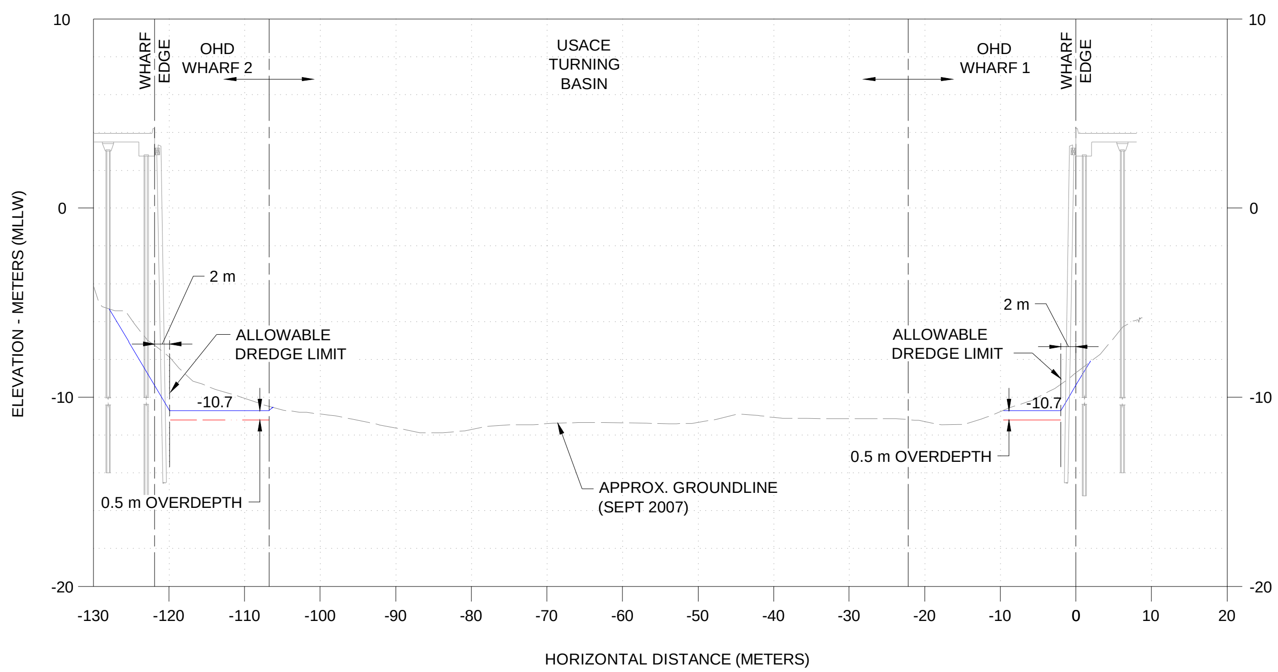
SECTION BF
OHD WHARVES 1 & 2 17|26
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION BH
OHD WHARVES 1 & 2 24|26
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

NOTES:

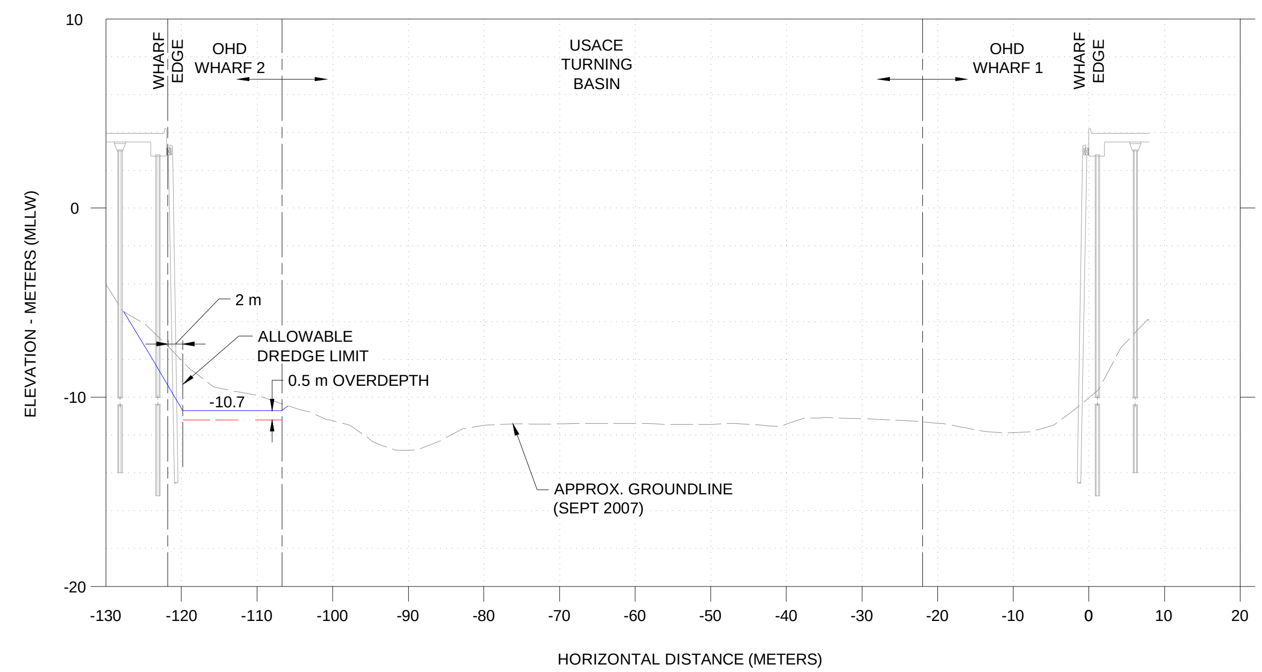
1. ALL CROSS-SECTIONAL REPRESENTATIONS OF U.S. NAVY AND OXNARD HARBOR DISTRICT WHARVES ARE BASED ON DESIGN DRAWINGS PROVIDED BY THE NAVY AND OHD, RESPECTIVELY. CONTRACTOR SHALL CONFIRM CONDITION, LAYOUT, AND EXTENTS OF ALL WHARF STRUCTURES IN THE FIELD.



SECTION BG
OHD WHARVES 1 & 2 17|26
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

LEGEND:

EXISTING BATHYMETRY	— — —
PROJECT DREDGE NEATLINE	———
0.5 m OVERDEPTH	— — —



SECTION BI
OHD WHARVES 1 & 2 24|26
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

This drawing was produced in METRIC

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGING CROSS SECTIONS BF TO BI - OHD WHARVES 1 & 2

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
REVISIONS			

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

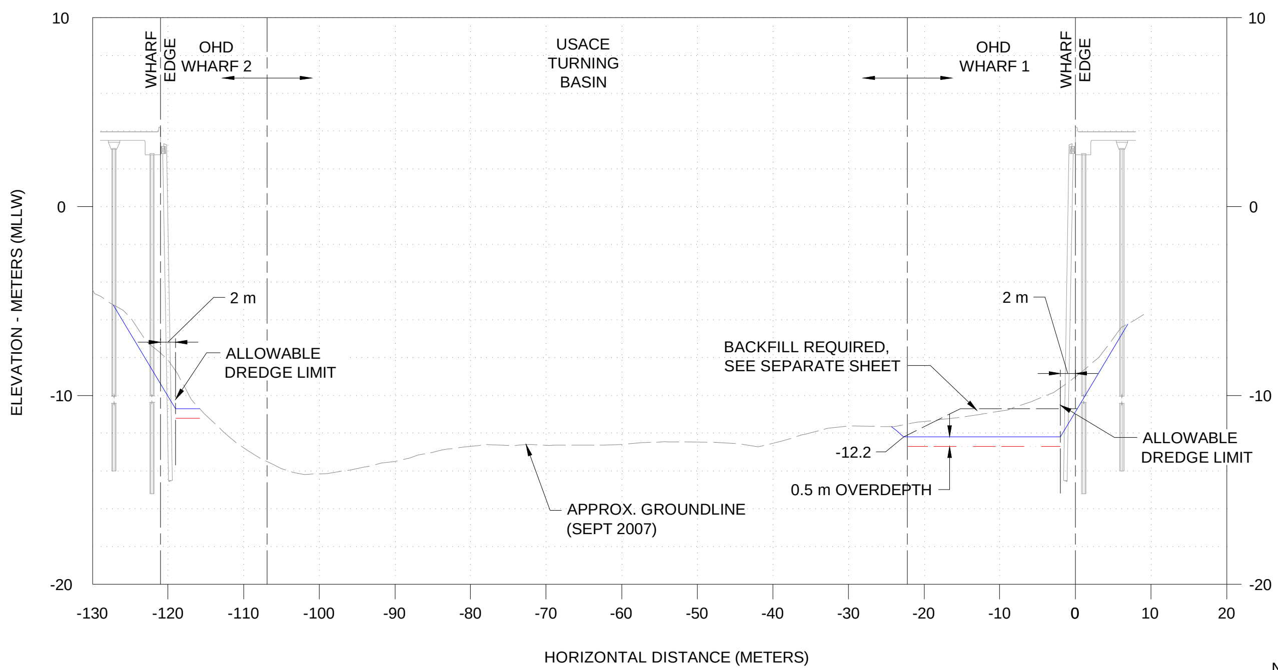
DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW
DATE:
SUBMITTED BY: DATE:
CHIEF, DESIGN BRANCH
APPROVED:
CHIEF, ENGINEERING DIVISION
SPEC. NO. W912PL-07-C-0002
FILE NAME: 08029501-SEC2.DWG

ANCHOR ENVIRONMENTAL, L.L.C.

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C56833 Exp. 6/07/08 CIVIL STATE OF CALIFORNIA

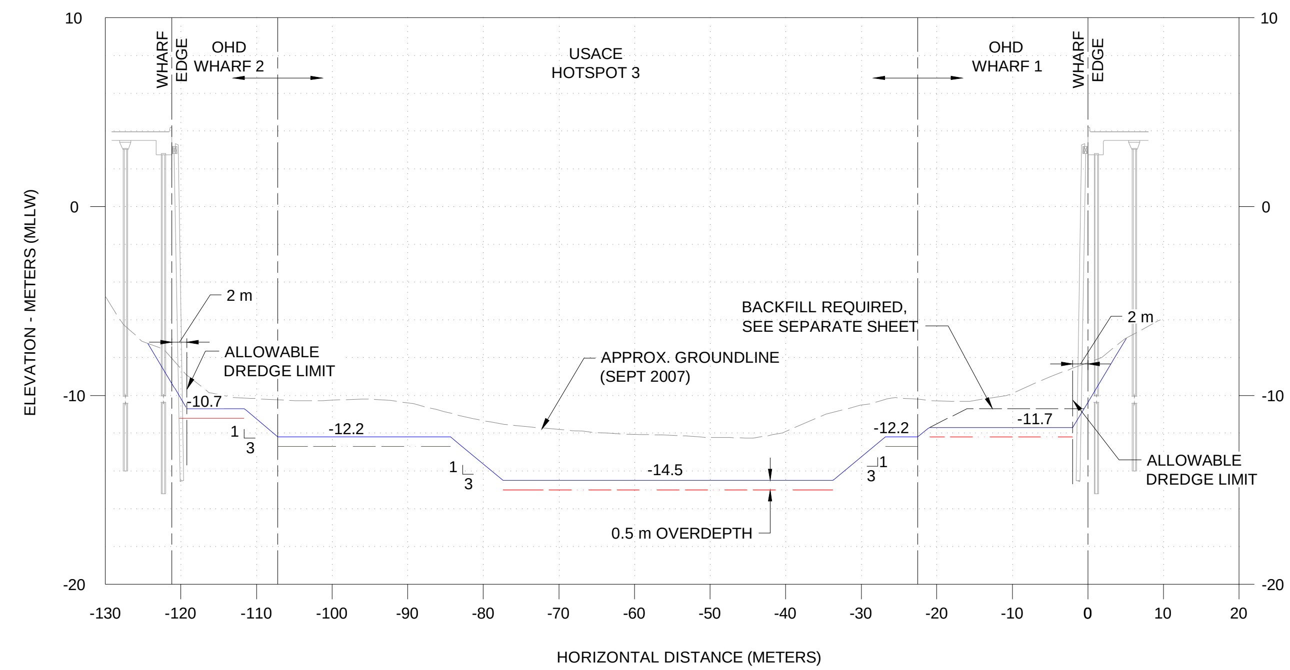
SCALE: 1:500
SHEET 26 OF 38 SHEETS
DATE: JUNE 2008
DISTRICT FILE NO. #####

K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\08029501-SEC2.dwg OHD-CS-2
Jun 25, 2008 2:21pm tpriga



SECTION BJ 24|27
OHD WHARVES 1 & 2

HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

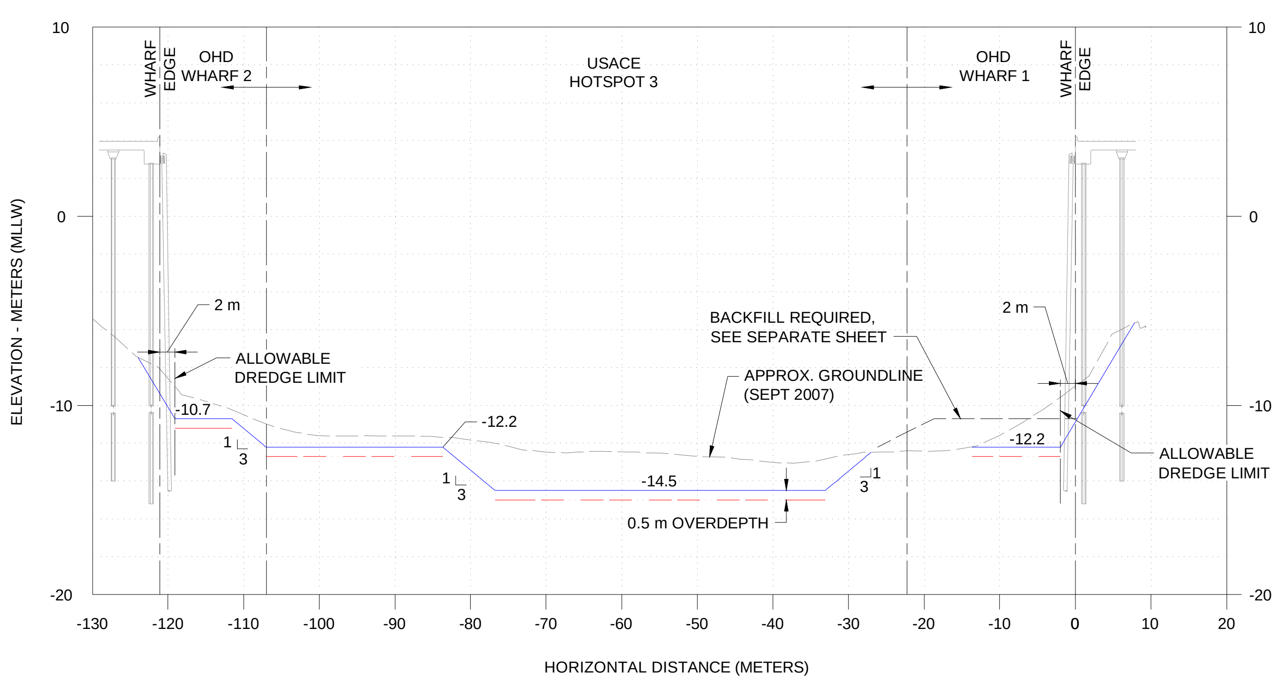


SECTION BL 24|27
OHD WHARVES 1, 2, & HOT SPOT 3

HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

NOTES:

1. ALL CROSS-SECTIONAL REPRESENTATIONS OF U.S. NAVY AND OXNARD HARBOR DISTRICT WHARVES ARE BASED ON DESIGN DRAWINGS PROVIDED BY THE NAVY AND OHD, RESPECTIVELY. CONTRACTOR SHALL CONFIRM CONDITION, LAYOUT, AND EXTENTS OF ALL WHARF STRUCTURES IN THE FIELD.

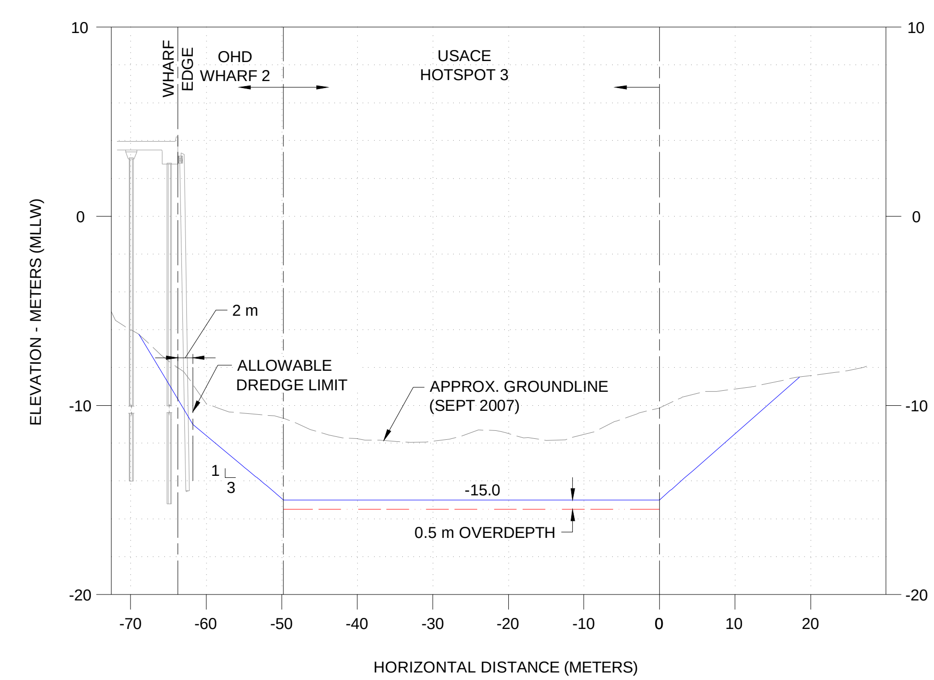


SECTION BK 24|27
OHD WHARVES 1, 2, & HOT SPOT 3

HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

LEGEND:

EXISTING BATHYMETRY	— — —
PROJECT DREDGE NEATLINE	——
0.5 m OVERDEPTH	— —



SECTION BM 24|27
OHD WHARVES 1, 2, & HOT SPOT 3

HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGING CROSS SECTIONS BJ TO BM - OHD W 1 & 2 & USACE HS3

SYMBOL | DESCRIPTIONS | DATE | APPROVAL
REVISIONS

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW
DATE:
SUBMITTED BY:
APPROVED:
DATE:
CHIEF, DESIGN BRANCH
CHIEF, ENGINEERING DIVISION
FILE NAME: 080295-SEC2.DWG
SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

SCALE: 1:500
SHEET 27 OF 38 SHEETS
DATE: JUNE 2008
DISTRICT FILE NO. #####

REGISTERED PROFESSIONAL ENGINEER MITCHELL P. WHELAN No. C56833 Exp. 6/07/08 CIVIL STATE OF CALIFORNIA

This drawing was produced in METRIC

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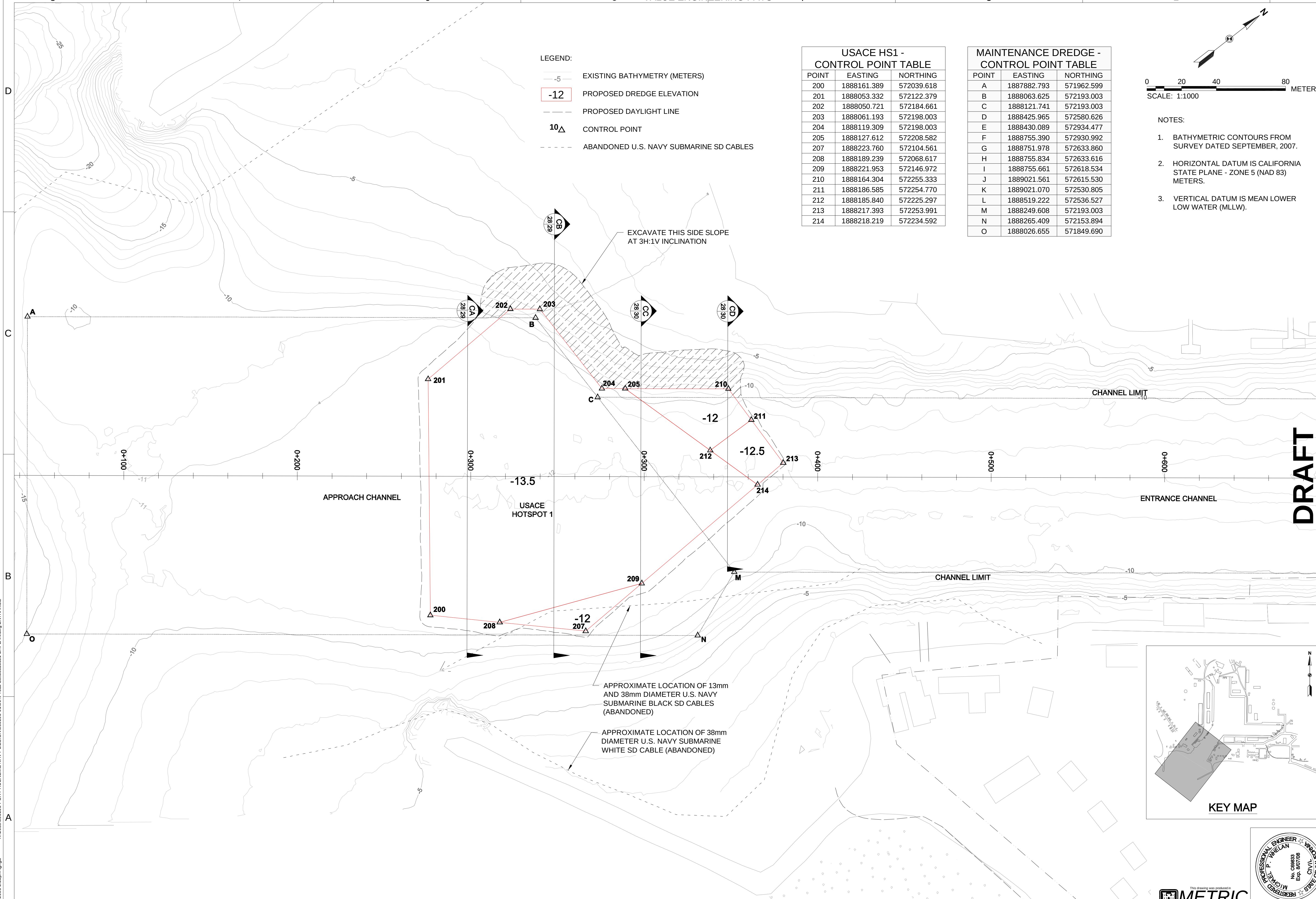
Jun 25, 2008 2:21pm tgriga

VALUE ENGINEERING PAYS



USACE HS1 - CONTROL POINT TABLE		
POINT	EASTING	NORTHING
200	1888161.389	572039.618
201	1888053.332	572122.379
202	1888050.721	572184.661
203	1888061.193	572198.003
204	1888119.309	572198.003
205	1888127.612	572208.582
207	1888223.760	572104.561
208	1888189.239	572068.617
209	1888221.953	572146.972
210	1888164.304	572255.333
211	1888186.585	572254.770
212	1888185.840	572225.297
213	1888217.393	572253.991
214	1888218.219	572234.592

MAINTENANCE DREDGE - CONTROL POINT TABLE		
POINT	EASTING	NORTHING
A	1887882.793	571962.599
B	1888063.625	572193.003
C	1888121.741	572193.003
D	1888425.965	572580.626
E	1888430.089	572934.477
F	1888755.390	572930.992
G	1888751.978	572633.860
H	1888755.834	572633.616
I	1888755.661	572618.534
J	1889021.561	572615.530
K	1889021.070	572530.805
L	1888519.222	572536.527
M	1888249.608	572193.003
N	1888265.409	572153.894
O	1888026.655	571849.690

NOTES:

1. BATHYMETRIC CONTOURS FROM SURVEY DATED SEPTEMBER, 2007.
2. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
3. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW).

REVISIONS

SYMBOL	DESCRIPTIONS	DATE	APPROVAL

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGING PLAN - USACE ENTRANCE CHANNEL

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 08029501-DRPLAN.DWG

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

DATE: JUNE 2008

DISTRICT FILE NO. #####

SCALE: 1:1000

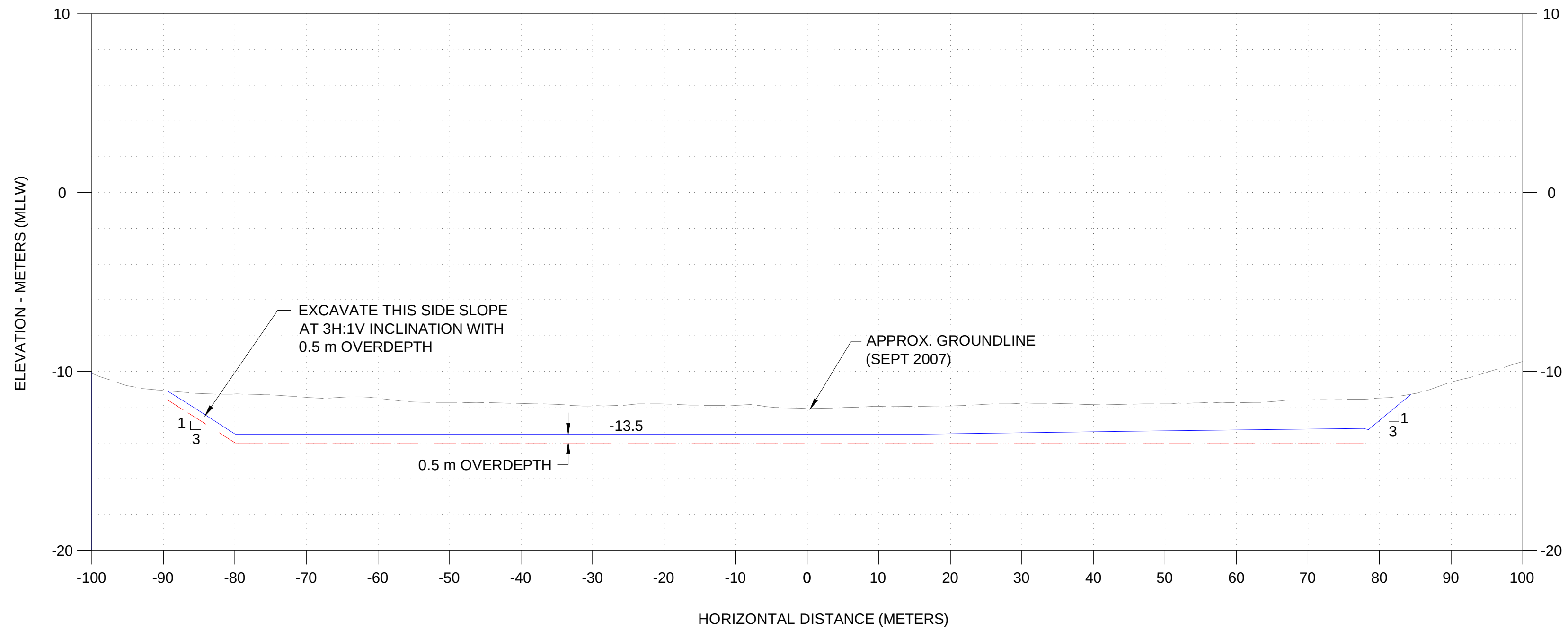
SHEET 28 OF 38 SHEETS

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C56833 Exp. 6/07/08 CIVIL STATE OF CALIFORNIA

This drawing was produced in METRIC

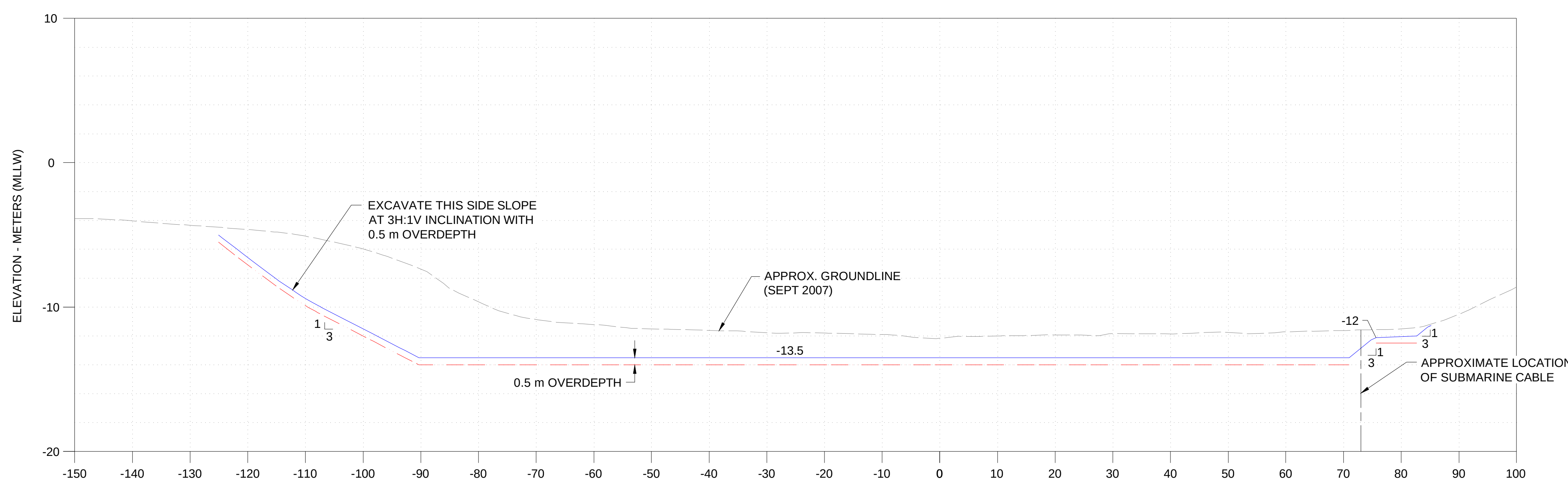
SAFETY PAYS

K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\08029501-DRPLAN.dwg ENTRANCE
Jun 25, 2008 2:22pm tgriga



SECTION CA
USACE HOTSPOT 1 2829

HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION CB
USACE HOTSPOT 1 2829

HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

NOTES:

1. ALL CROSS-SECTIONAL REPRESENTATIONS OF U.S. NAVY AND OXNARD HARBOR DISTRICT WHARVES ARE BASED ON DESIGN DRAWINGS PROVIDED BY THE NAVY AND OHD, RESPECTIVELY. CONTRACTOR SHALL CONFIRM CONDITION, LAYOUT, AND EXTENTS OF ALL WHARF STRUCTURES IN THE FIELD.

