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Final

Remedial Design Package
Installation Restoration Sites 7 and 18
Parcel B

Design Basis Report
Remedial Action Monitoring Plan
Land Use Control Remedial Design
Preconstruction Operation and Maintenance Plan
Preconstruction Cost Opinion

Hunters Point Shipyard
San Francisco, California

January 8, 2010

Prepared for:
Base Realignment and Closure
Program Management Office West
San Diego, California

Prepared by:
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Prepared under:
Naval Facilities Engineering Command
Contract Number N62473-04-D-3213
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Dear BCT members:

Enclosure (1) is the Final Remedial Design Package for Installation Restoration Sites 7 and 18 at Parcel B, Hunters Point Shipyard, San Francisco, California, January 8, 2010. Enclosure (2) provides responses to comments received on the Draft Final Remedial Design Package.

If you should you have any concerns with this matter, please contact Ms. Lara Urizar at (619) 532-0960 or me at (619) 532-0913.

Sincerely,

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BRAC Environmental Coordinator
By direction of the Director

Enclosures: 1. Final Remedial Design Package for Installation Restoration Sites 7 and 18 at Parcel B, Hunters Point Shipyard, San Francisco, California, January 8, 2010.
2. Responses to comments on the Draft Final Remedial Design Package

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GUIDE TO USING THIS BINDER

Final

Remedial Design Package
Installation Restoration Sites 7 and 18
Parcel B

Hunters Point Shipyard
San Francisco, California

January 8, 2010

This binder contains the following five components which, together, are the remedial design for IR Sites 7 and 18. Institutional controls in the land use controls remedial design apply to activities discussed in the remedial action monitoring plan and the operation and maintenance plan.

Design Basis Report: This document presents a description of the remedy to be constructed (soil cover and shoreline revetment). The report describes the basis for the design and contains design drawings, technical specifications, and supporting engineering calculations.

Remedial Action Monitoring Plan: This plan presents the approach for monitoring chemicals of concern in groundwater and methane in soil gas. The report presents details of the planned monitoring and the process for reporting.

Land Use Controls Remedial Design: This document addresses the institutional controls and land use restrictions required by the amended record of decision for Parcel B. The land use restrictions will limit exposure to future users of the property and maintain the integrity of the remedy.

Operation and Maintenance Plan: This plan describes the inspection, maintenance, monitoring, and repair approach for maintenance of the remedy at IR Sites 7 and 18. Details of this plan will be revised after construction to reflect actual as-built conditions and materials.

Cost Opinion: This document presents an engineer's opinion of probable costs for construction of the remedy based on the remedial design described in the design basis report.

Final

Design Basis Report
Installation Restoration Sites 7 and 18
Parcel B

Hunters Point Shipyard
San Francisco, California

January 8, 2010

Prepared for:
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Hunters Point Shipyard
San Francisco, California

Contract Number N62473-04-D-3213
Contract Task Order 0019

Prepared For:

DEPARTMENT OF THE NAVY

REVIEW AND APPROVAL

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ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or relevant and appropriate requirement
ASTM	ASTM International (formerly American Society for Testing and Materials)
BCDC	San Francisco Bay Conservation and Development Commission
bcy	Bank cubic yards
bgs	Below ground surface
BMP	Best management practice
Caltrans	California Department of Transportation
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	Cubic feet per second
COC	Chemical of concern
CTRM	Composite Turf Reinforced Matting
DBR	Design basis report
DTSC	Department of Toxic Substances Control
fps	Feet per second
FS	Feasibility study
HHRA	Human health risk assessment
HPS	Hunters Point Shipyard
IR	Installation Restoration
lcy	Loose cubic yards
LLRW	Low-level radioactive waste
LUC	Land use control
MHHW	Mean higher high water
MLLW	Mean lower low water
MCE	Maximum credible earthquake
MPE	Maximum probable earthquake
mph	Miles per hour
msl	Mean sea level
NGVD	National Geodetic Vertical Datum
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
O&M	Operation and maintenance

PAH	Polycyclic aromatic hydrocarbon
PCB	Polychlorinated biphenyl
psf	Pounds per square foot
PVC	Polyvinyl chloride
RD	Remedial design
ROD	Record of decision
SLERA	Screening-level ecological risk assessment
SVOC	Semivolatile organic compound
TCRA	Time-critical removal action
TMSRA	Technical Memorandum in Support of a ROD Amendment
TSP	Task specific plan
USGS	U.S. Geological Survey
VOC	Volatile organic compound
W_{50}	Average weight
yd^3	Cubic yard

EXECUTIVE SUMMARY

This design basis report presents the selected remedy to protect human health and the environment from actual or threatened releases of pollutants, chemicals, or hazardous substances at Installation Restoration (IR) Sites 7 and 18 at Parcel B at Hunters Point Shipyard (HPS) in San Francisco, California. This report develops the design for the remedy selected in the amended record of decision for Parcel B to protect human health and the environment from chemicals of concern (COC) in soil, shoreline sediment, and groundwater. The selected remedy includes a soil cover and shoreline revetment to provide a physical barrier to prevent human and ecological contact with COCs.

IR Sites 7 and 18 are located on the northwestern corner of HPS. The sites cover about 14 acres; IR Site 7 includes a shoreline of approximately 950 feet along San Francisco Bay. HPS has been owned by the U.S. Navy since about 1939. Although most of the expansion of Parcel B had been completed before 1946, much of the land area of IR Sites 7 and 18 was created during the 1950s and 1960s.

The COCs in soil at IR Sites 7 and 18 include metals, volatile organic compounds, semivolatile organic compounds, pesticides, polychlorinated biphenyls (PCB), and radionuclides. COCs in sediment along the shoreline at IR Site 7 include metals, pesticides, PCBs, polycyclic aromatic hydrocarbons, and radionuclides. The primary risk to human health and the environment from these COCs is through direct contact with the soil or sediment, or through external radiation for radionuclides. The remedial design developed in this report includes a soil cover to prevent exposure and a revetment that will prevent contact with shoreline sediment and prevent wave action from eroding sediment and transporting it into the bay. The selected remedy does not include active treatment of groundwater; therefore, this report does not present any design components related to groundwater. However, groundwater monitoring is part of the selected remedy, and details of the proposed strategy for monitoring are included in the remedial action monitoring plan (also contained in this binder).

This design basis report is one component of the overall remedial design (RD) for IR Sites 7 and 18. The other components include a land use control RD, a remedial action monitoring plan for groundwater and methane, an operation and maintenance plan, and an engineer's opinion of probable cost. These other components of the RD are also included in this binder with this report.

1.0 INTRODUCTION

The Navy is implementing the remedy identified in the amended record of decision (ROD) for Parcel B (ChaduxTt 2009) at Installation Restoration (IR) Program Sites 7 and 18 at Parcel B at Hunters Point Shipyard (HPS). This design basis report (DBR) develops the design for the selected remedy, a soil cover and shoreline revetment, to protect human health and the environment from chemicals of concern (COC) in soil, shoreline sediment, and groundwater. The document was developed and the remedy was selected in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan.

The remedy selected in the amended ROD protects the public health and welfare and the environment from actual or threatened releases of pollutants, chemicals, or hazardous substances from soil, shoreline sediment, and groundwater at IR Sites 7 and 18. The selected remedy was based on the following:

- Site histories
- Field investigations
- Laboratory analytical results
- Evaluation of potential human health and ecological risks
- Current and reasonably anticipated future land use
- The 1997 Parcel B ROD

The Navy prepared the amended ROD for Parcel B because the Navy concluded that the remedy selected in the 1997 ROD needed to be amended to be protective of human health and the environment in the long term and that the proposed amendments to the remedy would fundamentally alter its basic features. The original remedy for soil involved excavation and off-site disposal; however, this strategy was unable to achieve cleanup goals across Parcel B, including IR Sites 7 and 18. The widespread distribution of metals, especially arsenic and manganese, in soil was the primary obstacle to this strategy. The amended remedy incorporates covers for the remaining soil containing hazardous substances to prevent exposure. Likewise, groundwater contamination was found to be more widespread (in areas outside of IR Sites 7 and 18) and at higher concentrations than was known when the original remedy for groundwater was selected. The original remedy relied on monitoring; the amended remedy includes active treatment of groundwater for selected areas outside of IR Sites 7 and 18. Only groundwater monitoring is proposed for IR Sites 7 and 18. Finally, the original remedy did not address radiological contaminants, and the amended remedy incorporates actions to address radioactive chemicals found in soil and structures at Parcel B. The applicable or relevant and appropriate requirements (ARAR) from the amended ROD are included as Table 1 to this report.

This document describes the remedial design (RD) for the selected remedy the Navy will implement at IR Sites 7 and 18. Appendices and figures, referenced in this report follow Section 4.0. Attachments included with this report are Design Construction Drawings (Attachment 1), Construction Specifications (Attachment 2), and the Stability Evaluation Report (Attachment 3).

The DBR is one of several components that describe the selected remedy and its implementation. Other directly related documents are the land use control remedial design, the remedial action monitoring plan for groundwater and methane, the operation and maintenance (O&M) plan, and an engineer's opinion of probable cost. These documents are included in the same binder with this DBR. Other related documents include future transfer documents, such as a Covenant to Restrict Use of Property and a Quitclaim Deed.

Additionally, if it is prepared, the Parcel B risk management plan (RMP) for areas not covered by the area requiring institutional controls (ARIC) for radionuclides will set forth certain requirements or protocols that, if followed, will allow certain activities that are otherwise restricted to be performed without additional approval by the federal facility agreement (FFA) signatories. A separate RMP for the portions of IR Sites 7 and 18 covered by the radionuclide ARIC, if prepared, will also set forth certain requirements or protocols that, if followed, will allow certain activities that are otherwise restricted to be performed without additional approval by the FFA signatories and the California Department of Public Health (CDPH).

2.0 BACKGROUND

The following sections describe the facility, location, and general history of IR Sites 7 and 18.

2.1 SITE DESCRIPTION

Hunters Point Shipyard is located in the City and County of San Francisco, California (Figure 1). HPS includes 866 acres (420 acres on land and 446 acres under water in San Francisco Bay). HPS is divided into 10 parcels: B, C, D-1, D-2, E, E-2, F, G, UC-1, and UC-2. Parcel B includes 54 acres on the northern side of HPS (Figure 2). IR Sites 7 and 18 consist of about 14 acres on the western side of Parcel B. IR Site 7 includes a shoreline of approximately 950 feet along San Francisco Bay.

The climate in the Parcel B area is characterized by partly cloudy, cool summers with little precipitation and mostly clear, mild winters with moderate precipitation. Prevailing winds blow west to east toward San Francisco Bay; the average wind speed is about 10 miles per hour. Normal annual rainfall in San Francisco (as monitored at the San Francisco Federal Building) is approximately 20 inches. Other sections of this DBR, including Section 3.2.4 Surface Drainage and Section 3.3.2 Wave Dynamics, and the appendices describe more explicitly the climatic conditions specific to the site.

2.2 HISTORY

The Navy used HPS starting around 1939 for shipbuilding, repair, and maintenance. However, the Navy continued to operate carrier overhaul and ship maintenance and repair facilities through the 1960s. Other significant activities after World War II included decontamination of ships used during atomic weapons testing in the South Pacific and operation of the Naval Radiological Defense Laboratory from the late 1940s until 1969. Navy ships that participated in atomic and nuclear weapons testing were brought back to HPS for decontamination from 1946 through the 1960s. HPS was deactivated in 1974 and remained largely unused until 1976. Between 1976

and 1986, the Navy leased most of HPS to Triple A Machine Shop, Inc., a private ship repair company. The Navy resumed occupancy of HPS in 1987.

Small portions of the area that are now identified as IR Sites 7 and 18 were in existence when the property was purchased by the Navy. The Navy significantly expanded the original area during development of the shipyard to its present configuration; the majority of the land area at IR Sites 7 and 18 was created by depositing fill into the bay. The expansion of the current location of IR Sites 7 and 18 was primarily through the use of engineered fill materials that were derived by quarrying the local bedrock. Some of the fill included construction debris. Although most of the expansion of Parcel B had been completed before 1946, much of the land area of IR Sites 7 and 18 was created during the 1950s and 1960s.

2.3 GEOLOGY AND SURFACE SOILS

The peninsula that forms HPS is within a northwest-trending belt of Franciscan Complex bedrock known as the Hunters Point Shear Zone. HPS is underlain by five geologic units: the youngest of Quaternary age; and the oldest, the Franciscan Complex bedrock, of Jurassic-Cretaceous age. In general, the stratigraphic sequence of these geologic units, from youngest (shallowest) to oldest (deepest), is as follows: Artificial Fill; Undifferentiated Upper Sand Deposits; Bay Mud Deposits; Undifferentiated Sedimentary Deposits; and Franciscan Complex Bedrock.

Artificial Fill covers the entire surface at IR Sites 7 and 18, except for colluvium and alluvium on the hillside at the southwestern edge. The Bay Mud separates the Undifferentiated Upper Sands and the Artificial Fill from the lower Undifferentiated Sedimentary Deposits over most of Parcel B; however, the Bay Mud is absent in some areas within IR Sites 7 and 18, and these two formations directly contact each other in those areas. These site soils and the proposed remedy were assessed for stability as described in Attachment 3 and summarized in Section 3.3 of this report. Cross sections of the Parcel B area are provided as Figure 3 to this report.

The Franciscan Complex contains a variety of rock types, including basalt, chert, sandstone, shale, and serpentinite. Some of these rock types contain wide-ranging concentrations of naturally occurring metals; serpentinite also contains naturally occurring asbestos minerals.

The project area is bounded by San Francisco Bay and subject to tides and storm surges. Please see Section 3.2 for a discussion of these characteristics.

2.4 HYDROGEOLOGY

The hydrostratigraphic units at IR Sites 7 and 18 include (1) the A-aquifer, (2) the aquitard, (3) the B-aquifer, and (4) the deep bedrock water-bearing zone. The A-aquifer consists mainly of unconsolidated Artificial Fill that overlies the aquitard and bedrock and forms a continuous zone of unconfined groundwater across the parcel. Alluvium and colluvium, Undifferentiated Upper Sand Deposits, and shallow bedrock also are part of the A-aquifer at various locations across IR Sites 7 and 18. The B-aquifer consists mainly of Undifferentiated Sedimentary Deposits that overlie bedrock or are contained within the Bay Mud Deposits at a few locations near the bay margin. The B-aquifer is not continuous across IR Sites 7 and 18, however. Bay Mud Deposits act as an aquitard that separates the A- and B-aquifers over most of IR Sites 7 and 18, except for a small

area in the west-central portion of IR Site 18, where the Bay Mud is absent and the A- and B-aquifers are adjacent. The bedrock water-bearing zone is not considered an aquifer because of its low capacity for water production (primarily from fractures).

In general, groundwater flows from south to north, toward San Francisco Bay. Based on tidal influence studies conducted during the remedial investigation (PRC and others 1996) and the feasibility study (PRC 1996), the tidal influence zone extends inland up to about 300 feet from the shoreline. Tidal influence may also mix groundwater with bay water, but mixing usually does not occur as far inland as do the fluctuations in groundwater elevation. The proposed design summarized in this DBR does not include impermeable or low-permeability layers which would impede the natural mixing and infiltration of bay water and rain water with groundwater at the site.

2.5 NATURE AND EXTENT OF CONTAMINATION

Activities associated with known or potential chemical releases at IR Sites 7 and 18 were identified and environmental investigations were conducted to identify and assess the nature and extent of contaminants in soil, groundwater, and sediment. The following sections summarize the nature and extent of contamination; refer to the amended ROD (ChaduxTt 2009) and the Technical Memorandum in Support of a ROD Amendment (TMSRA) (ChaduxTt 2007) for more details. The remediation goals for soil have been provided as Table 2 to this report, and remediation goals for sediment have been provided as Table 3. The RD was selected to cover soil where contaminant concentrations exceed these goals.

2.5.1 Soil

The COCs in soil at Parcel B IR Sites 7 and 18 that pose a potential risk to human health based on current and reasonably anticipated future land uses include metals, volatile organic compounds (VOC), semivolatile organic compounds (SVOC), pesticides, polychlorinated biphenyls (PCB), and radionuclides. The Navy removed about 87,000 cubic yards of soil from IR Sites 7 and 18 and removed most of the organic chemicals that exceeded the remediation goals in place at that time (see Section 2.6 for details). However, concentrations of a group of metals, especially arsenic and manganese, consistently exceeded cleanup goals at locations across Parcel B. The widespread distribution of this group of metals in soil at Parcel B (that is, their ubiquitous nature) is related to the occurrence of these metals in the local bedrock that was quarried for fill during the expansion of HPS in the 1940s. These metals occur naturally in the Franciscan Formation bedrock (especially in the serpentinite, chert, and basalt rock types) and were distributed throughout all parcels, including Parcel B, as HPS was built. Although it is possible that some releases of these metals could have occurred from Navy activities, the range of concentrations of these metals at Parcel B is consistent with the range of concentrations in local bedrock. The resulting distribution of metals concentrations in soil is nearly random across the parcel. The concentrations of metals in the bedrock fill sometimes exceed the ROD cleanup goals. The remedial design developed in this DBR addresses these concentrations of metals, regardless of their source, by eliminating the exposure pathway. Likewise, the remedial design also eliminates the exposure pathway to the other COCs that remain in soil.

2.5.2 Radionuclides

The Historical Radiological Assessment identified the potential radionuclides of concern at IR Sites 7 and 18; these chemicals include strontium-90, cesium-137, radium-226, and plutonium-239 (NAVSEA 2004). The area at IR Sites 7 and 18 was used as a disposal site for excess large-scale shipyard debris as part of specific engineered fill operations conducted in that area to expand the shoreline. The Navy had limited controls for disposal of certain types of radioactive materials in place at the time of the shoreline expansion which may have allowed for land disposal of certain types of radioactive materials (such as sandblast grit used in decontamination of ships that participated in atomic weapons testing and radioluminescent dials and gauges). The remedial design also eliminates the exposure pathway to radionuclides. Vegetation established on the surface of the final cover as described in Section 3.2.2 of this report will not root to a depth that contains suspected radioactive contamination which will be at least 4 feet below the final cover elevation. (Four feet includes the cover thickness of 3 feet and the 1 foot of screened existing soil over the site. Refer to Section 3.2 for further information regarding the radionuclide screening.)

2.5.3 Groundwater

The human health risk assessment (HHRA) did not identify risks to human health from exposure to groundwater at IR Sites 7 and 18 based on current and future land uses (ChaduxTt 2007). A screening-level ecological risk assessment (SLERA) conducted as part of the TMSRA identified a potential risk to saltwater aquatic organisms from concentrations of copper and lead in groundwater at IR Sites 7 and 18 that could discharge into San Francisco Bay (ChaduxTt 2007). However, as described in the remedial action monitoring plan for groundwater, results from more recent samples do not indicate that copper or lead pose a risk to ecological receptors in the bay. Refer to the remedial action monitoring plan (located in this binder) for details on proposed groundwater monitoring.

2.5.4 Sediment

COCs in sediment along the shoreline at IR Site 7 that pose a potential risk to human health or ecological receptors include metals, pesticides, PCBs, polycyclic aromatic hydrocarbons (PAH), and radionuclides. The remedial design developed in this DBR includes a revetment that will cover and prevent access and erosion of shoreline sediment along the length and width of the revetment to prevent exposure and prevent wave action from eroding sediment and transporting it into the bay. Sediment in the area offshore from IR Site 7 was sampled during the feasibility study (FS) for Parcel F (Barajas and Associates 2008); the results for those samples did not exceed the benchmarks used to identify contamination that were established in the FS.

2.6 Previous Remedial and Removal Actions

After the remedial investigation and FS had been conducted and the original ROD completed, the Navy conducted remedial and removal actions at IR Sites 7 and 18 between 1998 and 2008.

Remedial Actions. The Navy selected excavation and off-site disposal as the remedy for contaminated soil at Parcel B, including IR Sites 7 and 18, in the ROD signed in October 1997 (Navy 1997). The Navy conducted remedial actions for soil in two phases: 1998 to 1999, and 2000 to 2001. The Navy excavated about 42,200 cubic yards of soil from 25 areas at IR Sites 7 and 18 between July 1998 and September 1999. However, the excavations failed to remove contaminants (mainly the ubiquitous metals) to below cleanup goals for soil in many excavations, and the soil remedial action paused in September 1999 while the Navy reevaluated the cleanup goals presented in the 1997 ROD. The Navy summarized revised cleanup goals in the May 2000 explanation of significant differences (Navy 2000). Between May 2000 and December 2001, the Navy excavated and disposed of off site an additional 27,700 cubic yards of soil from 10 areas, most of which had been originally excavated from 1998 to 1999. Similar to the first phase, the second phase of excavations did not remove all contaminants (again, mainly the ubiquitous metals) to below cleanup levels for soil, and the remedial action was halted for reevaluation. Details of the remedial action excavations are presented in the construction summary report (ChaduxTt 2008).

Removal Action for Methane. The Navy conducted a time-critical removal action (TCRA) to address methane detected in soil gas samples in the eastern portion of IR Site 7. The Navy excavated about 17,000 cubic yards of soil during August through October 2008. The excavated material included about 1,700 cubic yards of construction and demolition debris that could not be effectively screened for radioactivity and was, therefore, disposed of as low-level radioactive waste (LLRW). An additional 700 cubic yards of soil was identified as LLRW based on radiological sample results from screening of individual soil lifts.

The TCRA found that debris was confined to a layer that extended from about 2 to 8 feet below ground surface (bgs) and was above the water table, which was at about 18 feet bgs at the excavation site. Material below 8 feet bgs was predominantly clean, engineered fill without debris or staining. A layer of material at the top of the Bay Mud at about 23 to 25 feet bgs was observed to be highly organic and odiferous. Excavation continued into the native Bay Mud to a depth of about 27 feet bgs to remove the organic layer. The Navy concluded that the organic layer was the likely source of methane and that the debris used as fill located above the water table was not a likely source of methane. The Navy installed five soil gas monitoring probes in the excavation area. The Navy is monitoring the probes to evaluate whether methane remains at the site. Methane was not detected in any probe in samples collected in December 2008. Details of the TCRA for methane are presented in the removal action completion report (SES-TECH 2009).

2.7 LAND USE CONTROLS AND REUSE

The land use control objectives for IR Sites 7 and 18 include maintaining the physical barriers (such as fencing) and warning signs and maintaining the integrity of the soil cover and shoreline revetment, along with continued administrative restrictions that limit access to the site. The land use controls are described in the Land Use Control Remedial Design (LUC RD) report.

Parcel B is owned by the federal government under the jurisdiction of the Navy and is currently planned to be transferred to the City and County of San Francisco. Based on the City and County of San Francisco's reuse plan, Parcel B is expected to be zoned to accommodate mixed uses, including open space for the majority of IR Sites 7 and 18. The open space areas will allow public

access and use of the waterfront as well as provide a corridor for the Bay Trail (hiking and bicycle access) close to the shoreline (San Francisco Redevelopment Agency 1997). Plans for the open space area include recreational features such as sports fields, playgrounds, and gardens. Land uses other than open space will be allowed in other areas of IR Sites 7 and 18 outside the ARIC for radionuclides. Any modifications to the soil cover or revetment will be addressed the LUC RD report. Modifications to the soil cover or revetment are restricted throughout IR Sites 7 and 18 unless prior written approval for these activities is granted by the Federal Facility Agreement signatories (and the California Department of Health (CDPH) within the area requiring institutional controls for radionuclides). Land use controls are described in detail in the LUC RD report.

3.0 BASIS OF DESIGN

The following sections describe the basis of design for the two main containment components of the remedy for IR Sites 7 and 18: soil cover and revetment. Figure 4 is an overview of the design components and shows the extents of the soil cover and revetment. All of the potentially contaminated soil associated with IR Sites 7 and 18 will be contained by either the soil cover or the revetment. Future redevelopment of IR Sites 7 and 18 will likely change the surface grades and vegetation over the soil cover and may even change the nature of the cover. However, the basic features of the soil cover that provide protection from exposure to COCs will be maintained during development. This report describes one design approach proposed to meet the conditions present at IR Sites 7 and 18. Other types of soil covers may be appropriate for IR Sites 7 and 18 as well as other locations at Parcel B (see the amended ROD [ChaduxTt 2009]), so long as the covers prevent exposure to soil and are durable.

3.1 SITE PREPARATION

Site Security Fencing. The existing site security fence runs along the landward site boundary for IR Sites 7 and 18 and upslope from the shoreline as shown in Figure 5. This current fence location would obstruct construction of both the soil cover and the revetment and portions will need to be removed before construction. A temporary fence, also shown in Figure 5, will be constructed to provide site security and will be located sufficiently off of the site boundary to allow access along the boundary itself and allow for the sloping of the cover to meet the existing grade. Coordinates for the location of temporary security fencing have been included with the design construction drawings. An easement, or other agreement, between the Navy and the property owner northwest of the site will be needed to place the temporary fence on the neighboring property; however, neither the cover nor the off-cover slopes will run onto the neighboring property.

Open access between the landward portion of the site and the shoreline will be necessary for construction of the revetment. Therefore, no temporary fencing will be erected along the shoreline.

The existing site control fence and materials will be used wherever possible. Portions of the current site fence are located sufficiently outside of the work area and can be utilized during construction.

Clearing and Grubbing. The existing surface of IR Sites 7 and 18 will be cleared of vegetation and debris during the radionuclide surface screening of the site (TtEC 2009), which will be completed prior to the construction of the soil cover and revetment. Significant clearing and grubbing is not anticipated to be necessary, especially over the landward portion of the site; however, there may be some small areas around the perimeter of the site where some minimal clearing of vegetation or debris may be necessary to provide site access and allow for placement of the temporary fence.

Along the shoreline of the site, boulders and concrete have been placed in areas to provide slope stability. Radionuclide screening along the shoreline will likely be difficult due to the conditions along the shoreline and clearing and grubbing not conducted. Any rock and debris will need to be removed from the area before the excavation work and the revetment construction. Non-native materials (concrete, rebar and other metal debris, wood, and other refuse) that cannot be screened will be considered contaminated and disposed of off site at a low-level radioactive waste (LLRW) disposal facility. The rocks that have been used as shoreline armoring will be stockpiled and placed onto the exterior of revetment as supplemental armoring after the construction of revetment is completed. Extents of the clearing and grubbing for the site, including along the shoreline, are included in Figure 4 of this report.

Extension of Existing Monitoring Wells and Probes (Groundwater and Methane). The existing groundwater monitoring wells and methane monitoring probes on site will be extended by at least 2 or 3 feet, depending on location, to meet with the ground surface of the final soil cover. All existing bollards and stickup protective well casings will be removed. Concrete pads and flush-mounted protective casing materials will be left in place except when such materials are obstructive to the coupling between the extension and the existing well. New concrete pads and protective materials will be constructed flush to the completed cover ground surface following completion of the soil cover construction. The locations of the wells are provided in Figure 4 of this report. The following schedules summarize the groundwater monitoring well and methane monitoring probe information. Methods for extending and protecting the wells during soil cover construction will be at the discretion of the construction contractor.

GROUNDWATER MONITORING WELL EXTENSION SCHEDULE[1]

Well Identification	IR Site	Northing (NAD 27)	Easting (NAD 27)	Casing Stickup (feet)	Total Depth (feet)	Casing Diameter (inch)	Stickup
IR07MW20A1	IR-07	453944.26	1460379.24	-0.99	24.00	4	No
IR07MW21A1[2]	IR-07	453941.51	1459683.70	-0.12	16.50	4	No
IR07MW23A	IR-07	453693.82	1459476.14	-0.64	17.00	4	No
IR07MW24A	IR-07	453884.37	1459749.67	2.83	15.00	4	Yes
IR07MW25A	IR-07	453990.88	1459624.70	2.92	18.00	4	Yes
IR07MW26A	IR-07	453900.68	1460093.30	3.45	15.00	4	Yes
IR07MW93A	IR-07	453533.20	1459686.30	-0.07	29.00	2	No
IR07MW94A	IR-07	453749.30	1459659.70	-0.05	25.00	2	No

Well Identification	IR Site	Northing (NAD 27)	Easting (NAD 27)	Casing Stickup (feet)	Total Depth (feet)	Casing Diameter (inch)	Stickup
IR07MWS-2	IR-07	453860.98	1460286.15	2.62	15.50	4	Yes
IR07MWS-4	IR-07	453825.23	1459913.20	3.50	16.00	4	Yes
IR07P20A[2]	IR-07	453927.21	1460374.65	-0.68	25.00	2	No
IR18MW100B	IR-18	453579.54	1459329.10	-0.31	47.00	4	No
IR18MW101B	IR-18	453573.70	1459432.00	-0.07	45.00	4	No
IR18MW21A	IR-18	453595.74	1459304.90	-0.26	20.00	4	No
IR18MW92A	IR-18	453446.90	1459396.70	-0.20	27.00	2	No
PA18MW09A[2]	IR-18	453628.25	1459405.47	-0.37	25.00	4	No

Notes:

1 Some wells associated with the site are located outside of the site boundary along the northwest property boundary (IR07MW28A, IR07MW95A, IR18MW200A, and IR18MW91A). These wells will not be extended and have not been included in the schedule.

2 Well currently scheduled for decommissioning.

METHANE MONITORING PROBE EXTENSION SCHEDULE

Well Identification	IR Site	Northing (NAD 27)	Easting (NAD 27)	Total Depth (feet)	Casing Stickup	Construction
SG-PT15	IR-07	453673.40	1459922.63	3.0	No	Poly tube
SG-PT16	IR-07	453632.67	1459939.27	3.0	No	Poly tube
SG-PT17	IR-07	453601.10	1459917.88	3.0	No	Poly tube
SG-PT18	IR-07	453623.16	1459880.20	3.0	No	Poly tube
SG-PT19	IR-07	453660.16	1459884.61	3.0	No	Poly tube

Where existing groundwater monitoring wells or methane monitoring probes obstruct construction, the wells may be decommissioned in accordance with California regulations and replaced with newly constructed wells or probes. Wells that are designated for long-term monitoring in accordance with the RAMP will be replaced; however, wells that are not designated for long-term monitoring and that obstruct construction may be decommissioned. Any wells damaged during construction and that are designated for long-term monitoring will be properly decommissioned and replaced. New replacement wells will be constructed of like materials, will maintain the original screening intervals, and will be located as near to the original position as is feasible.

3.2 PROTECTIVE SOIL COVER

The existing surface of IR Sites 7 and 18 will be screened for radionuclides to a depth of 1 foot (the maximum effective depth of the surface scan) before the cover is installed. Any radiological contamination found to exceed the remediation goals for residential soil (see Table 8-4 of the amended ROD) will be removed, hauled off site, disposed of properly, and

replaced with clean fill. Procedures for the screening surveys will be consistent with the basewide radiological work plan (TtEC 2008) and task-specific plans (TSP), which are separate from this remedial design.

A soil cover of clean imported soil is the selected remedy to prevent contact with COCs that may be present on the landward portion of the site. These chemicals may include metals, organic chemicals, and radionuclides. The cover components vary over the site as follows:

- The final cover for the potentially radiologically impacted area at IR Sites 7 and 18 will consist of a minimum 3-foot cover layer of clean imported soil and a demarcation layer over the area and within the cover layer, 1-foot above the existing ground surface.
- The final cover for the non-radiologically impacted area at IR Sites 7 and 18 will consist of a minimum 2-foot cover layer of clean imported soil.

A conceptual cross section of the soil cover components for both portions of the site is included as Figure 6 of this DBR and cross sections are provided as Figure 7. The following sections describe the components of the proposed soil cover.

3.2.1 Initial Site Grading

The extents of potential radionuclide and non-radionuclide contaminated areas of the site will have been leveled during the radionuclide screening process and only minimal grading of the area will be necessary before construction of the soil cover over the site. Based on previous subsurface investigations, the existing soils at the site are suitable as an initial foundation for the soil cover, and settling of the existing material is not anticipated.

Special consideration needs to be given to both the property boundaries along the northwestern perimeter of the site and the access road along the southeastern perimeter. The neighboring property to the northwest (which is non-Navy property) and the access road abut the area that is addressed by the soil cover remedy. Neither the neighboring property nor the access road can be obstructed by the cover or the sloped portion of the cover where the cover will meet the existing grade. Therefore, excavations along the site boundary are needed to allow for the final cover to slope and meet the existing grade within the site boundary while maintaining the minimum cover thicknesses of 2 or 3 feet. The soil cover will slope to meet the existing grade and retaining walls or other structures will not be used to transition from the cover to the existing grade. Figures 5, 6, 7, and 8 of this DBR show the extents and grading of the final cover over the site.

The excavated soil from the site boundary areas described above will be screened for radionuclide contamination. Non-radionuclide impacted soil will be returned to the site and ultimately placed under the minimum 3-foot soil cover. Radionuclide-impacted soil will disposed of off site at a LLRW disposal facility along with any debris that cannot be screened. An estimated 430 cubic yards (yd^3) will be excavated along the boundary of the site.

Excavation along the property boundary as described above and excavation of the shoreline for the revetment is estimated to yield 4,000 yd^3 of excavated soil and sediment (not including the estimated volumes of radionuclide-impacted soil or the debris for disposal). The excavations related to the construction of the revetment are more fully described in the revetment portion of this DBR – Section 3.3. This material will be placed on site between the approximate 15 foot and 10 foot elevations, as seen on Figure 5, and compacted and graded. There will then be at least 3 feet of clean imported fill cover material over this placed material. More specific grading plans and extents are contained in the Design Construction Drawings included as Attachment 1 to this DBR.

3.2.2 Soil Cover

The soil cover over the site will be comprised of clean imported fill material and will be not less than 3 feet thick over the potentially radionuclide-impacted portion of the site and not less than 2 feet thick over the non-radionuclide impacted portion of the site. The total volume of the soil cover layer is estimated at 66,200 bcy or 86,000 lcy considering a 1.3 bulking factor. Refer to Appendix A for the volumetric calculations of soil necessary for the cover remedy. The final cover components, cross sections, and final cover contours are included as Figures 6, 7, and 8.

Soil compaction for the soil cover depends on depth from the final surface. All imported soils at depths greater than 0.5 foot below the final cover surface will be compacted to 90 percent or greater of the maximum dry density at or near optimum moisture, in accordance with ASTM modified proctor density testing. The construction of the cover will proceed in successive 6-inch lifts. The upper 0.5-foot portion of the soil cover will be compacted to not greater than 85 percent of the maximum dry density. This compaction scheme is based on U.S. Army Corps of Engineers technical guidance and optimizes slope stability with vegetative growth (U.S. Army Corps of Engineers 2001).

The majority of the final cover will have average slopes toward the north of between 1 vertical to 30 horizontal (1V:30H), or about 3 percent, and 1V:80H, or about 1 percent. Steeper slopes of approximately 1V:4H or 25 percent will exist in smaller portions of the southern and western corners of the site. Final cover slopes throughout the site will be approximately equal to the current existing slopes. The infiltration of water at the site is not a concern based on the nature of the COCs. However, the prescribed grading plan has been designed to maintain sheet flow or shallow concentrated flow of stormwater over the site to minimize ponding of water and infiltration.

The side portions of the cover will extend to meet the current existing grade at slopes not steeper than 1 vertical to 3 horizontal (1V:3H), or about 33 percent, along the perimeter of the site and retaining walls will not be used to transition from the cover to the existing off-site grade. This maximum slope of 1V:3H will also be maintained for the transition between the areas of 3 feet and 2 feet of cover.

The slope and vegetation of the cover will protect the final cover from erosion, as summarized in Section 3.2.5 of this DBR. The cover will be planted with the following seed mix, intended for survival without irrigation or significant maintenance after a 3-month establishment period.

SEED MIX

Scientific Name	Common Name	Pounds/Acre
Bromus carinatus	California Brome	25
Hordeum brachyantherum	Meadow Barley	10
Vulpia microstachys	Small Fescue	6
Trifolium wildenovii	Tomcat Clover	4
Eschscholzia californica	California Poppy	1.5

Binders or degradable geonet will be used to minimize erosion during the 3-month establishment period for vegetation, which will be the responsibility of the construction contractor. The seed mix was selected considering the likely conditions of the fill to be used for the cover, and an amended topsoil layer will not be necessary. Irrigation during the vegetation establishment period may be necessary.

Additional erosion control measures will be incorporated into the cover over the site to protect potentially susceptible areas. In addition to the vegetative cover, slopes greater than 1V:5H over the site and along the drainage swale will be further stabilized through the use of composite turf reinforced matting (CTRM).

The grading, compaction, and vegetative cover of the upper 0.5-foot layer of the cover have been designed to convey water as sheet flow, prevent excessive ponding of surface water, and to be resistant to erosion.

3.2.3 Demarcation Layer

During the construction of the soil cover, a demarcation layer, consisting of both geotextile material and utility marking tape, will be installed within the cover over the potentially radiologically impacted area to provide a warning against digging into the potentially contaminated soil. The demarcation layer will be installed at least 1 foot above the existing grade, and any placed excavated soil, and the layer will ultimately be located at least 2 feet beneath the final cover ground surface. The geotextile material will be permeable to allow water to pass and will be colored orange. The utility marking tape will be printed with a warning message indicating the presence of the contaminated soil beneath.

The extent of the demarcation layer is included in Figure 4 of this DBR and cross sections included as Figures 6 and 7. The demarcation fabric will be unrolled and secured with a minimum of 1 foot overlap between the fabric sections to insure the continuity of the layer. A narrow trench or other small excavation will be opened along the boundary of the potentially radionuclide-impacted area to a depth of not less than 1 foot below the existing ground surface,

and the demarcation fabric will be placed into the trench and anchored to hold the fabric in place. The anchoring of the fabric is intended to provide a warning for any angled excavations that would approach the potentially radionuclide-contaminated soil from the side. The anchored portion of the geotextile material along the boundary of the potentially radionuclide-contaminated area will be located at a depth of 3 to 4 feet below the final soil cover grade at the site. The geotextile material will also be secured within the crest of the revetment. The cross sections included in Figure 7 shows the anchoring of the demarcation fabric relative to the other cover layers.

The utility marking tape will be placed in a 10-foot grid on top of the fabric. Securing pins will hold both the tape and the fabric in place during placement of the subsequent soil cover layers. The utility tape will be of a material suitable to be detectable by electromagnetic geophysical equipment.

3.2.4 Surface Drainage

The final soil cover is designed to achieve sheet flow over the majority of the surface as a means to dissipate the energy and flow of runoff caused by storm events, as explained in the soil cover section (Section 3.2.2) of this DBR. Surface water runoff over the future cover is the same as the current drainage of the site, where water drains generally toward the north and flows either over the bank of the shoreline to the bay or joins the existing drainage along the northwestern property boundary and discharges to the bay. The portion of the soil cover in the vicinity of the shoreline will be constructed to slope gently toward the revetment and to minimize the ponding of water on this portion of the site. Final cover contours are provided in Figure 8 and as cross sections on Figure 7.

The natural topography of the area surrounding the site and the curbing and other drainage provisions along Innes Avenue prevent significant run-on to the IR 7 and 18 site. Given the future elevation and grade of the soil cover, only the area south of the site (between the boundary of IR Site 18 and Innes Avenue) will drain toward the soil cover. This drainage area is approximately 5 acres. The water flowing onto the site from this portion of the property will be controlled by a drainage swale incorporated into the soil cover along the boundary of the IR 18 site as shown on Figure 8. The drainage swale will be constructed through cover grading provisions on that portion of the site to direct flow toward the northeast along the southern boundary of the site and discharge to the existing off-site drainage channel along the southeastern portion of the site boundary. The minimum 2 feet and 3 feet cover requirements will be maintained under the drainage swale. The location of the drainage swale is included on Figures 7 and 8 of this DBR. The design of the drainage swale and the calculations are provided as Appendices C and D of this DBR.

The swale was designed to accommodate a storm event of a 100-year return interval. The methodology for the calculation of the peak flows is based on the methodology described in *Applied Hydrology* (Chow and others 1988) and methodology described in *Urban Hydrology for Small Watersheds – Technical Release 55* (Natural Resource Conservation Service [NRCS], 1986). The assumptions that were made when calculating the design peak flows from the watershed entering the swale channel were:

- Annual average precipitation of 21.5 inches
- Watershed drainage area of 5 acres divided by subcatchments
- A 100-year return interval storm was used in calculations
- The surface of the watershed is primarily grass and scrub growth in poor condition
- The average slope of the watershed is 14 percent
- The first 100 feet of runoff over the watershed is modeled as sheet flow and the remaining portion is shallow concentrated flow until inflow to the drainage.

The following criteria were used to design the drainage swale to convey the flows:

- The swale must drain the 100-year return interval storm without jeopardizing the integrity of the final cover.
- Peak flow rate of 6.3 cubic feet per second (cfs) associated with the design storm must be controlled.
- Velocities of intermittent flow in grass-lined reinforced channels cannot exceed 8 feet per second (fps) without armoring or other considerations to dissipate energy.
- Maximum shear stress on the grass-lined swale during the establishment of the vegetation is 3.2 pounds per square foot (psf) and 8 psf following establishment, which includes CTRM.
- The side slopes along the drainage route will vary between approximately 1V:17H and 1V:4H for the area upgradient of the water course.
- The slope along the channel water course is between 0.2 and 1.8 percent.

The peak flow under the 100-year storm event calculated for the drainage channel is a conservative 6.3 cfs. Detailed calculations for the peak flow in the watershed and channel are provided in Appendix C and Appendix D.

Using these assumptions, a reinforced grass-lined drainage swale of 1 foot in height is sufficient to control the peak flow of a 100-year return interval storm, and water depth along the swale would not exceed 0.75 foot. This peak flow will not erode the soil along the drainage route or soil cover over the site. The calculation is provided as Appendix D. The location of the drainage swale is provided in the cross sections of Figure 7 and the final cover grade of Figure 8.

The drainage swale will discharge overland to the existing off-site drainage feature running along the southeastern property boundary and ultimately discharge to the bay. The swale will control all appreciable flow onto the soil cover from off site and thus control erosion from water. Overall the existing drainage patterns of the site and the surrounding area are not

significantly affected by the proposed soil cover, and off-site drainage features will not receive significant increased flows as a result of the remedy. Overland sheet flow to the northwest property boundary will be reduced by 85 percent of current conditions as a result of the soil cover.

Although the drainage provisions for the project are being designed as a long-term remedy, it is anticipated that the City of San Francisco will begin construction of the park over the site within a relatively short period after the remedy is complete. Any future alterations to the soil cover or the areas draining toward the cover will affect the site drainage.

3.2.5 Erosion by Wind and Water

Erosion by wind and water of the soil cover was estimated, and the complete calculation is available as Appendix B of this report. The erosion calculations were completed for the two cover scenarios anticipated for the project: (1) the period just after the cover is seeded and before the grasses are established, which is considered the establishment period, and (2) the period after the grasses become established over the cover, which is considered the long-term cover scenario. These two scenarios were compared with the acceptable erosion rate of 2 tons/acre/year as suggested by the American Society of Civil Engineers for the design of landfill covers.

For the first scenario, it was assumed that the ground cover would be completely bare and fully exposed to wind and water erosion without protection for the period just after the grasses are planted over the soil cover. Under this scenario, total erosion losses over the cover would be anticipated to be approximately 5.3 tons/acre/year, or a loss of 0.034 inches of soil/year. This rate is considerably greater than the acceptable loss of 2 tons/acre/year; thus, vegetation is needed over the cover for erosion control and provisions are needed for erosion control during the establishment period. The establishment period is approximately 3 months; during this time, the construction contractor will use erosion control practices (binders or geonetting) to prevent erosion and ensure the success of the vegetative cover.

For the long-term vegetative cover scenario, it was assumed that the ground cover over the site would conservatively be 80 percent grass covered. Under this scenario, total erosion losses over the cover would be anticipated to be approximately 0.07 ton/acre/year, or a loss of less than 0.0005 inch of soil/year. This rate is considerably less than the acceptable loss of 2 tons/acre/year, and the recommended vegetative cover will be sufficient to control erosion over the site. Practices for controlling erosion and maintaining the vegetative cover are included in the O&M plan. It should be noted that the impact to the bay from sediment loading associated with the final cover will be negligible and provisions will be taken during the establishment period to control sediment migration.

The slope to the south of the site was not a part of the remedial design. No estimate of stability or erosion was performed for this area, and failure of this slope is not anticipated to threaten the integrity of the final cover.

3.2.6 Other Design Considerations – Soil Cover

Overall, the entire volume of soil estimated to be needed for the construction of the soil cover is 66,200 bcy or 86,000 lcy for acquisition, as calculated in Appendix A.

The elevation of the final cover over the site will be surveyed after the project is complete to document the final cover elevations. Two permanent survey monuments will be installed on the cover as required by Title 27 CCR 20950(d). It is anticipated that construction of the park will be initiated shortly after the property is transferred to the City of San Francisco, which may include significant filling and regrading on top of the soil cover. The final elevation of the future park will need to be considered in post-closure elevation monitoring of the cover.

The existing HPS radiological screening area is assumed to be available and sufficient for the screening of the soil excavated along the property boundary for the initial grading of the site. Grading this area is anticipated to generate less than 500 lcy of soil over a period of less than 1 week. The current screening area has a processing capacity at any given time of approximately 1,200 cubic yards of soil among six screening pads.

After the soil cover is installed, a permanent fence will be constructed around the perimeter of the site along the portions of the site abutting property that is not currently owned by the Navy. Portions of the current fence will be used during construction along with the temporary fencing, and it will be used again as permanent site fence after construction. However, new fence will need to be constructed along the northwestern property boundary to separate current Navy property from non-Navy property.

All construction will meet the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and a San Francisco Bay Conservation and Development Commission (BCDC) major permit. Best management practices (BMP) will be implemented and maintained to minimize erosion and control sediment migration during construction.

3.3 REVETMENT

A revetment is a facing of armor material such as stone or concrete that is intended to protect a shoreline feature from erosion or slope failure. The primary physical components of the revetment are the armoring material, the toe, the crest, and the filter layer. The armoring material is selected and sized based on the forces to which the structure is exposed, such as water currents, wave action, and gravity. The extent of the revetment, or the elevations of the toe and crest, is based on the expected high and low water conditions, significant wave heights, and wave runup on the structure. The filter layer is set between the armoring material and the underlying soil or engineered fill and is intended to allow water to pass while supporting the structure and preventing erosion.

The design of the revetment for HPS IR Site 7 differs slightly from traditional revetment designs. These differences are related to the additional function in containment of the contaminated soil and sediment of the IR 7 site and protection of human and ecological health — similar to the

provisions of the soil cover over the landward portion of the site. The following list summarizes the primary design considerations that were used in developing the revetment design.

- The impact of anticipated wave energy.
- Water levels from tidal fluctuations and potential sea level rise is considered.
- Encapsulation of all potentially contaminated sediment of IR Site 7; thus, the revetment needs to extend to the off-shore property boundary.
- Prevention of human contact with the potentially contaminated soil and sediment beneath and provision of a sufficient barrier similar to the function of the on-shore soil cover.
- Filling of the bay from riprap must be minimized.
- The future use of the area as a park, and the possibility for tampering with and foot traffic along the revetment.

The following sections summarize development of the design of the revetment for IR Site 7. The proposed revetment would be installed along the approximate 950 feet of shoreline where IR Site 7 meets the bay and is between 60 and 120 feet wide, depending on location along the shore. A conservative approach for design of the revetment was taken to maximize its ability to prevent contaminated soil from migrating to the bay while remaining protective of human and ecological health, considering the future use of the area. The following sections and procedures for the revetment design are based on the U.S. Army Corps of Engineers "Design of Coastal Revetments, Seawalls, and Bulkheads" and "Coastal Engineering Manual" (1995 and 2006). A typical cross section of the revetment is provided as Figure 9 to this DBR, and the extent of the revetment is shown in Figure 10.

3.3.1 Water Level Ranges

The tidal ranges for HPS Parcel B IR Site 7 were estimated from data obtained through the National Oceanic and Atmospheric Administration (NOAA) Center for Operational Oceanographic Products and Resources and from NOAA tidal data for the area. Tidal data serve as the basis for design of a revetment as a primary component in calculating the crest elevation and the extent of the structure.

The tidal range between the mean higher high water (MHHW) and the mean lower low water (MLLW) was approximately 6.73 feet for the tidal epochs of 1960 through 1978 (NOAA Hunters Point Tidal Bench Mark and Datum). The MHHW and MLLW are defined as the mean of the higher high water height and the lower low water height of each tidal day observed over the tidal datum epoch. When adjusted for the location specific mean sea level (msl) at the site, the MHHW is +3.17 feet above msl and the MLLW is -3.56 feet below msl. Tidal ranges are generally referenced to MLLW; however, elevations are referenced to msl in this design to remain consistent with overall site elevations and the surveys completed. The surveyed elevations used in this DBR have been corrected to reflect the actual local sea levels at the site.

Also of significance for the revetment design is the determination of the highest water levels expected. Tidal data were obtained to assess the extreme high and low water events for the tidal epochs described above. An extreme high tide of +6.14 feet above msl can be expected for the project location and is associated with a 100-year return period (Moffatt and Nichol 2009). The tidal range calculations and adjustment factors are included as Appendix E to this DBR. The following table summarizes the primary tidal data elevations used for the revetment design and calculations.

TIDAL RANGES AND ELEVATION DATUMS

Tidal Datum	Reference Datum		
	MLLW	NGVD 1929	MSL[b]
Extreme	+9.7[a]	+6.58	+6.14
MHHW	+6.73	+3.61	+3.17
MHW	+6.10	+2.98	+2.54
MSL	+3.56	+0.44	0
NGVD	+3.12	0	-0.44
MLW	+1.12	-2.06	-2.44
MLLW	0	-3.12	-3.56

Notes:

a From Moffatt and Nichols, 2009. "Candlestick Point/Hunters Point development Project – Initial Shoreline Assessment".

b The MSL for the site is a locally established datum for the site. This datum is consistent with the survey data associated with the site as used in the design drawings and calculations.

MHHW Mean higher high Water
MHW Mean high water
MLLW Mean lower low water
MLW Mean low water
MSL Mean sea level
NGVD National Geodetic Vertical Datum

The potential for an increase in the sea level elevation as a result of atmospheric warming has been considered in the design of the revetment. A contingency of up to a 3-foot increase in sea level has been considered (Church and others 2001, 2008; Moffatt and Nichol 2009), based on comments from the public and the regulatory agencies. This assumption incorporates additional conservatism into the design.

3.3.2 Wave Dynamics

Wave height depends largely on the velocity of wind over the water, the duration of the sustained wind, and the available wind fetch (the uninterrupted over-water distance where wind can affect the water surface). The greatest sustained wind speeds that might affect generation of waves for the site are anticipated to be from the northeast at a range between 36 and 41 miles per hour (mph) and have been estimated to have a 100-year return period. Unsustained wind gusts of short duration do not effect formation of waves significantly. Determination of the wind dynamics for the design is summarized in Appendix F.

Fetch distances available for the IR 7 site are from the cardinal directions from north to east-northeast of the site. Fetch distances in the other cardinal directions are restricted by significant land masses. Additionally, the Bay Bridge north of the site is considered a limitation to the fetch distances because it interrupts the winds and waves that will affect the site. The range of available fetch distances associated with the site is between 4.1 miles and 6.2 miles. The summary of the available fetch distances for the site is provided as Appendix G to this report.

A series of deep-water wave heights can be calculated for given wind and fetch parameters available for a location. Appendix H summarizes the anticipated wave heights by appropriate cardinal direction for the site. The highest calculated wave height is considered the significant wave and is used in the design of a revetment or other coastal structures. The highest calculated significant wave height anticipated for the site would be from the north of the site with a height of 3.0 feet associated with the 100-year return period winds. This maximum anticipated significant wave of 3.0 feet serves as the design wave in calculations throughout the design.

This calculation of the design wave correlates with independent analysis of the wave conditions available for HPS when the site-specific conditions of the IR 7 site are considered (Woods Hole Group 2001, Moffatt and Nichol 2009).

The design wave, as summarized above, is an open water wave that would break before it reached the shoreline and the revetment. It is used in this design and provides a conservative estimate of the wave energy that can be expected to affect the revetment. Generally, a wave will break when it reaches a water depth equal to or less than approximately 127 percent of its height (U.S. Army Corps of Engineers 2006). Based on this ratio of wave height to depth, the design wave will crash in 3.8 feet of water or 20 to 100 feet from shore, depending on water elevation. This calculation and a figure that shows the wave breaking distance from shore is provided as Appendix I to this report. After it breaks, the design wave will move toward shore and its energy will dissipate. The open water wave has been used in this design because it is conservative; however, the actual wave energy along the revetment will be less.

3.3.3 Selection of Suitable Armor Material

Revetments can be constructed from a wide variety of materials, including stone, concrete, or prefabricated mats and blocks. Potential materials were screened and selected based on the strength, availability, cost, and constructability.

Special consideration was also given to the future use of the area as a park in selecting the material. Materials such as concrete and prefabricated alternatives were eliminated from consideration because of their unnatural appearance when compared with the stone options.

In addition to appearing more natural, stone-based options are flexible and are able to withstand minor damage without compromising strength and function. Revetments constructed from stone can also be repaired more easily than can structures made from prefabricated materials.

There are three primary natural stone based options: (1) multiple layers of angular uniform sized rock (quarrystone), (2) graded rock of sizes between upper and lower limits (riprap), and (3) layers of subrounded to rounded boulders (field stone). The primary disadvantage to revetments constructed of field stone is that they have considerably less strength than revetments constructed of more angular quarrystone or riprap material of the same weight. Obtaining larger field stone needed for a revetment could be difficult, and placement of this material is costly. For this reason, field stone was not considered.

When comparing the strengths of randomly placed quarrystone versus randomly placed riprap, a greater thickness of quarrystone is needed to achieve the strength of a less thick layer of riprap. The quarrystone option would likely have a greater cost than riprap for a comparable strength. For this reason, uniform quarrystone was not considered suitable. Additionally it has significant void space between rocks, which could pose a trip hazard to potential foot traffic given the anticipated future use of the site as a park.

Riprap is not recommended for revetments with sustained exposure to waves larger than 5 feet. The significant wave for this design was estimated at 3 feet, and a natural riprap material was deemed the most appropriate option. This design and calculations found in the appendices related to the revetment were completed using a randomly placed natural riprap, which is typically composed of two layers of the selected median size armor stone.

3.3.4 Revetment Slope Selection

The slope of a revetment is determined based on the existing conditions of the site and cost factors. A uniform slope along the revetment is desirable for ease in construction and to maintain uniform rock gradation throughout the structure. More steeply sloped riprap revetments are inherently less stable, and larger rock sizes are needed to achieve the same strength as less steeply sloped structures. If varying slopes are used along the revetment, varying riprap sizes are needed to maintain the stability, which can increase the risk of failure and can complicate O&M of the structure. Therefore, a uniform slope has been used in this design.

The other primary consideration in selection of the slope is the assessment of the existing shoreline slope and the amount of soil and sediment that would need to be excavated or filled to achieve the prescribed slope. The existing slope along the extent of the revetment varies considerably between about 1V:2H and 1V:10H. A uniform slope of 1V:4H approximates the existing slope along the shoreline, which reduces the total amount of excavation necessary along the upper portion of the revetment.

The revetment also needs to extend to at least the northern IR 7 site boundary with Parcel F to contain or encapsulate all the potentially contaminated shoreline soil and sediment. Revetments designed for nonhazardous waste sites ordinarily would not include this provision. As a result, an extended toe portion of the revetment will be necessary to achieve this lateral extent along portions of the structure. The extended toe portion of the structure will approximate the existing off-shore slopes in an effort to limit the amount of excavation while keeping the toe portion of the revetment submerged by sediment, which provides increased stability and reduces obstruction. Figure 9 of this report shows a typical cross section of the revetment and includes the extended toe portion. Figure 10 of this report shows a plan view of the revetment extents.

The construction of the revetment as designed will not result in a filling of the bay and the bay area will increase slightly as a result of this grading plan.

Approximately 5,100 bcy of material will excavated along the shoreline and 970 bcy (1,100 lcy) of fill material is necessary to achieve these prescribed slopes for the revetment. Refer to Appendix J for this calculation. This volumetric calculation includes debris and boulders that will be removed from the work area before excavation begins. The excavated materials will be screened for radionuclide contamination at the existing HPS radiological screening area. Radionuclide-contaminated material will be disposed of off site at a LLRW disposal facility; non-radionuclide contaminated material will be placed on the landward portion of the site and contained under the 3-foot soil cover as explained previously in Section 3.2.1 of this DBR and shown in Figure 5.

3.3.5 Armor Unit Sizing

Armor unit sizing for revetments depends on five primary physical factors: (1) wave height, (2) the slope of the structure, (3) the type of material used, (4) the configuration of the revetment, and (5) the degree of access by the public.

Considered in the determination of the armor unit size was the future use of the site as a park. Issues such as vandalism, theft, and inadvertent movement of the rocks caused by foot traffic needs to be considered in the design because of the public access to the area. Generally, rocks of weight between 400 to 500 pounds or rocks with an approximate diameter of 1.35 to 1.45 feet are of sufficient size to withstand vandalism, theft, and inadvertent movement. This sizing is based on guidance from the U.S. Army Corps of Engineers (1985).

The calculation of the median rock size (W_{50}) of the riprap was calculated using the Hudson formula. The calculation is included as Appendix K of this DBR. The calculation is based on a revetment slope of 1V:4H, revetment material consisting of randomly placed riprap, and a design wave height of 3.0 feet. Using this formula yields a W_{50} of approximately 130 pounds, which corresponds to a diameter of 0.93 foot.

The median weight calculated using the Hudson formula is considerably less than the recommended weight for projects with a high degree of public access of 500 pounds, as described above. The recommend weight of 500 pounds is the more conservative of the two sizing methodologies, so this weight was selected as the W_{50} for the revetment.

The layer thickness of graded riprap measured perpendicular to the slope is calculated based on both the W_{50} rock size and the largest rocks obtained (W_{100}). The California Department of Transportation (Caltrans) publishes rock gradation for riprap revetments. Based on the W_{50} of 500 pounds, the upper rock size of the gradation specified by Caltrans is 1,000 pounds with a minimum weight of 75 pounds. This gradation is commonly referred to as "1/4-ton riprap" and is readily available in the vicinity of the site. Based on this gradation, the revetment will be 3.0 feet thick, or two times the diameter of the W_{50} rock. This calculation is provided as Appendix L of this DBR.

A 3-foot uniform thickness of the revetment with a W_{50} rock weight of 500 pounds will prevent any human contact with the potentially contaminated soil and sediment beneath. This thickness is also consistent with the thickness of the soil cover over the potentially radionuclide-impacted portion of the landward portion of the site.

3.3.6 Crest Elevation

Ideally, the elevation of the top of the revetment or the crest should be at a sufficient height above the water level to prevent overtopping of water. Thus, maximum water levels, wave heights, contingencies, and potential wave runup are considered for selection of the crest elevation. Runup is defined as the vertical height above the still water level to which the uprush from a wave will rise on a structure.

The wave runup onto a revetment is based on the design wave, the design wave period, the depth of water on the revetment, and the slope of the revetment. The wave runup is calculated using the Ahrens and Heimbaugh Formula and the calculation is provided as Appendix M of this DBR. Using this formula and the site conditions anticipated yields a maximum wave runup of approximately 2.5 feet, which is associated with a 100-year return period.

The expected high water and wave conditions associated with a 100-year return interval are used in calculating the crest of the revetment. The following summarizes the data that were used.

- 100-year high water level of 6.1 feet msl
- Design wave of 3.0 feet
- Wave runup on the revetment of 2.5 feet

Using these 100-year return interval high water and wave conditions yields a crest height of the revetment of 11.6 feet above msl. This calculation assumes that the 100-year return interval wave would occur during the 100-year high water event and is an inherently conservative estimate for the crest elevation that would prevent wave overtopping.

A revetment crest elevation was selected of 15 feet msl, which is significantly greater than the extreme conditions summarized above. The 15 feet elevation will provide for 3.4 feet of allowance for freeboard and sea level rise. Sea level rise has been projected to be up to 3 feet (Church and others 2001, 2008; Moffatt and Nichol 2009).

Secondarily, the selected 15 feet crest elevation will also be protective of the soil cover over the landward portion of the site. The soil cover along the shoreline of the site will reach an elevation of approximately 15 feet above msl. Designing the revetment to rise to meet the elevation of the cover is more protective of the cover than sloping the cover more steeply downward to meet the revetment, which would be more susceptible to erosion from wind, water, and foot traffic.

Figures that show the typical cross section and extents of the revetment are provided as Figures 9 and 10 to this DBR.

3.3.7 Toe Protection

Toe protection is provisions in front of the revetment on the beach, bottom surface, or subsurface that prevents undercutting and scour of the structure. Scour potential at the location of the revetment is anticipated to be minimal based on the near-horizontal slope of the nearshore area. Additionally, sediment dynamics studies conducted for the HPS peninsula associated with Parcel F indicate that the nearshore area of the IR 7 site has a high potential for sediment deposition, regardless of tide (Woods Hole Group 2001). Based on the available data, the potential for scour along the toe of the revetment is low; however, the toe has been designed conservatively assuming that a low to moderate potential for scouring exists. Using this conservative scour potential criterion, the general toe design shown in Figure 9 was selected, which would be protective of the structure.

The toe will be of uniform 3-foot thickness, and the end of the toe will be excavated and placed a minimum of 4.5 feet below the existing off-shore grade. The top of the submerged toe will be at least 1 foot below the existing grade. Submerging the toe below the existing grade provides additional stability to the structure than would be the case of an exposed toe. Refer to the seismic stability analysis provided as Attachment 3 for information on the stability of the structure.

Some portions of the revetment, primarily in the central portion of the shoreline, will not reach the site boundary with Parcel F at the 1V:4H slope without excessive excavation based on the distance off shore of the property boundary. The toe will be extended in these areas at a less steep slope, similar to the existing off-shore conditions, until the site boundary is reached. This extension will reduce the amount of excavation necessary. This toe extension will contain the potentially contaminated shoreline sediments up to the site boundary without excessive excavation. Refer to Figures 8, 9, and 10 for the extent of the revetment and a typical cross section.

Using an equation similar as is used for armor unit sizing, the minimum weight of the riprap can be calculated specifically for the revetment toe. This calculation is provided as Appendix N of this report. Using this process and conservative assumptions about the final depths of the structure, a minimum stone weight of approximately 32 pounds is obtained for the revetment toe. Based on the Caltrans gradation for 1/4-ton riprap provided in the calculation, all rock in the revetment will be at least twice the minimum weight requirement for the toe.