LEGEND:

- EXISTING BATHYMETRY
- PROJECT DREDGE NEATLINE
- 0.5 m OVERDEPTH

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGING CROSS SECTIONS CA & CB - USACE HS1

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW
DATE:
SUBMITTED BY:
APPROVED:
CHIEF, DESIGN BRANCH
CHIEF, ENGINEERING DIVISION
SPEC. NO. W912PL-07-C-0002
FILE NAME: 08029501-SEC2.DWG

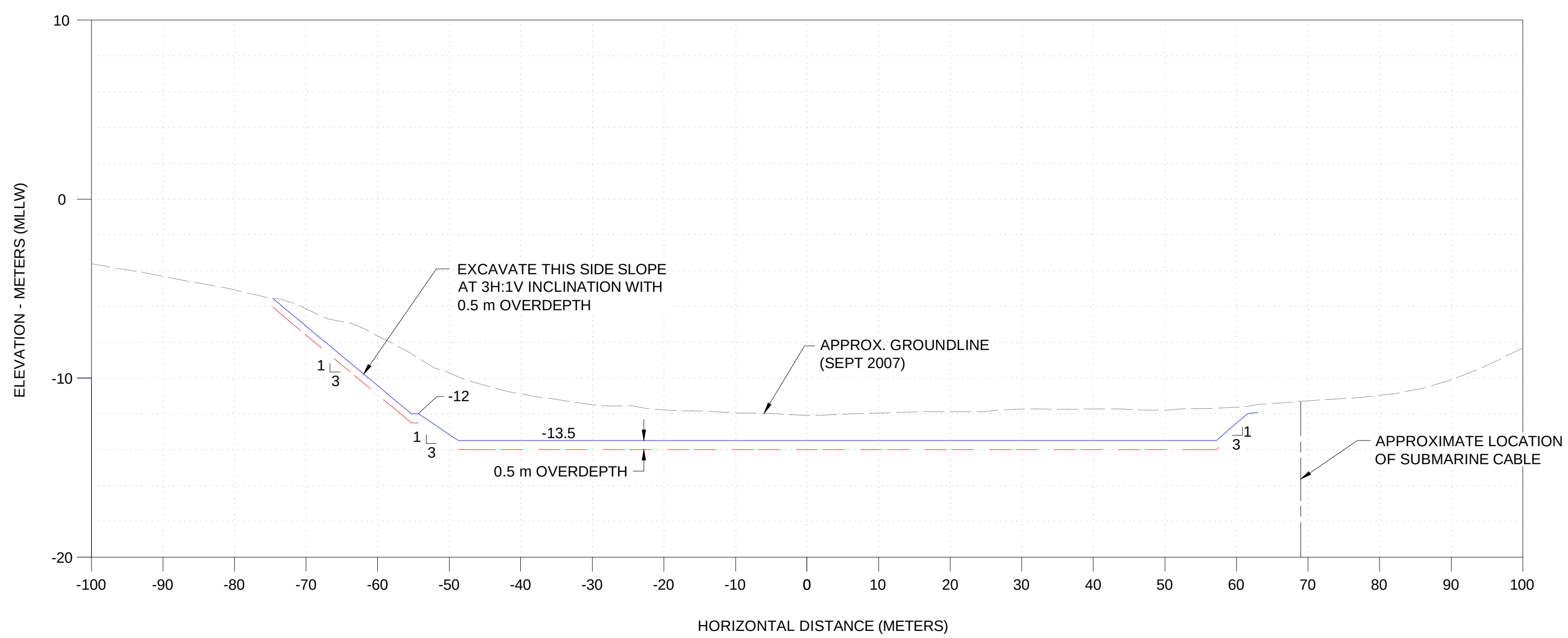
ANCHOR ENVIRONMENTAL, L.L.C.

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C56833 Exp. 6/07/08 CIVIL STATE OF CALIFORNIA

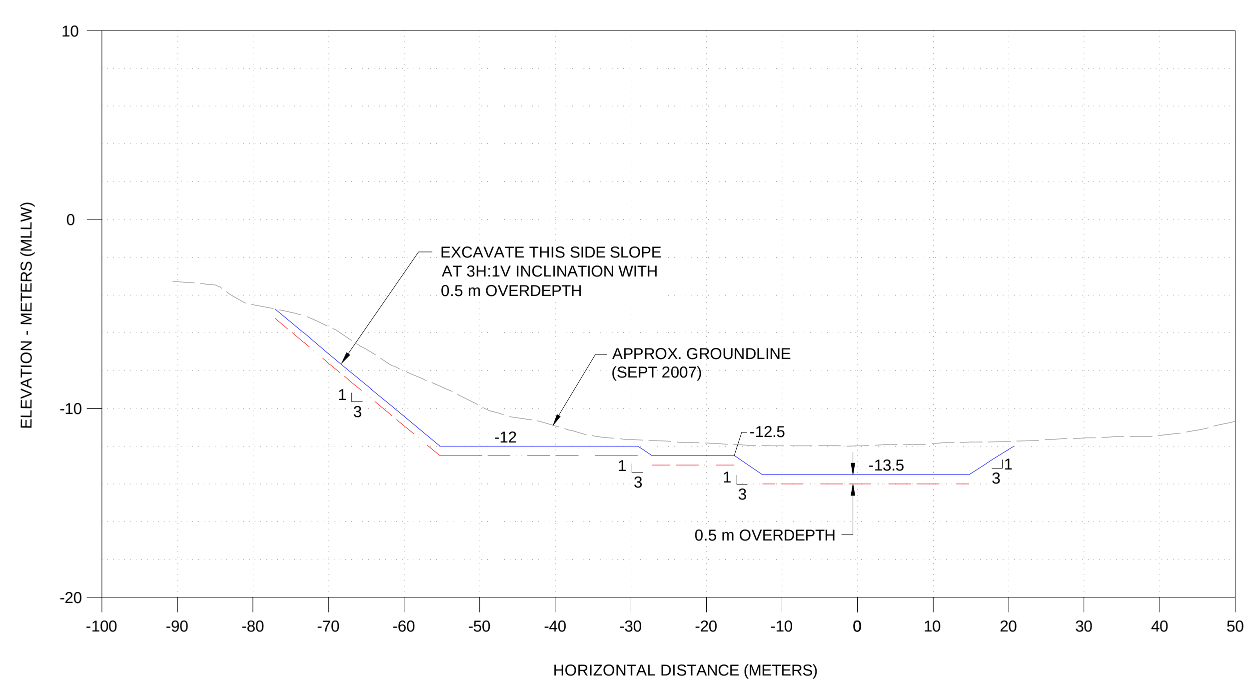
SCALE: 1:500
SHEET 29 OF 38 SHEETS
DATE: JUNE 2008
DISTRICT FILE NO. #####

This drawing was produced in METRIC

K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\08029501-SEC2.dwg HS1-CS-1
Jun 25, 2008 2:22pm tgriga



SECTION CC
USACE HOTSPOT 1 28 30
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION CD
USACE HOTSPOT 1 28 30
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

NOTES:

1. ALL CROSS-SECTIONAL REPRESENTATIONS OF U.S. NAVY AND OXNARD HARBOR DISTRICT WHARVES ARE BASED ON DESIGN DRAWINGS PROVIDED BY THE NAVY AND OHD, RESPECTIVELY. CONTRACTOR SHALL CONFIRM CONDITION, LAYOUT, AND EXTENTS OF ALL WHARF STRUCTURES IN THE FIELD.

LEGEND:

- EXISTING BATHYMETRY
- PROJECT DREDGE NEATLINE
- 0.5 m OVERDEPTH

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

DREDGING CROSS SECTIONS CC & CD - USACE HS1

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
REVISIONS			

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW
DATE:
SUBMITTED BY: DATE:
CHIEF, DESIGN BRANCH
APPROVED: DATE:
CHIEF, ENGINEERING DIVISION
SPEC. NO. W912PL-07-C-0002
FILE NAME: 080295-01-SEC2.DWG

ANCHOR ENVIRONMENTAL, L.L.C.

SCALE: 1:500
SHEET 30 OF 38 SHEETS
DATE: JUNE 2008
DISTRICT FILE NO. #####

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C56833 Exp. 6/07/08 CIVIL STATE OF CALIFORNIA

This drawing was produced in METRIC

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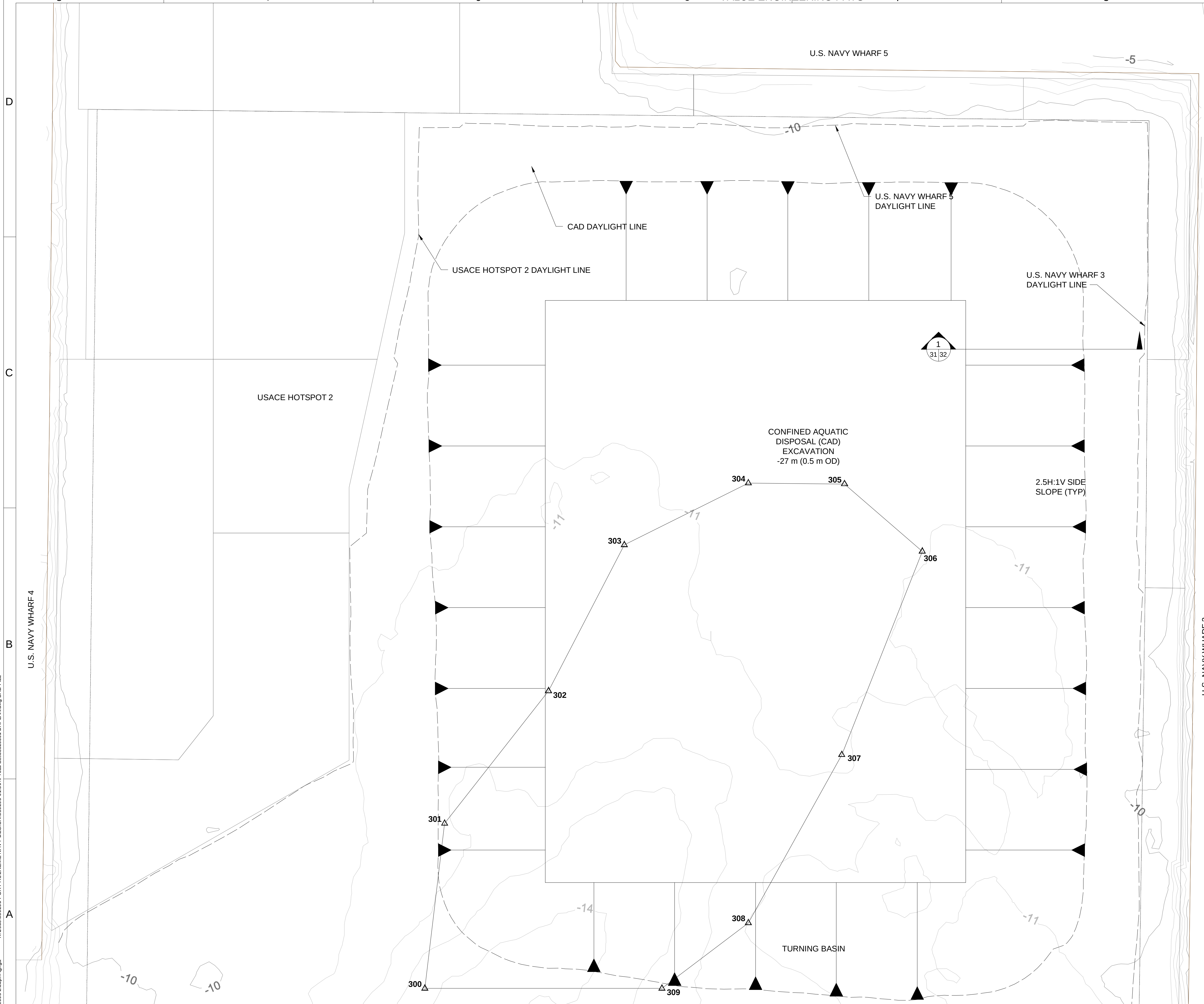
Jun 25, 2008 2:22pm tgriga



0 10 20 40 METER
SCALE: 1:600

N

NOTES:

1. BATHYMETRIC CONTOURS FROM SURVEY DATED SEPTEMBER, 2007.
2. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
3. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW).

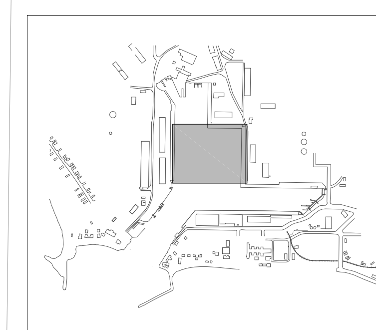
LEGEND:

-5 EXISTING BATHYMETRY (METERS)

10△ CONTROL POINT

ROCK PLACEMENT - CONTROL POINT TABLE

POINT	EASTING	NORTHING
300	1888531.414	572662.646
301	1888537.548	572713.657
302	1888569.657	572754.622
303	1888593.116	572799.780
304	1888631.451	572818.929
305	1888661.204	572818.643
306	1888685.235	572797.779
307	1888660.346	572734.901
308	1888631.451	572682.883
309	1888604.728	572662.646



KEY MAP

METRIC

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

CAD FILLING AND CAPPING PLAN

SYMBOL | DESCRIPTIONS REVISIONS | DATE | APPROVAL

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 080295-01-DRPLAN.DWG

SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

REGISTERED PROFESSIONAL ENGINEER MITCHELL P. WHELAN No. C56833 Exp. 9/07/08 CIVIL STATE OF CALIFORNIA

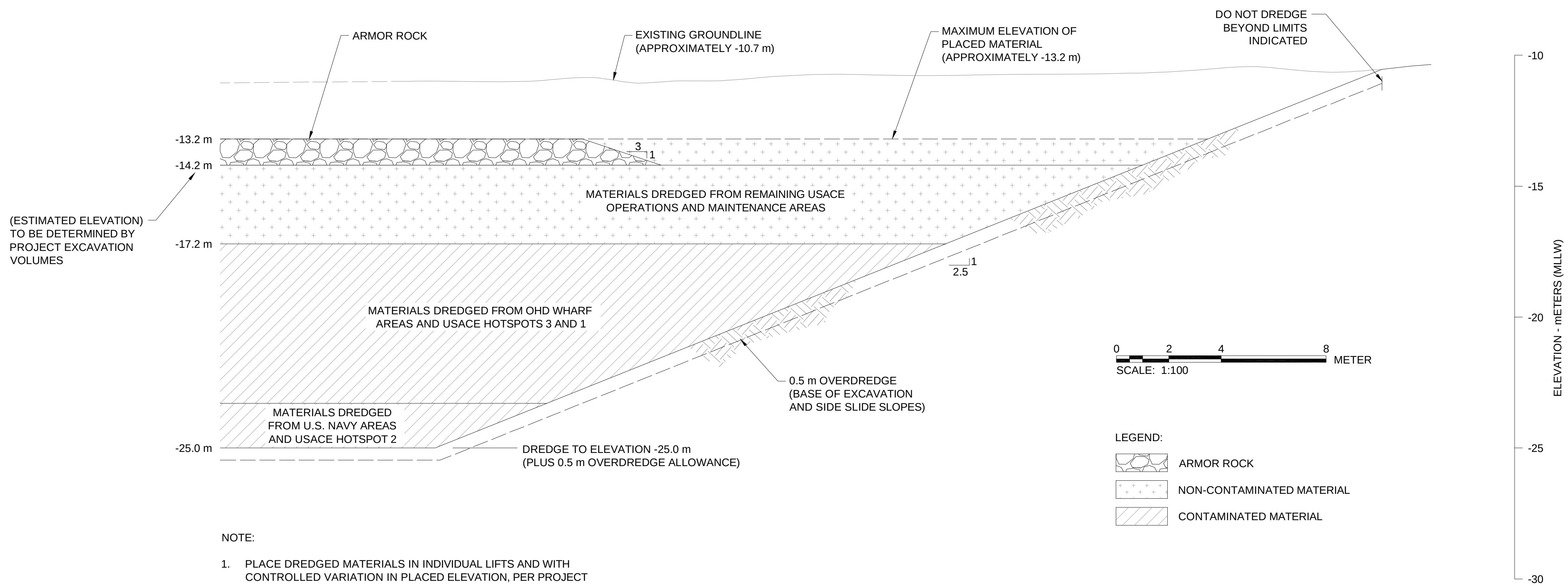
DATE: JUNE 2008

DISTRICT FILE NO. #####

SCALE: 1:600

SHEET 31 OF 38 SHEETS

K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\080295-01-DRPLAN.dwg CAD-FILL
Jun 25, 2008 2:22pm tgriga



NOTE:

1. PLACE DREDGED MATERIALS IN INDIVIDUAL LIFTS AND WITH CONTROLLED VARIATION IN PLACED ELEVATION, PER PROJECT SPECIFICATIONS.

TYPICAL SECTION 1
FILLING OF CAD EXCAVATION 31 32
HORIZONTAL SCALE: 1:100
VERTICAL SCALE: 1:100
1X VERTICAL EXAGGERATION

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

CAD FILLING AND CAPPING TYPICAL SECTIONS

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW
SUBMITTED BY: DATE:
APPROVED: DATE:
CHIEF, DESIGN BRANCH
CHIEF, ENGINEERING DIVISION
SPEC. NO. W912PL-07-C-0002
FILE NAME: 080295-01-SEC2.DWG

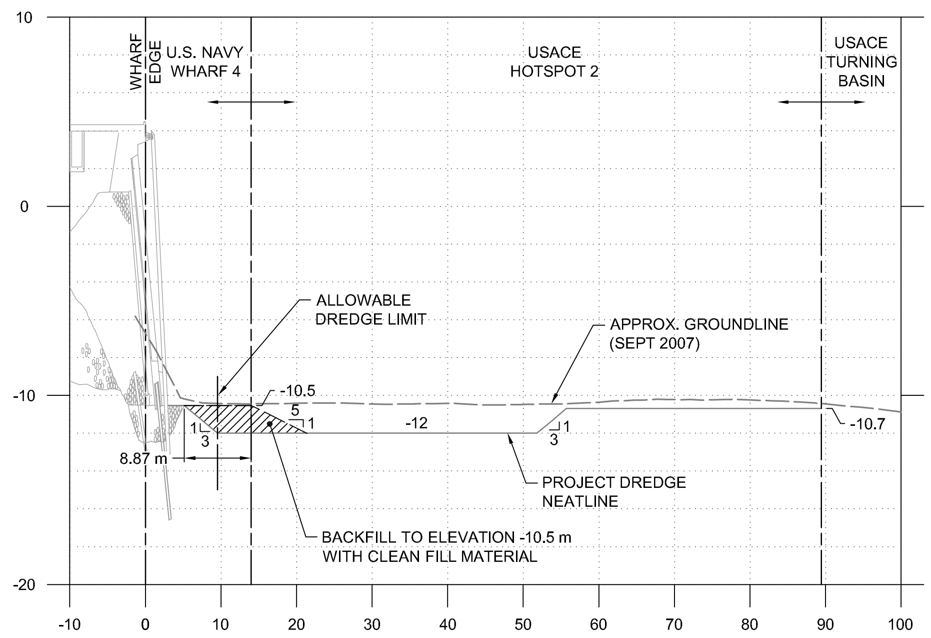
ANCHOR ENVIRONMENTAL, L.L.C.

SCALE: 1:500
SHEET 32 OF 38 SHEETS
DATE: JUNE 2008
DISTRICT FILE NO. #####

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C56833 Exp. 6/07/08 CIVIL STATE OF CALIFORNIA

This drawing was produced in METRIC

Jun 25, 2008 2:22pm tgriga K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\08029501-SEC2.dwg CAD-CS-2



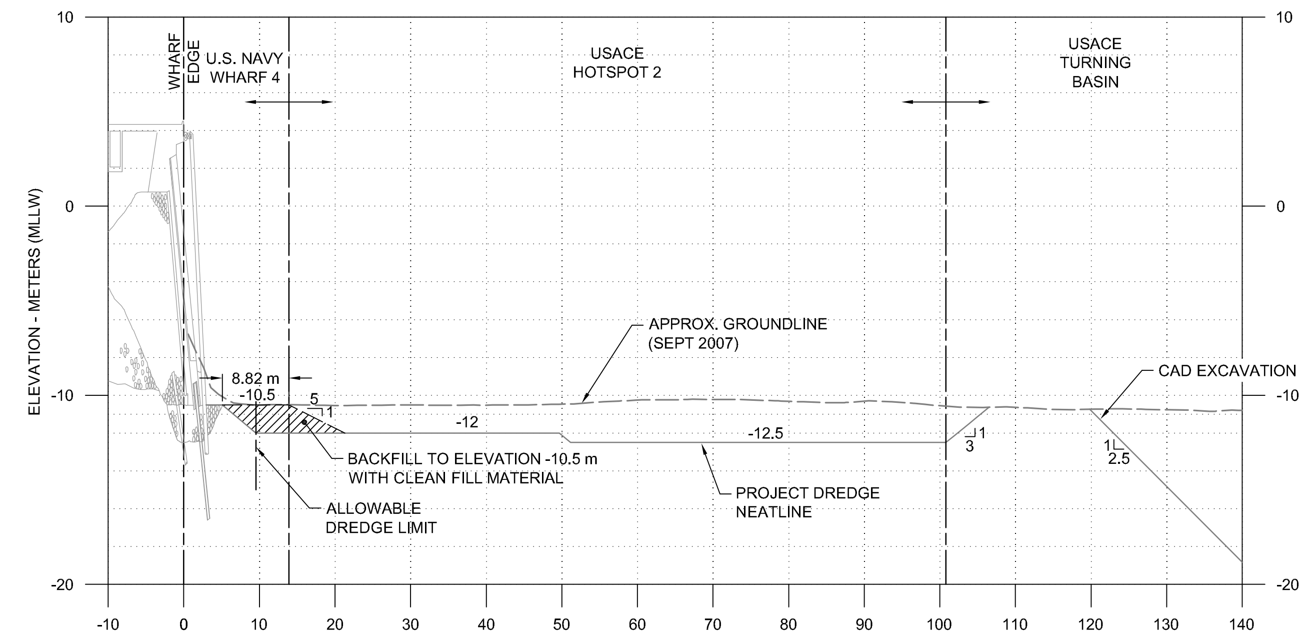
SECTION - BACKFILL (AB 17|33)
WHARF 4
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

LEGEND:

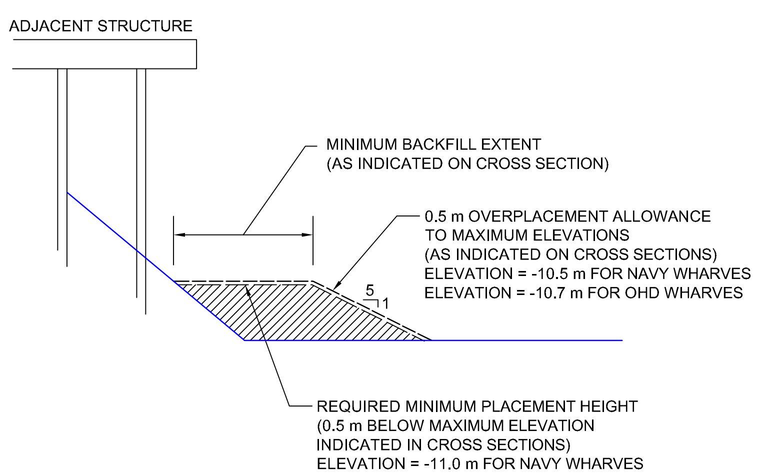
BACKFILL ALONG WHARF FACES

GENERAL NOTES:

1. ALL CROSS-SECTIONAL REPRESENTATIONS OF U.S. NAVY AND OXNARD HARBOR DISTRICT WHARVES ARE BASED ON DESIGN DRAWINGS PROVIDED BY THE NAVY AND OHD, RESPECTIVELY. CONTRACTOR SHALL CONFIRM CONDITION, LAYOUT, AND EXTENTS OF ALL WHARF STRUCTURES IN THE FIELD.



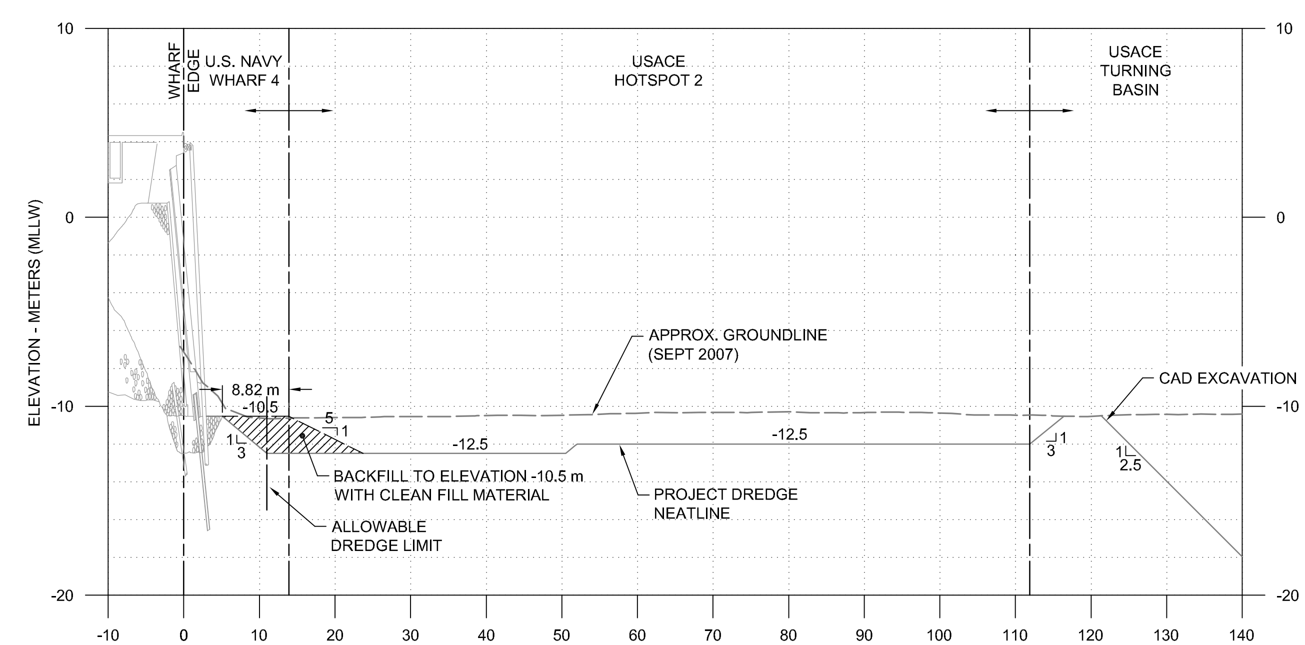
SECTION - BACKFILL (AC 17|33)
WHARF 4
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



WHARF BACKFILL DETAIL (TYP)
NOT TO SCALE

DETAIL NOTE:

1. BACKFILL USING MATERIAL REMOVED FROM IDENTIFIED BACKFILL EXCAVATION AREA WITHIN THE USACE TURNING BASIN (SEE SHEET 7).



SECTION - BACKFILL (AD 17|33)
WHARF 4
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

BACKFILL PLACEMENT CROSS SECTIONS AB, AC & AD

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 08029501-SEC1.DWG

ANCHOR ENVIRONMENTAL, L.L.C.

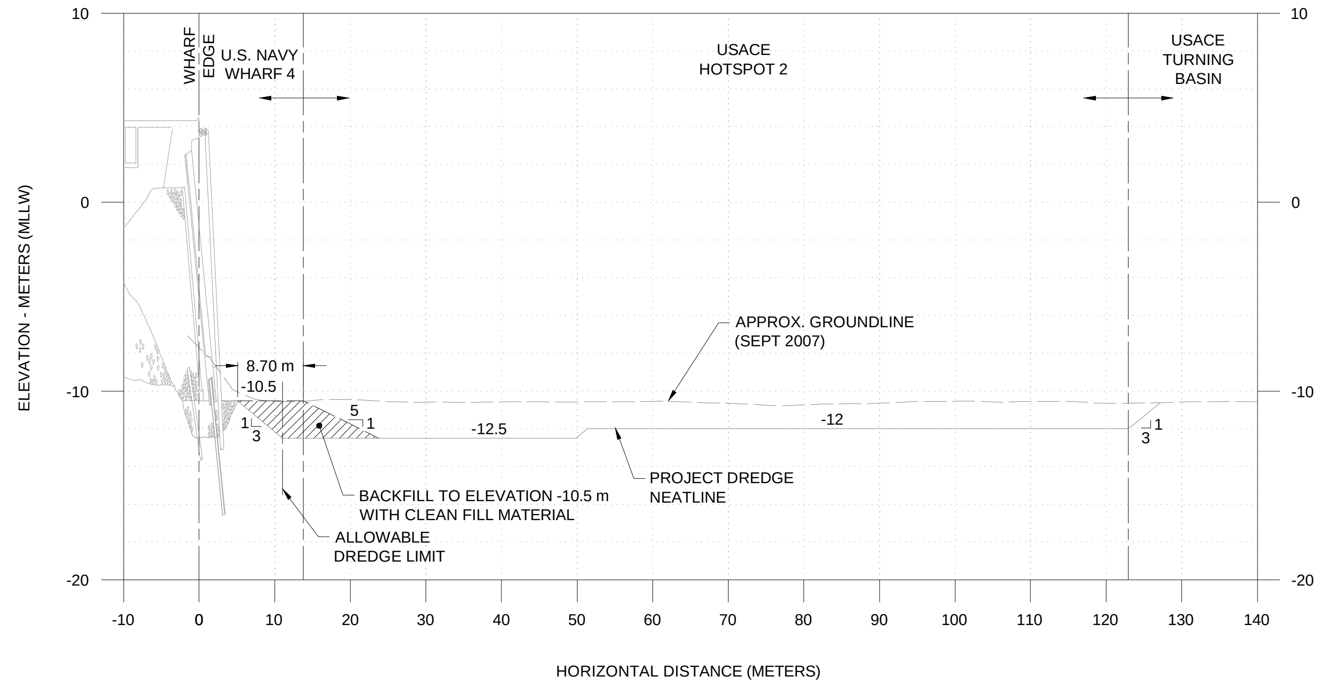
SPEC. NO. W912PL-07-C-0002

SCALE: 1:500
SHEET 33 OF 38 SHEETS
DATE: JUNE 2008
DISTRICT FILE NO. #####

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C69833 Exp. 6/30/08 CIVIL STATE OF CALIFORNIA

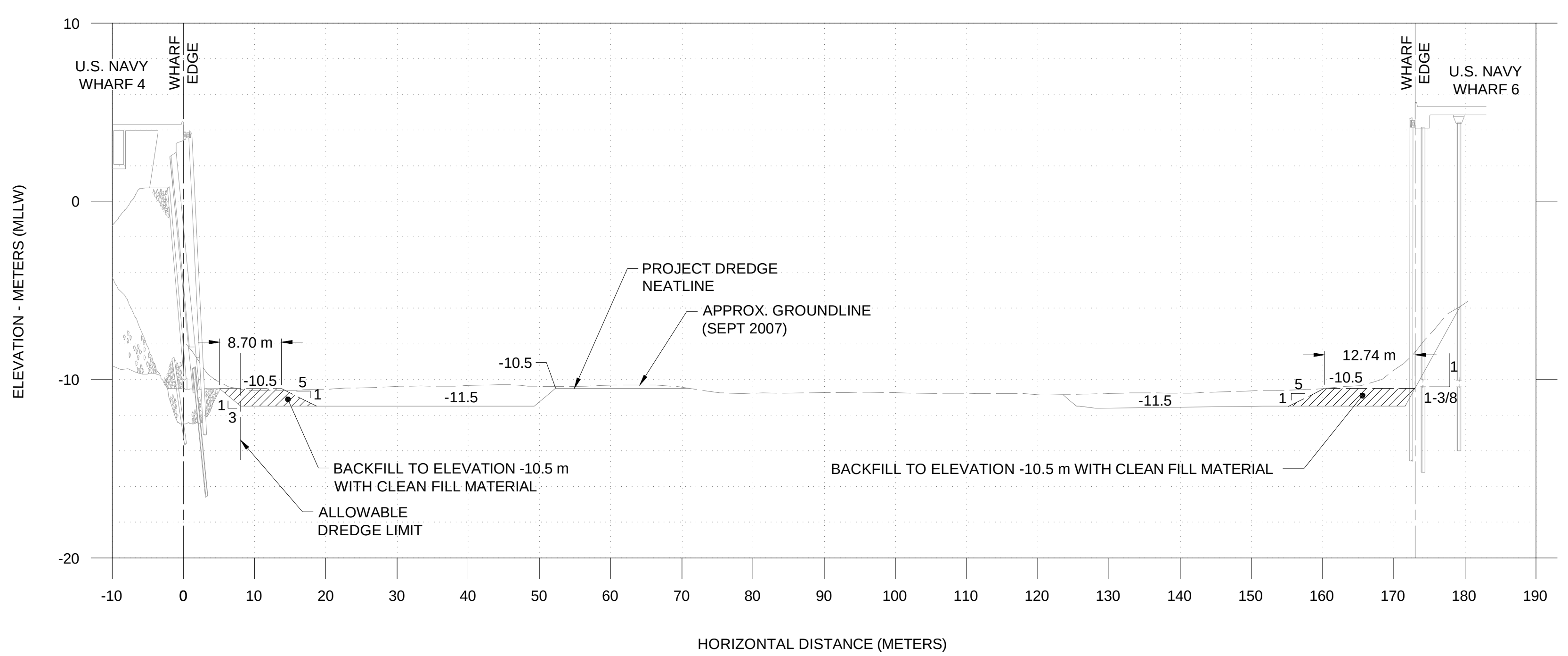
This drawing was produced in METRIC

K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\08029501-SEC1.dwg BF-CS-1
Jun 25, 2008 5:02pm tgriga



SECTION - BACKFILL WHARF 4 | AE 17 34

HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION -BACKFILL WHARF 4 / WHARF 6 | AF 18 34

HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

NOTES:

1. ALL CROSS-SECTIONAL REPRESENTATIONS OF U.S. NAVY AND OXNARD HARBOR DISTRICT WHARVES ARE BASED ON DESIGN DRAWINGS PROVIDED BY THE NAVY AND OHD, RESPECTIVELY. CONTRACTOR SHALL CONFIRM CONDITION, LAYOUT, AND EXTENTS OF ALL WHARF STRUCTURES IN THE FIELD.

LEGEND:

BACKFILL ALONG WHARF FACES

SYMBOL | DESCRIPTIONS | DATE | APPROVAL
REVISIONS

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

BACKFILL PLACEMENT CROSS SECTIONS AE & AF

U.S. ARMY ENGINEER DISTRICT LOS ANGELES CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 08029501-SEC1.DWG

SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

DATE: JUNE 2008

DISTRICT FILE NO. #####

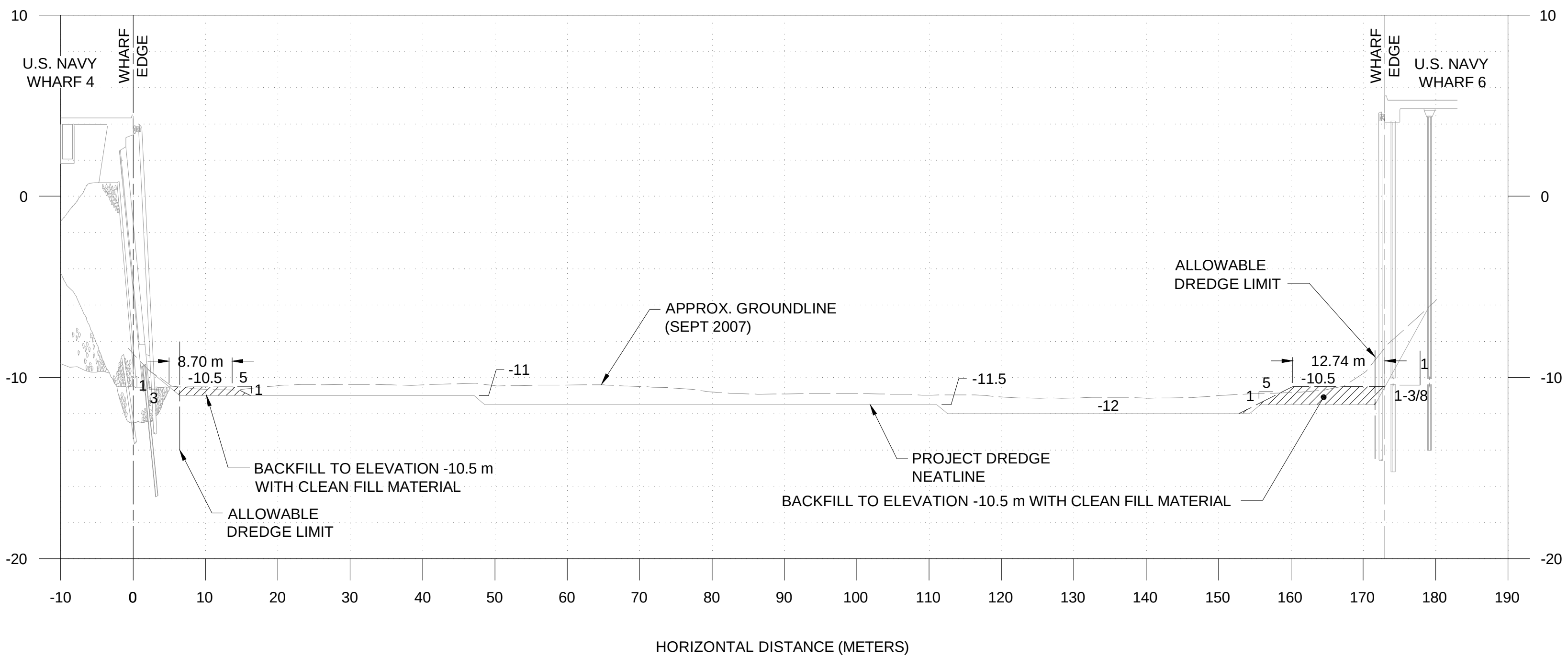
SCALE: 1:500

SHEET 34 OF 38 SHEETS

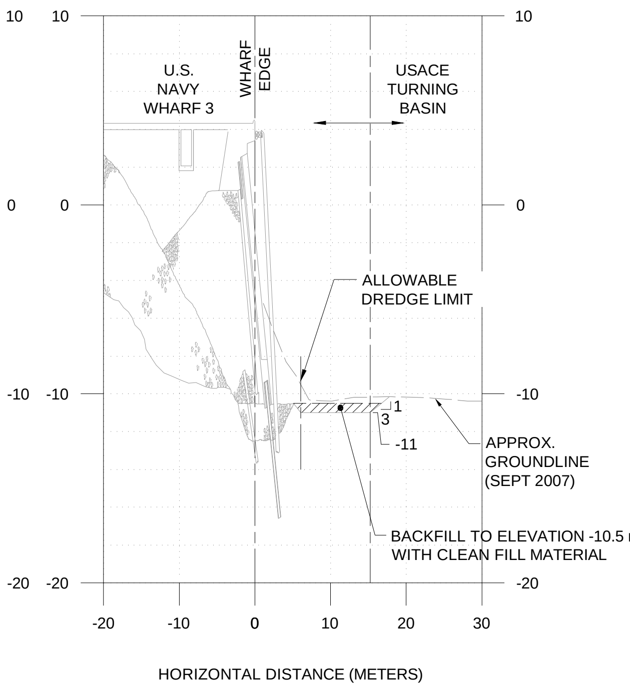
REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C56833 Exp. 6/07/08 CIVIL STATE OF CALIFORNIA

This drawing was produced in METRIC

K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\08029501-SEC1.dwg BF-CS-2
Jun 25, 2008 2:22pm tgriga



SECTION - BACKFILL WHARF 4 / WHARF 6 — AG 18 35
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



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VERTICAL SCALE: 1:200
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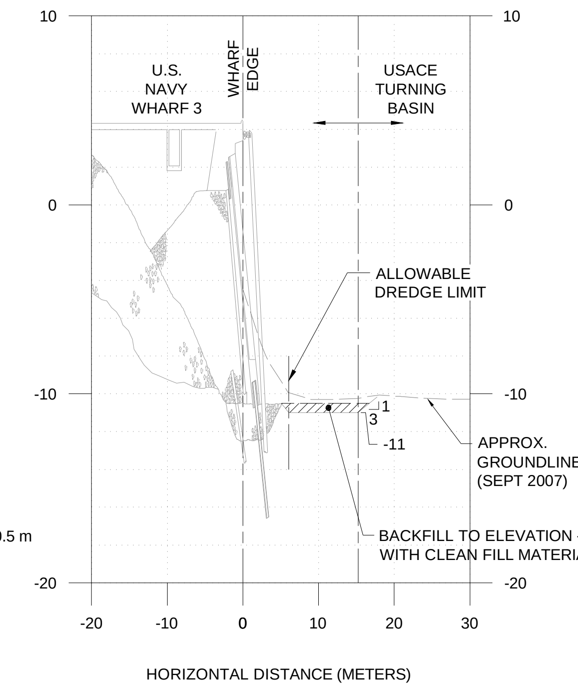

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HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
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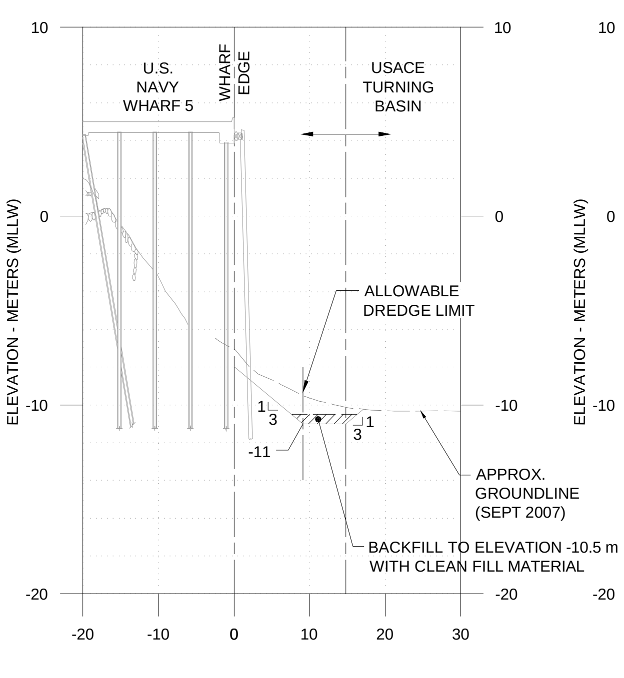

SECTION - BACKFILL WHARF 5 — AN 17 35
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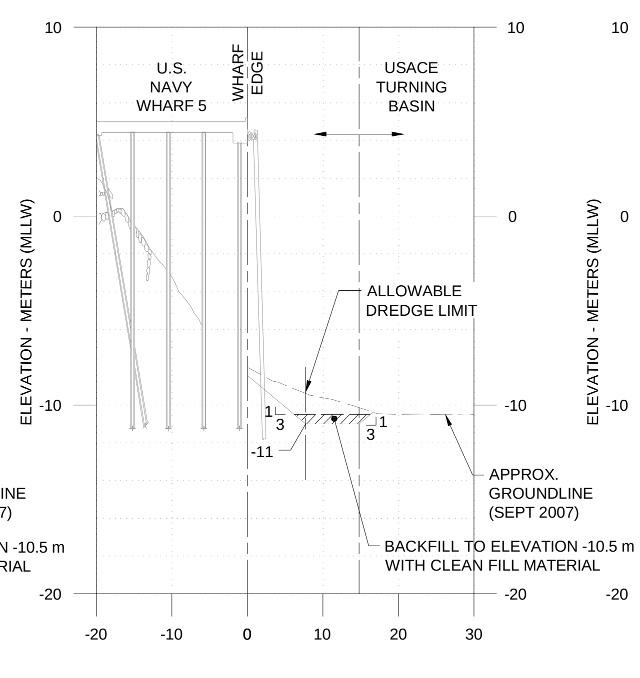
2.5X VERTICAL EXAGGERATION



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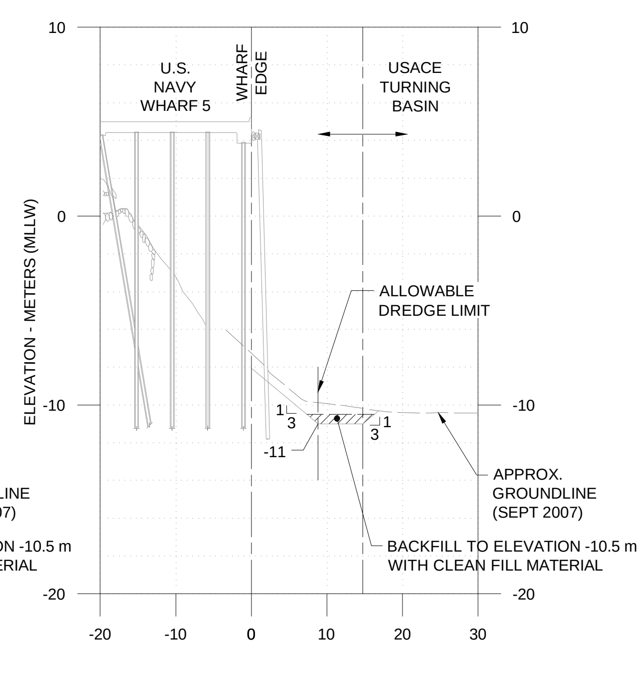


SECTION - BACKFILL WHARF 5 — AP 17 35
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

NOTES:

1. ALL CROSS-SECTIONAL REPRESENTATIONS OF U.S. NAVY AND OXNARD HARBOR DISTRICT WHARVES ARE BASED ON DESIGN DRAWINGS PROVIDED BY THE NAVY AND OHD, RESPECTIVELY. CONTRACTOR SHALL CONFIRM CONDITION, LAYOUT, AND EXTENTS OF ALL WHARF STRUCTURES IN THE FIELD.

LEGEND:

BACKFILL ALONG WHARF FACES

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

BACKFILL PLACEMENT CROSS SECTIONS AG, AN-AP, AR-AS

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 080295-01-SEC1.DWG

SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

DATE: JUNE 2008
DISTRICT FILE NO. #####

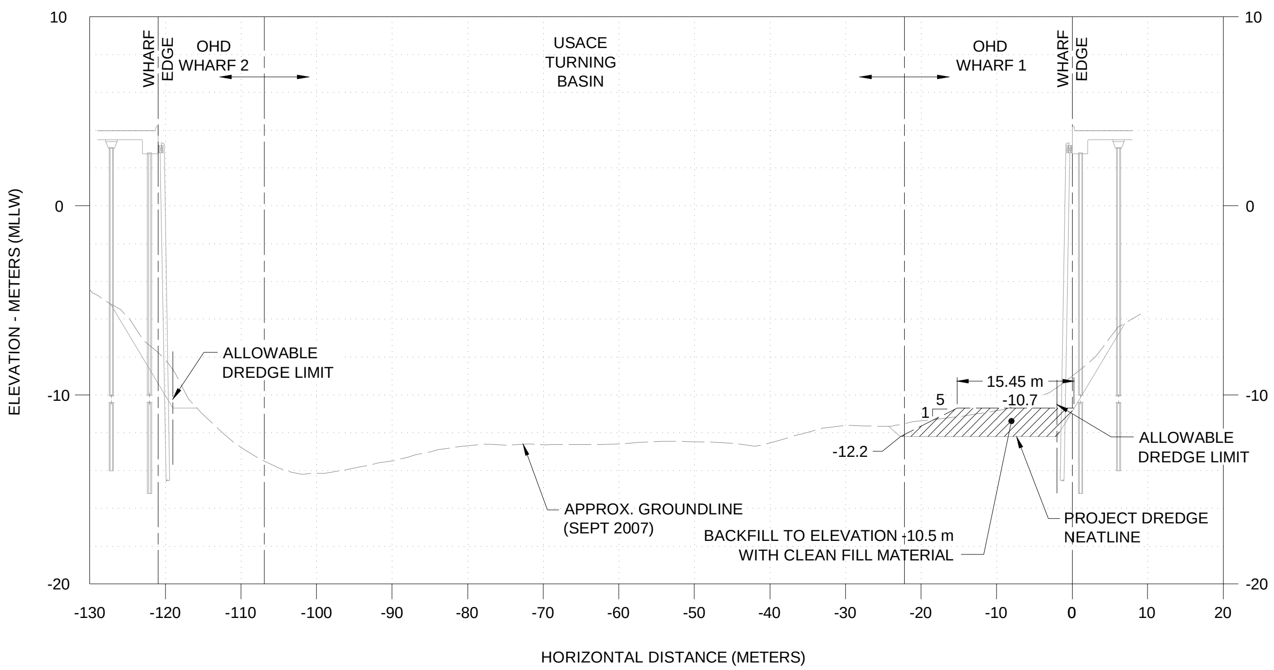
SCALE: 1:500
SHEET 35 OF 38 SHEETS

MICHAEL P. WHELAN No. C56633 Exp. 6/07/08 CIVIL REGISTERED PROFESSIONAL ENGINEER STATE OF CALIFORNIA

This drawing was produced in METRIC

K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\080295-01-SEC1.dwg BF-CS-3

Jun 25, 2008 2:22pm tpriga



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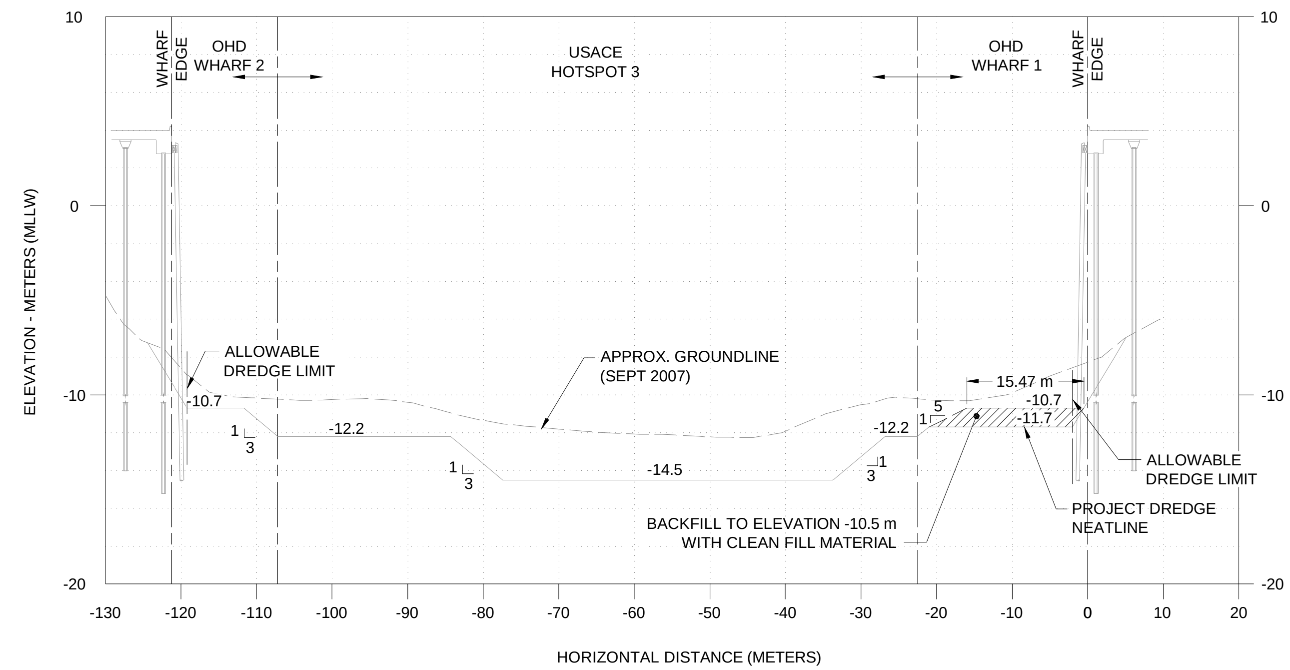
2.5X VERTICAL EXAGGERATION



SECTION - BACKFILL BL
OHD WHARVES 1, 2, & HOT SPOT 3 24|36
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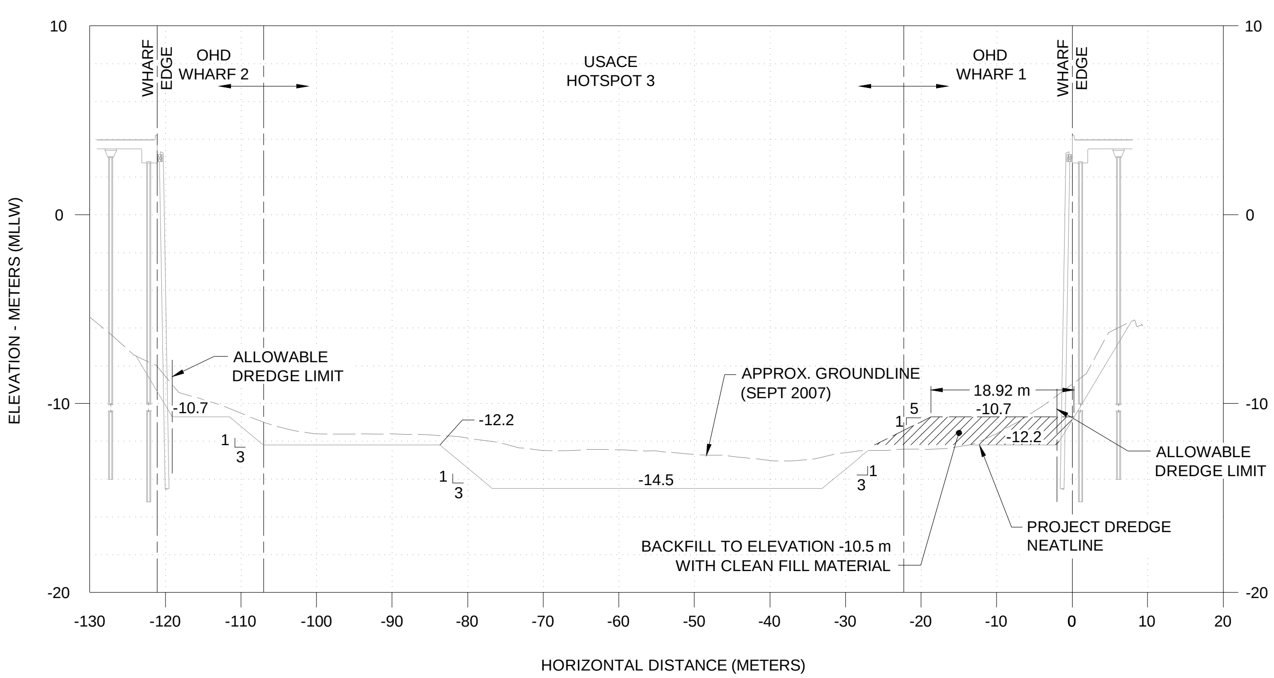
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION - BACKFILL BK
OHD WHARVES 1, 2, & HOT SPOT 3 24|36
HORIZONTAL SCALE: 1:500
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

NOTES:

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LEGEND:

BACKFILL ALONG WHARF FACES

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

BACKFILL PLACEMENT CROSS SECTIONS BJ, BK & BL

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW
SUBMITTED BY: DATE:
CHIEF, DESIGN BRANCH
APPROVED: DATE:
CHIEF, ENGINEERING DIVISION
SPEC. NO. W912PL-07-C-0002
FILE NAME: 0802950I-SEC2.DWG

ANCHOR ENVIRONMENTAL, L.L.C.