3.3.8 Filters and Underlayers

A filter layer is needed between the revetment rock and the underlying soil to ensure that the revetment is supported. The filter layer has a tramsmissivity of at least the surrounding sediment and soil allowing water to pass (both groundwater and surface water) while maintaining the stability of the soil. A geotechnical filter fabric intended for ocean shoreline and revetment applications is placed onto the base of the excavation in overlapping lateral sections and extends beyond the toe and crest sections to prevent sinking or moving of the entire structure as a result of soil erosion. A layer of gravel or crushed rock is spread over the filter fabric to protect it from the armoring and distribute the load of the rock. This gravel layer also contributes to the interlocking and securing of the armor material. Refer to Figure 9 for the typical cross section of the revetment and the filter layer and its location relative to the revetment stone.

The filter fabric will run under the entire length of the revetment and will be tied into the revetment rock at both the toe and the crest, as shown in Figure 9. Securing the filter fabric into the revetment as shown will secure the material in place even if the revetment material settles over time.

Given the site-specific conditions and the construction of the revetment, filter fabric sections should overlap by at least 2 feet to ensure continuity of the fabric material when the weight of the revetment armor is added and during any shift of the revetment that may occur over time. Additionally, a 6-inch layering of crushed rock of 3/4-inch diameter would be sufficient as protection of the geofabric filter material from the weight of the revetment rock. These provisions are based on initial conversations with filter fabric manufacturers and given the conditions at the site.

3.3.9 Materials Quantities

Materials quantities for the revetment were calculated for the amounts of riprap, crushed rock, and filter fabric material that would be needed for the project. These calculations are provided as Appendix O and are summarized below.

- Riprap rock – 8,640 yd^3 or 13,470 tons
- Crushed rock – 1,440 yd^3 or 2,250 tons
- Filter fabric – 10,110 yd^2

The calculations include a 30 percent porosity for the crushed rock and riprap, 2 feet of overlap between filter fabric sections, and 15-foot fabric sections.

3.3.10 Other Design Considerations - Revetment

After construction of the revetment is complete, the structure will be surveyed to document the final elevations. These final elevations will be used for assessing the movement of the structure over time during O&M. Some movement and settlement of the structure are expected and will increase the strength and stability of the structure.

The majority of the revetment is to be located above the mean sea level elevation and can be constructed from shore without the use of barges or other provisions for construction from off shore.

The lateral extents of the revetment along the existing shoreline, or where the revetment meets the adjacent sites, will be below the existing grade for the toe and the lower portions of the revetment. Sediment will fill in above the revetment over time to meet the existing grade. The crest portion of the revetment at the lateral extents will be above the existing adjacent site grade and will slope on site to meet the existing grade of the adjacent site while maintaining the 3-foot thickness. Eventually, the northeastern revetment extent will be tied into the revetment anticipated for the remainder of Parcel B.

A permanent site security fence will be constructed as described in Section 3.2.6 of this DBR to prevent unauthorized access to the site from non-Navy property. The fence will extend along the northeastern property boundary to meet the mean sea level elevation, as is the current condition, and will be installed into the revetment armoring material as necessary.

Studies completed for the HPS peninsula (Woods Hole Group 2001) indicate that the bay area in the vicinity of the site is depositional and it is expected that over time the toe portions of the revetment will fill with sediment. The extent of filling is not known but could reach to the existing elevations. This filling will enhance the stability of the revetment to some degree through the further stabilization of the toe. This filling will have a negligible effect on the near shore wave dynamics.

It is anticipated that the construction contractor will excavate and construct the revetment in completed sections and progress along the shoreline as sections are completed. Constructing the revetment in this method will ensure that the bay water will not be in direct contact with the potentially contaminated soil and sediment that will be contained by the revetment. It also will ensure that erosion of the shoreline material will be minimal during construction, as excavations will be open only during the work day. Erosion control and soil stabilization practices such as silt fencing and hay bales will be used as necessary to ensure that erosion is prevented. Specific methods will be included in the construction contractor's construction plans.

The existing HPS radiological screening area is assumed to be available and sufficient for screening the soil excavated during construction of the revetment. Grading the revetment area is anticipated to generate approximately 5,100 bcy of soil, sediment, and debris over a period of 2 months. Debris and boulders will be removed from this volume before screening. The current soil screening area has a processing capacity of approximately 1,200 cubic yards of soil among six screening pads The material excavated along the shoreline will be handled and screened in accordance with the requirements currently in place for the basewide radiological removal action (TtEC 2008). Excavated material that has been screened and meets residential radiological remediation goals (see Table 8-4 of the amended ROD [ChaduxTt 2009]) may be used as fill behind the revetment structure or spread on the land portion of the site under the proposed cover when possible to reduce or eliminate the need for off-site disposal.

3.4 STABILITY AND SEISMIC CONSIDERATIONS

The stability of the proposed soil cover and the riprap revetment was assessed and is included as Attachment 3 of this DBR. The analysis follows previously completed seismic studies at HPS, in particular an analysis completed for at Parcel E (Tetra Tech EM Inc. 2004).

The calculations were performed using the U.S. Department of the Interior, U.S. Geological Survey (USGS), "Java Programs for Using Newmark's Method and Simplified Decoupled Analysis to Model Slope Performance during Earthquakes" (Jibson and Jibson 2003).

Each of the three calculation methods is a variation of Newmark's method of analysis. The methods used are (1) Simplified Rigid Block Analysis, (2) Simplified Decoupled Analysis, and (3) Rigorous Rigid Block Analysis. All three methods were used to generate results for comparison with each other.

The input parameters selected for these Newmark analyses are site specific. The method uses actual earthquake records from other locations, but these records are mathematically altered to scale for postulated duration and acceleration that mimic the estimated peak ground acceleration and magnitude of the maximum credible earthquake at Parcel B in San Francisco. The maximum probable earthquake (MPE) used in each of the analyses is a very large 7.9 magnitude event located on the San Andreas Fault at a distance of 12 kilometers (7.5 miles) from the site. A peak ground surface acceleration of 0.5g was used based on site-specific evaluations at HPS. The maximum credible earthquake (MCE) was not used in the analysis as it is generally more appropriate for projects where there is an immediate risk of loss of life during an earthquake – for instance buildings and bridges. There would not be a risk of an immediate loss of life during an earthquake at the site and any damages incurred could be easily repaired before there would be a risk of exposure to site contaminants. The conclusions of the assessment are as follows:

- The proposed slopes associated with the soil cover and the revetment are stable under static loading conditions.
- The range of estimated displacement from the MPE is from less than 1 centimeter to 44 centimeters. Most of the estimated displacements are less than 10 centimeters.
- Significant damage resulting from any potential deformation of the ground surface would not be anticipated during earthquake shaking given the estimated displacement.
- Any damage from earthquake shaking could be easily and inexpensively repaired and release of potential radiologically impacted soil is not anticipated. Provisions to secure the site in the event of damage or release of potentially impacted soil are included in the O&M plan.
- Site soils are predominantly sands and gravels and are not susceptible to liquefaction.
- More accurate evaluation of impacts during earthquakes would require significant additional subsurface investigation. Considering the limited risks associated with the site and the ease and low associated cost of repairs, further subsurface investigation is not recommended.

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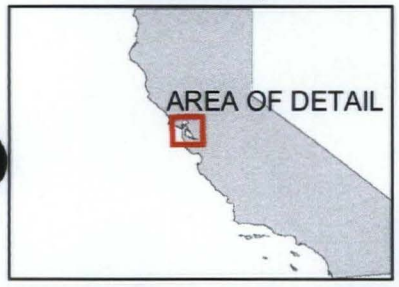
FIGURES

Location Map



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Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 1
HUNTERS POINT SHIPYARD
LOCATION MAP

Remedial Design for IR Sites 7 and 18

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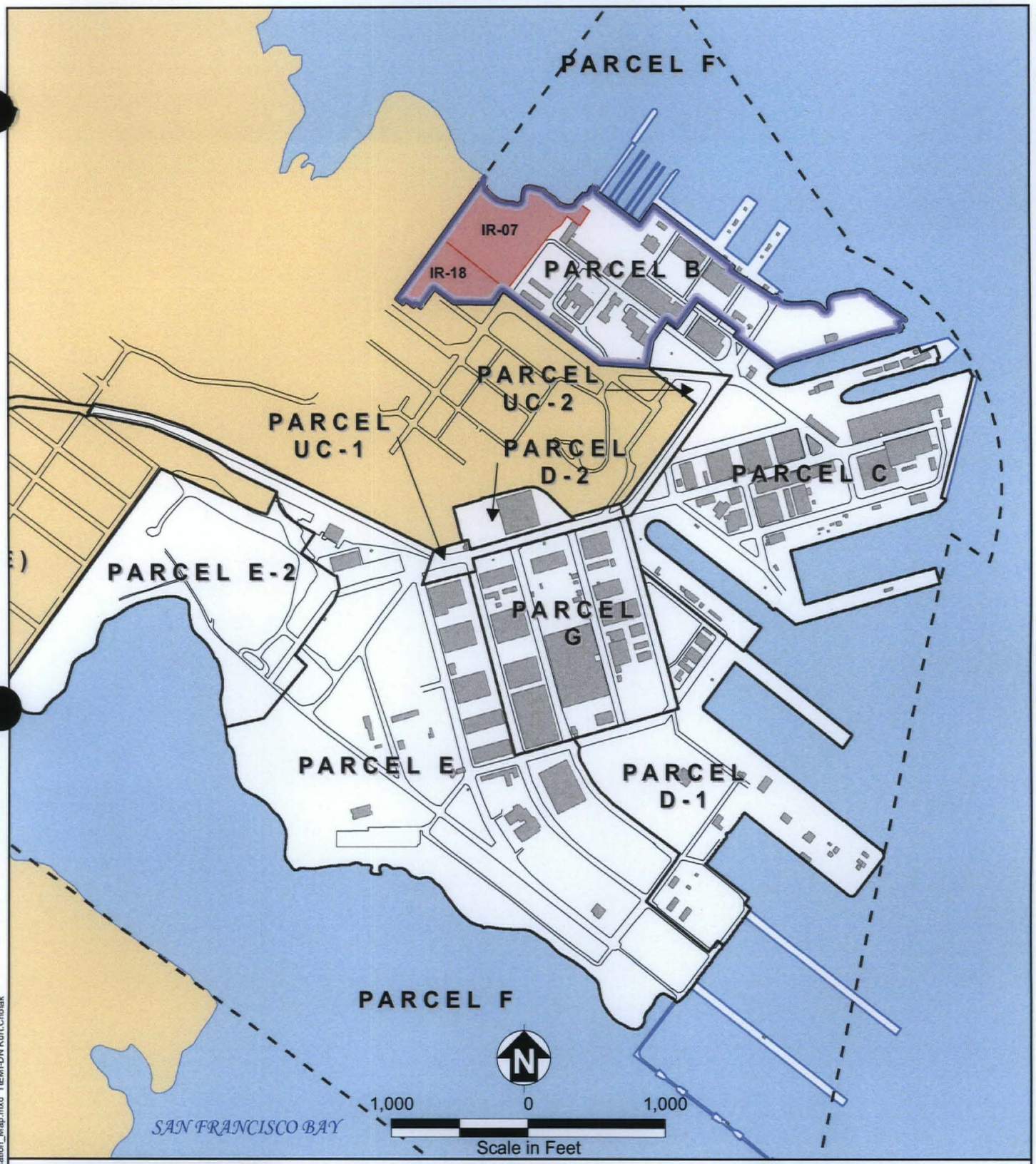

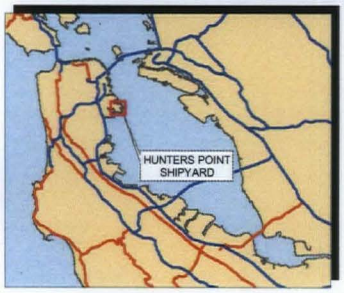

Location Map

- Installation Restoration Sites 7 and 18
- Parcel B Boundary
- Parcel Boundary
- Parcel F Boundary
- Building
- Non-Navy Property
- Road

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FIGURE 2

FACILITY LOCATION MAP

Remedial Design for IR Sites 7 and 18

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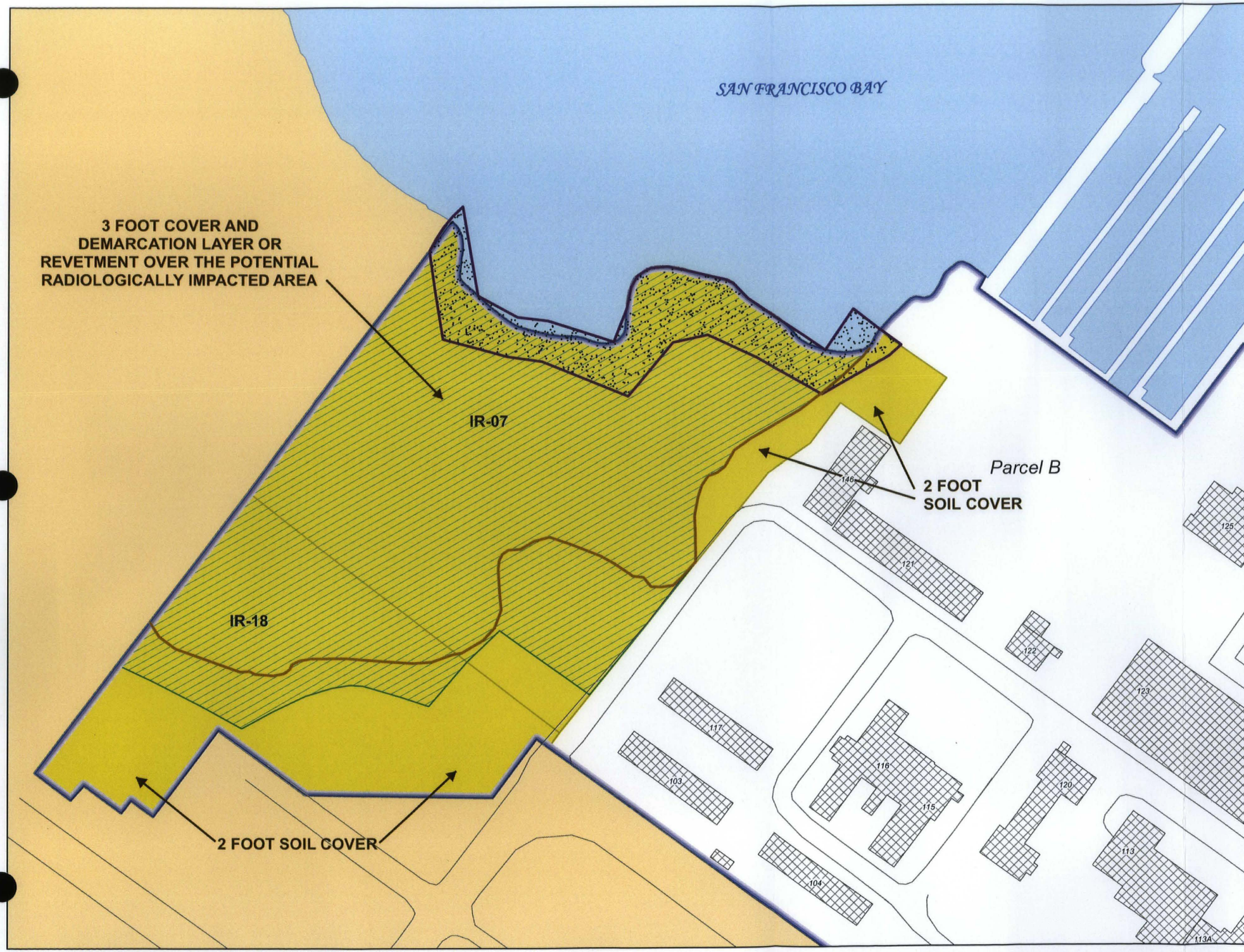
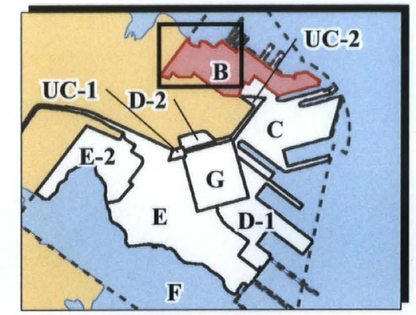
PARTIALLY SCANNED OVERSIZE ITEM(S)

See document # 2253538
for partially scanned image(s).

FIGURE 3

For complete hardcopy version of the oversize document contact the Region IX Superfund Records Center





Location Map

- 1946 Shoreline
- Road
- Potential Radiologically Impacted Area
- IR Sites 7 and 18
- Revetment
- Parcel B Boundary
- Other Parcel Boundary
- Building
- San Francisco Bay
- Non-Navy Property

Notes:

Refer to drawing C11 for details of the cover components. The cover in the potentially radiologically impacted area will include, from the top down, 2 feet of clean imported fill, a demarcation layer, and 1 foot of clean imported fill.

IR Installation Restoration

N

0 150 300

Scale in Feet

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Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 4
DESIGN OVERVIEW

Remedial Design for IR Sites 7 and 18

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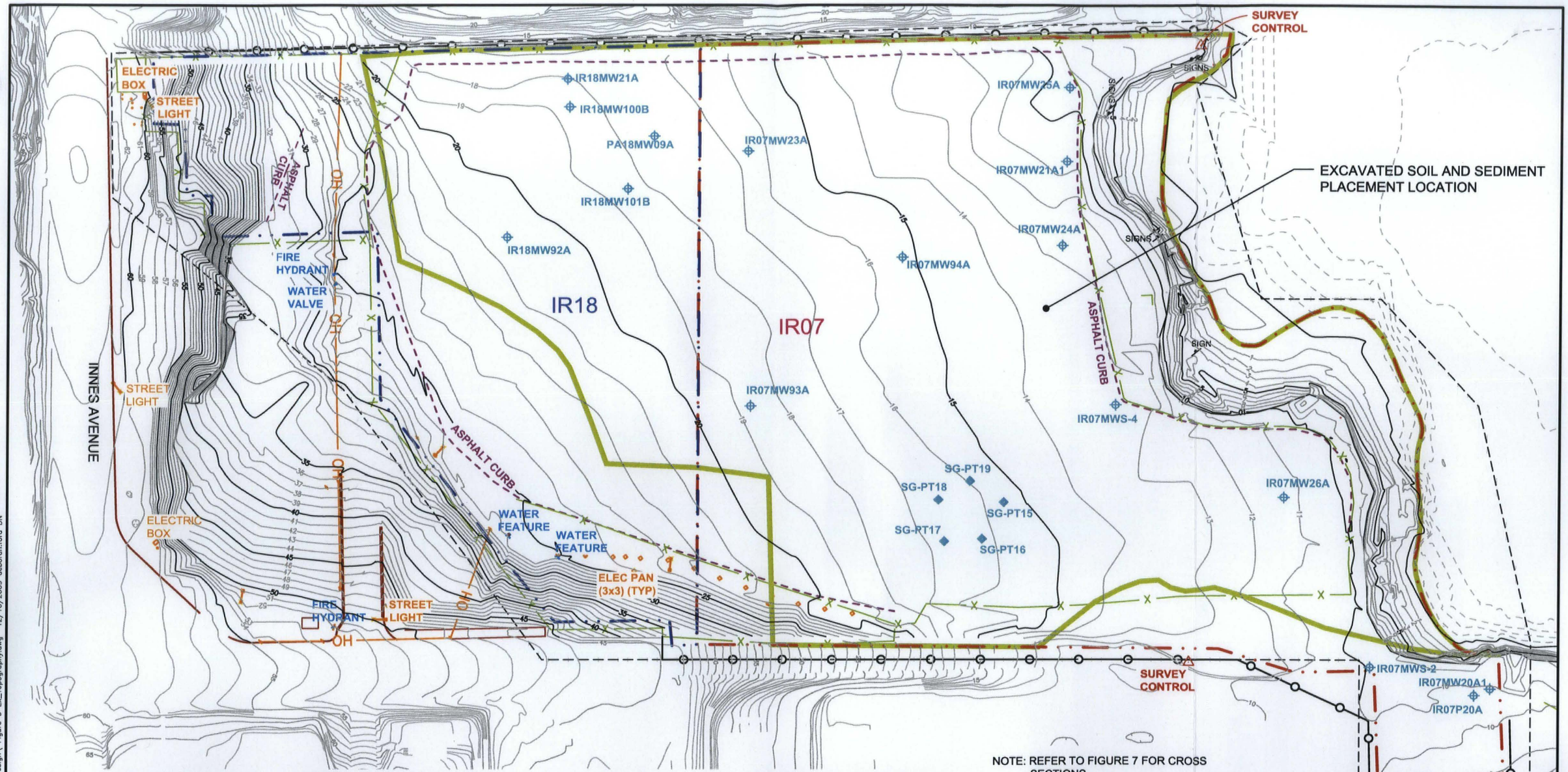


LEGEND

- IR SITE 7 BOUNDARY
- IR SITE 18 BOUNDARY
- RESTRICTIONS RELATED TO RADIONUCLIDES
- MAJOR CONTOUR
- MINOR CONTOUR
- A — A' CROSS SECTION LINE
- SURVEY CONTROL
- CONCRETE CURB / PAD
- FENCE
- OH — OVERHEAD POWER LINE
- TEMPORARY FENCE (DURING CONSTRUCTION)
- APPROXIMATE LIMITS OF CLEARING AND GRUBBING AND DEBRIS REMOVAL
- UTILITY FEATURE
- WATER FEATURE
- ASPHALT CURB
- MONITORING WELL
- METHANE MONITORING PROBE

SURVEY CONTROL DATUM

HORIZONTAL (BASIS OF BEARINGS): NAD27 ZONE-III (HUNTERS POINT WEST 1 PID HT0613) USFT.

VERTICAL (BENCH MARK): NGVD 29 LESS CORRECTION 7.76 FEET MSL

50' 0 50' 100'

SCALE: 1" = 100'

NOT FOR CONSTRUCTION

Hunters Point Shipyard, San Francisco, California

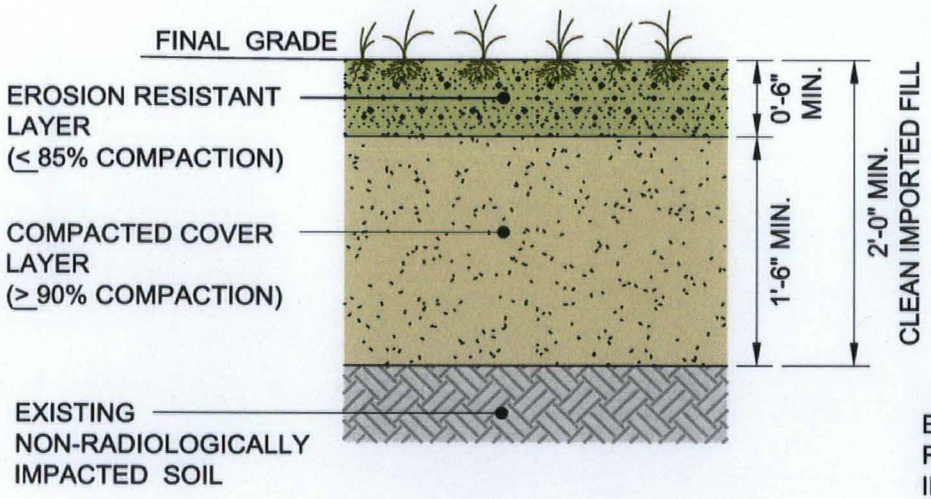
Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 5

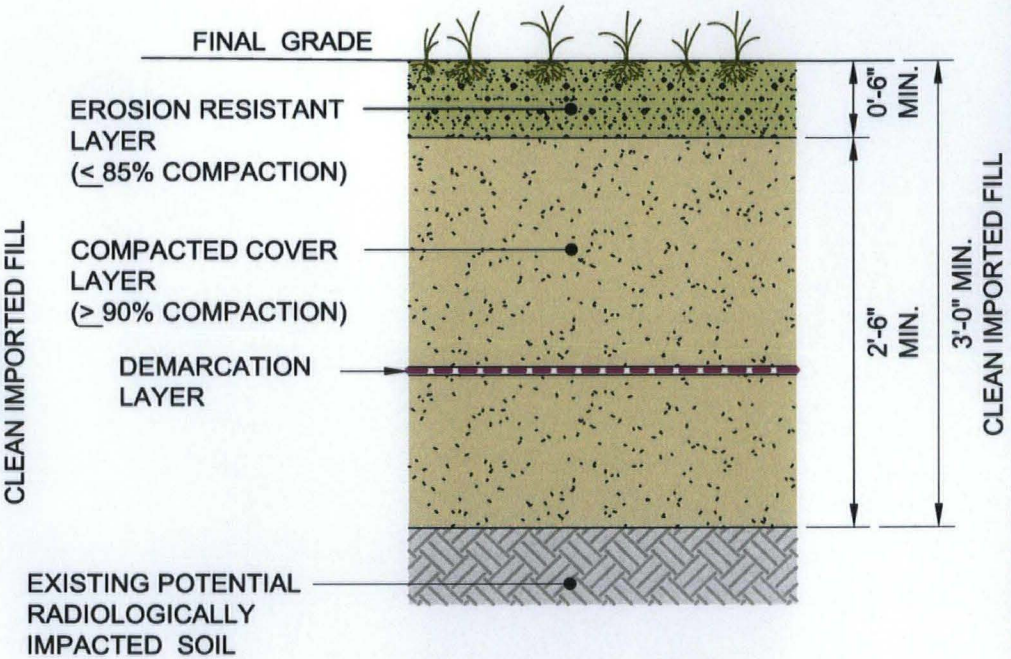
EXISTING TOPOGRAPHY AND CROSS-SECTION LOCATIONS

Remedial Design for IR Sites 7 and 18

R:\Navy\Hunters-Pt\Parcel B\Ir07_Ir08\Remedial Design\ Figure 5 Ex_Topography.dwg 12/10/2009 deborah.ford DN



COVER OVER NON-RADIOLOGICALLY IMPACTED AREA (2 FOOT COVER)



COVER OVER POTENTIAL RADIOLOGICALLY IMPACTED AREA (3 FOOT COVER)

ChaduxTt JV
Consulting Engineers and Scientists

NOTE:
EXCAVATED NON-RADIOLOGICALLY IMPACTED SOIL TO BE PLACED UNDER COMPACTED COVER LAYER.

NOT TO SCALE

NOT FOR CONSTRUCTION

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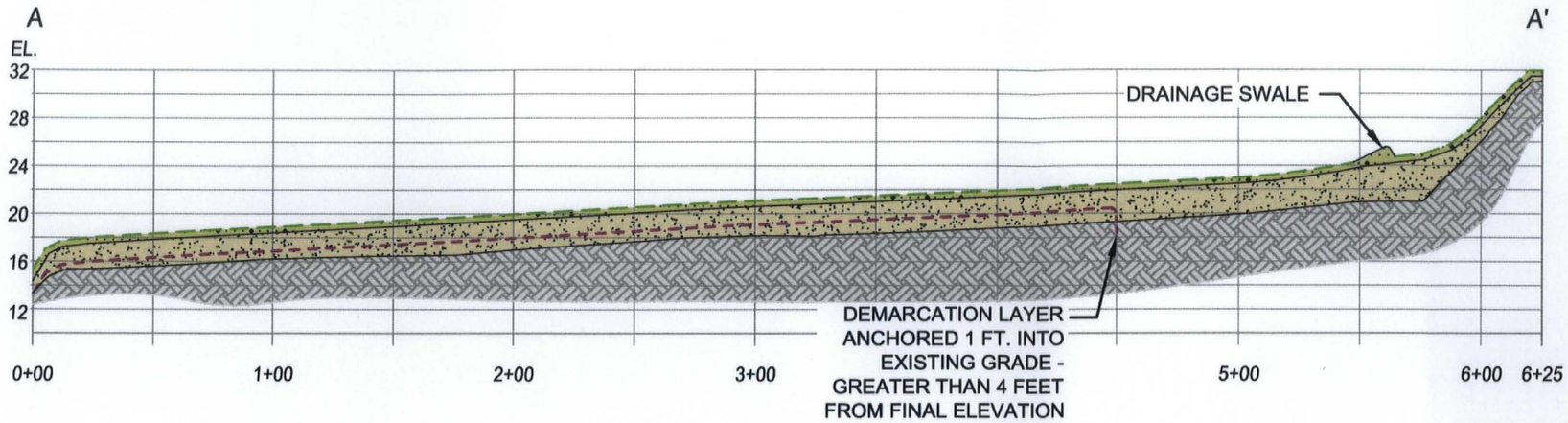
Department of the Navy, BRAC PMO West, San Diego, California

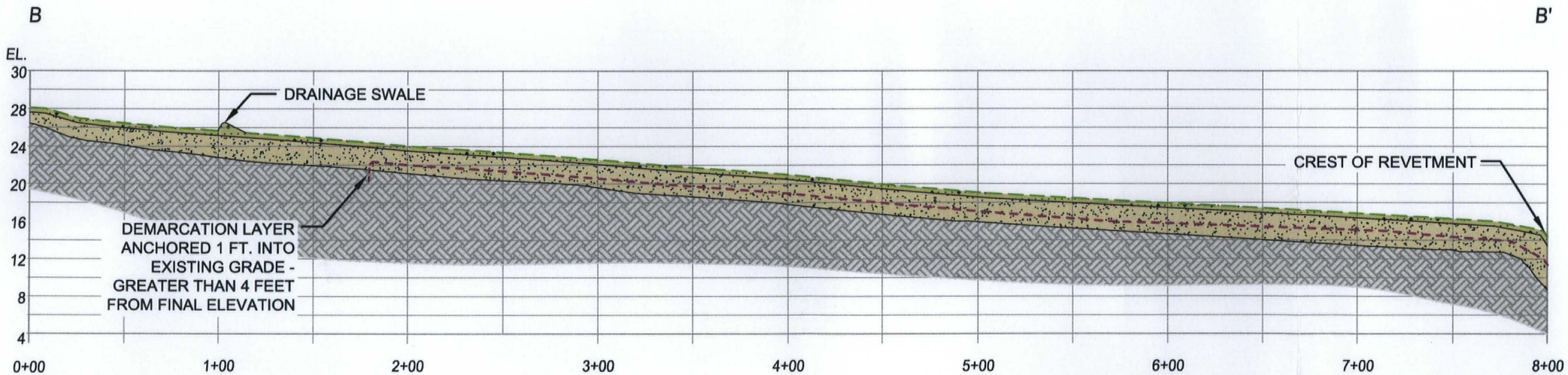
FIGURE 6
COVER COMPONENTS

Remedial Design for IR Sites 7 and 18



LEGEND

- EROSION RESISTANT LAYER
- COMPACTED COVER LAYER
- EXISTING SURFACE
- DEMARCATION LAYER
- EL. ELEVATION



NOTES:

1. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.
2. SEE FIGURES 4 AND 7 FOR CROSS SECTION LOCATIONS.

NOT FOR CONSTRUCTION

30' 0 30' 60'
SCALE: 1" = 60'
HORIZONTAL

6' 0 6' 12'
SCALE: 1" = 12'
VERTICAL

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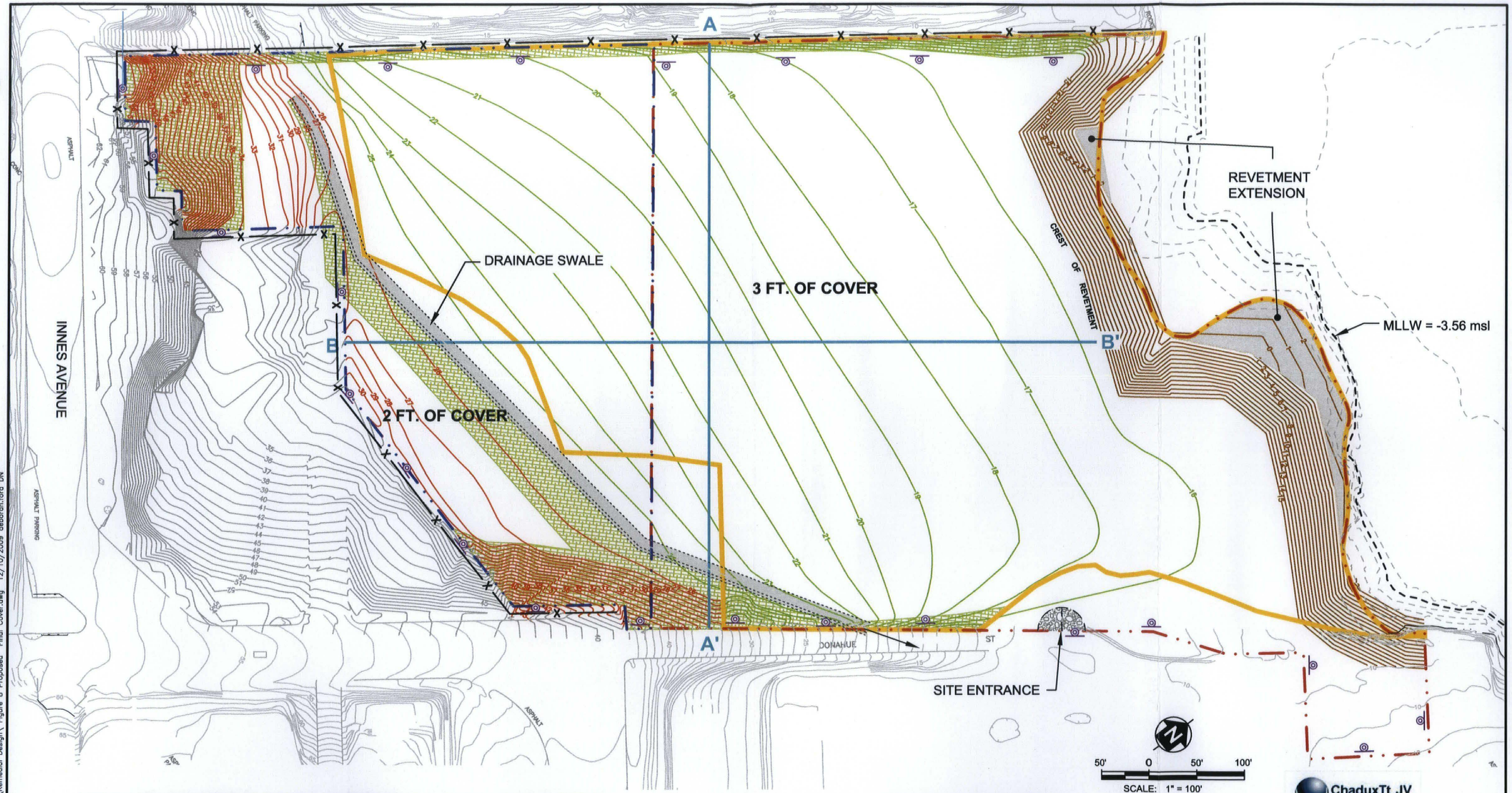
Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 7
CROSS SECTIONS A-A' AND B-B'

Remedial Design for IR Sites 7 and 18

R:\Navy\Hunters-Pt\Parcel B\Ir07_Ir08\Remedial Design\ Figure 7 Cover Cross Sections.dwg 12/10/2009 deborah.ford DN



IR07 BOUNDARY
IR18 BOUNDARY
RESTRICTIONS RELATED TO RADIONUCLIDES
EXISTING CONTOUR
A — A' CROSS SECTION LINE
SIGN
PROPOSED CONTOUR 3 FT. COVER
PROPOSED CONTOUR 2 FT. COVER
PROPOSED OFFSHORE CONTOUR
DRAINAGE SWALE
PERMANENT FENCE
COMPOSITE TURF REINFORCED MATTING (CTRM)

NOTE: REFER TO FIGURE 6 FOR CROSS SECTIONS.

SURVEY CONTROL DATUM

HORIZONTAL (BASIS OF BEARINGS): NAD27 ZONE-III (HUNTERS POINT WEST 1 PID HT0613) USFT.

VERTICAL (BENCH MARK): NGVD 29 LESS CORRECTION 7.76 FEET MSL

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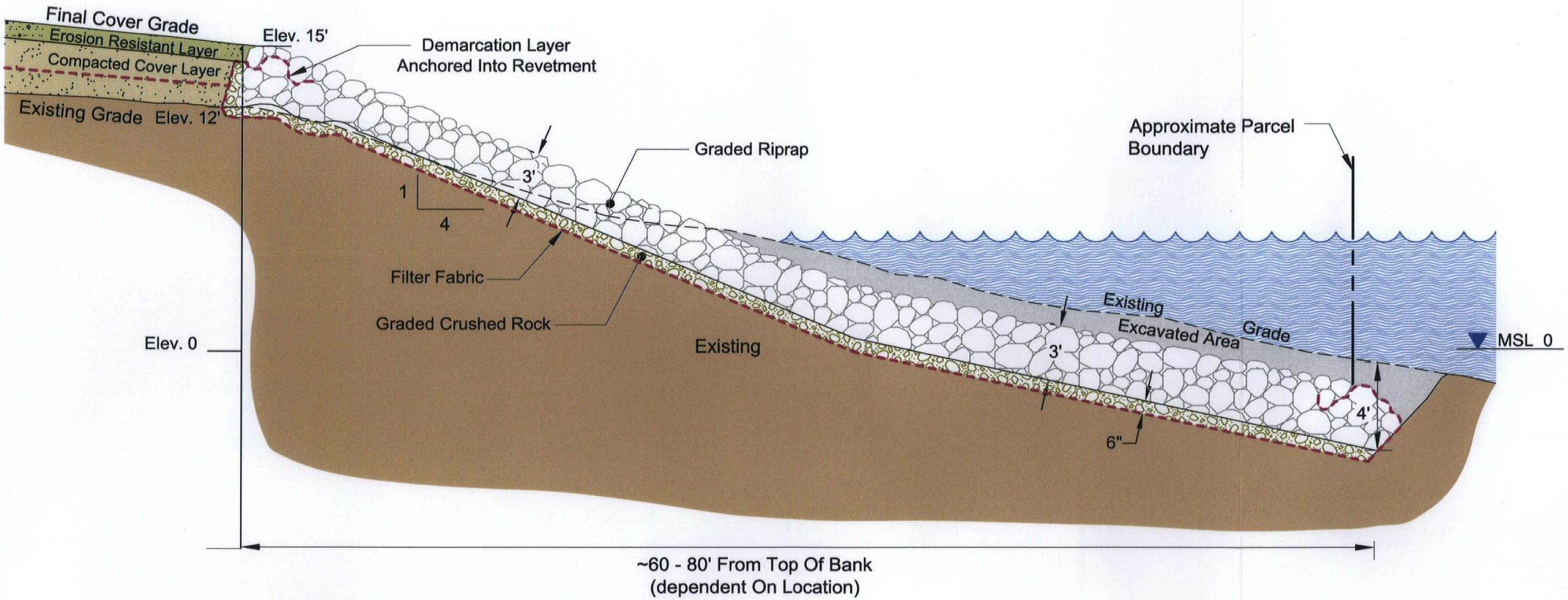
Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 8
PROPOSED COVER CONTOURS

Remedial Design for IR Sites 7 and 18

R:\Navy\Hunters-Pt\Parcel B\IR07_IR08\Remedial Design\ Figure 8 Proposed Final Cover.dwg 12/10/2009 deborah.ford DN



LEGEND

	RIPRAP		APPROXIMATE PARCEL BOUNDARY
	GRADED CRUSHED ROCK		APPROXIMATE EXISTING GRADE
	EXISTING MATERIAL	Elev.	ELEVATION
	SAN FRANCISCO BAY	MSL	MEAN SEA LEVEL
	EXCAVATED GRADE	MHHW	MEAN HIGHER HIGH WATER
	FILTER FABRIC	MLLW	MEAN LOWER LOW WATER

NOTES:

1. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.
2. FOLLOWING THE COMPLETION OF THE REVETMENT IT IS ANTICIPATED THAT DEPOSITION OF SEDIMENT WILL FILL IN THE EXCAVATED AREA ABOVE THE REVETMENT. THE AMOUNT OF DEPOSITION IS UNKNOWN.

NOT FOR CONSTRUCTION

NOT TO SCALE

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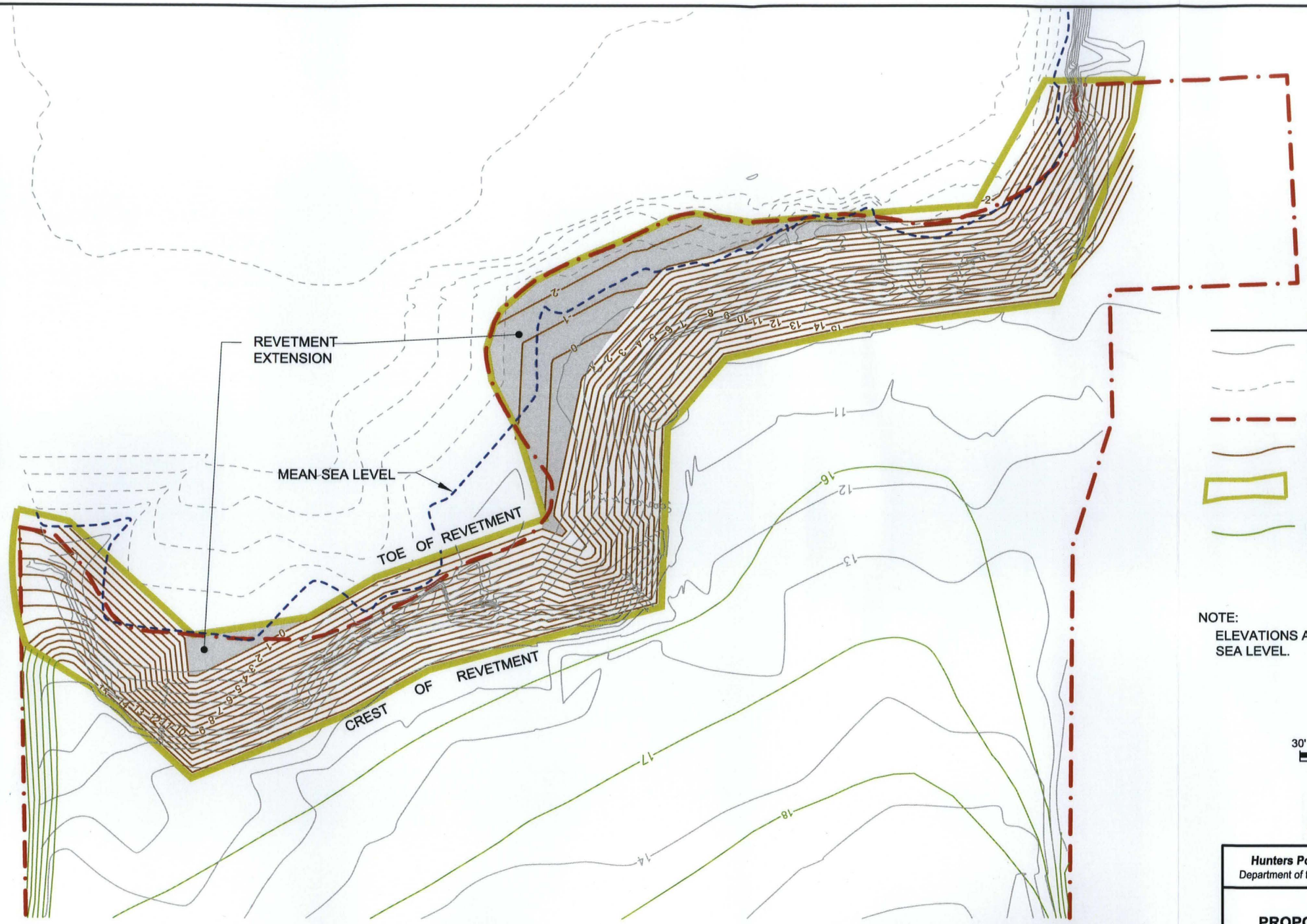
Consulting Engineers and Scientists

Hunters Point Shipyard, San Francisco, California
Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 9
TYPICAL REVETMENT
CROSS SECTION

Remedial Design for IR Sites 7 and 18

R:\Navy\Hunters-Pt\Parcel B\r07_ir08\Remedial Design\ Figure 9 Shoreline Revetment Wall.dwg 12/10/2009 deborah.ford DN



LEGEND

- EXISTING MAJOR CONTOUR
- EXISTING OFFSHORE CONTOUR
- IR SITE 7 BOUNDARY
- PROPOSED CONTOUR
- REVETMENT EXCAVATION AREA
- PROPOSED COVER CONTOURS

NOTE:
ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.

30' 0 30' 60'
SCALE: 1" = 60'

ChaduxTt JV
Consulting Engineers and Scientists

NOT FOR CONSTRUCTION

Hunters Point Shipyard, San Francisco, California
Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 10
PROPOSED REVETMENT GRADE

Remedial Design for IR Sites 7 and 18

R:\Navy\Hunters-Pt\Parcel B\IR07_IR08\Remedial Design\ Figure 10 Proposed Offshore Contours.dwg 12/10/2009 deborah.ford DN

TABLES

TABLE 1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SOIL COVER AND REVETMENT
Design Basis Report for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL – CONSTRUCTION OF SOIL COVER AND SHORELINE REVETMENT					
FEDERAL					
Resource Conservation and Recovery Act (42 U.S.C., Chapter 82, §§ 6901-6991[i])[a]					
Construct a shoreline revetment or soil cover.	The final cover must accommodate lateral and vertical shear forces generated by the maximum credible earthquake so that the integrity of the final cover is maintained.	RCRA hazardous waste management unit.	Cal. Code Regs. tit. 22, § 66264.310(a)(5)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Construct a shoreline revetment or soil cover.	Maintain the integrity and effectiveness of the final cover, including making repairs to the cover as necessary to correct the effects of settling, subsidence, erosion, or other events throughout the post-closure period. Prevent runon and runoff from eroding or otherwise damaging the final cover throughout the post-closure period.	RCRA hazardous waste management unit.	Cal Code Regs. tit. 22, § 66264.310(b)(1) and (4)	Relevant and appropriate	The Navy has determined that these requirements are potential ARARs for constructing a shoreline revetment and covers for the soil. These requirements are relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.

TABLE 1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SOIL COVER AND REVETMENT (CONTINUED)
Design Basis Report for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL – CONSTRUCTION OF SOIL COVER AND SHORELINE REVETMENT (Continued)					
FEDERAL (Continued)					
Resource Conservation and Recovery Act (42 U.S.C., Chapter 82, §§ 6901-6991[i])[a] (Continued)					
Construct a shoreline revetment or soil cover.	Protect and maintain surveyed benchmarks throughout the post-closure period.	RCRA hazardous waste management unit.	Cal. Code Regs. tit. 22, § 66264.310(b)(5)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Clean Water Act					
Construct a shoreline revetment or soil cover.	Owners and operators of construction activities must be in compliance with discharge standards.	Construction activities at least 1 acre in size.	Clean Water Act §402 40 CFR § 122.44(k)(2) and (4)	Applicable	The Navy anticipates disturbing more than 1 acre in the alternatives that involve excavation and off-site disposal of soil and constructing soil covers. The Navy will use the requirements of state general storm water discharge permit, Order 99-08-DWQ, as TBCs for complying with the storm water discharge requirements under the Clean Water Act.
Clean Air Act					
Construct a shoreline revetment or soil cover.	Prohibits emission equal or greater to 20 percent opacity.	Emission from a source.	BAAQMD Rule 6-302	Applicable	This requirement is applicable to excavation.

TABLE 1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SOIL COVER AND REVETMENT (CONTINUED)
Design Basis Report for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL – CONSTRUCTION OF SOIL COVER AND SHORELINE REVETMENT (Continued)					
STATE					
State Water Resources Control Board[a]					
Construct a shoreline revetment or soil cover.	Alternatives to construction or prescriptive standards contained in the SWRCB-promulgated regulations of this subdivision may be considered.	Waste management unit. Cal. Code Regs. tit. 27 requirements are applicable only for waste discharged after 18 July 1997 unless otherwise noted.	Cal. Code Regs. tit. 27 § 20080(b)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Construct a shoreline revetment or soil cover.	Actions taken by or at the direction of public agencies to clean up or abate conditions of pollution or nuisance resulting from unintentional or unauthorized releases of waste or pollutants to the environment; provided that wastes, pollutants, or contaminated materials removed from the immediate place of release shall be discharged according to the SWRCB-promulgated sections of Article 2, Subchapter 2, Chapter 3, Subdivision 1 of this division (§ 20200 et seq.); and further provided that remedial actions intended to contain the wastes at the place of release shall implement applicable SWRCB-promulgated provisions of this division to the extent feasible.	Action taken by or at the direction of a public agency to cleanup release of pollutant.	Cal. Code Regs. tit. 27, § 20090(d)	Relevant and appropriate	This requirement is a potential ARAR for the Navy's response actions.

TABLE 1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SOIL COVER AND REVETMENT (CONTINUED)
Design Basis Report for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL – CONSTRUCTION OF SOIL COVER AND SHORELINE REVETMENT (Continued)					
STATE (Continued)					
State Water Resources Control Board[a] (Continued)					
Construct a shoreline revetment or soil cover.	Closed units shall be provided with at least two permanent monuments installed by a licensed land surveyor or a registered civil engineer, from which the location and elevation of containment structures can be determined throughout the post-closure maintenance period.	Waste management unit.	Cal. Code Regs. tit. 27 § 20950(d)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Constructing a shoreline revetment and soil covers.	In spite of differential settlement, the final cover of closed landfills (including waste piles and surface impoundments closed as landfills) shall be designed, graded, and maintained to prevent ponding and to prevent soil erosion caused by high run-off velocities. All portions of the final cover shall have a slope of at least three percent unless Water Board allows portions of the final cover to be built with slopes of less than three percent when the discharger proposes an effective system for diverting surface drainage from laterally adjacent areas and preventing ponding in the allowed flatter portion. The final grading design shall be designed and approved by a registered civil engineer or certified engineering geologist taking into consideration pertinent natural and constructed topographic features (including any related to the proposed post-closure land use), and climate.	Waste management unit.	Cal. Code Regs. tit. 27, § 21090(b)(1)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.

TABLE 1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SOIL COVER AND REVETMENT (CONTINUED)
Design Basis Report for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL – CONSTRUCTION OF SOIL COVER AND SHORELINE REVETMENT (Continued)					
STATE (Continued)					
State Water Resources Control Board[a] (Continued)					
Constructing a shoreline revetment and soil covers.	Throughout post-closure maintenance period, the discharger shall prevent erosion and related damage of the final cover caused by drainage.	Waste management unit.	Cal. Code Regs. tit. 27, § 21090(c)(4)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Constructing a shoreline revetment and soil covers.	For a closed landfill, when all closure activities are complete for the unit, the discharger shall conduct an aerial photographic survey, or alternative survey under (e)(3), of the closed portions of the unit and of its immediate surrounding area, including at least the surveying monuments [of § 20950(d)]. The data obtained shall be used to produce a topographic map of the site at a scale and contour interval sufficient to depict the as-closed topography of each portion of the unit, and to allow the early identification of any differential settlement. The map produced pursuant to this paragraph shall act as a baseline against which to measure the total settlement, through time, of all portions of the final cover since the date when that landfill, or portion thereof, was closed.	Waste management unit.	Cal. Code Regs. tit. 27, § 21090(e)(1) and (3)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.

TABLE 1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SOIL COVER AND REVETMENT (CONTINUED)
Design Basis Report for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL – CONSTRUCTION OF SOIL COVER AND SHORELINE REVETMENT (Continued)					
STATE (Continued)					
State Water Resources Control Board[a] (Continued)					
Constructing a shoreline revetment and soil covers.	The final cover shall function with minimum maintenance and shall be compatible with post-closure land use. Alternative final cover designs shall meet the performance requirements of paragraph (a). The local enforcement agency may require additional thickness, quality, and type of final cover depending on, but not limited to the future reuse of the site.	Waste management unit.	Cal. Code Regs. tit. 27, § 21140	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Constructing a shoreline revetment and soil covers.	The operator shall ensure the integrity of final slopes under both static and dynamic conditions to protect public health and safety and prevent damage to post-closure land uses, roads, structures, utilities, and to prevent exposure of waste.	Waste management unit.	Cal. Code Regs. tit. 27, §21145(a)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Constructing a shoreline revetment and soil covers.	The drainage and erosion control system shall be designed and maintained to ensure integrity of post-closure land uses, roads, and structures; to prevent public contact with waste; to prevent safety hazards; and to prevent exposure of waste. Slopes not underlain by waste shall be stabilized to prevent soil erosion. Methods used to protect slopes and control erosion shall include, but are not limited to, terracing, contour furrows, and trenches.	Waste management unit.	Cal. Code Regs. tit. 27, § 21150	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.

TABLE 1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SOIL COVER AND REVETMENT (CONTINUED)
Design Basis Report for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL – CONSTRUCTION OF SOIL COVER AND SHORELINE REVETMENT (Continued)					
STATE (Continued)					
Air Resources Board[a]					
Excavating soil, constructing a shoreline revetment, and constructing soil covers.	No person shall engage in any construction or grading operation on property where the area to be disturbed is greater than 1 acre unless an asbestos dust mitigation plan for the operation has been submitted to and approved by the district before the start of any construction or grading; and the provisions of that dust mitigation plan are implemented at the beginning and maintained throughout the duration of the construction or grading. Further, upon completion of project, the disturbed areas must be stabilized using one of the following methods: (1) vegetative cover, (2) placement of at least 3 inches of non-asbestos-containing material; (3) paving; (4) any other measure deemed sufficient to prevent wind speeds of 10 miles per hour or greater from causing visible dust emissions.	Construction and grading activities in an ultramafic rock unit; or naturally occurring asbestos, serpentine, or ultramafic rock.	Cal. Code Regs. tit. 17, § 93105	Applicable	The Navy has determined that this regulation is a potential ARAR for maintained landscaping, excavating, constructing a shoreline revetment, and soil covers.

TABLE 1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SOIL COVER AND REVETMENT (CONTINUED)
Design Basis Report for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL – CONSTRUCTION OF SHORELINE REVETMENT ONLY					
FEDERAL					
Resource Conservation and Recovery Act (42 U.S.C., Chapter 82, §§ 6901-6991[I])[a]					
Construct a shoreline revetment.	Alternative requirements that are protective of human health or the environment may replace design, operating, or closure standards for temporary tanks and container storage areas.	Temporary storage of RCRA hazardous waste.	Cal Code Regs. tit. 22, § 66264.553(b), (d), (e), and (f)	Applicable or relevant and appropriate	These requirements are applicable for the temporary storage of dredged material that meets the definition of RCRA hazardous waste or non-RCRA, state regulated hazardous waste under Cal. Code Regs. tit. 22, including sediment with TTLC wet weight concentrations of PCBs greater than or equal to 50 mg/kg. Concentrations of PCBs equal to or greater than 50 mg/kg have been measured in the sediment along the shoreline of IR-07. These requirements are relevant and appropriate for dredged material that does not meet the definition of RCRA hazardous waste.
Stockpile soil for off-site disposal.	Allows generators to accumulate solid remediation waste in an EPA-designated pile for storage only up to 2 years during remedial operations without triggering land disposal restrictions.	RCRA hazardous remediation waste temporarily stored in piles.	40 CFR § 264.554(d)(1)(i) through (ii), (d)(2), (e), (f), (h), (i), (j), and (k)	Applicable or relevant and appropriate	The Navy will temporarily stockpile soil in staging piles for off-site disposal. The Navy will characterize the soil, but does not anticipate that all soil will be RCRA hazardous waste, in which case the requirements will be relevant and appropriate. These requirements would be applicable to stockpiled soil that meets the definition of RCRA hazardous waste. Therefore, the Navy will identify these requirements as either applicable or relevant and appropriate, depending on the results of sampling and analysis for waste characterization.

TABLE 1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SOIL COVER AND REVETMENT (CONTINUED)
Design Basis Report for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL – CONSTRUCTION OF SHORELINE REVETMENT ONLY (Continued)					
FEDERAL (Continued)					
Clean Water Act, as Amended (33 U.S.C., ch. 26, §§ 1251–1387)[a]					
Construct a shoreline revetment.	Action to prohibit discharge of dredged or fill material into waters of the United States without permit.	Waters of the United States.	33 U.S.C. § 1344 40 CFR § 230.10; 230.11; 230.20 through 230.25; 230.31; 230.32; 230.41; 230.42; 230.53	Applicable	The soil remedy includes construction of a shoreline revetment that will result in the discharge of fill material into a wetland sufficiently connected to the bay to be regulated under the Clean Water Act. This discharge will be in compliance with the substantive provisions of Nationwide General Permit 38. The Navy is not required to obtain a permit or submit notification that it will discharge in compliance with Nationwide General Permit 38; however, the Navy will use the substantive requirements of this permit as a means to comply with these potential ARARs. In addition, the Navy will mitigate the loss of the wetland.
Resource Conservation and Recovery Act (42 U.S.C., Chapter 82, §§ 6901-6991[i])[a]					
Construct a shoreline revetment.	U.S. Army Corps of Engineers requirements for permitting discharges of dredged material into waters of the United States.	Discharge of dredged material into waters of the United States.	33 CFR § 320.4 and 323	Applicable	The soil remedy includes construction of a shoreline revetment that will result in the discharge of fill material into a wetland sufficiently connected to the bay to be regulated under the Clean Water Act. This discharge will be in compliance with the substantive provisions of Nationwide General Permit 38. The Navy is not required to obtain a permit or submit notification that it will discharge in compliance with Nationwide General Permit 38; however, the Navy will use the substantive requirements of this permit as a means to comply with these potential ARARs. In addition, the Navy will mitigate the loss of the wetland.

TABLE 1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SOIL COVER AND REVETMENT (CONTINUED)

Design Basis Report for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Notes:

a	Statutes and policies, and their citations, are provided as headings to identify general categories of ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy accepts the entire statutes or policies as ARARs. Specific ARARs are addressed in the table below each general heading; only substantive requirements of the specific citations are considered ARARs.
§	Section
§§	Sections
ARAR	Applicable or relevant and appropriate requirement
BAAQMD	Bay Area Air Quality Management District
Cal. Code Reg.	California Code of Regulations
CFR	*Code of Federal Regulations*
EPA	U.S. Environmental Protection Agency
IR	Installation Restoration
mg/kg	Milligram per kilogram
PCB	Polychlorinated biphenyl
RCRA	Resource Conservation and Recovery Act
SWRCB	State Water Resources Control Board
TBC	To be considered
tit.	Title
TTLC	Total threshold limit concentration
U.S.C.	*United States Code*

TABLE 2: REMEDIATION GOALS FOR SOIL

Design Basis Report for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Exposure Scenario	Chemical of Concern	Remediation Goal (mg/kg)	Basis for Goal
Residential	Antimony	10	RBC
	Aroclor-1254	0.093	RBC
	Aroclor-1260	0.21	RBC
	Arsenic	11.1	HPAL
	Benzo(a)anthracene	0.37	RBC
	Benzo(a)pyrene	0.33	PQL
	Benzo(b)fluoranthene	0.34	RBC
	Benzo(k)fluoranthene	0.34	RBC
	Beta-BHC	0.0066	RBC
	Bis(2-ethylhexyl)phthalate	1.1	RBC
	Cadmium	3.5	RBC
	Copper	159	RBC
	Dibenz(a,h)anthracene	0.33	PQL
	Dieldrin	0.0034	PQL
	Heptachlor epoxide	0.0017	PQL
	Indeno(1,2,3-cd) pyrene	0.35	RBC
	Iron	58,000	HPAL
	Lead	155	RBC
	Manganese	1,431	HPAL
	Mercury	2.3	HPAL
	Naphthalene	1.7	RBC
	Tetrachloroethene	0.48	RBC
	Trichloroethene	2.9	RBC
	Vanadium	117	HPAL
	Zinc	373	RBC
Recreational	Aroclor-1254	0.74	RBC
	Aroclor-1260	0.74	RBC
	Arsenic	11.1	HPAL
	Benzo(a)pyrene	0.33	PQL
	Lead	155	RBC
Industrial	Arsenic	11.1	HPAL
	Benzo(a)anthracene	1.8	RBC
	Benzo(a)pyrene	0.33	PQL
Construction Worker	Aroclor-1260	2.1	RBC
	Arsenic	11.1	HPAL
	Benzo(a)pyrene	0.65	RBC
	Lead	800	RBC
	Trichloroethene	151	RBC

Notes: Exposures in the residential, industrial, and construction worker scenarios consider exposure to soil from 0 to 10 feet below ground surface. The recreational exposure scenario considers exposure to soil from 0 to 2 feet below ground surface.