SCALE: 1:500
SHEET 36 OF 38 SHEETS
DATE: JUNE 2008
DISTRICT FILE NO. #####

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C58833 Exp. 6/07/08 CIVIL STATE OF CALIFORNIA

This drawing was produced in METRIC

K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\0802950I-SEC2.dwg BF-CS-4
Jun 25, 2008 2:23pm tgriga

NOTES:

1. HORIZONTAL DATUM IS CALIFORNIA STATE PLANE - ZONE 5 (NAD 83) METERS.
2. VERTICAL DATUM IS MEAN LOWER LOW WATER (MLLW)
3. HUENEME BEACH FILL ADJACENT TO THE REVETMENT SHALL NOT EXTEND SEAWARD OF THE ANGLE POINT OF THE EAST JETTY.
4. HUENEME BEACH FILL ADJACENT TO THE REVETMENT SHALL NOT EXCEED 4.9 METERS MLLW IN HEIGHT.
5. THE DISCHARGE PIPELINE (APPROXIMATELY 100 METERS IN LENGTH) MAY BE BURIED AT THE CONTRACTING OFFICER'S REQUEST TO ALLOW EASY ACCESS TO BEACH USERS. THE TOP OF DISCHARGE PIPELINE SHALL HAVE APPROXIMATELY 0.5 METERS OF SAND COVER AND BACKFILL TO MATCH EXISTING GRADE.

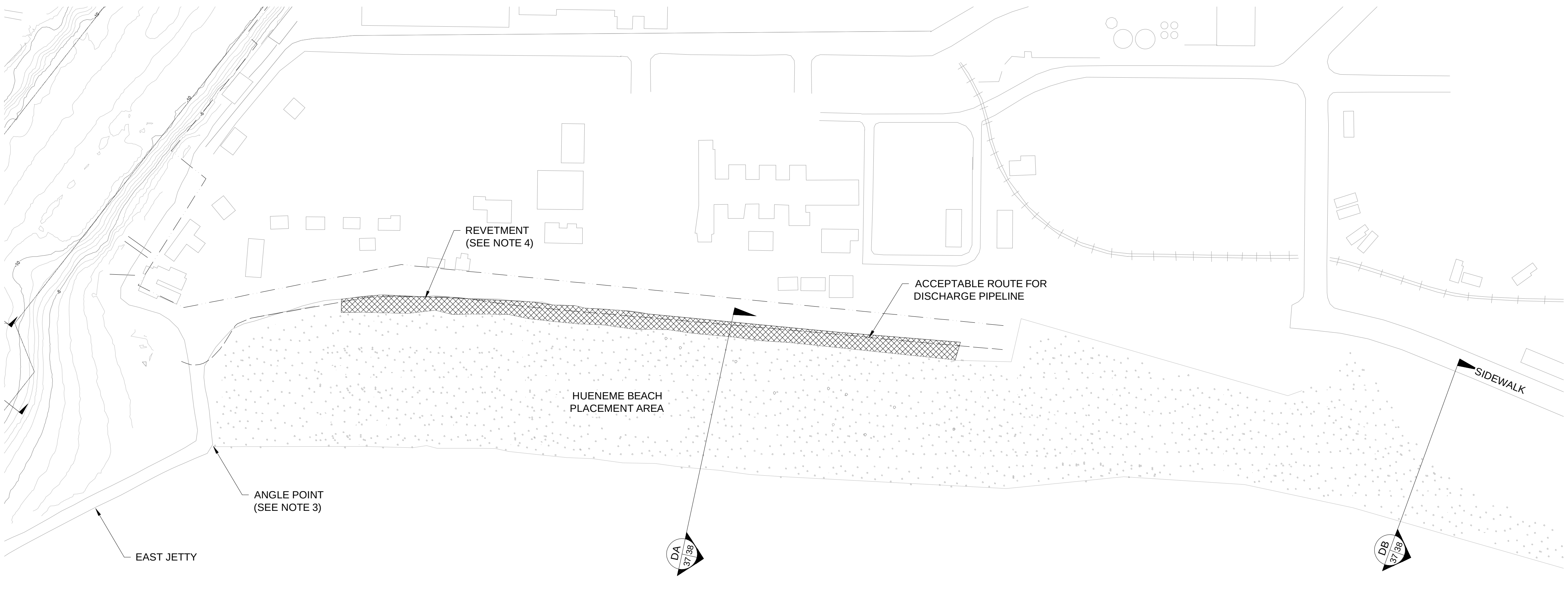
N

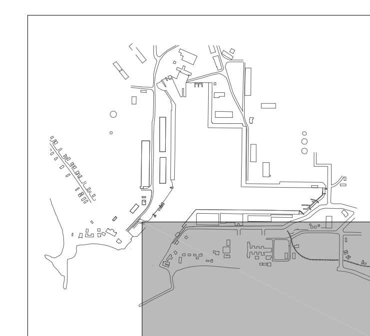
0 40 80 160 METER

SCALE: 1:2000

LEGEND:

- DISCHARGE PIPELINE
- PROPERTY LINE
- AREA FOR BEACH PLACEMENT
- REVETMENT





KEY MAP

This drawing was produced in METRIC

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

BEACH PLACEMENT PLAN - HUENEME BEACH

SYMBOL	DESCRIPTIONS	DATE	APPROVAL

REVISIONS

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

FILE NAME: 08029501-DRPLAN.DWG

SPEC. NO. W912PL-07-C-0002

ANCHOR ENVIRONMENTAL, L.L.C.

DATE: JUNE 2008

DISTRICT FILE NO. #####

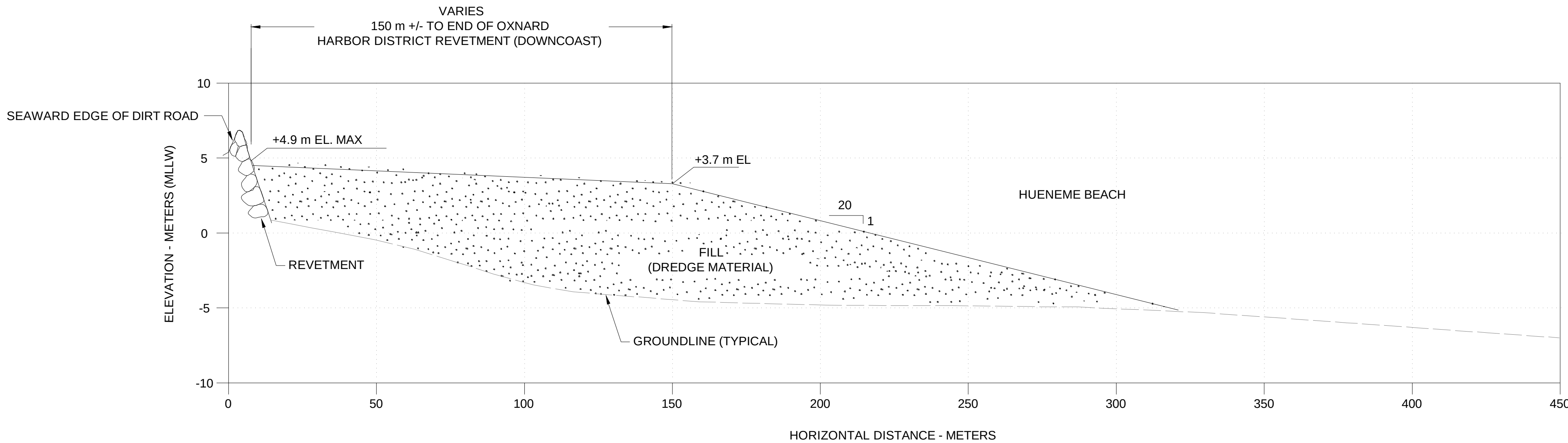
SCALE: 1:2000

SHEET 37 OF 38 SHEETS

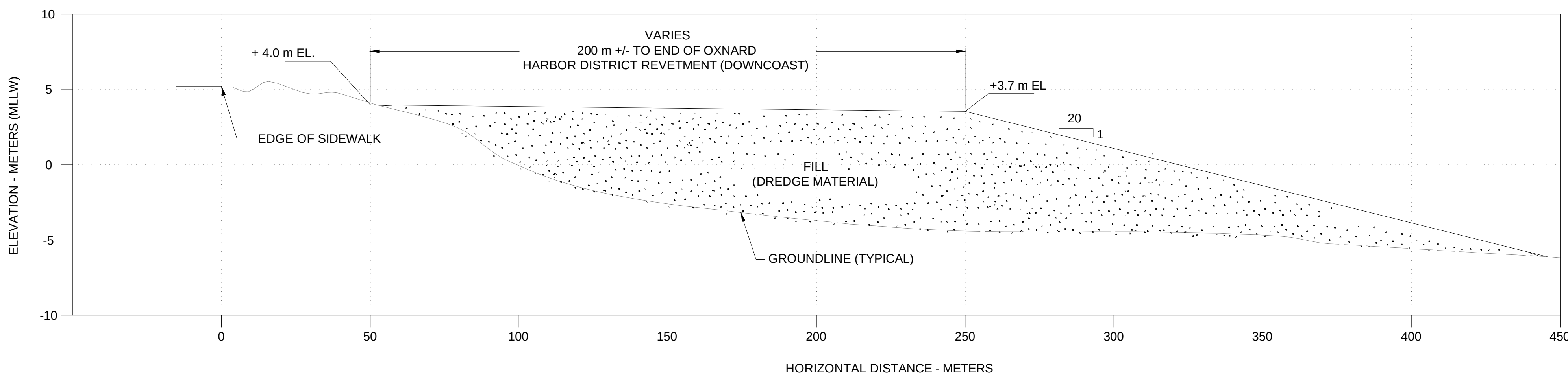
K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\08029501-DRPLAN.dwg BEACH

Jun 25, 2008 2:23pm tgriga

VALUE ENGINEERING PAYS



SECTION DA 37/38
HUENEME BEACH
HORIZONTAL SCALE: 1:1000
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION



SECTION DB 37/38
HUENEME BEACH
HORIZONTAL SCALE: 1:1000
VERTICAL SCALE: 1:200
2.5X VERTICAL EXAGGERATION

NOTES:

1. ALL CROSS-SECTIONAL REPRESENTATIONS OF U.S. NAVY AND OXNARD HARBOR DISTRICT WHARVES ARE BASED ON DESIGN DRAWINGS PROVIDED BY THE NAVY AND OHD, RESPECTIVELY. CONTRACTOR SHALL CONFIRM CONDITION, LAYOUT, AND EXTENTS OF ALL WHARF STRUCTURES IN THE FIELD.

DRAFT
SUBJECT TO REVISION

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL
PORT HUENEME, CALIFORNIA
DRAFT 90% DESIGN SUBMITTAL

BEACH PLACEMENT CROSS SECTION - HUENEME BEACH

SYMBOL	DESCRIPTIONS	DATE	APPROVAL
	REVISIONS		

U.S. ARMY ENGINEER DISTRICT
LOS ANGELES
CORPS OF ENGINEERS

DESIGNED BY: WJD
DRAWN BY: TPG
CHECKED BY: MPW

SUBMITTED BY: DATE:
CHIEF, DESIGN BRANCH

APPROVED: DATE:
CHIEF, ENGINEERING DIVISION

SPEC. NO. W912PL-07-C-0002
FILE NAME: 08029501-SEC2.DWG

ANCHOR ENVIRONMENTAL, L.L.C.

SCALE: 1:XXX
SHEET 38 OF 38 SHEETS
DATE: JUNE 2008
DISTRICT FILE NO. #####

REGISTERED PROFESSIONAL ENGINEER MICHAEL P. WHELAN No. C69833 Exp. 8/07/08 CIVIL STATE OF CALIFORNIA

This drawing was produced in METRIC

SAFETY PAYS

Jun 25, 2008 2:23pm tgriga K:\Jobs\080295-PORT HUENEME NAVY DESIGN\080295-01\90% Total Set\08029501-SEC2.dwg BEACH

APPENDIX H

90 PERCENT SPECIFICATIONS

Contract W912PL-07-C-0002
modification

US Army Corps
of Engineers
Los Angeles District

DRAFT

Port Hueneme Maintenance Dredging & Confined Aquatic Disposal

Contract Modification
Plans and Specifications

DRAFT

26 June 2008 - 90% Design Submittal

PROJECT TABLE OF CONTENTS

SECTION 00010
BIDDING SCHEDULE

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT OF MEASURE	UNIT PRICE	TOTAL AMOUNT
1	MOBILIZATION AND DEMOBILIZATION	1	Job	Lump Sum	$ ____________
2	DREDGING of CAD with BEACH PLACEMENT	533,400	Cubic Meter	$ ________	$ ____________
3	DREDGING of SEDIMENTS with CAD DISPOSAL				
3A	Hotspot 1	71,000	Cubic Meter	$ ________	$ ____________
3B	Hotspot 2	36,200	Cubic Meter	$ ________	$ ____________
3C	Hotspot 3	31,800	Cubic Meter	$ ________	$ ____________
3D	U.S. Navy Areas - Non-Restricted Dredging	53,300	Cubic Meter	$ ________	$ ____________
3E	OHD Wharves - Non-Restricted Dredging	22,500	Cubic Meter	$ ________	$ ____________
3F	U.S. Navy Wharves - Dredging Restriction and Backfill Areas	20,000	Cubic Meter	$ ________	$ ____________
3G	OHD Wharves - Dredging Restriction and Backfill Areas	5,000	Cubic Meter	$ ________	$ ____________
3H	Additional Dredging with CAD Disposal (if required*)	10,000 [a]	Cubic Meter	$ ________	$ ____________
4	DREDGING of USACE O&M SEDIMENTS with PLACEMENT in CAD	110,000	Cubic Meter	$ ________	$ ____________
5	ADDITIONAL CAP MATERIAL (if required**)	10,000 [a]	Cubic Meter	$ ________	$ ____________
6	ARMOR ROCK	33,900	Metric Tons	$ ________	$ ____________
7	PILE REMOVAL	1	Job	Lump Sum	$ ____________
8	HYDROGRAPHIC SURVEYS				
8A	Post-Excavation Survey of CAD	1	Job	Lump Sum	$ ____________
8B	Post-Dredging Survey No. 1 - following Dredging of Sediments with CAD Disposal	1	Job	Lump Sum	$ ____________
8C	Post-Dredging Survey No. 2 - following Dredging of USACE O&M Sediments	1	Job	Lump Sum	$ ____________

TOTAL ESTIMATED AMOUNT $___________

* If required to accomplish full removal of contaminated sediments.

** If required to meet minimum cap thickness requirements.

[a] Nominal value for bidding purposes.

SECTION 01200

GENERAL REQUIREMENTS
05/08

PART 1 GENERAL

1.1 OVERALL PROJECT SCOPE OF WORK

This project involves excavating a rectangular pit in the U.S. Army Corps of Engineers (USACE) - managed Turning Basin, and using this Confined Aquatic Disposal (CAD) facility to hold the volume of contaminated sediments that will need to be dredged from areas of the Port Hueneme Harbor. Dredging of the Harbor is required for areas owned by the Oxnard Harbor District (OHD), the U.S. Navy, and USACE as part of their routine maintenance programs, and is also being done to achieve removal of contaminated sediments from the Harbor.

Dredging is divided into several separate payment bid items, as described herein. Dredging will take place in a sequential fashion, involving five main events, based on type, placement, and owner of the areas in which dredging is performed (OHD, U.S. Navy, or USACE). Note that the sequence of Dredging Events, as described herein, does not necessarily Bid Items does not, in every case, indicate the order in which the work is to be accomplished).

The following is a description of the five dredging events that comprise the project. Each encompasses one or more individual payable bid items for the work.

Dredging Event No. 1 consists of:

- **Dredging of CAD with Beach Placement (Bid Item 2)**

Approximately 533,400 cubic meters of clean sand will be excavated from the pit as detailed in the Contract Plans and will be pumped on to Hueneme Beach, located immediately south of the Entrance Channel, to renourish the beach. This work will be paid for under the Bid Item “Dredging of CAD with Beach Placement.”

Dredging Event No. 2 consists of:

- **Hotspot 2 (Bid Item 3B)**
- **U.S. Navy Areas – Non-Restricted Dredging (Bid Item 3D)**
- **U.S. Navy Wharves – Dredging Restriction and Backfill Areas (Bid Item 3F)**

Approximately 73,300 cubic meters of contaminated sediments from the U.S. Navy Wharves and North Harbor areas, and approximately 36,200 cubic meters from the adjacent USACE Hotspot 2 area, will be dredged using mechanical equipment, and dredged material will be placed within the CAD pit by bottom dump barge in lifts not more than 2 meters in thickness.

This work will be paid for as part of the Bid Item category “Dredging of Sediments with CAD Disposal”, with the majority of this work paid under the specific Bid Items “Hotspot 2” and “U.S. Navy Areas – Non-

Restricted Dredging”. Certain areas along the Navy Wharves, however, are identified to be Dredging Restriction and Backfill Areas, in which dredging operations shall be conducted in individual segments of limited width (measured along the wharf face), to maintain stability and prevent undermining of wharves. Dredging in such areas along the Navy wharves will be paid for under the Bid Item “U.S. Navy Wharves - Dredging Restriction and Backfill Areas.”

After dredging to the required elevations, the Contracting Officer will verify (through a series of confirmatory sediment samples) if contaminated sediments have been fully removed. If not, then the Contracting Officer may require additional localized dredging, which would be paid for under the Bid Item “Additional Dredging with CAD Disposal (if required).”

Dredging Event No. 3 consists of:

- **Hotspot 3 (Bid Item 3C)**
- **OHD Wharves - Non-Restricted Dredging (Bid Item 3E)**
- **OHD Wharves – Dredging Restriction and Backfill Areas (Bid Item 3G)**

Approximately 27,500 cubic meters of contaminated sediments along OHD Wharves 1 and 2 and approximately 31,800 cubic meters from the adjacent USACE Hotspot 3 area will be dredged using mechanical equipment and dredged material will be placed within the CAD pit by bottom dump barge in lifts not more than 2 meters in thickness.

This work will be paid for as part of the Bid Item category “Dredging of Sediments with CAD Disposal”, with the majority of this work paid under the specific Bid Items “Hotspot 3” and “OHD Wharves – Non-Restricte Dredging”. Certain areas along OHD Wharf 1, however, are identified to be Dredging Restriction and Backfill Areas, in which dredging operations shall be conducted in individual segments of limited width (measured along the wharf face), to maintain stability and prevent undermining of wharf. Dredging in such areas along OHD Wharf 1 will be paid for under the Bid Item “OHD Wharves - Dredging Restriction and Backfill Areas.”

After dredging to the required elevations, the Contracting Officer will verify (through a series of confirmatory sediment samples) that contaminated sediments have been fully removed. If not, then the Contracting Officer may require additional localized dredging, which would be paid for under the Bid Item “Additional Dredging with CAD Disposal (if required).”

Concurrent Backfilling Along Wharf Faces in Dredging Restriction Areas. Concurrent with dredging events nos. 2 and 3, approximately 17,000 cubic meters of material will be dredged from an available excavation area in the Turning Basin, as shown on the Plans, and placed as a stabilizing backfill in the Dredging Restriction and Backfill Areas along U.S. Navy and OHD wharf faces, to maintain stability and prevent undermining of fender piles as a result of the dredging operations. The backfilling work will be paid for as part of the Bid Items “U.S. Navy Wharves – Dredging Restriction and Backfill Areas” and “OHD Wharves – Dredging Restriction and Backfill Areas.”

Dredging Event No. 4 consists of:

- **Hotspot 1 (Bid Item 3A)**

Approximately 71,000 cubic meters of contaminated sediments from USACE Hotspot 1 within the entrance channel will be dredged using mechanical equipment and dredged material placed within the CAD pit by bottom dump barge in lifts not more than 2 meters in thickness. This work will be paid for as part of the Bid Item category "Dredging of Sediments with CAD Disposal", under the specific Bid Item "Hotspot 1".

After dredging to the required elevations, the Owner will conduct confirmatory sampling to verify if contaminated sediments have been fully removed. If not, then the Owner may require additional localized dredging, which would be paid for under the Bid Item "Additional Dredging with CAD Disposal (if required)."

Dredging Event No. 5 consists of:

- **Dredging of USACE Operation and Maintenance (O&M) Sediments with Placement in CAD (Bid Item 4)**
- **Additional Cap Material (if required) (Bid Item 5)**

Approximately 110,000 cubic meters of operation and maintenance material remaining within the Federal Channel will be dredged using mechanical equipment, and dredged material will be placed within the CAD pit by bottom dump barge in lifts not more than 1 meter in thickness. This material will serve as the cap for the underlying contaminated sediments. Dredging will take place first from the turning basin, then from the entrance channel and the approach channel. This work will be paid for under the Bid Item "Dredging of USACE O&M Sediments with Placement in CAD."

If, after completion of Operation and Maintenance Dredging, it is found that the cap within the CAD is not sufficiently thick (i.e. 3 meters), then the Contracting Officer may require the Contractor to obtain additional cap material and place it in the CAD. This material would be obtained from an available excavation area in the Turning Basin, as shown on the Plans, and would be paid for under the Bid Item "Additional Cap Material (if required)".

Armor Rock (Bid Item 6)
After the five required dredging and CAD filling events occur, approximately 33,900 metric tons of armor rock will be placed over the southwest portion of the CAD site to protect the cap from erosion and propeller wash forces. This work will be paid for under the Bid Item "Armor Rock."

1.2 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

CFR 29 Part 1926	Safety and Health Regulations for Construction
CFR 33 Part 80	Colregs Demarcation Lines
CFR 33 Part 156	Oil and Hazardous Material Transfer Operations

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2003) Safety and Health Requirements Manual
ER 415-1-15	Construction Time Extensions for Weather

U.S. DEPARTMENT OF COMMERCE (DOC)

DOC PS 1	(1983) Construction and Industrial Plywood
DOC PS 20-70	American Softwood Lumber Standard

FEDERAL SPECIFICATIONS (FS)

FS FF-B-575	(Rev C) Bolts, Hexagon and Square
FS FF-N-105	(Rev B; Int Am 4) Nails, Brads, Staples and Spikes: Wire, Cut and Wrought
FS FF-N-836	(Rev D; Am 2) Nut: Square, Hexagon,Cap, Slotted, Castle, Knurled, Welding and Single Ball Seat
FS TT-E-529	(Rev D) Enamel, Alkyd, Semi-Gloss
FS TT-P-25	(Rev E; Am 2) Primer Coating, Exterior (Undercoat for Wood, Ready-Mixed, White and Tints)

CALIFORNIA OCCUPATIONAL SAFETY AND HEALTH REGULATIONS

Title 8 Regulations	California Occupational Safety and Health Regulations

1.3 SUBMITTALS

Contracting Officer approval is required for all submittals with a "G" designation.
The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Site Safety Health Plan G

Activity Hazards Safety Analysis G

Work and Storage Areas Plan G

1.4 PROJECT SIGNS AND BULLETIN BOARDS

1.4.1 General

The Contractor shall construct and erect a project sign and hard hat sign and a bulletin board at respective locations designated by the Contracting Officer. The signs shall conform to the requirements of the drawings attached at the end of this section. Signs shall be erected as soon as possible and within 5 days after commencement of work under this contract.

1.4.2 Construction Signs

1.4.2.1 Materials. Lumber shall conform to DOC PS 20-70, and shall be seasoned Douglas Fir, S4S, Grade D or better except that posts, braces and spacers shall be construction Grade (WCLB).

Plywood shall conform to DOC PS 1, grade AC, Group 1, Exterior.

Bolts, Nuts and Nails. Bolts and nuts shall be galvanized conform to FS FF-B-575 and FS FF-N-836. Nails shall conform to FS FF-N-105.

Paints and Oils. Paints shall conform to FS TT-P-25 for primer and FS TT-E-529 for finish paint and lettering.

1.4.2.2 Execution. The following signs shall be erected:

Project Sign at location designated by the Contracting Officer.

Warning Signs facing approaching traffic on all haul roads crossing under overhead power transmission lines.

Two (2) hard hat signs at locations directed.

Four (4) beach placement signs at locations directed.

Project and hard hat signs shall be constructed as detailed in Figures 1, 2, and 3. Decals for hard hat signs will be furnished by the Contracting Officer.

Warning Signs shall be constructed of plywood not less than 12mm thick and shall be securely bolted to the supports with the bottom of the sign face 900 mm above the ground. The sign face shall be 600 X 1200 mm, all letters shall be 100 mm in height. Haul road signs shall depict the wording: "WARNING: OVERHEAD TRANSMISSION LINES". Beach placement signs shall depict the wording: "DANGER - KEEP OUT, BEACH CLOSED, U.S. ARMY CORPS OF ENGINEERS BEACH NOURISHMENT PROJECT".

All exposed surfaces and edges of plywood shall be given one coat of linseed oil and be wiped prior to applying primer. All exposed surfaces of signs and supports shall be given one coat of primer and 2 finish coats of white paint. Except as otherwise indicated, lettering on all signs shall be black and sized as indicated.

1.4.3 Bulletin Board at the Contractor's office

A weatherproof bulletin board, approximately 900 mm wide and 760 mm high, with hinged glass door shall be provided adjacent to or mounted on the Contractor's project office. If adjacent to the office, the bulletin board shall be securely mounted on no less than 2 posts. Bulletin board and posts shall be painted or have other approved factory finish. The bulletin board shall be easily accessible at all times and shall contain wage rates, equal opportunity notice, and such other items required to be posted.

1.4.4 Maintenance and Disposal

The Contractor shall maintain the signs in good condition throughout the life of the project. Signs shall remain the property of the Contractor and upon completion of the project they shall be removed from the site.

1.5 CONTRACTING OFFICER FIELD OFFICE

The Contractor shall provide as a minimum, a separate room in the Contractor's project trailer/office for the Contracting Officer's Representative. The room shall be accessed by an outside door (locked) separate from the Contractor's entry door. The space shall not be less than 3 meters wide by 4.5 meters long, and shall contain the following:

* suitable desk and minimum 2 chairs
* 1 telephone
* independent service for telephone and modem
* 1 file cabinet, minimum 3 drawer, legal, lockable
* access to a copy machine
* access to a FAX machine
* electric light and power
* heater and air conditioning
* toilet facilities consisting of one lavatory and one water closet complete with connections to water (hot and cold) and sewer mains.

A mail slot in the door or a lockable mail box mounted on the surface of the door shall be provided. At completion of the project, the office shall remain the property of the Contractor and shall be removed from the site. Utilities shall be connected and disconnected in accordance with local codes and to the satisfaction of the Contracting Officer.

1.6 PUBLIC UTILITIES

1.6.1 General

The approximate location of all pipelines, sewer lines, and other utilities known to exist within the limits of the work are indicated on the drawings. The sizes, locations, and names of owners of such utilities are given from available information, but their accuracy is not guaranteed. Except as otherwise indicated on the drawings, all existing utilities will be left in place and the Contractor shall conduct his operations in such a manner that the utilities will be protected from damage at all times, or arrangements shall be made by the Contractor for their relocation at the Contractor's own expense. The Contractor shall be responsible for any damage to utilities known to exist and shall reimburse the owners for such damage caused by his operations.

1.6.2 Utilities To be Relocated or Protected

The Contractor shall notify the Contracting Officer, in writing, 14 calendar days prior to starting work on any utility to be relocated or protected. On each relocation, notification shall include dates on which the Contractor plans excavation, by-pass work, removal work and/or installation work, as applicable.

1.6.3 Relocation or Removal

Utilities to be relocated or removed not as part of this contract are designated "To be Relocated by Others" or "To be Removed by Others," respectively. Utilities shown on the plans and not so designated shall be left in place and will be subject to the provisions of clause 52.236-9 entitled "Protection of Existing Vegetation, Structures, Utilities, and Improvements" of Section 00700 CONTRACT CLAUSES. The Contractor without cost to the Contracting Officer, may make arrangements with the owner for the temporary relocation and restoration of utilities not designated to be relocated, or for additional work in excess of the work needed to relocate utilities designated for relocation.

1.6.4 Coordination

The Contractor shall consult and cooperate with the owner of utilities that are to be relocated or removed by others to establish a mutual performance schedule and to enable coordination of such work with the construction work. These consultations shall be held as soon as possible after award of the contract or sufficiently in advance of anticipated interference with construction operations to provide required time for the removal or relocation of affected utilities.

1.6.5 Utilities Not Shown

If the Contractor encounters, within the construction limits of the entire project, utilities not shown on the plans and not visible as of the date of this contract and if such utilities will interfere with construction operations, he shall immediately notify the Contracting Officer in writing to enable a determination by the Contracting Officer as to the necessity for removal or relocation. If such utilities are left in place, removed or relocated, as directed by the Contracting Officer, the Contractor shall be entitled to an equitable adjustment for any additional work or delay.

1.6.6 Electric Current

All electric current required by the Contractor shall be furnished at his expense. All temporary lines shall be furnished, installed, connected, and maintained by the Contractor in a workmanlike manner satisfactory to the Contracting Officer Representative and shall be removed by the Contractor in a like manner at his expense prior to final acceptance of the construction.

1.7 NOTICES

Copies of letters or notifications made to utility companies, U.S. Navy, U.S. Coast Guard, Harbor Districts, County, etc. shall be provided to the Contracting Officer.

1.7.1 Harbor Districts / Navy Port Operations

At least 2 weeks prior to the commencement of dredge operations, the Contractor shall notify:

* Contracting Officer
* U.S. Navy Port Operations (Building 494), Port Hueneme - Mike Miller
* Oxnard Harbor District - Pete Wallace

The following information shall be provided:

a. Size and type of construction equipment performing work in the project area, including any equipment to be working on the beach.

b. 24-hour telephone numbers of the project engineer, superintendent, and foreman.

c. Schedule for completion of project.

1.7.2 Traffic Routing

The Contractor shall notify the Contracting Officer Representative 7 days in advance of the time work will be started in areas requiring the rerouting of traffic, traffic lane striping, or removal of street signs. The foregoing shall apply to progressive modifications of traffic routing within an area in which work is in progress.

1.7.3 Existing Bench Marks and R/W Markers

The Contractor shall notify the Contracting Officer, in writing, 7 days in advance of the time he proposes to remove any bench mark or right-of-way marker.

1.7.4 United States Coast Guard

The Contractor shall notify the Commander Eleventh Coast Guard District, and the Coast Guard Sector LA-LB not less than 14 calendar days prior to commencing work. The notifications, preferably by e-mail (although letter or fax are accepted), shall include as a minimum the following information:

a. Project description including the type of operation (i.e. dredging, diving, construction, etc).

b. Location of operation, including Latitude / Longitude (NAD 83). Include dredge disposal location.

c. Work start and completion dates and the expected duration of operations. The Coast Guard need to be notified if these dates change.

d. Vessels involved in the operation (name, size and type).

e. VHF-FM radio frequencies monitored by vessels on scene.

f. Point of contact and 24 hour phone number.

g. Potential hazards to navigation.

h. Chart number for the area of operation.

i. Recommend the following language be used in the Local Notice to Mariners: "Mariners are urged to transit at their slowest safe speed to minimize wake, and proceed with caution after passing arrangements have been made."

Mail address:

Commander, 11th Coast Guard District(dpw)
ATTN: Local Notice to Mariners
Coast Guard Island, Building 50-2
Alameda, CA 94501-5100
Tel: (510) 437-2970
Fax: (510) 437-3423
e-mail: d11LNM@uscg.mil
cc: Stephen.B.Walters@.uscg.mil

U.S. Coast Guard
Sector LA-LB
1001 South Seaside Ave, Bldg 20
San Pedro, CA 90731
Attn: Waterways Management
Phone # (310) 732-2020
Fax # (310) 732-2029
e-mail:Peter.W.Gooding@.uscg.mil

Website: http://www.uscg.mil/d11/dp/dpw/

1.8 POINTS OF CONTACT

The following is a list of points of contact:

Company or Agency	Contact	Telephone
U.S. Army Corps of Engineers		
Resident Engineer	Eleanor Encinas	(909) 578-9703
Project Engineer	Stan Fujimoto	(626) 401-4084
Construction Representative	Rich Falcon	(626) 401-4091
U.S. Naval Base Ventura County		
Public Works	Sal Cervantes	(805) 982-4305
Port Operations	Mike Miller	(805) 982-5202
Frequency Management Representative	Phil Powell	(805) 898-8109
Oxnard Harbor District (Port Hueneme)	Pete Wallace	(805) 488-3677
City of Port Hueneme - City Engineer	Kit Nell	(805) 986-6568
U.S. Coast Guard		
Local Notice to Mariners	BM1 Ronald Hellberg	(510) 437-2970
Aids-to-Navigation	LT Steve Walters	(510)437-2982/2969
Sector LA-LB	LT Peter Gooding	(310) 732-2020
CG Station Channel Islands	LT Marcus Gherardi	(805) 985-9822
Ventura Air Pollution District	Keith Duval	(805) 645-1410

1.9 AIDS TO NAVIGATION

The Contractor shall not remove, relocate, obstruct, willfully damage, make fast to, or interfere with any aids to navigation. The Contractor shall notify the Eleventh Coast Guard District in writing with a copy to the Contracting Officer not less than 30 calendar days in advance of the time he plans to operate any equipment adjacent to any aids to navigation which requires relocation or removal.

1.10 DREDGING AIDS

The Contractor shall obtain the approval of the 11th Coast Guard District and the Harbor Master prior to placing any buoy or other aid marker in the water. Buoys and other dredging aid markers shall be equipped with the necessary lights and the Contractor shall insure that all lights are in proper working order prior to installation. Buoys and dredging aids markers shall be maintained throughout the length of the dredging operation and shall not be colored, marked, or placed in a manner that will obstruct or be confused with other navigational aids. The Contractor's buoys and aid markers shall conform to U.S. Coast Guard regulations.

1.11 RESTRICTIONS

1.11.1 Obstruction of Channel

The Contracting Officer will not undertake to keep the harbor entrance or navigation channels free from vessels or other obstructions. The Contractor shall be required to conduct the work in such a manner as to obstruct navigation as little as possible, and in case the Contractor's plant so obstructs the channel as to make difficult or endanger the passage of vessels, said plant shall be promptly moved on the approach of any vessel to such an extent as may be necessary to afford a practicable passage. Upon the completion of the work, the Contractor shall promptly remove his plant, including ranges, temporary buoys, and piles and other marks placed by him under the contract in navigable waters or on shore. The Contractor's dredge shall be equipped for bridge to bridge communication with other vessels and the Contractor shall monitor prescribed channel in compliance with Coast Guard regulations.

All underwater and above surface hazards to navigation associated with this work shall be marked with a white light of at least 40 candella.

If the Contractor feels it is necessary to completely obstruct the navigation channel, he shall coordinate in advance with the U.S. Navy Port Operations and the Oxnard Harbor District.

1.12 PIPELINE AND POWERLINE CROSSINGS

1.12.1 General

At the shore ends of the submerged dredging pipelines crossing Port Hueneme, the Contractor shall construct lighted signs. The sign's face shall be not less than 2 x 4 meters, all letters shall be 100 mm in height and the wording shall be "Pipeline (Powerline) Crossing, Do not Drop Anchor - Stay within 15 meters of channel centerline". The Contractor shall provide anchors or similar provisions to prevent rupture along the pipelines as required and where pipelines change direction by 22 degrees or more. Spills resulting from rupture shall be removed by and at the expense of the Contractor. Should submerged pipeline cause shoaling in Port Hueneme Harbor, the Contractor shall remove such shoals and restore to the depths as existed prior to the laying of the submerged pipe. Materials so removed shall be disposed of in a manner approved by the Contracting Officer. No separate payment will be made for the removal of such shoals and all cost thereof shall be included in the contract price. Where discharge pipelines are buried on shore, stakes shall be placed not less than 1.5 meters above the sand with the words "DREDGE PIPELINE BELOW" printed in 25 mm letters.

1.12.2 Pipeline Leakage

No discharge is allowed within Port Hueneme Harbor. To prevent accidental discharge, no valves, ball joints, or other connections likely to leak or subject to breakage, shall be placed between the West and East Jetties at Port Hueneme Harbor without the Contracting Officer’s approval.

1.13 SHORE PIPELINE PLACEMENT AND REMOVAL

The Contractor shall coordinate with the USACE regarding placement of the hydraulic pipeline along the shore for placement of material on Hueneme Beach.

The discharge pipeline shall be free from holes, and joints shall be watertight outside the designated limits of the disposal area.

The Contractor shall provide access ramps over the discharge pipeline at 30-meter intervals on Hueneme Beach, unless otherwise authorized or directed by the Contracting Officer. The ramps shall be constructed with material from adjacent area. Maintenance and protection of the discharge pipeline and ramps shall be the responsibility of the Contractor.

1.14 PERMITS

Reference is made to the clause of the contract entitled: PERMITS AND RESPONSIBILITIES, which obligate the Contractor to obtain all required licenses and permits.

1.14.1 Air Quality

Contractor shall have a current, valid Air Quality permit for all equipment that require an Air Quality permit from Ventura Air Pollution Control District prior to commencement of dredging operations coinciding with the notice to proceed. The Contractor shall allow approximately 2-3 months to obtain the permit. P.O.C. Keith Duval.

1.15 MARINE PLANT

a. All marine plant and equipment which are required by federal regulations to be inspected by the United States Coast Guard, shall have valid certifications. No marine plant or equipment requiring Coast Guard inspection shall be put into use on the job without the required certification issued by the U.S. Coast Guard Officer in Charge of Marine Inspections.

b. All marine construction equipment shall monitor appropriate VHF marine safety radio channels.

c. Fuel transfer operations shall conform to U.S. Coast Guard design regulations, CFR 33 Part 156.

1.16 PUBLIC SAFETY

Attention is invited to the CONTRACT CLAUSE 52.236-7: PERMITS AND RESPONSIBILITIES. The Contractor shall provide temporary fencing, barricades, and/or guards, as required, to provide protection in the interest of public safety. Whenever the Contractor's operations create a condition hazardous to the public, he shall furnish at his own expense and without cost to the Contracting Officer, such flagmen and guards as are necessary to give adequate warning to the public of any dangerous conditions to be encountered and he shall furnish, erect, or maintain such fences, barricades, lights, signs and other devices as are necessary to prevent accidents and avoid damage or injury to the public. Flagmen and guards, while on duty and assigned to give warning and safety devices shall conform to applicable city, county, and state requirements. Should the Contractor appear to be neglectful or negligent in furnishing adequate warning and protection measures, the Contracting Officer may direct attention to the existence of a hazard and the necessary warning and protective measures shall be furnished and installed by the Contractor without additional cost to the Contracting Officer. Should the Contracting Officer point out the inadequacy of warning and protective measures, such action of the Contracting Officer shall not relieve the Contractor from any responsibility for public safety or abrogate his obligation to furnish and pay for those devices. The installation of any general illumination shall not relieve the Contractor of his responsibility for furnishing and maintaining any protective facility.

The Contractor shall furnish flagmen, watchmen, or other security personnel to control traffic and protect pedestrians in the vicinity of the discharge pipe at all times while discharging material in the placement area.

1.17 GENERAL SAFETY REQUIREMENTS

1.17.1 General

The Corps of Engineers Safety and Health Requirements Manual, EM 385-1-1, (see CONTRACT CLAUSES: SECTION 00700, ACCIDENT PREVENTION), the Occupational Safety and Health Act (OSHA) Standards for Construction (Title 29, Code of Federal Regulations Part 1926 as revised from time to time), and the Dredging Contractor of America (DCA) / United States Army Corps of Engineers (USACE) Dredging Safety Management Program (DSMP) are all applicable to this contract. In case of conflict, the most stringent requirement of the three standards is applicable. Pursuant to EM 385-1-1, the Contractor shall submit a Site Safety Health Plan /Accident Prevention Plan (APP).

If the Contractor is a currently accepted participant in the Dredging Contractors of America (DCA) / United States Army Corps of Engineers (USACE) Dredging Safety Management Program (DSMP), as determined by the DCA/USACE Joint Committee, and holds a current valid Certificate of Compliance for both the Contractor Program and the dredges to be used to perform the work required under this contract, the Contractor may, in lieu of the submission of a Site Safety Health Plan / Accident Prevention Plan,

(a) make available for review, upon request, the Contractor's current Safety Management System (SMS) documentation,

(b) submit to the Contracting Officer the current valid Company Certificate of Compliance for its SMS

(c) submit the current dredge(s) Certificate of Compliance based on third party audit, and

(d) submit for review and acceptance, site specific addenda to the SMS as specified in the solicitation.

1.17.2 Activity Hazard Analysis

Based on the construction schedule, the Contractor shall submit an Activity Hazards Safety Analysis of each major phase of work prior to entering that phase of activity. The analysis shall include major or high risk hazards, as well as commonly recurring deficiencies that might possibly be encountered for that operation, and shall identify proposed methods and techniques of accomplishing each phase in a safe manner. The Prime Contractor's superintendent shall take active participation in the Job Hazard Analysis, including the subcontractors' work. Prior to start of actual work a meeting shall be held with Prime Contractor, Contracting Officer, and affected subcontractor to review the Job Hazard Analysis. In addition, job site meetings shall be held to indoctrinate foreman and workers on details of this analysis.

1.18 SIGNAL LIGHTS

The Contractor shall display signal lights and conduct his operations in accordance with the General Regulations of the Department of the Army and of the Coast Guard, governing lights and day signals to be displayed by towing vessels with tows, on which no signals can be displayed, vessels working on dredging, jetty, bank protection operations, lights to be displayed on dredge pipelines, and day signals to be displayed by vessels of more than 20 meters in length moored or anchored in a fairway or channel, and the passing by other vessels of floating plant working in navigable channels, as approved by the Secretary of the Army (33 C.F.R. 201.1-201.16) and the Commandant U.S. Coast Guard (33 C.F.R. 80.18-80.31a and 33 C.F.R. 95.51-95.70). All Contractor's anchor buoys, floating line, and plant shall be marked with flashing beacon lights after dark. Obstructions and hazards to navigation mentioned above shall be painted for visibility during daylight hours.

1.19 RADIO COMMUNICATION

To facilitate and insure the safe passage of vessels in the channel, the Contractor shall provide, operate and maintain on his plant, radio facilities capable of voice communication with vessels using the channel. Station licensing and frequency authorizations shall be the responsibility of the Contractor.

Radio transmitters (i.e., hand held radios, etc.) and/or electronic positioning equipment shall conform to restrictions and procedures as directed by the Contracting Officer. The Contractor shall monitor VHF marine safety radio channels and coordinate with the Frequency Management Representative, Naval Base Ventura County, prior to any transmittal on VHF radio or use of electronic positioning equipment. For additional information, contact the Frequency Management Representative.

1.20 REPAIR OF STREETS, ACCESS ROADS, AND WORK AREAS

The Contractor shall restore streets, sidewalks, parking lots, and access roads (used for haul routes and mobilizing equipment) and work areas to original condition upon completion of the work. Contractor shall restore to the local municipality standards.

1.21 INSPECTION

Reference is made to the clause of the contract entitled: INSPECTI0N OF CONSTRUCTION. In addition, the Contractor will be required:

a. To furnish, on the notification of the Contracting Officer, his authorized representative, or any Corps inspector, the use of such boats, boatmen, laborers, and material forming a part of the ordinary and usual equipment and crew of the plant as may be reasonably necessary in inspecting and supervising the work.

b. To furnish, on the notification of the Contracting Officer, his authorized representative, or any Corps inspector, suitable transportation from all points on shore designated by the Contracting Officer to and from the various pieces of plant, and to and from the work areas. Should the Contractor refuse, neglect, or delay compliance with these requirements, the specific facilities may be furnished and maintained by the Contracting Officer, and the cost thereof will be deducted from any amounts due or to become due the Contractor.

c. Upon notification by the Contracting Officer or his authorized representative or any Corps inspector, to allow authorized representatives of the California Regional Water Quality Control Board and the Ventura County Air Pollution Control District or State Air Resources Board to:

* enter upon the Contractor's premises where a regulated facility or activity is located or conducted, or where records are kept;

* have access to and copy, at reasonable times, any records that must be kept per agency requirements;

* inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated by these agencies;

* and sample or monitor at reasonable times any substances or parameters at any location for the purpose of assuring compliance with agency regulations.

1.22 NAVIGATION

The Contractor's operations shall conform to the U.S. Coast Guard publication "Navigation Rules, International-Inland, INST M16672.28" latest edition.

1.23 WORK AREAS AND EASEMENTS

The Contractor shall submit a Work and Storage Areas Plan for approval within 15 days after receipt of Notice to Proceed. The Contractor's work areas and temporary construction easements are as indicated, subject to approval of the Contracting Officer. The Contractor's work area(s) shall be fenced according to the instruction of the Contracting Officer. Upon completion of the work, the fence materials shall become the property of the Contractor and shall be removed from the site.

Any damage to electrical underground installations, light poles, pavement, fence, shrubs or other facilities within the Contractor's work area shall be repaired or replaced by and at the expense of the Contractor.

The Contractor shall mark the shoreward limits of the construction easement by means of suitable marker buoys. The remaining portion of the navigation channel shall not be obstructed and shall remain open to traffic. Areas within the construction easement not being used by the Contractor for construction shall be made available for anchorage, however, moorings within the easement will be moved by others within 5 days after written notice by the Contractor to the Contracting Officer.

1.24 CORPS OF ENGINEERS RESERVE FLEET (CERF) IMPLEMENTATION

If the work specified in this contract is performed by a hopper dredge(s), the owner must have an active Basic Ordering Agreement (BOA) for the hopper dredge(s) on file with the Corps. The Contractor shall be obligated to make the hopper dredge(s) available to serve in the Corps of Engineers Reserve Fleet (CERF) at any time that the hopper dredge(s) is performing work under this contract. When the Contracting Officer is notified of the decision to activate this dredge(s) into the CERF, he shall take appropriate action to release the dredge(s). He may then extend or terminate the contract to implement whichever action is in the best interest of the Contracting Officer. The CERF Contractor shall also be subject to the following conditions:

a. The Director of Civil Works may require the Contractor to perform emergency dredging at another CONUS (48 contiguous states) site for a period of time equal to the remaining time under this contract at the date of notification plus up to ninety (90) days at the previously negotiated rate which appears on the schedule of prices in the BOA.

b. The Chief of Engineers may require the Contractor to perform emergency dredging at an OCONUS (Outside CONUS which includes Alaska, Hawaii, Puerto Rico, the Virgin Islands, or U.S. Trust Territories) site for a period of time equal to the time remaining under this contract at the date of notification plus up to one hundred eighty (180) days at the negotiated rate which appears on the schedule of prices in the BOA.

c. The CERF shall be activated by the Chief of Engineers or the Director of Civil Works; then the Ordering Contracting Officer will notify the Contractor. From the time of notification, the selected hopper dredge(s) must depart for the emergency assignment within seventy-two (72) hours for CONUS or ten (10) days for OCONUS assignments.

d. A confirming delivery order will be issued pursuant to the Basic Ordering Agreement (BOA) by the Ordering Contracting Officer. Such delivery order shall utilize the schedule of rates in the BOA for the specific hopper dredge(s).

e. If during the time period specified in the paragraphs above, a CERF vessel(s) is still required, the contract performance may be continued for additional time by mutual agreement.

1.25 TIME EXTENSIONS FOR UNUSUALLY SEVERE WEATHER

This provision specifies the procedure for determination of time extensions for unusually severe weather in accordance with the CONTRACT CLAUSES: SECTION 00700, entitled DEFAULT (FIXED PRICE CONSTRUCTION). In order for the Contracting Officer to award a time extension under this clause, the following conditions must be satisfied:

a. The weather experienced at the project site during the contract period must be found to be unusually severe, that is, more severe than the adverse weather anticipated for the project location during any given month.

b. The unusually severe weather must actually cause a delay to the completion of the project. The delay must be beyond the control and without the fault or negligence of the Contractor.

The following schedule of monthly anticipated adverse weather delays is based upon National Oceanic and Atmospheric Administration (NOAA) or similar data for the project location and will constitute the base line for monthly weather time evaluations. The Contractor's progress schedule must reflect these anticipated adverse weather delays in all weather dependent activities.

MONTHLY ANTICIPATED ADVERSE WEATHER DAYS
Work Days Based on Five (5) Day Work Week

JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
4	7	4	2	1	1	1	1	1	1	3	4

c. Upon acknowledgment of the Notice to Proceed and continuing throughout the contract, the Contractor will record on the daily CQC report, the occurrence of adverse weather and resultant impact to normally scheduled work. Actual adverse weather delay days must prevent work on critical activities for 50 percent or more of the Contractor's scheduled work day. The number of actual adverse weather days shall include days impacted by actual adverse weather (even if adverse weather occurred in previous month), be calculated chronologically from the first to the last day of each month, and be recorded as full days. If the number of actual adverse weather delay days exceeds the number of days anticipated in paragraph b, the Contracting Officer will convert any qualifying days to calendar days, giving full consideration for equivalent fair weather work days, and issue a modification in accordance with the Contract Clause entitled: DEFAULT (FIXED PRICE CONSTRUCTION).

1.26 NON CONTRACT WORK

The Contractor and/or his subcontractors shall not perform any work or erect any structure for third parties, landowners or otherwise, within the limits of the rights-of-way without prior approval of the Contracting Officer.

1.27 COORDINATION WITH OTHER CONSTRUCTION

The Contractor shall coordinate work with other construction projects in the vicinity of the project.

1.28 ACCESS TO ADJACENT PROPERTIES

(a) Access to both the U.S. Naval Base Ventura County and Oxnard Harbor District properties at Port Hueneme is limited. Arrangements for obtaining access may be made by contacting Pete Wallace (OHD), and Mike Miller (U.S. Navy).

(b) Access to the Naval Base Ventura County (NBVC) may be obtained by contacting Pass and ID Section at telephone (805) 982-2019.

(c) Contractor employees shall be required to park within the designated work / storage area while working at NBVC. The Contractor shall provide a list of employees names and social security numbers to the NBVC Security Officer. Employees who require access to NBVC shall be U.S. Citizens.

1.29 NOTICE OF PARTNERSHIP

The Contracting Officer intends to encourage the foundation of a cohesive partnership with the Contractor and its subcontractors. This partnership will be structured to draw on the strengths of each organization to identify and achieve reciprocal goals. The objectives are effective and efficient contract performance and intended to achieve completion within budget, on schedule, and in accordance with plans and specifications. This partnership shall be bilateral in makeup, and participation will be totally voluntary. Any cost associated with effectuating this partnership will be agreed to by both parties and will be shared equally with no change in contract price.

To implement this partnership initiative, it is anticipated that within 60 days of Notice to Proceed, the Contractor's on-site Project Manager and the Contracting Officer's Resident Engineer would attend a one or two day partnership development seminar/team building workshop together with the Contractor's key on-site staff and key Contracting Officer personnel. Follow-up workshops of 1 to 2 days duration would be held periodically throughout the duration of the contract as agreed to by the Contractor and Contracting Officer.

PART 2 MATERIALS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section --

SECTION 01270

MEASUREMENT AND PAYMENT
05/08

PART 1 GENERAL

1.1 SUBMITTALS

None

1.2 LUMP SUM PAYMENT ITEMS

Payment items for the work of this contract for which contract lump sum payments will be made are listed in the PRICING SCHEDULE and described below. All costs for items of work, which are not specifically mentioned to be included in a particular lump sum or unit price payment item, shall be included in the listed lump sum item most closely associated with the work involved. The lump sum price and payment made for each item listed shall constitute full compensation for furnishing all plant, labor, materials, and equipment, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all work required for which separate payment is not otherwise provided.

1.2.1 Mobilization and Demobilization

a. Payment. Payment will be made for costs associated with mobilization and demobilization, as defined in Special Clause PAYMENT FOR MOBILIZATION AND DEMOBILIZATION.

b. Unit of Measure: Job.

1.2.2 Pile Removal

a. Payment. Payment will be made for costs associated with full removal of timber pile stubs that are encountered during dredging.

b. Unit of Measure: Job.

1.2.3 Hydrographic Surveys

a. Payment. Payment will be made for costs associated with performing each specified hydrographic to the extents and accuracies that are required.

b. Unit of Measure: Job.

1.3 UNIT PRICE PAYMENT ITEMS

Payment items for the work of this contract on which the contract unit price payments will be made are listed in the PRICING SCHEDULE and described below. The unit price and payment made for each item listed shall constitute full compensation for furnishing all plant, labor, materials, and equipment, and performing any associated Contractor quality control, environmental protection, meeting safety requirements, tests and reports, and for performing all work required for each of the unit price items.

Incidental costs such as surveying, quality control, water quality monitoring, etc. shall not be loaded into a few or one bid item, but should be accounted for reasonably in each applicable, separate bid item.

1.3.1 Dredging of CAD with Beach Placement

a. Payment. Payment will be made on a unit price basis for work associated with dredging the CAD area, including paid allowable overdepth dredging, transporting and placing dredge material at designated beach disposal placement site(s), and other operations incidental thereto, including but not limited to hydrographic progress surveys, positioning control, quality control, and water quality control.

b. Measurement. The total quantity of dredge material for which payment will be made will be by in-place (quantity) measurement in cubic meters by computing the difference in available material between the pre-dredge survey and the post-excavation survey of the CAD. Misplaced materials (including any required removal and placement), excessive overdepth dredging and material falling or drawn into the cut from beyond the side slope plane or beyond the limits indicated, will be excluded from the quantities for which payment will be made. The Triangulated Irregular Network (TIN) method will be used for quantity determination. For method of soundings, see SECTION 02020: DREDGING.

c. Unit of Measure: cubic meter

1.3.2 Dredging of Sediments with CAD Disposal

a. Payment.

1. Hotspot 1, Hotspot 2, and Hotspot 3 (Bid Items No. 3A, 3B, and 3C). Payment will be made on a unit price basis for work associated with dredging sediments from the three identified Hotspots, to be disposed within the CAD, including paid allowable overdepth dredging, transporting and placing dredge material as specified within the CAD, and other operations incidental thereto, including hydrographic progress surveys, debris removal (except for timber piles), positioning control, quality control, and water quality control.

2. U.S. Navy Areas and OHD Wharves - Non-Restricted Dredging (Bid Items No. 3D and 3E). Payment will be made on a unit price basis for work associated with dredging sediments from all non-restricted portions of the U.S. Navy areas (including areas along wharves as well as the North Harbor area) and OHD Wharf areas, to be disposed within the CAD, including paid allowable overdepth dredging, transporting and placing dredge material as specified within the CAD, and other operations incidental thereto, including hydrographic progress surveys, debris

removal (except for timber piles), positioning control, quality control, and water quality control.

3. U.S. Wharves and OHD Wharves - Dredging Restriction and Backfill Areas (Bid Items No. 3F and 3G). Payment will be made on a unit price basis for work associated with dredging sediments from dredging restriction areas in the U.S. Navy and OHD Wharf areas, as identified on the Plans, including paid allowable overdepth dredging, transporting and placing dredge material as specified within the CAD, obtaining backfill material from specified available excavation area, placing the backfill within the specified areas along the wharf faces, and other operations incidental thereto, including hydrographic progress surveys, debris removal (except for timber piles), positioning control, and water quality control. (Subsequent backfilling will be paid for under a separate pay item.)

4. Additional Dredging with CAD Disposal (if required) **(Bid Item No, 3H).** Payment will be made for costs associated with additional dredging of sediments from areas identified by the Contracting Officer as a result of conformational sampling results, including transporting and placing dredge material as specified within the CAD and other operations incidental thereto, including hydrographic progress surveys, debris removal (except for timber piles), positioning control, quality control, and water quality control.

b. Measurement.

The total quantity of dredge material for which payment will be made in each of the above bid items will be by in-place (quantity) measurement in cubic meters by computing the difference in available material between the relevant pre-dredge survey and the relevant post-dredge survey. Misplaced materials (including any required removal and placement), excessive overdepth dredging, and material falling or drawn into the cut from beyond the side slope plane or beyond the limits indicated will be excluded from the quantities for which payment will be made. The Triangulated Irregular Network (TIN) method will be used for quantity determination. For method of soundings, see SECTION 02020: DREDGING.

c. Unit of Measure: cubic meter.

1.3.3 Dredging of USACE Operations and Maintenance Sediments with Placement in CAD

a. Payment.

Payment will be made on a unit price basis for work associated with dredging sediments from remaining USACE Operations and Maintenance areas, and placing the dredged material as a discrete cover layer (as cap material) over the surface of the previously placed contaminated sediment layer in the CAD, including paid allowable overdepth dredging, transporting and placing dredge material as specified as cap material on the CAD, and other operations incidental thereto, including hydrographic progress surveys, debris removal (except for timber piles), positioning control, quality control, and water quality control.

b. Measurement.