HPAL Hunters Point ambient level
mg/kg Milligram per kilogram
PQL Practical quantitation limit
RBC Risk-based concentration

TABLE 3: REMEDIATION GOALS FOR SEDIMENT

Design Basis Report for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Exposure Scenario	Chemical of Concern	Remediation Goal (mg/kg)	Basis for Goal
Ecological Receptor	Aluminum	3,400	RBC
	Copper	270	RBC
	Dibenz(a,h)anthracene	0.33	PQL
	Dieldrin	0.008	RBC
	Lead	218	RBC
	Methoxychlor	0.4	RBC
	Total Aroclors	0.18	RBC
	Total DDT	0.046	RBC
	Zinc	410	RBC

Notes:

DDT Dichlorodiphenyltrichloroethane
mg/kg Milligram per kilogram
PQL Practical quantitation limit
RBC Risk-based concentration

Appendices

APPENDIX A
COVER SOIL VOLUME ESTIMATE

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Cover Soil Volume Estimate	
Prepared by:	**Date**	**Checked by:**	**Date**
AJ	4-15-09	SF	4-28-09

SITE AREA:

IR-07	407,856 ft^2
IR-18	210,725 ft^2
Total	618,581 ft^2
	14.2 acres

SOIL FILL VOLUMES BY POTENTIAL RADIONUCLIDE AND NON-RADIONUCLIDE AREAS

Potential Radiologically Impacted Area

473,785 ft^2

3 feet of cover soil

1,421,355 ft^3

52,642 bank cubic yards (bcy)

~ 53,000 bcy

Non-radiologically Impacted Area

144,796 ft^2

2 feet of cover soil

289,592 ft^3

10,726 bcy

~11,000 bcy

Total Estimated Cover Soil Requirement (in-place after compaction)

63,367 bcy

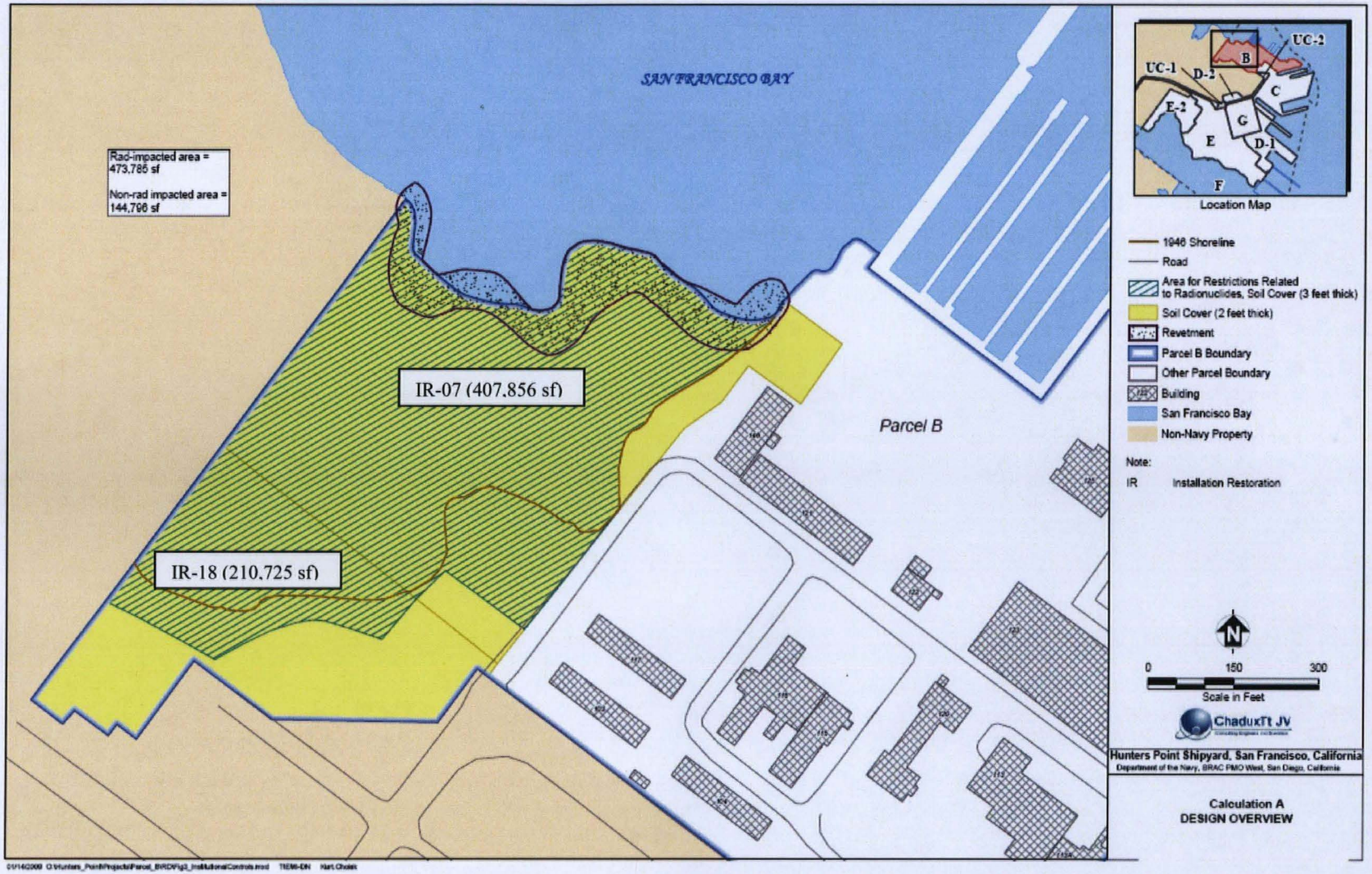
~64,000 bcy

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Cover Soil Volume Estimate	
Prepared by:	**Date**	**Checked by:**	**Date**
AJ	4-15-09	SF	4-28-09

The soil fill volume was also estimated using GIS and CAD computer programs which estimated the soil cover volume at approximately 66,200 bcy. This calculation was conducted by comparing the elevation difference between the existing surface and the final cover grade. This calculation is more accurate as it accounts for the transitional areas and side slopes over the cover.

These calculations assume compacted soil. A bulking factor of 1.3 or 30% will be used to calculate the loose cubic yardage (lcy) when appropriate – for instance in calculations for acquisition and transport.

Refer to the figures of the DBR and the design drawings for the areas referenced in the calculation.


SAN FRANCISCO BAY
Rad-impacted area = 473,786 sf
Non-rad impacted area = 144,796 sf
IR-07 (407,856 sf)
IR-18 (210,725 sf)
Parcel B
UC-1
UC-2
B
D-2
C
E-2
G
E
D-1
F
Location Map
1946 Shoreline
Road
Area for Restrictions Related to Radionuclides, Soil Cover (3 feet thick)
Soil Cover (2 feet thick)
Revetment
Parcel B Boundary
Other Parcel Boundary
Building
San Francisco Bay
Non-Navy Property
Note:
IR Installation Restoration
N
0 150 300
Scale in Feet
ChaduxTt JV
Hunters Point Shipyard, San Francisco, California
Department of the Navy, BRAC PMO West, San Diego, California
Calculation A
DESIGN OVERVIEW

APPENDIX B
SOIL LOSS DUE TO EROSION CALCULATION

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Soil Loss Due to Erosion Calculation	
Prepared by:	**Date**	**Checked by:**	**Date**
AJ	4-15-09	SF	4-28-09

Each year a certain amount of soil will be lost from the site as a result of erosion from wind and runoff. Koerner and Daniel suggest that most designers follow the general guideline of 2.45 tons/acre/year (ASCE 1997) in Final Covers for Solid Waste Landfills and Abandoned Dumps, published by the American Society of Civil Engineers (ASCE) in 1997. A more conservative value of 2 tons/acre/year was suggested at an ASCE conference, Design of Waste Containment Liner and Final Closure Systems, presented in 1997. These estimates reflect a balance between topsoil generation and topsoil loss from erosion – or what can be considered the sustainable loss. Erosion losses at or less than these rates would be offset by topsoil formed resulting in an estimated net gain of soil.

The following pages present the wind and runoff erosion calculations to determine whether the designed cover will meet these minimum erosion requirements. A summary of the results are in the following table.

SOIL LOSS ESTIMATES

	Soil Loss Due to Runoff	Soil Loss Due to Wind	Total Annual Soil Loss	Total Annual Soil Loss
No Established Vegetation	2.4 tons/acre/year	2.9 tons/acre/year	5.3 tons/acre/year	0.034 inches/year
With Established Vegetation	0.07 tons/acre/year	0 tons/acre/year	0.07 tons/acre/year	0.00045 inches/year

The total annual soil loss was calculated for two scenarios; soil loss before vegetation is established and soil loss after vegetation is established. Before vegetation is established soil loss is greater than the accepted 2 tons/acre/year. To ensure soil loss is minimized in the short period before vegetation is established, the soil cover will need to have erosion controls.

The erosion caused by runoff was determined using the widely accepted Revised Universal Soil Loss Equation (RUSLE). The erosion due to wind was determined using the United States Department of Agriculture Wind Erosion Forces in the United States and Their Use in Predicting Soil Loss; Agriculture Handbook 346. All calculations and explanations for the runoff and wind erosion are contained in the following calculations:

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Soil Loss Due to Erosion Calculation	
Prepared by:	**Date**	**Checked by:**	**Date**
AJ	4-15-09	SF	4-28-09

REVISED UNIVERSAL SOIL LOSS EQUATION (CALCULATION OF SOIL LOSS FROM RUNOFF)
From: Water Quality, Vladimir Novotny/ Harvey Olem

$$A = R*k*(Ls)*C*P$$

Where:

A = annual soil loss due to runoff (tons/acre/year)
R = rainfall energy factor (tons/acre)
K = soil erodibility factor
Ls = length-slope factor
C = cropping management factor
P = erosion control factor

R (tons/acre) from Isoerodent map of California (EPA 2001).
at Hunters Point Shipyard, San Francisco, CA
R= 40 tons/acre

k from Table 5.3 (Novotny and Olem)
Value based on conservative k value from an estimate of suitable cover soil based on performance and availability. A Fine Sandy Loam was chosen with an organic content less than 0.5%
k= 0.35

Ls from Figure 5.14 (Novotny and Olem)
Refer to the Figure 4 of design basis report for determination of the length. The prevailing wind direction for HPS is west.

Slope	Length	LS Factor
$S_1 = 2\%$	$L_1 = 250m$	**0.38**

C from Table A1 Source: Reference not available. Downloaded from: http://ecn.www.ecn.purdue.edu/~sedspec/sedspec/doc/usleapp.doc

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Soil Loss Due to Erosion Calculation	
Prepared by:	**Date**	**Checked by:**	**Date**
AJ	4-15-09	SF	4-28-09

Prior to vegetation being established the percent ground cover value of 0 is used.

C = 0.45

After vegetation is established a conservative percent ground cover of 80% is used; when vegetation is fully established the percent ground cover should be in the 95 to 100% range.

C = 0.013

P if no erosion control practice is in place (conservative)

P= 1

Determine Soil Loss with a bare ground surface

R	k	LS	C	P =	A
40 *	0.35 *	0.38 *	0.45 *	1 =	**2.39 tons/acre/year**

Determine Soil Loss with a vegetative cover

R	k	LS	C	P =	A
40 *	0.35 *	0.38 *	0.013 *	1 =	**0.07 tons/acre/year**

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Soil Loss Due to Erosion Calculation	
Prepared by:	**Date**	**Checked by:**	**Date**
AJ	4-15-09	SF	4-28-09

CALCULATION OF SOIL LOSS FROM WIND

Reference: USDA. Handbook 346 - Wind Erosion Forces in the United States and their Use in Predicting Soil Loss.

$$E = f(I, K, C, L, V)$$

Where:

I = Soil Erodibility Factor
K = Soil Ridge Roughness Factor
C = Local Average Monthly or Annual Climate Factor
L = Median Unsheltered Field Length along Direction of Prevailing Wind
V = Equivalent Vegetative Cover in Pounds per Acre

Let $E_1 = I$

Assuming at least 25% of the soil retained on number 20 sieve (0.84 mm), from Table 3, the soil erodibility factor is 86. The table recommends for a fully crusted soil surface, values are approximately shown. A conservative approach is to use values shown, knowing that the site is represented neither by a fully crusted soil surface nor by tilled or disturbed soil. Therefore:

$$\mathbf{E_1 = 86\ tons/acre * 1/3 = 29\ tons/acre}$$

Let $E_2 = E_1 K$

From Figure 7, conservatively assume the field is flat and smooth, soil ridge roughness $K_r = 0$ and therefore $K' = 1.0$. Therefore:

$$\mathbf{E_2 = 29\ tons/acre * 1.0 = 29\ tons/acre.}\ \text{Let } E_3 = E_2 C$$

Where $C = 10$ percent per month per the C factor isoline map developed by the NRCS in 1987

$$\mathbf{E_3 = 29\ tons/acre * 0.1/year = 2.9\ tons/acre\ year}$$

Let $E_4 = f(E_2, E_3, L)$

Since the longest unobstructed distance L is greater than 10,000 feet, using Figure 23 we get $E_4 = E_3$. Therefore:

$$\mathbf{E_4\ 2.9\ tons/acre\ year}$$

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Soil Loss Due to Erosion Calculation	
Prepared by:	**Date**	**Checked by:**	**Date**
AJ	4-15-09	SF	4-28-09

Prior to vegetation being established the weight of vegetation covering the soil is zero. On figure 24 the lines for E_4 = 2.9 tons per acre per year and V = **0** lbs per acre intersect at a value of:

E_5 = 2.9 TONS/ACRE/YEAR

V is determined from the actual weight of vegetation and the type of stand of grass. Assuming a percent coverage of established vegetation at Hunters Point Shipyard of 90 percent and using the expert opinion of a seed specialist from Pacific Coast Seeds, the small grain mass coverage is taken as 3,570 lbs of residue per acre from the table entitled "Percent ground cover to pounds residue." Vegetation at Hunters Point Shipyard was conservatively approximated as a combination of 45 percent blue grama, 30 percent buffalo grass, and 25 percent ungrazed western wheatgrass from NRCS guidance shown on the table titled "Properly grazed range grass mixtures." From this table, an equivalent flat small grain residue value of 3,570 corresponds to 900 lbs per acre of the chosen vegetation mixture. From Figure 9 then, a weight R' of 900 lbs per acre on smooth ground yields that V=7,600 lbs per acre.

On Figure 24, the lines for E_4 = 2.9 tons per acre per year and V = 7,600 lbs per acre do not intersect, therefore the soil loss due to wind with an established vegetative cover is negligible.

E_5 = 0 TONS/ACRE/YEAR

Assumptions:

1. Soil Dry Density = 85 lb/ft3 (typical of a loam to sandy loam soil, consistent with the expected site conditions)
2. Soil loss of 1.02 Tons/Acre/Year (based on soil loss calculations above)

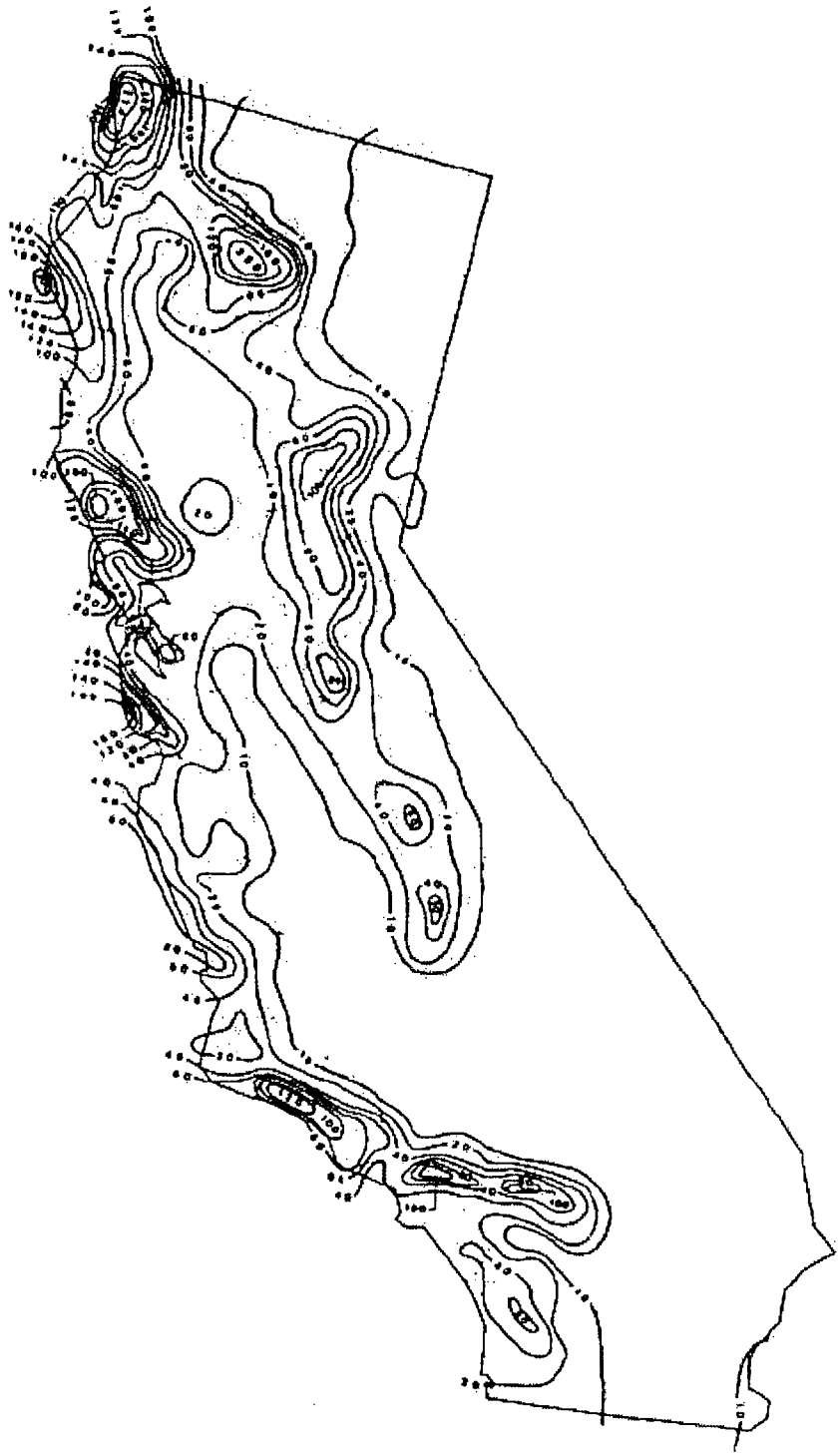
Depth of soil loss per year with no established vegetative cover

5.3 Tons/Acre/Year * 2,000 lb/Ton	=	10,600 lb/Acre/Year
10,600 lb/Acre/Year * 1Acre/43,560 ft2	=	0.243 lb/ft2/Year
0.243 lb/ft2/Year / 85 lb/ft3	=	0.0029 ft/Year
	=	**0.034 in/Year**

Depth of soil loss per year with an established vegetative cover

0.07 Tons/Acre/Year * 2,000 lb/Ton	=	140 lb/Acre/Year
140 lb/Acre/Year * 1Acre/43,560 ft2	=	0.0032 lb/ft2/Year
0.0032 lb/ft2/Year / 85 lb/ft3	=	0.000038 ft/Year
	=	**0.00045 in/Year**

B-1: WATER EROSION REFERENCES



Values of the Annual Rainfall Energy Factor (R) in tons/acre

Isoerodent Map of California
Source: California EPA (2001)

TABLE 5.3 Magnitude of Soil Erodibility Factor, K

Technical Class	K for Organic Matter Content (%)		
	0.5	2	4
Sand	0.05	0.03	0.02
Fine sand	0.16	0.14	0.10
Very fine sand	0.42	0.36	0.28
Loamy sand	0.12	0.10	0.16
Loamy fine sand	0.24	0.20	0.16
Loamy very fine sand	0.44	0.38	0.30
Sandy loam	0.27	0.24	0.19
Fine sandy loam	0.35	0.30	0.24
Very fine sandy loam	0.47	0.41	0.35
Silt loam	0.48	0.42	0.33
Silt	0.60	0.52	0.42
Sandy clay loam	0.27	0.25	0.21
Clay loam	0.28	0.25	0.21
Silty clay loam	0.37	0.32	0.26
Sandy clay	0.14	0.13	0.12
Silty clay	0.25	0.23	0.19
Clay		0.13–0.2	

Source: After Steward et al. (1975)

Note: The values shown are the estimated averages of broad ranges of specific soil values. When a texture is near the borderline of two texture classes, use the average of the two *K* values.

D–5

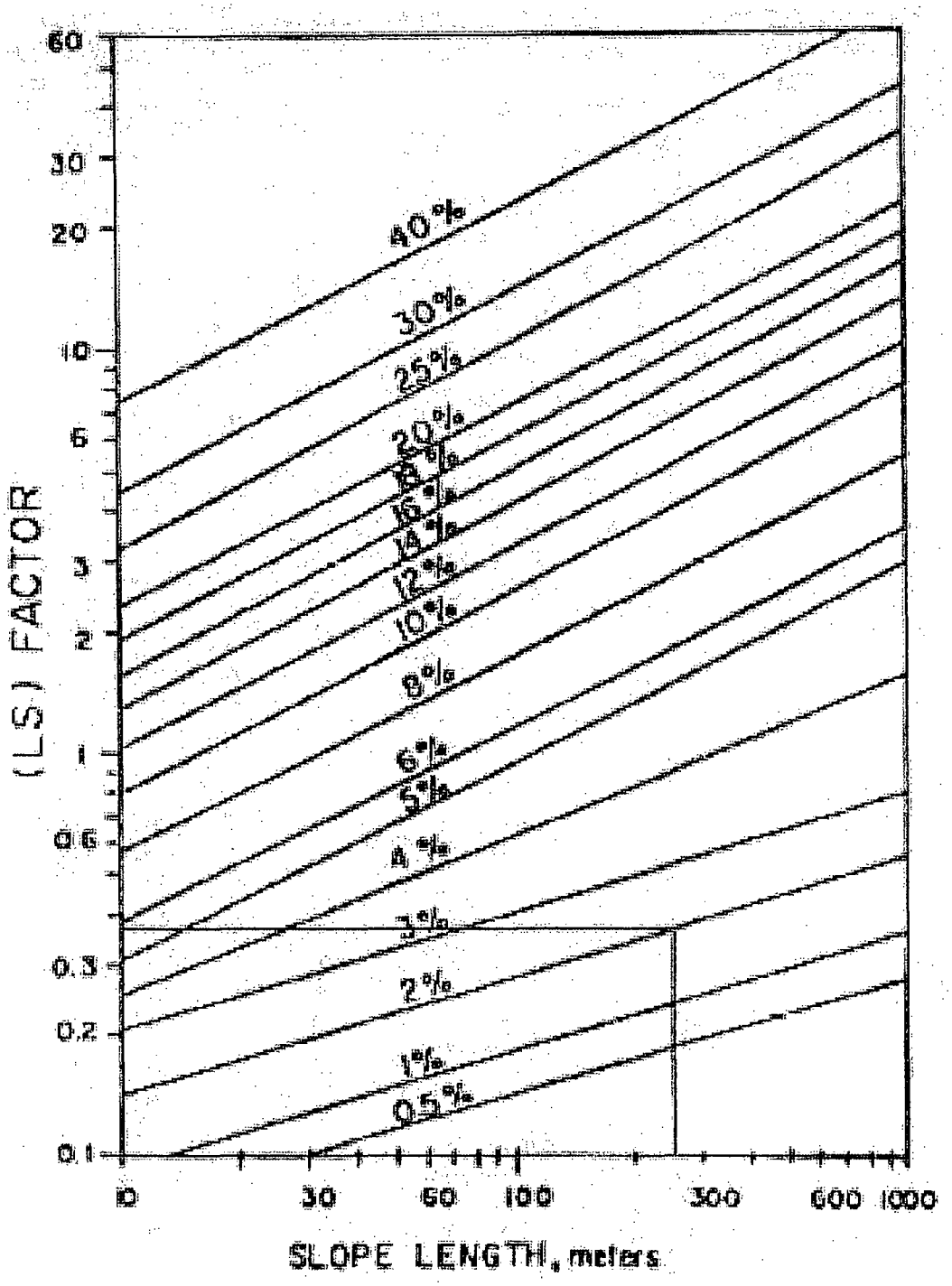


FIGURE 5.14. Slope-length factor (LS) for different slopes. (From Stewart et al., 1975.)

The cover and management factor, C, is the ratio of soil loss from land use under specified conditions to that from continuously fallow and tilled land. The USLE was developed for use on agricultural fields. It is adapted to use in nonagricultural conditions by appropriate selection of the C factor. This is often done by relating the land use conditions to some agricultural situation. For example, a firing range with a grass cover might be assumed to be similar to a pasture. Annual values of C for various cover and management conditions applicable to Army land uses are presented in Table A1.

Table A1 Cover management, "C" factors for permanent pasture, rangeland, and idle land.

Vegetal Canopy			Cover That Contacts the Surface					
			Percent Ground Cover					
Type and Height of Raised Canopy[2]	Canopy Covers[3] %	Type[4]	0	20	40	60	80	95-100
No appreciable canopy		G	.45	.20	.10	.042	.013	.003
		W	.45	.24	.15	.090	.043	.011
Canopy of tall weeds or short brush, 0.5 m (1.6 ft.) fall ht.	25	G	.36	.17	.09	.038	.012	.003
		W	.36	.20	.13	.082	.041	.011
	50	G	.26	.13	.07	.035	.012	.003
		W	.26	.16	.11	.075	.039	.011
	75	G	.17	.10	.06	.031	.011	.003
		W	.17	.12	.09	.068	.038	.011
Appreciable brush or bushes, 2 m 6.6 ft. fall ht.	25	G	.40	.18	.09	.040	.013	.003
		W	.40	.22	.14	.085	.042	.011
	50	G	.34	.16	.085	.038	.012	.003
		W	.34	.19	.13	.081	.041	.011
	75	G	.28	.14	.08	.036	.012	.003
		W	.28	.17	.12	.077	.040	.011
Trees but no appreciable, low brush , 4 m (13.1 ft.) fall ht.	25	G	.42	.19	.10	.041	.013	.003
		W	.42	.23	.14	.087	.042	.011
	50	G	.39	.18	.09	.040	.013	.003
		W	.39	.21	.14	.085	.042	.011
	75	G	.36	.17	.09	.039	.012	.003
		W	.36	.20	.13	.083	.041	.011

[1]All values shown assume: (1) random distribution of mulch or vegetation, and (2) mulch of appreciable depth where it exists. Idle land refers to land with undisturbed profiles for at least a period of three consecutive years.
[2]Average fall height of waterdrops from canopy to soil surface.
[3]Portion of total-area surface that would be hidden from view by canopy in a vertical projection (a birds's-eye view).
[4]G: Cover at surface is grass, grasslike plants, decaying compacted duff, or litter at least 2 inches deep. W: Cover at surface is mostly broadleaf herbaceous plants (as weeds with little lateral-root network near the surface, and/or undecayed residue).

Source: Reference not available. Downloaded from:
http://ecn.www.ecn.purdue.edu/~sedspec/sedspec/doc/usleapp.doc

B-2: WIND EROSION REFERENCES

TABLE 3.—*Soil erodibility I[1] for soils with different percentages of nonerodible fractions as determined by standard dry sieving*[1]

Dry soil fractions >0.84 mm. (percent) Units → Tens ↓	0	1	2	3	4	5	6	7	8	9
	Tons per acre	*Tons per acre*	*Tons per acre*	*Tons per acre*	*Tons per acre*	*Tons per acre*	*Tons per acre*	*Tons per acre*	*Tons per acre*	*Tons per acre*
0	------	310	250	220	195	180	170	160	150	140
10	134	131	128	125	121	117	113	109	106	102
20	88	85	82	80	88	85	83	81	79	76
30	74	72	71	69	67	65	63	62	60	58
40	56	54	52	51	50	48	47	45	43	41
50	38	36	33	31	29	27	25	24	23	22
60	21	20	19	18	17	16	16	15	14	13
70	12	11	10	8	7	6	4	3	3	2
80	2	------	------	------	------	------	------	------	------	------

[1] For fully crusted soil surface, regardless of soil texture, erodibility *I* is, on the average, about one-sixth of that shown.

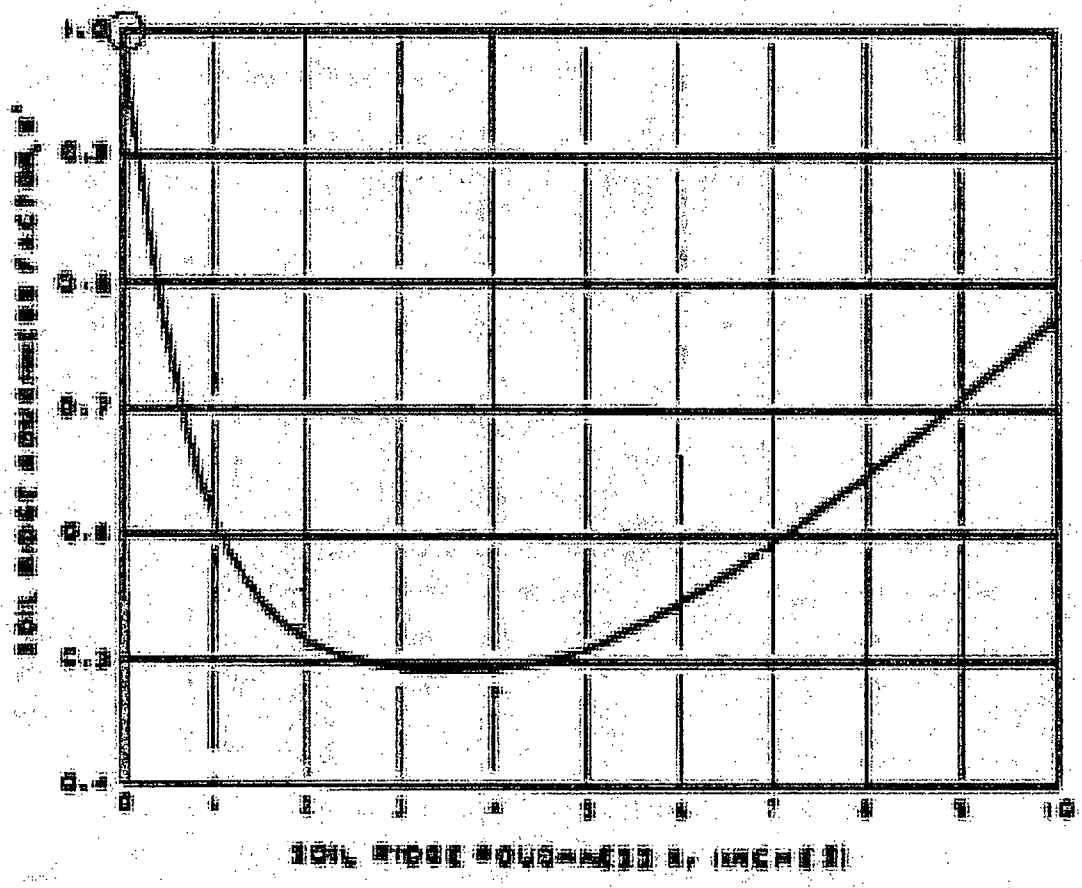
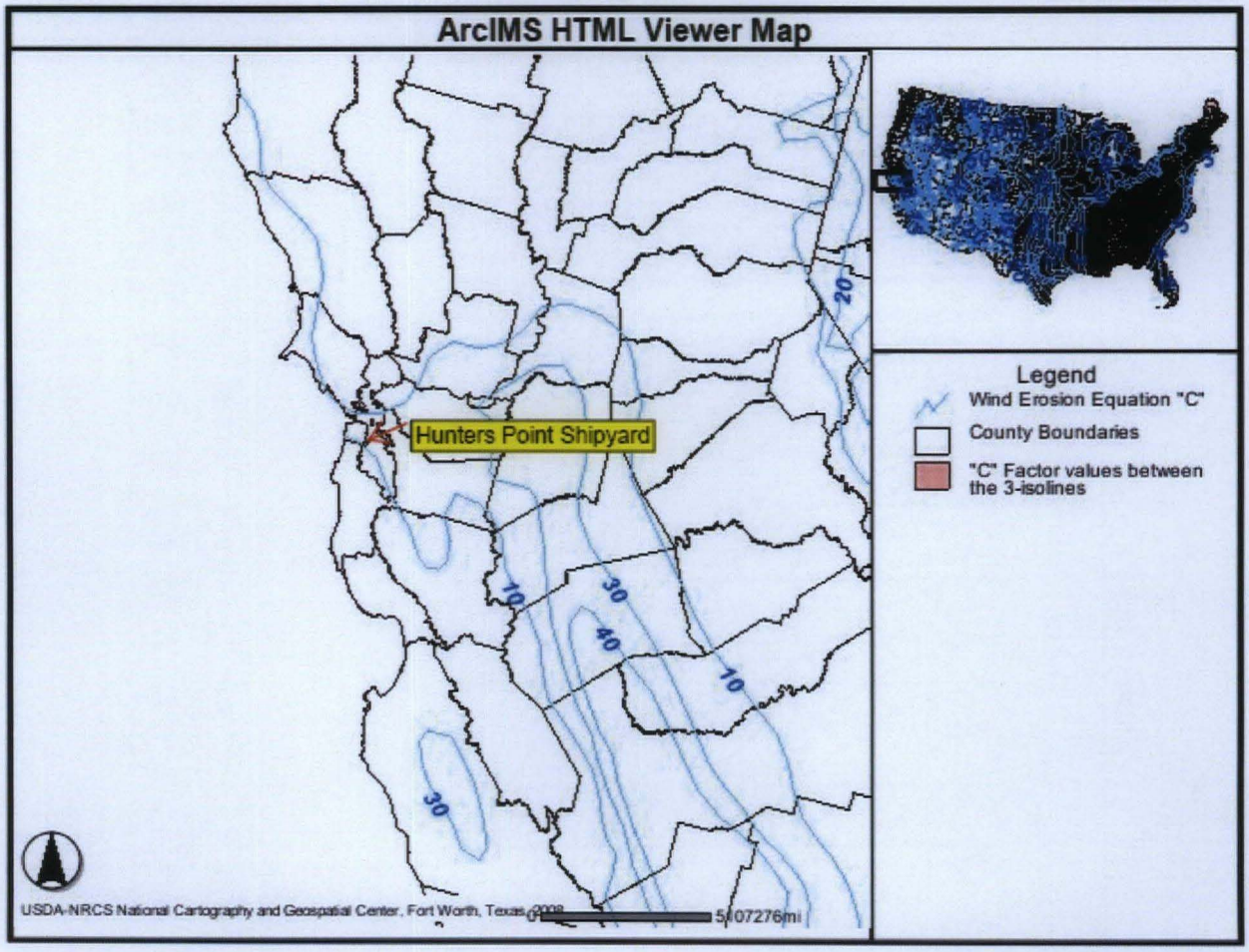


FIGURE 7.—Chart to determine soil ridge roughness factor K' from soil ridge roughness K.


ArcIMS HTML Viewer Map
Hunters Point Shipyard
20
10
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40
10
30
Legend
Wind Erosion Equation "C"
County Boundaries
"C" Factor values between the 3-isolines
USDA-NRCS National Cartography and Geospatial Center, Fort Worth, Texas, 2008
5.107276mi

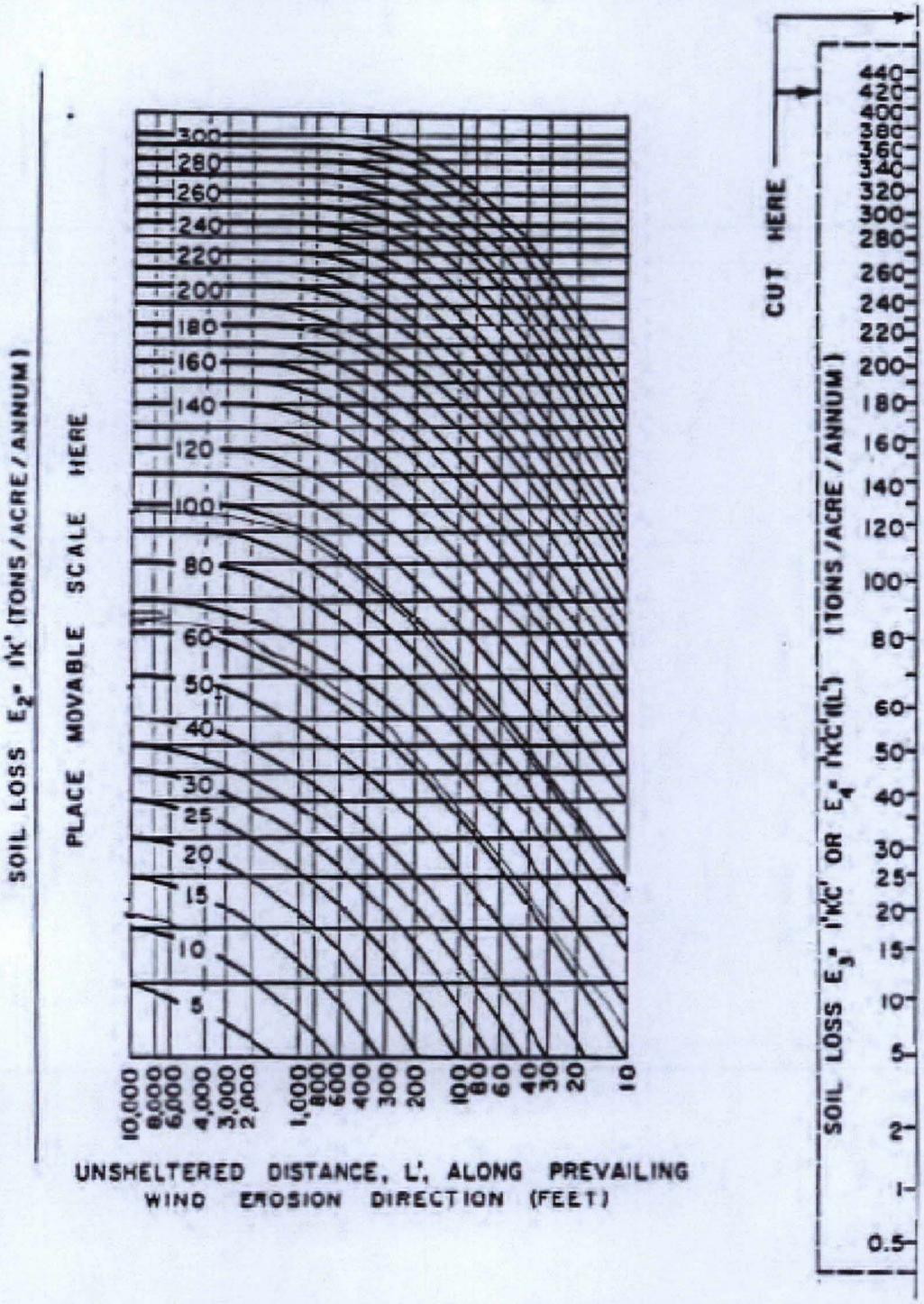


FIGURE 23.—Chart to determine soil loss $E_4 = I'K'C'/(L')$ from soil loss $E_2 = I'K'$ and $E_3 = I'K'C'$ and from unsheltered distance L' across field.

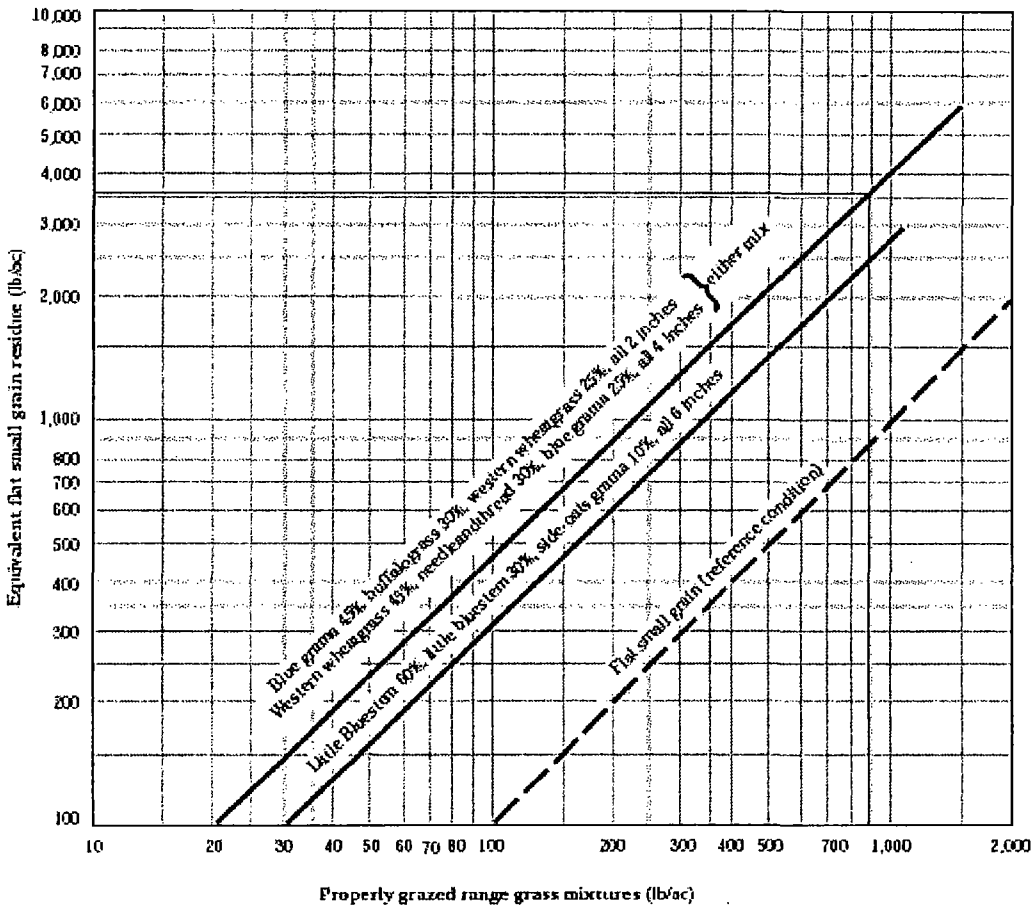
276-724 O-68—1

Percent ground cover to pounds residue				
The required crop residue may be expressed in percent ground cover in some plans and in pounds per acre in other plans. This table should be used to make the conversion from percent ground cover to pounds of residue. Residue weight varies with the variety of small grain grown. Some varieties might convert to more pounds than indicated on the table. Your SCS office may have a table that better represents the small grain varieties grown in your area	% cover	lbs. per acre	% cover	lbs. per acre
	5	80	55	1240
	10	160	60	1420
	15	250	65	1630
	20	350	70	1870
	25	450	75	2150
	30	550	80	2500
	35	670	85	2940
	40	790	90	3570
	45	930	95	4650
	50	1080	99	7140

New Mexico AGRONOMY TECHNICAL NOTE NO.73
http://www.nm.nrcs.usda.gov/technical/tech-notes/agro/ag73.doc

Flat small grain equivalent charts — Continued

Figure d-4 Flat small grain equivalents of properly grazed range grass mixture



Reference condition: Dry small grain stalks 10 inches long, lying flat on the soils surface in 10-inch rows perpendicular to wind direction, stalks oriented to wind direction.

Source: Lyles and Allison – 1980 Journal Range Management, 33(2), pages 143–146.

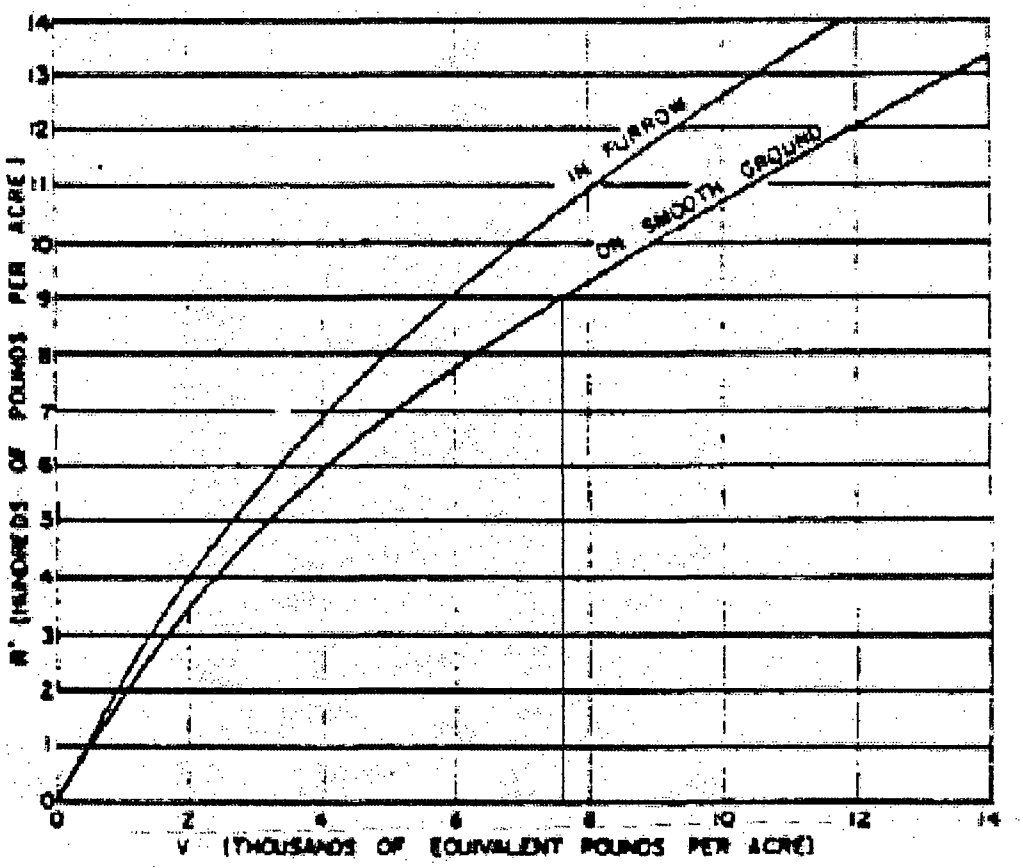


FIGURE 9.—Chart to determine V from R' or R' from V of live or dead small grain crops in seedling and stooling stage, above surface of ground, for crop in 3-inch-deep furrow as created by deep-furrow drill on smooth ground.

276-724 O-68—2

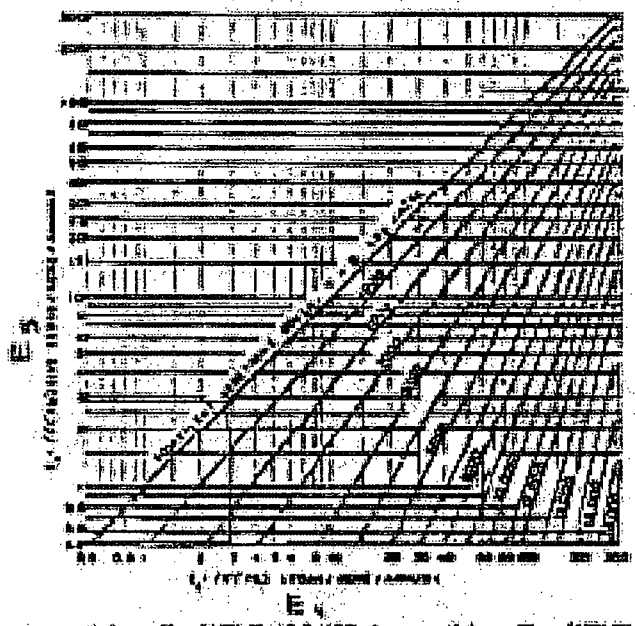


FIGURE 36.—Chart to determine soil loss $E=(E'C'/L')(V)$ from soil loss $E_1=(E'C'/L')$ and from vegetative cover factor V. Chart can be used in reverse to determine V needed to reduce soil loss to any degree.

APPENDIX C
WATERSHED SURFACE FLOW CALCULATION

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Watershed Surface Flow Calculation	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SF	4-28-09

Drainage calculations for the watershed areas affecting the remedy for IR Sites 7 and 18 were developed using the rational method for the hydrologic analysis and the time of concentration as calculated using the kinematic wave formula for overland flow and is based on the methodology explained in "Applied Hydrology" (Chow and others 1988) and the Natural Resource Conservation Service (NRCS) "Urban Hydrology for Small Watersheds – Technical Release (TR) -55" (NRCS 1986).

A 100-year return interval storm has been used for calculation to provide a conservative estimate.

A drainage swale was deemed necessary to divert flow and protect the cover from overland flow originating from upgradient of the proposed cover. Refer to Appendix D for the swale design and Figure C-1 of this appendix for the location of the swale. For the watershed that drains to the swale from south of the site the longest flow length is approximately 400 feet prior to channel flow divided as follows. The first 100 feet of flow is modeled as uniform sheet flow or shallow overland flow. The flow then turns into concentrated flow prior to entering the constructed diversion structure or swale, a distance of 300 ft. Using the flow generated from this watershed the swale/channel is designed as shown in Appendix D.

The drainage provisions and curbing along Innes Avenue provide an effective diversion of the majority of flow toward the site from upgradient. Therefore Innes Avenue is considered the upgradient limits of the watershed to the proposed swale or in essence the watershed divide. The total watershed area draining to the cover area is approximately 5 acres.

The time of concentration for the sheet flow overland flow portion of this watershed is calculated using an iterative process based on the kinematic wave formula below:

$$t_c = \frac{0.94 L^{0.6} n^{0.6}}{(i^{0.4} S^{0.3})}$$

Where:

$t_c =$ time of concentration (minutes)
$L =$ water course flow length for overland flow (ft)
$n =$ Manning's roughness coefficient
$i =$ storm intensity (in/hr)
$S =$ average slope (ft/ft)

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Watershed Surface Flow Calculation	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SF	4-28-09

Assumptions:

1. Shallow steady uniform flow
2. Constant intensity of rainfall excess – rain available for runoff
3. Minor effect of infiltration on travel time
4. The first 100 ft of flow is in sheet flow prior to concentrated flow
5. The watershed is grass covered without full coverage. Manning's n = 0.24 (NRCS 1986)
6. Average slope over the overland flow portion of the flow length is .14 ft/ft

An iterative process is used where the equation is solved for the conditions when the precipitation from the duration-frequency-depth curves and its corresponding time of concentration is equal to the time of concentration solved using that precipitation. The precipitation duration-frequency-depth curves have been included in this appendix

Time of concentration overland sheet flow

$$t_c = \frac{0.94 L^{0.6} n^{0.6}}{(i^{0.4} S^{0.3})}$$

t_c	6.97	time of concentration (min)
L	100	flow length (ft)
n	0.24	manning's roughness for grasses not fully covered
i	3.43	storm intensity (in)
S	0.14	average slope along flow length (ft/ft)

From Depth-Duration-Frequency Curves
0.4 inches in 7 minutes

$t_c \sim 7$ min

After the first 100 feet of sheet flow over the watershed the flow continues as shallow concentrated flow until the flow enters the diversion. The velocity, and thus the travel time, is calculated using the following figure.

Assumptions:

1. 300 ft of flow along the longest watercourse prior to entering swale
2. The water course is not paved
3. Average slope along the watercourse is 0.063 ft/ft

Using the above figure and the given assumptions yields an average flow of rate along the water course of 4.1 ft/sec.

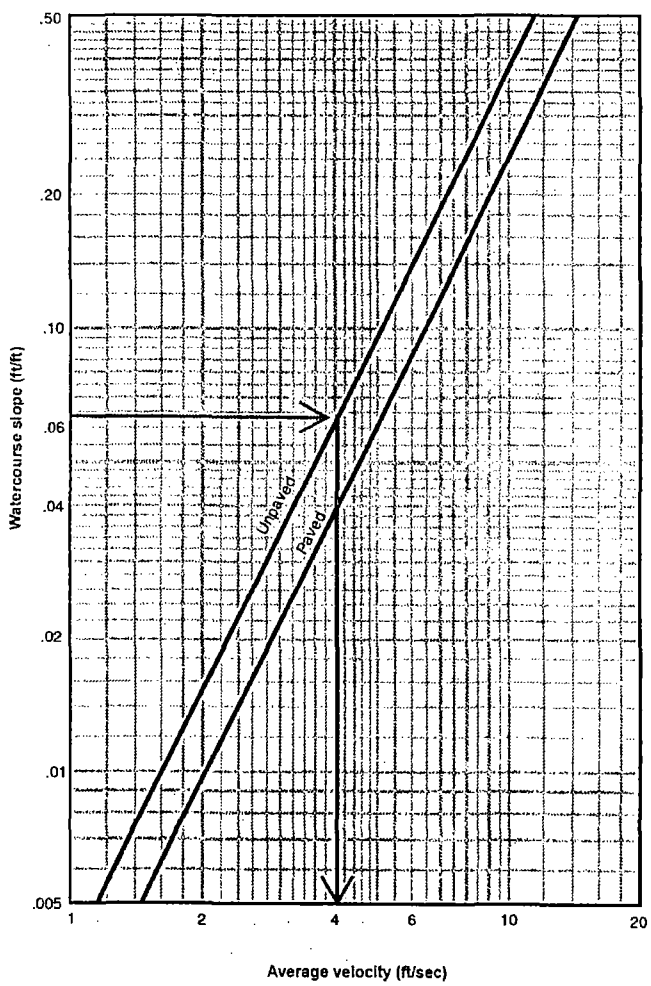
Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Watershed Surface Flow Calculation	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SF	4-28-09

$$\frac{300\text{ ft}}{4.1\frac{\text{ft}}{\text{sec}}} = 73\text{ sec}$$

Total time of concentration for overland flow

t_c sheet flow + t_c concentrated flow

7 min + 1.2 min = **8.2 minutes**



From: NRCS 1986

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Watershed Surface Flow Calculation	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SF	4-28-09

Using the provided Precipitation Duration-Frequency-Depth Curves (provided as attachment) the rainfall intensity for the time of concentration is determined.

Assumptions:

1. Average annual rainfall of 21.5 inches/year (NOAA 1995)
2. The duration-frequency-depth curves were established for Contra Costa County and it is assumed they are reasonable for estimation for San Francisco. Precipitation patterns between the 2 locations should not vary significantly given their relative proximity.

From the precipitation duration-frequency-depth curves the rainfall intensity for a 100-year return interval is corresponding to the 8.2 minute time of concentration is:

0.44 inches/8.2 minutes

or an intensity of: **3.2 in/hr**

The flow rate entering the channel is calculated using the Rational Equation

$$Q = CiA$$

Where:

Q = flow (cubic feet per second, cfs)
C = runoff coefficient (0.55 see attached runoff coefficient table)
i = rainfall intensity (in/hr)
A = watershed area (acres)

Assumptions:

1. Average slope over the area is greater than 7%
2. The condition of the watershed vegetation is relatively poor with grass covering less than 55% of the area – this is conservative scenario.
3. Calculation is based on a 100-year return interval storm

$$Q = (0.55)(3.2\ in/hr)(3\ acres)$$
$$Q = \mathbf{5.3\ cfs}$$

This is considered the peak flow rate entering the upper portion of the channel associated with a 100-year return interval storm. This flow rate will be used for the design of the swale channel as explained in Appendix D.

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Watershed Surface Flow Calculation	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SF	4-28-09

The change in the watershed flow as a result of the cover was calculated using a similar methodology as described above. The majority of the existing site flows toward the north to the natural channel along the northwestern property boundary or over the shoreline as shown in the attached Figure C-2 of this attachment. The general flow of the area will be maintained by the cover however the drainage swale will divert a portion of the flow that originates from to south to the east as shown in the figure. The change in flow to the northwestern property boundary was calculated as described below. First the flow for the proposed cover was calculated followed by the flow for the existing conditions.

Assumptions for Both Scenarios:

1. Shallow steady uniform flow
2. Constant intensity of rainfall excess – rain available for runoff
3. Minor effect of infiltration on travel time
4. The proposed cover will be maintained and the first 300 ft of flow is modeled as sheet flow. The remainder as shallow overland flow (520 ft). A Manning's n of 0.3 has been used for grass covered area (NRCS 1986)
5. The existing cover is not maintained to promote sheet flow and the first 100 ft of flow is modeled as sheet flow. The remainder as shallow overland flow (1,100 ft). A Manning's n of 0.011 has been used for smooth gravel surface (NRCS 1986).
6. Average slope over the overland flow portion of the flow length is .025 ft/ft for both the existing conditions and the proposed cover.

For the watershed over the proposed cover a time of concentration of 34 minutes was calculated as shown below.

Time of concentration overland sheet flow

t_c	34.40	time of concentration (min)
L	300	flow length (ft)
n	0.3	manning's roughness for grasses
i	1.68	storm intensity (in)
S	0.025	average slope along flow length (ft/ft)

From Depth-Duration-Frequency Curves
0.95 inches in 34 minutes

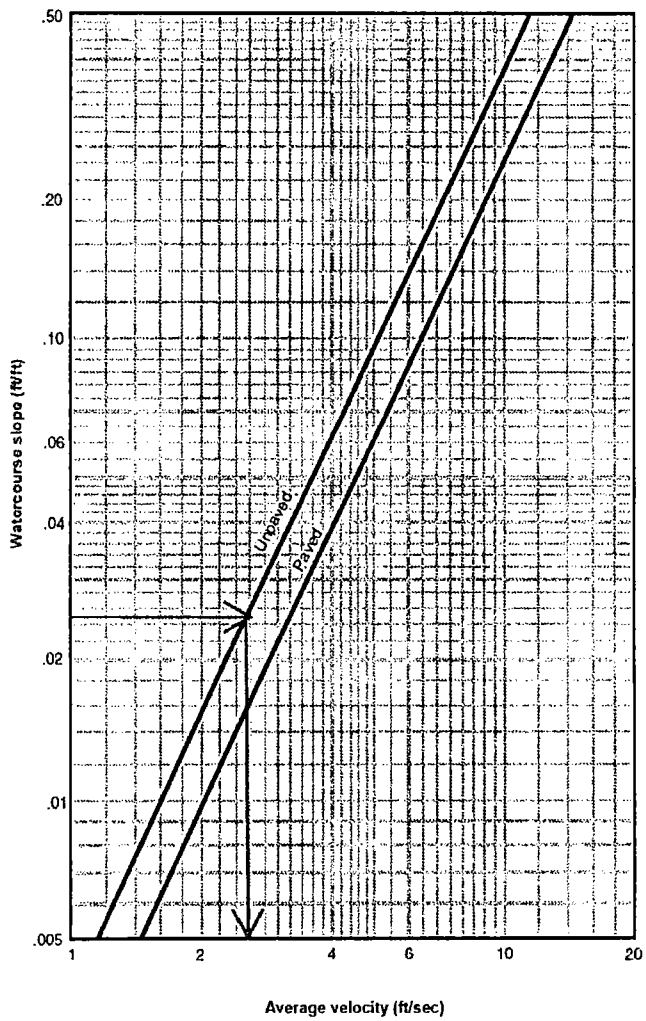
TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Watershed Surface Flow Calculation	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SF	4-28-09

After the first 300 feet of sheet flow over the watershed the flow continues as shallow concentrated flow until discharge to the bay from the natural channel at the watershed discharge point. The velocity, and thus the travel time, is calculated using the following figure.

Assumptions:

1. 520 ft of flow along the longest watercourse over the remainder of the cover and through the channel
2. The water course is unpaved
3. Average slope along the watercourse is 0.025 ft/ft



Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Watershed Surface Flow Calculation	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SF	4-28-09

Using the above figure and the given assumptions yields an average flow of rate along the water course of 2.5 ft/sec.

$$\frac{520\text{ ft}}{2.5\frac{\text{ft}}{\text{sec}}} = 208\text{ sec}$$

Total time of concentration for overland flow

t_c sheet flow + t_c concentrated flow

34 min + 3.5 min = **37.5 minutes**

Using the provided Precipitation Duration-Frequency-Depth Curves (provided as attachment) the rainfall intensity for the time of concentration is determined.

Assumptions:

1. Average annual rainfall of 21.5 inches/year (NOAA 1995)
2. The duration-frequency-depth curves were established for Contra Costa County and it is assumed they are reasonable for estimation for San Francisco. Precipitation patterns between the 2 locations should not vary significantly given their relative proximity.

From the precipitation duration-frequency-depth curves the rainfall intensity for a 100-year return interval is corresponding to the 37.9 minute time of concentration is:

1.0 inches/38 minutes

or an intensity of: **1.6 in/hr**

The flow rate from the watershed is calculated using the Rational Equation

$$Q = CiA$$

Where:

Q = flow (cubic feet per second, cfs)
C = runoff coefficient (0.41 for moderate condition, see attached runoff coefficient table)
i = rainfall intensity (in/hr)
A = watershed area (acres)

$$Q = (0.41)(1.6\text{ in/hr})(4.5\text{ acres})$$
$$Q = \mathbf{3.0\ cfs}$$

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Watershed Surface Flow Calculation	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SF	4-28-09

This is considered the peak flow rate entering from the watershed created by the proposed cover and swale at the discharge point associated with a 100-year return interval storm.

For the watershed over the existing area the first 100 ft of flow along the longest flow path is the same as for the watershed associated with the swale because that area will not be affected by the cover and thus has the same associated time of concentration of 7 minutes.

Time of concentration overland sheet flow

t_c	6.97	time of concentration (min)
L	100	flow length (ft)
n	0.24	manning's roughness for grasses not fully covered
i	3.43	storm intensity (in)
S	0.14	average slope along flow length (ft/ft)

From Depth-Duration-Frequency Curves
0.4 inches in 7 minutes

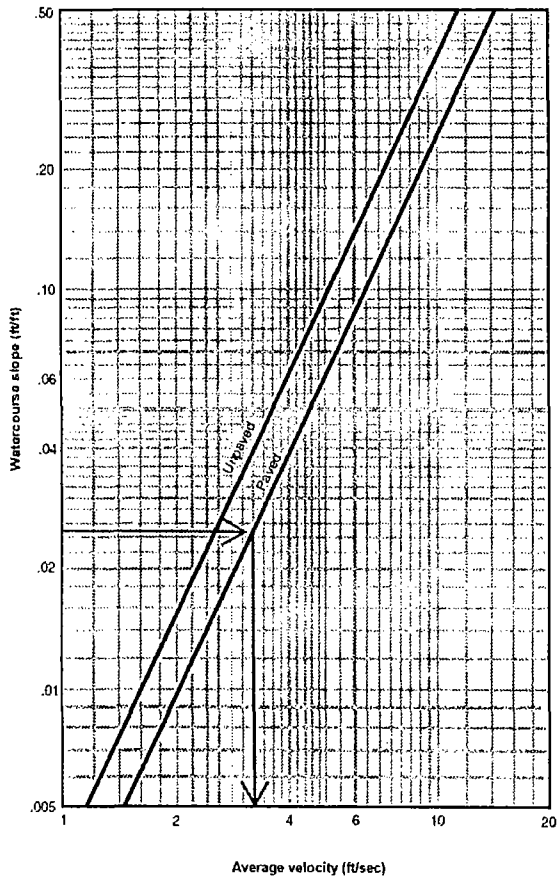
After the first 100 feet of sheet flow over the watershed the flow continues as shallow concentrated flow until discharge to the bay from the natural channel at the watershed discharge point. The velocity, and thus the travel time, is calculated using the following figure.

Assumptions:

1. 1,100 ft of flow along the longest watercourse over the remainder of the cover and through the channel
2. The water course is not improved but the existing cover is similar to being paved
3. Average slope along the watercourse is 0.025 ft/ft

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Watershed Surface Flow Calculation	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SF	4-28-09



The average flow rate over the existing watershed will be:

$$\frac{1100\text{ ft}}{3.2\,\frac{\text{ft}}{\text{sec}}} = 344\text{sec}$$

Total time of concentration for overland flow

t_c sheet flow + t_c concentrated flow

7 min + 5.7 min = **12.7 minutes**

Using the provided Precipitation Duration-Frequency-Depth Curves (provided as attachment) the rainfall intensity for the time of concentration is determined.

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Watershed Surface Flow Calculation	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SF	4-28-09

Assumptions:

1. Average annual rainfall of 21.5 inches/year (NOAA 1995)
2. The duration-frequency-depth curves were established for Contra Costa County and it is assumed they are reasonable for estimation for San Francisco. Precipitation patterns between the 2 locations should not vary significantly given their relative proximity.

From the precipitation duration-frequency-depth curves the rainfall intensity for a 100-year return interval is corresponding to the 12.7 minute time of concentration is:

0.55 inches/13 minutes

or an intensity of: **2.5 in/hr**

The flow rate from the watershed is calculated using the Rational Equation

$$Q = CiA$$

Where:

Q = flow (cubic feet per second, cfs)
C = runoff coefficient (0.95 for developed asphaltic, see attached runoff coefficient table)
i = rainfall intensity (in/hr)
A = watershed area (acres)

$$Q = (0.95)(2.5\ in/hr)(8.8\ acres)$$
$$Q = \mathbf{20.9\ cfs}$$

This is considered the peak flow rate entering from the watershed as the discharge point associated with a 100-year return interval storm.

As a result of the proposed cover and the drainage swale (see Appendix D) the peak flow to the unimproved channel along the northwestern property boundary will be approximately 15% of the existing peak flow, or about 3 cfs under 100-year return interval storm scenario. This decrease is due to proposed swale and the reduced drainage size to that portion of the site and the maintained cover which will has a larger Manning's roughness coefficient and greater infiltration than the current conditions. Because of the significantly decreased peak flows and proximity to the discharge to the bay drainage improvements were not investigated along the boundary.

REFERENCES

Chow, V., Maidment, D., and Mays, L. 1988. "Applied Hydrology." McGraw-Hill Publishing.

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U.S. Department of Agriculture, Natural Resource Conservation Service (NRCS). 1986. "Urban Hydrology for Small Watersheds – Technical Release 55." June.

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TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Watershed Surface Flow Calculation	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SF	4-28-09

RUNOFF COEFFICIENTS FOR USE IN THE RATIONAL METHOD

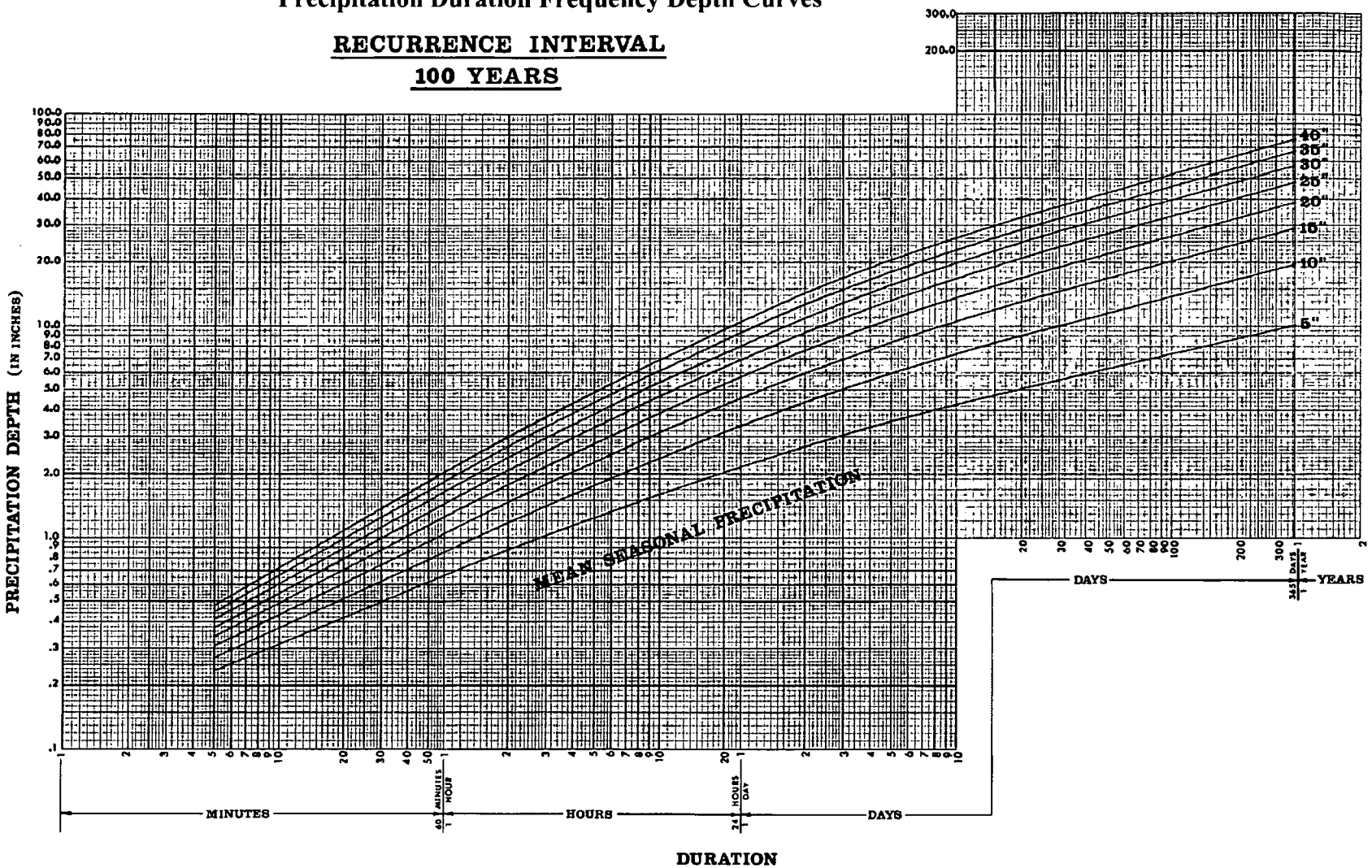
Character of Surface	Return Period						
	2 Years	5 Years	10 Years	25 Years	50 Years	100 Years	500 Years
DEVELOPED							
Asphaltic	0.73	0.77	0.81	0.86	0.90	0.95	1.00
Concrete	0.75	0.80	0.83	0.88	0.92	0.97	1.00
Grass Areas (Lawns, Parks, etc.)							
Poor Condition*							
Flat, 0-2%	0.32	0.34	0.37	0.40	0.44	0.47	0.58
Average, 2-7%	0.37	0.40	0.43	0.46	0.49	0.53	0.61
Steep, over 7%	0.40	0.43	0.45	0.49	0.52	0.55	0.62
Fair Condition**							
Flat, 0-2%	0.25	0.28	0.30	0.34	0.37	0.41	0.53
Average, 2-7%	0.33	0.36	0.38	0.42	0.45	0.49	0.58
Steep, over 7%	0.37	0.40	0.42	0.46	0.49	0.53	0.60
Good Condition***							
Flat, 0-2%	0.21	0.23	0.25	0.29	0.32	0.36	0.49
Average, 2-7%	0.29	0.32	0.35	0.39	0.42	0.46	0.56
Steep, over 7%	0.34	0.37	0.40	0.44	0.47	0.51	0.58
UNDEVELOPED							
Cultivated							
Flat, 0-2%	0.31	0.34	0.36	0.40	0.43	0.47	0.57
Average, 2-7%	0.35	0.38	0.41	0.44	0.48	0.51	0.60
Steep, over 7%	0.39	0.42	0.44	0.48	0.51	0.54	0.61

Reference: Chow 1988

Precipitation Duration Frequency Depth Curves

RECURRENCE INTERVAL

100 YEARS



Reference: Contra Costa Public Works

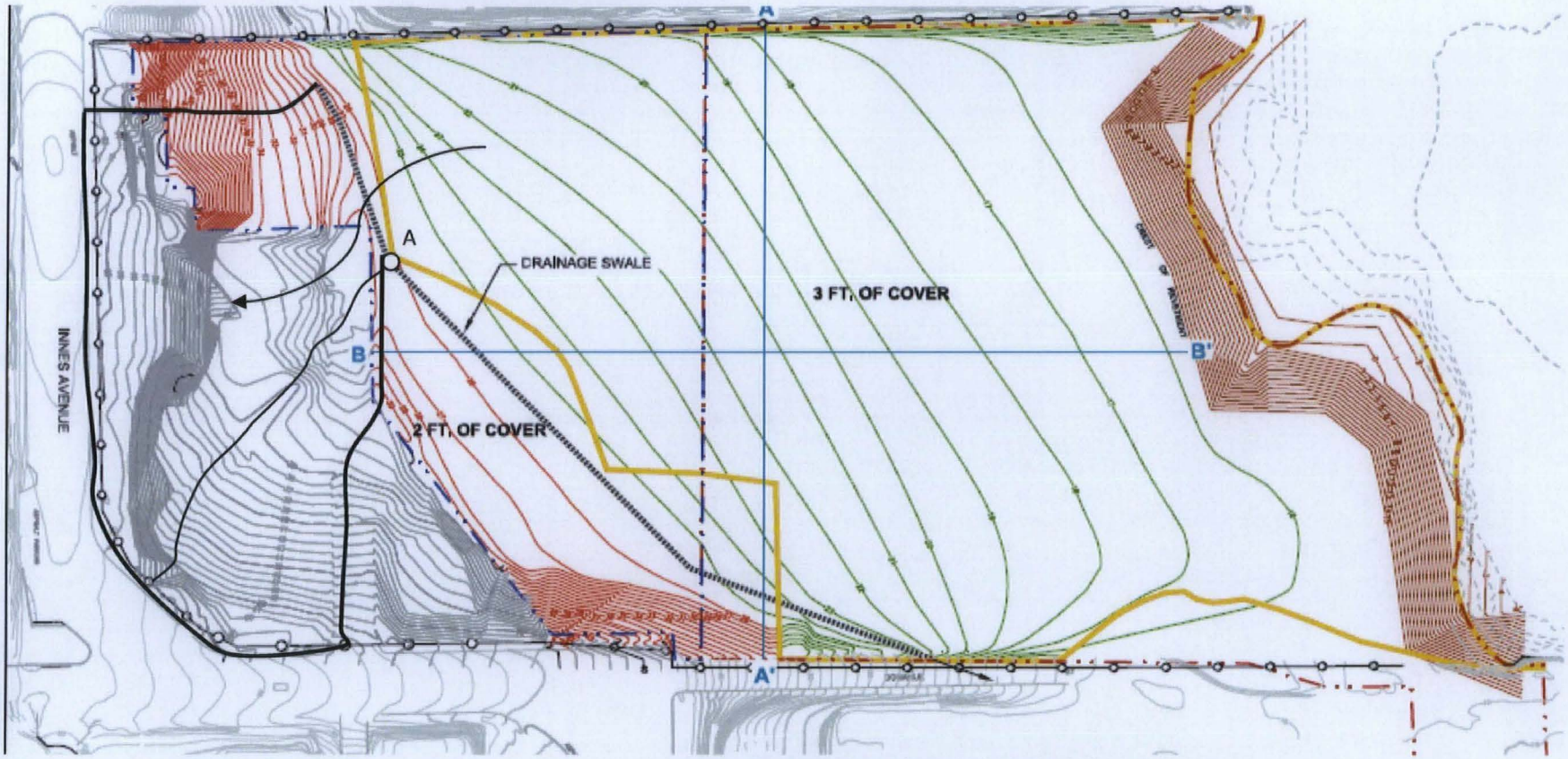
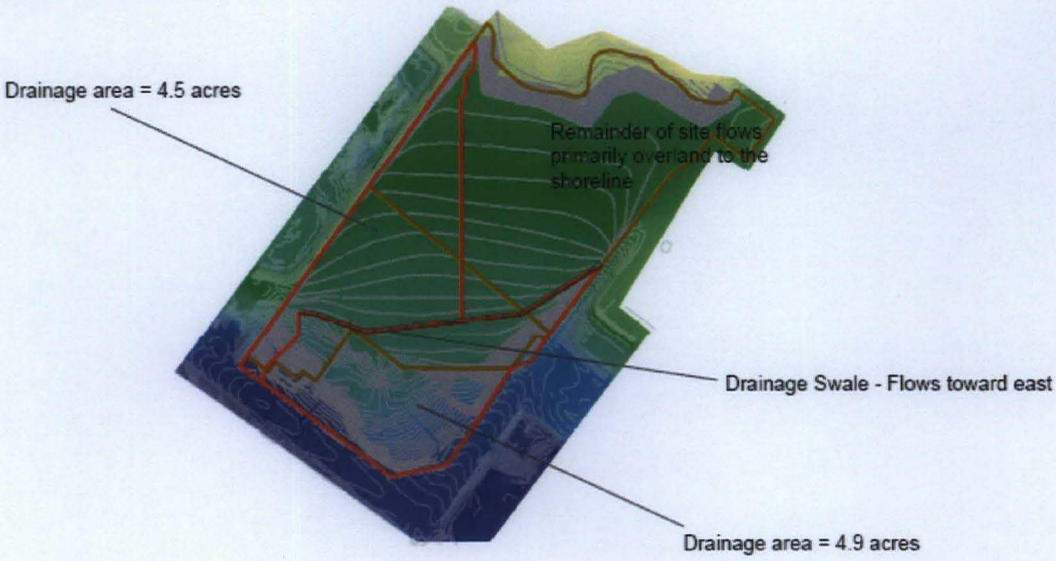


Figure C-1
Drainage Area to the Upper Portion of the Swale (used for swale design see Appendix D)

Primary Watersheds - Proposed Cover



Primary Watersheds - Existing Elevations

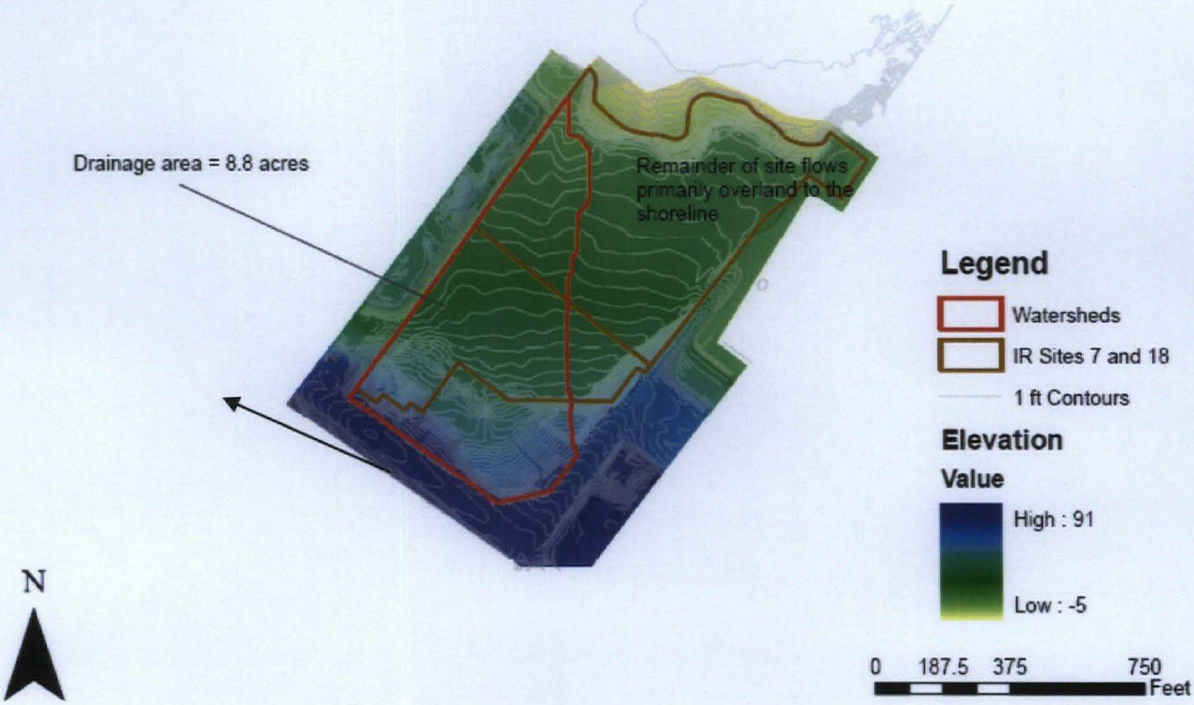


Figure C-2
Primary Watersheds

APPENDIX D
DRAINAGE SWALE CALCULATIONS AND DESIGN

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Drainage Swale Calculations and Design	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

The drainage swale is designed based on the anticipated peak flows associated with a 100-year return interval storm throughout the channel. The calculation of the dimensions of the grass lined swale is an iterative process using the Rational Method for small watersheds (Appendix C) and Manning's equation and adjusting the swale slope and height for the conveyance of the estimated peak flow.

An estimation of the channel/swale geometry is calculated from manning's equation for flow using the flow rate entering the upper portion of the channel (calculation Appendix C) of 5.3 cfs and solving for water depth while adjusting the slopes and bottom width for that portion of the channel. The flow rate is then recalculated to account for additional inflow into the channel and the selected channel geometry is tested against total flow given the change in channel slope. This process is continued to ensure that the peak flow is conveyed to the channel outlet point.

The swale was broken into 2 segments along the longest flow path based on flow characteristics. The upper potion of the channel (segment A) has an average slope along the segment of 0.2% and a segment length of 425 feet. The lower portion of the channel (segment B) has an average slope of 1.8% and a length of 250 feet. Shallower slopes will be associated with deeper water depths and steeper slopes will be associated with increased water velocity and greater shear forces along the channel. A figure showing the channel segments has been attached to this calculation.

The following variation of Manning's equation is used equation to estimate channel geometry along the channel segments:

$$Q = \frac{1.49}{n} S_{A,B}^{\frac{1}{2}} A R^{\frac{2}{3}}$$

Where:

$Q =$ flow rate (cfs)
$n =$ manning's roughness coefficient (0.045 for grass lined channels intermittent flow)
$S_A =$ average slope along channel/swale segment A (0.2% or 0.002 ft/ft)
$S_B =$ average slope along channel/swale segment B (1.8% or 0.018 ft/ft)
$A =$ cross sectional area of flow (see below)
$R =$ hydraulic radius (see below)

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Drainage Swale Calculations and Design	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

$$A = B_w y + \left[\frac{(z_1 + z_2)}{2}\right] y^2 \qquad R = \frac{B_w y + \left[\frac{(z_1 + z_2)}{2}\right] y^2}{B_w + \sqrt{(z_1 y)^2 + y^2} + \sqrt{(z_2 y)^2 + y^2}}$$

Where:

B_w = channel bottom width
z_1 = channel side slope ($1/z$) of upgradient side slope
z_2 = channel side slope ($1/z$) of swale side slope
y = water depth (ft)

Using the above formulas an iterative process was used to solve for water depth for a variety of swale geometry options for the channel influent to segment A. The following shows the results of the process:

Flow in channel at A (irregular trapezoid)

$$Q = \frac{1.49}{n} S^{\frac{1}{2}} A R^{\frac{2}{3}}$$

$$A = B_w y + \left[\frac{(z_1 + z_2)}{2}\right] y^2$$

$$R = \frac{B_w y + \left[\frac{(z_1 + z_2)}{2}\right] y^2}{B_w + \sqrt{(z_1 y)^2 + y^2} + \sqrt{(z_2 y)^2 + y^2}}$$

n	0.045	Mannings roughness
B_w	2	Bottom width (ft)
z_1	17	Average updradient slope
z_2	3	Swale side slope
S	0.002	Water course slope (ft/ft)
Q	5.3	Flow rate (cfs) incoming channel
y	**0.74**	Solve for y using Q
	5.30	Flow rate (cfs)

Using the flow rate of 5.3 cfs (see Appendix C) and a bottom width of 2 feet and side slopes of 1V:3H for the swale downgradient of the flow path and 1V:17H upgradient of the swale yields a water depth of 0.74 feet.

The time of concentration for the swale portion of the water course is calculated using Manning's equation for velocity using the following equation based on the swale/channel geometry from above:

$$V = \frac{1.49 r^{\frac{2}{3}} s^{\frac{1}{2}}}{n}$$

Where:

V = average velocity (ft/sec)
r = hydraulic radius (ft)
s = slope of the gradient line (ft/ft)
n = manning's roughness coefficient

The hydraulic radius (r) is calculated from:

$$R = \frac{B_w y + \left[\frac{(z_1 + z_2)}{2}\right] y^2}{B_w + \sqrt{(z_1 y)^2 + y^2} + \sqrt{(z_2 y)^2 + y^2}}$$

Where:

B_w = channel bottom width
z_1 = channel side slope ($1/z$) of upgradient side slope
z_2 = channel side slope ($1/z$) of swale side slope
y = water depth (ft)

Velocity along upper channel segment points A-B

$$V = \frac{1.49 r^{\frac{2}{3}} s^{\frac{1}{2}}}{n}$$

V	**0.95**	average velocity in channel (ft/sec)
r	0.51	hydraulic radius (ft)
s	0.002	channel slope (ft/ft)
n	0.045	mannings roughness

Using the above relationships yields a velocity along the drainage of **0.95 ft/sec**.

The flow length along the upper channel segment is approximately 360 feet. The time of concentration along the channel of the entering flow is calculated using the associated velocity of 1.12 ft/sec as shown below.

t_c = (distance)/(velocity)
t_c = (425 ft)/(0.95 ft/sec)
t_c = 7.4 min

Using the times of concentration calculated entering the channel the total time of concentration along the longest flow path is calculated.

8.2 min = t_c peak flow entering channel (from Appendix C)
7.4 min = t_c along the channel segment A
15.6 min

From the precipitation duration-frequency-depth curves the rainfall intensity for a 100-year return interval corresponding to the 13.6 minute total time of concentration for the water course is:

0.63 inches/15.6 minutes
or an intensity of: **2.4 in/hr**

The maximum flow rate along segment A or in influent of segment B is calculated using the Rational Equation

$$Q = CiA$$

Where:

Q = flow (cubic feet per second, cfs)
C = runoff coefficient (0.55 see following table)
i = rainfall intensity (in/hr)
A = watershed area (4.5 acres)

Assumptions:

1. Average slope of the watershed is steep greater than 1%
2. The condition of the vegetation over the entire watershed associated with the location is considered relatively poor with grass covering less than 55% of the channel (assumption used for conservation and yields a higher flow – the channel vegetation would be maintained according to the O&M Plan)
3. Calculation is based on a 100-year return interval storm

$$Q = (0.55)(2.4\ in/hr)(4.5\ acres)$$

$$Q = \mathbf{5.9\ cfs}$$

This flow of 5.9 cfs is considered the influent to segment B of the channel. Using the same process described above the channel geometry along segment B is tested and the velocity is calculated.

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Drainage Swale Calculations and Design	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

Flow in channel at B (irregular trapezoid)

$$Q = \frac{1.49}{n} S^{\frac{1}{2}} A R^{\frac{2}{3}}$$

$$A = B_w y + \left[\frac{(z_1 + z_2)}{2}\right] y^2$$

$$R = \frac{B_w y + \left[\frac{(z_1 + z_2)}{2}\right] y^2}{B_w + \sqrt{(z_1 y)^2 + y^2} + \sqrt{(z_2 y)^2 + y^2}}$$

n	0.045	Mannings roughness
B_w	2	Bottom width (ft)
z_1	4	Average updradient slope
z_2	3	Swale side slope
S	0.018	Water course slope (ft/ft)
Q	5.9	Flow rate (cfs) incoming channel
y	0.66	Solve for y using Q
	5.90	Flow rate (cfs)

A peak water depth of 0.66 feet is estimated using the same channel geometry as the calculation for the previous segment. It should be noted that the upgradient slopes are steeper than for the previous segment which has been accounted for in the equation. Using this data the channel velocity is calculated.

Velocity along upper channel segment points A-B

$$V = \frac{1.49 r^{\frac{2}{3}} s^{\frac{1}{2}}}{n}$$

V	2.57	average velocity in channel (ft/sec)
r	0.51	hydraulic radius (ft)
s	0.018	channel slope (ft/ft)
n	0.045	mannings roughness

The velocity along the lower channel portion, channel B, is **2.6 ft/sec**.

The flow length along the lower channel segment is approximately 250 feet. The time of concentration along the channel of the entering flow is calculated using the associated velocity of 2.6 ft/sec as shown below.

t_c = (distance)/(velocity)
t_c = (250 ft)/(2.6 ft/sec)
t_c = 1.6 min

Using the times of concentration calculated entering the channel the total time of concentration along the longest flow path is calculated.

8.2 min =	t_c peak flow entering channel (from Appendix C)
7.4 min =	t_c along the channel segment A
1.6 min =	t_c along the channel segment B
17.2 min	

From the precipitation duration-frequency-depth curves the rainfall intensity for a 100-year return interval is corresponding to the 17.2 minute total time of concentration for the water course is:

0.65 inches/17.2 minutes
or an intensity of: **2.3 in/hr**

The peak flow rate along segment B or channel effluent is calculated using the Rational Equation

$$Q = CiA$$

Where:

Q =	flow (cubic feet per second, cfs)
C =	runoff coefficient (0.55 see following table)
i =	rainfall intensity (in/hr)
A =	watershed area (5 acres)

Assumptions:

1. Average slope of the watershed is steep greater than 1%
2. The condition of the vegetation over the entire watershed associated with the location is considered relatively poor with grass covering less than 55% of the channel (assumption used for conservation and yields a higher flow – the channel vegetation would be maintained according to the O&M Plan)
3. Calculation is based on a 100-year return interval storm

$Q = (0.55)(2.3\ in/hr)(5\ acres)$

$Q = \mathbf{6.3\ cfs}$

Based on these results and the corresponding peak flows associated with the 100-year return interval storm the following swale geometry will be used in the design. The upgradient slopes vary over the length of the channel which has been accounted for in the design.

Swale height of:	**1 foot**
Swale slope of:	**33% or 1V:3H**
Peak depth of:	**.74 feet**

The 100-year return interval storm will result in a peak water depth of 0.74 feet along the drainage swale in both channel segment A and B and thus an overall swale height of 1 foot gives significant freeboard given the shallow water depth. The upgradient slopes leading to the swale vary over the channel which has been accounted for in the design calculations.

It should be noted that this method of calculation where flow rates are calculated along the channel was used given the length of travel time along the swale portion of the water course relative to drainage size. If the travel time along the channel is assumed to be negligible a peak flow of 8.8 cfs would be calculated. The given channel geometry would be able to covey this flow with a peak depth of approximately 0.8 feet along the channel for the 100-year storm event.

The channel will be grass lined underlain with a composite turf reinforced mat. The assessment of the channel material is based on the susceptibility of the channel to the shearing imposed by the water flowing through the channel as calculated above.

Shear stress increases with slope and velocity. Channel B has a slope of 1.8% and the calculated velocity is 2.57 ft/sec which is greater than the associated values of channel A. The depth of 0.74 feet associated with channel A is used to yield the greatest shear force.

The equation used for calculating the shear stress is:

$$\tau = wys$$

Where:

τ = unit tractive force in lbs/ft^2
w = unit weight of water (62.4 lbs/ft^3
y = water depth (0.74 ft)
s = average slope (0.018 ft/ft)

$\tau = (62.4)(0.71)(0.018)$

Using the above relationship yields a shear stress of **0.83 lbs/ft^2** when using the maximum depth and slope along the drainage channel.

Appropriate shear stress for a grass lined reinforced channel is 3.2 lbs/ft^2 for short duration unvegetated channels and 8 lbs/ft^2 for established vegetation for short and long duration flows (North American Green). Therefore the channel and vegetative stability is ensured based on the described geometry and a reinforced lining.

SPILLWAY

Stormwater flowing along the swale will spill over the side slope of the cover and migrate overland to existing off-site drainage channels. This spill area over the side slope will require additional armoring to prevent erosion from stormwater during a 100-year storm.

Flow over spillway (irregular trapezoid)

$$Q = \frac{1.49}{n} S^{\frac{1}{2}} A R^{\frac{2}{3}}$$

$$A = B_w y + \left[\frac{(z_1 + z_2)}{2}\right] y^2$$

$$R = \frac{B_w y + \left[\frac{(z_1 + z_2)}{2}\right] y^2}{B_w + \sqrt{(z_1 y)^2 + y^2} + \sqrt{(z_2 y)^2 + y^2}}$$

n	0.033	Mannings roughness
B_w	5	Bottom width (ft)
z_1	20	Average updradient slope
z_2	20	Swale side slope
S	0.33	Water course slope (ft/ft)
Q	5.9	Flow rate (cfs) incoming channel
y	0.15	Solve for y using Q
	5.90	Flow rate (cfs)

The base width and side slopes are assumed values and represent a reasonably flat flow area. The slope of the cover side slope is 1V:3H. Using this flow depth over the spillway the velocity is calculated.

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Drainage Swale Calculations and Design	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

Velocity over spillway

$$V = \frac{1.49 r^{\frac{2}{3}} s^{\frac{1}{2}}}{n}$$

V	**8.32**	average velocity in channel (ft/sec)
r	0.18	hydraulic radius (ft)
s	0.33	channel slope (ft/ft)
n	0.033	mannings roughness

Using methodology described in (Federal Highway Administration 1990) and as shown in the attached calculation sheets a median riprap size of approximately 8 inches is calculated.

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Drainage Swale Calculations and Design	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

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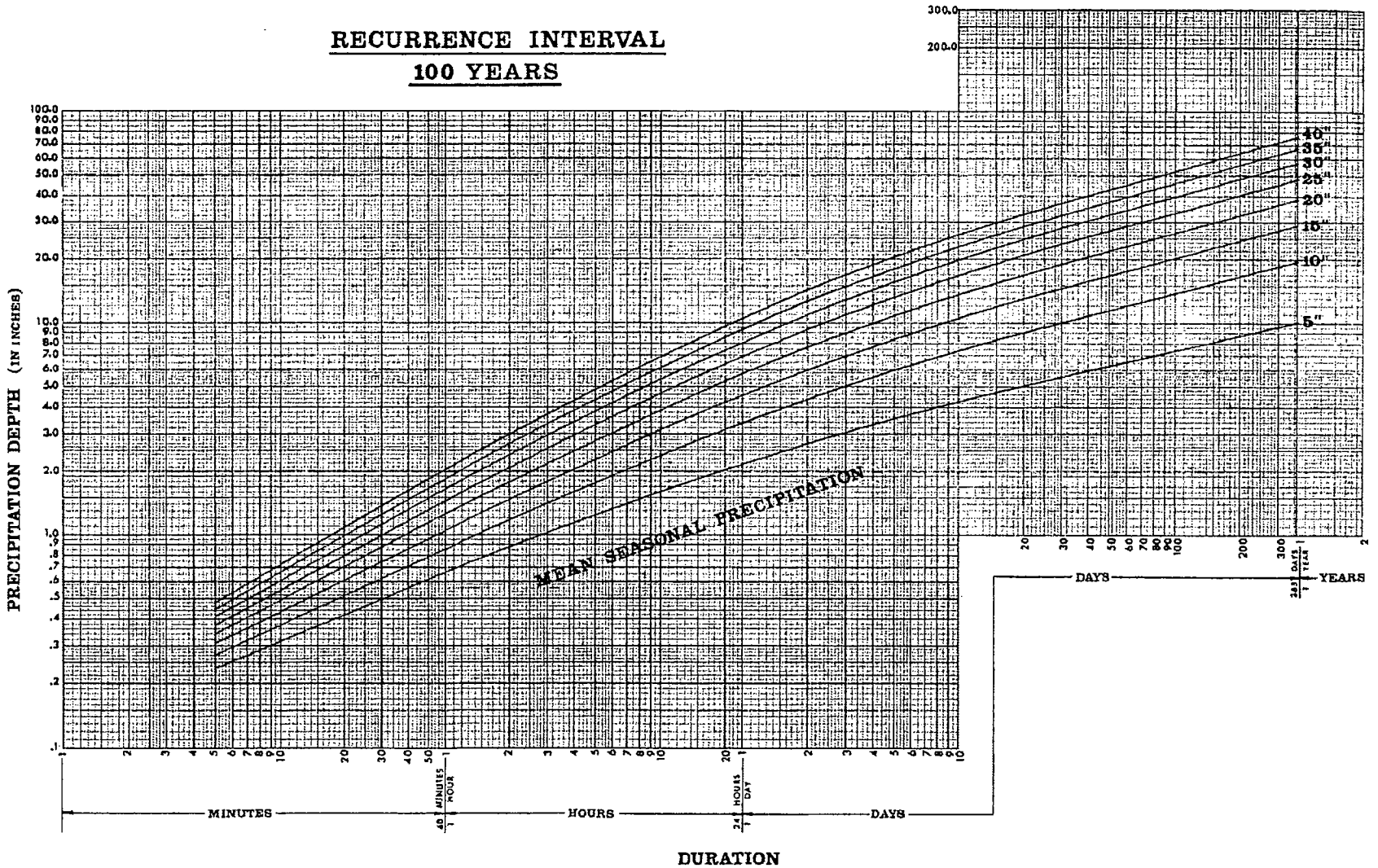
TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Drainage Swale Calculations and Design	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

TABLE 2-2
RATIONAL METHOD RUNOFF COEFFICIENTS FOR COMPOSITE ANALYSIS
Runoff Coefficient (C)

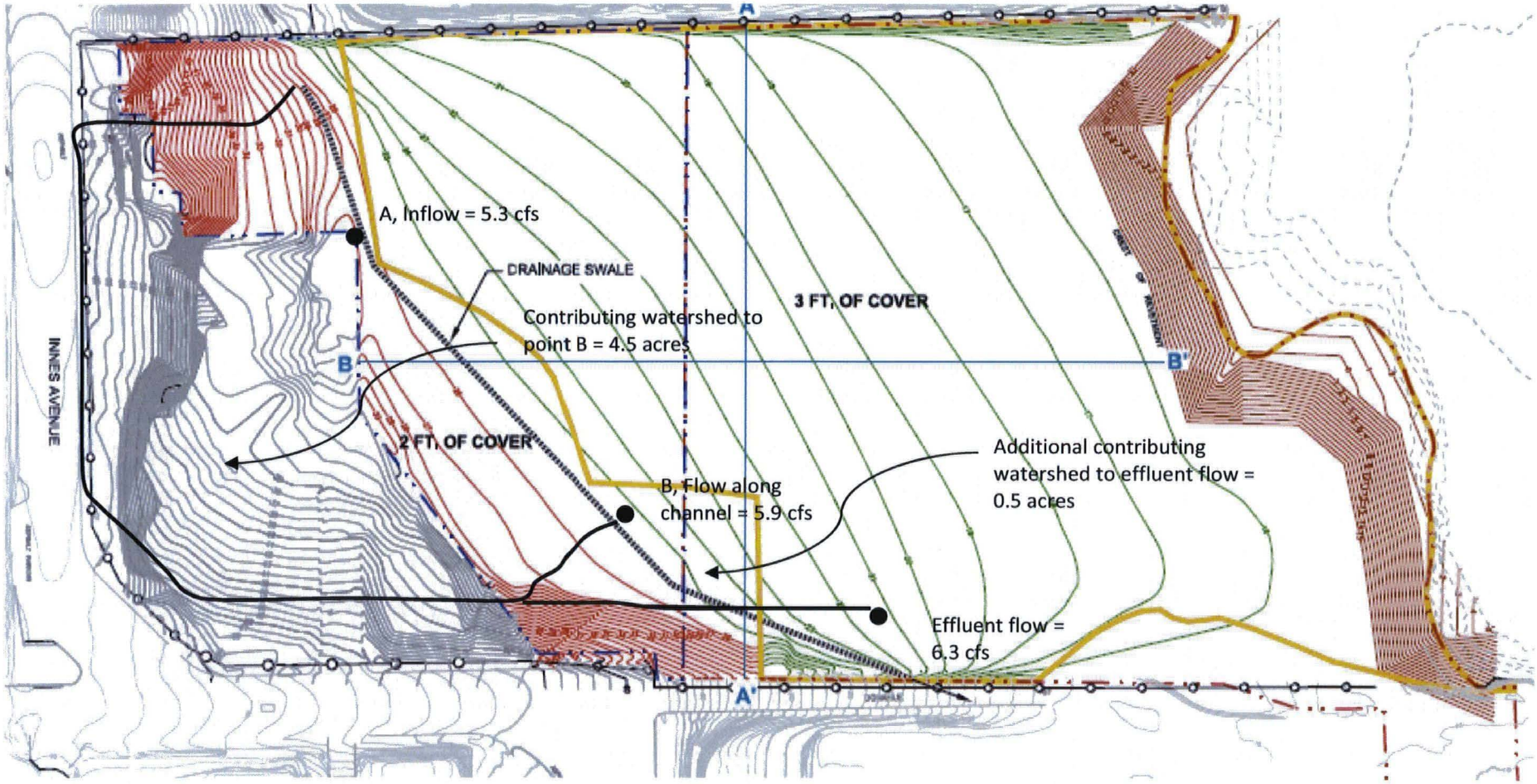
Character of Surface	Return Period						
	2 Years	5 Years	10 Years	25 Years	50 Years	100 Years	500 Years
DEVELOPED							
Asphaltic	0.73	0.77	0.81	0.86	0.90	0.95	1.00
Concrete	0.75	0.80	0.83	0.88	0.92	0.97	1.00
Grass Areas (Lawns, Parks, etc.)							
Poor Condition*							
Flat, 0-2%	0.32	0.34	0.37	0.40	0.44	0.47	0.58
Average, 2-7%	0.37	0.40	0.43	0.46	0.49	0.53	0.61
Steep, over 7%	~~0.40~~	~~0.43~~	~~0.45~~	~~0.49~~	~~0.52~~	0.55	0.62
Fair Condition**							
Flat, 0-2%	0.25	0.28	0.30	0.34	0.37	0.41	0.53
Average, 2-7%	0.33	0.36	0.38	0.42	0.45	0.49	0.58
Steep, over 7%	0.37	0.40	0.42	0.46	0.49	0.53	0.60
Good Condition***							
Flat, 0-2%	0.21	0.23	0.25	0.29	0.32	0.36	0.49
Average, 2-7%	0.29	0.32	0.35	0.39	0.42	0.46	0.56
Steep, over 7%	0.34	0.37	0.40	0.44	0.47	0.51	0.58

Precipitation Duration Frequency Depth Curves

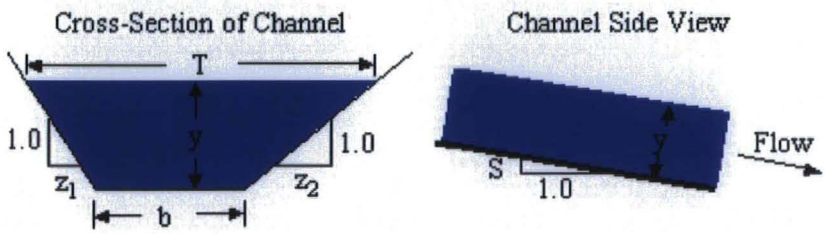


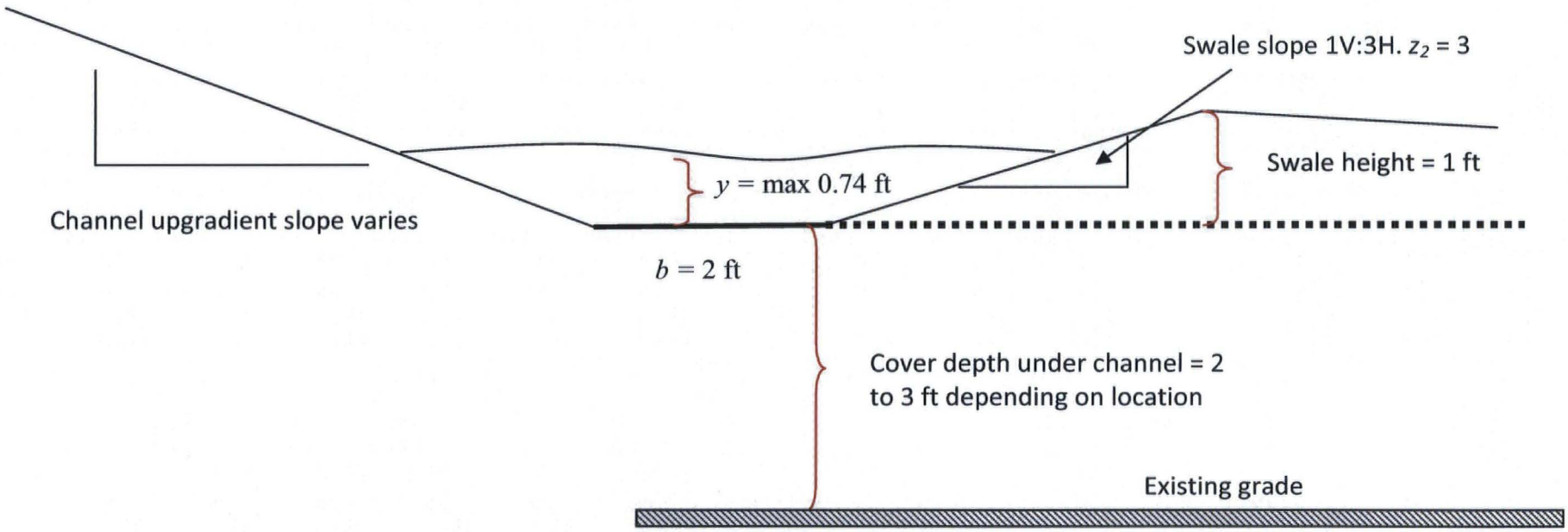
Riprap Sizing Calculation

```
                    D A T A                    (enter in highlighted cells below)
        22-Sep-09                                                    by: B Latham
    P R O J E C T : HPS IR 7&18                                     job #: ————————
                    Swale Spillway
RIPRAP SIZING
BASED ON : HIGHWAYS IN THE RIVER ENVIRONMENT-FHWA-SEC 6A5-printed 7/83
                                          given:
RIPRAP SPECIFIC WEIGHT                      2.5  (2.5 minimum per C.D.O.T.)
RIPRAP ANGLE OF REPOSE (deg                  41  (angular=41+/-, round=38 to 40 typ.)
SIDE SLOPE H (horiz):1 (vert)                20  :1
FACTOR OF SAFETY                             1.5  (1.5 suggested /manual)
FLOW DEPTH                                  0.15  (ft)
FLOW VELOCITY                               8.32  (fp.s.)
SLOPE                                       0.33  (ft/ft)
FLOW AREA                                    1.2  (sq ft)
WETTED PERIMETER                           11.01  (ft)

T H E N :
COMPUTED SHEAR STRESS:  =                  2.244  (lbs per sq ft)
A N D : required  riprap  size  is:
D50:  (MINIMUM)                              8.1  (inches)

NOTE: COMPUTATIONS ARE BASED UPON THE FOLLOWING ASSUMPTIONS:

.velocity vector is horizontal (i.e. no downslope component)
.effective rock size = D65 = 1.25 X D50 (ref FHWA manual pg VIA-12)
.recommended values of riprap angle of repose are based on referenced
 FHWA manual Fig. 3.7.3 page III-29
```


A
A, Inflow = 5.3 cfs
DRAINAGE SWALE
3 FT. OF COVER
Contributing watershed to point B = 4.5 acres
B
B'
INNES AVENUE
2 FT. OF COVER
Additional contributing watershed to effluent flow = 0.5 acres
B, Flow along channel = 5.9 cfs
Effluent flow = 6.3 cfs
A'

Typical Swale Channel Cross Section





APPENDIX E
TIDAL DATUMS

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Tidal Datums	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

There are three primary tidal datums that are used for the site based on NOAA National Ocean Service data sheets from which both the land based topographic and ocean based bathymetric surveys were completed. Surveys completed for the Hunters Point Site 7 and 18 are based on the tidal elevation benchmark: HUNTER WEST 1 1941; PID# HT0613; Station ID 9414358 (lat: 37° 43.8' N and long: 122° 21.4' W). These elevations are based on the tidal epoch 1960 to 1978. The actual tidal data sheets are provided.

The tidal elevation data is summarized below with references to the Mean Lower Low Water (MLLW), National Geodetic Vertical Datum (NGVD), 1929, and the actual mean sea level at the site.

Tidal Datum	Reference Datum		
	MLLW	NGVD	MSL
Extreme	+9.7[a]	+6.58	+6.14
MHHW	+6.73	+3.61	+3.17
MHW	+6.10	+2.98	+2.54
MSL	+3.56	+0.44	0
NGVD	+3.12	0	-0.44
MLW	+1.12	-2.06	-2.44
MLLW	0	-3.12	-3.56

Notes:

a From "Candlestick Point/Hunters Point development Project – Initial Shoreline Assessment".

MHHW	Mean higher high Water	MLW	Mean low water
MHW	Mean high water	MSL	Mean sea level
MLLW	Mean lower low water	NGVD	National Geodetic Vertical Datum

The highest observed tide for the site as recorded at the above referenced station was 8.16 feet MLLW recorded on in December 1974. The extreme water level was obtained from long term monitoring in the bay area and corresponding projects and reflects a 100-year return interval (Moffatt & Nichol, 2009).

The Mean Sea Level (MSL) is specific for the site and was established during the survey of the property based on correspondence with NOAA.

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Tidal Datums	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

Conversion factors between references:

MLLW to NGVD:	-3.12 ft (interpretation: MLLW reported as -3.12 NGVD)
NGVD to MLLW:	+3.12 ft
MLLW to MSL:	-3.56 ft (interpretation: MLLW reported as -3.56 MSL)
MSL to MLLW:	+3.56 ft
NGVD to MSL:	-0.44 ft
MSL to NGVD:	+0.44 ft

Note: A second tidal datum summary is available from NOAA for tidal epoch 1983 to 2001; however, the data is incomplete. Tidal ranges and heights are about equal to the ranges available for the 1960 to 1978 epoch but there is no reference to either NGVD or NAVD.

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Tidal Datums	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

REFERENCES

Correspondence with Juan Lovato of Espinosa Surveying. 11/12/2008. Responsible party for the IR Site 7 and 18 topographic survey.

Moffatt & Nichol. 2009. "Candlestick Point/Hunters Point Development Project."

U.S. Department of Commerce, National Oceanic and Atmospheric Administration (NOAA), National Ocean Service. Tidal Datums for Station ID 9414358. Published 06/24/1983. **(Attached)**

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Ocean Service

PUBLICATION DATE: 06/24/1983

Station ID: 9414358
Name: HUNTERS POINT, SAN FRANCISCO BAY CALIFORNIA
NOAA Chart: 18649 **Latitude: 37° 43.8' N**
USGS Quad: HUNTERSPOINT **Longitude: 122° 21.4' W**

To reach the tidal bench marks from I-280 and U.S. Highway 101 interchange proceed 1.4 miles (2.2 km) south to Bayshore Blvd., Third Street exit, left onto Third Street, north 1.8 miles (2.9 km) to Evans Street, right turn on Evans Street, 0.7 mile (1.1 km) SE on Evans Street, one block south on Evans Street to Fairfax Street, right on Hunters Point Boulevard, 0.2 mile (0.3 km) after left turn on Innes Avenue and then 0.4 mile (0.6 km) to entrance to guard house with dry dock area at bottom of hill. The tide gage was located 50 feet (15.2 m) NW of NW corner of drydock No. 2 and the staff was located on an adjacent pier.

BENCH MARK STAMPING: HUNTER WEST 1 1941

MONUMENTATION: Survey Disk VM#: 8102
AGENCY: PID#: HT0613
SETTING CLASSIFICATION: Concrete Post

The bench mark is set in a concrete post at the head of drydock, No. 2, covered with a steel handhole and cover plate, 108 feet (32.9 m) south by east of center of capstan at head of drydock, 95 feet (29 m) west by north of fireplug on south side and near west end of drydock, 6 feet (1.8 m) west of inner rail of 50 ton crane, and 0.7 foot (0.2 m) below the pavement.

NOAA Chart: 18649 **Latitude: 37° 43.8' N**
USGS Quad: HUNTERSPOINT **Longitude: 122° 21.4' W**

T I D A L D A T U M S

Tidal datums at HUNTERS POINT, SAN FRANCISCO BAY based on:

LENGTH OF SERIES:	13 MONTHS
TIME PERIOD:	NOV 1974-FEB 1976
TIDAL EPOCH:	1960-1978
CONTROL TIDE STATION:	9414760 ALAMEDA, CA

Elevations of tidal datums referred to Mean Lower Low Water (MLLW), in FEET:

HIGHEST OBSERVED WATER LEVEL (12/27/1974)	=	8.16
MEAN HIGHER HIGH WATER (MHHW)	=	6.73
MEAN HIGH WATER (MHW)	=	6.10
MEAN TIDE LEVEL (MTL)	=	3.61
* NATIONAL GEODETIC VERTICAL DATUM-1929 (NGVD)	=	3.12
MEAN LOW WATER (MLW)	=	1.12
MEAN LOWER LOW WATER (MLLW)	=	0.00
LOWEST OBSERVED WATER LEVEL (12/01/1975)	=	-1.86

* NGVD reference based on adjustment of 1958 and NOS levels of1974-1976.
National Geodetic Vertical Datum (NGVD 29)

Bench Mark Elevation Information — In FEET above:

Stamping or Designation	MLLW	MHW
HUNTERS POINT BM 2 1917	11.88	5.78
HUNTERS POINT BM 3 1917	12.14	6.04
4 1941	15.33	9.23
5 1941	15.38	9.28
HUNTER WEST 1 1941	11.32	5.22
HUNTER EAST 1941	10.65	4.55

APPENDIX F
WIND PARAMETERS

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Wind Parameters	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

Wave height is largely dependent on the velocity of wind over the water, the duration of the sustained wind, and the wind fetch (the uninterrupted over-water distance where wind can affect the water surface). Data on wind can be summarized by a wind rose, which is a radial plot of sustained wind speed by cardinal direction.

Peak wind speeds often are stated in terms of "fastest-mile," which is the speed of a parcel of wind 1-mile long as it passes a gauge 10 meters above the ground. The sustained duration of the wind generally is 1 to 2 minutes. The figure below shows a fastest-mile wind rose for the former Naval Air Station (NAS) Alameda. Fastest-mile speeds for several cardinal points were also compiled for the San Francisco International Airport (SFO), which is near HPS and has very similar wind exposures. Using the SFO data and the geometry of the wind rose for NAS Alameda, a fastest-mile wind rose was predicted for HPS.

Analysis of fetch distances for HPS indicated that sustained winds of approximately 1-hour duration would be appropriate for wave analysis at the site. Therefore, fastest-mile wind speeds were used to predict "fastest-hour" wind speeds, the fastest average wind speed for a wind event that lasts one hour. The provided figure shows the predicted fastest-hour wind rose for the general area of HPS. The greatest wind speed potentially affecting wave size at the site (fastest hour) is anticipated to be from the northeast at about 40 miles per hour (mph).

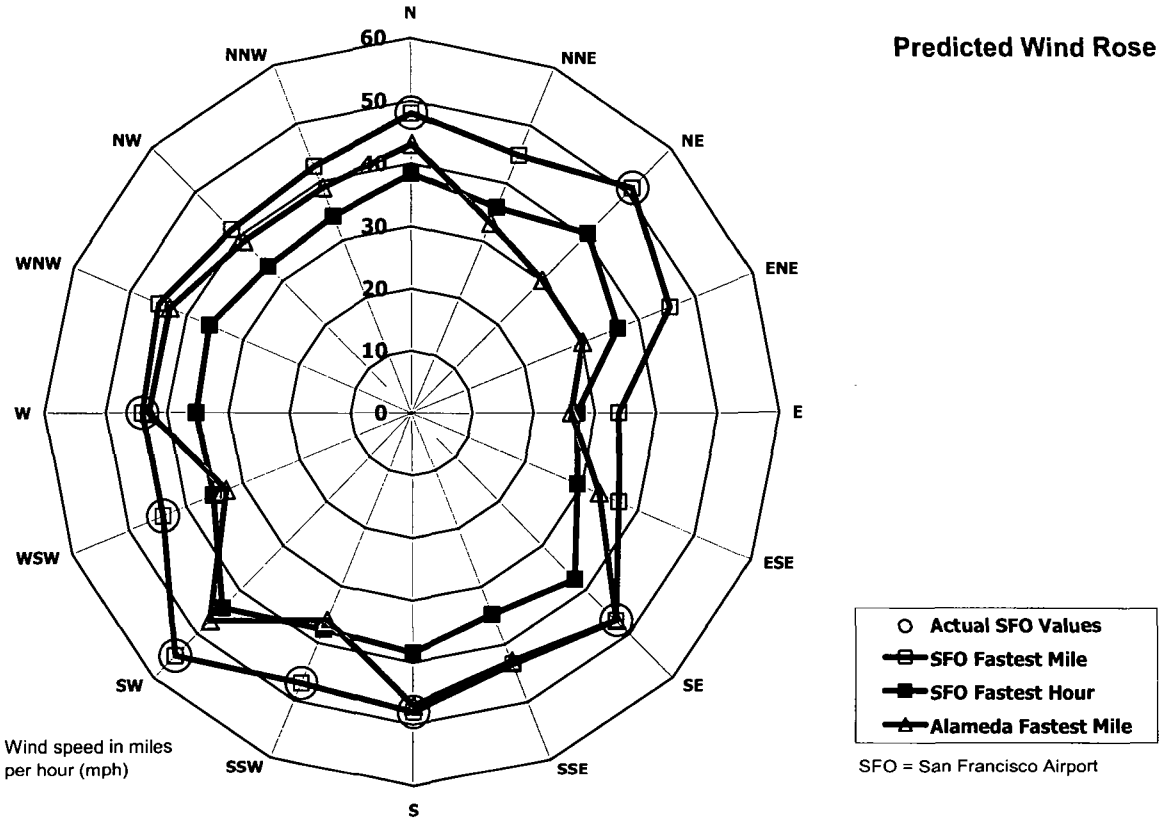
Assumptions

1. Wind speeds were obtained from land based meteorological stations at the SFO which is located approximately 8 miles south of Hunters Point. The airport receives unobstructed winds from the north and northeast which is similar to the wind exposure and wave generating winds applicable to IR Sites 7 and 18. Based on the similarities between the two locations no corrections of the wind speeds were necessary.
2. Winds at the SFO are overwater and unobstructed to the north and northeast direction, which is the same as IR Sites 7 and 18. Therefore, no corrections were made to account for differences in the velocity measured overland versus over-water.
3. Fastest hour winds assumed to be 80 percent of fastest-mile based on guidance from JCSS (2001).

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Wind Parameters	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

Predicted Wind Rose



SFO = San Francisco Airport

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Wind Parameters	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

Direction	Actual Fastest-mile Data, SFO			Actual Fastest-mile Alameda NAS		Predicted SFO Wind Rose		
	NOAA SRCC Data	Golden Gate Weather Service	Max	Wind Rose	Ratio to avg of adjacent directions	Fastest-mile	Fastest Hour	Ratio to avg of adjacent directions
	"Fastest-mile", mph			mph	%	mph	mph	%
N	48	38	48	43	119%	48.0	38.4	110%
NNE				33	90%	44.8	35.8	90%
NE		51	51	30	95%	51.0	→ 40.8	113%
ENE				30	107%	45.4	36.4	107%
E				26	83%	33.8	27.1	83%
ESE				33	90%	36.5	29.2	90%
SE		47	47	47	124%	47.0	37.6	118%
SSE				43	91%	43.5	34.8	91%
S	47	48	48	47	119%	48.0	38.4	106%
SSW	47		47	36	77%	47.0	37.6	91%
SW	55		55	47	136%	55.0	44.0	121%
WSW	44		44	33	73%	44.0	35.2	89%
W	44	40	44	43	113%	44.0	35.2	99%
WNW				43	105%	44.9	35.9	105%
NW				39	95%	41.6	33.3	95%
NNW				39	95%	42.6	34.1	95%

Note: Grey area indicates directions from which the wind is obstructed by land and does not generate waves that will affect the site

Wind data obtained from National Oceanographic and Atmospheric Administration (NOAA) Southern Region Climate Center (http://www.srcc.lsu.edu/index.php) and Golden Gate Weather Service (http://ggweather.com/) and corresponds with other completed studies (Moffatt and Nichol 2009).

REFERENCES

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APPENDIX G
AVAILABLE FETCH DISTANCES

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Available Fetch Distances	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

Fetch distance is the length of exposed surface water available to a coastal location over which an unobstructed wind can blow. Fetch distances are used in the calculation of waves that could affect a coastal location. The longest fetch distance for HPS IR Sites 7 and 18 is approximately 6.2 miles to the north-northeast of the site. The following table summarizes the fetch distances available at the HPS IR Sites 7 and 18.

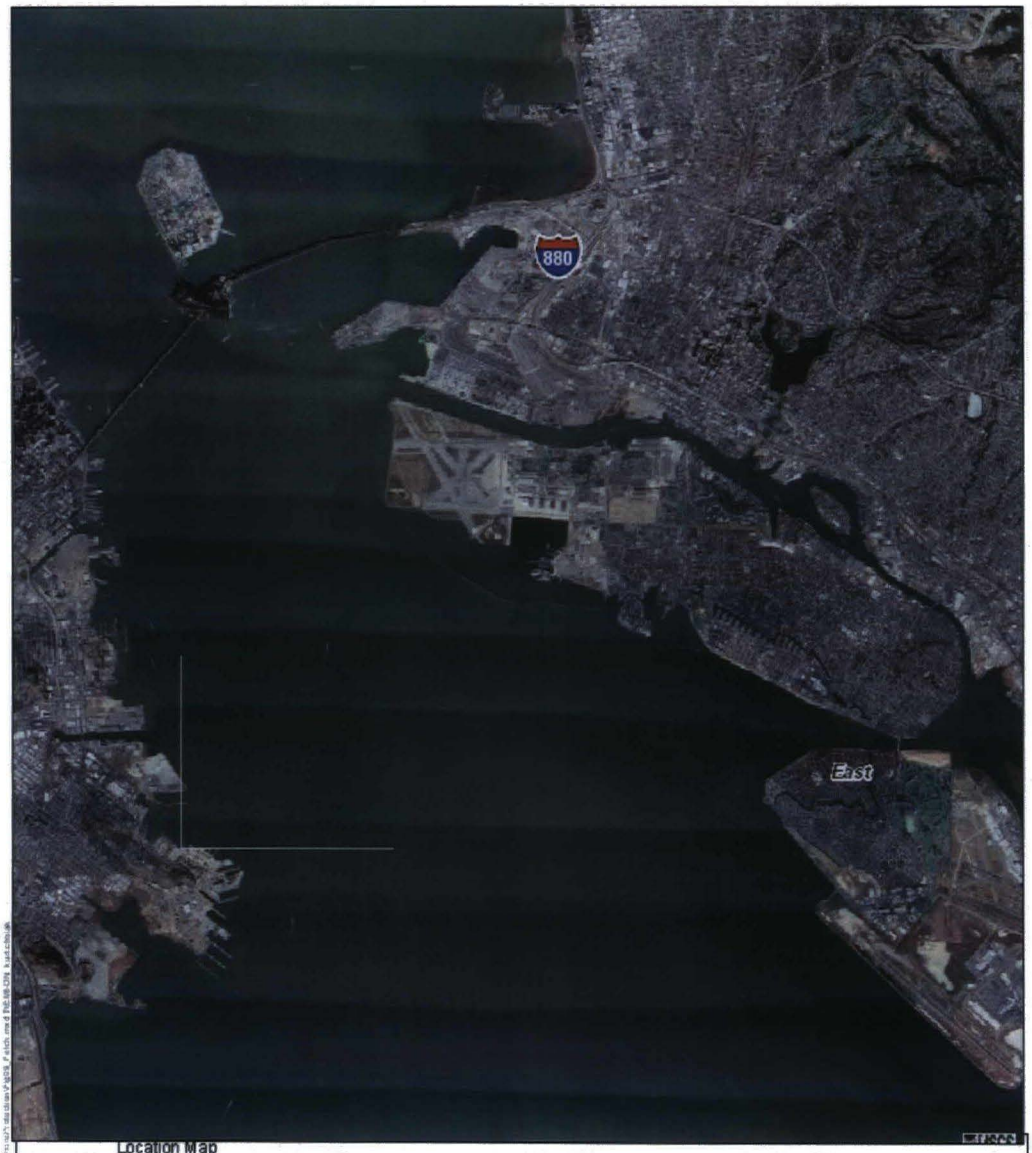
SUMMARY OF AVAILABLE FETCH DISTANCES

Direction	Degrees from North	Fetch Distance from Site (miles)
N	0°	5.2
N	6°	5.7
NNE	12°	→ 6.2
NNE	18°	5.4
NNE	24°	5.1
NNE	30°	4.1
NE	36°	4.3
NE	42°	4.4
NE	48°	4.7
NE	54°	4.9
ENE	60°	5.2
ENE	66°	5.9

Fetch distances producing waves are available to the site in cardinal directions from north to the east-northeast and are limited (effectively blocked) by land masses in the other cardinal directions. Additionally, the fetch is obstructed to the north by the Bay Bridge.

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Available Fetch Distances	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09



Location Map

N

1 0.5 0 1
Miles

ChaduxTt JV

Hunters Point Shipyard, San Francisco, California
Department of the Navy, BRAC PMO West, San Diego, California

Available Fetch

APPENDIX H
SIGNIFICANT WAVE HEIGHT

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Significant Wave Height	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

Wave height and wave period is governed primarily by the wind speed and fetch for a given cardinal direction. The calculation for open water waves and wave period is estimated based on the following relationships (Army Corps of Engineers 2006):

$$\frac{gH_{m_0}}{u_*^2} = 4.13 \times 10^{-2} * \left(\frac{gX}{u_*^2}\right)^{\frac{1}{2}}$$

and

$$\frac{gT_p}{u_*} = 0.751\left(\frac{gX}{u_*^2}\right)^{\frac{1}{3}}$$

$$C_D = \frac{u_*^2}{U_{10}^2}$$

$$C_D = 0.001(1.1 + 0.035U_{10})$$

Where:

X = straight line fetch distance over which wind blows (m)
H_{m0} = energy-based significant wave height (m)
C_D = drag coefficient
U_{10} = wind speed at 10 m elevation (m/sec)
U_* = friction velocity (m/sec)
g = gravitational acceleration (m/sec/sec)
T_p = wave period (sec)

Assumption

1. Waves generated from winds originating north of the Bay Bridge are obstructed by the bridge and reform south of the bridge (see Fetch Distance Calculation).

Using these relationships, wave periods and wave heights were generated as summarized in the following table.

ESTIMATED PEAK WAVE DISTRIBUTION BY DIRECTION

Cardinal Direction	Fetch (miles)	Fetch (km)	Fastest Hour Wind (mph)	Fastest Hour Wind (m/sec)	Drag Coefficient (dimensionless)	Friction Velocity (m/sec)	Period (sec)	Wave Height (m)	Wave Height (ft)
N	5.7	9.2	38.4	16.9	0.00169	0.695	3.0	0.88	2.9
NNE	6.2	10.0	35.8	15.8	0.00165	0.64	3.0	0.84	2.8
NE	4.9	7.9	40.8	18.0	0.00173	0.747	2.9	0.87	2.9
ENE	5.9	9.5	36.4	16.0	0.00166	0.653	3.0	0.84	2.8

Notes:

ft	Feet
km	Kilometer
m	Meter
m/sec	Meters per second
mph	Miles per hours
sec	Seconds

The table shows the highest wave anticipated for the site is 2.9 feet with a wave period of 2.9, originating from northeast of the site. **For simplicity in calculations, a height of 3.0 feet will be used as the significant wave height**.