The total quantity of dredge material for which payment will be made will be by in-place (quantity) measurement in cubic meters by computing the difference in available material between the relevant pre-dredge survey and the relevant post-dredge survey. Misplaced materials (including any required removal and placement), excessive overdepth dredging, and material falling or drawn into the cut from beyond the side slope plane or beyond the limits indicated will be excluded from the quantities for which payment will be made. The TIN method will be used for quantity determination. For method of soundings, see SECTION 02020: DREDGING.

c. Unit of Measure: cubic meter.

1.3.4 Additional Cap Material (if required)

Payment will be made for costs associated with additional dredging of sediments from specified available excavation area, if required by the Contracting Officer in order to achieve required thickness for the non-contaminated cap on the CAD, including transporting and placing dredge material as specified within the CAD and other operations incidental thereto, including hydrographic progress surveys, debris removal (except for timber piles), positioning control, quality control, and water quality control.

b. Measurement.

The total quantity of dredge material for which payment will be made for this bid items will be by in-place (quantity) measurement in cubic meters by computing the difference in available material between the relevant pre-dredge survey of the excavation area and the relevant post-dredge survey of that area. Misplaced materials (including any required removal and placement), excessive dredging, and material falling or drawn into the cut from beyond the side slope plane or beyond the limits indicated will be excluded from the quantities for which payment will be made. The Triangulated Irregular Network (TIN) method will be used for quantity determination. For method of soundings, see SECTION 02020: DREDGING.

c. Unit of Measure: cubic meter.

1.3.5 Armor Rock

a. Payment.

Payment will be made on a unit price basis for work associated with purchasing, transporting to the Site, and placing Armor Rock, including paid allowable overplacement and other operations incidental thereto, including hydrographic progress surveys, positioning control, quality control, and water quality control.

b. Measurement.

The total quantity of Armor Rock considered for payment will be measured using barge displacement weight tickets certified by the provider of the Armor Rock and the transporter of the material to the site. The payable quantity will be calculated by taking the total quantity of Armor Rock brought to the site, minus excessive overplacement, and minus the amount of placement outside of the required limits. Excessive overplacement will be determined by a volumetric comparison of pre-Armor Rock and post-Armor Rock surveys, and utilizing a volume-to-weight conversion ratio of 2.25 metric tons per cubic meter.

c. Unit of Measure: metric tons.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION (NOT APPLICABLE)

-- End of Section --

SECTION 01355

ENVIRONMENTAL PROTECTION
05/08

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

36 CFR 800.11	Properties Discovered During Implementation of an Undertaking
40 CFR 261	Identification and Listing of Hazardous Waste

U.S. ARMY CORPS OF ENGINEERS

EM 385-1-1	(2003) Safety and Health Requirements Manual

1.2 DEFINITIONS

Environmental pollution and damage is defined as the presence of chemical, physical, or biological elements or agents that adversely affect human health or welfare; unfavorably alter ecological balances of plant or animal communities of importance to human life; affect other species of importance to man; or degrade the environment from an aesthetic, recreational, cultural or historic perspective. Environmental protection is the prevention/control of pollution and habitat disruption that may occur during construction. The control of environmental pollution and damage requires consideration of air, water, land, biological and cultural resources; and includes management of visual aesthetics; noise; solid, chemical, gaseous, and liquid waste; radiant energy and radioactive materials; and other pollutants.

1.3 SUBMITTALS

Government approval is required for all submittals with a "G" designation; submittals not having a "G" designation are for information only. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Environmental Protection Plan; G

Water Quality Firm; G

Water Quality Monitoring Work Plan; G

Caulerpa taxifolia Survey Firm; G

Caulerpa taxifolia Survey; G

1.4 ENVIRONMENTAL PROTECTION REQUIREMENTS

The Contractor shall comply with all applicable Federal, State, and local laws and regulations. The Contractor shall provide environmentally protective measures and procedures as specified herein, to prevent and control pollution, limit habitat disruption and impacts to water quality, and correct environmental damage that occurs during construction.

1.4.1 Protection of Features

This section supplements the Contract Clause PROTECTION OF EXISTING VEGETATION, STRUCTURES, EQUIPMENT, UTILITIES, AND IMPROVEMENTS. The Contractor shall prepare a list of features requiring protection under the provisions of the contract clause which are not specially identified on the drawings as environmental features requiring protection. The Contractor shall protect those environmental features, indicated specially on the drawings, in spite of interference which their preservation may cause to the Contractor's work under the contract.

1.4.2 Permits

This section supplements the Contractor's responsibility under the contract clause PERMITS AND RESPONSIBILITIES to the extent that the Contracting Officer has already obtained environmental permits. The permits that have been obtained are attached to these contract documents. The Contractor shall maintain copies of all permits at the site and shall comply with the terms, and conditions of these permits. The Contractor shall also comply with other environmental commitments made by the Contracting Officer and incorporated in this section. The Contractor is responsible for obtaining any necessary permits or licenses not previously obtained by the Contracting Officer, including:

Air Quality - Permit to Operate. The Contractor is required to obtain or have in possession appropriate Permits to Operate from the California Air Resources Board (CARB) or Ventura Air Pollution Control District (VCAPCD) for all applicable equipment prior to commencement of work and to pay all associated fees.

1.4.3 Special Environmental Requirements

The Contractor shall comply with the special environmental requirements listed in paragraphs 3.3, 3.4, 3.5, and 3.6. These special environmental requirements are an outgrowth of environmental commitments made by the Government during the project development.

1.4.4 Environmental Assessment of Contract Deviations

These contract specifications have been prepared to comply with the special conditions and mitigation measures of an environmental nature which were established during the planning and development of this project. The Contractor is advised that deviations from the drawings or specifications (e.g., proposed alternate borrow areas, disposal areas, staging areas, alternate access routes, scheduling delays, and unauthorized activities in designated "no work" or "no dredge" areas) could result in the requirement for the Government to reanalyze the project from an environmental standpoint. Deviations from the construction methods and procedures indicated by the plans and specifications which may have an environmental impact will require an extended review, processing, and approval time by the Government. The Contracting Officer reserves the right to disapprove alternate methods, even if they are more cost effective, if the Contracting Officer determines that the proposed alternate method will have an adverse environmental impact.

1.5 ENVIRONMENTAL PROTECTION PLAN

Within twenty (20) calendar days of Contract Modification Award, the Contractor shall submit an Environmental Protection Plan for review and acceptance by the Contracting Officer. The Contractor shall incorporate Government comments into the final Environmental Protection Plan within 15 calendar days after receipt of comments from the government.

Acceptance is conditional and is predicated upon satisfactory performance during construction. The Government reserves the right to require the Contractor to make changes in the Environmental Protection Plan or operations if the Contracting Officer determines that environmental protection requirements are not being met.

The plan shall detail the actions which the Contractor shall take to comply with all applicable Federal, State, and local laws and regulations concerning environmental protection and pollution control and abatement, as well as the additional specific requirements of this contract. The Contractor shall address each topic at a level of detail equal to the environmental issue and required construction task(s). No physical work at the site shall begin prior to acceptance of the Contractor's plan or an interim plan covering the work to be performed. The Environmental Protection Plan shall include, but not be limited to, the following:

1.5.1 Laws, Regulations, and Permits

The Contractor shall provide, as part of the Environmental Protection Plan, a list of all Federal, State, and local laws, regulations, and permits concerning environmental protection, pollution control, and abatement that are applicable to the Contractor's proposed operation and the requirements imposed by those laws, regulations, and permits. Permits obtained by the Contractor shall be attached to, and specific conditions included in the Environmental Protection Plan.

1.5.2 Spill Control Plan

The Contractor shall include, as part of the Environmental Protection Plan, a Spill Control Plan. The Spill Control Plan shall include the procedures, instructions, and reports to be used in the event of an unforeseen spill of a substance regulated by the Emergency Response and Community Right-to-Know Act or regulated under State or local laws or regulations. The Spill Control Plan supplements the requirements of EM 385-1-1. This plan shall include as a minimum:

a. The name of the individual who will be responsible for implementing and supervising the containment and cleanup.

b. Training requirements for Contractor's personnel and methods of accomplishing the training.

c. A list of materials and equipment to be immediately available at the job site, tailored to cleanup work of the potential hazard(s) identified.

d. The names and locations of suppliers of containment materials and locations of additional fuel oil recovery, cleanup, restoration, and material-placement equipment available in case of an unforeseen spill emergency.

e. The methods and procedures to be used for expeditious contaminant cleanup.

f. The name of the individual who will report any spills or hazardous substance releases and who will follow up with complete documentation. This individual shall immediately notify the Contracting Officer in addition to the legally required Federal, State, and local reporting channels (including the National Response Center 1-800-424-8802) if a reportable quantity spill occurs. The plan shall contain a list of the required reporting channels and current telephone numbers.

1.5.3 Recycling and Waste Minimization Plan

The Contractor shall submit a Recycling and Waste Minimization Plan as a part of the Environmental Protection Plan. The plan shall detail the Contractor's actions to comply with the following recycling and waste minimization requirements:

a. The Contractor shall participate in State and local government sponsored recycling programs to reduce the volume of solid waste materials at the source.

b. The Contractor shall collect glass bottles, aluminum cans, and paper at the job site for recycling.

1.5.4 Contaminant Prevention Plan

As a part of the Environmental Protection Plan, the Contractor shall prepare a contaminant prevention statement identifying potentially hazardous substances to be used on the job site and intended actions to prevent accidental or intentional introduction of such materials into the air, water, or ground. The Contractor shall detail provisions to be taken to meet Federal, State, and local laws and regulations regarding the storage and handling of these materials.

1.5.5 Debris Management Plan / Non-Hazardous Solid Waste Diversion Report

As a part of the Environmental Protection Plan, the Contractor shall prepare a Debris Management Plan identifying methods and locations for solid waste disposal. The Debris Management Plan shall include sources and expected types of debris, debris separation and retrieval methods, and debris disposal methods.

1.5.6 Environmental Monitoring Plan

The Contractor shall include in the plan the details of environmental monitoring requirements under the laws and regulations and a description of how this monitoring will be accomplished. The Contractor shall also include in the plan the name of the individual(s) performing the environmental monitoring.

1.5.7 Water Quality Control Plan

The Contractor shall prepare, as part of the Environmental Protection Plan, a Water Quality Control Plan, which describes how the Contractor will limit the dispersion of suspended solids into surface waters during their dredging and disposal activites, and how they will comply with all permit requirements related to maintenance of water quality during construction. The Water Quality Control Plan shall provide manufacturer's specifications for the floating silt curtains that will be used, including cables, connections, and anchoring system for the floating silt curtains. This plan shall also describe contingency measures that will be employed by the Contractor in the event that water quality criteria are exceeded during their operations.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 SPECIAL ENVIRONMENTAL PROTECTION REQUIREMENTS

3.1.1 Vegetation Protection / Landscape

The Contractor shall thoroughly clean all construction equipment and vehicles at the prior job site in a manner that ensures all residual soil is removed and that egg deposits from plant pests are not present. The Contractor shall consult with the USDA Plant Protection and Quarantine (USDA - PPQ) jurisdictional office for additional cleaning requirements that may be necessary.

3.1.2 Disposal of Solid Wastes

Solid waste is rubbish, debris, waste materials, garbage, and other discarded solid materials excluding clearing debris and hazardous waste as defined in following paragraphs. Solid waste shall be placed in containers and disposed on a regular schedule. All handling and disposal shall be conducted in such a way as to prevent spillage and contamination. The Contractor shall transport all solid waste off of the project site (and away from the Hueneme Beach area), and shall dispose of the waste in compliance with Federal, State, and local requirements.

3.1.3 Disposal of Contractor Generated Hazardous Wastes

Hazardous wastes are hazardous substances as defined in 40 CFR 261, or as defined by applicable State and local regulations. Hazardous waste generated by construction activities shall be removed from the work area and be disposed in compliance with Federal, State, and local requirements. The Contractor shall segregate hazardous waste from other materials and wastes, and shall protect it from the weather by placing it in a safe, covered location; precautionary measures against accidental spillage such as berming or other appropriate measures shall be taken. Hazardous waste shall be removed from Government property within 60 days. Hazardous waste shall not be dumped onto the ground, into storm sewers or open water courses, or into the sanitary sewer system.

3.1.4 Fuels and Lubricants

Fueling and lubrication of equipment and motor vehicles shall be conducted in a manner that affords the maximum protection against spills and evaporation. Lubricants and waste oil to be discarded shall be stored in marked corrosion-resistant containers and recycled or disposed in accordance with Federal, State, and local laws and regulations.

3.2 HISTORICAL, ARCHAEOLOGICAL, AND CULTURAL RESOURCES

3.2.1 Known Historic, Archaeological, and Cultural Resources

There are no known historic, archaeological, or cultural resources within the Contractor's work area.

3.2.2 Discovered Historic, Archaeological, and Cultural Resources

If during construction activities, items are observed that may have historic or archaeological value (e.g., anchors, shipwrecks, Native American human remains or associated objects, etc.), such observations shall be reported immediately to the Contracting Officer so that the appropriate authorities may be notified and a determination made as to their significance and what, if any, special disposition of the finds should be made. The Contractor shall cease all activities that may result in impact to these resources until the requirements of 36 CFR 800.11, Discovery of Properties During Implementation of an Undertaking, are met. The Contractor shall prevent his employees from trespassing on, removing, or otherwise disturbing such resources.

3.3 PROTECTION OF WATER RESOURCES

The Contractor shall exercise reasonable care to prevent a turbidity plume from forming inside Port Hueneme Harbor or in the vicinity of Hueneme Beach as a result of dredging, beach disposal, or CAD disposal operations. The Contractor shall keep construction activities under surveillance, management, and control to avoid pollution and excessive dispersion of suspended solids within surface waters.

The Contractor shall stay within the boundaries of the identified construction zones. All dredging and fill activities shall remain within the boundaries specified in the plans. There shall be no dumping of any material in the marine environment, which includes fill or material outside of the project area or within any adjacent aquatic community. Environmentally sensitive areas, such as estuaries, shall be avoided.

3.3.1 Water Quality Monitoring

The Contracting Officer's Representative (COR) will perform water quality monitoring during all sediment dredging and disposal activities.

During beach placement, this will consist of visual monitoring by the COR of turbidity conditions in surrounding waters. The COR will look for indications of a visible turbidity plume (exhibiting turbidity that is greater than ambient conditions) that extends one-half mile or more from the beach placement area, for a prolonged period of time (two or more consecutive days). Such a plume would be regarded as an exceedance of water quality criteria at the beach placement site.

During sediment dredging, water quality monitoring will consist of regular sampling of water quality in the vicinity of sediment dredging operations, immediately outside of floating silt curtains. Water quality criteria for these operations are cited in the Waste Discharge Requirements issued by the Regional Water Quality Control Board. The details of the water quality monitoring program are provided in an Operations, Maintenance, and Monitoring Plan (OMMP) for the project, which is available for review under separate cover. The Contractor shall allow access to the work site and the area around floating silt curtains for the Contracting Officer to perform this water quality monitoring.

3.3.2 Mitigation Measures

When dredging contaminated sediment for CAD disposal, floating silt curtains shall be installed and maintained in an arrangement that completely surrounds the dredging activity. The floating silt curtain enclosure shall be closed and the silt curtains continuous at the time of dredging. Floating silt curtains shall extend a minimum of 3 meters below the water surface, and shall be installed and anchored in such a way as to remain in place and functional (i.e. not damaged or separated) throughout the full range of tidal cycles. If the floating silt curtain tears, becomes disconnected, or otherwise fails to prevent turbidity from migrating outside the work area, the Contractor shall repair the floating silt curtain immediately and shall suspend all work until the floating silt curtain is replaced.

Floating silt curtains are not required to be in place during dredging of non-contaminated USACE operations and maintenance sediments (for placement as cap material in the CAD). Similarly, floating silt curtains are not required to be in place during backfilling along wharf faces.

If at any point water quality monitoring indicates that water quality criteria are being exceeded, the Contractor shall modify operations as necessary to reduce the turbidity. If directed by the Contracting Officer, the Contractor shall immediately modify operations as necessary to reduce turbidity or other water quality impacts. Modifications could include slowing operations, using alternate equipment (i.e., closed, sealed, or smaller-sized buckets, in the case of clamshell dredging), avoidance of certain tidal conditions, stopping overflow of the disposal scow or hopper dredge, and/or temporarily stopping the work to allow turbidity to dissipate. For control of turbidity generated by beach placement activities, the Contractor may also elect to modify the sequence of beach disposal and grading (i.e placing a strip of sand along the waterward edge of the beach placement area, then progressively placing sand behind that).

3.3.3 Floating Debris

During the performance of the work, the Contractor shall institute and enforce procedures to prevent spills and floating debris from fouling the local waters and beaches. Should these procedures fail, the Contractor shall promptly clean up all spills and debris. At the end of each work shift, and a minimum of once each workday, loose materials on adjoining structures and debris in the water and on the beach shall be removed by the Contractor and disposed of off site.

3.3.4 Other Discharges

Should the Contractor lose, dump, throw overboard, sink or misplace material, plant, machinery appliance, or cause pollution of the waters, the Contractor shall give immediate notice to the Contracting Officer and, if required shall boom, buoy or otherwise mark the location of the incident until the obstruction or pollution problem is removed. Should the Contractor refuse, neglect or delay compliance with these requirements, the necessary removal and cleanup may be deducted from the monies due or to become due to the Contractor.

3.3.5 Boundaries

All dredging and fill activities shall remain within the boundaries specified in the plans. There will be no dumping of fill or material outside of the project area or within any adjacent aquatic community.

3.4 PROTECTION OF FISH AND WILDLIFE RESOURCES

The Contractor shall keep construction activities under surveillance, management, and control to minimize interference with, disturbance to, and damage of fish, wildlife and plants including their habitat. The Contractor shall be responsible for the protection of threatened and endangered animal and plant species including their habitat in accordance with federal, state, regional, and local laws and regulations. Endangered or protected species known to frequent the project area and their respective nesting season include:

California least tern	15 April through 15 September each year
California grunion	15 March through 30 September each year
Western snowy plover	01 March through 30 September each year
California brown pelican	non-breeding individuals may occur year-round roosting on breakwater

3.4.1 Marine Mammals and Coastal Habitat

Personnel shall not harass any marine mammals, avian species, or waterfowl.

3.4.2 Incidental Take of Wildlife

The Contractor shall report any incidental take (dead or injured species) immediately to the Contracting Officer. The Contracting Officer shall consult with U.S. Fish and Wildlife Service immediately in the event of incidental take in the form of direct mortality through accidental death of a California least tern, western snowy plover, or California brown pelican. Operations may be stopped if it is suspected that the impact of the taking causes an irreversible and adverse impact on the species.

3.4.3 Beach Placement Construction Window

Impacts to the California least tern and grunion shall be avoided by limiting operations at the Hueneme Beach placement area to the period between 30 September and 15 March of each year of operations. Other work conducted in the federal channels, turning basin, and U.S. Navy and OHD wharf areas is not subject to this restriction.

If beach placement activities extend beyond 15 March then the zone of beach placement shall be restricted to a fixed position (clearly marked and visible, using flagging or similar method) that is 500 feet in width and extending offshore. Lateral movement of the outfall shall, in this case, only occur when seaward extension of the hydraulic pipeline is no longer feasible and only when the placed material will still remain within the 500-foot-wide zone.

3.5 CAULERPA TAXIFOLIA

Prior to dredging, the Contractor shall perform a survey for *Caulerpa taxifolia* covering the entire project area.

The Contractor shall submit the name and qualifications of the *Caulerpa taxifolia* Survey Firm to be hired to conduct the *Caulerpa taxifolia* survey for acceptance by the Contracting Officer. Work shall not proceed until the Contracting Officer has provided written approval of the selected firm.

The Contractor shall, not earlier than 90 days and not later than 30 days prior to the start of dredging in the above listed areas, survey the project area for the presence of *Caulerpa taxifolia*. This survey shall be conducted in accordance with the "Caulerpa Control Protocol" published by the National Marine Fisheries Service, [http://swr.nmfs.noaa.gov/hcd/ccpv1.htm]. The level of survey shall be surveillance, and shall cover the entire project area. Results of the *Caulerpa taxifolia* survey shall be submitted to the Contracting Officer prior to the start of construction. If *Caulerpa taxifolia* is detected, all construction activity shall cease and shall not resume until written approval is provided by the Contracting Officer.

3.6 PROTECTION OF AIR RESOURCES

3.6.1 Construction Activities

Special management techniques as set out below shall be implemented to control air pollution by the construction activities. These techniques supplement the requirements of Federal, State, and local laws and regulations, and the safety requirements under this Contract. If any of the following techniques conflict with the requirements of Federal, State, or local laws or regulations, or safety requirements under this contract, then those requirements shall be followed in lieu of the following.

The Contractor shall keep construction activities under surveillance, management and control to minimize pollution of air resources.

3.6.2 Particulates

Airborne particulates, including dust particles, from construction activities and processing and preparation of materials shall be controlled at all times, including weekends, holidays, and hours when work is not in progress. The Contractor shall maintain all excavations, stockpiles, haul roads, permanent and temporary access roads, plant sites, disposal sites, borrow areas, and all other work areas free from airborne dust which would cause a hazard or nuisance.

3.6.3 Other Air Pollutants

Hydrocarbons and Carbon Monoxide - Hydrocarbons and carbon monoxide emissions from equipment shall be controlled to Federal and State allowable limits at all times.

Odors - Odors shall be controlled at all times for all construction activities, processing, and preparation of materials.

Monitoring of air quality shall be the responsibility of the Contractor. All air areas affected by the construction activities shall be monitored by the Contractor.

3.6.4 Air Quality Management District

All activities, equipment, processes, and work operated or performed by the Contractor in accomplishing the specified construction shall be in strict accordance with the Ventura County Air Pollution Control District permit requirements and all Federal emission and performance laws and standards. The Contractor shall obtain a Permit to Operate from the Ventura County Air Pollution Control District prior to commencement of work, pay all associated fees, and follow all permit requirements. Point of contact for VCAPCD is Keith Duval, (805) 645-1410. The Contractor should schedule suitable time to acquire appropriate VCAPCD permits, waivers or credits.

Construction equipment shall be properly maintained to minimize release of diesel and hydrocarbons effluent. The Contractor shall follow all air quality standards.

3.6.4.1 Resource Commitments

Air Quality. The Contractor shall comply with Ventura County's Air Pollution Control District (VCAPCD) Ordinances. Listed below are applicable measures to comply with the VCAPCD ordinances.

a. Maintaining equipment in tune as per manufacturer's specifications.

b. Utilizing catalytic converters on any gasoline-powered equipment.

c. Utilizing selective catalytic reduction (SCR) and ammonia injection on any tugs.

d. Retarding engine timing by 2 degrees, where applicable.

e. Installing high pressure fuel injectors.

f. Using reformatted, low-emissions diesel fuel.

g. Substituting gasoline-powered for diesel-powered equipment where feasible.

h. Equipment will not be left idling for prolonged periods.

i. Curtailing (ceasing or reducing) construction during periods of high ambient pollutant concentrations (e.g., State I smog alerts).

j. Using equipment that is currently permitted within VCAPCD.

3.7 NOISE

a. The Contractor shall designate a disturbance coordinator responsible for responding to noise complaints. His/her name and telephone number shall be clearly posted at the construction site. It is the responsibility of the disturbance coordinator to respond to complaints, determine the cause, and implement measures to mitigate the noise impact as well as notify the Contracting Officer of any complaints received and action taken.

The disturbance coordinator shall maintain a log of complaints with the following information:

Name of caller
Phone # and address of caller
Date and time of call
Caller's complaint, and the response to the caller.

b. All internal combustion powered equipment shall be equipped with properly operating mufflers and kept in a proper state of tune to alleviate back-fires. Engines, if exposed, shall be fitted with protective shrouds to reduce motor noise.

c. All portable and support equipment shall be located as far as possible from any sensitive areas. The Contractor shall use, where feasible, electricity from the local power grid to avoid the use of portable generators.

d. Noise levels of the dredge operation shall not exceed the limits established by the Ventura County's Noise Ordinance.

e. Construction equipment shall be properly maintained and scheduled to minimize nuisance and unsafe noise effects to sensitive biological resources, residential areas, and socio-economic (tourist) environments.

3.8 INSPECTION REQUIREMENTS / FOLLOW UP ACTIONS

If the Contracting Officer notifies the Contractor in writing of any observed noncompliance with contract requirements or Federal, State, or local laws, regulations, or permits, the Contractor shall inform the Contracting Officer of proposed corrective action and take such action to correct the noncompliance. If the Contractor fails to comply promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action is taken. No time extensions will be granted or costs or damages allowed to the Contractor for any such suspension.

The Contractor shall promptly inform the Contracting Officer of the Environmental Protection Plan's non-compliance activities and proposed action to be taken to correct such activities.

3.9 MAINTENANCE OF POLLUTION CONTROL FACILITIES

The Contractor shall maintain all constructed pollution control facilities and portable pollution control devices for the duration of the Contract or for the length of time construction activities create the particular pollutant.

3.10 TRAINING OF CONTRACTOR PERSONNEL

Prior to construction, the Contracting Officer will conduct a meeting with Contractor representatives to review permit requirements and environmental compliance issues. The Contractor will then be responsible for ensuring that all Contractor personnel are sufficiently trained in environmental protection and pollution control. The Contractor shall conduct environmental protection/pollution control meetings for all Contractor personnel. The training and meeting agenda shall include methods of detecting and avoiding pollution, familiarization with pollution standards, both statutory and contractual, installation and care of facilities (vegetative covers, etc.), and instruments required for monitoring purposes to ensure adequate and continuous environmental protection/pollution control. Anticipated hazardous or toxic chemicals or wastes, and other regulated contaminants, shall also be discussed. Other items to be discussed shall include recognition and protection of archaeological sites and artifacts, as well as protection of western snowy plover, California brown pelican, marine mammals, grunion and least tern.

-- End of Section --

SECTION 02020

DREDGING AND SEDIMENT PLACEMENT
05/08

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 1110-1-1003	(July 2003) NAVSTAR Global Positioning System Surveying
EM 1110-2-1003	(January 2002) Hydrographic Surveying

1.2 SUBMITTALS

The following shall be submitted in accordance with SECTION 01330 SUBMITTAL PROCEDURES:

SD-01 Preconstruction Submittals

Dredge, Backfill and Placement Plan G

Documentation of Independent Hydrographic Survey Firm G

SD-03 Product Data

Beach Nourishment Information

SD-04 Samples

Sediment Samples

SD-06 Test Reports

Daily Report of Operations

Progress Surveys

CAD Site Placement Records

Post-Excavation Survey of CAD

Post-Dredging Survey No. 1

Post-Dredging Survey No. 2

Contracting Officer approval is required for all submittals with a "G" designation.

1.3 REQUIRED WORK

1. Excavation of the CAD and placement of material on Hueneme Beach
2. Performing post-excavation survey of CAD site
3. Dredging of contaminated sediments from U.S. Navy Wharves and USACE Hotspot 2 and placement of materials in CAD pit
4. Dredging of contaminated sediments from OHD Wharves 1 and 2 and USACE Hotspot 3 and placement of materials in CAD pit
5. Backfilling of U.S. Navy and OHD Wharves in conjunction with dredging operations
6. Dredging of USACE Hotspot 1 and placement of materials in CAD pit
7. Performing Post-Dredge Survey No. 1
8. Dredging of Operation and Maintenance material from the Federal Channel (turning basin, entrance channel, approach channel) and placement of materials in the CAD pit
9. Performing Post-Dredge Survey No. 2

In the area to be dredged, all materials shall be removed and disposed of as indicated. Should material which cannot be removed without unreasonable methods be encountered, the Contractor shall remove all overlying material which in the judgment of the Contracting Officer Representative can be removed. Nothing in this paragraph shall be construed as prohibiting the removal of excepted material by special means at prices agreed upon and approved in accordance with the CONTRACT CLAUSE: DIFFERING SITE CONDITIONS. The dredging area shall be dredged to the indicated depths below mean lower low water (MLLW). Debris shall become the property of the Contractor and shall be removed from the site.

1.4 AVOIDANCE OF EXISTING CONSTRUCTION

The Contractor shall conduct dredging operations in such a manner as to prevent undermining or damage to the breakwaters, jetties, revetments, and wharves. Excessive or unnecessary dredging may result in an unstable condition at the toe of the structures. The Contractor shall strictly adhere to the indicated dredging template, restrictions, and durations when working near any structures, and shall be responsible for repairing any damage which may result from failure to comply with the requirements of these specifications or their own operations.