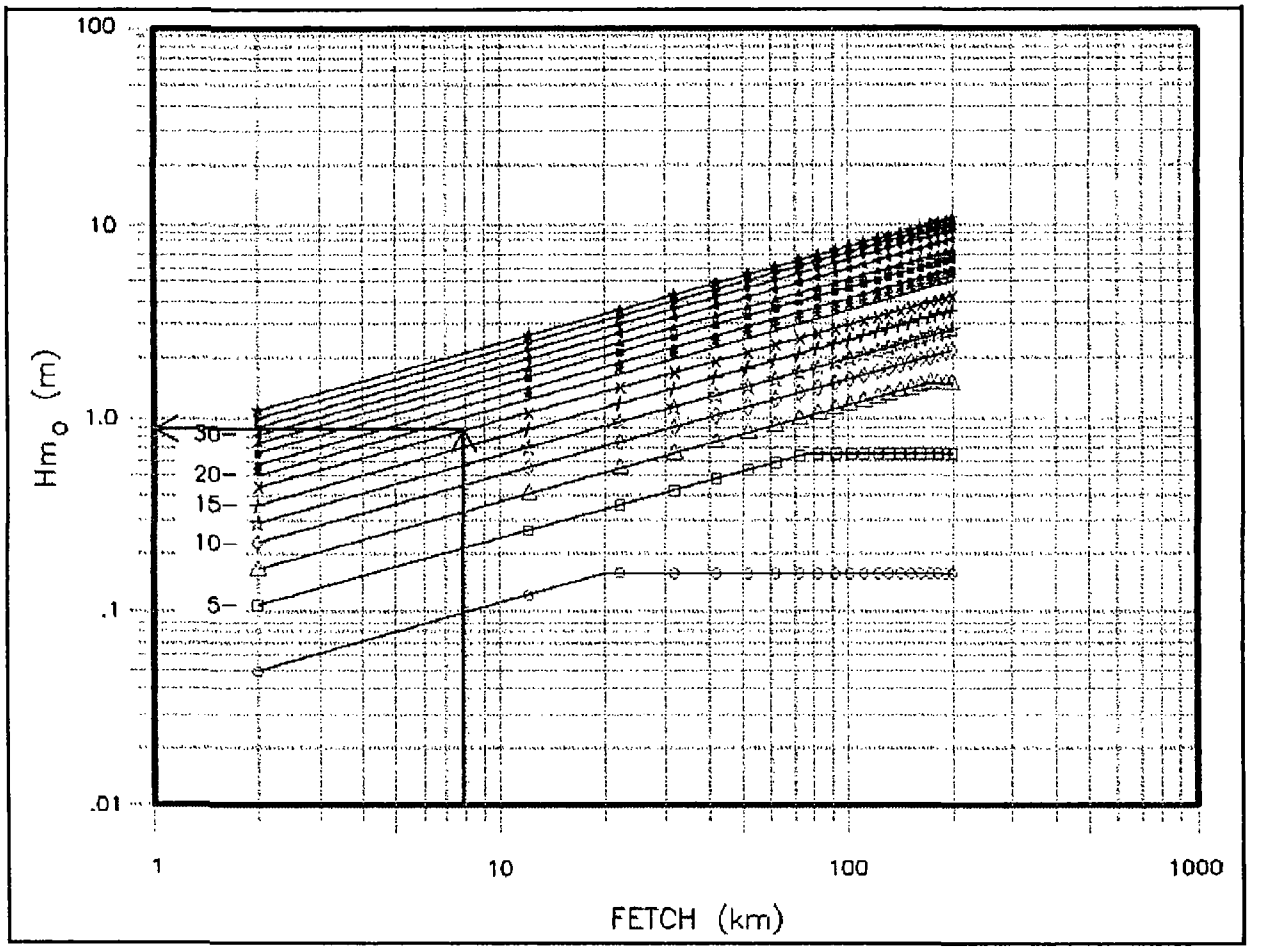
It should be noted that these equations yield an anticipated open water wave height which can be used as a conservative estimate for the significant wave height in revetment designs. Actual waves anticipated to reach the shoreline of the site would be smaller than this height due to off-shore breaking and energy dissipation as waves approach the site.

The following nomograms can also be used to estimate wave heights under fetch-limited and duration-limited conditions.

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Significant Wave Height	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

WAVE HEIGHT ESTIMATION NOMOGRAM



Note:

Reference: Army Corps of Engineers 2006

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Significant Wave Height	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

REFERENCE

U.S. Army Corps of Engineers. 2006. "Coastal Engineering Manual".

APPENDIX I
WAVE CRASH DEPTH

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Wave Crash Depth	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

According to the Army Corps of Engineers Coastal Engineering Manual (2006) for depth limited situations, a wave will crash when:

$$0.78 = \frac{h}{d}$$

Where:
h = wave height
d = water depth

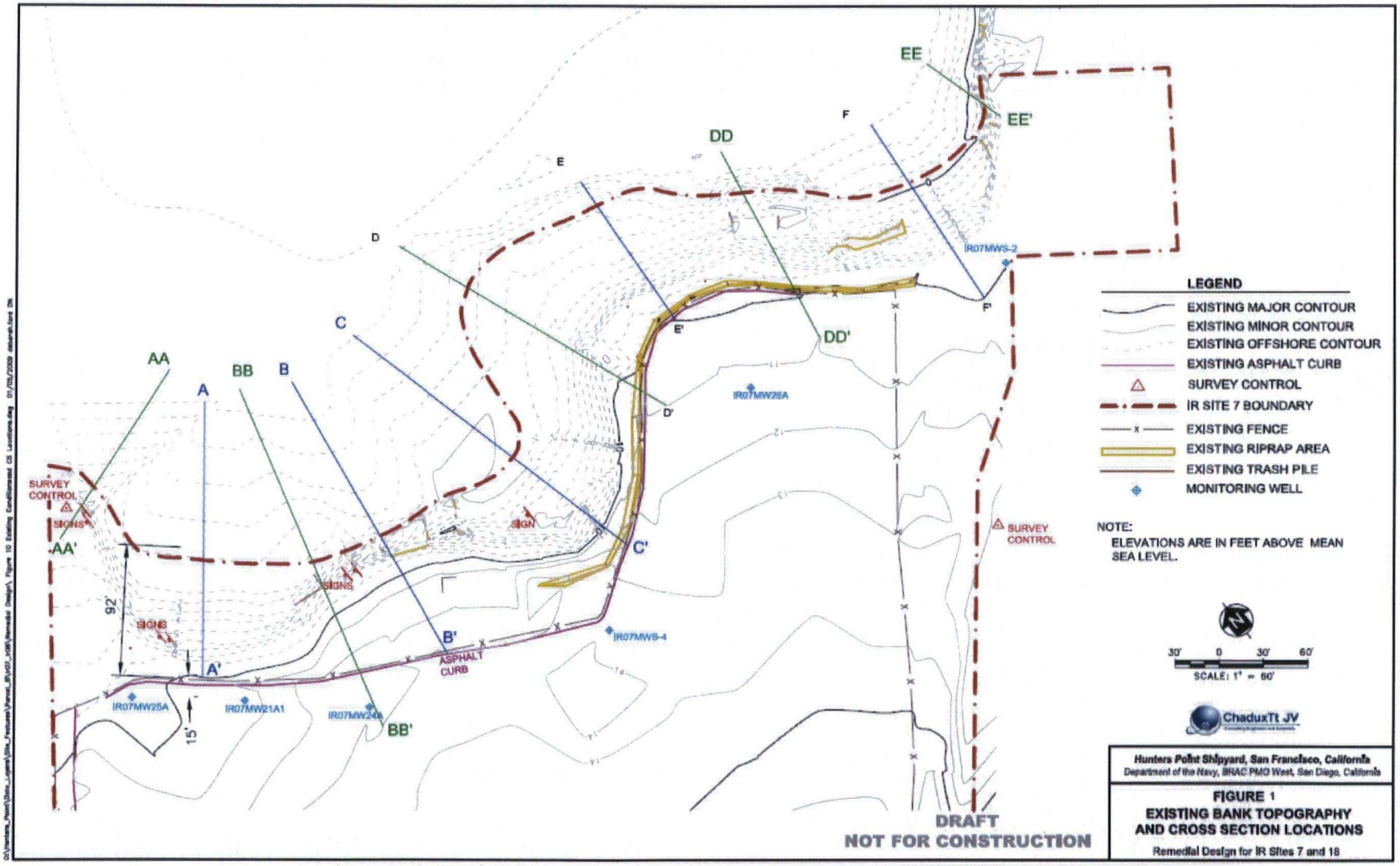
Using this relationship, a 3.0 foot wave will crash when water depth is 3.8 feet. At mean higher high water (MHHW) this will occur as a wave passes over the approximate -1 feet mean sea level (msl) contour which approximates the property boundary, or 20 to 50 feet from the MHHW elevation along the shore as shown in the figure below. At mean lower low water (MLLW), the same wave would crash more than 100 ft from the property line at approximately the -7.0 foot contour line (this line occurs beyond the limit of the figure below).

The revetment will not be exposed to the open water wave. The open water wave will crash off-shore and its energy will dissipate before reaching the shoreline and the revetment. Therefore, use of the open water wave for the design of the revetment for IR Sites 7 and 18 is considered conservative.

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Wave Crash Depth	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

REFERENCE

U.S. Army Corps of Engineers. 2006. "Coastal Engineering Manual".


EE
EE'
DD
DD'
F
F'
E
E'
D
D'
C
C'
B
B'
BB
BB'
A
A'
AA
AA'
IR07MWS-2
IR07MW26A
IR07MWS-4
IR07MW25A
IR07MW21A1
IR07MW24A
SURVEY CONTROL
SIGNS
SIGN
ASPHALT CURB
92'
15'
LEGEND
EXISTING MAJOR CONTOUR
EXISTING MINOR CONTOUR
EXISTING OFFSHORE CONTOUR
EXISTING ASPHALT CURB
SURVEY CONTROL
IR SITE 7 BOUNDARY
EXISTING FENCE
EXISTING RIPRAP AREA
EXISTING TRASH PILE
MONITORING WELL
NOTE:
ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.
30' 0 30' 60'
SCALE: 1" = 60'
ChaduxTt JV
Hunters Point Shipyard, San Francisco, California
Department of the Navy, BRAC PMO West, San Diego, California
FIGURE 1
EXISTING BANK TOPOGRAPHY AND CROSS SECTION LOCATIONS
Remedial Design for IR Sites 7 and 18
DRAFT
NOT FOR CONSTRUCTION

APPENDIX J
REVETMENT EXCAVATION VOLUMES

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Revetment Excavation Volumes	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

The following approach was used for the calculation of the shoreline excavation and fill volumes.

The cross sectional areas of the excavation and fill were calculated in CAD based on the existing shoreline topography and the geometry of the revetment. Those cross sectional areas were then multiplied by the length of shoreline appropriate for that cross section to produce the approximate volumes. Refer to the attached shoreline and cross section figures used in the calculations.

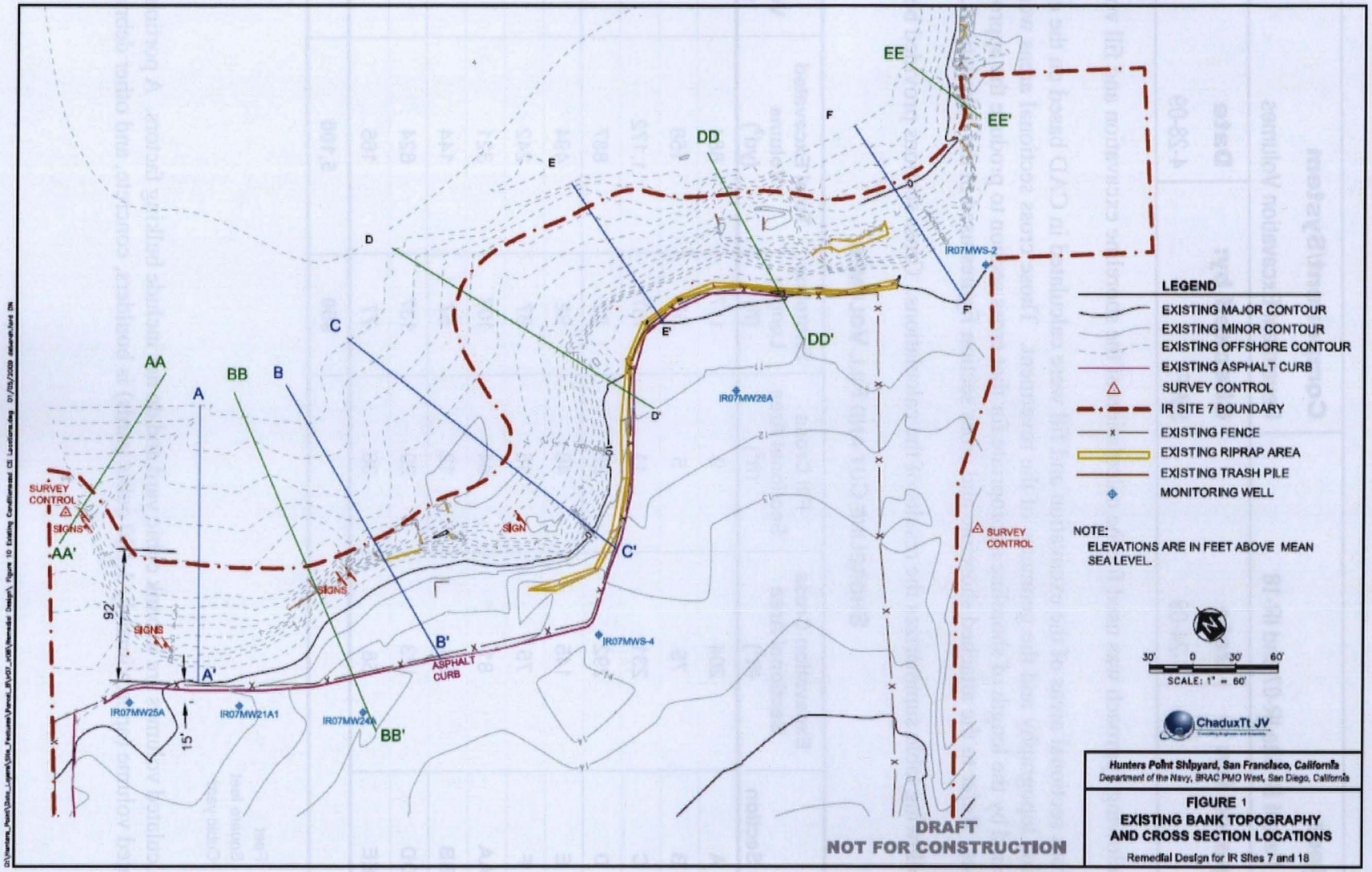
The following table summarizes the results of the calculations. Cross sections provided below.

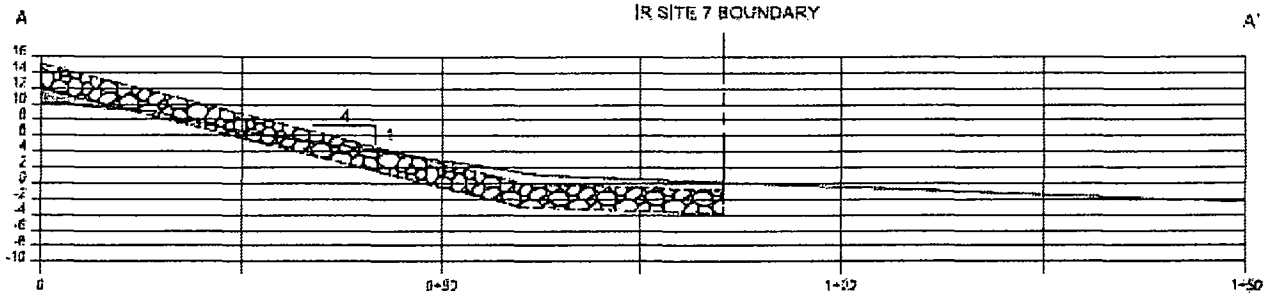
SHORELINE CUT AND FILL VOLUMES

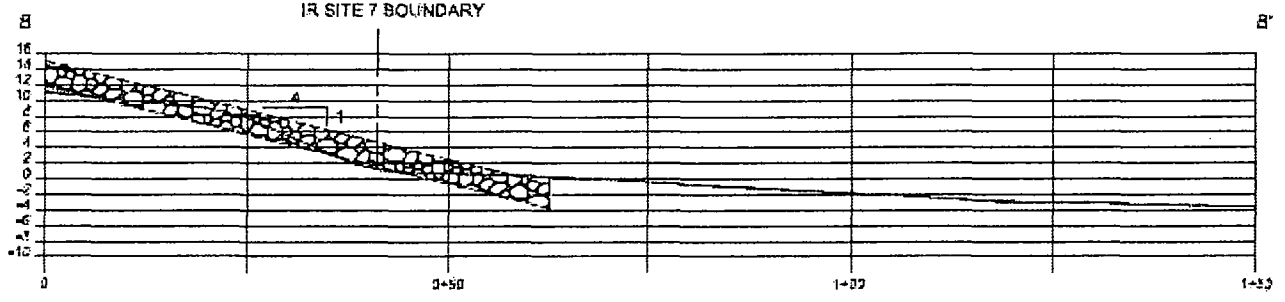
Cross Section	Excavation Cross Sectional Area (ft^2)	Fill Cross Sectional Area (ft^2)	Shoreline Length (ft)	Total Excavated Volume (yd^3)	Fill Volume (yd^3)
A	204	9	117	884	39
B	75	5	57	158	11
C	231	11	137	1,172	56
D	292	25	82	887	76
E	145	40	92	494	136
F	75	15	87	242	48
AA	81	84	107	321	333
BB	68	12	57	144	25
DD	123	29	137	624	147
EE	58	36	77	165	103
			950	**5,100**	**970**

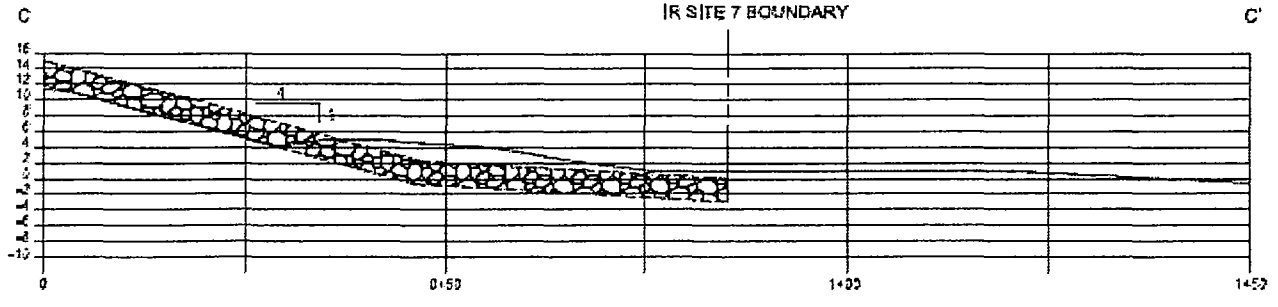
Notes:
ft Feet
ft^2 Square feet
yd^3 Cubic yard

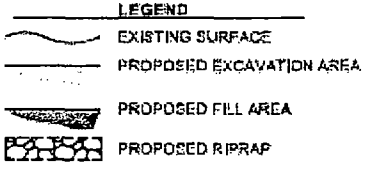
The calculated volumes are in bank cubic yard and do not include bulking factors. A portion of the excavated volume (approximately 1,100 cubic yards) is boulders, concrete, and other debris.

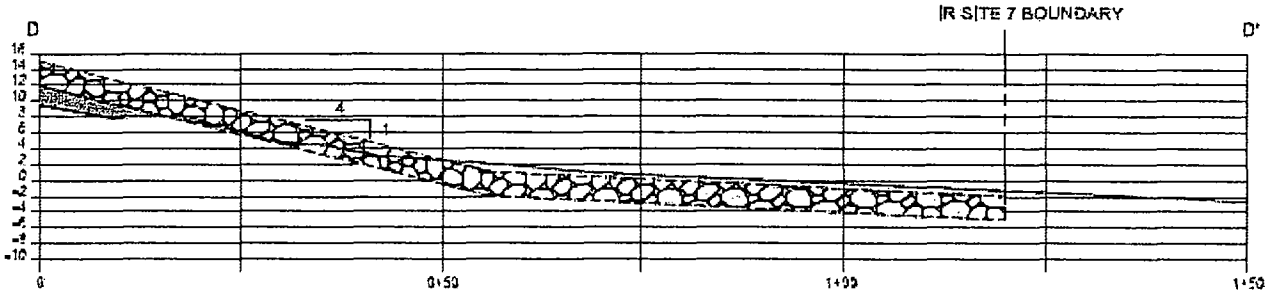

AA
AA'
A
A'
BB
BB'
B
B'
C
C'
D
D'
DD
DD'
E
E'
EE
EE'
F
F'
SURVEY CONTROL
SIGNS
SIGN
92'
15'
IR07MW25A
IR07MW21A1
IR07MW24A
IR07MW26A
IR07MWS-4
IR07MWS-2
ASPHALT CURB
LEGEND
EXISTING MAJOR CONTOUR
EXISTING MINOR CONTOUR
EXISTING OFFSHORE CONTOUR
EXISTING ASPHALT CURB
SURVEY CONTROL
IR SITE 7 BOUNDARY
EXISTING FENCE
EXISTING RIPRAP AREA
EXISTING TRASH PILE
MONITORING WELL
NOTE:
ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.
30' 0 30' 60'
SCALE: 1" = 60'
ChaduxTt JV
DRAFT
NOT FOR CONSTRUCTION
Hunters Point Shipyard, San Francisco, California
Department of the Navy, BRAC PMO West, San Diego, California
FIGURE 1
EXISTING BANK TOPOGRAPHY AND CROSS SECTION LOCATIONS
Remedial Design for IR Sites 7 and 18

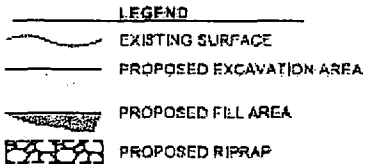

A
IR SITE 7 BOUNDARY
A'
4
1
0
0+50
1+00
1+50

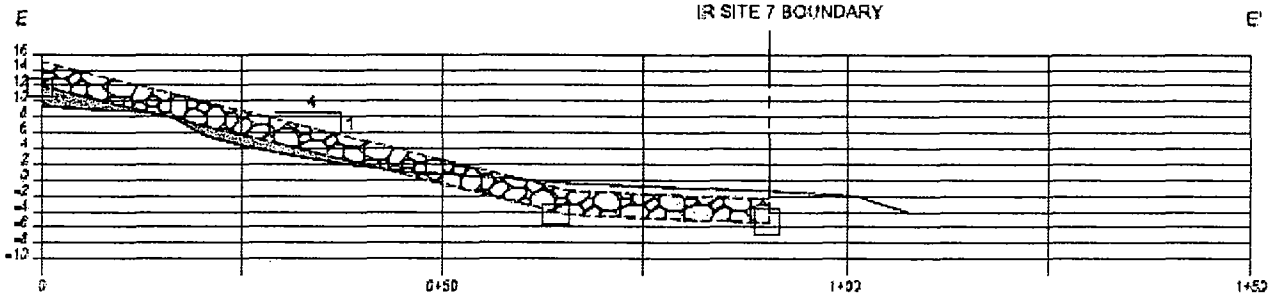

B
IR SITE 7 BOUNDARY
B'
4
1
0
0+50
1+00
1+50

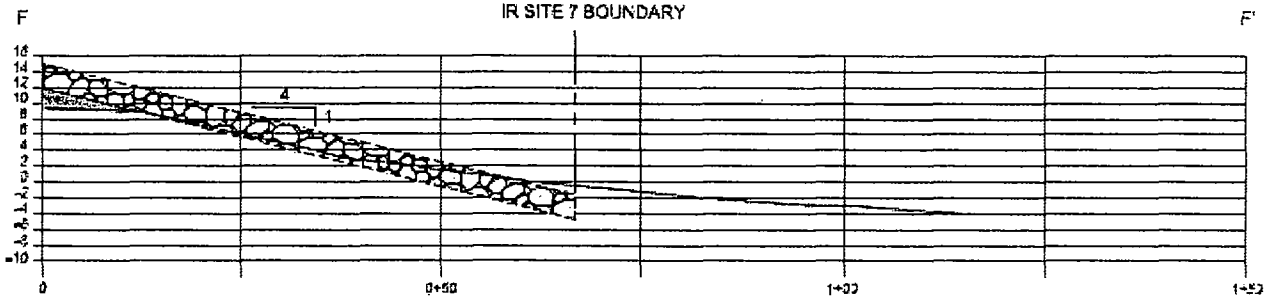

C
IR SITE 7 BOUNDARY
C'
4
1
0
0+50
1+00
1+50

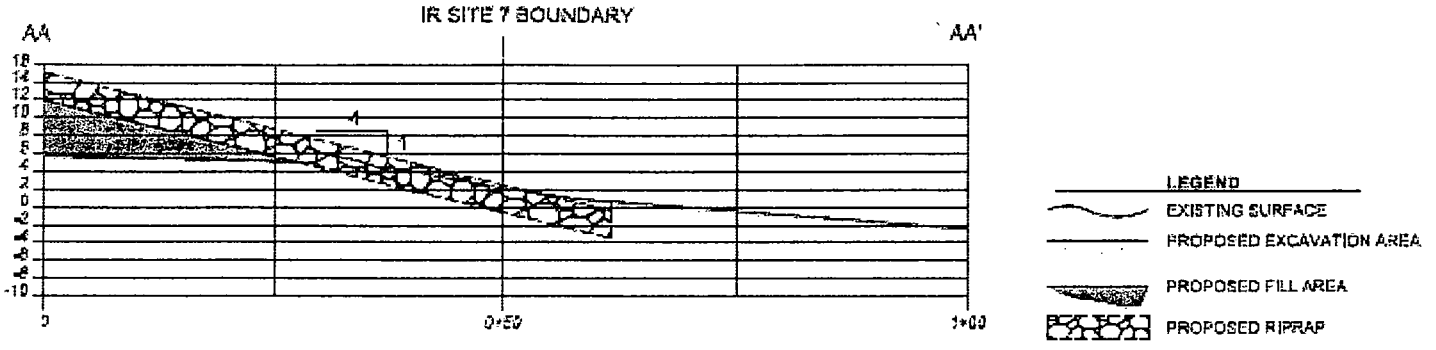

LEGEND
EXISTING SURFACE
PROPOSED EXCAVATION AREA
PROPOSED FILL AREA
PROPOSED RIPRAP

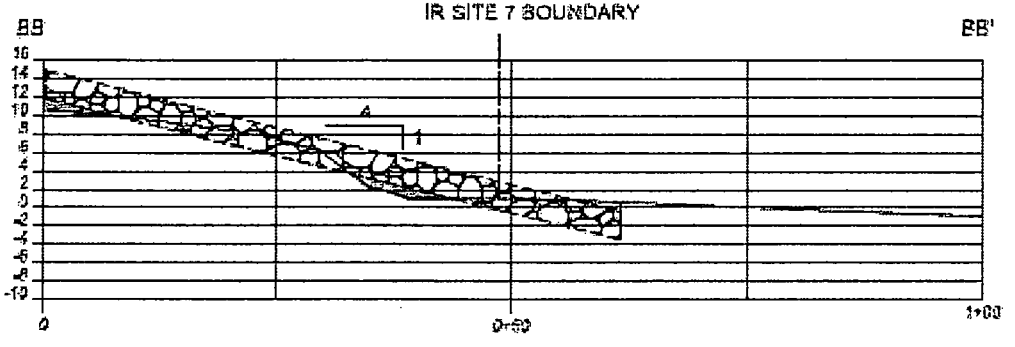

D
D'
IR SITE 7 BOUNDARY
4
1
0
0+50
1+00
1+50

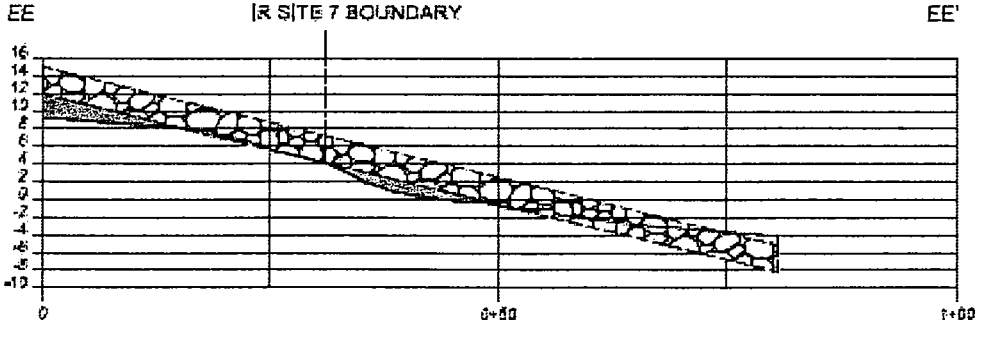

LEGEND
EXISTING SURFACE
PROPOSED EXCAVATION AREA
PROPOSED FILL AREA
PROPOSED RIPRAP

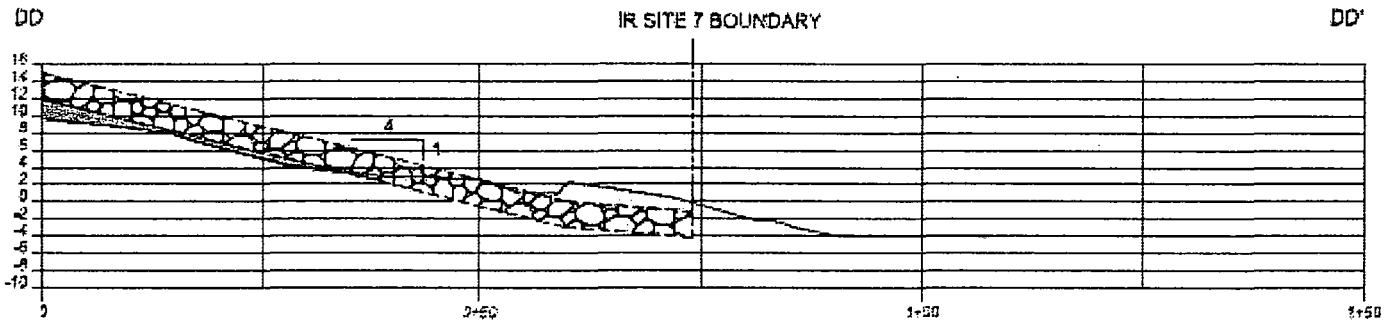

E
E'
IR SITE 7 BOUNDARY
4
1
0
0+50
1+00
1+50


F
F'
IR SITE 7 BOUNDARY
4
1
0
0+50
1+00
1+50


IR SITE 7 BOUNDARY
AA
AA'
LEGEND
EXISTING SURFACE
PROPOSED EXCAVATION AREA
PROPOSED FILL AREA
PROPOSED RIPRAP


IR SITE 7 BOUNDARY
BB
BB'


IR SITE 7 BOUNDARY
EE
EE'


DD
IR SITE 7 BOUNDARY
DD'
4
1
0
0+50
1+50
2+50

APPENDIX K
REVETMENT ARMOR UNIT SIZING

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Revetment Armor Unit Sizing	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

Sizing of the revetment armor stone is based on the geometry of the revetment, anticipated wave energy, material used, and the intended use of the area. In situations where there is a high degree of public access a stone size of at least 400 to 500 pounds (lbs) is recommend by the U.S. Army Corps of Engineers, Coastal Engineering Research Center (USACE 1985). Additionally, experience at other similar project sites has shown that 500 lbs is more appropriate than 400 lbs. This consideration is relevant for HPS Sites 7 and 18 revetment design given the intended future use of the area as a public park. When public access is not a consideration the Hudson formula, below, is used alone. Using these two criteria for armor unit sizing the method that yields the largest and most conservative stone size was used for the design.

The Hudson Formula for the determination of revetment armor sizing using the largest projected anticipated open water wave.

From: USACE Design of Coastal Seawalls, and Bulkheads, Revetments

$$W = \frac{\gamma_r H^3}{K_D \left(\frac{\gamma_r}{\gamma_w} - 1 \right)^3 \cot\theta}$$

Where:

W = required individual armor unit weight, lb (or W_{50} for graded riprap)
γ_r = specific weight of the armor unit, lb/ft^3 = 165 lb/feet^3
H = wave height ft = 3 feet
K_D = stability coefficient = 2.2 for randomly placed riprap at slopes from 2.0 to 6.0. (see table below)
$\cot\theta$ = slope = 1 vertical to 4 horizontal
γ_w = specific weight of saltwater = 64 lbs/feet

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Revetment Armor Unit Sizing	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

Assumptions

1. The slope of the revetment is 1 horizontal to 4 vertical (1V:4H). This is based on the existing shoreline grade and the need for the revetment to extend to at least the site boundary with Parcel F off-shore.
2. A stability coefficient of 2.2 is used for randomly placed riprap at a slope of 1V:4H (refer to included figure).
3. The open water wave of 3 feet has been used. This is a conservative estimate of the wave energy the revetment will be exposed to, given the bathymetry of the near-shore area.
4. The specific weights of the armor unit material and water are generally accepted values and are not site specific.

$$W = \frac{165 * 3^3}{2.2\left(\frac{165}{64} - 1\right)^3 4}$$

$$W = W_{50} = 128.8\,lb$$

A stone of about 130 lbs will have a volume of 0.79 cf and have an approximate nominal diameter of 0.93 feet ($0.79^{0.33}$).

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Revetment Armor Unit Sizing	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

Table 2-3
Suggested Values for Use in Determining Armor Weight (Breaking Wave Conditions)

Armor Unit	n[1]	Placement	Slope (cot θ)	K_D
Quarrystone				
Smooth rounded	2	Random	1.5 to 3.0	1.2
Smooth rounded	>3	Random	1.5 to 3.0	1.6
Rough angular	1	Random	1.5 to 3.0	Do Not Use
Rough angular	2	Random	1.5 to 3.0	2.0
Rough angular	>3	Random	1.5 to 3.0	2.2
Rough angular	2	Special[2]	1.5 to 3.0	7.0 to 20.0
Graded riprap[3]	2[4]	Random	2.0 to 6.0	2.2
Concrete Armor Units				
Tetrapod	2	Random	1.5 to 3.0	7.0
Tripod	2	Random	1.5 to 3.0	9.0
Tripod	1	Uniform	1.5 to 3.0	12.0
Dolos	2	Random	2.0 to 3.0[5]	15.0[6]

[1] n equals the number of equivalent spherical diameters corresponding to the median stone weight that would fit within the layer thickness.

[2] Special placement with long axes of stone placed perpendicular to the slope face. Model tests are described in Markle and Davidson (1979).

[3] Graded riprap is not recommended where wave heights exceed 5 ft.

[4] By definition, graded riprap thickness is two times the diameter of the minimum W_{50} size.

[5] Stability of dolosse on slope steeper than 1 on 2 should be verified by model tests.

[6] No damage design (3 to 5 percent of units move). If no rocking of armor (less than 2 percent) is desired, reduce K_D by approximately 50 percent.

The Hudson formula yields a median stone weight considerably less than the 500-pound stone weight recommend by the USACE. Therefore, a stone weight of 500 lbs was selected as the median stone weight for the design of the revetment.

A riprap revetment with a median stone weight of 500 lbs would yield a design wave of about 4.7 feet when using the same formula and solving for *H*. This wave height is greater than any of the projected heights for the site and would be significantly greater than both open water waves and the waves anticipated to actually reach the shore. A gradation table has been provided with this calculation to show an appropriate gradation of this size rock based on the California Department of Transportation specifications.

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Revetment Armor Unit Sizing	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

REFERENCES

State of California Department of Transportation Engineering Service Center. 2000. California Bank and Shore Rock Slope Protection Design.

U.S. Army Corps of Engineers. 1985. "Coastal Engineering Technical Note – Riprap Revetment Design." CETN-III-1.

U.S. Army Corps of Engineers. 1995. "Design of Coastal Revetments, Seawalls, and Bulkheads".

U.S. Army Corps of Engineers. 2006. "Coastal Engineering Manual".

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Revetment Armor Unit Sizing	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

GRADING OF ROCK SLOPE PROTECTION PERCENTAGE LARGER THAN

STANDARD Rock SIZE or Rock MASS or Rock WEIGHT		RSP-Classes [A]											
		Method A Placement					Method B Placement						
		RSP-Classes other than Backing									Backing No.		
US unit		8 ton	4 ton	2 ton	1 ton	1/2 ton	1 ton	1/2 ton	1/4 ton	Light	1 [B]	2	3
	SI unit	8 T	4 T	2 T	1 T	1/2 T	1 T	1/2 T	1/4 T	Light	1 [B]	2	3
16 ton	14.5 tonne	0-5											
8 ton	7.25 tonne	50-100	0-5										
4 ton	3.6 tonne	95-100	50-100	0-5									
2 ton	1.8 tonne		95-100	50-100	0-5		0-5						
1 ton	900 kg			95-100	50-100	0-5	50-100	0-5					
1/2 ton	450 kg				95-100	50-100	----	50-100	0-5				
1/4 ton	220 kg					95-100	95-100	----	50-100	0-5			
200 lb	90 kg							95-100	----	50-100	0-5		
75 lb	34 kg								95-100	-----	50-100	0-5	
25 lb	11 kg									95-100	90-100	25-75	0-5
5 lb	2.2 kg											90-100	25-75
1 lb	0.4 kg												90-100

[A] US customary names (units) of RSP-Classes listed above SI names, example US is "2 ton" metric is "2 T".
[B] "Facing" has same gradation as "Backing No. 1". To conserve space "Facing" is not shown .

APPENDIX L
ARMOR LAYER THICKNESS

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Armor Layer Thickness	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

The layer thickness of graded riprap must be at least twice the nominal diameter of the W_{50} stone defined as the cube root of the stone volume. Additionally, it should be at least 25 percent greater than the nominal diameter of the W_{100} stone and it should always be greater than 1 foot. The following equation summarizes the relationship.

Ahrens 1975 Formula – from: USACE Design of Coastal Revetments Seawalls, and Bulkheads.

$$r_{\min} = \max\left[2.0\left(\frac{W_{50}}{\gamma_r}\right)^{1/3};1.25\left(\frac{W_{100}}{\gamma_r}\right)^{1/3};1ft\right]$$

Where:

W = riprap unit weight, lb (W_{50} or W_{100})

γ_r = specific weight of the armor unit, lb/ft^3 = 165 lb/ft^3

$r_{\min}$ = minimum layer thickness perpendicular to the slope

Assumptions

1. 500 lb W_{50} median rock weight (see calculation for Revetment Armor Unit Sizing)
2. 1,000 lb W_{100} rock weight based on California Department of Transportation specifications (see below)
3. Specific weights of the armor unit materials are generally accepted values and are not site specific.

$$r_{\min} = \max\left[2.0\left(\frac{500}{165}\right)^{1/3};1.25\left(\frac{1000}{165}\right)^{1/3};1\,\text{ft}\right]$$

$$r_{\min} = \max\left[2.89\,\text{ft};2.27\,\text{ft};1\,\text{ft}\right]$$

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Armor Layer Thickness	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

The minimum layer thickness is obtained by using the W_{50} rock which yields a thickness of 2.89 feet. For simplification, a thickness of 3.0 feet will be used in the design.

GRADATION 1/4 TON RIP RAP

STANDARD Rock SIZE or Rock MASS or Rock WEIGHT		GRADING OF ROCK SLOPE PROTECTION PERCENTAGE LARGER THAN											
		RSP-Classes [A]											
		Method A Placement					Method B Placement						
		RSP-Classes other than Backing									Backing No.		
US unit		8 ton	4 ton	2 ton	1 ton	1/2 ton	1 ton	1/2 ton	1/4 ton	Light	1 [B]	2	3
	SI unit	8 T	4 T	2 T	1 T	1/2 T	1 T	1/2 T	1/4 T	Light	1 [B]	2	3
16 ton	14.5 tonne	0-5											
8 ton	7.25 tonne	50-100	0-5										
4 ton	3.6 tonne	95-100	50-100	0-5									
2 ton	1.8 tonne		95-100	50-100	0-5		0-5						
1 ton	900 kg			95-100	50-100	0-5	50-100	0-5					
1/2 ton	450 kg				95-100	50-100	----	50-100	0-5				
1/4 ton	220 kg					95-100	95-100	----	50-100	0-5			
200 lb	90 kg							95-100	----	50-100	0-5		
75 lb	34 kg								95-100	----	50-100	0-5	
25 lb	11 kg									95-100	90-100	25-75	0-5
5 lb	2.2 kg											90-100	25-75
1 lb	0.4 kg												90-100

[A] US customary names (units) of RSP-Classes listed above SI names, example US is "2 ton" metric is "2 T".
[B] "Facing" has same gradation as "Backing No. 1". To conserve space "Facing" is not shown .

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Armor Layer Thickness	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

REFERENCES

Linsley, Ray K., and Franzini, Joseph B. 1979. "Water-Resources Engineering." McGraw-Hill Book Company.

State of California Department of Transportation Engineering Service Center. 2000. California Bank and Shore Rock Slope Protection Design.

U.S. Army Corps of Engineers. 1995. "Design of Coastal Revetments, Seawalls, and Bulkheads.

APPENDIX M
MAXIMUM WAVE RUNUP

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Maximum Wave Runup	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

The wave runup on a structure is derived using the Ahrens and Heimbaugh Formula for maximum run-up from irregular waves.

$$\frac{R_{\max}}{H_{mo}} = \frac{a\xi}{1+b\xi}$$

From: USACE Design of Coastal Revetments, Seawalls, and Bulkheads

Where:

R_{max} = maximum vertical height in feet of the runup of wave on riprap
H_{mo} = wave height in feet at zeroth moment of the wave spectrum
a, b = regression coefficients determined as 1.022 and 0.247, respectively (constant)
ξ = surf parameter defined as:

$$\frac{\tan\theta}{\left(\frac{2\pi H_{mo}}{gT_p^2}\right)^{1/2}}$$

Where:

θ = the angle of the revetment slope with the horizontal (see attached figure)
T_p = wave period in seconds of peak energy density of the wave spectrum

And

$$\frac{H_s}{H_{mo}} = \exp\left[C_0\left(\frac{d}{gT_p^2}\right)^{-C_1}\right]$$

Where:

H_s = design wave height
C_0, C_1 = regression coefficients given as 0.00089 and 0.834 respectively
g = gravitational acceleration = 32.2 ft/sec
d = water depth on structure = 10 ft max

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Maximum Wave Runup	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

Assumptions

1. Design wave H_s height of 3 feet
2. Max water depth at toe of 10 feet. The average depth of the water over the revetment toe at MHHW + 5 feet for conservation or +2 feet over the highest anticipated tide of approximately 6 ft above msl.
3. Revetment slope of 1V:4H
4. Wave period of 3 seconds as previously calculated (see calculation for Significant Wave Height)

To calculate H_{mo}

$$\frac{3.0}{H_{mo}} = \exp\left[0.00089\left(\frac{10}{32.2*3.0^2}\right)^{-0.834}\right]$$

$$H_{mo} = 2.92 \text{ ft}$$

Calculation of the surf parameter ξ

$$\frac{\tan\theta}{\left(\frac{2\pi H_{mo}}{gT_p^2}\right)^{1/2}} \qquad \frac{\tan(14.03)}{\left(\frac{2\pi 2.92}{32.2*3.0^2}\right)^{1/2}} \qquad = 0.99$$

Calculation of maximum runup

$$\frac{R_{max}}{H_{mo}} = \frac{a\xi}{1+b\xi} \quad = \quad \frac{R_{max}}{2.92} = \frac{1.022*0.99}{1+0.247*0.99} = \textbf{Rmax = 2.37 ft}$$

For simplicity an R_{max} of 2.5 has been used in the design.

TETRA TECH

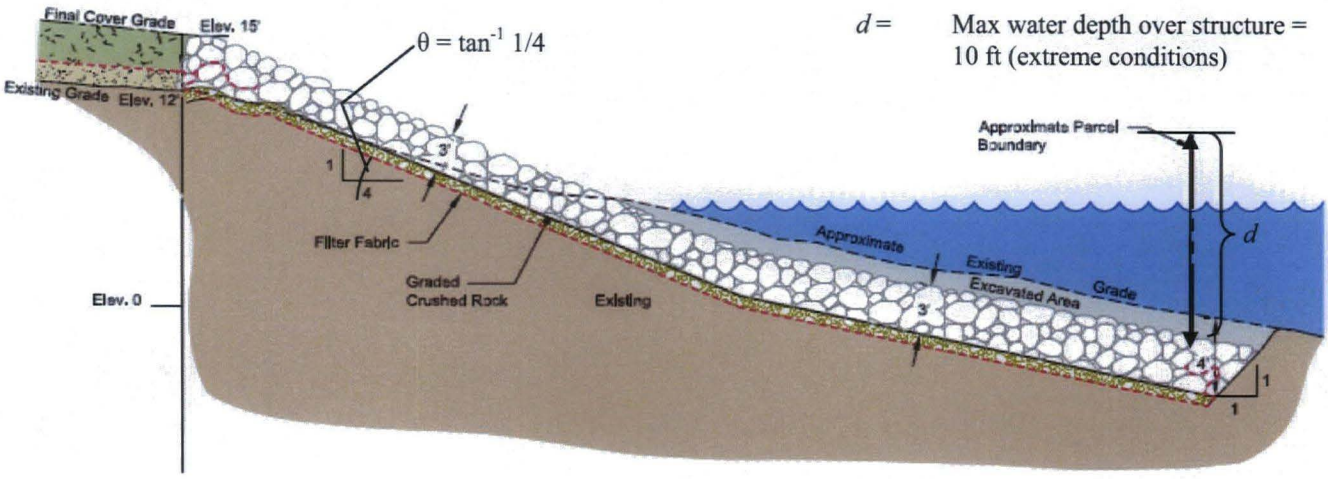
Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Maximum Wave Runup	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

REFERENCE

U.S. Army Corps of Engineers. 1995. "Design of Coastal Revetments, Seawalls, and Bulkheads.

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Maximum Wave Runup	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09



d = Max water depth over structure = 10 ft (extreme conditions)

APPENDIX N
TOE UNIT SIZING

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Toe Unit Sizing	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

Hudson Formula for Revetment Toe (submerged) (USACE 1995):

$$W_{\min} = \frac{\gamma_r H^3}{N_S^3 \left(\frac{\gamma_r}{\gamma_w} - 1 \right)^3}$$

Where:

W_{min} = minimum required individual armor unit weight, lbs
γ_r = specific weight of the armor unit, lbs/ft^3 = 165 lb/ft^3
H = wave height = 3 ft
N_s^3 = design stability number for rubble toe protection = 35 (USACE 1995)
γ_w = specific weight of saltwater = 64 lbs/ft^3

Assumptions

1. The open water wave of 3 ft has been used. This is a conservative estimate of the wave energy the revetment will be exposed to, given the bathymetry of the near-shore area.
2. Lower water conditions will yield a higher more conservative estimate than higher water conditions. The revetment will be above the water level when the tide is at or below the mean sea level elevation.
3. Specific weights of the armor unit materials and water are generally accepted values and are not site specific.
4. The stability number of 35 is used based on the average depth of 1 foot to the top of the toe of the revetment and 4 feet to the base of toe. (See figure below for determination of the stability number.)

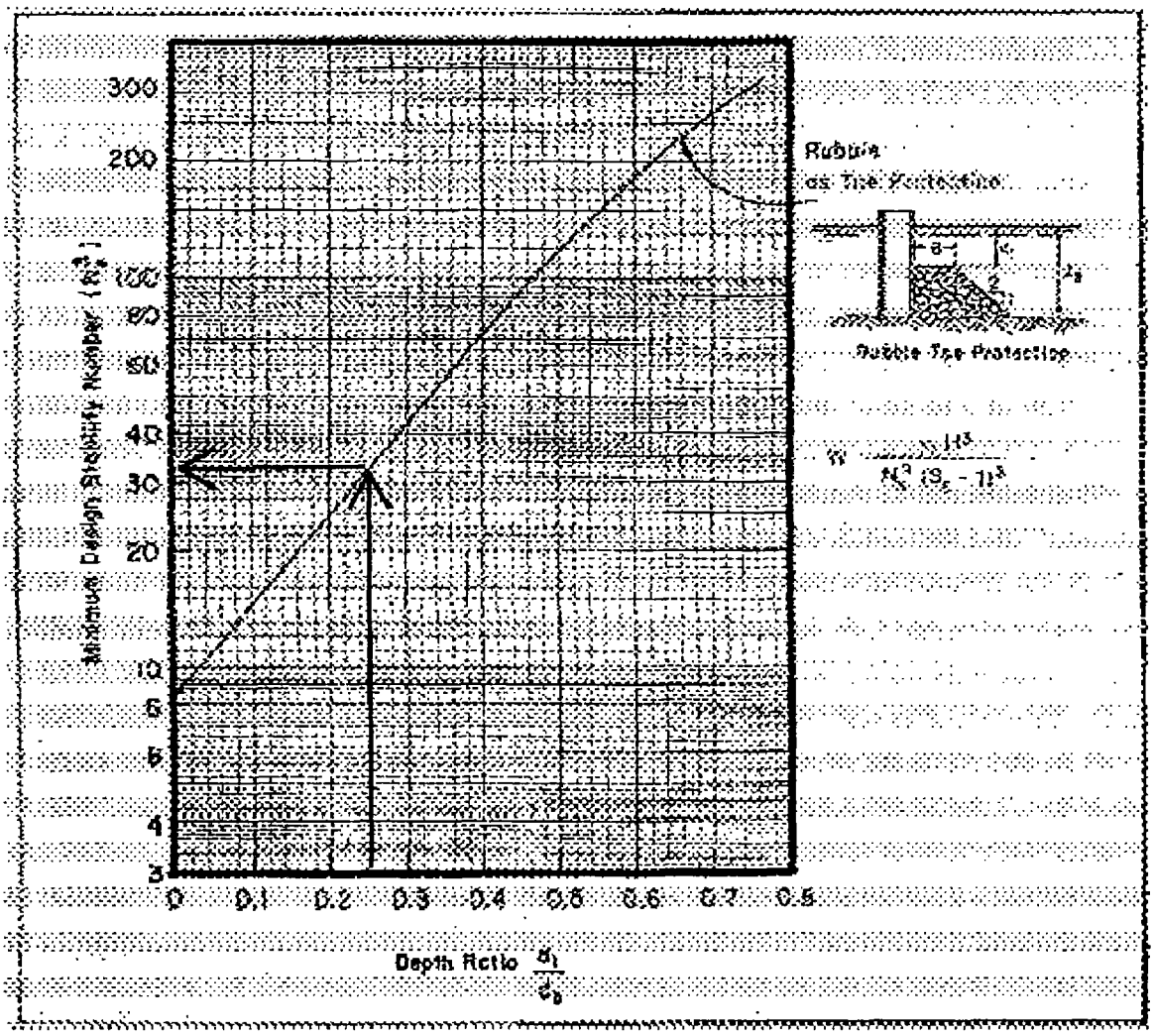
TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Toe Unit Sizing	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

$$W_{\min} = \frac{165 * 3^3}{35\left(\frac{165}{64} - 1\right)^3}$$

$$W_{\min} = 32.4\ lbs$$

Stability Number (N)



Reference: USACE 1995.

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Toe Unit Sizing	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

It should be noted that this calculation yields a minimum stone weight rather than a median weight which is calculated using the Hudson formula for the selection of riprap armor size. Using a median rock weight of 500 lbs (1/4 ton) will require gradation as specified by the California Department of Transportation and shown in the following table. The material is readily obtainable in the vicinity of the project.

STANDARD Rock SIZE or Rock MASS or Rock WEIGHT		GRADING OF ROCK SLOPE PROTECTION PERCENTAGE LARGER THAN											
		RSP-Classes [A]											
		Method A Placement					Method B Placement						
		RSP-Classes other than Backing									Backing No.		
US unit		8 ton	4 ton	2 ton	1 ton	1/2 ton	1 ton	1/2 ton	1/4 ton	Light	1 [B]	2	3
	SI unit	8 T	4 T	2 T	1 T	1/2 T	1 T	1/2 T	1/4 T	Light	1 [B]	2	3
16 ton	14.5 tonne	0-5											
8 ton	7.25 tonne	50-100	0-5										
4 ton	3.6 tonne	95-100	50-100	0-5									
2 ton	1.8 tonne		95-100	50-100	0-5		0-5						
1 ton	900 kg			95-100	50-100	0-5	50-100	0-5					
1/2 ton	450 kg				95-100	50-100	----	50-100	0-5				
1/4 ton	220 kg					95-100	95-100	----	50-100	0-5			
200 lb	90 kg							95-100	-----	50-100	0-5		
75 lb	34 kg								95-100	-----	50-100	0-5	
25 lb	11 kg									95-100	90-100	25-75	0-5
5 lb	2.2 kg											90-100	25-75
1 lb	0.4 kg												90-100

[A] US customary names (units) of RSP-Classes listed above SI names, example US is "2 ton" metric is "2 T".
[B] "Facing" has same gradation as "Backing No. 1". To conserve space "Facing" is not shown .

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Toe Unit Sizing	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

REFERENCES

State of California Department of Transportation Engineering Service Center. 2000. California Bank and Shore Rock Slope Protection Design.

U.S. Army Corps of Engineers. 1995. "Design of Coastal Revetments, Seawalls, and Bulkheads.

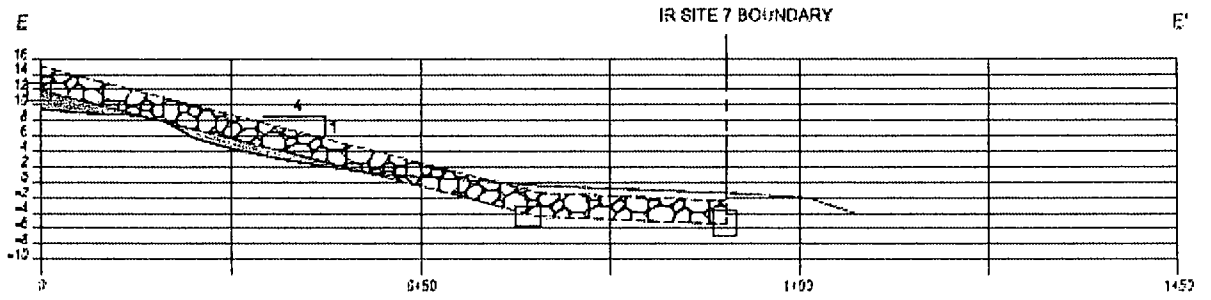
APPENDIX O
REVETMENT MATERIALS CALCULATION

TETRA TECH

Project		Component/System	
HPS, Parcel B, Site IR-07 and IR-18		Revetment Materials Calculations	
Prepared by:	**Date**	**Checked by:**	**Date**
JBL	4-24-09	SWF	4-28-09

The following approach was used for the calculation of materials quantities necessary for the construction of the revetment.

The elevations and the distances of the key points along the revetment were taken from the CAD drawings of the revetment cross sections. The key points along the revetment for the calculation of the materials quantities are: (1) the crest, (2) the toe, and (3) the location where the slope of the changes between the upper portion of the revetment and the lower portion toward the toe. A typical cross section of the revetment with these key locations is shown below.



Using these points the and uniform thicknesses of 3 feet for the riprap and 0.5 feet for the crushed rock filter layer the upper and lower cross sectional areas were calculated. These cross sectional areas were then multiplied by the appropriate shoreline length applicable to the specific cross section to yield the approximate volume of material. The area of coverage for the geotextile filter layer was calculated using a similar methodology.

The following tables summarize the materials quantities calculations.

Revetment Riprap Quantities Calculation

Cross Section	Distance (ft)	Elevation (ft msl)
X-Section A		
Crest	0	15
Slope Transition	62	0
Toe end	85	-1
X-Section B		
Crest	0	15
Slope Transition		
Toe end	62	-1
X-Section C		
Crest	0	15
Slope Transition	50	2
Toe end	86	0
X-Section D		
Crest	0	15
Slope Transition	64	0
Toe end	120	-3
X-Section E		
Crest	0	15
Slope Transition	67	-2
Toe end	91	-3
X-Section F		
Crest	0	15
Slope Transition		
Toe end	67	-2
X-Section AA		
Crest	0	15
Slope Transition		
Toe end	62	-1
X-Section BB		
Crest	0	15
Slope Transition		
Toe end	66	-1
X-Section DD		
Crest	0	15
Slope Transition	60	-1
Toe end	74	-1
X-Section EE		
Crest	0	15
Slope Transition		
Toe end	79	-5

	Upper Area	Lower Area	Shoreline Length	Revetment Volume[1]	Rock Weight[2]
	ft^2	ft^2	ft	yd^3	Tons
X-Section A	191	69	117	1,127	1,757.3
X-Section B	192	0	57	405	631.5
X-Section C	155	108	137	1,334	2,080.7
X-Section D	197	168	82	1,109	1,726.5
X-Section E	207	72	92	951	1,482.4
X-Section F	207	0	87	667	1,040.0
X-Section AA	192	0	107	761	1,186.4
X-Section BB	204	0	57	431	671.6
X-Section DD	186	42	137	1,157	1,803.8
X-Section EE	244	0	77	696	1,085.0
			Totals	8,637.0	13,467.2

Assumptions
from: "Design of Coastal Revetments, Seawalls, and Bulkheads"

Graded riprap porosity	0.3
Unit weight of rock	165 lb/ft^2
	4455 lb/ft^2

Riprap layer thickness 3 ft

Notes:

1 Volume including pore space
2 Accounds for pore space
msl = mean sea level

Crushed Rock Quantities Calculations

Cross Section	Distance (ft)	Elevation (ft msl)
X-Section A		
Crest	0	12
Slope Transition	62	-3
Toe end	85	-4
X-Section B		
Crest	0	12
Slope Transition	0	0
Toe end	62	-4
X-Section C		
Crest	0	12
Slope Transition	50	-1
Toe end	86	-3
X-Section D		
Crest	0	12
Slope Transition	64	-3
Toe end	120	-6
X-Section E		
Crest	0	12
Slope Transition	67	-5
Toe end	91	-6
X-Section F		
Crest	0	12
Slope Transition	0	0
Toe end	67	-5
X-Section AA		
Crest	0	12
Slope Transition	0	0
Toe end	62	-4
X-Section BB		
Crest	0	12
Slope Transition	0	0
Toe end	66	-4
X-Section DD		
Crest	0	12
Slope Transition	60	-4
Toe end	74	-4
X-Section EE		
Crest	0	12
Slope Transition	0	0
Toe end	79	-8

	Upper area	Lower area	Shoreline Length	Revetment Volume[1]	Rock Weight[2]
	ft^2	ft^2	ft	yd^3	Tons
X-Section A	31.89	11.51	117	188	293.1
X-Section B	32.02	0	57	68	105.4
X-Section C	25.83	18.03	137	223	347.0
X-Section D	32.87	28.04	82	185	288.5
X-Section E	34.56	12.01	92	159	247.5
X-Section F	34.56	0	87	111	173.7
X-Section AA	32.02	0	107	127	197.8
X-Section BB	33.96	0	57	72	111.8
X-Section DD	31.05	7	137	193	300.9
X-Section EE	40.75	0	77	116	181.1
			Totals	1,441.1	2,246.9

Assumptions
from: "Design of Coastal Revetments, Seawalls, and Bulkheads"

Porosity	0.3	Porosity of gravel
Unit weight	165	lb/ft^2
	4455	lb/ft^3
Gravel layer thickness	0.5	ft

Notes:

1 Volume including pore space
2 Accounds for pore space
msl = mean sea level

Geotextile Quantities Calculation

	Distance (ft)	Elevation (ft msl)
X-Section A		
Crest	0	11.5
Slope Transition	62	-3.5
Toe end	85	-4.5
X-Section B		
Crest	0	11.5
Slope Transition	0	0
Toe end	62	-4.5
X-Section C		
Crest	0	11.5
Slope Transition	50	-1.5
Toe end	86	-3.5
X-Section D		
Crest	0	11.5
Slope Transition	64	-3.5
Toe end	120	-6.5
X-Section E		
Crest	0	11.5
Slope Transition	67	-5.5
Toe end	91	-6.5
X-Section F		
Crest	0	11.5
Slope Transition	0	0
Toe end	67	-5.5
X-Section AA		
Crest	0	11.5
Slope Transition	0	0
Toe end	62	-4.5
X-Section BB		
Crest	0	11.5
Slope Transition	0	0
Toe end	66	-4.5
X-Section DD		
Crest	0	11.5
Slope Transition	60	-4.5
Toe end	74	-4.5
X-Section EE		
Crest	0	11.5
Slope Transition	0	0
Toe end	79	-8.5

	Upper Length	Lower Length	Shoreline Length	Area Covered	Fabric Area[1]
	ft	ft	ft	ft^2	ft^2
X-Section A	63.79	11.51	117	979	1,275
X-Section B	64.03	0	57	406	539
X-Section C	51.66	18.03	137	1,061	1,395
X-Section D	65.73	28.04	82	854	1,087
X-Section E	69.12	12.01	92	829	1,071
X-Section F	69.12	0	87	668	880
X-Section AA	64.03	0	107	761	1,012
X-Section BB	67.91	0	57	430	567
X-Section DD	62.1	7	137	1,052	1,385
X-Section EE	81.49	0	77	697	900
			Totals	7,737.5	10112

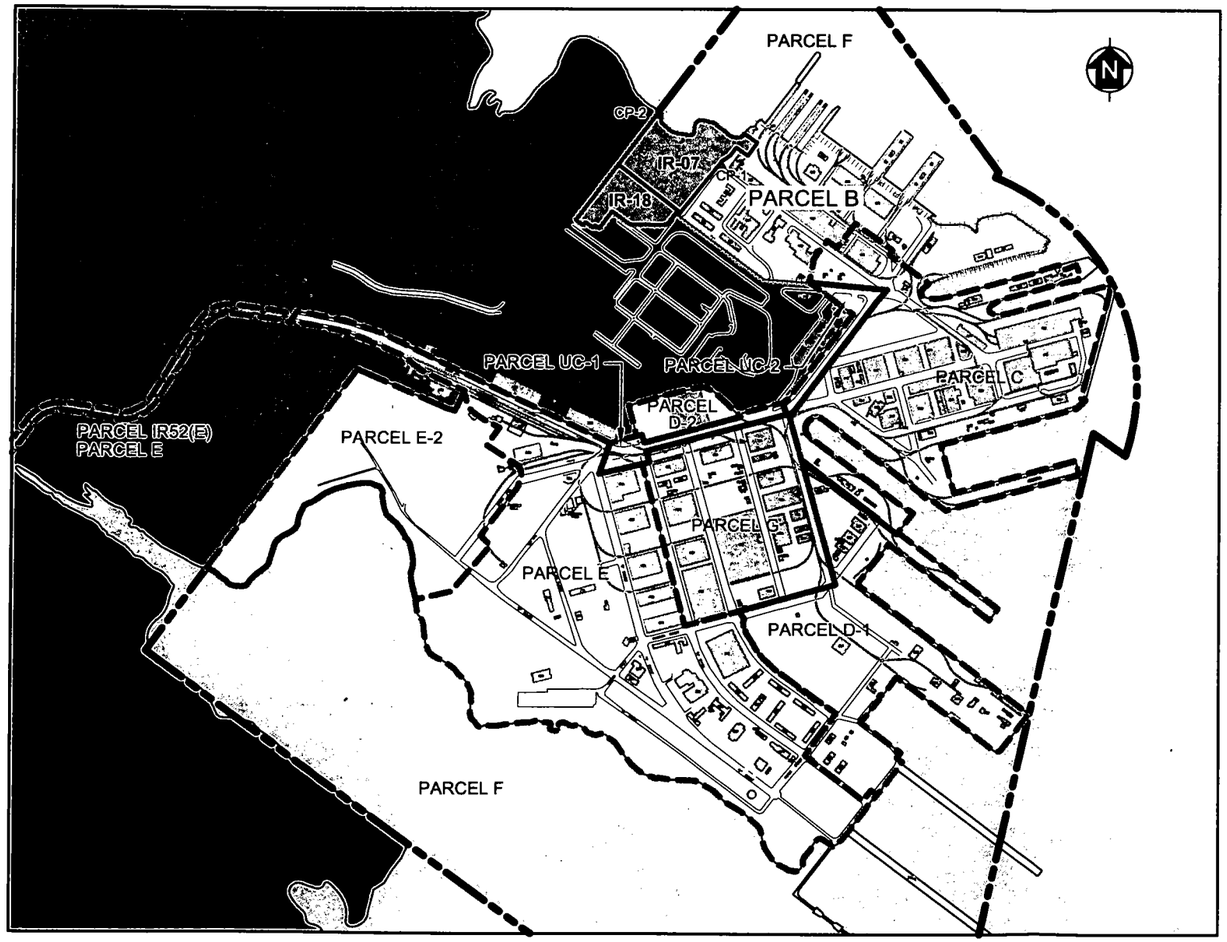
Notes

1 Includes 2 ft of overlay between sections and 10 ft for anchoring

msl = mean sea level

ATTACHMENT 1
DESIGN CONSTRUCTION DRAWINGS

HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
INSTALLATION RESTORATION SITES 7 AND 18
SOIL COVER AND SHORELINE REVETMENT
DESIGN DRAWINGS



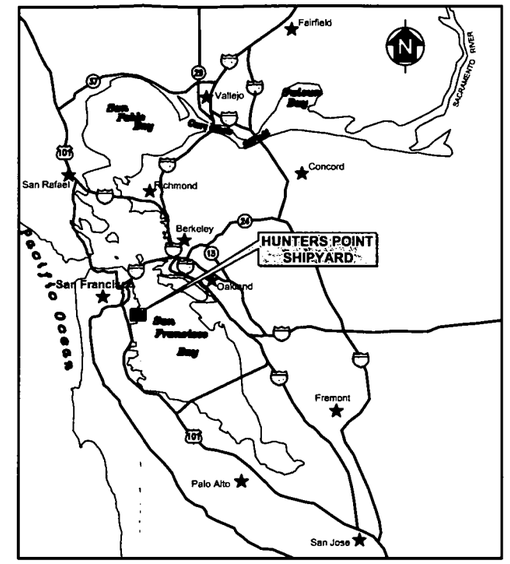
LOCATION MAP

600' 0 600' 1200'

SCALE: 1" = 600'

SURVEY CONTROL POINTS			
Control Point	Easting	Northing	Elevation
CP-1	1460168.99	453718.89	11.76
CP-2	1459671.50	454121.67	5.81

NOTE: OFF-SITE TOPOGRAPHY HAS BEEN SHOWN AS REFERENCED BUT HAS NOT BEEN TIED TO THE SITE TOPOGRAPHY. EXISTING TOPOGRAPHY ESTIMATED PRECISION ± 1' DUE TO MINOR REGRADING OF THE SITE FOLLOWING AS SHOWN BASELINE SURVEY.

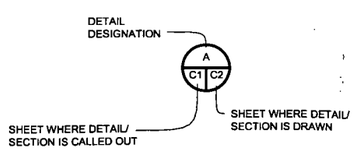


VICINITY MAP

NOT TO SCALE

INDEX OF DRAWINGS

DWG	DESCRIPTION
G1	VICINITY MAP, LOCATION MAP, AND SHEET INDEX
C1	SITE PLAN - CLEARING, GRUBBING, SURFACE DEBRIS REMOVAL AND WELL AND PROBE EXTENSIONS
C2	SOIL COVER AND REVETMENT SUBGRADE PLAN
C3	SOIL COVER AND SHORELINE REVETMENT FINAL GRADING PLAN
C4	CONTROL POINTS
C5	SHORELINE AND REVETMENT CROSS-SECTIONS A, B, AND C
C6	SHORELINE AND REVETMENT CROSS-SECTIONS D, E, AND F
C7	SHORELINE AND REVETMENT CROSS-SECTIONS G, H, I, AND J
C8	SOIL COVER BOUNDARY CROSS-SECTIONS DETAILS A, B, C, AND D
C9	SOIL COVER CROSS-SECTIONS DETAILS A-A' AND B-B'
C10	MONITORING WELL AND METHANE MONITORING PROBE EXTENSION DETAILS
C11	DETAILS I
C12	DETAILS II



NOTE: SECTION DETAILS ARE DESIGNATED BY A LETTER AND PLAN DETAILS ARE DESIGNATED BY A NUMBER.

BASIS OF BEARINGS AND ELEVATION

HORIZONTAL: NAD 1927 ZONE-III (HUNTERS POINT WEST 1 PID HT0613) USFT.

VERTICAL :
NGVD 29 LESS CORRECTION 7.76 FEET MSL

LIMITS OF RESPONSIBILITY

THE DESIGNER AND ITS SUBCONTRACTORS SHALL NOT BE RESPONSIBLE FOR VARIANCES FROM THE CONSTRUCTION SPECIFICATIONS, DESIGN DRAWINGS, AND OTHER REQUIREMENTS AND RECOMMENDATIONS UNAPPROVED BY THE DESIGNER.

Hunters Point Shipyard
REGISTERED PROFESSIONAL ENGINEER STEPHEN WELLS FISHER No. C 047281 Exp. 31 DEC 09 CIVIL STATE OF CALIFORNIA

DGN: CHAD ... 0019-0024

SYMBOL	DESCRIPTION	PREP.BY	DATE	APPROVED

REVISIONS

PREPARED BY: ChaduxTt JV

DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RE-CHECKED BY:
APPROVED BY:
DATE: 12/09/2009

SIZE D
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT
SCALE REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
VICINITY MAP, LOCATION MAP, AND SHEET INDEX

CODE IDENT. NO.

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

CONSTR. CONTR. NO.
N62473-09-D-2608

SPECIFICATION
(D.O. –)

NAVFAC DWG. NO.

DWG. NO.
G1

SHEET 1 OF 13

R:\Navy\Hunters-PY\...\07_08\Preliminary Design\ G1_Hunters Point IR7-18 Location Map.dwg 12/09/2009 deborah.ford DN

NOTES:

1. REMOVE EXISTING FENCE WHERE FENCE IS OBSTRUCTIVE TO THE WORK AREA. REPLACE REMOVED FENCE WITH A TEMPORARY FENCE OFFSET AS NEEDED TO ALLOW WORK ALONG THE BOUNDARY.
2. USE EXISTING FENCE ALONG SOUTHWESTERN BOUNDARY AS TEMPORARY FENCE. USE EXISTING FENCE AND FENCE MATERIALS AS APPROPRIATE IN CONSTRUCTION OF THE TEMPORARY FENCE.
3. REMOVE ALL FENCING, ASPHALT CURB, AND OTHER OBSTRUCTIVE OBJECTS FROM WITHIN THE WORK AREA. REMOVE SIGNS AND OTHER MATERIALS FROM THE SHORELINE WHERE THEY OBSTRUCT THE WORK AREA. CLEAR AND GRUB EXISTING VEGETATION.
4. BOULDERS REMOVED FROM THE SHORELINE DURING DEBRIS REMOVAL ARE TO BE STOCKPILED FOR USE AS ADDITIONAL ARMORING ON THE COMPLETED REVETMENT. OTHER DEBRIS (CONCRETE, METAL, WOOD, ETC.) IS TO BE DISPOSED.
5. ALL GROUNDWATER MONITORING WELLS AND METHANE MONITORING PROBES ARE TO BE EXTENDED AS NEEDED OR REPLACED TO MEET THE FINAL COVER SURFACE GRADE WITH LIKE MATERIALS. CONCRETE PADS CAN REMAIN IN PLACE IF NOT OBSTRUCTIVE TO THE EXTENSION. REMOVE ALL WELL COMPLETIONS ABOVE GROUND AND PROTECTIVE BOLLARDS. CONSTRUCT NEW WELL HEAD BOXES TO MATCH EXISTING WELL HEAD BOXES' INTERNAL DIAMETER AT A MINIMUM.
6. OBTAIN CONTRACTING OFFICER'S APPROVAL IF PERMANENT SURFACE FEATURES MUST BE REMOVED FROM THIS AREA FOR CONSTRUCTABILITY
7. EXISTING TOPOGRAPHY ESTIMATED PRECISION +/- 1 FT DUE TO SITE ACTIVITIES FOLLOWING COMPLETION OF THE TOPOGRAPHIC SURVEY.
8. SURROUNDING AREA CONTOURS HAVE NOT BEEN TIED INTO SITE CONTOURS.
9. REMOVE ALL EXISTING UTILITY FEATURES FROM WITHIN SITE BOUNDARY. PROTECT EXISTING UTILITY FEATURES OUTSIDE THE SITE BOUNDARY AS NECESSARY.
10. EXISTING FENCE WAS CONSTRUCTED AFTER THE SITE SURVEY AND LOCATION IS APPROXIMATE.

LEGEND

- IR SITE BOUNDARY
- EXTENT OF RESTRICTIONS RELATED TO RADIONUCLIDES
- EXISTING MAJOR CONTOUR (5 FT.)
- EXISTING MINOR CONTOUR (1 FT.)
- ASPHALT CURB (REMOVE)
- OVERHEAD POWER LINE (PROTECT DURING CONSTRUCTION)
- OVERHEAD POWER LINE (REMOVE)
- EXISTING FENCE (APPROXIMATE LOCATION)
- EXISTING FENCE (REMOVE)
- TEMPORARY FENCE (TO BE INSTALLED DURING CONSTRUCTION)
- SURVEY CONTROL POINT
- UTILITY FEATURE (REMOVE)
- UTILITY POLE APPROX. LOCATION (REMOVE)
- UTILITY FEATURE (PROTECT AND LEAVE IN PLACE)
- UTILITY POLE (PROTECT AND LEAVE IN PLACE)
- WATER FEATURE
- MONITORING WELL (PROTECT AND EXTEND)
- METHANE MONITORING PROBE (PROTECT AND EXTEND)
- GB-5 GRUBBING BOUNDARY CONTROL POINT
- FN-6 TEMPORARY FENCE CONTROL POINT
- MEAN SEA LEVEL (MSL)
- MEAN LOWER LOW WATER (-3.56 MSL)
- APPROXIMATE LIMITS OF CLEARING AND GRUBBING AND DEBRIS REMOVAL

SYMBOL	DESCRIPTION	DATE	APPROVED

REVISIONS

PREPARED BY: ChaduxTt JV

DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RE-CHECKED BY:
APPROVED BY:
DATE: 12/09/2009

SIZE D
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT
SCALE REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
SAN DIEGO, CALIFORNIA

BRAC PMO WEST

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
SITE PLAN - CLEARING, GRUBBING, SURFACE DEBRIS REMOVAL AND WELL AND PROBE EXTENSIONS

CODE IDENT. NO.

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

CONSTR. CONTR. NO.
N62473-09-D-2608

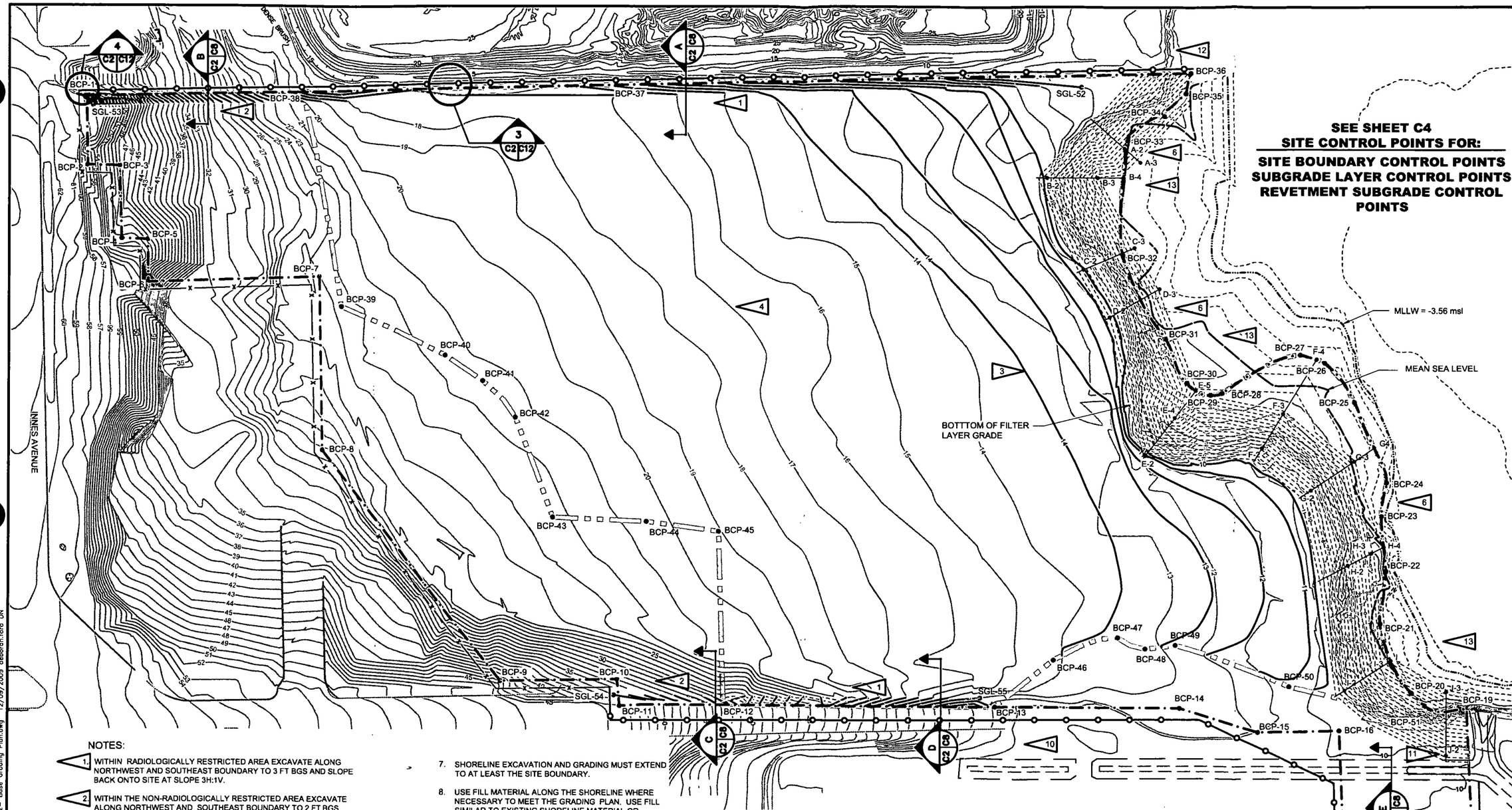
SPECIFICATION
(D.O. –)

NAVFAC DWG. NO.

DWG. NO.
C1

SHEET 2 OF 13

R:\Navy\Hunters-Pt\Parcel B\v07_r08\Preliminary Design\ C1 Ex_Topography.dwg 12/09/2009 deborah.ford DN



NOTES:

1. WITHIN RADIOLOGICALLY RESTRICTED AREA EXCAVATE ALONG NORTHWEST AND SOUTHEAST BOUNDARY TO 3 FT BGS AND SLOPE BACK ONTO SITE AT SLOPE 3H:1V.
2. WITHIN THE NON-RADIOLOGICALLY RESTRICTED AREA EXCAVATE ALONG NORTHWEST AND SOUTHEAST BOUNDARY TO 2 FT BGS AND SLOPE BACK ONTO SITE AT 3H:1V.
3. EXCAVATED SOIL AND SEDIMENT PLACEMENT ZONE. GRADING BASED ON ESTIMATED VOLUME OF MATERIAL REMOVED FROM ALONG THE SITE BOUNDARY AND SHORELINE. VOLUME VARIABLE AS CONTAMINATED MATERIAL WILL BE REMOVED AND DISPOSED OF OFF SITE. COMPACTION 90% OR GREATER OF MAXIMUM DENSITY BASED ON MODIFIED PROCTOR TESTING. GRADE AT DISCRETION OF CONTRACTOR TO BEST ACHIEVE FINAL GRADE (SHEET C3).
4. GRADE AND COMPACT EXCAVATION SPOILS OVER THE EXISTING GRADE TO THE EXTENT POSSIBLE WITH CONSIDERATION TO THE FINAL COVER GRADE. FINISHED SURFACE GRADE AS SHOWN CONSTITUTES BOTTOM OF COVER .
5. EXCAVATED SOIL AND SEDIMENT REQUIRES SCREENING FOR RADIONUCLIDES PRIOR TO PLACEMENT ON SITE. MINIMIZE EXCAVATION VOLUMES TO THE EXTENT POSSIBLE.
6. GRADE UPPER SHORELINE TO 4H:1V. BREAK IN SLOPE AT POINTS B3, E4, F3, G3, AND H3 AND THEN FOLLOW EXISTING GRADE.
7. SHORELINE EXCAVATION AND GRADING MUST EXTEND TO AT LEAST THE SITE BOUNDARY.
8. USE FILL MATERIAL ALONG THE SHORELINE WHERE NECESSARY TO MEET THE GRADING PLAN. USE FILL SIMILAR TO EXISTING SHORELINE MATERIAL OR FILTER LAYER CRUSHED ROCK.
9. SHORELINE EXCAVATIONS ARE NOT TO BE EXPOSED TO INCOMING TIDAL WATER WITHOUT STABILIZATION.
10. GRADE AREA OFF SITE AS NECESSARY TO PREVENT SURFACE WATER PONDING.
11. DIVERT EXISTING DRAINAGE AS NECESSARY TO ACCOMMODATE EXCAVATION ALONG SHORE AND CONSIDERING FINAL ELEVATION.
12. EXTEND TEMPORARY FENCE TO SHORELINE.
13. USE SILT CURTAIN OFFSHORE TO CONTROL SEDIMENT MIGRATION.

LEGEND

- EXTENT OF COVER BOUNDARY
- EXTENT OF RESTRICTIONS RELATED TO RADIONUCLIDES
- EXISTING CONTOUR
- EXISTING FENCE (APPROXIMATE)
- TEMPORARY FENCE (DURING CONSTRUCTION)
- SUBGRADE CONTOUR
- SUBGRADE CONTOUR INDICATING AREA TO PLACE EXCAVATED SOIL AND ANTICIPATED FILL AREA
- REVETMENT SUBGRADE CONTOUR (SEE SHEET C4 FOR CONTROL COORDINATES)
- BCP-15 ● SITE CONTROL POINT
- SGL-53 ● SUBGRADE EXCAVATION CONTROL POINT
- MEAN SEA LEVEL (MSL)
- MEAN LOWER LOW WATER (-3.56 MSL)

50' 0 50' 100'
SCALE: 1" = 50'

Hunters Point Shipyard

REGISTERED PROFESSIONAL ENGINEER STEPHEN WELLS FISHER No. C 047281 Exp. 31 DEC 09 CIVIL STATE OF CALIFORNIA

DCN: CHEX-[illegible]-0019-0024

SYMBOL	DESCRIPTION	PREP'BY	DATE	APPROVED

REVISIONS

PREPARED BY: ChaduxTt JV

DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RE-CHECKED BY:
APPROVED BY:
DATE: 12/09/2009

SIZE D
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT
SCALE REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
SOIL COVER AND REVETMENT SUBGRADE PLAN

CODE IDENT. NO.

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

CONSTR. CONTR. NO.
N62473-09-D-2608

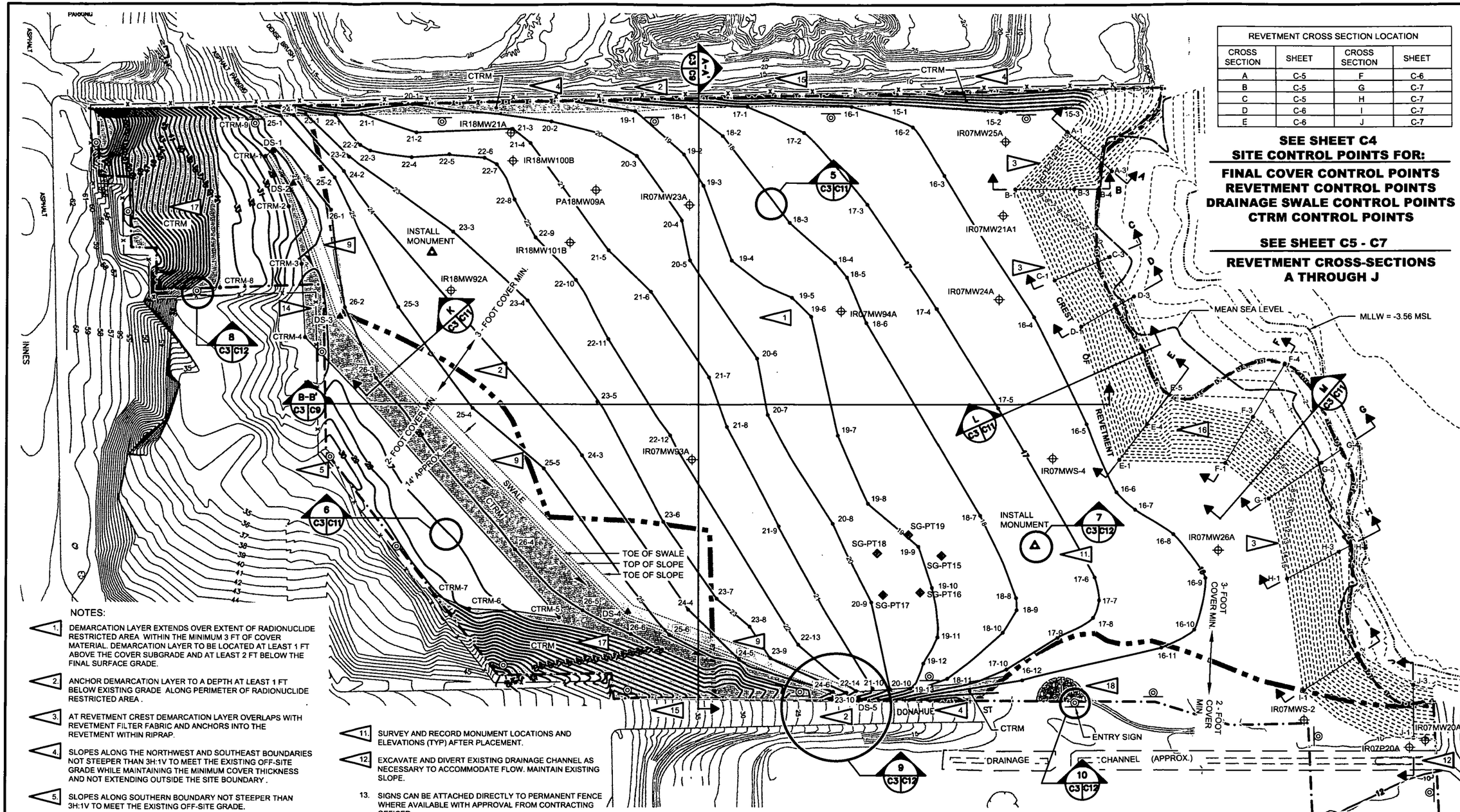
SPECIFICATION
(D.O. –)

NAVFAC DWG. NO.

DWG. NO.
C2

SHEET 3 OF 13

R:\Navy\Hunters-Pt\[illegible]3\07_J\08\Preliminary Design\ C2- Base Grading Plan.dwg 12/09/2009 deborah.ford DN



REVETMENT CROSS SECTION LOCATION			
CROSS SECTION	SHEET	CROSS SECTION	SHEET
A	C-5	F	C-6
B	C-5	G	C-7
C	C-5	H	C-7
D	C-6	I	C-7
E	C-6	J	C-7

SEE SHEET C4
SITE CONTROL POINTS FOR:

FINAL COVER CONTROL POINTS
REVETMENT CONTROL POINTS
DRAINAGE SWALE CONTROL POINTS
CTRM CONTROL POINTS

SEE SHEET C5 - C7
REVETMENT CROSS-SECTIONS A THROUGH J

NOTES:

1. DEMARCATION LAYER EXTENDS OVER EXTENT OF RADIONUCLIDE RESTRICTED AREA WITHIN THE MINIMUM 3 FT OF COVER MATERIAL. DEMARCATION LAYER TO BE LOCATED AT LEAST 1 FT ABOVE THE COVER SUBGRADE AND AT LEAST 2 FT BELOW THE FINAL SURFACE GRADE.
2. ANCHOR DEMARCATION LAYER TO A DEPTH AT LEAST 1 FT BELOW EXISTING GRADE ALONG PERIMETER OF RADIONUCLIDE RESTRICTED AREA .
3. AT REVETMENT CREST DEMARCATION LAYER OVERLAPS WITH REVETMENT FILTER FABRIC AND ANCHORS INTO THE REVETMENT WITHIN RIPRAP.
4. SLOPES ALONG THE NORTHWEST AND SOUTHEAST BOUNDARIES NOT STEEPER THAN 3H:1V TO MEET THE EXISTING OFF-SITE GRADE WHILE MAINTAINING THE MINIMUM COVER THICKNESS AND NOT EXTENDING OUTSIDE THE SITE BOUNDARY .
5. SLOPES ALONG SOUTHERN BOUNDARY NOT STEEPER THAN 3H:1V TO MEET THE EXISTING OFF-SITE GRADE.
6. ELEVATIONS ALONG SHORELINE CORRESPOND TO FINAL REVETMENT GRADE .
7. COMPACTION OF COVER 90% OR GREATER OF MAXIMUM DENSITY BASED ON MODIFIED PROCTOR TESTING TO 0.5 FT BELOW FINAL COVER GRADE. COMPACTION OF FINAL 0.5 FT NOT TO EXCEED 85%.
8. USE MATERIALS FROM THE TEMPORARY FENCE IN THE CONSTRUCTION OF THE PERMANENT FENCE AS APPROPRIATE .
9. DRAINAGE SWALE SLOPES 3H:1V ON SIDE FACING UPGRADIENT AND 10H:1V ON SIDE FACING DOWNGRADIENT. PLACE COMPOSITE TURF REINFORCED MATTING (CTRM) ALONG WATERCOURSE TO ELEVATION 1 FT ABOVE WATER COURSE.
10. REFER TO C5 THROUGH C7 FOR SHORELINE CROSS SECTIONS A THROUGH J
11. SURVEY AND RECORD MONUMENT LOCATIONS AND ELEVATIONS (TYP) AFTER PLACEMENT.
12. EXCAVATE AND DIVERT EXISTING DRAINAGE CHANNEL AS NECESSARY TO ACCOMMODATE FLOW. MAINTAIN EXISTING SLOPE.
13. SIGNS CAN BE ATTACHED DIRECTLY TO PERMANENT FENCE WHERE AVAILABLE WITH APPROVAL FROM CONTRACTING OFFICER.
14. REMOVE AND REPLACE FENCE AS NECESSARY FOR PLACEMENT OF CTRM.
15. INSTALL CTRM ALONG PROPERTY BOUNDARY WHERE SLOPED PORTION OF COVER MEETS EXISTING GRADE OFF SITE.
16. TRANSITION GRADE BETWEEN ADJACENT CROSS-SECTIONS A THROUGH J.
17. SOIL COVER CONSTRUCTED AS MIN. 2 FT CLEAN IMPORTED FILL OVER EXISTING GRADE.
18. INSTALL ROAD BASE AS ENTRY POINT TO DIRECT AND DISPERSE TRAFFIC OVER FINAL COVER. INSTALL ROAD BASE IN 25 FT RADIAL ARC AND INSTALL ENTRY SIGN AT SITE BOUNDARY.

LEGEND

- EXTENT OF COVER BOUNDARY
- EXTENT OF RESTRICTIONS RELATED TO RADIONUCLIDES
- EXISTING CONTOUR
- FINAL COVER CONTOUR
- REVETMENT CONTOUR
- PERMANENT FENCE
- COMPOSITE TURF REINFORCED MATTING (CTRM)
- A-1 ● REVETMENT CONTROL POINT (SEE SHEET C4 FOR COORDINATES)
- 22-5 ● FINAL COVER CONTROL POINT (SEE SHEET C4 FOR COORDINATES)
- MONITORING WELL
- METHANE MONITORING PROBE
- DRAINAGE SWALE
- SIGN (STANDARD)
- SURVEY MONUMENT
- DS-1▲ DRAINAGE CONTROL POINT (SEE SHEET C4 FOR COORDINATES)

50' 0 50' 100'
SCALE: 1" = 50'

Hunters Point Shipyard
REGISTERED PROFESSIONAL ENGINEER STEPHEN WELLS FISHER No. C 047281 Exp. 31 Dec 09 CIVIL STATE OF CALIFORNIA
DGN: GRAD 1241 0019-0024

SYMBOL	DESCRIPTION	PREP BY	DATE	APPROVED

REVISION

PREPARED BY: ChaduxTt JV Consulting Engineers and Scientists

DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RECHECKED BY:
APPROVED BY:
DATE: 12/09/2009

SIZE D
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SCALE REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
SAN DIEGO, CALIFORNIA

BRAC PMO WEST

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
SOIL COVER AND SHORELINE REVETMENT
FINAL GRADING PLAN

CODE IDENT. NO.

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

CONSTR. CONTR. NO.
N62473-09-D-2608

SPECIFICATION
(D.O. –)

NAVFAC DWG. NO.

DWG. NO.
C3

SHEET 4 OF 13

SHEET C1 CONTROL POINTS

EXISTING GROUNDWATER MONITORING WELLS AND METHANE MONITORING PROBES EXTENSION SCHEDULE

Well ID	Easting	Northing	Well Depth (ft. bgs)	Casing Dia. (in.)	Stick-Up Construction	TOS_ft BGS Well Log	BOS_ft BGS Well Log
IR07MW20A1	1460379.24	453944.26	24.00	4	NO	6.00	24.00
IR07MW21A1	1459683.70	453941.51	16.50	4	NO	6.00	16.00
IR07MW23A	1459476.14	453693.82	17.00	4	NO	7.00	17.00
IR07MW24A	1459749.67	453884.37	15.00	4	YES	5.00	15.00
IR07MW25A	1459624.70	453990.88	18.00	4	YES	8.00	18.00
IR07MW26A	1460093.30	453900.68	15.00	4	YES	5.00	15.00
IR07MW93A	1459686.30	453533.20	29.00	2	NO	19.00	29.00
IR07MW94A	1459659.70	453749.30	25.00	2	NO	14.00	24.00
IR07MWS-2	1460286.15	453860.98	15.50	4	YES	5.50	15.50
IR07MWS-4	1459913.20	453825.23	16.00	4	YES	6.00	16.00
IR07P20A	1460374.65	453927.21	25.00	2	NO	5.00	25.00
IR18MW100B	1459329.10	453579.54	47.00	4	NO	40.00	45.00
IR18MW101B	1459432.00	453573.70	45.00	4	NO	37.00	42.00
IR18MW21A	1459304.90	453595.74	20.00	4	NO	10.00	20.00
IR18MW92A	1459396.70	453446.90	27.00	2	NO	17.00	27.00
PA18MW09A	1459405.47	453628.25	25.00	4	NO	10.00	25.00
SG-PT15	1459922.63	453673.40	3.00	TUBE	NO	–	–
SG-PT16	1459939.27	453632.67	3.00	TUBE	NO	–	–
SG-PT17	1459917.88	453601.10	3.00	TUBE	NO	–	–
SG-PT18	1459880.20	453623.16	3.00	TUBE	NO	–	–
SG-PT19	1459884.61	453660.16	3.00	TUBE	NO	–	–

CLEARING AND GRUBBING CONTROL POINTS

Point ID	Easting	Northing
GB-1	1458996.94	453244.69
GB-2	1459116.91	453154.18
GB-3	1459419.24	453219.12
GB-4	1459764.15	453204.97
GB-5	1460273.78	453857.25
GB-6	1460376.47	453777.02
GB-7	1460484.04	453914.71
GB-8	1460366.54	454006.50
GB-9	1460335.57	454014.91
GB-10	1460270.80	453980.39
GB-11	1460196.05	454003.03
GB-12	1460105.13	454074.42
GB-13	1459990.79	454103.70
GB-14	1459916.77	454008.96
GB-15	1459703.93	454091.38
GB-16	1459696.86	454165.65
GB-17	1459661.06	454150.64
GB-18	1459351.58	453728.48

TEMPORARY FENCE CONTROL POINTS

Point ID	Easting	Northing
FN-1	1459017.62	453272.42
FN-2	1459082.63	453223.10
FN-3	1459102.71	453247.39
FN-4	1459161.41	453204.17
FN-5	1459177.80	453223.76
FN-6	1459212.11	453197.62
FN-7	1459312.53	453335.49
FN-8	1459447.51	453234.19
FN-9	1459745.12	453231.37
FN-10	1459813.18	453321.25
FN-11	1459839.64	453301.58
FN-12	1460198.00	453760.27
FN-13	1460329.59	453825.86
FN-14	1460381.11	453787.53
FN-15	1460469.00	453901.98
FN-16	1459678.38	454157.90

DRAINAGE SWALE CONTROL POINT COORDINATES

POINT	EASTING	NORTHING	ELEVATION FT.
DS-1	1459169.98	453390.68	27.40
DS-2	1459209.43	453386.50	27.43
DS-3	1459347.70	453339.84	26.00
DS-4	1459771.01	453384.65	25.51
DS-5	1459988.70	453515.24	20.00

SHEET C2 CONTROL POINTS

REVETMENT CONTROL POINT COORDINATES

POINT	EASTING	NORTHING	ELEVATION (FT.)
A-2	1459672.54	454113.72	5.04
A-3	1459706.42	454126.26	-3.88
B-2	1459674.56	453974.29	9.36
B-3	1459706.81	454015.55	-3.50
B-4	1459722.49	454035.63	-4.42
C-2	1459770.28	453946.01	10.00
C-3	1459784.90	454001.11	-3.90
D-2	1459824.09	453936.29	10.40
D-3	1459832.53	453995.31	-4.21
E-2	1459956.37	453879.30	11.06
E-4	1459944.99	453923.84	-1.26
E-5	1459935.47	453961.05	-3.50
F-2	1460021.68	453975.56	8.00
F-3	1460006.79	454014.55	2.02
F-4	1459983.97	454074.31	-5.77
G-2	1460084.02	453985.89	8.00
G-3	1460087.85	454040.56	-0.46
G-4	1460087.85	454065.03	-5.93
H-2	1460165.87	453968.07	3.47
H-3	1460171.19	453997.18	-3.50
H-4	1460173.69	454010.87	-4.69
I-2	1460262.82	453889.47	9.00
I-3	1460268.13	453946.18	-5.15
J-2	1460356.91	453946.56	8.15
J-3	1460299.59	453991.73	-8.54

SUBGRADE LAYER CONTROL POINT COORDINATES

CONTROL POINT	EASTING	NORTHING	ELEV. (FT.)
SGL-52	1459624.74	454059.46	7.00
SGL-53	1459037.27	453275.10	58.00
SGL-54	1459821.66	453319.71	36.00
SGL-55	1460046.84	453602.85	13.00

SITE BOUNDARY CONTROL POINT COORDINATES

CONTROL POINT	EASTING	NORTHING
BCP-1	1459026.47	453275.75
BCP-2	1459081.35	453234.11
BCP-3	1459101.36	453258.32
BCP-4	1459160.10	453215.07
BCP-5	1459176.57	453234.76
BCP-6	1459210.46	453208.94
BCP-7	1459310.84	453346.76
BCP-8	1459450.21	453242.17
BCP-9	1459741.14	453239.37
BCP-10	1459811.27	453331.97
BCP-11	1459833.74	453317.59
BCP-12	1459896.48	453401.49
BCP-13	1460063.06	453608.80
BCP-14	1460176.75	453751.84
BCP-15	1460243.50	453798.03
BCP-16	1460291.50	453862.25
BCP-17	1460383.75	453795.81
BCP-18	1460457.50	453900.59
BCP-19	1460352.74	453975.89
BCP-20	1460306.13	453942.47
BCP-21	1460232.38	453960.75
BCP-22	1460194.37	453997.75
BCP-23	1460148.13	454028.06
BCP-24	1460124.63	454053.06
BCP-25	1460041.38	454077.34
BCP-26	1459991.75	454078.34
BCP-27	1459970.62	454064.34
BCP-28	1459953.38	453979.91
BCP-29	1459947.75	453969.75
BCP-30	1459923.88	453958.75
BCP-31	1459875.75	453969.34

SITE BOUNDARY CONTROL POINT COORDINATES

CONTROL POINT	EASTING	NORTHING
BCP-32	1459783.63	453987.34
BCP-33	1459695.62	454062.34
BCP-34	1459698.63	454106.06
BCP-35	1459694.00	454137.00
BCP-36	1459681.00	454153.72
BCP-37	1459359.41	453722.67
BCP-38	1459154.98	453448.28
SLF-39	1459348.36	453345.68
BCP-40	1459450.19	453397.33
BCP-41	1459492.98	453410.62
BCP-42	1459541.68	453413.57
BCP-43	1459643.51	453381.10
BCP-44	1459704.01	453451.94
BCP-45	1459755.66	453502.11
BCP-46	1460061.58	453683.68
BCP-47	1460082.98	453747.32
BCP-48	1460108.60	453761.74
BCP-49	1460124.07	453787.53
BCP-50	1460226.16	453850.62
BCP-51	1460327.73	453936.20

COMPOSITE TURF REINFORCED MATTING (CTRM) CONTROL POINT COORDINATES

POINT	EASTING	NORTHING	ELEVATION
CTRM-1	1459169.91	453381.59	28.68
CTRM-2	1459225.64	453368.16	28.68
CTRM-3	1459280.57	453342.21	26.83
CTRM-4	1459342.85	453298.45	26.00
CTRM-5	1459732.40	453325.43	26.72
CTRM-6	1459669.03	453258.57	26.00
CTRM-7	1459635.72	453239.71	23.30
CTRM-8	1459248.98	453261.82	23.30
CTRM-9	1459107.38	453365.05	23.30

SHEET C3 CONTROL POINTS

FINAL COVER CONTROL POINT COORDINATES

POINT	EASTING	NORTHING	ELEVATION
15-1	1459520.68	453921.63	15.00
15-2	1459598.04	454005.55	15.00
15-3	1459635.06	454060.88	15.00
16-1	1459498.70	453889.15	16.00
16-2	1459554.22	453925.04	16.00
16-3	1459613.74	453919.42	16.00
16-4	1459786.16	453901.18	16.00
16-5	1459906.78	453874.85	16.00
16-6	1459981.12	453855.29	16.00
16-7	1460007.31	453859.17	16.00
16-8	1460051.68	453874.67	16.00
16-9	1460107.81	453872.50	16.00
16-10	1460143.12	453830.20	16.00
16-11	1460136.64	453791.86	16.00
16-12	1460075.35	453658.66	16.00
17-1	1459432.35	453803.90	17.00
17-2	1459490.07	453833.78	17.00
17-3	1459588.62	453838.87	17.00
17-4	1459717.87	453827.97	17.00
17-5	1459837.97	453813.87	17.00
17-6	1460036.90	453782.85	17.00
17-7	1460058.39	453771.68	17.00
17-8	1460068.91	453755.49	17.00
17-9	1460062.66	453714.03	17.00
17-10	1460056.49	453652.90	17.00
18-1	1459393.06	453753.40	18.00
18-2	1459440.56	453765.03	18.00
18-3	1459554.91	453764.43	18.00
18-4	1459616.37	453775.43	18.00
18-5	1459635.96	453775.62	18.00
18-6	1459685.03	453761.97	18.00
18-7	1459914.16	453730.30	18.00
18-8	1460004.30	453706.46	18.00
18-9	1460014.51	453699.19	18.00
18-10	1460024.20	453673.62	18.00
18-11	1460026.72	453599.13	18.00
19-1	1459365.11	453710.21	19.00
19-2	1459431.29	453721.67	19.00
19-3	1459469.25	453717.55	19.00
19-4	1459548.38	453692.75	19.00
19-5	1459617.53	453718.29	19.00
19-6	1459645.26	453721.69	19.00
19-7	1459759.20	453667.09	19.00
19-8	1459833.70	453647.61	16.00
19-9	1459900.66	453660.58	16.00
19-10	1459943.02	453645.25	19.00
19-11	1459986.87	453617.86	19.00
19-12	1459999.44	453589.74	19.00
19-13	1460011.65	453563.23	19.00
20-1	1459220.06	453534.21	20.00
20-2	1459320.94	453636.06	20.00
20-3	1459403.04	453682.77	20.00
20-4	1459484.04	453677.73	17.00
20-5	1459521.74	453658.93	20.00
20-6	1459645.07	453650.75	20.00
20-7	1459697.86	453623.49	20.00
20-8	1459828.08	453606.59	20.00
20-9	1459916.56	453586.96	20.00
20-10	1459999.24	453546.18	20.00
21-1	1459195.51	453486.80	21.00
21-2	1459245.79	453519.42	21.00
21-3	1459302.75	453599.82	21.00
21-4	1459325.50	453605.21	21.00
21-5	1459462.80	453600.02	21.00
21-6	1459522.97	453607.41	21.00
21-7	1459629.73	453599.63	21.00
21-8	1459681.53	453582.40	21.00
21-9	1459796.10	453561.37	21.00
21-10	1459988.09	453532.65	21.00
22-1	1459180.07	453463.88	22.00
22-2	1459219.98	453466.07	22.00
22-3	1459231.06	453470.39	22.00
22-4	1459262.99	453499.76	22.00
22-5	1459284.18	453532.40	22.00
22-6	1459308.88	453558.49	22.00
22-7	1459321.61	453564.32	22.00

FINAL COVER CONTROL POINT COORDINATES

POINT	EASTING	NORTHING	ELEVATION
22-8	1459361.96	453556.14	22.00
22-9	1459406.12	453549.08	22.00
22-10	1459466.24	453554.57	19.00
22-11	1459535.33	453543.17	22.00
22-12	1459652.96	453531.18	19.00
22-13	1459905.43	453501.33	22.00
22-14	1459979.74	453518.09	22.00
23-1	1459160.56	453440.29	23.00
23-2	1459222.40	453448.89	20.00
23-3	1459350.00	453486.20	23.00
23-4	1459452.78	453502.33	20.00
23-5	1459589.51	453494.86	23.00
23-6	1459719.27	453470.25	23.00
23-7	1459816.09	453464.19	23.00
23-8	1459859.93	453473.09	23.00
23-9	1459898.63	453469.99	23.00
23-10	1459975.16	453509.34	23.00
24-1	1459153.99	453430.19	24.00
24-2	1459230.88	453435.41	24.00
24-3	1459602.59	453448.26	24.00
24-4	1459806.98	453434.21	24.00
24-5	1459879.87	453443.41	24.00
24-6	1459965.77	453499.12	24.00
25-1	1459145.58	453418.93	25.00
25-2	1459230.41	453423.80	25.00
25-3	1459377.01	453393.57	25.00
25-4	1459506.31	453389.36	25.00
25-5	1459600.62	453408.34	25.00
25-6	1459815.85	453402.89	25.00
26-1	1459254.10	453391.12	26.00
26-2	1459343.27	453349.78	26.00
26-3	1459421.08	453330.25	26.00
26-4	1459648.81	453333.20	26.00
26-5	1459741.55	453348.98	26.00
26-6	1459791.40	453372.70	26.00

REVETMENT CONTROL POINT COORDINATES

POINT	EASTING	NORTHING	TOP OF RIPRAP ELEVATION (FT.)
A-1	1459648.27	454104.74	15.00
A-3	1459706.42	454126.26	-0.38
B-1	1459669.87	453968.27	15.00
B-3	1459706.81	454015.55	0.00
B-4	1459722.49	454035.63	-0.92
C-1	1459769.00	453941.19	15.00
C-3	1459784.90	454001.11	-0.40
D-1	1459823.63	453933.06	15.00
D-3	1459832.53	453995.31	-0.71
E-1	1459956.62	453878.33	15.00
E-4	1459944.99	453923.84	2.23
E-5	1459935.47	453961.05	0.00
F-1	1460026.69	453962.45	15.00
F-3	1460006.79	454014.55	1.02
F-4	1459983.97	454074.31	-2.27
G-1	1460083.25	453974.91	15.00
G-3	1460087.85	454040.56	-1.46
G-4	1460087.85	454065.03	-2.43
H-1	1460160.41	453938.16	15.00
H-3	1460171.19	453997.18	0.00
H-4	1460173.69	454010.87	-1.19
I-1	1460261.91	453879.72	15.00
I-3	1460268.13	453946.18	-1.65
J-1	1460369.67	453936.62	11.00
J-3	1460326.49	453970.55	-2.87

Hunters Point Shipyard

REGISTERED PROFESSIONAL ENGINEER STEPHEN WELLS FOSTER No. C 047281 Exp. 31 Dec 09 CIVIL STATE OF CALIFORNIA

DCN: [illegible]

SYMBOL	DESCRIPTION	PREP.BY	DATE	APPROVED

REVISIONS

PREPARED BY: ChaduxTt JV

DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RECHECKED BY:
APPROVED BY:
DATE: 12/09/2009

SIZE D
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT
SCALE REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND CONTROL POINTS

CODE IDENT. NO.

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

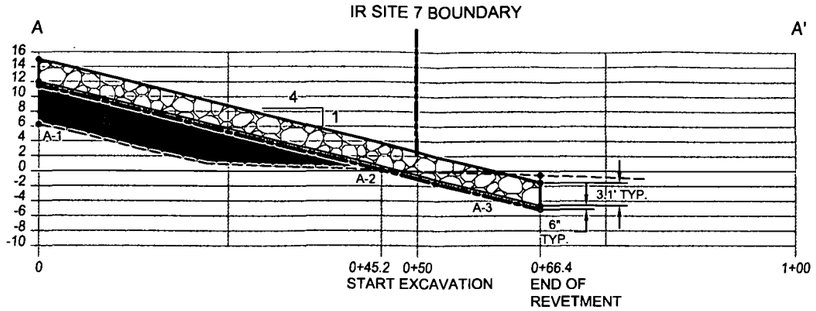
CONSTR. CONTR. NO.
N62473-09-D-2608

SPECIFICATION
(D.O. –)

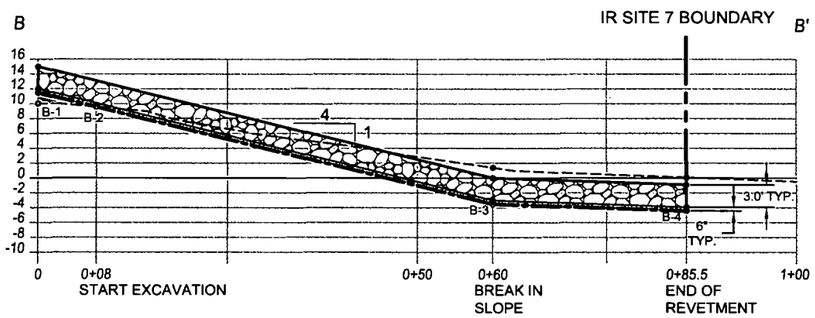
NAVFAC DWG. NO.

DWG. NO.
C4

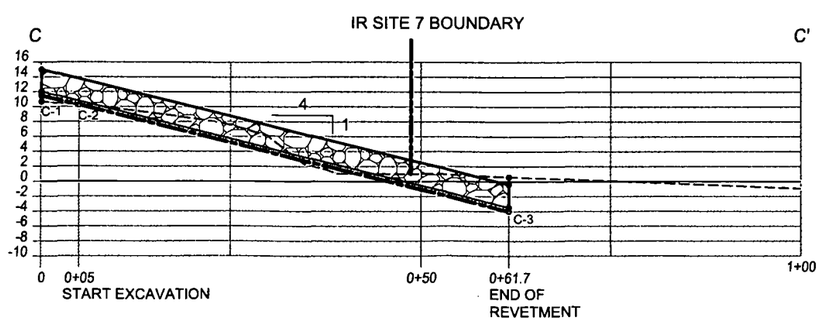
SHEET 5 OF 13



POINT	EASTING	NORTHING	ELEVATION			
			EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
A-1	1459655.37	454046.72	6.26	15.00	12.00	11.50
A-2	1459699.86	454054.86	0.14	--	--	--
A-3	1459720.69	454058.67	-0.56	-1.56	-4.56	-4.06



POINT	EASTING	NORTHING	ELEVATION			
			EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
B-1	1459669.87	453968.27	10.04	15.00	12.00	11.50
B-2	1459674.56	453974.29	9.36	--	--	--
B-3	1459706.81	454015.55	1.41	0.00	-3.00	-3.50
B-4	1459722.49	454035.63	0.08	-0.92	-3.92	-4.42



POINT	EASTING	NORTHING	ELEVATION			
			EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
C-1	1459769.00	453941.19	10.67	15.00	12.00	11.50
C-2	1459770.28	453946.01	10.00	–	–	–
C-3	1459784.90	454001.11	0.60	-0.40	-3.40	-3.90

NOTE:
ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.

NOTES:

1. POINTS A-2, B-2, AND C-2 CORRESPOND TO SHORELINE EXCAVATION START. GRADE ACCORDINGLY SLOPE 4H:1V.
2. AT ELEVATIONS ABOVE MHHW COVER FILL MATERIAL TO BE USED.
3. COMPACT FILL UNDER REVETMENT TO AT LEAST 90% OF MAX. DRY DENSITY BASED ON PROCTOR ASTM D1557.
4. GRADE UPPER BANK OF SHORELINE TO A SLOPE OF 4H:1V AND EXTEND GRADE OFF SHORE TO A POINT WHERE THE COMPLETED REVETMENT TOE WILL BE AT LEAST 1 FT BELOW THE EXISTING GRADE. WHERE NECESSARY EXTEND THE EXCAVATION TO THE PROPERTY BOUNDARY FOLLOWING THE EXISTING GRADE TO A DEPTH SO THAT THE COMPLETED REVETMENT TOE WILL BE AT LEAST 1 FT BELOW THE EXISTING GRADE AT THE PROPERTY BOUNDARY.
5. AT ELEVATIONS LESS THAN MHHW FILL MATERIAL USED TO MEET THE PRESCRIBED GRADE SHOULD BE OF SIMILAR MATERIAL AS EXISTING OR FILTER ROCK MAY BE USED. IF FILTER ROCK IS USED COMPACTION IS NOT NECESSARY.
6. EXCAVATED SOIL AND SEDIMENT REQUIRES SCREENING FOR RADIONUCLIDES PRIOR TO PLACEMENT ON SITE. MINIMIZE EXCAVATION VOLUMES TO THE EXTENT POSSIBLE.
7. SHORELINE EXCAVATIONS ARE NOT TO BE EXPOSED TO INCOMING TIDAL WATER WITHOUT STABILIZATION.
8. CONSTRUCT REVETMENT OFF SHORE AND ALONG SHORE TO AT LEAST THE PROPERTY BOUNDARY.
9. CREST OF REVETMENT MEETS THE FINAL COVER GRADE AT ELEVATION +15 FT MSL.

TIDAL RANGES AND ELEVATION DATUMS

Tidal Datum	Reference Datum		
	MLLW	NGVD 1929	MSL
Extreme	+9.7	+6.58	+6.14
MHHW	+6.73	+3.61	+3.17
MHW	+6.10	+2.98	+2.54
MSL	+3.56	+0.44	0
NGVD	+3.12	0	-0.44
MLW	+1.12	-2.06	-2.44
MLLW	0	-3.12	-3.56

EXAMPLE: MSL = MLLW + 3.56 (REF: MLLW)

LEGEND

- TOP OF RIPRAP
- EXISTING GRADE
- GEOTEXTILE FILTER FABRIC
- EXCAVATION AREA
- CLEAN FILL AREA
- RIPRAP (3' THICK)
- 6" FILTER ROCK

MHHW	MEAN HIGHER HIGH WATER
MHW	MEAN HIGH WATER
MSL	MEAN SEA LEVEL
NGVD	NATIONAL GEODETIC VERTICAL DATUM
MLW	MEAN LOW WATER
MLLW	MEAN LOWER LOW WATER

10' 0 10' 20'
SCALE IN FEET

Hunters Point Shipyard
Site 7
REGISTERED PROFESSIONAL ENGINEER
STEPHEN WELLS FISHER
No. C 047281
Exp. 31 Dec 09
CIVIL
STATE OF CALIFORNIA
DCN: CHED 1 10315 0024

SYMBOL	DESCRIPTION	PREP.BY	DATE	APPROVED

REVISION

PREPARED BY: ChaduxTt JV
DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RECHECKED BY:
APPROVED BY:
DATE: 12/09/2009

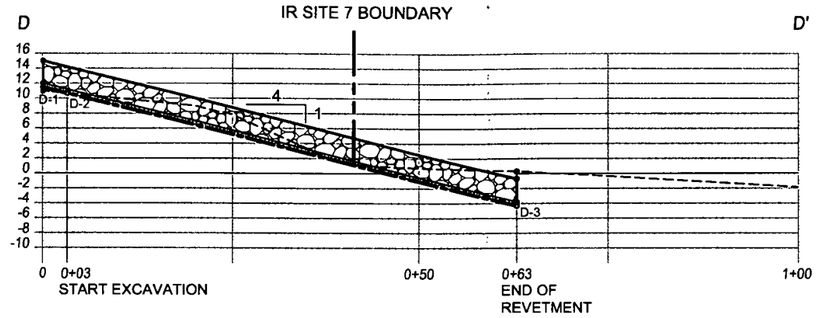
SIZE D
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT
SCALE REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

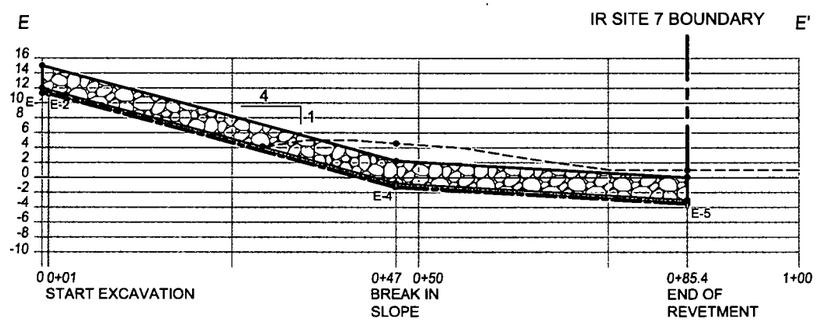
IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
SHORELINE AND REVETMENT CROSS-SECTIONS A, B, AND C

CODE IDENT. NO.
PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California
CONSTR. CONTR. NO.
N62473-09-D-2608
SPECIFICATION
(D.O. –)
NAVFAC DWG. NO.
DWG. NO.
C5
SHEET 6 OF 13

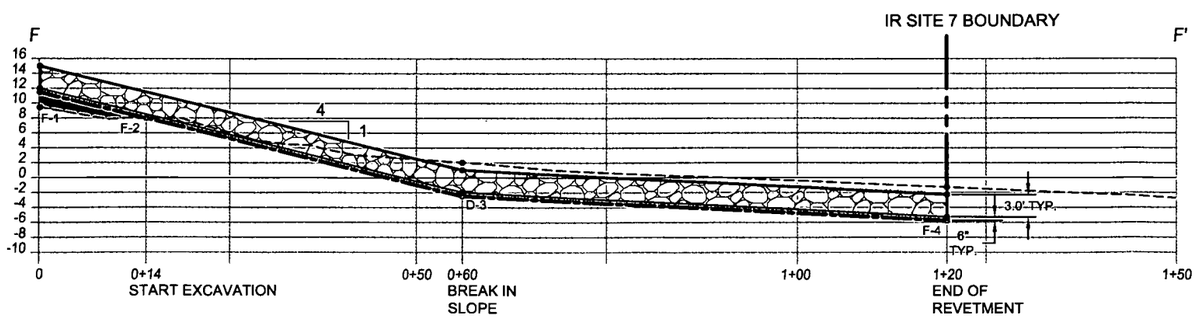
R:\Navy\Hunters-Pt\Parcel B\r07_lr08\Preliminary Design\ C5-6-7- Shore Line Cross Sections.dwg 12/09/2009 deborah.ford DN



POINT	EASTING	NORTHING	ELEVATION			
			EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
D-1	1459823.63	453933.06	11.00	15.00	12.00	11.50
D-2	1459824.09	453936.29	10.40	--	--	--
D-3	1459832.53	453995.31	0.30	-0.71	-3.71	-4.21



POINT	EASTING	NORTHING	ELEVATION			
			EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
E-1	1459956.62	453878.33	11.28	15.00	12.00	11.50
E-2	1459956.37	453879.30	11.06	--	--	--
E-3	1459949.41	453906.53	4.16	--	--	--
E-4	1459944.99	453923.84	4.59	2.23	-0.76	-1.26
E-5	1459935.47	453961.05	1.00	0.00	-3.00	-3.50



POINT	EASTING	NORTHING	ELEVATION			
			EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
F-1	1460026.69	453962.45	9.46	15.00	12.00	11.50
F-2	1460021.68	453975.56	8.00	--	--	--
F-3	1460006.79	454014.55	2.02	1.02	-1.98	-2.52
F-4	1459983.97	454074.31	-1.27	-2.27	-5.27	-5.77

NOTE:
ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.

10' 0 10' 20'
SCALE IN FEET

TIDAL RANGES AND ELEVATION DATUMS

Tidal Datum	Reference Datum		
	MLLW	NGVD 1929	MSL
Extreme	+9.7	+6.58	+6.14
MHHW	+6.73	+3.61	+3.17
MHW	+6.10	+2.98	+2.54
MSL	+3.56	+0.44	0
NGVD	+3.12	0	-0.44
MLW	+1.12	-2.06	-2.44
MLLW	0	-3.12	-3.56

EXAMPLE: MSL = MLLW + 3.56 (REF: MLLW)

NOTES:

1. POINTS D-2, E-2, AND F-2 CORRESPOND TO SHORELINE EXCAVATION START. GRADE ACCORDINGLY SLOPE 4H:1V.
2. AT ELEVATIONS ABOVE MHHW COVER FILL MATERIAL TO BE USED.
3. COMPACT FILL UNDER REVETMENT TO AT LEAST 90% OF MAX. DRY DENSITY BASED ON PROCTOR ASTM D1557.
4. GRADE UPPER BANK OF SHORELINE TO A SLOPE OF 4H:1V AND EXTEND GRADE OFF SHORE TO A POINT WHERE THE COMPLETED REVETMENT TOE WILL BE AT LEAST 1 FT BELOW THE EXISTING GRADE. WHERE NECESSARY EXTEND THE EXCAVATION TO THE PROPERTY BOUNDARY FOLLOWING THE EXISTING GRADE TO A DEPTH SO THAT THE COMPLETED REVETMENT TOE WILL BE AT LEAST 1 FT BELOW THE EXISTING GRADE AT THE PROPERTY BOUNDARY.
5. AT ELEVATIONS LESS THAN MHHW FILL MATERIAL USED TO MEET THE PRESCRIBED GRADE SHOULD BE OF SIMILAR MATERIAL AS EXISTING OR FILTER ROCK MAY BE USED. IF FILTER ROCK IS USED COMPACTION IS NOT NECESSARY.
6. EXCAVATED SOIL AND SEDIMENT REQUIRES SCREENING FOR RADIONUCLIDES PRIOR TO PLACEMENT ON SITE. MINIMIZE EXCAVATION VOLUMES TO THE EXTENT POSSIBLE.
7. SHORELINE EXCAVATIONS ARE NOT TO BE EXPOSED TO INCOMING TIDAL WATER WITHOUT STABILIZATION.
8. CONSTRUCT REVETMENT OFF SHORE AND ALONG SHORE TO AT LEAST THE PROPERTY BOUNDARY.
9. CREST OF REVETMENT MEETS THE FINAL COVER GRADE AT ELEVATION +15 FT MSL.

LEGEND

- TOP OF RIPRAP
- EXISTING GRADE
- GEOTEXTILE FILTER FABRIC
- EXCAVATION AREA
- CLEAN FILL AREA
- RIPRAP (3' THICK)
- 6" FILTER ROCK
- MHHW MEAN HIGHER HIGH WATER
- MHW MEAN HIGH WATER
- MSL MEAN SEA LEVEL
- NGVD NATIONAL GEODETIC VERTICAL DATUM
- MLW MEAN LOW WATER
- MLLW MEAN LOWER LOW WATER

Hunters Point Shipyard
REGISTERED PROFESSIONAL ENGINEER STEPHEN WELLS FIGER No. C 047281 Exp. 31 Dec 09 CIVIL STATE OF CALIFORNIA
DCN: CHAD-[illegible]-0024

REVISIONS

SYMBOL	DESCRIPTION	PREP.BY	DATE	APPROVED

PREPARED BY: ChaduxTt JV
DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RECHECKED BY:
APPROVED BY:
DATE: 12/09/2009

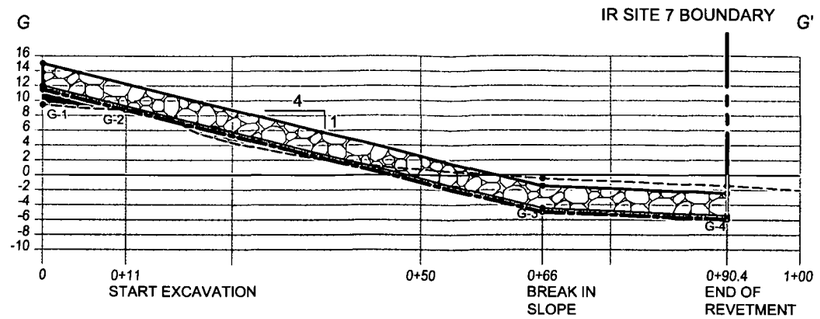
SIZE D
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT
SCALE REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

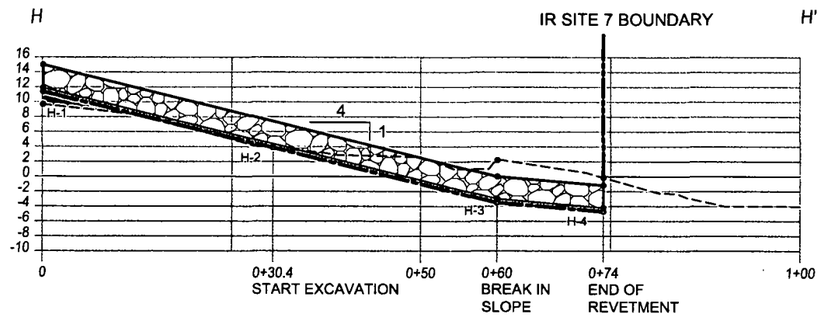
IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
CROSS-SECTIONS D, E, AND F

CODE IDENT. NO.
PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California
CONSTR. CONTR. NO.
N62473-09-D-2608
SPECIFICATION
(D.O. –)
NAVFAC DWG. NO.
DWG. NO.
C8
SHEET 7 OF 13

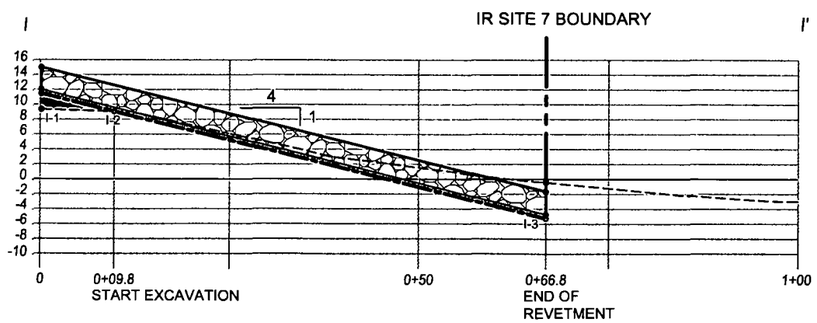
R:\Navy\Hunters-Pt\Phase B\r07_r08\Preliminary Design\ C5-6-7- Shore Line Cross Sections.dwg 12/09/2009 deborah.ford DN



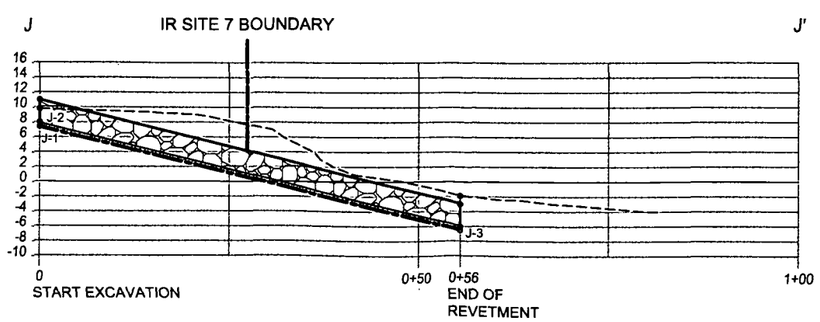
POINT	EASTING	NORTHING	EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
			ELEVATION			
G-1	1460083.25	453974.91	9.45	15.00	12.00	11.50
G-2	1460084.02	453985.89	8.76	–	–	–
G-3	1460087.85	454040.56	-0.46	-1.46	-4.46	-4.96
G-4	1460087.85	454065.03	-1.43	-2.43	-5.43	-5.93



POINT	EASTING	NORTHING	EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
			ELEVATION			
H-1	1460160.41	453938.16	9.67	15.00	12.00	11.50
H-2	1460165.87	453968.07	3.47	–	–	–
H-3	1460171.19	453997.18	2.21	0.00	-3.00	-3.50
H-4	1460173.69	454010.87	-0.19	-1.19	-4.19	-4.69



POINT	EASTING	NORTHING	EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
			ELEVATION			
I-1	1460261.91	453879.72	9.35	15.00	12.00	11.50
I-2	1460262.82	453889.47	9.00	–	–	–
I-3	1460268.13	453946.18	-0.65	-1.65	-4.65	-5.15



POINT	EASTING	NORTHING	EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
			ELEVATION			
J-1	1460369.67	453936.62	9.79	11.00	8.00	7.50
J-2	1460369.67	453936.62	9.79	–	–	–
J-3	1460326.49	453970.55	-1.87	-2.87	–5.87	-5.37

NOTE:
ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.