1.5 CHARACTER OF MATERIALS

In general, the upper 1 to 2 meters of material to be removed from Port Hueneme Harbor is classified as grey to black, loose to medium dense, silty to very silty fine-grained sand with some shell hash and woody debris. It has an occasional surface layer of soft black silt. Overall, the materials that appears in the upper 1 to 2 meters of most of the site is defined herein as a “maintenance-type” material, since it appears to be recently deposited and low in strength.

Materials below this surface layer consist of primarily clean, light-colored, dense to very dense sands and silty sands, which appears to be a native, virgin material. The sand is typically poorly graded sand with less than 5 percent passing the No. 200 sieve. Moisture content of the sediments ranges from 24.5% to 38%. The organic carbon content ranges from 0.55% to 0.9% (dry weight measurement).

Subsurface materials in the CAD excavation area largely consist of a fairly consistent sequence of dense to very dense, slightly silty to silty, medium to fine sand with occasional thin (less than 1 foot thick) clay layers. Occasional cobbles, trace gravels, and shell fragments may be present. Laboratory testing of grain size distribution on composite samples indicated a sand content of 92 to 93 percent by weight. Chemical analyses were not conducted on these materials because they are native in origin and expected to be essentially free of any significant contamination sources. Blow counts have not been obtained for these materials, but geotechnical boring in adjacent upland areas indicate that this geologic unit is in a dense to very dense condition.

Chemical testing on the maintenancematerial detected elevated concentrations of the pesticide DDT, TBT, and PCBs at levels of concern above levels that have been suggested by research to cause “medium”-range adverse effects on biological resources. The material, however, is not considered to be hazardous waste, as defined by State of California Title 22 requirements.

No bedrock was encountered in any explorations conducted in the harbor, including the area and planned excavation depth of the CAD.

Based on surveys conducted in 2000, existing debris items and timber pile stubs are likely to be present in the southern portion of the Turning Basin, near OHD Wharf 1, as shown on the Plans. Other debris items which were not detected by the 2000 survey may be present elsewhere in the project area.

1.6 COORDINATION WITH HARBOR ACTIVITIES

Dredging is required along currently active wharves operated by the U.S. Navy and the Oxnard Harbor District. In many cases this dredging will be accompanied by backfilling as well. These activities shall be sequenced in such a way as to avoid disruption to ongoing wharf-related activities. The U.S. Navy will attempt to set aside a single wharf at a time, so as to make it available for the dredging and backfilling work, provided that it is provided at least 30 days’ notice of the Contractor’s sequencing and schedule. If, however, a mission critical vessel needs to use a wharf which the Contractor is working at, then the Contractor will be given 72 hours notice and will then need to move or reposition their vessels as needed to ensure that their activities do not impede that mission critical vessel’s use of the wharf.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 DREDGE, BACKFILL, AND PLACEMENT PLAN

The Contractor shall submit a Dredge, Backfill and Placement Plan indicating the methods and equipment proposed for dredging, positioning, disposing, repositioning, and maintaining the placement areas during construction operations. The plan shall be submitted to the Contracting Officer for approval, at least 30 days prior to start of dredging operations and shall also include, as a minimum, the following information:

a. Method of dredging and disposal, and name of dredge(s).

b. Order of dredging operations and layout of dredging and disposal areas, and anticipated time progress of dredging on a weekly basis.

c. Plan and sequence for segmental dredging and backfilling in dredging restriction areas along wharf faces.

d. Layout of all buoys, anchors, pipelines, and ancillary equipment. Time frame for placement of pipeline (if pipeline is used).

e. Method and equipment for transporting and placing material at the placement sites, and equipment that will be working within the CAD and on the beach.

f. A beach placement plan indicating the targeted beach width of the fill, the starting point of the fill, etc.

g. A CAD disposal plan indicating methods for placing sediments in the CAD, for reduction of resuspension of dredged material during placement of dredged material, and for minimizing intermixing of previously placed sediments in the CAD with the subsequently placed O&M surface material (used as the clean cap layer for the CAD).

h. Lighting plan for night work.

i. Layout of dredge, including: dimensions; location of engines, fuel storage, electrical/transformer rooms; description of engine types and horsepower ratings, types and size of generating equipment, fuel storage capacity, and vertical clearance. A copy of this information shall be provided to the local fire fighting agency.

3.2 METHOD OF DREDGING

The contract work will include dredging by the following methods:

- Hydraulic cutterhead with pipeline for dredging the CAD and transporting the excavated sand to Hueneme Beach
- Mechanical dredging with a clamshell bucket for the remaining sediments, with placement of dredged material on a barge, for disposal within the excavated CAD.

The following restrictions shall apply:

a. Watertight barges or scows will be required for holding and transporting dredged material from dredging operations.

b. The Contractor shall comply with all applicable federal, state, County, and municipal laws, regulations, and permits governing the work.

3.3 DREDGING SEQUENCE

The order of dredging operations and layout is presented in the Contract Plans and presented in the table below.

Dredging Order	Dredging Area	Applicable Bid Item No.	Dredge Type	Placement Location
1	CAD	2	Hydraulic	Hueneme Beach
2	USACE Hotspot 2	3B	Mechanical	CAD
3	US Navy Wharf 3	3D and 3F	Mechanical	CAD
4	US Navy Wharf 4	3D and 3F	Mechanical	CAD
5	US Navy Wharf 5	3D and 3F	Mechanical	CAD
6	US Navy Wharf 6	3D and 3F	Mechanical	CAD
7	US Navy North Harbor	3D	Mechanical	CAD
8	US Navy Wharves A & B	3D	Mechanical	CAD
9	USACE Hotspot 1	3A	Mechanical	CAD
10	USACE Hotspot 3	3C	Mechanical	CAD
11	OHD Wharf 1	3E and 3G	Mechanical	CAD
12	OHD Wharf 2	3E	Mechanical	CAD
13	USACE O&M Turning Basin	4	Mechanical	CAD
14	USACE O&M Entrance and Approach Channels (in either order)	4	Mechanical	CAD (non-contaminated cap)
15	Additional Cap Material (if required)	5	Mechanical	CAD (non-contaminated cap)_

Recent maintenance dredge history of Port Hueneme Harbor (Quantity removed):

Dec 1990 153,000 cubic meters
Feb 1999 52,000 cubic meters
Dec 2004 21,000 cubic meters

3.4 DREDGING RESTRICTION AND BACKFILL AREAS

Certain areas along the OHD and Navy wharves are identified on the Plans as Dredging Restriction and Backfill Areas. In these areas, dredging shall occur in segments not more than 30 meters in length as measured along (parallel to) the wharf face. In areas of dredging below -12.5 meters, as indicated on the Contract Plans, dredging shall occur in segments not more than 15 meters in length as measured along (parallel to) the wharf face. Segmental dredging is only necessary within a distance of 20 meters measured outward from the wharf face.

The Contractor shall perform progress surveys after dredging each segment. Using these progress surveys, dredging depths in each segment shall be approved by the Contracting Officer's Representative (COR) prior to backfilling the segment.

Backfilling operations in each segment shall be completed to the extents and top elevations shown on the Contract Plans, using a clamshell bucket to place the material, and shall be completed in each segment within 36 hours following completion of dredging in that segment.

Dredging and backfilling in Dredge Restriction Areas can be done in different segments concurrently, as long as no two immediately adjacent dredging segments are dredged at the same time. Dredging and backfilling in one segment shall be fully completed and approved by the COR before starting dredging in an immediately adjacent segment.

3.5 DEBRIS, TIMBER PILE STUBS, AND ANODE SLEDGE BEDS

The Plans show locations of debris items and apparent exposed timber pile stubs based on a 2000 survey. Any timber pile stubs that are encountered during the dredging shall be removed in their entirety, to the degree feasible, and shall become the property of the Contractor, not suitable for disposal within the CAD. Similarly, debris items more than 1 meter in size are unsuitable for disposal within the CAD.

A number of Anode Sledge Beds are known to be present near the U.S. Navy's Wharf "B", Wharf "C", and Surface Craft Berth, as shown on the Plans. These items shall be dealt with as described on the Plans.

3.6 PLACEMENT OF DREDGED MATERIAL

3.6.1 General

Dredged material shall be transported and deposited within the disposal limits of the area(s) indicated on the drawings and as specified herein after. Any dredged material that is deposited other than in the area indicated on the drawings, or as approved by the Contracting Officer, will not be included in the measurement and the Contractor may be required to remove such misplaced material and deposit it where directed at his own expense. Debris and other unsuitable materials encountered shall become the property of the Contractor and shall be removed from the site at no additional cost to the Contracting officer representative. Locations of known debris are identified on the project plans, but additional areas not specified may be encountered.

3.6.2 Placement of Material on Beach (during CAD dredging)

a. As directed by the Contracting Officer, the Contractor shall place materials dredged to form the CAD, on Hueneme Beach as shown on the plans.

b. The Contractor shall provide necessary equipment to shape the beach during fill operations. Disposal operations shall be conducted in such a manner so as to capture the maximum amount of sand and to widen the beach in the most efficient manner. Slotted discharge pipes, multiple discharge points or other approved means shall be employed to minimize loss of dredged material.

The fill elevations depicted are ideal; the actual elevation of the fill may vary 0.3 meters above or below the indicated elevations.

c. At the end of the CAD dredging and beach nourishment, the Contractor shall provide a 1-page report listing the Beach Nourishment Information, to include but not be limited to:

* start and end positions of the beachfill
* width of the beachfill
* length of the beachfill
* start and end dates of beachfill construction
* significant events or problems encountered during the beachfill (i.e any storms that eroded the beach)

3.6.3 Disposal of Contaminated Sediments in CAD (U.S. Navy Wharves, OHD Wharves, and USACE Hotspots)

a. As directed by the Contracting Officer, the Contractor shall deposit dredged material from Hotspots 1, 2, and 3, the U.S. Navy Wharf areas, and the OHD Wharf areas, within the CAD as shown on the plans, in the sequence indicated.

b. The Contractor shall provide necessary equipment to minimize resuspension of placed dredged material during placement operations. Disposal operations shall be conducted in such a manner so as to place dredged material strictly within the CAD footprint. The bottom dump barge shall be located within the limits of the CAD such that no material is deposited outside the limits of the CAD during bottom-dump placement. The Contractor shall confirm and document the barge location prior to any dump event.

c. The bottom dump barge shall be opened gradually and in a controlled manner to minimize mixing of freshly placed material with previously placed material.

d. The Contractor shall place material in individual lifts across the entire footprint of the CAD. Each lift shall not be more than 2 meters in thickness Upon completion of each lift, it shall have no more than a 0.5 meter variation in its surface elevation.

e. CAD Site Placement Records: For CAD site placement, the Contractor shall record scow disposal information. A spreadsheet shall be submitted to the Contracting Officer's Representative listing:

* disposal number;
* barge identification;
* date;
* time of disposal, recorded to the nearest minute;
* easting and northing of disposal;
* quantity of disposal (cubic meters);
* cumulative quantity;
* area from which the load was dredged (i.e. Hot Spot 1).

Cumulative	Area Dredged

Dump #	Date	Time	Easting	Northing	Qty	Qty	(Station)

The spreadsheet shall be produced in Microsoft Excel and e-mailed to the Contracting Officer's Representative daily during CAD Disposal operations, with Cc:joseph.a.ryan@usace.army.mil.

The heading of the spreadsheet shall include the following:
CAD Disposal
Port Hueneme Dredging

f. At a minimum, progress surveys shall be conducted at the end of each lift of material placed in the CAD, for approval by the COR. Additional progress surveys may be requested by the COR.

3.6.4 Disposal of USACE Operation and Maintenance Material

Operation and Maintenance material from the USACE Federal Channel shall be dredged and placed in the CAD site as a non-contaminated cap over the underlying sediments. This material shall be placed in the same manner as described in above Section 3.4.3 with the following exception:

Operation and Maintenance material shall be placed in individual lifts not exceeding 1 meter in thickness across the footprint of the CAD and with no more than a 0.5-meter variation in the top surface.

After completion and approval of Operation and Maintenance Dredging in the Turning Basin, Entrance Channel, and Approach Channel, the COR will determine if the layer of clean O&M material within the CAD is sufficient to meet the minimum clean cap thickness of 3 meters. If not, the COR may elect to require additional dredging of material from the identified available excavation area within the Turning Basin, and the placement of this material within the CAD.

3.7 ADDITIONAL MONITORING

3.7.1 Hydraulic Dredges and Hopper Dredges

The Contractor shall provide:

a. Continuous records of measurement of bulk density and mass flow rate with time, and location - cutterhead / draghead coordinates (horizontal and vertical). Data shall be recorded electronically and shall be made available in time increments as designated by the Contracting Officer and in either printed record or electronic format as designated by the Contracting Officer.

b. Records of continuous loading of hoppers, barges, or scows based on hull displacement (load charts).

These records shall be submitted to the Contracting Officer daily with the Quality Control Reports.

3.7.2 Barges and Scows

The Contractor shall provide a record of the measurements of the draft of the hull and freeboard of bins of each barge or scow when empty and prior to placement operations. Measurement for displacement shall be taken at each corner, on the outside of the barge or scow, immediately before the start of a placement operation. These records shall be submitted to the Contracting Officer daily with the Quality Control Reports.

3.8 OVERDEPTH AND SIDE SLOPES

3.8.1 Overdepth and Excessive Dredging

To cover inaccuracies of the dredging process, an allowable overdepth of 0.5 meters applies to this contract. Excessive dredging in the CAD area will be non-payable. For all other dredging, material dredged from below the allowable overdepth will be considered excessive dredging and will be deducted from the total amount dredged (with the exception of dredging to obtain material that will be re-used as backfill). This restriction is necessary because of the fact that there is limited capacity to store sediments within the CAD, and because excessive removal of material in front of wharf structures could lead to undermining. Materials dredged from below the allowable depth limit, which result in extra costs, shall be the responsibility of the Contractor.

3.8.2 Side Slopes

Side slopes for the CAD excavation, and for the western side of Hotspot No. 1, shall be dredged to the inclinations depicted on the contract drawings, with an allowable overdepth of 0.5 meters.

For all other dredged areas, final side slopes shall not be flatter than those indicated on the drawings and will be estimated at the indicated slope inclination of 3:1 and paid for. The Contractor may dredge material at the bottom of the slope to allow for sloughing of upslope material capable of falling into the cut (box dredge). Material removed below any pay slope plane will not be estimated for payment. In computing the limiting amount of side slope dredging, the overdepth indicated on the drawings, measured vertically, will be used. The quantity of material to be paid for shall not be in excess of that originally lying above this limiting slope. Side slopes are given for pay purposes only and are not necessarily the angle of repose of the soil. Sloughing side slopes shall not be the basis for claims against the Contracting Officer. End slopes, where indicated on the drawings, shall be treated in the same manner as side slopes.

Along the wharves, the Contractor shall not encroach within the specified dredge limits. In those areas, it is acceptable for the side slopes to form their own slope.

3.9 SAMPLING OF MATERIAL

During CAD excavation and beach disposal, the Contractor shall obtain representative Sediment Samples at the discharge point as material is being discharged onto the beach, or in the case of a hopper dredge or clamshell-scow operation, as material is placed into the hopper bin or scow. The exact location and depth of each sample shall be as directed by the

Contracting Officer during the dredging operation. The number of required samples shall be taken as follows:

Area	Number of Samples Required
Port Hueneme CAD Area	5

The samples shall be taken at evenly spaced intervals of time and volume as the CAD is dredged. Each sample (with free water removed) shall be at least one (1) liter or larger, and shall be placed in clear plastic bottles. The sample bottles shall be labeled in indelible ink with the sample number, date sampled, and name of person obtaining sample. Sample bottle lids shall be securely fastened to prevent spillage or leakage during shipment. Sample bottles shall be placed in a suitable shipping container with adequate cushioning to prevent breakage during shipment. The samples shall be delivered to the address specified herein below at weekly intervals, or at such other times as may be determined by the Contracting Officer.

A Dredge Sample Data Form with the description of the dredge cut location by coordinates and stationing, dredge cut elevation, placement location and description of where sample was taken, date, time, sample number, and the name of the person who collected the sample shall accompany each sample. The sample form shall be placed in a waterproof sealed plastic bag for protection during shipment. A copy of a sample form is provided at the end of this section.

A copy of the sample form shall be submitted to the Contracting Officer's Representative along with the transmittal form.

The Contractor shall notify the COR 48 hours in advance of sample collection. Samples shall be delivered to:

Corps of Engineers
Prado Dam Quality Assurance Laboratory
2493 Pomona-Rincon Road
Corona, CA 92880
Attn: Jim Miller Tel: (951) 898-6182

3.10 ADDITIONAL DREDGING (IF REQUIRED)

Full removal of contaminated materials from the U.S. Navy Wharves, Hotspot 2, OHD Wharves, Hotspot 3, and Hotspot 1, as shown on the Contract Plans, will be verified by the Contracting Officer's Representative (COR) after dredging in each area has been completed to the extents and depths specified on the Contract Plans (subject to the approval of the COR). This verification will be accomplished through a series of confirmatory samples of the remaining sediment surface, intended to determine whether chemically impacted sediments have been adequately removed from the individual dredged areas represented by each sample.

Based on this evaluation, the COR may require an additional round of re-dredging in selected areas of the site. Should additional dredging be required, it will be payable at the unit contract bid price for Bid Item No. 3H, "Additional Dredging With CAD Disposal (if required)".

Additional dredging (if required) shall occur after the required dredging of contaminated sediment areas is completed, and the depths and extents approved by the COR. After the additional dredging, if any, is completed to the COR's satisfaction, the COR may elect to perform another round of confirmatory sampling, subject to the same clauses and requirements as stated above. Additional dredging that may be required as a result of this additional sampling round will be payable at the unit contract bid price for Bid Item No. 3H, "Additional Dredging With CAD Disposal (if required)".

The Contractor shall be prepared to allow for a time period of 10 working days after completion of dredging in a given area, for the COR to perform this evaluation of whether additional dredging is needed. The Contractor shall not consider these time periods to constitute a delay to their work.

3.11 CONTRACTOR'S HYDROGRAPHIC SURVEYS

3.11.1 CAD and Turning Basin Surveys

a. The Contractor shall be responsible for performing the following hydrographic surveys, utilizing an independent hydrographic survey firm:

- Post-excavation survey of CAD. This survey shall cover the entire CAD area and shall also include the adjacent areas to a distance of at least 20 meters beyond the top of the excavated slopes. This survey will be used by the COR as the basis for payment for Dredging of CAD with Beach Placement.
- Post-Dredging Survey No. 1. This survey shall be conducted after all contaminated sediment has been placed in the CAD, as approved by the COR, and shall encompass the entire Turning Basin (including CAD area), U.S. Navy areas, and OHD Wharf areas.
- Post-Dredging Survey No. 2. This survey shall be conducted after all capping material has been placed on the CAD, as approved by the COR, and shall encompass the entire Turning Basin, adjacent dredged side slopes, U.S. Navy areas, and OHD Wharf areas.

The COR may direct the Contractor to perform additional surveys if conditions warrant.

b. The CAD and Turning Basin Surveys shall be 100% coverage and shall use multi-beam equipment.

c. Products: The following products from the CAD and Turning Basin Surveys shall be provided by the Contractor for each survey within one day of the survey being conducted:

- a. Plot of representative soundings at a plot scale of 1:1000
- b. Contours shown every 1 meter
- c. x,y,z data files

Each plot of soundings shall be converted into a pdf file and transmitted electronically to Joe Ryan at the USACE (joseph.a.ryan@usace.army.mil), and copied to the COR, along with the x,y,z data files.

3.11.2 Daily Progress Surveys

The Contractor shall be responsible for performing daily progress surveys for each day of dredging, backfilling, and/or placement of material within the CAD. The daily progress surveys may, at the Contractor’s option, be performed using the Contractor’s own equipment and crews. The Contractor's daily progress surveys shall use multi-beam equipment and shall provide full coverage of all areas dredged or receiving placed sediment (i.e. the CAD area or backfill areas) during that day.

Contractor's progress surveys shall be performed electronically (automated) and the data shall be submitted electronically to the Contracting Officer in delimited files of easting, northing, and depth (x,y,z), where the depth is indicated as negative if recorded below MLLW, the horizontal position is given in State Plane Coordinates System Based on the California Lambert Conformal Projection System for Zone 5 (SPCS 83 Meters). The first lines of the data file will list the information as follows:

- Project Name (Maintenance Dredging and Confined Aquatic Disposal, Port Hueneme, CA)
- Surveyor's Name and Company
- Area Surveyed
- Type of Survey and Date of Survey (i.e. Progress Survey, 09/22/2008)
- Vertical Datum / Control utilized
- Horizontal Datum
- Tide Gage Location

These first 7 lines will be preceded by an asterisk (*), which indicates a comment line.

A plot of representative soundings shall be created using the x,y,z data, at a plot scale of 1:1000, and all data shall be collected and plotted in metric units (meters). All survey data (x,y,z) files and plots of soundings (in pdf form) shall be submitted electronically to the COR within one day of the progress survey’s completion.

Progress payments or evidence (condition surveys) supporting extreme weather (storm) related shoaling, will be based upon Contractor's daily hydrographic progress surveys, provided that the Contractor's progress surveys clearly show the condition before and after each shoaling event and the condition after removal of material from the shoaled area. Survey data that does not meet all applicable requirements and quality assurance verifications will not constitute a valid request for payment of shoaling.

3.11.3 Sounding Data Standards

The Contractor's hydrographic surveys shall meet or exceed the survey standards listed in EM 1110-2-1003 (Hydrographic Surveying). Surveys shall be in the State Plane Coordinate System of 1983 - meters (SPCS 83), Zone 5, State of California, and be performed by an independent hydrographic survey contractor with at least three (3) years of experience in hydrographic surveying of navigable channels and have either a current Land Surveyor's or a Professional Engineer's license, authorized to certify surveys in the State of California. The Hydrographic Surveyor firm selected by the Contractor must be approved by the Contracting Officer prior to performing surveys for this contract.

3.11.4 Positioning System

Hydrographic surveys shall be conducted using an Automated Range-Azimuth Positioning System or Differential Global Positioning System (DGPS), with positional accuracy of +/- 1 meter or exceed the survey standards listed in EM 1110-1-1003 and EM 1110-2-1003 (Hydrographic Surveying) that is linked to an automated (digital) depth recording device capable of continuous logging of x,y,z positional data with depth measurement resolution to the nearest five-hundredths (5/100) of a meter. Digital depths shall be supplemented by analog depth records if survey is performed by single beam echosounder. Sounding lines shall be verified by crosslines at least 10 percent of the principal lines and along the centerline of channel. Distance between successive soundings (sounding interval) shall be no more than 1 meter. Soundings shall be reduced to sounding datum (Mean Lower Low Water) by using actual tides and other appropriate corrections resulting in an accuracy of +/- 0.1 meters from actual depth.

3.11.5 Acceptance of Independent Hydrographic Survey Firm

For the Contracting Officer to approve the selected independent hydrographic survey firm, the Contractor must provide documentation indicating that modern electronic horizontal positioning and sounding system equipment will be used for the surveys, as well as documentation verifying the experience of the operators using the equipment. Typical information that will be required, as a minimum, includes the name, model, and year of manufacture of the electronic equipment, the electronic frequencies of the horizontal positioning equipment and sounding equipment, and the manufacturer's stated positioning and sounding accuracies, and capability of the equipment proposed for usage. In addition, the Contractor must provide information that a safe and suitable vessel meeting U.S. Coast Guard requirements is available and will be used for operation in the waters where the surveys are to be performed. The Contractor shall submit credentials / qualifications as evidence that qualified, experienced staff are available and will be used for the operation of the vessel as well as for the electronic positioning and sounding equipment.

3.11.6 Data Processing

The Contractor shall use a Data Processing System or software that is capable of mapping the sounding data and calculating quantities. The Data Processing system shall be capable of importing reduced sounding data and using it to create cross-sections that can be compared to dredge templates, and calculating volume quantities. The software shall be capable of digital terrain modeling and shall produce, as a minimum, sounding sheets, cross section profiles, 3-dimensional area profiles, and quantity volume calculations using the Triangulated Irregular Network (TIN) method.

3.12 PRE-DREDGE AND FINAL SURVEYS

The Contractor shall notify the Contracting Officer not less than 30 calendar days prior to the scheduled commencement of dredging. The Contracting Officer will then perform a pre-dredge survey of Port Hueneme Harbor (USACE, US Navy and OHD dredge areas) based upon the Contractor's scheduled commencement date.

For the final survey, the Contractor shall notify the Contracting Officer not less than ten (10) working days prior to completion of armor stone placement on the CAD. The Contracting Officer will perform the final survey as soon as possible after completion of the dredging and capping work, generally within 10 (ten) calendar days. All areas found to be in compliance with the contract requirements will be accepted and measured for payment in accordance with SECTION 01270 Measurement and Payment.

If the Contracting Officer is unable to perform the final survey(s) due to the failure of the Contractor to complete the work in accordance with his prior notification, the Contracting Officer will charge the cost of the survey plant and standby labor, at $3,000.00 per day, to the Contractor. Preliminary data from the final Contracting Officer survey will be available within ten (10) calendar days. If the preliminary survey data indicates that the dredged area is not at the required depth, the Contractor will be directed to resume dredging and to complete the work to project depth. Adjustment in cost for additional Contracting Officer post-dredge surveys shall be as specified in paragraph: FINAL EXAMINATION AND ACCEPTANCE.

3.13 METHOD OF SOUNDINGS

The material removed will be measured by cubic meter in place, by means of surveys taken before and after dredging. The Contracting Officer intends to perform pre-dredge and post-dredge surveys utilizing multi-beam swath methods. However, the Contracting Officer reserves the right to take soundings by any methods, including: lead line, trigonometric leveling (total station)/differential leveling, 200 kHz single-beam acoustic methods, acoustic multi-beam swath methods. Results of soundings by any of these methods, singularly or in combination, will be the basis for payment. The Contractor has the option of being present when such soundings are made.

3.14 SHOALING

If, before the contract is completed, shoaling occurs in any section (area) previously accepted, including shoaling in the finished channel, because of the natural lowering of the side slopes or from sediments transported inside the project area, re-dredging at contract price, within the limit of available funds, may be done if agreeable to both the Contractor and the Contracting Officer.

3.15 REPORTING REQUIREMENT

The Contractor shall prepare and maintain a Daily Report of Operations and furnish copies thereof to the Contracting Officer's representative, along with that day’s Progress Survey(s). The daily reports shall document dredging operations for all shifts in a 24-hour period. Further instruction on the preparation of the report will be furnished at a pre-construction conference. Copies of sample submittals are provided at the end of the Contractor's Quality Control section.

3.16 FINAL EXAMINATION AND ACCEPTANCE

Interim acceptance of individual dredge areas to be done based on Contractor’s progress surveys does not preclude Contracting Officer from requiring additional dredging based on final post-dredge survey and to adjust pay quantities.

As soon as practicable after the completion of the CAD excavation and again after completion of the dredging and capping work, a final examination of the said work will be conducted by the Contracting Officer. Should any shoals, lumps, or other lack of contract depth be disclosed by these examinations, the Contractor will be required to remove same dredging at the contract rate for dredging. However, if the bottom is soft and the shoal areas are small and form no material obstruction to navigation, the removal of such shoal may be waived by the discretion of the Contracting Officer. The Contractor or his authorized representative will be notified when soundings are to be made, and will be permitted to accompany the survey party. When the areas are found to be in a satisfactory condition, they will be accepted finally. Should more than two sounding operations by the Contracting Officer over an area be necessary by reason of work for the removal of shoals disclosed at a prior sounding, the cost of such third and any subsequent sounding operations will be charged against the Contractor at the rate of $3,000.00 per day for each day in which the Contracting Officer plant is engaged in sounding and/or is en route to or from the site or held at or near the said site for such operations.

Final acceptance of the whole or a part of the work and the deductions or corrections of deductions made thereon will not be reopened after having once been made, except on evidence of collusion, fraud, or obvious error, and the acceptance of a completed section shall not change the time of payment of the retained percentages of the whole or any part of the work.

Dredge Sample Data Form

MAINTENANCE DREDGING AND CONFINED AQUATIC DISPOSAL, PORT HUENEME, CALIFORNIA

Contract No.:______________________________ Sample No.:

Contractor Name:______________________________ Date:

Name of Dredge:______________________________ Time:

Type of Dredge: ___Hydraulic Cutterhead ___other

If other, specify:

Cut Location

area: _________________________ northing: __________________________

station: _________________________ easting: ___________________________

range: _______________________

elevation: _______________________

Placement Location

area: _________________________ northing: __________________________

station: _________________________ easting: ___________________________

range: _______________________

elevation: _______________________

Sample Obtained By:

Sample Obtained From:

Note: A copy of this completed form shall accompany the sample when shipped to the laboratory for testing, a copy of this completed form shall be faxed to Joe Ryan at (213) 452-4248 or emailed to joseph.a.ryan@usace.army.mil and a copy to be provided to the Contracting Officer's Representative."