10' 0 10' 20'
SCALE IN FEET

NOTES:

1. POINTS G-2, H-2, I-2, AND J-2 CORRESPOND TO SHORELINE EXCAVATION START. GRADE ACCORDINGLY SLOPE 4H:1V.
2. AT ELEVATIONS ABOVE MHHW COVER FILL MATERIAL TO BE USED.
3. COMPACT FILL UNDER REVETMENT TO AT LEAST 90% OF MAX. DRY DENSITY BASED ON PROCTOR ASTM D1557.
4. GRADE UPPER BANK OF SHORELINE TO A SLOPE OF 4H:1V AND EXTEND GRADE OFF SHORE TO A POINT WHERE THE COMPLETED REVETMENT TOE WILL BE AT LEAST 1 FT BELOW THE EXISTING GRADE. WHERE NECESSARY EXTEND THE EXCAVATION TO THE PROPERTY BOUNDARY FOLLOWING THE EXISTING GRADE TO A DEPTH SO THAT THE COMPLETED REVETMENT TOE WILL BE AT LEAST 1 FT BELOW THE EXISTING GRADE AT THE PROPERTY BOUNDARY.
5. AT ELEVATIONS LESS THAN MHHW FILL MATERIAL USED TO MEET THE PRESCRIBED GRADE SHOULD BE OF SIMILAR MATERIAL AS EXISTING OR FILTER ROCK MAY BE USED. IF FILTER ROCK IS USED COMPACTION IS NOT NECESSARY.
6. EXCAVATED SOIL AND SEDIMENT REQUIRES SCREENING FOR RADIONUCLIDES PRIOR TO PLACEMENT ON SITE. MINIMIZE EXCAVATION VOLUMES TO THE EXTENT POSSIBLE.
7. SHORELINE EXCAVATIONS ARE NOT TO BE EXPOSED TO INCOMING TIDAL WATER WITHOUT STABILIZATION.
8. CONSTRUCT REVETMENT OFF SHORE AND ALONG SHORE TO AT LEAST THE PROPERTY BOUNDARY.
9. CREST OF REVETMENT MEETS THE FINAL COVER GRADE AT ELEVATION +15 FT MSL.

TIDAL RANGES AND ELEVATION DATUMS

Tidal Datum	Reference Datum		
	MLLW	NGVD 1929	MSL
Extreme	+9.7	+6.58	+6.14
MHHW	+6.73	+3.61	+3.17
MHW	+6.10	+2.98	+2.54
MSL	+3.56	+0.44	0
NGVD	+3.12	0	-0.44
MLW	+1.12	-2.06	-2.44
MLLW	0	-3.12	-3.56

EXAMPLE: MSL = MLLW + 3.56 (REF: MLLW)

LEGEND

- TOP OF RIPRAP
- EXISTING GRADE
- GEOTEXTILE FILTER FABRIC
- EXCAVATION AREA
- CLEAN FILL AREA
- RIPRAP (3' THICK)
- 6" FILTER ROCK

MHHW	MEAN HIGHER HIGH WATER
MHW	MEAN HIGH WATER
MSL	MEAN SEA LEVEL
NGVD	NATIONAL GEODETIC VERTICAL DATUM
MLW	MEAN LOW WATER
MLLW	MEAN LOWER LOW WATER

Hunters Point Shipyard
Site 7
REGISTERED PROFESSIONAL ENGINEER STEPHEN WELLS FISHER No. C 047281 Exp. 31 Dec 09 CIVIL STATE OF CALIFORNIA
DCN: CHAD 5211-0319-0026

SYMBOL	DESCRIPTION	PREP.BY	DATE	APPROVED

REVISION

PREPARED BY: ChaduxTt JV
DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RECHECKED BY:
APPROVED BY:
DATE: 12/09/2009

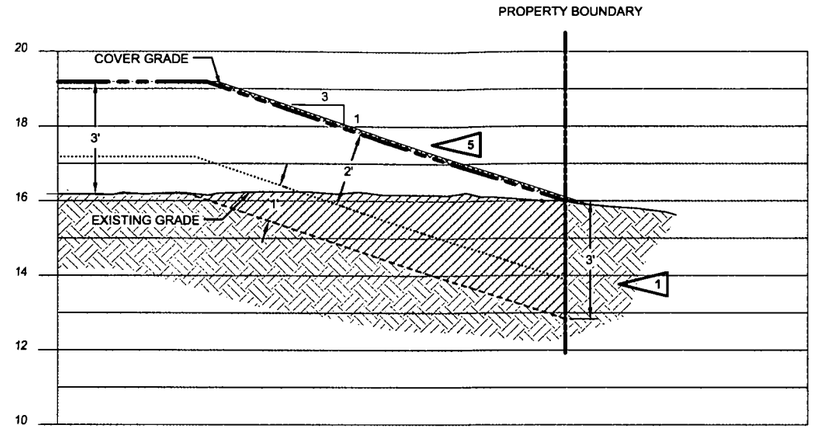
SIZE D
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT
SCALE REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
SHORELINE AND REVETMENT CROSS-SECTIONS G, H, I, AND J

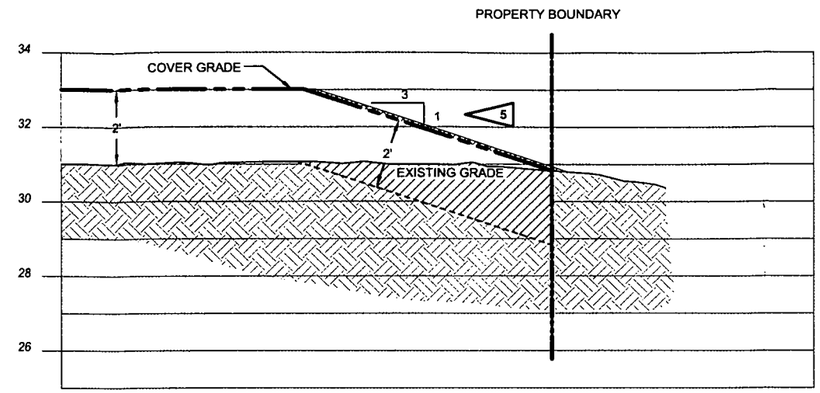
CODE IDENT. NO.
PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California
CONSTR. CONTR. NO.
N62473-09-D-2608
SPECIFICATION
(D.O. –)
NAVFAC DWG. NO.
DWG. NO.
C7
SHEET 8 OF 13

R:\Navy\Hunters-Pt\Parcel B\r07_Jr08\Preliminary Design\ C5-6-7- Shore Line Cross Sections.dwg 12/09/2009 deborah.ford DN



A C2 C8 WEST BOUNDARY 3 FT. COVER CROSS-SECTION (TYP.)

SCALE: 1" = 2'-0"

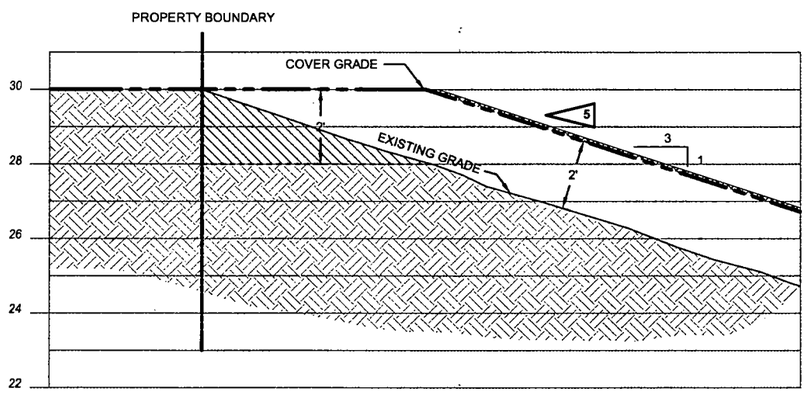


B C2 C8 WEST BOUNDARY 2 FT. COVER CROSS-SECTION (TYP.)

SCALE: 1" = 2'-0"

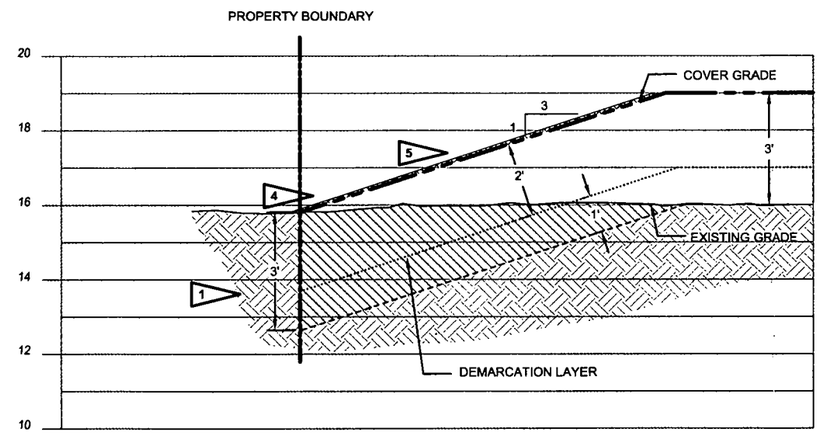
NOTE:

1. DEMARCATION LAYER TO EXTEND TO SITE BOUNDARY.
2. COVER FILL COMPOSED OF COMPACTED SOIL LAYER AND EROSION RESISTANT LAYER.
3. OFF-SITE BOUNDARY ELEVATIONS ARE APPROXIMATE.
4. UTILIZE EXCESS GRAVEL, CRUSHED ROCK, AND OTHER MATERIAL AND EXISTING SIMILAR SITE MATERIAL AS EROSION RESISTANT ARMORING ALONG SIDE SLOPE FOR THE NORTHERN PORTION OF THE SOUTHEAST PROPERTY BOUNDARY.
5. INSTALL CTRM ON SLOPED PORTION OF COVER TO OFF-SITE BOUNDARY.
6. MAINTAIN EXISTING CHANNEL BED SLOPE AND CROSS-SECTION GEOMETRY. REPLACE EXISTING ARMORING MATERIAL WITH SIMILAR MATERIAL OR REUSE EXISTING.



C C2 C8 EAST BOUNDARY 2 FT. COVER CROSS-SECTION (TYP.)

SCALE: 1" = 2'-0"



D C2 C8 EAST BOUNDARY 3 FT. COVER CROSS-SECTION (TYP.)

SCALE: 1" = 2'-0"

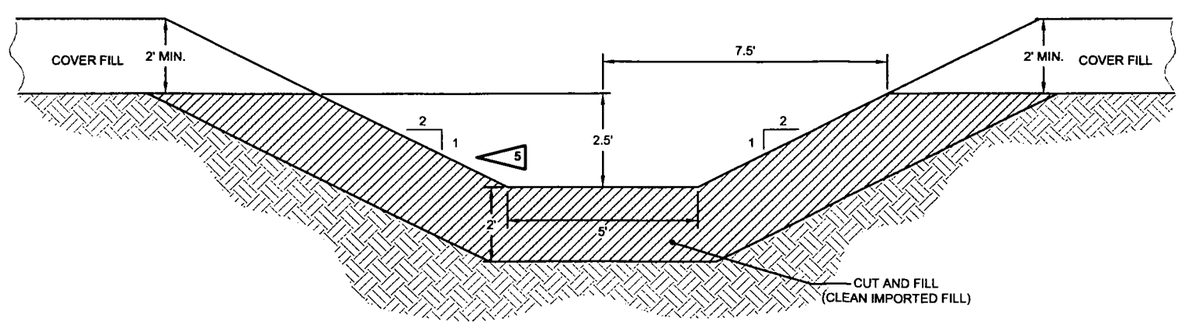
LEGEND

- EXISTING SURFACE
- DEMARCATION LAYER
- FINAL COVER SURFACE
- EXCAVATION SURFACE
- CTRM
- EXISTING
- PROPOSED COVER FILL
- PROPOSED EXCAVATION

TIDAL RANGES AND ELEVATION DATUMS

Tidal Datum	Reference Datum		
	MLLW	NGVD 1929	MSL
Extreme	+9.7	+6.58	+6.14
MHHW	+6.73	+3.61	+3.17
MHW	+6.10	+2.98	+2.54
MSL	+3.56	+0.44	0
NGVD	+3.12	0	-0.44
MLW	+1.12	-2.06	-2.44
MLLW	0	-3.12	-3.56

ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.



E C2 C8 CHANNEL CROSS-SECTION

SCALE: 1" = 2'-0"

NOTE:

ALL DIMENSIONS APPROXIMATE.

2' 0 2' 4'

SCALE: 1" = 2'-0"

Hunters Point Shipyard

Sites 7 & 18

REGISTERED PROFESSIONAL ENGINEER STEPHEN WELLS FISHER No. C 047281 Exp. 31 Dec 09 CIVIL STATE OF CALIFORNIA

DCN: CHAD-[illegible]-0024

REVISIONS

SYMBOL	DESCRIPTION	PREP. BY	DATE	APPROVED

PREPARED BY: ChaduxTt JV

DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RE-CHECKED BY:
APPROVED BY:
DATE: 12/09/2009

SIZE D
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT
SCALE REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
SAN DIEGO, CALIFORNIA

BRAC PMO WEST

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
SOIL COVER BOUNDARY CROSS-SECTIONS
DETAILS A, B, C, AND D

CODE IDENT. NO.

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

CONSTR. CONTR. NO.
N62473-09-D-2608

SPECIFICATION
(D.O. –)

NAVFAC DWG. NO.

DWG. NO.
C8

SHEET 9 OF 13

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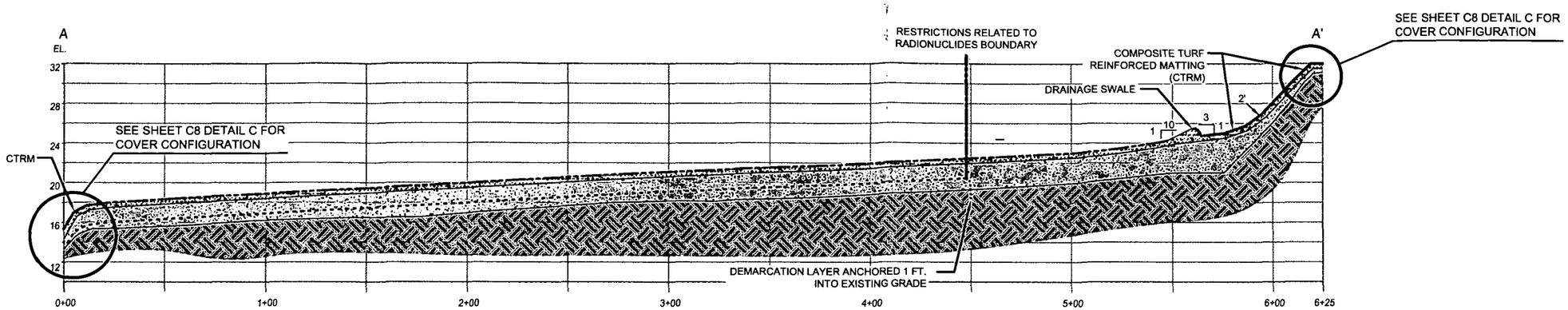
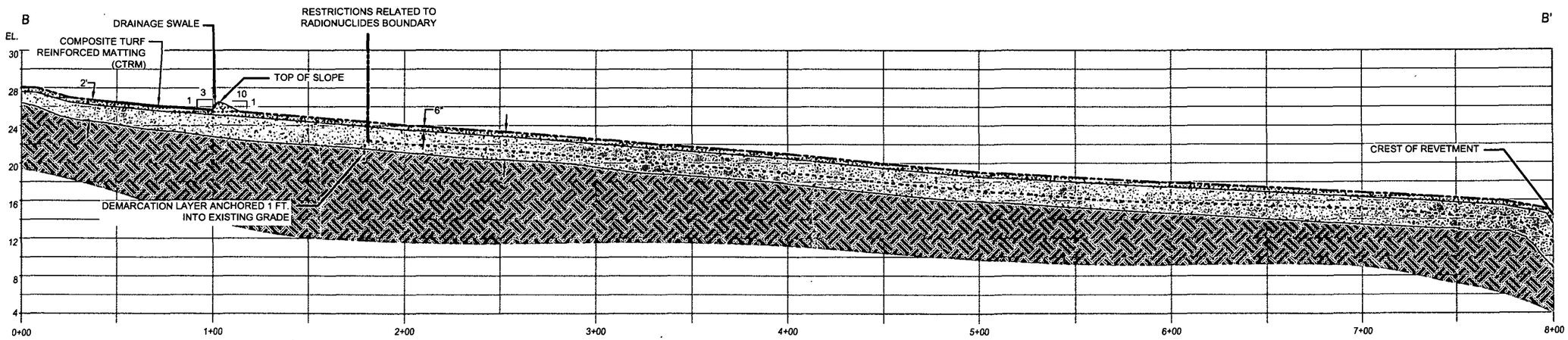


A–A' C3 C9 COVER CROSS SECTION A-A' (TYP.)

HORIZONTAL SCALE: 1" = 30'
VERTICAL SCALE: 1" = 6'



B–B' C3 C9 COVER CROSS SECTION B-B' (TYP.)

HORIZONTAL SCALE: 1" = 30'
VERTICAL SCALE: 1" = 6'

LEGEND

- PROPOSED EROSION RESISTANT LAYER
- PROPOSED COMPACTED COVER LAYER
- EXISTING SURFACE
- DEMARCATION LAYER
- COMPOSITE TURF REINFORCED MATTING
- EL. ELEVATION

NOTE:

1. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.
2. COVER FILL COMPOSED OF COMPACTED SOIL LAYER AND EROSION RESISTANT LAYER.

6' 0 6' 12'
SCALE: 1" = 6'
VERTICAL

30' 0 30' 60'
SCALE: 1" = 30'
HORIZONTAL

Hunters Point Shipyard
Sites 7 & 18
REGISTERED PROFESSIONAL ENGINEER STEPHEN WELLS FISHER No. C 047281 Exp. 31 DEC 09 CIVIL STATE OF CALIFORNIA
DCN: GHD-[illegible]-0019-0034

SYMBOL	DESCRIPTION	PREP.BY	DATE	APPROVED

REVISION

PREPARED BY: ChaduxTt JV

DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RECHECKED BY:
APPROVED BY:
DATE: 12/09/2009

SIZE D
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SCALE REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
SOIL COVER CROSS SECTIONS DETAILS
A-A' AND B-B'

CODE IDENT. NO.

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

CONSTR. CONTR. NO.
N62473-09-D-2608

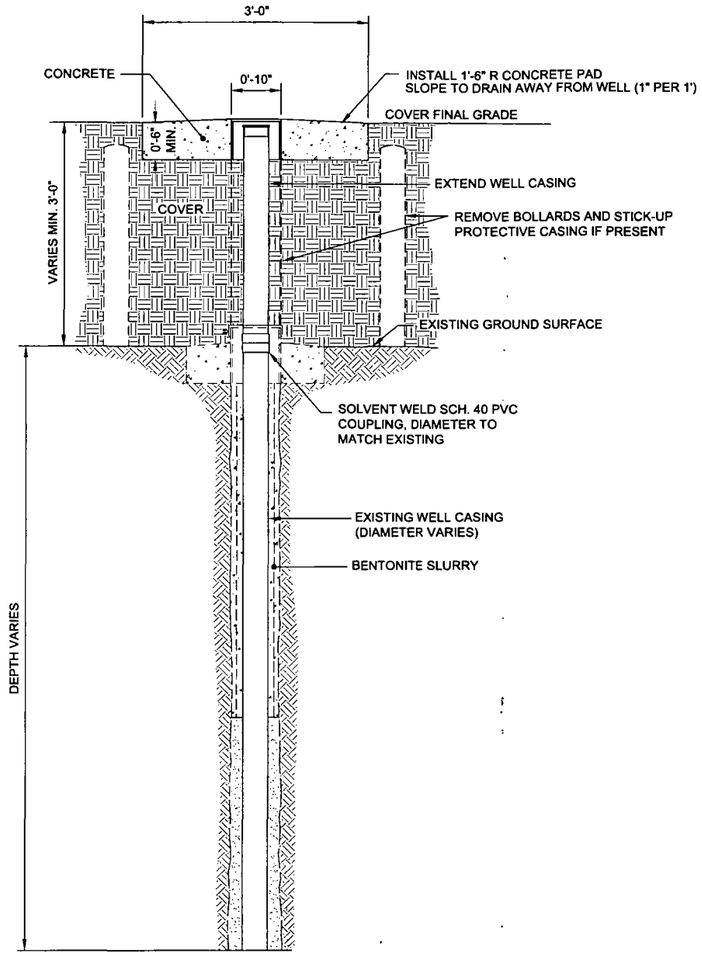
SPECIFICATION
(D.O. –)

NAVFAC DWG. NO.

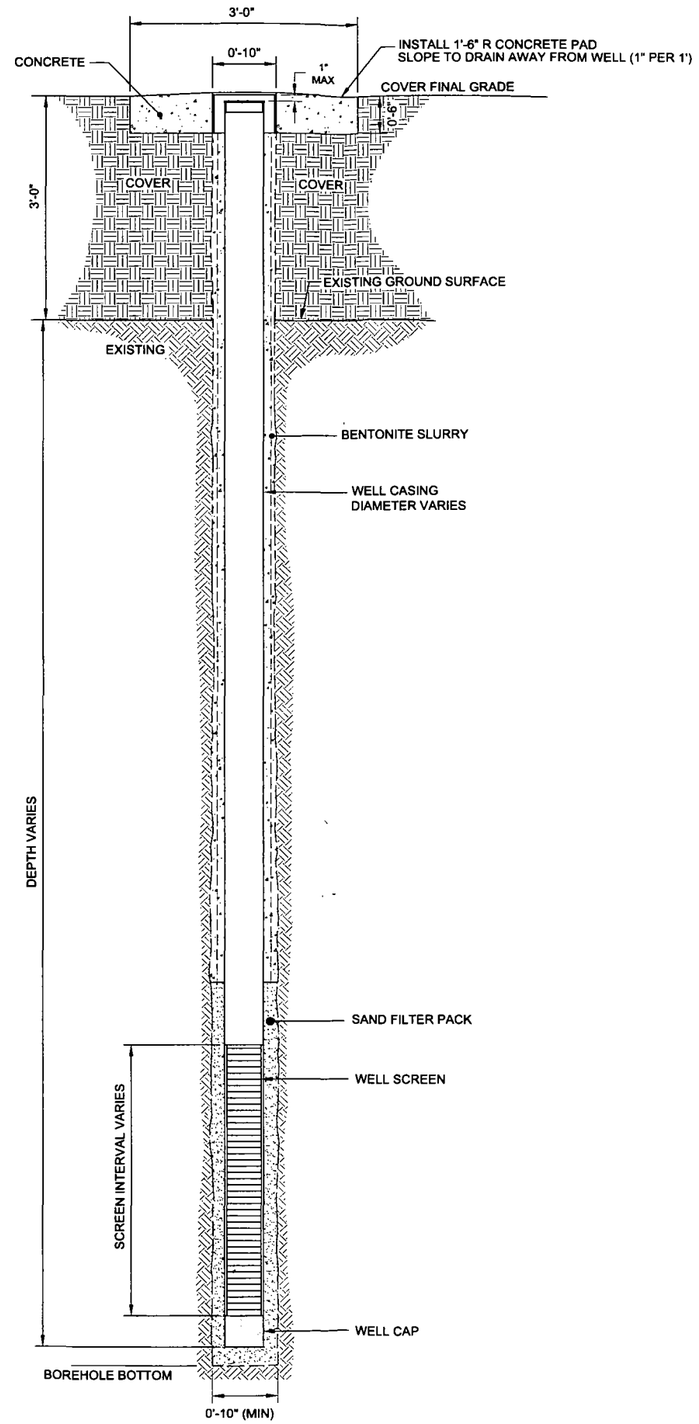
DWG. NO.
C9

SHEET 10 OF 13

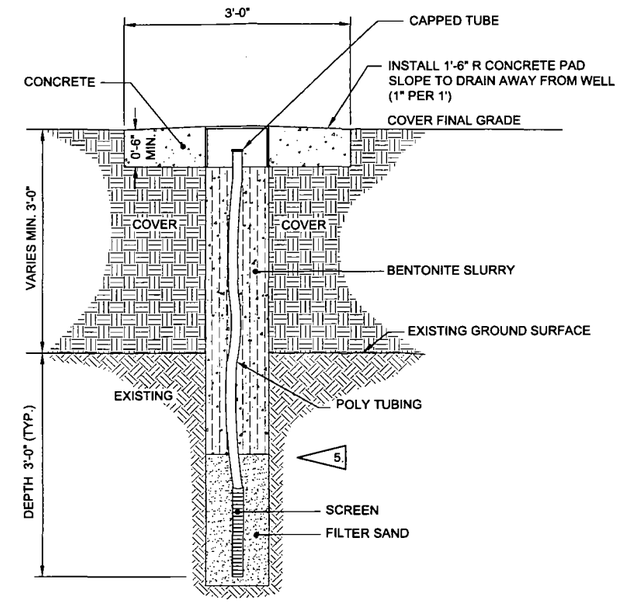
R:\Navy\Hunters-Pt\Parcel B\I07_I08\Preliminary Design\ C9 Cover Cross Sections.dwg 12/09/2009 deborah.ford DN



1 C1 C10 FLUSH MOUNTED MONITORING WELL EXTENSION (TYP.)
FOR ALL EXISTING WELLS IRXXMWXX
SCALE: 1" = 1'-0"



1 C1 C10 NEW FLUSH MOUNTED MONITORING WELL (TYP.)
FOR ALL REPLACEMENT WELLS IRXXMWXX
SCALE: 1" = 1'-0"



2 C1 C10 NEW FLUSH MOUNTED METHANE PROBE (TYP.)
FOR ALL PROBES SG-XX
NOT TO SCALE

NOTE:

1. PROTECT GROUNDWATER MONITORING WELLS AND METHANE MONITORING PROBES AS NECESSARY DURING CONSTRUCTION OF THE COVER.
2. REMOVE CONCRETE PADS AND/OR FLUSH MOUNTED PROTECTIVE CASING IF OBSTRUCTIVE TO THE EXTENSION COUPLING.
3. INSTALL AT ALL WELLS AND PROBES A PERMANENT IDENTIFICATION MARKER TO FACILITATE LOCATING WELLS. MARKER HEIGHT OF AT LEAST 3 FT ABOVE FINAL WELL ELEVATION.
4. SEE C4 FOR EXISTING MONITORING WELL AND METHANE PROBE SCHEDULE.

5. INSTALL FILTER SAND TO 6" ABOVE TOP OF SCREEN

1' 0 1' 2'
SCALE: 1" = 1'-0"

Hunters Point Shipyard
REGISTERED PROFESSIONAL ENGINEER STEPHEN WELLS FOSTER No. C 047281 Exp. 31 DEC 09 CIVIL STATE OF CALIFORNIA
DGN: CTJV 5213-0619-0024

SYMBOL	DESCRIPTION	PREP.BY	DATE	APPROVED

REVISIONS

PREPARED BY: ChaduxTt JV
DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RE-CHECKED BY:
APPROVED BY:
DATE: 12/11/2009

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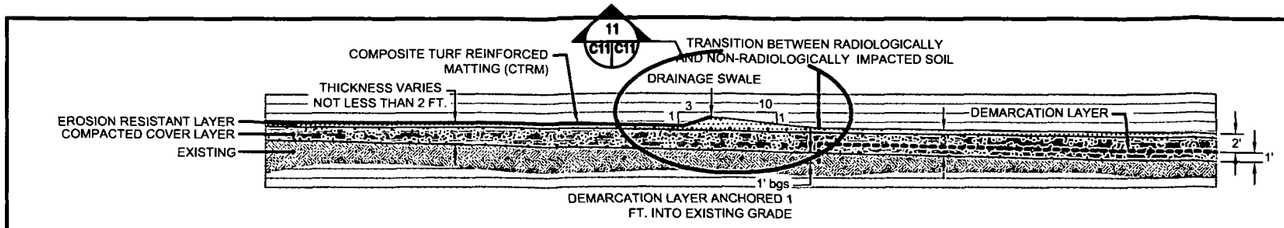
DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
MONITORING WELL AND METHANE MONITORING PROBE EXTENSION DETAILS

CODE IDENT. NO.
PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California
CONSTR. CONTR. NO.
N62473-09-D-2608
SPECIFICATION
(D.O. –)
NAVFAC DWG. NO.
DWG. NO.
C10
SHEET 11 OF 13

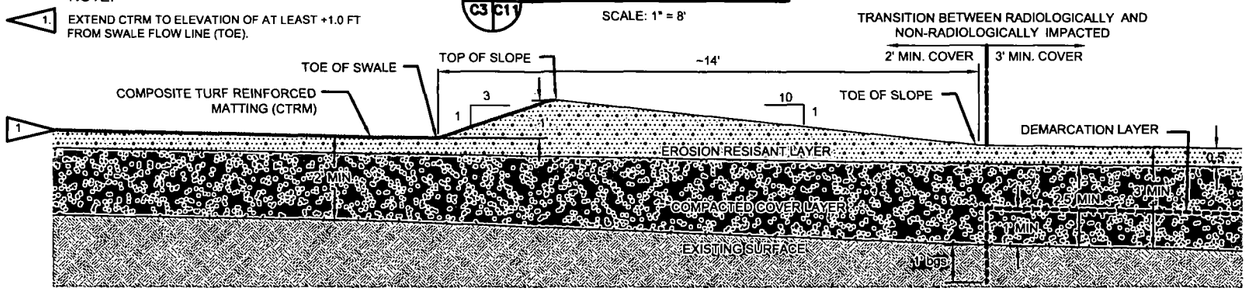


K C3 C11 DRAINAGE SWALE / CHANNEL

SCALE: 1" = 8'

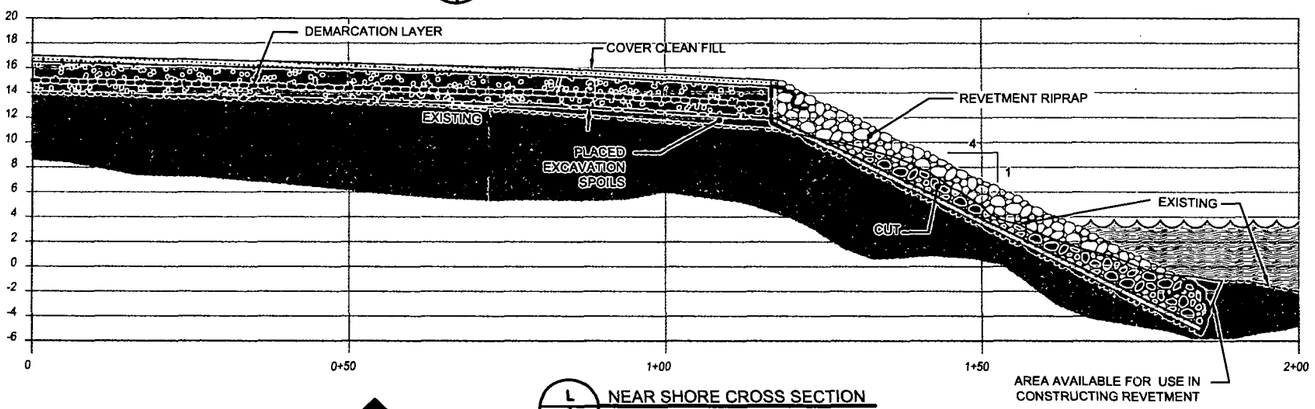
NOTE:

1 EXTEND CTRM TO ELEVATION OF AT LEAST +1.0 FT FROM SWALE FLOW LINE (TOE).



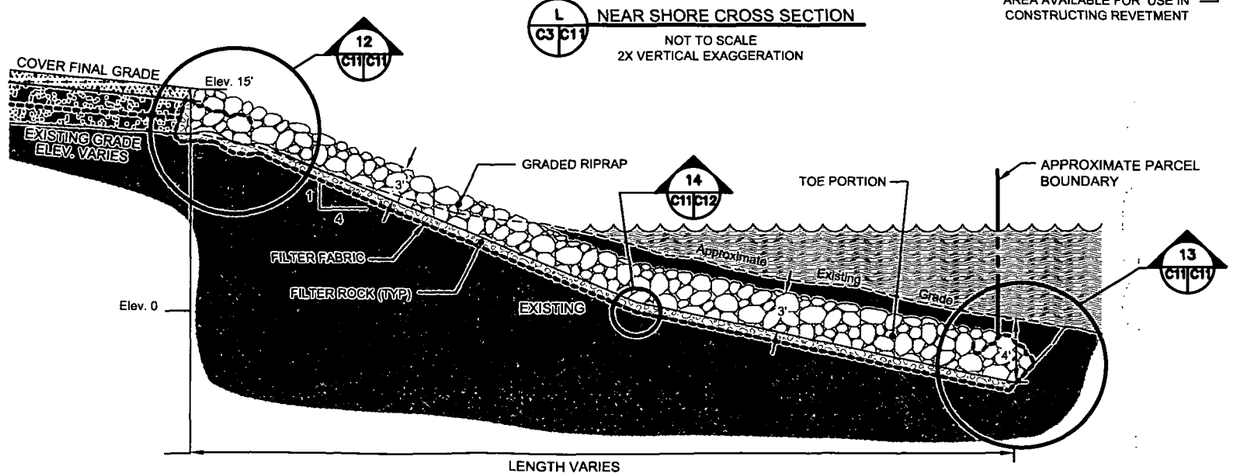
11 C11 C11 DRAINAGE SWALE / CHANNEL DETAIL

SCALE: 1" = 2'



L C3 C11 NEAR SHORE CROSS SECTION

NOT TO SCALE
2X VERTICAL EXAGGERATION

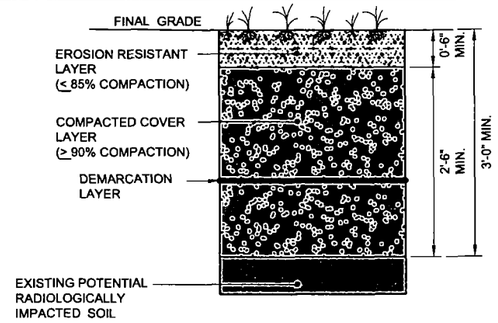


M C3 C11 GENERALIZED REVETMENT CROSS SECTION

NOT TO SCALE

NOTE:

ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.



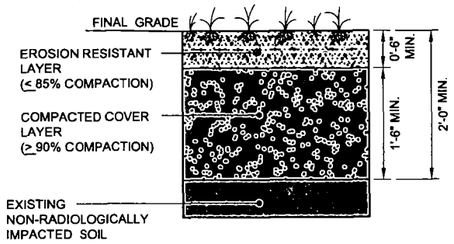
COVER OVER POTENTIAL RADIOLOGICALLY IMPACTED AREA

5 C3 C11 COVER COMPONENTS

SCALE: 1" = 1'-0"

NOTE:

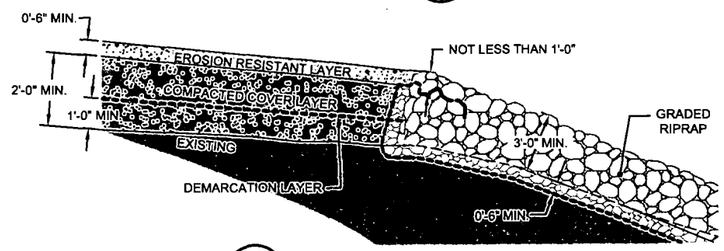
EXCAVATED NON-RADIOLOGICALLY IMPACTED SOIL TO BE PLACED UNDER COMPACTED COVER LAYER.



COVER OVER NON-RADIOLOGICALLY IMPACTED AREA

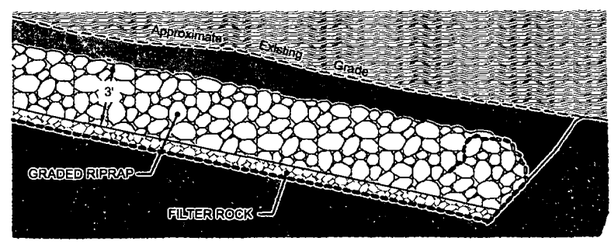
6 C3 C11 COVER COMPONENTS

SCALE: 1" = 1'-0"



12 C11 C11 TIE IN OF FILTER FABRIC AT CREST

SCALE: 1" = 3'-0"



13 C11 C11 TIE IN OF FILTER FABRIC AT TOE

SCALE: 1" = 3'-0"

Hunters Point Shipyard

Sites 7 & 18

REGISTERED PROFESSIONAL ENGINEER STEPHEN WELLS FISHER No. C 047281 Exp. 31 Dec 09 CIVIL STATE OF CALIFORNIA

DCN: CHAD-[illegible]-0019-0074

3' 0 3' 6'
SCALE: 1" = 3'

1' 0 1' 2'
SCALE: 1" = 1'

2' 0 2' 4'
SCALE: 1" = 2'

8' 0 8' 16'
SCALE: 1" = 8'

SYMBOL	DESCRIPTION	PREP.BY	DATE	APPROVED

REVISION

PREPARED BY: ChaduxTt JV

DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RECHECKED BY:
APPROVED BY:
DATE: 12/09/2009

SIZE D
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DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT DETAILS I

CODE IDENT. NO.

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

CONSTR. CONTR. NO.
N62473-09-D-2608

SPECIFICATION
(D.O. –)

NAVFAC DWG. NO.

DWG. NO.
C11

SHEET 12 OF 13

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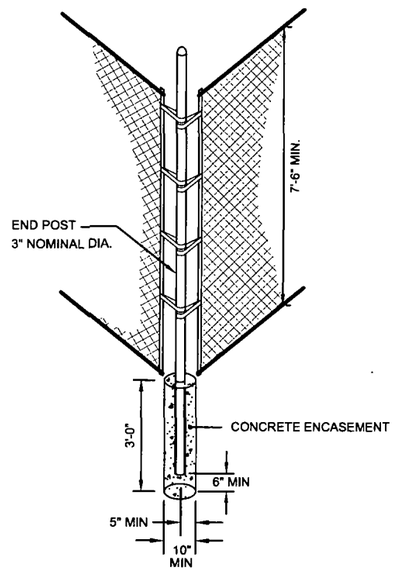
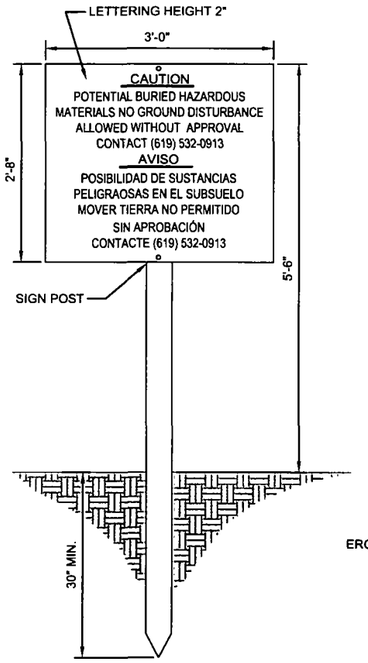
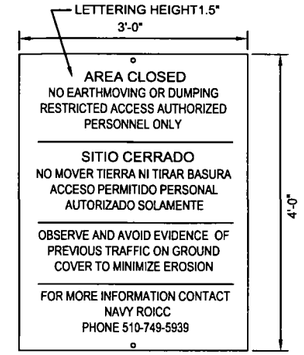


4 C3 C12 FENCE POST DETAIL
SCALE: ½" = 1'-0"

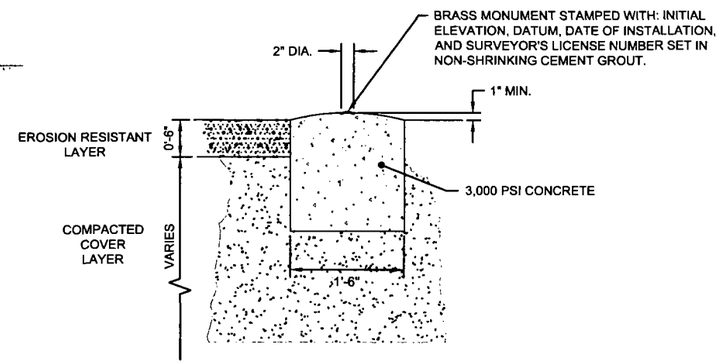
NOTE:
CONCRETE ENCASEMENT OF FENCE POST NOT NECESSARY FOR TEMPORARY FENCE. REMOVE ANY CONCRETE USED OFF NAVY PROPERTY.



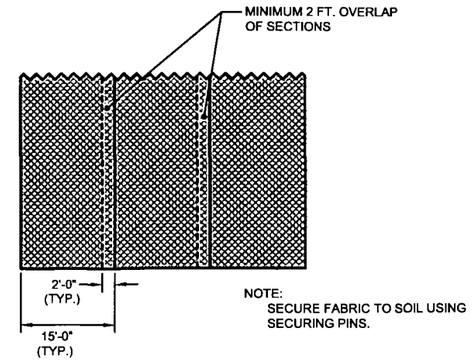
8 C3 C12 WARNING SIGN
SCALE: 1" = 1'-0"



10 C3 C12 ENTRANCE SIGN
SCALE: 1" = 1'-0"

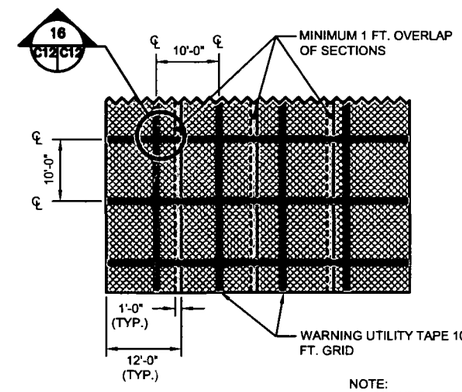


7 C3 C12 MONUMENT (TYP.)
SCALE: 1" = 1'-0"



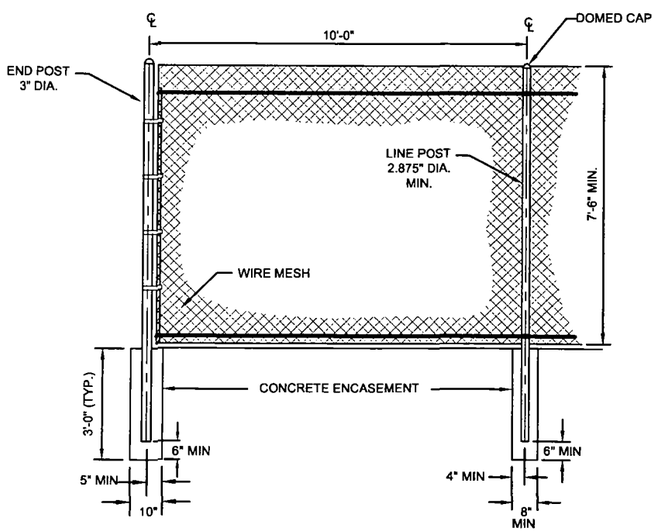
NOTE:
SECURE FABRIC TO SOIL USING SECURING PINS.

14 C12 C12 FILTER FABRIC DETAIL - REVETMENT
SCALE = 1'-0"



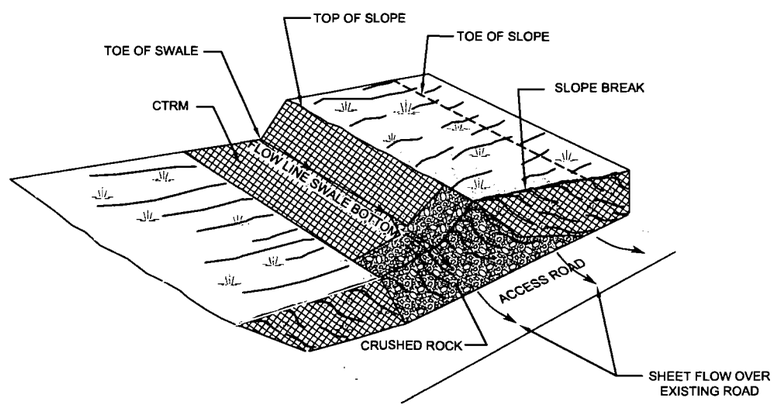
NOTE:
SECURE FABRIC AND UTILITY TAPE TO SOIL USING SECURING PINS.

15 C11 C12 DEMARCATON LAYER - EXTENT OF RESTRICTIONS RELATED TO RADIONUCLIDES
SCALE = 1'-0"



3 C2 C12 FENCE DETAIL
SCALE: ½" = 1'-0"

NOTE:
CONCRETE ENCASEMENT OF FENCE POST NOT NECESSARY FOR TEMPORARY FENCE. REMOVE ANY CONCRETE USED OFF NAVY PROPERTY.



9 C3 C12 SWALE OUTLET
NOT TO SCALE

CAUTION - DO NOT DIG BELOW
AVISO - NO EXCAVAR DEBAJO
3"

16 C12 C12 UTILITY WARNING TAPE
NOT TO SCALE

8' 0 8' 16'
SCALE: 1" = 8'

Hunters Point Shipyard
REGISTERED PROFESSIONAL ENGINEER STEPHEN WELLS FOWLER No. C 047281 Exp. 31 Dec 09 CIVIL STATE OF CALIFORNIA
DCR. CHRD 11/19/09

SYMBOL	DESCRIPTION	PREP. BY	DATE	APPROVED

REVISIONS

PREPARED BY: ChaduxTt JV
DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RE-CHECKED BY:
APPROVED BY:
DATE: 12/09/2009

SIZE D
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DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT DETAILS II

CODE IDENT. NO.
PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California
CONSTR. CONTR. NO.
N62473-09-D-2608
SPECIFICATION
(D.O. –)
NAVFAC DWG NO.
DWG. NO.
C12
SHEET 13 OF 13

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ATTACHMENT 2
CONSTRUCTION SPECIFICATIONS

NAVAL FACILITIES ENGINEERING COMMAND
Contract Number N62473-04-D-3213
Contract Task Order 0019

Prepared For

Base Realignment and Closure
Program Management Office West
San Diego, California

CONSTRUCTION SPECIFICATIONS

Engineered Soil Cover and
Revetment
IR Sites 7 & 18
Hunters Point Shipyard
San Francisco, California

CHAD-3213-0019-0024

January 8, 2010

Prepared By

ChaduxTt, A Joint Venture of St. George Chadux Corp.
and Tetra Tech EM Inc.
1230 Columbia Street, Suite 1000
San Diego, California 92101

Timothy E. Mower

Tim Mower, Project Manager

REGISTERED PROFESSIONAL ENGINEER
STEPHEN WELLS RUSHER
No. C 047281
Exp. 31 DEC 09
CIVIL
STATE OF CALIFORNIA

SUMMARY OF SPECIFICATIONS

Section	Title
00 01 15	List of Drawings
01 11 00	Summary of Work
01 30 00	Administrative Requirements
01 32 16.00 20	Construction Progress Documentation
01 33 00	Submittal Procedures
01 35 29.13	Health Safety and Emergency Response
01 45 02	Quality Control
01 50 00	Temporary Facilities and Controls
01 57 19.00 20	Temporary Environmental Controls
02 41 00	Site Demolition
03 30 00	Concrete
10 14 01	Signs
31 00 00	Earthwork
31 05 22	Geotextiles
32 31 26	Fencing and Gates
32 92 19	Seeding
33 24 13	Monitoring Wells
35 31 19	Coastal Protection

SECTION 00 01 15
LIST OF DRAWINGS

PART 1 GENERAL

1.1 SUMMARY

This section lists the drawings for the project.

1.2 CONTRACT DRAWINGS

Contract Drawings are as follows:

Drawing No.	Revision No.	Title
G1	0	Vicinity Map, Location Map, and Sheet Index
C1	0	Site Plan – Clearing, Grubbing, Surface Debris Removal and Well and Probe Extensions
C2	0	Soil Cover and Revetment Subgrade Plan
C3	0	Soil Cover and Shoreline Revetment Final Grading Plan
C4	0	Control Points
C5	0	Shoreline and Revetment Cross Sections A, B, and C
C6	0	Shoreline and Revetment Cross Sections D, E, and F
C7	0	Shoreline and Revetment Cross Sections G, H, I, and J
C8	0	Soil Cover Boundary Cross Sections Details A, B, C, and D
C9	0	Soil Cover Cross Sections Details A-A' and B-B'
C10	0	Monitoring Well and Methane Monitoring Probe Extension Details
C11	0	Details I
C12	0	Details II

END OF SECTION

SECTION 01 11 00
SUMMARY OF WORK

PART 1 GENERAL

1.1 PROJECT DESCRIPTION

Install a soil cover over potentially radiologically and chemically impacted soils. Construct a rip rap revetment along San Francisco Bay.

The area at IR Sites 7 and 18 was used as a disposal site for excess large-scale shipyard debris as part of specific engineered fill operations conducted in that area to expand the shoreline. The Navy had limited controls for disposal of certain types of radioactive materials in place at the time of the shoreline expansion which may have allowed for land disposal of certain types of radioactive materials (such as sandblast grit used in decontamination of ships that participated in atomic weapons testing and radioluminescent dials and gauges). Install a soil cover over IR Sites 7 and 18 and a shoreline revetment along the India Basin of San Francisco Bay.

1.2 SITE CONTAMINANTS

The following chemicals were identified in soil at IR Sites 7 and 18 as posing risk to human health: metals, volatile organic compounds (VOC), semivolatile organic compounds (SVOC), pesticides, polychlorinated biphenyls (PCB), and radionuclides. Chemicals identified in the sediment along the shoreline at IR Site 7 include metals, pesticides, PCBs, polycyclic aromatic hydrocarbons, and radionuclides. The primary risk to human health and the environment from these chemicals is through direct contact with the soil or sediment, or through external radiation for radionuclides. Risk to industrial workers is present and requires personal protective equipment (PPE) for workers.

1.3 LOCATION

The work shall be located at Hunters Point Shipyard IR Sites 7 and 18, San Francisco, California, as shown on the Drawings.

1.4 SUBMITTALS

Submit the following:

1.4.1 SD-01, Preconstruction Submittal

a. List of contact personnel; G
b. Sampling and Analysis Plan (for confirmation sampling of excavations) G

1.5 CONTRACTOR PERSONNEL REQUIREMENTS

1.5.1 Subcontractors and Personnel

Furnish a list of contact personnel of the Contractor and subcontractors, including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

1.5.2 Contact Personnel List

Submit for approval, at least 15 days in advance of the desired date of entry, an original alphabetical list of personnel who require entry into Government property to perform work on the project. Furnish for each person:

a. Name
b. Date and place of birth
c. Citizenship
d. Home address

The request for personnel passes shall be accompanied with the following certification:

"I hereby certify that all personnel on this list are either born U.S. citizens or naturalized U.S. citizens with the naturalization number shown."

1.6 CONTRACTOR ACCESS AND USE OF PREMISES

1.6.1 Base Regulations

Ensure that Contractor personnel employed on the base become familiar with and obey base regulations. Keep within the limits of the work and avenues of ingress and egress. Do not enter restricted areas unless required to do so and until cleared for entry. Permission to interrupt any station roads or utility services shall be requested in writing a minimum of 15 calendar days prior to the desired date of interruption. The Contractor's equipment shall be conspicuously marked for identification. Arrive and depart the work site at a location designated by the Contracting Officer.

1.6.2 Working Hours

Regular working hours shall consist of a period established by the Contracting Officer between 6:00 a.m. and 6:00 p.m., Monday through Saturday, excluding Government holidays.

1.6.3 Work Outside Regular Hours

Work outside regular working hours requires Contracting Officer approval. Provide written request 7 calendar days prior to such work to allow arrangements to be made by the Government for inspecting the work in progress. During periods of darkness, work shall be lighted in a manner approved by the Contracting Officer.

1.6.4 Unauthorized Access

Ensure that the public and other unauthorized personnel do not have access to the area during the construction period.

1.7 UNDERGROUND FACILITIES

The locations of existing underground utilities shown on the Drawings are only approximate. Verify the locations of the utilities shown and any other utilities that may be present. Scan the construction site with electromagnetic or sonic equipment, and mark the surface of the ground where existing underground utilities are discovered. Verify the location and elevation of existing piping, utilities, and other types of underground obstructions not indicated but discovered during scanning. Protect all utilities encountered during construction.

1.8 SCHEDULE

Contractor shall schedule construction activity, in addition to other stated requirements, within the constraints and fulfilling the requirements of Section 31 00 00 Earthwork, and Section 01 57 19.00 20 Temporary Environmental Controls. In all cases, construction shall be completed within 180 days of the start of clearing and grubbing.

1.9 DELAYS

Notify the Contracting Officer of delays or changes in construction schedule within 48 hours. Cessation of construction activities resulting from delays shall not constitute the release of Contractor's responsibility to maintain a tidy, secured, and protected site. In such case, Contractor shall protect all surfaces from erosion and all materials from degradation. When construction activities resume, Contractor shall return grades and installed items to their condition before construction ceased.

1.10 ESTIMATION OF EARTHWORK

Topographical and survey information on Drawings must be field verified. Accurate cut and fill volume must be determined by Contractor after clearing and grubbing and surface debris removal has been performed.

1.11 LIMITS OF RESPONSIBILITY

The designer and its subcontractors shall not be responsible for variances from the construction specifications, design drawings, and other requirements and recommendations unapproved by the designer.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

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 the basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

15 CFR 772	Definition of Terms
15 CFR 773	Special Licensing Procedures

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 Submittal Procedures.

1.2.1 SD-01, Preconstruction Submittal

a. List of Contact Personnel; G

b. View Location Map; G

c. Progress and Completion Pictures; G

d. Personnel List; G

e. Vehicle List; G

f. Site Specific Health and Safety Plan; G

g. Imported Fill Sampling Plan; G

h. Air Monitoring Plan: G

i. Construction Stormwater Pollution Prevention Plan; G

1.3 VIEW LOCATION MAP

Submit to the Contracting Officer prior to or with the first submittals, a sketch or drawing indicating the required photographic locations. Update as required if the locations are moved.

1.4 PROGRESS AND COMPLETION PICTURES

Photographically document site conditions prior to start of construction operations. Provide at least weekly photographs showing the sequence and progress of work. Take a minimum of 40 photographs each week throughout the entire project from a minimum of ten views from points located by the Contracting Officer. Submit a view location sketch indicating points of view. Submit with the monthly invoice two sets of digital photographs each set on a separate CD-R, cumulative of all photos to date. Indicate photographs demonstrating environmental procedures. Photographs for each month shall be in a separate monthly directory and each file shall be named to indicate its location on the view location sketch. The view location sketch shall also be provided on the CD as digital file. All file names shall include a date designator. Cross reference submittals in the appropriate daily report. Photographs shall be provided for unrestricted use by the Government.

1.5 MINIMUM INSURANCE REQUIREMENTS

Procure and maintain during the entire period of performance under this contract the following minimum insurance coverage:

a. Comprehensive general liability: $500,000 per occurrence

b. Automobile liability: $200,000 per person, $500,000 per occurrence for bodily injury, $20,000 per occurrence for property damage

c. Workmen's compensation as required by Federal and State workers' compensation and occupational disease laws.

d. Employer's liability coverage of $100,000, except in States where workers compensation may not be written by private carriers,

e. Others as required by State

1.6 CONTRACTOR PERSONNEL REQUIREMENTS

1.6.1 Subcontractors and Personnel

Furnish a list of contact personnel of the Contractor and subcontractors including addresses and telephone numbers for use in the event of an emergency. As changes occur and additional information becomes available, correct and change the information contained in previous lists.

1.6.2 Identification Badges

Identification badges, if required, will be furnished without charge. Application for and use of badges will be as directed.

1.6.3 Contractor Personnel Requirements

Failure to obtain entry approval will not affect the contract price or time of completion.

1.7 SUPERVISION

Have at least one qualified supervisor capable of reading, writing, and conversing fluently in the English language on the job site during working hours. In addition, if a Quality Control (QC) representative is required on the contract, then that individual shall also have fluent English communication skills.

1.8 PRECONSTRUCTION CONFERENCE

After award of the contract but prior to commencement of any work at the site, meet with the Contracting Officer to discuss and develop a mutual understanding relative to the administration of the value engineering and safety program, preparation of the schedule prices, shop drawings, and other submittals, scheduling programming, and prosecution of the work. Major subcontractors who will engage in the work shall also attend.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END SECTION

SECTION 01 32 16.00 20
CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 GENERAL

1.1 SUBMITTALS

Submit the following in accordance with Section 01 33 00 Submittal Procedures.

1.1.1 SD-01, Preconstruction Submittals

a. Construction schedule; G
b. Material delivery schedule; G

1.2 CONSTRUCTION SCHEDULE

Within 21 days after receipt of the Notice of Award, prepare and submit to the Contracting Officer for approval a Critical Path Method (CPM) and Completed Network Schedule, including a completed list of definable features of work, in accordance with the terms in Contract Clause "FAR 52.236-15, Schedules for Construction Contracts," except as modified in this contract.

1.3 MATERIAL DELIVERY SCHEDULE

Within 21 calendar days after approval of the proposed construction schedule, submit for Contracting Officer approval a schedule showing procurement plans for materials and rental equipment. Submit in the format and content as prescribed by the Contracting Officer, and include as a minimum the following information:

a. Description

b. Date of the purchase order

c. Promised shipping date

d. Name of the manufacturer or supplier

e. Date delivery is expected

f. Date the material or equipment is required, according to the current construction schedule.

1.4 NETWORK ANALYSIS SYSTEM (NAS)

The Contractor shall use the CPM to schedule and control construction activities. The schedule shall identify at a minimum:

- Construction time for all major systems and components
- Manpower requirements for each activity
- Major submittals and submittal processing time

1.4.1 CPM Submittals and Procedures

Submit all network analysis and updates in hard copy. The network analysis system shall be kept current, with changes made to reflect the actual progress and status of construction.

1.5 UPDATED SCHEDULES

Update the construction schedule and equipment delivery schedule at monthly intervals or when the schedule has been revised. Reflect any changes that occurred since the last update. Submit copies of the purchase orders and confirmation of the delivery dates as directed.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 DEFINITIONS

1.1.1 Submittal

Shop Drawings, product data, samples, and administrative submittals presented for review and approval. Contract Clauses "FAR 52.236-5, Material and Workmanship," paragraph (b) and "FAR 52.236-21, Specifications and Drawings for Construction," paragraphs (d), (e), and (f) apply to all "submittals."

1.1.2 Types of Submittals

All submittals are classified as indicated in Paragraph 1.2, Schedule of Submittal Descriptions. The submittals also are grouped as follows:

a. Shop Drawings: As used in this section, drawings, schedules, diagrams, and other data prepared specifically for this Contract, by the Contractor, or through the Contractor by way of a subcontractor, manufacturer, supplier, distributor, or other lower-tier contractor, to illustrate a portion of the work.

b. Product data: Preprinted material such as illustrations, standard schedules, performance charts, instructions, brochures, diagrams, manufacturer's descriptive literature, catalog data, and other data to illustrate a portion of the work, but not prepared exclusively for this Contract.

c. Samples: Physical examples of products, materials, equipment, assemblies, or workmanship that are physically identical to a portion of the work, illustrate a portion of the work, or establish standards for evaluating the appearance of the finished work or both.

d. Administrative submittals: Data presented for review and approval to ensure that the administrative requirements of the project are adequately met but not to ensure directly that the work is in accordance with the design concept and in compliance with the Contract documents.

1.2 SCHEDULE OF SUBMITTAL DESCRIPTIONS (SD)

<u>SD-01, Preconstruction Submittals</u>

Certificates of insurance
Surety bonds
List of proposed subcontractors
List of proposed products
Construction Progress Schedule
Submittal schedule
Schedule of values

Health and safety plan
Work plan
Quality control plan
Sampling and analysis plan
Environmental protection plan, including ecological management and mitigation procedures

SD-02, Shop Drawings

Drawings, diagrams, and schedules specifically prepared to illustrate some portion of the work.