-- End of Section --

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SECTION 02380

ARMOR ROCK
06/03

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

American Society for Testing and Materials (ASTM)

ASTM C 88 (1990)	Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
ASTM C 127 (1988)	Specific Gravity and Absorption of Coarse Aggregate
ASTM C 131 (1989)	Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 295 (1990)	Petrographic Examination of Aggregates for Concrete
ASTM C 535 (1989)	Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM D 1141 (1998)	Substitute Ocean Water
ASTM D 3740 (2001)	Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D 4791 (1995)	Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D 4992 (2001)	Standard Practice for Evaluation of Rock to be Used for Erosion Control
ASTM D 5313 (1997)	Standard Test Method for Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditions
ASTM E 548 (1994)	General Criteria Used for Evaluating Laboratory Competence
ASTM C 295	(1990) Petrographic Examination of Aggregates for Concrete
ASTM C 535	(1989) Resistance to Degradation of Large-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM D 1141	(1998) Substitute Ocean Water

ASTM D 3740	(2001) Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM D 4791	(1995) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D 4992	(2001) Standard Practice for Evaluation of Rock to be Used for Erosion Control
ASTM D 5313	(1997) Standard Test Method for Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditons
ASTM E 548	(1994) General Criteria Used for Evaluating Laboratory Competence

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 1110-1-1003	(July 2003) NAVSTAR Global Positioning System Surveying
EM 1110-2-1003	(January 2002) Hydrographic Surveying

CORPS OF ENGINEERS (COE)

COE CRD-C 148	Accelerated Expansion
COE CRD-C 169	(1993) Resistance of Rock to Wetting and Drying

1.2 SUBMITTALS

Government approval is required for all submittals with a "G" designation; submittals not having a "G" designation are for information only. When used, a designation following the "G" designation identifies the office that will review the submittal for the Government. The following shall be submitted in accordance with Section 01330 SUBMITTAL PROCEDURES:

a. SD-06 Armor Rock Material Characteristics Test Results

b. SD-01 Armor Rock Placement Plan; G

c. SD-10 Operation and Maintenance Data Daily Reports

1.3 REQUIRED WORK

The work includes furnishing all labor, equipment, and materials necessary to place Armor Rock in the CAD area, as described on the Contract Plans and in these Specifications.

A 1-meter-thick layer of Armor Rock will comprise the uppermost layer of the Confined Aquatic Disposal (CAD) cap as specified and as shown on the Contract Plans. The Armor Rock will be underlain by cap material (previously dredged and placed operational and maintenance materials) described in Section 02020 and as shown in the Contract Plans.

1.4 AVOIDANCE OF EXISTING CONSTRUCTION

1.4.1 Existing Breakwaters, Jetties, and Wharves

The Contractor shall conduct placement operations in such a manner as to prevent damage to existing structures. The Contractor shall strictly adhere to the indicated Armor Rock placement template when working near any structures, and shall be responsible for repairing any damage which may result from failure to comply with the requirements of these specifications or from Contractor’s operations.

1.5 QUALITY CONTROL

The Contractor shall provide testing and inspection services, as required. Sampling and testing to ensure compliance with the Contract provisions Section 01451 – Contractor Quality Control of these Specifications and are the Contractor’s responsibility. The Engineer reserves the right to require additional testing as deemed necessary.

1.6 DAILY REPORTS

The Contractor shall prepare and maintain a Daily Report of Armor Rock construction, locations, and operations and furnish copies thereof to the Engineer on the day after the activity. At a minimum, information to be included in the report is the date, period covered by the report, equipment used, description of activity as identified by stationing and offset, quantity of materials placed that day and to date as identified by barge displacement, downtime and delays to the operation, safety, and other relevant comments concerning the conduct of the operation. The report shall include the results of all inspections, surveys, and monitoring activities and shall be signed by the Contractor's quality control manager.

PART 2 PRODUCTS

2.1 ARMOR ROCK

2.1.1 General

The Contractor shall make all arrangements, pay all royalties, and secure all permits for the procurement, furnishing and transporting of Armor Rock. The Contractor shall vary the quarrying, processing, loading and placing operations to produce the sizes and quality of Armor Rock specified. If the Armor Rock material being furnished by the Contractor does not fully meet all of the requirements of these specifications, the Contractor shall furnish, at no additional costs to the Government, other Armor Rock material meeting the requirements of these specifications.

All Armor Rock stone shall be obtained from bedrock deposits and shall be angular in shape. It shall be a durable material as approved by the Contracting Officer. In case an unlisted source is to be used, the Contractor shall show that an adequate quantity of material is available and provide quality test data. Armor Rock shall be of a suitable quality to ensure permanence. The Armor Rock material shall be free from cracks, blast fractures, bedding, seams and other defects that would tend to increase its deterioration from natural causes. Inspections for cracks, fractures, seams and defects shall be made by visual examination. If, by visual examination, it is determined that 10 percent or more of the rock produced contains hairline cracks, then all rock produced by the means and measures which caused the fractures shall be rejected. A hairline crack that is defined as being detrimental shall have a minimum width of 0.1 mm and shall be continuous for one-third the dimension of at least two sides of the stone. The rock shall be clean and adequately free from all foreign matter. Any foreign material adhering to or combined with the rock as a result of stockpiling shall be removed prior to placement.

2.1.2 Sources of Armor Rock

Armor Rock shall be furnished from any of the sources listed in paragraph 2.1.3.1. or at the option of the Contractor may be furnished from any other source proposed by the Contractor and accepted by the Contracting Officer, subject to the conditions herein stated. If the Contractor proposes to furnish Armor Rock from a source not currently listed in paragraph 2.1.3.1 the Government will conduct a quarry investigation and evaluate the quality test data provided by the contractor to determine whether acceptable Armor Rock can be produced from the proposed source. Satisfactory service records on other work may be acceptable. In order for Armor Rock to be acceptable on the basis of service records, rock of a similar size must have been placed in a similar thickness and exposed to similar marine conditions as are anticipated for this contract, and must have satisfactorily withstood such weathering for a minimum of 5 years. If no such records are available, the Government will require the Contractor to conduct tests at the Contractor's expense to assure the acceptability of the rock. In addition to an acceptable 5 year service record, the Contracting Officer has the option to elect to have representative samples taken and tested at the Contractors expense.

2.1.3.1 List of Sources

On the basis of information and data available to the Contracting Officer, Armor Rock meeting the quality requirements of these specifications has been produced from Connolly-Pacific's Pebbly Beach Quarry located near Avalon on Santa Catalina Island. Other sources (both offshore and on-land) may be appropriate as well.

2.1.3.2 Selection of Source

The Contractor shall designate in writing only one source or one combination of sources from which the Contractor proposes to furnish Armor Rock.

It is the Contractor's responsibility to determine that the Armor Rock source or combination of sources selected is capable of providing the quality, quantities and gradation needed and at the rate needed to maintain the scheduled progress of the work. Samples for acceptance testing shall be provided in accordance with paragraph EVALUATION TESTING below. If a source for Armor Rock so designated by the Contractor is not accepted for use by the Contracting Officer, the Contractor may propose other sources at no additional cost to the Government.

2.1.3.3 Source Authorization

Before any Armor Rock is produced from a source for completion of the work under this contract, the source of Armor Rock must be authorized by the Contracting Officer's Representative. Authorization of a Armor Rock source shall not be construed as a waiver of the right of the Government to require the Contractor to furnish Armor Rock which complies with these specifications.

2.1.3.4 Acceptance of Materials

Acceptance of a source of Armor Rock is not to be construed as acceptance of all material from that source. The right is reserved to reject materials from certain localized areas, zones, strata, or channels, when such materials are unsuitable for use as Armor Rock, as determined by the Contracting Officer. The Contracting Officer also reserves the right to reject individual units of produced specified materials in stockpiles at the quarry, all transfer points, and at the project construction site when such materials are determined to be unsuitable. During the course of the work, the Armor Rock may be tested by the Contracting Officer, if the Contracting Officer determines that testing is necessary. If such tests are determined necessary, the testing will be done in a commercial laboratory selected by the Contractor and approved by the Contracting Officer. Any and all materials

produced from a listed or unlisted source shall meet all the requirements herein. The cost of all testing will be at the Contractor's expense.
During the contract period, both prior to and after materials are delivered to the job site, visual inspections and measurements of the Armor Rock may be performed by the Contracting Officer. If the Contracting Officer, during the inspections, finds that the Armor Rock quality, gradation or weights of stone being furnished are not as specified or are questionable, re-sampling and re-testing by the Contractor shall be required. Sampling of the delivered Armor Rock for testing and the manner in which the testing is to be performed shall be as directed by the Contracting Officer. This additional sampling and testing shall be performed at the Contractor's expense when test results indicate that the materials do not meet specified requirements. When test results indicate that materials meet specified requirements, an equitable adjustment in the contract price will be made for the sampling and testing. Any material rejected shall be removed or disposed of as specified and at the Contractor's expense.

2.1.4 Armor Rock Quality

2.1.4.1 Evaluation Testing

If the Contractor proposes to furnish Armor Rock from an unlisted source, or a listed source which has not been tested in 5 years, the Contractor shall have evaluation tests performed on Armor Rock samples collected from the proposed source. The quarry investigation shall be performed by the Contracting Officer's Representative and an engineering geologist from the Geotechnical Branch of the Los Angeles District. The tests to which the Armor Rock shall be subjected include petrographic examination ASTM C 295, bulk specific gravity (SSD), unit weight, absorption ASTM C 127, wetting and drying COE CRD-C 169 & ASTM D 5313, Abrasion L.A. Rattler-ASTM C 131 and sulfate soundness ASTM C 88, COE CRD-C 148, and X-ray diffraction ASTM C 295.

The laboratory to perform the required testing shall be approved based on compliance with ASTM E 548 and relevant paragraphs of ASTM D 3740, and no work requiring testing shall be permitted until the laboratory has been inspected and approved by the Contracting Officer's Representative.

a. Bulk Specific Gravity. All Armor Rock shall have a minimum bulk specific gravity, saturated surface dry (SSD), of 2.65 based upon water having a unit weight of 1000 kN/m3. The method of test for bulk specific gravity (SSD) shall be ASTM C 127.

b. Unit Weight and Absorption. All Armor Rock shall have an absorption less than 2 percent unless other tests and service records show that the stone is satisfactory. The method of test for unit weight and absorption shall be ASTM C 127, except the unit weight shall be calculated in accordance with Note No. 3 using bulk specific gravity, saturated surface dry.

c. Petrographic Examination. Armor Rock shall be evaluated in accordance with ASTM C 295 which shall include information required by ASTM D 4992, paragraph 10. COE CRD-C 148 shall be used to perform Ethylene Glycol tests required on rocks containing smectite as specified in ASTM D 4992 and on samples identified to contain swelling clays. See note 5 below.

d. Sulfate Soundness: In accordance with ASTM C 88; 10% maximum loss. (see Notes 3 and 4 below).

e. Abrasion - L.A. Rattler: In accordance with ASTM C 131 and ASTM C 535: 45% maximum loss after 1,000 revolutions. See Note 4.

f. Diffraction Analysis - Armor Rock shall be subjected to X-Ray diffraction analysis in accordance with ASTM C 295. The stone must not contain any expansive clays.

g. Samples. Samples of Armor Rock from the proposed source shall be taken at the quarry by the Contracting Officer's Representative, the Superintendent of the quarry, the Contractor and an engineering geologist from the Geotechnical Branch of the Los Angeles District. The samples shall consist of at least 135 Kg.(300 pounds) of material. The quarry faces and the stockpiles to be used shall be examined and sampled. The Contractor will then ship the samples at the Contractor's expense to a licensed testing Laboratory which has been approved by the Contracting Officer's Representative. The laboratory will be under the direct supervision of a state licensed Civil Engineer, Geotechnical Engineer, Geologist or Engineering Geologist. The results of the tests shall be delivered to the Contracting Officer's Representative as soon as they are received from the laboratory.

h. Tests. The tests shall be conducted by the Contractor in accordance with applicable ASTM and Corps of Engineers methods of tests given in the Handbook for Concrete and Cement, and shall be performed at a laboratory approved by the Contracting Officer's Representative. All cost of testing shall be borne by the Contractor.

NOTE: (2): Weakening and loss of individual surface particles is permissible unless bonding of the surface grains softens and causes general disintegration of the surface material.

NOTE: (3): The test shall be made on 50 particles each weighing 100 Grams, +_ 5 grams, in lieu of the gradation given in ASTM C 88.

NOTE: (4): Armor Rock which has a loss greater than the specified limit will be accepted if the Contractor demonstrates that the stone has a satisfactory service record.

NOTE: (5): The test procedure for the Petrographic and X-Ray Diffraction is performed according to ASTM C 295, except for the following:

(a). A colored microscopic photograph shall be made of each rock type (whether igneous, sedimentary or metamorphic) and the individual minerals within the rock type shall be identified by labels and arrows upon the photograph.

(b). A very detailed macroscopic and microscopic description shall be made of the rock, to include the entire mineral constituents, individual sizes, their approximate percentages and mineralogical histories. A description of the rock hardness, texture, weathering and durability factors shall also be discussed.

(c). A written summary of the suitability of the Armor Rock material for use on the project, based upon the Petrographic and X-Ray tests and the abrasion loss (L. A. Rattler) shall be presented in the final laboratory report on Armor Rock quality.

2.1.4.2 Demonstration Stockpile at Source

Prior to the Government's approval of a source and prior to shipment of Armor Rock to the job site, the Contractor shall make arrangements to provide a demonstration stockpile. The stockpile shall be located at the source of the Armor Rock and consist of at least two cubic meters of material placed in an area at least 10 meter wide by 7 meters long. The purpose of the stockpile is to verify that the proposed quarry source is capable of producing acceptable quality rock of the specified shape, weights, and size distribution.

The Armor Rock placed in the demonstration stockpile shall be representative of the overall quality of materials in the quarry and shall also be representative of the rock types and quality submitted for laboratory testing.

The Contractor shall notify the Contracting Officer 3 days in advance of when the stockpile is ready for evaluation. The Contractor's Quality Control inspector shall accompany the Contracting Officer's Representative (COR) during the Government's evaluation of the stockpile. The stockpile and representative individual stones will be evaluated based on criteria in paragraph: Stone Acceptance Criteria. The Contractor shall arrange to have individual stones turned as necessary to accommodate the COR's evaluation. The weights of all acceptable stones in the stockpile will be tabulated and compiled against the specified gradation requirements.

If approved, a representative sample of the Armor Rock in the demonstration stockpile shall be shipped to and prominently displayed at the project site for a visual comparison to the Armor Rock subsequently shipped. The rock from the demonstration stockpile shall be placed as the final order of work.

2.1.4.3 Armor Rock Acceptance Criteria

Prior to placement, all Armor Rock shall be subject to acceptance by the Contracting Officer. Acceptance of any Armor Rock shall not constitute acceptance of all Armor Rock material from a source. All Armor Rock shall be unweathered, durable material as approved by the Contracting Officer. Armor Rock shall be of a suitable quality to ensure permanence in the marine conditions in which it is to be used. It shall be free from cracks, blast fractures, bedding, laminations, weak cleavages, seams and other defects that would tend to increase its deterioration from natural causes. Inspections for cracks, fractures, seams and defects shall be made by visual examination. If, by visual examination, it is determined that 15 percent or more of the Armor Rock contains hairline cracks, then all Armor Rock produced by the means and measures which caused the fractures shall be rejected. A hairline crack that is defined as being detrimental shall have a minimum width of 0.1 mm and shall be continuous for 1/3 the dimension of at least two sides of the stone. In addition, all accepted Armor Rock shall be:

a. of the same lithology as the demonstration stockpile and the original Armor Rock from which test results or service records were taken as a basis for authorization of the source.

b. angular quarried material with a shape which assures interlocking with adjacent stones. All Armor Rock shall have the greatest dimension not greater than three times the least dimension.

c. The Armor Rock shall be: (1) sound, durable, hard, and free from laminations, weak cleavages, undesirable weathering, or blasting or handling-induced fractures. (2) of such character that it will not disintegrate from the action of air, water or conditions of handling and placing: (3) clean and free from earth, clay, refuse or adherent coatings.

2.1.5 Gradation

2.1.5.1 General

Specified grading of all Armor Rock shall be met both at the source and as delivered to the project. In addition, material not meeting the required grading due to segregation or degradation during placement shall be rejected. If test results show that Armor Rock does not meet the required grading, the hauling operation will be stopped immediately and will not resume until processing procedures are adjusted and a gradation test is completed showing gradation requirements are met. All gradation tests shall be at the expense of the Contractor. The relationship between stone weight in the paragraph below is based on a specific gravity of 2.65.

2.1.5.2 Armor Rock

Armor Rock shall be quarried, angular stone reasonably well distributed within the limits specified. The required size gradation is:

Sieve Sizes	Percent Passing (by weight)
12	95-100
9	70-100
6	50-70
3	30-40
No. 4	5-10

All Armor Rock shall be manufactured to the required grading at the source, and individual loads as delivered to the project shall meet the required grading. If such percentages are not met, the Armor Rock shall be removed and replaced with suitable rock. The neat line volume of Armor Rock to be placed has been calculated to be approximately 33,900 tons.

The Contractor shall be responsible for maintaining the Armor Rock gradation indicated in these specifications. When requested, the Contractor shall provide proof of compliance to the Contracting Officer's Representative by specifying the weight gradation of Armor Rock in a representative barge and/or truck load of A-stone. If truck or rail is used to move Armor Rock from a quarry to a barge loading area, this same documentation may be required by the Contracting Officer's Representative for each truck or rail load or stockpile prior to loading of any barge.

If at any time the Contracting Officer's Representative determines that re-weighing or re-testing of the Armor Rock is necessary for any barge load or other delivery unit, this action will constitute a gradation test.

2.1.6 Rejected Armor Rock

New Armor Rock of unsuitable quality and/or size distribution as required by these specifications shall be rejected. Any rejected Armor Rock shall be promptly removed from the project at no expense to the Government.

Any portions of the work covered by these specifications containing rejected Armor Rock will be considered incomplete.

2.1.7 Quarry Operations

Quarry operations shall be conducted by the Contractor in a manner that shall produce Armor Rock conforming to the requirements specified and may involve selective quarrying, handling, processing, blending, and loading as necessary, all of which shall be as specified in Section 01451A CONTRACTOR QUALITY CONTROL. If the Armor Rock appears unacceptable, then additional gradation tests will be required at the Contractor's expense to delineate the limits of unacceptable Armor Rock. The additional gradation tests shall not count as part of the minimum number of gradation tests required. The unacceptable Armor Rock shall either be reworked to bring the Armor Rock within the specified gradation or the Armor Rock shall be removed from the project site as determined by the Contracting Officer. The Contracting Officer may direct this testing under the Contract Clause INSPECTION OF CONSTRUCTION. The Contractor shall provide all necessary screens, scales and other equipment, and operating personnel, and shall grade the sample. Certification and test results shall represent the Armor Rock shipped from the quarry.

Certification and tests results must be received by the Contracting Officer at the jobsite before any stone is used in the work.

2.1.8 Proportional Dimension Limitations

The maximum aspect ratio (greatest dimension:least dimension) of any piece of Armor Rock shall be not greater than 3:1 when measured across mutually perpendicular axis. Not more than 25 percent (25%) of the rock within a gradation range shall have an aspect ratio greater than 2.5:1. ASTM D 4791 shall be used as a guide to perform the test.

2.1.9 Material Quality

Before selecting a source for preparation of a demonstration stockpile, the Contractor shall be reasonably certain that the sources of Armor Rock proposed, per paragraph 2.1.3.2 shall be capable of meeting the quality and source requirements specified in paragraphs SOURCES and EVALUATION TESTING OF STONE, including their respective subparagraphs.

PART 3 EXECUTION

3.1 ARMOR ROCK PLACEMENT PLAN

a. The Contractor shall submit a Armor Rock Placement Plan indicating the methods and equipment proposed to conduct all construction related operations. The plan shall be submitted to the Contracting Officer for approval not less than 10 days prior to the start of construction operations. The plan shall include as a minimum, but is not limited to, the following information:

- Order of work and all proposed time lines.
- Proposed source of construction stone.
- Proposed demonstration section location.
- Operation/use of the work/storage area.
- Layout of all vessels, barges, buoys, anchors, and ancillary equipment. Site access route(s).
- Site preparation requirements.

b. Sources of all Armor Rock. (Samples of the materials are required to be submitted separately).

c. Proposed methods, procedures, and equipment types that will be employed to place and control the thickness of the Armor Rock. The plan shall include drawings depicting water- and/or land-based rock placement equipment and plans for placement of Armor Rock.

d. Methods for monitoring Armor Rock placement. The Contractor shall describe in detail how it will monitor each rock placement and thickness, as well as how it will adjust its methods if exceedances are observed.

e. Proposed water and land working areas, equipment, and material and operations layout diagrams. Diagrams shall indicate anticipated approximate locations of all relevant ancillary equipment, including but not limited to buoys, anchors, mooring lines, cables, hoses, and pipelines. The plan shall indicate the approximate area of work during rock placement, standby, and downtime conditions. If Revetment Rock and Armor Rock are delivered by truck, the Contractor shall indicate the hauling and site access routes on this plan.

f. If Armor Rock is delivered by barge to the project site, a written summary or diagrams of the Contractor barge marshalling area and tow route plan.

g. A written summary of procedures and notifications to be used by the Contractor for moving rock placement equipment while accommodating inbound and outbound commercial vessel traffic in the surrounding waterway. Contractor operations shall be scheduled so they do not interfere with vessel traffic, as specified in Section 1D – Special Conditions.

h. A written summary of procedures and equipment for control of vertical and horizontal positioning during placement of Armor Rock and for coordinating and performing bathymetric progress surveys.

All Armor Rock shall be placed to the lines and grades shown. The rock shall be placed so as to form a well-seated mat with a minimum of voids.

The rock shall be placed within the cross sectional area shown on the plans in such a manner as to produce a reasonably well graded mass with a minimum practicable percentage of voids. The armor rock shall be free of pockets of fines or clusters of large rock.

Placement of rock shall not vary more than the 0.5 meters from the neat line cross sections.

All Armor Rock deposited elsewhere than the places designated or approved by the Engineer shall be removed and deposited in an approved location at the Contractor's expense.

3.2 DAILY REPORT OF OPERATIONS

The Contractor shall be required to prepare and maintain a Daily Report of Operations and furnish copies thereof to the Contracting Officer's Representative. The daily reports shall document all construction related operations for all shifts in a 24-hour period. Further instruction on the preparation of the report shall be provided.

3.3 PLACEMENT OF ARMOR ROCK

3.3.1 Debris

Any timbers, unsatisfactory material and debris within the reaches for construction shall be removed except as otherwise directed by the Contracting Officer, and upon removal shall become the property of the Contractor. All materials shall be properly disposed of in accordance with the requirements of Section 01355A ENVIRONMENTAL PROTECTION, including any applicable local requirements.

3.3.2 Placement Control

The Contractor shall establish and maintain quality control for all work performed at the job site under this section to assure compliance with contract requirements. He shall maintain records of his quality control tests, inspections and corrective actions. Quality control measures shall cover all construction operations including, but not limited to, the placement of all materials to the slope and grade lines shown and in accordance with this section.

3.3.3 Armor Rock Placement Requirements

Armor Rock shall be placed in the locations and at the thickness shown without deviating from the lines and grade shown, including allowance for tolerances. Where slopes are present, placement shall begin at the bottom of the slope.

Armor Rock shall be placed in a manner to avoid displacing underlying materials or placing undue impact force on underlying material that would cause the breaking of

3.4 ARMOR ROCK DELIVERY

3.4.1 Records of Transportation

Copies of records of weights, including displacement weight date, shall be submitted for each load of material delivered to the site. The Contracting Officer's Representative will determine from the displacement weight date, the weight of Armor Rock shipped by barge and will certify displacement weight records. Each record shall include the gross, rate, tonnage, and net weight of Armor Rock. The weight of tonnage for each load will be determined, recorded, and certified by the Contracting Officer's Representative. Deliveries and numbered records shall be recorded on an approved system to maintain delivery control. Copies of records shall accompany each load of Armor Rock and a copy shall be delivered to the Contracting Officer's Representative as part of the Daily Report of Operations. Prior to the final payment, the Contractor shall furnish written certification that the material recorded on the submitted certified records of weights was actually used in the construction covered by the contract.

3.5 OVERPLACEMENT

The Contractor shall avoid placement operations that result in an excessively thick layer of Armor Rock. The Contractor shall avoid placement operations that result in areas where Armor Rock thickness exceeds the allowable overplacement. The Contractor shall avoid placement of Armor Rock above the required final surface elevation of -12.7 meters. In areas of overplacement, the Engineer may require the Contractor to remove, at its own expense, overplaced material that comprises the extra armor thickness. Any Armor Rock that is deposited outside of the area indicated on the Plans, or that exceeds the allowable overplacement, or that is other than as approved by the Engineer, will not be included in the measurement for payment, and the Contractor may be required to remove such misplaced material and deposit it where directed, at its own expense.

3.6 INSPECTIONS

The Contractor shall notify the Engineer at least 2 days before starting Armor Rock placement operations. During construction operations, the Engineer may elect to send a dive team, at the Engineer’s discretion, to intermittently inspect proper placement of the Armor Rock. The Engineer will give the Contractor at least 1 day notice before sending a dive team, and will provide the location of the dive survey. If the dive inspection reveals that required Armor Rock thickness is not met, or that Armor Rock material is overplaced, the Engineer may require the Contractor to place additional material and/or remove overplaced material, at no additional cost to the Owner. The Contractor shall coordinate its Armor Rock placement operation to minimize delays due to dive inspections of the site. The Owner will not be responsible for any delays created by dive inspection of the Armor Rock layer.

3.7 SURVEYS

3.7.1 Pre-Armor Rock Survey

The post-capping surveys in the CAD area shall serve as the pre-Armor Rock bathymetric survey.

3.7.2 Armor Rock Progress Surveys

For Armor Rock progress surveys, placed quantities shall be computed by the Contractor to the nearest ton based on barge displacement. Furthermore, dimensions and thicknesses of Armor Rock shall be computed based on progress sounding lines surveyed prior to and immediately following placement of Armor Rock. The apparent thickness of Armor Rock, as measured by the progress survey, shall be shown graphically. Tabular summaries shall be submitted that present the total placed rock quantities in tons, based on barge displacement and truck tickets, including both incremental and cumulative quantities, per 100-foot stations or less. The COR will use a combination of tonnage placed with the results of progress surveys to evaluate thickness.

3.7.3 Post-Armor Rock Survey

At least 5 days prior to completion of placement of Armor Rock, as demonstrated by Contractor progress surveys, the Contractor will notify the COR so that the Owner can schedule a final post-Armor Rock survey. The COR will use the results of this survey, possibly in conjunction with other information, to determine whether all Armor Rock has been satisfactorily completed to the extents, grades, and thicknesses specified. The COR will make appropriate allowances for settlement of the underlying subgrade in interpreting these surveys. Specifically, the Engineer may use tonnages of materials placed (based on barge displacement records and/or truck tickets) as additional information for determining actual quantities and rock thicknesses.

The determination of adequacy of Armor Rock will be made by the Engineer. If all of the required Armor Rock placement has not been satisfactorily completed, as determined by the Engineer, the Contractor shall place additional Armor Rock, or remove same, in the area(s) indicated in the survey and as indicated by the Engineer. These areas will be resurveyed and rechecked as directed by the Engineer. The cost for resurvey will be at Contractor’s expense.

The pre- and post-Armor Rock surveys, coupled with tonnage placement records, will be used as the basis for determining the conformance of the Contractor’s work to these Specifications and to compute Armor Rock thicknesses and quantities using the TIN method to generate surfaces.

3.8 FINAL EXAMINATION

After Armor Rock placement is completed, the COR may elect to conduct a survey and/or dive team inspection of the cap. If the COR’s analysis of the Armor Rock survey confirms the work was satisfactorily performed and is in satisfactory condition, the work will be accepted as complete. However, if the Contractor’s activities damage a previously placed cap segment, then the Contractor shall repair the damage at its own expense, as directed by the COR. If the work is determined to be incomplete or if allowable overplacement has been exceeded, the Contractor shall immediately perform such additional work as may be necessary to satisfactorily complete the project, at the Contractor’s own expense, as determined by the Engineer. If the cap area has not been satisfactorily armored, as determined by the Engineer, the Contractor shall place additional Armor Rock in the “low spots” indicated in the cross sections and the area will be rechecked by the

Engineer. Costs for resurveying to verify completion of the work shall be at the Contractor’s expense.

-- End of Section -