Diagrams and instructions from a manufacturer or fabricator for use in producing the product and as aids to the contractor for integrating the product or system into the project.

Drawings prepared by or for the contractor to show how multiple systems and interdisciplinary work will be coordinated.

SD-03, Product Data

Catalog cuts, illustrations, schedules, diagrams, performance charts, instructions, and brochures illustrating size, physical appearance, and other characteristics of materials or equipment for some portion of the work.

Samples of warranty language when the contract requires extended product warranties.

SD-04, Samples

Physical examples of materials, equipment, or workmanship that illustrate functional and aesthetic characteristics of a material or product and establish standards that can be used to judge the work.

Color samples from the manufacturer's standard line (or custom color samples if specified) to be used in selecting or approving colors for the project.

Field samples and mock-ups constructed on the project site to establish standards that can be used to judge the work. Includes assemblies or portions of assemblies that are to be incorporated into the project and those that will be removed at the conclusion of the work.

SD-05, Design Data

Calculations, mix designs, analyses, or other data pertaining to a part of the work.

SD-06, Test Reports

Report signed by authorized official of testing laboratory that a material, product, or system identical to the material, product, or system to be provided has been tested in accord with specified requirements. (Testing must have occurred within 3 years of the date of contract award for the project.)

Report that includes findings of a test required to be performed by the contractor on an actual portion of the work or prototype prepared for the project before shipment to the job site.

Report that includes finding of a test made at the job site or on a sample taken from the job site, on a portion of work during or after installation.

Investigation reports

Daily checklists

Final acceptance test and operational test procedure

SD-07, Certificates

Statements signed by responsible officials of the manufacturer of the product, system, or material attesting that the product, system, or material meets the specification requirements. Must be dated after award of the project contract and clearly name the project.

Document required of the Contractor, or of a supplier, installer, or subcontractor through the Contractor, the purpose of which is to further the quality of orderly progression of a portion of the work by documenting procedures, acceptability of methods, or personnel qualifications.

SD-08, Manufacturer's Instructions

Preprinted material describing the installation of a product, system, or material, including special notices and Material Safety Data Sheets concerning impedances, hazards, and safety precautions.

SD-09, Manufacturer's Field Reports

Documentation of the testing and verification of actions taken by the manufacturer's representative to confirm compliance with the manufacturer's standards or instructions.

Factory test reports.

SD-10, Operation and Maintenance Data

Data intended to be incorporated in operations and maintenance manuals.

SD-11, Closeout Submittals

Documentation to record compliance with technical or administrative requirements or to establish an administrative mechanism.

As-built Drawings
As-built Field Summary Report
Special warranties
Posted operating instructions
Training plan

1.2.1 Approving Authority

The person authorized to approve a submittal.

1.2.2 Work

As used in this section, on- and off-site construction required by the Contract documents, including labor necessary to produce the construction and materials, products, equipment, and systems incorporated or to be incorporated in such construction.

1.3 SUBMITTALS

Submit the following in accordance with the requirements of this section.

1.3.1 SD-11, Closeout Submittals

a. Submittal register; G
b. As-built drawings; G
c. As-built field summary report; G

1.4 USE OF SUBMITTAL REGISTER OR DATABASE

Prepare and maintain a submittal register as work progresses. Use the electronic submittal register program furnished by the Government or any other format. Do not change data which are output in columns (c), (d), (e), and (f) as delivered by the Government; retain data which are output in columns (a), (g), (h), and (i) as approved.

1.4.1 Submittal Register

Submit a hard copy of the submittal register and also as an electronic database. Submit with the quality control plan and the project schedule required by Section 01 45 02 Quality Control and Section 01 32 16.00 20 Construction Progress Documentation. Do not change data in columns (c), (d), (e), and (f) as delivered by the Government. Verify that all submittals required for the project are listed and add missing submittals. Complete the following on the register:

Column (a) Activity Number: Activity number from the project schedule.

Column (g) Contractor Submit Date: Scheduled date for the approving authority to receive submittals.

Column (h) Contractor Approval Date: Date the Contractor needs approval of the submittal.

Column (i) Contractor Material: Date that the Contractor needs material delivered to Contractor control.

1.4.2 Contractor Use of the Submittal Register

Update the following fields in the submittal register:

Column (b) Transmittal Number: Contractor assigned list of consecutive numbers.

Column (j) Action Code (k): Date of action used to record Contractor's review when forwarding submittals to quality control (QC).

Column (l): List date of submittal transmission.

Column (q): List date approval is received.

1.4.3 Approving Authority Use of the Submittal Register

Update the following fields in the submittal register:

Column (b):

Column (l): List date of submittal receipt.

Column (m) through (p).

Column (q): List date returned to Contractor.

1.4.4 Contractor Action Code and Action Code

Entries used will be as follows:

NR - Not received

AN - Approved as noted

A - Approved

RR - Disapproved, Revise, and Resubmit

1.4.5 Copies Delivered to the Government

Deliver one copy of the submitted register updated by the Contractor to Government with each invoice request. Deliver in electronic format, unless a paper copy is requested by the Contracting Officer.

1.5 PROCEDURES FOR SUBMITTALS

1.5.1 Reviewing, Certifying, Approving Authority

The QC Manager, in accordance with Section 01 45 02 Quality Control, shall be responsible for reviewing and certifying that submittals are in compliance with contract requirements. The approving authority on submittals is the QC Manager unless otherwise specified for the specific submittal. At each "Submittal" paragraph in the individual specification sections, the notation "G" following a submittal item indicates that the Contracting Officer is the approving authority.

1.5.2 Constraints

a. Submittals listed or specified in this Contract shall conform to the provisions of this section, unless explicitly stated otherwise.

b. Submittals shall be complete for each definable feature of work; components of the definable feature interrelated as a system shall be submitted at the same time.

c. When acceptability of a submittal is dependent on conditions, items, or materials included in separate, subsequent submittals, the submittal will be returned without review.

d. Approval of a separate material, product, or component does not imply approval of the assembly in which the item functions.

1.5.3 Scheduling

a. Coordinate scheduling, sequencing, preparing, and processing of submittals with performance of the work so that work will not be delayed by submittal processing. Allow for potential requirements to resubmit.

b. Except as specified otherwise, allow a review period, beginning with receipt by the approving authority, that includes at least 15 working days for submittals for QC Manager approval and 20 working days for submittals for Contracting Officer approval. The period of review for submittals with Contracting Officer approval begins when the Government receives the submittal from the QC Manager. The period of review for each resubmittal is the same as for the initial submittal.

1.5.4 Variations

Variations from contract requirements require Government approval pursuant to Contract Clause "FAR 52.236-21, Specifications and Drawings for Construction," and will be considered where advantageous to the Government.

When proposing a variation, submit a written request to the Contracting Officer, with documentation of the nature and features of the variation and an explanation why the variation is desirable and beneficial to the Government. If lower cost is a benefit, also include an estimate of the cost saving. Identify the proposed variation separately and include documentation for the proposed variation along with the required submittal for the item. When submitting a variation for approval, the Contractor warrants the following:

1.5.4.1 Variation Is Compatible

The Contract has been reviewed to establish that the variation, if incorporated, will be compatible with other elements of the work.

1.5.4.2 Review Schedule Is Modified

In addition to the normal submittal review period, a period of 10 working days will be allowed for consideration by the Government of submittals with variations.

1.5.5 Contractor's Responsibilities

a. Determine and verify field measurements, materials, field construction criteria; review each submittal; and check and coordinate each submittal with requirements of the work and Contract documents.

b. Transmit submittals to the QC Manager in orderly sequence; in accordance with the approved submittal register; and to prevent delays in the work, delays to the Government, or delays to separate contractors.

c. Advise the Contracting Officer of the variation, as required by Paragraph 1.5.4, Variations.

d. Correct and resubmit submittal as directed by the approving authority. When resubmitting disapproved transmittals or transmittals noted for resubmittal, the Contractor shall provide a copy of the transmittal submitted previously, including all reviewer comments, for use by the approving authority. Direct specific attention, in writing or on resubmitted submittal, to revisions not requested by the approving authority on previous submissions.

e. Furnish additional copies of submittals when requested by the Contracting Officer, to a limit of 20 copies per submittal.

f. Complete work that must be accomplished as a basis of a submittal in time to allow the submittal to occur as scheduled.

g. Ensure no work has begun until submittals for that work have been returned as "approved," or "approved as noted" or "approved except as noted; resubmission not required," except to the extent that a portion of the work must be accomplished as a basis for the submittal.

1.5.6 QC Manager Responsibilities

a. Note the date the submittal was received from the Contractor on each submittal.

b. Review each submittal and check and coordinate each submittal with requirements of the work and Contract documents.

c. Review submittals for conformance with project design concepts and compliance with Contract documents.

d. Act on submittals, determining the appropriate action based on the QC Manager's review of the submittal.

(1) When the QC Manager is the approving authority, take the appropriate action on the submittal from the possible actions defined in Paragraph 1.5.8, Actions Possible.

(2) When the Contracting Officer is the approving authority or when a variation has been proposed, forward the submittal to the Government with the certifying statement or return the submittal marked "not reviewed" or "revise and resubmit," as appropriate. The QC Manager's review of the submittal determines the appropriate action.

e. Ensure that material is clearly legible.

f. Stamp each sheet of each submittal with the QC certifying statement or approving statement, except that data submitted in bound volume or on one sheet printed on two sides may be stamped on the front of the first sheet only.

(1) When the approving authority is the Contracting Officer, the QC Manager will certify submittals forwarded to the Contracting Officer with the following certifying statement:
"I hereby certify that the (equipment) (material) (article) shown and marked in this submittal is that proposed to be incorporated with Contract Number XXX, is in compliance with the contract Drawings and specification, can be installed in the allocated spaces, and is submitted for Government approval."

Certified by Submittal Reviewer _____ Date _____
(Signature when applicable)

Certified by QC Manager _____ Date _____
(Signature)

(2) When the approving authority is the QC Manager, the QC Manager will use the following approval statement when returning submittals to the Contractor as "approved" or "approved as noted."

"I hereby certify that the (material) (equipment) (article) shown and marked in this submittal and proposed to be incorporated with Contract Number XXX, is in compliance with the contract Drawings and specification, can be installed in the allocated spaces, and is _____ approved for use."

Certified by Submittal Reviewer _____ Date _____
(Signature when applicable)

Approved by QC Manager _____ Date _____
(Signature)

g. Sign the certifying statement or approval statement. The person signing the certifying statements shall be the QC Manager member designated in the approved QC plan. The signatures shall be original and in ink. Stamped signatures are not acceptable.

h. Update the submittal register [database] as submittal actions occur and maintain the submittal register at the project site until final acceptance of all work by the Contracting Officer.

i. Retain a copy of approved submittals at the project site, including the Contractor's copy of approved samples.

1.5.7 Government's Responsibilities

When the approving authority is the Contracting Officer, the Government will:

a. Note the date the submittal was received from the QC Manager on each submittal for which the Contracting Officer is the approving authority.

b. Review submittals for approval within the scheduling period specified and only for conformance with project design concepts and compliance with Contract documents.

c. Identify returned submittals with one of the actions defined in Paragraph 1.5.8, Actions Possible, and with markings appropriate for the action indicated.

1.5.8 Actions Possible

Submittals will be returned with one of the following notations:

a. Submittals marked "not reviewed" will indicate the submittal has been previously reviewed and approved, is not required as a submittal, does not show evidence of being reviewed and approved by the Contractor, or is not complete. A submittal marked "not reviewed" will be returned with an explanation of the reason it is not reviewed. Returned submittals deemed to lack review by the Contractor or to be incomplete shall be resubmitted with appropriate action, coordination, or change.

b. Submittals marked "approved" or "approved as submitted" authorize the Contractor to proceed with the work covered.

c. Submittals marked "approved as noted" or "approved except as noted; resubmission not required" authorize the Contractor to proceed with the work as noted provided the Contractor takes no exception to the notations.

d. Submittals marked "revise and resubmit" or "disapproved" indicate that the submittal is incomplete or does not comply with the design concept or the requirements of the Contract documents and shall be resubmitted with appropriate changes. No work shall proceed for this item until the resubmittal is approved.

1.6 FORMAT OF SUBMITTALS

1.6.1 Transmittal Form

Transmit each submittal, except sample installations and sample panels, to the office of the approving authority. Transmit submittals with a transmittal form that is prescribed by the Contracting Officer and standard for the project. The transmittal form shall identify the Contractor, indicate the date of the submittal, and include information prescribed by the transmittal form and required in Paragraph 1.6.2, Identifying Submittals. Process transmittal forms to record actions regarding sample panels and sample installations.

1.6.2 Identifying Submittals

Identify submittals, except sample panel and sample installation, with the following information permanently adhered to or noted on each separate component of each submittal and noted on the transmittal form. Mark each copy of each submittal identically, with the following:

a. Project title and location.

b. Construction Contract number.

c. The section number of the specification section by which the submittal is required.

d. The submittal description (SD) number of each component of the submittal.

e. When a resubmission, an alphabetic suffix on the submittal description, for example, SD-10A, to indicate the resubmission.

f. The name, address, and telephone number of the subcontractor, supplier, manufacturer, and any other second-tier contractor associated with the submittal.

g. Product identification and location in project.

1.6.3 Format for Product Data

a. Present product data submittals for each section as a complete, bound volume. Include a table of contents listing page and catalog item numbers for product data.

b. Indicate, by prominent notation, each product that is being submitted; indicate the specification section number and paragraph number to which it pertains.

c. Supplement product data with material prepared for the project to satisfy submittal requirements for which product data do not exist. Identify this material as developed specifically for the project.

1.6.4 Format for Shop Drawings

a. Shop Drawings shall not be less than A4, 8½ by 11 inches, nor more than AO, 30 by 42 inches.

b. Present shop Drawings as a part of the bound volume for the submittals required by the section. Present larger Drawings in sets.

c. Include on each Drawing the Drawing title, number, date, and revision numbers and dates, in addition to the information required in Paragraph 1.6.2, Identifying Submittals.

d. Dimension Drawings, except diagrams and schematic Drawings; prepare Drawings demonstrating interface with other trades to scale. Dimensions of shop Drawings shall be the same unit of measure as indicated on the contract Drawings. Identify materials and products for work shown.

1.6.5 Format of Samples

a. Furnish samples in the sizes below, unless otherwise specified or unless the manufacturer has prepackaged samples of approximately the same size as specified:

(1) Color Selection Samples: 2 inches by 4 inches.

1.6.6 Format of Administrative Submittals

a. When the submittal includes a document that is to be used in the project or will become a part of the project record, other than as a submittal, do not apply the Contractor's approval stamp to the document, but to a separate sheet accompanying the document.

1.7 QUANTITY OF SUBMITTALS

1.7.1 Number of Copies of Product Data

a. Submit six copies of submittals of product data requiring review and approval only by the QC Manager and seven copies of product data requiring review and approval by the Contracting Officer.

1.7.2 Number of Copies of Shop Drawings

Submit shop Drawings in compliance with the quantity requirements specified for product data.

1.7.3 Number of Samples

a. Submit two samples, or two sets of samples showing range of variation, of each required item. One approved sample or set of samples will be retained by the approving authority, and one will be returned to the Contractor.

1.7.4 Number of Copies of Administrative Submittals

a. Unless otherwise specified, submit the administrative submittals in compliance with the quantity requirements specified for product data.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

SUBMITTAL REGISTER (PART A)

CONTRACT NO: N62473-04-D-3213 PROJECT TITLE HPS IR Sites 7 and 18

SPEC SECTION NO. (a)	SD NO & TYPE OF SUBMITTAL-MATL OR PRODUCT (b)	SPEC PARA NO. (c)	CLASSIF/ APPR BY CO (d)	GOVT OR A/E REVR (e)	TRANS CONTL NO. (f)	PLANNED SUBMITTAL DATE (g)
01 11 00	SD-01, PRECONSTRUCTION SUBMITTAL	1.4				
	a. List of Contact Personnel		G			
	b. Sampling and Analysis Plan		G			
01 30 00	SD-01, PRECONSTRUCTION SUBMITTAL	1.2.1				
	a. List of Contact Personnel		G			
	b. View Location Map		G			
	c. Progress and Completion Pictures		G			
	d. Personnel List		G			
	e. Vehicle List		G			
	f. Site Specific Health and Safety Plan		G			
	g. Imported Fill Sampling Plan		G			
	h. Air Monitoring Plan		G			
	i. Construction Stormwater Pollution Prevention Plan		G			
01 32 16.00 20	SD-01, PRECONSTRUCTION SUBMITTALS	1.1.1				
	a. Construction Schedule		G			
	b. Material Delivery Schedule		G			
01 33 00	SD-11, CLOSEOUT SUBMITTALS	1.3.1				
	a. Submittal Register		G			
	b. As-built Drawings		G			
	c. As-built Field Summary Report		G			
01 35 29.13	SD-02, SHOP DRAWINGS	1.3.1				
	a. Work Zones		G			
	b. Decontamination Facilities		G			
01 35 29.13	SD-03, PRODUCT DATA	1.3.2				
	a. Site Control Log					
	b. Employee Certificates					
01 35 29.13	SD-06, FIELD TEST REPORTS	1.3.3				
	a. Dosimetry Results					
	b. Air Sampling Results					
01 45 02	SD-01, PRECONSTRUCTION SUBMITTAL	1.2.1				
	a. Quality Control (QC) Plan		G			
01 50 00	SD-02, DRAWINGS	1.2.1				
	a. Traffic Control Plan		G			
	b. Project Sign					

SPEC SECTION NO. (a)	SD NO & TYPE OF SUBMITTAL-MATL OR PRODUCT (b)	SPEC PARA NO. (c)	CLASSIF/ APPR BY CO (d)	GOVT OR A/E REVR (e)	TRANS CONTL NO. (f)	PLANNED SUBMITTAL DATE (g)
01 57 19.00 20	SD-01, PRECONSTRUCTION SUBMITTALS a. Environmental Protection Plan b. Preconstruction Survey Report c. Site Health and Safety Plan	1.4.1	 G G			
01 57 19.00 20	SD-07, CERTIFICATES a. Solid Waste Disposal Permit/Manifests b. Disposal Permit/Manifests for Hazardous Waste c. Erosion and Sediment Control Inspection Reports	1.4.2	 G G G			
02 41 00	SD-01, PRECONSTRUCTION SUBMITTAL a. Demolition Plan	1.2.1	 G			
03 30 00	SD-02, SHOP DRAWINGS a. Welded Wire Fabric	1.2.1	 G			
03 30 00	SD-05, DESIGN DATA a. Concrete Mix Design	1.2.2	 G			
03 30 00	SD-07, CERTIFICATES a. Cement b. Aggregate c. Admixtures d. Welded Wire Fabric	1.2.3				
10 14 01	SD-02, DRAWINGS a. Warning Sign	1.2.1	 G			
31 00 00	SD-01, PRECONSTRUCTION SUBMITTALS a. Sampling and Analysis Plan b. Materials Handling Plan	1.3.1	 G			
31 00 00	SD-03, PRODUCT DATA a. Composite Turf Reinforcement Matting	1.3.2				
31 00 00	SD-04, SAMPLES a. Select Fill					
31 00 00	SD-06, FIELD TEST REPORTS a. Select Fill Materials Tests b. Confirmation Screening sampling Results c. Borrow Source Assessment d. Moisture Content and density Tests In-Place Select Fill	1.3.3	 G G			

SPEC SECTION NO. (a)	SD NO & TYPE OF SUBMITTAL-MATL OR PRODUCT (b)	SPEC PARA NO. (c)	CLASSIF/ APPR BY CO (d)	GOVT OR A/E REVR (e)	TRANS CONTL NO. (f)	PLANNED SUBMITTAL DATE (g)
31 00 00	SD-07, CERTIFICATES a. California Registered Civil Engineer or Geologist Certification	1.3.4				
31 00 00	SD-11, CLOSEOUT SUBMITTALS a. Final Soil Cover Survey With As-Built Drawings b. Survey Information on Permanent Local Site Monuments	1.3.5				
31 05 22	SD-03, PRODUCT DATA a. Thread b. Manufacturing Quality Control Sampling and Testing	1.3.1				
31 05 22	SD-04, SAMPLES a. Geotextile	1.3.2				
31 05 22	SD-07, CERTIFICATES a. Geotextile	1.3.3				
32 31 26	SD-03, MANUFACTURER'S CATALOG DATA a. Fencing Components b. Accessories	1.4.1				
32 92 19	SD-01, PRECONSTRUCTION SUBMITTAL a. Vegetation Establishment Plan	1.3.1				
32 92 19	SD-03, PRODUCT DATA a. Seed Mixes b. Binders/Tackifiers c. Fertilizer d. Straw Mulch e. Lime	1.3.2				
32 92 19	SD-06, TEST REPORTS a. Soil Composition Tests	1.3.3				
32 92 19	SD-07, CERTIFICATES a. State Certification and Approval for Seed	1.3.4				
33 24 13	SD-03, PRODUCT DATA a. Casing b. Screen c. Filter Pack d. Bentonite e. Cement f. Protective Cover	1.2.1				

SPEC SECTION NO. (a)	SD NO & TYPE OF SUBMITTAL-MATL OR PRODUCT (b)	SPEC PARA NO. (c)	CLASSIF/ APPR BY CO (d)	GOVT OR A/E REVR (e)	TRANS CONTL NO. (f)	PLANNED SUBMITTAL DATE (g)
33 24 13	SD-11, CLOSEOUT SUBMITTAL a. Horizontal Location (Northing and Easting) b. Top of Casing (TOC) Elevation c. Adjacent Ground Elevation	1.2.2				
35 31 19	SD-03, PRODUCT DATA a. Riprap b. Filter Material c. Filter Rock e. Bulk Specific Gravity of Stone and Redesign	1.4.1	 G G G			
35 31 19	SD-04, SAMPLES a. Stone	1.4.2	 G			
35 31 19	SD-07, CERTIFICATES a. Rip Rap Specific Gravity b. Filter Fabric c. Filter Rock	1.4.3				

END OF SECTION

SECTION 01 35 29.13
HEALTH, SAFETY, AND EMERGENCY RESPONSE

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 the basic designation only.

NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH (NIOSH)

NIOSH 85-115	(1985) Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities

U.S. ARMY CORPS OF ENGINEERS (USACE)

EM 385-1-1	(2008) Safety and Health Requirements Manual

CODE OF FEDERAL REGULATIONS (CFR)

10 CFR 20	Standards for Protection Against Radiation
29 CFR 1904	Recording and Reporting Occupational Injuries and Illnesses
29 CFR 1910	Occupational Safety and Health Standards
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response
29 CFR 1926	Safety and Health Regulations for Construction
29 CFR 1926.65	Hazardous Waste Operations and Emergency Response
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials Table, Special Provisions, Hazardous Materials Communications, Emergency Response Information, and Training Requirements

1.2 DESCRIPTION OF WORK

This section requires Contractors to implement practices and procedures for working safely and in compliance with OSHA and USACE regulation while performing cleanup activities on uncontrolled hazardous waste sites.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 Submittal Procedures.

1.3.1 SD-02, Shop Drawings

a. Work Zones; G

b. Decontamination Facilities; G

1.3.2 SD-03, Product Data

a. Site Control Log;

b. Employee Certificates;

1.3.3 SD-06, Field Test Reports

a. Dosimetry Results

b. Air Sampling Results

1.4 REGULATORY REQUIREMENTS

Comply with EM 385-1-1, OSHA requirements in 29 CFR 1910 and 29 CFR 1926 with work performed under this contract, especially OSHA's Standards 29 CFR 1926.65 and 29 CFR 1910.120 and state specific OSHA requirements where applicable. Submit to the Contracting Officer for resolution matters of interpretation of standards before starting work. The most stringent requirements apply where the requirements of this specification, applicable laws, criteria, ordinances, regulations, and referenced documents vary.

1.5 PRECONSTRUCTION SAFETY CONFERENCE

Conduct a preconstruction safety conference prior to the start of site activities and after submission of the Contractor's APP/SSHP. The objective of the meeting will be to discuss health and safety concerns related to the impending work, discuss project health and safety organization and expectations, review and answer comments and concerns regarding the APP/SSHP or other health and safety concerns the Contractor may have. Ensure that those individuals responsible for health and safety at the project level are available and attend this meeting.

1.6 ACCIDENT PREVENTION PLAN/SITE SAFETY AND HEALTH PLAN (APP/SSHP)

Develop and implement a Site Safety and Health Plan and attach to the Accident Prevention Plan (APP) as an appendix (APP/SSHP). Address all occupational safety and health hazards (traditional construction as well as contaminant-related hazards) associated with cleanup operations within the APP/SSHP. Cover each SSHP element in section 28.A.01 of EM 385-1-1 and each APP element in Appendix A of EM 385-1-1. There are overlapping elements in Section 28.A.01 and Appendix A of EM 385-1-1. SSHP appendix elements that overlap with

APP elements need not be duplicated in the APP/SSHP provided each SOH issue receives adequate attention and is documented in the APP/SSHP. The APP/SSHP is a dynamic document, subject to change as project operations/execution change. The APP/SSHP will require modification to address changing and previously unidentified health and safety conditions. It is the Contractor's responsibility to ensure that the APP/SSHP is updated accordingly. Submit amendments to the APP/SSHP to the COR as the APP/SSHP is updated. For long duration projects resubmit the APP/SSHP to the COR annually for review. The APP/SSHP must contain all updates.

1.6.1 Acceptance and Modifications

Prior to submittal, the APP/SSHP must be signed and dated by the Safety and Health Manager and the Site Superintendent. Submit for review 14 days prior to the Preconstruction Safety Conference. Deficiencies in the APP/SSHP will be discussed at the preconstruction safety conference, and be revised to correct the deficiencies and resubmitted for acceptance. On site work must not begin until the plan has been accepted. Maintain a copy of the written APP/SSHP on site. Changes and modifications to must be made with the knowledge and concurrence of the Safety and Health Manager, the Site Superintendent, and the Contracting Officer. Bring to the attention of the Safety and Health Manager, the Site Superintendent, and the Contracting Officer any unforeseen hazard that becomes evident during the performance of the work, through the Site Safety and Health Officer (SSHO) for resolution as soon as possible. In the interim, take necessary action to re-establish and maintain safe working conditions in order to safeguard on site personnel, visitors, the public, and the environment. Disregard for the provisions of this specification or the accepted APP/SSHP will be cause for stopping work until the matter has been rectified. 1.6.2 Availability Make available the APP/SSHP in accordance with 29 CFR 1910.120, (b)(1)(v) and 29 CFR 1926.65, (b)(1)(v).

1.7 SITE DESCRIPTION AND CONTAMINATION CHARACTERIZATION

1.7.1 Project/Site Conditions

Refer to the following reports and information for the site description and contamination characterization.

ChaduxTt. 2007. "Final Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California." December 12.

ChaduxTt. 2009. "Final Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California." January 26.

PRC, Harding Lawson Associates, Levine-Fricke, and Uribe & Associates. 1996. "Parcel B Remedial Investigation, Draft Final Report, Hunters Point Shipyard, San Francisco, California." June 3.

1.8 TASK SPECIFIC HAZARDS, INITIAL PPE, HAZWOPER MEDICAL SURVEILLANCE AND TRAINING APPLICABILITY

Task specific occupational hazards, task specific HAZWOPER medical surveillance and training applicability and task specific initial PPE requirements for the project are listed on the **Task Hazard and Control Sheets** at the end of this section. It is the Contractor's responsibility to reevaluate occupational safety and health hazards as the work progresses and to adjust the PPE and on site operations, if necessary, so that the work is performed safely and in compliance with occupational safety and health regulations.

1.9 STAFF ORGANIZATION, QUALIFICATION AND RESPONSIBILITIES

1.9.1 Safety and Health Manager

Safety and Health Manager must be an Industrial Hygienist certified by the American Board of Industrial Hygiene with significant experience with health physics or certified by the American Board of Health Physicists.

1). The Safety and Health Manager must have the following additional qualifications:

a. A minimum of 3 years experience in developing and implementing safety and health programs at hazardous waste sites.

b. Documented experience in supervising professional and technician level personnel.

c. Documented experience in developing worker exposure assessment programs and air monitoring programs and techniques.

d. Documented experience in managing personal protective equipment programs and conducting PPE hazard evaluations for the types of activities and hazards likely to be encountered on the project.

e. Working knowledge of state and Federal occupational safety and health regulations.

2). The Safety and Health Manager will:

a. Be responsible for the development, implementation, oversight, and enforcement of the APP/SSHP.

b. Sign and date the APP/SSHP prior to submittal.

c. Conduct initial site-specific training.

d. Be present on site during the first 3 days of remedial activities and at the startup of each new major phase of work.

e. Visit the site as needed and at least once per week for the duration of activities, to audit the effectiveness of the APP/SSHP.

f. Be available for emergencies.

g. Provide on site consultation as needed to ensure the APP/SSHP is fully implemented.

h. Coordinate any modifications to the APP/SSHP with the Site Superintendent, the SSHO, and the Contracting Officer.

i. Provide continued support for upgrading/downgrading of the level of personal protection.

j. Be responsible for evaluating air monitoring data and recommending changes to engineering controls, work practices, and PPE.

k. Review accident reports and results of daily inspections.

l. Serve as a member of the Contractor's quality control staff.

1.9.2 Additional Certified Health and Safety Support Personnel

Retain health physics support from a health physicist certified by the American Board of Health Physics to develop radiation protection requirements of the APP/SSHP and, when necessary, visit the site to help implement ionizing radiation protection requirements of the APP/SSHP.

1.9.3 Site Safety and Health Officer

Designate an individual and one alternate as the Site Safety and Health Officer (SSHO). Include the name, qualifications, and work experience of the Site Safety and Health Officer and alternate in the APP/SSHP.

1). The SSHO must have the following qualifications:

a. A minimum of 2 years experience in implementing safety and health programs at hazardous waste sites where Level C personal protective equipment was required.

b. Documented experience in construction techniques and construction safety procedures.

c. Working knowledge of Federal and state occupational safety and health regulations.

d. Specific training in personal and respiratory protective equipment, confined space entry and in the proper use of air monitoring instruments and air sampling methods including monitoring for ionizing radiation.

2). The Site Safety and Health Officer must:

a. Assist and represent the Safety and Health Manager in on site training and the day to day on site implementation and enforcement of the accepted APP/SSHP.

b. Be assigned to the site on a full time basis for the duration of field activities. The SSHO can have collateral duties in addition to Safety and Health related duties. If operations are performed during more than 1 work shift per day, a site Safety and Health Officer must be present for each shift and when applicable, act as the radiation safety officer (RSO) as defined in paragraph 06.E.02 of EM 385-1-1 on radioactive waste cleanup projects.

c. Have authority to ensure site compliance with specified safety and health requirements, Federal, state and OSHA regulations and all aspects of the APP/SSHP including, but not limited to, activity hazard analyses, air monitoring, monitoring for ionizing radiation, use of PPE, decontamination, site control, standard operating procedures used to minimize hazards, safe use of engineering controls, the emergency response plan, confined space entry procedures, spill containment program, and preparation of records by performing a daily safety and health inspection and documenting results on the Daily Safety Inspection Log in accordance with 29 CFR 1904.

d. Have authority to stop work if unacceptable health or safety conditions exist, and take necessary action to re-establish and maintain safe working conditions.

e. Consult with and coordinate any modifications to the APP/SSHP with the Safety and Health Manager, the Site Superintendent, and the Contracting Officer.

f. Serve as a member of the Contractor's quality control staff on matters relating to safety and health.

g. Conduct accident investigations and prepare accident reports.

h. Conduct daily safety inspection and document safety and health findings into the Daily Safety Inspection Log. Track noted safety and health deficiencies to ensure that they are corrected.

i. In coordination with site management and the Safety and Health Manager, recommend corrective actions for identified deficiencies and oversee the corrective actions.

1.9.4 Occupational Physician

Utilize the services of a licensed physician, who is certified in occupational medicine by the American Board of Preventative Medicine, or who, by necessary training and experience is Board eligible. The physician must be familiar with this site's hazards and the scope of this project. Include the medical consultant's name, qualifications, and knowledge of the site's conditions and proposed activities in the APP/SSHP. The physician will be responsible for the determination of medical surveillance protocols and for review of examination/test results performed in compliance with 29 CFR 1910.120, (f) and 29 CFR 1926.65, (f) and paragraph MEDICAL SURVEILLANCE.

1.9.5 Persons Certified in First Aid and CPR

At least two persons who are currently certified in first aid and CPR by the American Red Cross or other approved agency must be on site at all times during site operations. They must be trained in universal precautions and the use of PPE as described in the Bloodborne Pathogens Standard of 29 CFR 1910, Section 1030. These persons may perform other duties but will be immediately available to render first aid when needed.

1.9.6 Safety and Health Technicians

For each work crew in the exclusion zone, one person, designated as a Safety and Health technician, must perform activities such as air monitoring, decontamination, and safety oversight on behalf of the SSHO. They must have appropriate training equivalent to the SSHO in each specific area for which they have responsibility and report to and be under the supervision of the SSHO.

1.10 TRAINING

Meet the following requirements in the Contractor's training program for workers performing cleanup operations and who will be exposed to contaminants.

1.10.1 General Hazardous Waste Operations Training

All Personnel performing duties with potential for exposure to on site contaminants must meet and maintain the following 29 CFR 1910.120/29 CFR 1926.65 (e) training requirements:

a. 40 hours of off site hazardous waste instruction.

b. 3 days actual field experience under the direct supervision of a trained, experienced supervisor.

c. 8 hours refresher training annually.
On site supervisors must have an additional 8 hours management and supervisor training specified in 29 CFR 1910.120/29 CFR 1926.65 (e) (4).

d. Specific site training based on the hazards present including radiological.

1.10.2 Pre-entry Briefing

Prior to commencement of on site field activities, all site employees, including those assigned only to the Support Zone, must attend a site-specific safety and health training session. This session will be conducted by the Safety and Health Manager and the Site Safety and Health Officer to ensure that all personnel are familiar with requirements and responsibilities for maintaining a safe and healthful work environment. Thoroughly discuss procedures and contents of the accepted APP/SSHP and Sections 01.B.02 and 28.D.03 of EM 385-1-1 . Each employee must sign a training log to acknowledge attendance and understanding of the training. Notify the Contracting Officer at least 5 days prior to the initial site-specific training session so government personnel involved in the project may attend.

1.10.3 Periodic Sessions

Conduct periodic on site training by the SSHO at least daily for personnel assigned to work at the site during the following day. Address safety and health procedures, work practices, any changes in the APP/SSHP, activity hazard analyses, work tasks, or schedule; results of previous week's air monitoring, review of safety discrepancies and accidents. Convene a meeting prior to implementation of the change must be convened should an operational change affecting on site field work be made, to explain safety and health procedures. Conduct a site-specific training sessions for new personnel, visitors, and suppliers by the SSHO using the training curriculum outlines developed by the Safety and Health Manager. Each employee must sign a training log to acknowledge attendance and understanding of the training.

1.10.4 Other Training

Site specific training for sites where radioactive wastes are to be cleaned up include:

a. Site specific procedures for handling and storing radioactive materials;

b. Health and safety hazards associated with exposure to the radioactive material that will be cleaned up or otherwise handled and the purpose and function of protective devices and precautions used to minimize exposures;

c. Elements of the APP/SSHP and company specific procedures intended to provide protection from radiation exposure;

d. Worker responsibility to report any unsafe acts which might result in exposure to ionizing radiation;

e. Appropriate worker response procedures to events that may result in worker exposure to ionizing radiation;

f. Worker rights and responsibilities with respect to ionizing radiation exposure. Provide training as specified by 29 CFR 1910 Section 146, by the Safety and Health Manager shall for employees who are required to supervise, standby, or enter permit-required confined spaces. Train in accordance with 49 CFR 172 Subpart H, Persons involved in any aspect of the transportation of hazardous materials.

1.11 PERSONAL PROTECTIVE EQIPMENT

1.11.1 Site Specific PPE Program

Provide on site personnel exposed to contaminants with appropriate personal protective equipment. Components of levels of protection (B, C, D and modifications) must be relevant to site-specific conditions, including heat and cold stress potential and safety hazards. Use only respirators approved by NIOSH. Commercially available PPE, used to protect against chemical agent, must be approved by the director of Army Safety through the Chemical Agent Safety and Health Policy Action Committee (CASHPAC). Keep protective equipment and clothing clean and well maintained. Include site-specific procedures to determine PPE program effectiveness and for on site fit-testing of respirators, cleaning, maintenance, inspection, and storage of PPE within the PPE section of the APP/SSHP.

1.11.2 Levels of Protection

The Safety and Health Manager must establish and evaluate as the work progresses the levels of protection for each work activity. Also establish action levels for upgrade or downgrade in levels of PPE. Describe in the SSHP the protocols and the communication network for changing the level of protection. Address air monitoring results, potential for exposure, changes in site conditions, work phases, job tasks, weather, temperature extremes, individual medical considerations, etc. within the PPE evaluation protocol.

1.11.2.1 Initial PPE Components

The following items constitute initial minimum protective clothing and equipment ensembles.

a. Level D. Coveralls or appropriate work clothing, safety/steel toed boots, other PPE as needed (gloves etc).

b. Modified Level D. Includes provisions for Level D but including hard hat, safety glasses, and hearing protection as necessary.

c. Level C.
Full-face air purifying respirator (APR) with NIOSH-approved combination high efficiency particulate air (HEPA)/organic vapor cartridges
Work clothing as prescribed by weather
Steel-toed boots
Chemical resistant boot covers and/or outer boots (PVC/Latex/Neoprene)
Tyvek® coveralls with hoods (as determined by the CHP), elastic wrists and ankles (or equivalent cloth/synthetic fiber)
Nitrile, latex, or vinyl gloves (inner) or cloth liners
Nitrile gloves or PVC (outer) or leather palm gloves
Hearing protection (if necessary)
Cooling vest (if necessary)
Hard-hat
Splash shield (if necessary)
Openings at ankles, wrists, and hoods shall be taped (as directed by the CHP).

d. Level B. ·
Supplied air respirator
Work clothing (light or insulated) as prescribed by weather
Steel-toed boots
Chemical resistant boot covers and/or outer boots (as selected by a CIH)
Tyvek® coveralls with hoods (as determined by the CHP), elastic wrists and ankles (or equivalent cloth/synthetic fiber)
Saranex® coveralls with hoods, elastic wrists, and ankles (as determined by a CIH)
Acid gear, splash suit, rain gear, etc. (as determined by a CIH)
Nitrile, latex, or vinyl gloves (inner) and/or cloth liners
Outer gloves (as selected by a CIH)
Hearing protection (if necessary)
Cooling vest (if necessary)
Hard-hat

Splash shield (if necessary)
Openings at ankles, wrists, and hoods shall be taped (as directed by the CHP).

Level D and Modified Level D PPE is anticipated for this project.

1.11.3 PPE for Government Personnel

Three clean sets of personal protective equipment and personal dosimeters for work on radioactive waste cleanup sites and clothing (excluding air-purifying negative-pressure respirators and safety shoes, which will be provided by individual visitors), as required for entry into the Exclusion Zone and/or Contamination Reduction Zone, must be available for use by the Contracting Officer or official visitors. The items must be cleaned and maintained by the Contractor and stored in the clean room of the decontamination facility.

1.12 MEDICAL SURVEILLANCE PROGRAM

Meet 29 CFR 1910.120/29 CFR 1926.65 (f) and the following requirements for medical surveillance program for workers performing cleanup operations and who will be exposed to contaminants. Assure the Occupational Physician or the physician's designee performs the physical examinations and reviews examination results. Participation in the medical surveillance program will be without cost to the employee, without loss of pay and at a reasonable time and place.

1.12.1 Frequency of Examinations

Medical surveillance program participants must receive medical examinations and consultations on the following schedule:

a. Every 12 months

b. If and when the participant develops signs and symptoms indicating a possible overexposure due to an uncontrolled release of a hazardous substance on the project.

c. Upon termination or reassignment to a job where medical surveillance program participation is not required, unless his/her previous annual examination/consultation was less than 6 months prior to reassignment or termination.

d. On a schedule specified by the occupational physician.

1.12.2 Content of Physical Examinations/Consultation

Verify the following information about medical surveillance program participants:

a. Baseline health conditions and exposure history.

b. Allergies/sensitivity/susceptiblity to hazardous substances exposure.

c. Ability to wear personal protective equipment inclusive of NIOSH certified respirators under extreme temperature conditions.

d. Fitness to perform assigned duties.
Provide the occupational physician with the following information for each medical surveillance program participant:

a. Information on the employee's anticipated or measured exposure.

b. A description of any PPE used or to be used.

c. A description of the employee's duties as they relate to the employee's exposures (including physical demands on the employee and heat/cold stress).

d. A copy of 29 CFR 1910.120, or 29 CFR 1926.65.

e. Information from previous examinations not readily available to the examining physician.

f. A copy of Section 5.0 of NIOSH 85-115.

g. Information required by 29 CFR 1910 Section 134.

1.12.3 Physician's Written Opinion

Obtain and furnish to the Safety and Health Manager; and the employee before work begins, a copy of the physician's written opinion for each employee. Address the employee's ability to perform hazardous waste site remediation work and containing the following:

a. The physician's verification of the employee's fitness to perform duties as well as recommended limitations upon the employee's assigned work and/or PPE usage.

b. The physician's opinion about increased risk to the employee's health resulting from work; and

c. A statement that the employee has been informed and advised about the results of the examination.

1.12.4 Employee Certificates

Provided on employee certificates, documentation that employees have received medical examinations.

1.12.5 Site Specific Medical Surveillance

Site specific Medical Surveillance medical monitoring will be based on the direction of the Contracting Officer in accordance with current regulations and standards. Additional input will be provided.

1.13 EXPOSURE MONITORING/AIR SAMPLING PROGRAM

Prepare and implement by the Safety and Health Manager an exposure monitoring/air sampling program to identify and quantify safety and health hazards and airborne levels of hazardous substances in order to assure proper selection of engineering controls, work practices and personal protective equipment for affected site personnel. Include action levels for upgrading/downgrading PPE in the program.

1.13.1 Air Sampling and Dosimetery

Use dosimeters to evaluate occupational exposure to radioactive isotopes and ionizing radiation fields in coordination with current standards and procedures at the facility. Provide results to the California Department of Public Health.

1.13.1.1 Evaluation

Radiation dosimetry must be evaluated by an individual or company holding current personnel dosimetry accreditation from the National Voluntary Laboratory Accreditation Program (NVLAP). Electronic dosimetry may be used to assign external dose if approved by the Contracting Officer. Internal intake assessment and applicable monitoring must be evaluated by the CHP.

1.13.1.2 Documentation

Document employee exposure to external radiation. Include reviewing each employee's radiation exposure history in accordance with 10 CFR 20 Section 2104, for compliance with exposure standards prior to allowing the employee access to a restricted area. If the employee has no exposure history, the employee must provide a signed written statement to that effect.

1.13.1.3 Reporting

Furnish reports of exposure to ionizing radiation to the Contracting Officer as soon as available and to each employee annually, upon termination, and within 30 days of any personal request.

1.14 EVALUATION

Document in the APP/SSHP and implement the procedures and practices in section 06.J. in EM 385-1-1 to monitor and manage heat stress.

1.15 SPILL AND DISCHARGE CONTROL

Develop and implement written spill and discharge containment/control procedures. Address radioactive wastes, shock sensitive wastes, laboratory waste packs, material handling equipment, as well as drum and container handling, opening, sampling, shipping and transport. Describe prevention measures, such as building berms or dikes; spill control measures and material to be used (e.g. booms, vermiculite); location of the spill control material; personal protective equipment required to cleanup spills; disposal of contaminated material; and who is responsible to report the spill. Storage of contaminated material or hazardous materials must be appropriately bermed, diked and/or contained to prevent any spillage of material on uncontaminated soil. If the spill or discharge is reportable, and/or human health or the environment are threatened, the National Response Center, the state, and the Contracting Officer must be notified as soon as possible.

1.16 SITE CONTROL MEASURES

1.16.1 Work Zones

Initial anticipated work zone boundaries (exclusion zone, contamination reduction zone, support zone, all access points and decontamination areas) are to be clearly delineated on the site drawings. Base delineation of work zone boundaries on the contamination characterization data and the hazard/risk analysis to be performed as described in paragraph: HAZARD/RISK ANALYSIS. As work progresses and field conditions are monitored, work zone boundaries may be modified (and site drawings modified) with approval of the Contracting Officer. Clearly identify work zones and marked in the field (using fences, tape, signs, etc.). Post a site map, showing work zone boundaries and locations of decontamination facilities in the on site office. Work zones must consist of the following:

a. Exclusion Zone (EZ): The exclusion zone is the area where hazardous contamination is either known or expected to occur and the greatest potential for exposure exists. Control entry into this area and exit may only be made through the CRZ.

b. Contamination Reduction Zone (CRZ): The CRZ is the transition area between the Exclusion Zone and the Support Zone. The personnel and equipment decontamination areas must be separate and unique areas located in the CRZ.

c. Support Zone (SZ): The Support Zone is defined as areas of the site, other than exclusion zones and contamination reduction zones, where workers do not have the potential to be exposed to hazardous substances or dangerous conditions resulting from hazardous waste operations. Secure the Support Zone against active or passive contamination. Site offices, parking areas, and other support facilities must be located in the Support Zone.

d. The contractor is responsible for the designation of areas restricted due to radioactive risks.

1.16.2 Site Control Log

A log of personnel visiting, entering, or working on the site must be maintained. Include the following: date, name, agency or company, time entering and exiting site, time entering and exiting the exclusion zone (if applicable). Before visitors are allowed to enter the Contamination
Reduction Zone or Exclusion Zone, they must show proof of current training, medical surveillance and respirator fit testing (if respirators are required for the tasks to be performed) and fill out a Certificate of Worker or Visitor Acknowledgment. Record this visitor information, including date, in the log.

1.16.3 Communication

Provide and install an employee alarm system that has adequate means of on and off site communication in accordance with 29 CFR 1910 Section 165. The means of communication must be able to be perceived above ambient noise or light levels by employees in the affected portions of the workplace. The signals must be distinctive and recognizable as messages to evacuate or to perform critical operations. This includes: air horns, walkie talkies, and cell phones.

1.16.4 Site Security

Provide the following site security: warning signs and fences, and site access procedures. Print signs in bold large letters on contrasting backgrounds. Signs must be visible from all points where entry might occur and at such distances from the restricted area that employees may read the signs and take necessary protective steps before entering.

1.17 PERSONAL HYGIENE AND DECONTAMINATION

Personnel entering the Exclusion or Contamination Reduction Zones or otherwise exposed to hazardous chemical vapors, gases, liquids, or contaminated solids must decontaminate themselves and their equipment prior to exiting the contamination reduction zone (CRZ) and entering the support zone. Consult Chapter 10.0 of NIOSH 85-115 when preparing decontamination procedures. Submit a detailed discussion of personal hygiene and decontamination facilities and procedures to be followed by site workers as part of the APP/SSHP. Train employees in the procedures and enforce the procedures throughout site operations.

1.17.1 Decontamination Facilities

Initially set up a decontamination line in the CRZ. Employees must exit the exclusion zone through the CRZ and implement the following decontamination procedures: removal or outerwear or tyvek as necessary and thorough inspection (Additional provisions to be included as specification is revised). Showers, if needed, must comply with 29 CFR 1910, Section 141 and EM 385-1-1, 02 C, Washing Facilities. It is the Site Safety and Health Officer's responsibility to recommend techniques to improve personnel decontamination procedures, if necessary.

1.17.2 Equipment Decontamination

Decontaminate the vehicles and equipment used in the EZ shall be decontaminated in the CRZ prior to leaving the site. 1.41.2.1 Facilities for Equipment and Personnel.

Provide a vehicle/equipment decontamination station within the CRZ for decontaminating vehicles and equipment leaving the EZ. Construct a decontamination station pad, which meets the site decontamination needs for all vehicles and larger equipment decontamination. Construct the pad to capture decontamination water, including overspray, and allow for collection and removal of the decontamination water using sumps, dikes and ditches as required. Or, a dry decontamination area can be used using a broom to remove dry/loose spilled materials on accessible surfaces. Provide a designated "clean area" in the CRZ for performing equipment maintenance. Use this area when personnel are required by normal practices to come in contact with the ground, i.e., crawling under a vehicle to change engine oil. Equipment within the EZ or CRZ must be decontaminated before maintenance is performed.

1.17.3 Procedures

Procedures for equipment decontamination must be developed and utilized to prevent the spread of contamination into the SZ and offsite areas. These procedures must address disposal of contaminated products and spent materials used on the site, including containers, fluids, oils, etc. Assume any item taken into the EZ to be contaminated and perform an inspection and decontaminate. Vehicles, equipment, and materials must be cleaned and decontaminated prior to leaving the site. Handle construction material in such a way as to minimize the potential for contaminants being spread and/or carried offsite. Prior to exiting the site, vehicles and equipment must be monitored to ensure the adequacy of decontamination.

1.18 EMERGENCY EQUIPMENT AND FIRST AID REQUIREMENTS

Maintain, as a minimum, the following items on site and available for immediate use:

a. First aid equipment and supplies approved by the consulting physician.

b. Emergency eyewashes and showers that comply with ISEA Z358.1.

c. Provide fire extinguishers of sufficient size and type at site facilities and in all vehicles and at any other site locations where flammable or combustible materials present a fire risk.

1.19 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURES

An Emergency Response Plan, that meets the requirements of 29 CFR 1910.120 (l) and 29 CFR 1926.65 (l), must be developed and implemented as a section of the APP/SSHP. In the event of any emergency associated with remedial action, without delay, alert all on site employees and as necessary offsite emergency responders that there is an emergency situation; take action to remove or otherwise minimize the cause of the emergency; alert the Contracting Officer; and institute measures necessary to prevent repetition of the conditions or actions leading to, or resulting in, the emergency. Train employees that are required to respond to hazardous emergency situations to their level of responsibility according to 29 CFR 1910.120 (q) and 29 CFR 1926.65 (q) requirements. Rehearse the plan regularly as part of the overall training program for site operations. Review the plan periodically and revised as necessary to reflect new or changing site conditions or information. Provide copies of the Emergency Response Portion of the accepted APP/SSHP to the affected local emergency response agencies. Address, as a minimum, the following elements in the plan:

a. Pre-emergency planning. Coordinate with local emergency response providers during preparation of the Emergency Response Plan. At a minimum, coordinate with local fire, rescue, hazardous materials response teams, police and emergency medical providers to assure all organizations are capable and willing to respond to and provide services for on-site emergencies. Ensure the Emergency Response Plan for the site is compatible and integrated with the local fire, rescue, medical and police security services available from local emergency response planning agencies.

b. Personnel roles, lines of authority, communications for emergencies.

c. Emergency recognition and prevention.

d. Site topography, layout, and prevailing weather conditions.

e. Criteria and procedures for site evacuation (emergency alerting procedures, employee alarm system, emergency PPE and equipment, safe distances, places of refuge, evacuation routes, site security and control).

f. Specific procedures for decontamination and medical treatment of injured personnel.

g. Route maps to nearest prenotified medical facility. Site-support vehicles must be equipped with maps. At the beginning of project operations, drivers of the support vehicles must become familiar with the emergency route and the travel time required.

h. Emergency alerting and response procedures including posted instructions and a list of names and telephone numbers of emergency contacts (physician, nearby medical facility, fire and police departments, ambulance service, Federal, state, and local environmental agencies; as well as Safety and Health Manager, the Site Superintendent, the Contracting Officer and/or their alternates).

i. Criteria for initiating community alert program, contacts, and responsibilities.

j. Procedures for reporting incidents to appropriate government agencies. In the event that an incident such as an explosion or fire, or a spill or release of toxic materials occurs during the course of the project, the appropriate government agencies must be immediately notified. In addition, verbally notify the Contracting Officer and the local district safety office immediately and receive a written notification within 24 hours. Include within the report the following items:

(1) Name, organization, telephone number, and location of the Contractor.

(2) Name and title of the person(s) reporting.

(3) Date and time of the incident.

(4) Location of the incident, i.e., site location, facility name.

(5) Brief summary of the incident giving pertinent details including type of operation ongoing at the time of the incident.

(6) Cause of the incident, if known.

(7) Casualties (fatalities, disabling injuries).

(8) Details of any existing chemical hazard or contamination.

(9) Estimated property damage, if applicable.

(10) Nature of damage, effect on contract schedule.

(11) Action taken to ensure safety and security.

(12) Other damage or injuries sustained, public or private.

k. Procedures for critique of emergency responses and follow-up.

1.20 CERTIFICATE OF WORKER/VISITOR ACKNOWLEDGEMENT

A copy of a Contractor-generated certificate of worker/visitor acknowledgement must be completed and submitted for each visitor allowed to enter contamination reduction or exclusion zones, and for each employee, following the example certificate at the end of this section.

1.21 INSPECTIONS

Attach to and submit with the Daily Quality Control reports the SSHO's Daily Inspection Logs. Include with each entry the following: date, work area checked, employees present in work area, PPE and work equipment being used in each area, special safety and health issues and notes, and signature of preparer.

1.22 SAFETY AND HEALTH PHASE-OUT REPORT

Submit a Safety and Health Phase-Out Report in conjunction with the project close out report and will be received prior to final acceptance of the work. Include the following minimum information:

a. Summary of the overall performance of safety and health (accidents or incidents including near misses, unusual events, lessons learned, etc.).

b. Final decontamination documentation including procedures and techniques used to decontaminate equipment, vehicles, and on site facilities.

c. Summary of exposure monitoring and air sampling accomplished during the project.

d. Signatures of Safety and Health Manager and SSHO.

Task Hazard and Control Requirements Sheets.

PART 2 PRODUCTS

Not used

PART 3 EXECUTION

Not used

END OF SECTION

SECTION 01 45 02
QUALITY CONTROL

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 the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3740	(2008) Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(2008) Agencies Engaged in the Testing and/or Inspection of Materials used on Construction

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 Submittal Procedures.

1.2.1 SD-01, Preconstruction Submittal

a. Quality Control (QC) plan; G

1.3 INFORMATION FOR THE CONTRACTING OFFICER

Deliver the following to the Contracting Officer:

a. Combined Contractor Production Report/Contractor Quality Control Report (1 sheet): Original and 1 copy by 10:00 a.m. the next working day after each day that work is performed;

b. QC Specialist Reports: Originals and 1 copy by 10:00 a.m. the next working day after each day that work is performed, attached to the Contractor Quality Control Report;

c. Field Test Reports: 2 copies, within 2 working days after the test is performed, attached to the Contractor Quality Control Report;

d. Monthly Summary Report of Tests: 2 copies attached to the Contractor Quality Control Report;

e. Testing Plan and Log, 2 copies, at the end of each month;

f. Rework Items List: 2 copies, by the last working day of the month

g. QC Meeting Minutes: 2 copies, within 2 working days after the meeting and;

h. QC Certifications: As required by the paragraph titled "QC Certifications."

1.4 QC PROGRAM REQUIREMENTS

The QC program requirements are contained in the Remedial Action Contract (RAC).

1.5 QC ORGANIZATION

1.5.1 QC Manager

1.5.1.1 Duties

Provide a QC Manager at the work site to implement and manage the QC program. In addition to implementing and managing the QC program, the QC Manager may perform the duties of project superintendent.

The QC Manager is required to attend the Coordination and Mutual Understanding Meeting, conduct the QC meetings, perform the three phases of control, perform submittal review, perform submittal approval, ensure testing is performed, and provide QC certifications and documentation required in this Contract. The QC Manager is responsible for managing and coordinating the three phases of control and documentation performed by Testing Laboratory personnel and any other inspection and testing personnel required by this contract.

1.5.1.2 Qualifications

An individual with a minimum of 5 years experience as a superintendent, inspector, QC Manager, project manager, or construction manager on similar size and type construction contracts that included the major trades that are part of this Contract.

1.6 QUALITY CONTROL (QC) PLAN

1.6.1 Requirements

Provide for approval by the Contracting Officer, a QC plan submitted in accordance with the requirements of the RAC.

1.7 COORDINATION AND MUTUAL UNDERSTANDING MEETING

After submission of the QC Plan and prior to the start of construction, meet with the Contracting Officer to present the QC program required by this Contract. The purpose of this meeting is to develop a mutual understanding of the QC details, including documentation, administration for on-site and off-site work, and the coordination of the Contractor's management, production, and QC personnel. At the meeting, the Contractor will be required to explain in detail how the three phases of control will be implemented for each definable feature of work. As a minimum, the Contractor's personnel required to attend shall include an officer of the firm, the project manager, project superintendent, QC Manager, Architectural Engineering (A/E) Firm, and subcontractor representatives. Each subcontractor who will be assigned QC responsibilities shall have a principal of the firm at the meeting. Minutes of the meeting will be prepared by the QC Manager and signed by the Contractor, the A/E, and the Contracting Officer. A copy of the signed minutes shall be provided to all attendees by the Contractor.

1.8 QC MEETINGS

After the start of construction, the QC Manager shall conduct weekly QC meetings at the work site with the project superintendent. The QC Manager shall prepare the minutes of the meeting and provide a copy to the Contracting Officer within 2 working days after the meeting. The Contracting Officer may attend these meetings. The QC Manager shall notify the Contracting Officer at least 48 hours in advance of each meeting. As a minimum, the following shall be accomplished at each meeting:

a. Review the minutes of the previous meeting;

b. Review the schedule and the status of work:

- Work or testing accomplished since last meeting;
- Rework items identified since last meeting;
- Rework items completed since last meeting;

c. Review the status of submittals:

- Submittals reviewed and approved since last meeting;
- Submittals required in the near future;

d. Review the work to be accomplished in the next 2 weeks and the documentation required:

- Establish completion dates for rework items
- Update the schedule showing planned and actual dates of the preparatory, initial, and follow-up phases, including testing and any other inspection required by this Contract
- Discuss construction methods and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each definable feature of work
- Discuss status of off-site work or testing
- Documentation required;

e. Resolve QC and production problems:

- Assist in resolving Request for Information issues; and

f. Address items that may require revising the QC plan:

- Changes in QC organization personnel
- Changes in procedures.

1.9 THREE PHASES OF CONTROL

The three phases of control shall adequately cover both on-site and off-site work and shall include the following for each definable feature of work.

1.9.1 Preparatory Phase

Notify the Contracting Officer at least 1 work day in advance of each preparatory phase. Conduct the preparatory phase with the superintendent and the foreman responsible for the definable feature. Document the results of the preparatory phase actions in the daily Contractor Quality Control Report and in the Quality Control Checklist. Perform the following prior to beginning work on each definable feature of work:

a. Review each paragraph of the applicable specification sections;

b. Review the Contract Drawings;

c. Verify that appropriate shop Drawings and submittals have been submitted and approved. Verify receipt of approved factory test results, when required;

d. Review the testing plan and ensure that provisions have been made to provide the required QC testing;

e. Examine the work area to ensure that the required preliminary work has been completed;

f. Examine the required materials, equipment, and sample work to ensure that they are on hand and conform to the approved shop Drawings and submitted data;

g. Review the safety plan and appropriate activity hazard analysis to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted; and

h. Discuss construction methods and the approach that will be used to provide quality construction for each definable feature of work.

1.9.2 Initial Phase

Notify the Contracting Officer at least 1 work day in advance of each initial phase. When construction crews are ready to start work on a definable feature of work, conduct the initial phase with the superintendent and the foreman responsible for that definable feature of work. Observe the initial segment of the definable feature of work to ensure that the work complies with Contract requirements. Document the results of the initial phase in the daily Contractor Quality Control Report and in the Quality Control Checklist. Repeat the initial phase for each new crew to work on site, or when acceptable levels of specified quality are not being met. Perform the following for each definable feature of work:

a. Establish the quality of workmanship required;

b. Resolve conflicts;

c. Review the Safety Plan and the appropriate activity hazard analysis to ensure that applicable safety requirements are met; and

d. Ensure that testing is performed.

1.9.3 Follow-up Phase

Perform the following for on-going work daily, until the completion of each definable feature of work and document in the daily Contractor Quality Control Report and in the Quality Control Checklist:

a. Ensure the work is in compliance with Contract requirements;

b. Maintain the quality of workmanship required;

c. Ensure that testing is performed; and

d. Ensure that rework items are being corrected.

1.10 SUBMITTAL REVIEW AND APPROVAL

Procedures for submission, review, and approval of submittals are described in the RAC.

1.11 TESTING

Except as stated otherwise in the specification sections, perform sampling and testing required under this Contract.

1.11.1 Testing Laboratory Requirements

Provide an independent testing laboratory qualified to perform sampling and tests required by this Contract. When the proposed testing laboratory is not accredited by an acceptable accreditation program as described by the paragraph titled "Accredited Laboratories," submit to the Contracting Officer for approval, certified statements signed by an official of the testing laboratory attesting that the proposed laboratory meets or conforms to the following requirements:

a. Laboratories engaged in testing of construction materials shall meet the requirements of ASTM E 329.

b. Laboratories engaged in testing of soil and rock, as used in engineering design and construction, shall meet the requirements of ASTM D 3740.

1.11.2 Accredited Laboratories

In addition to applicable U.S. Navy approval through the Naval Facilities Engineering Service Center (NFESC), acceptable accreditation programs are the National Institute of Standards and Technology (NIST)/National Voluntary Laboratory Accreditation Program (NVLAP), the American Association of State Highway and Transportation Officials (AASHTO) program, and the American Association for Laboratory Accreditation (A2LA) program. Furnish to the Contracting Officer a copy of the Certificate of Accreditation and Scope of Accreditation and latest directory of the accrediting organization for accredited laboratories. The scope of the laboratory's accreditation shall include the test methods required by the Contract.

1.11.3 Inspection of Testing Laboratories

Prior to approval of non-accredited laboratories, the proposed testing laboratory facilities and records may be subject to inspection by the Contracting Officer. Records subject to inspection include equipment inventory, equipment calibration dates and procedures, library of test procedures, audit and inspection reports by agencies conducting laboratory evaluations and certifications, testing and management personnel qualifications, test report forms, and the internal QC procedures.

1.11.4 Capability Check

The Contracting Officer retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this Contract.

1.11.5 Test Results

Cite applicable Contract requirements, tests, or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. If item fails to conform, notify Contracting Officer immediately. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results shall be signed by a testing laboratory representative authorized to sign certified test reports. Furnish the signed reports, certifications, and other documentation to the Contracting Officer via the QC Manager. Furnish a summary report of field tests at the end of each month. Attach a copy of the summary report to the last daily Contractor Quality Control Report of each month.

1.11.6 Test Reports and Monthly Summary Report of Tests

The QC Manager shall furnish the signed reports, certifications, and a summary report of field tests at the end of each month to the Contracting Officer. Attach a copy of the summary report to the last daily Contractor Quality Control Report of each month.

1.12 QC CERTIFICATIONS

1.12.1 Contractor Quality Control Report Certification

Each Contractor Quality Control Report shall contain the following statement: "On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract Drawings and specifications to the best of my knowledge, except as noted in this report."

1.12.2 Invoice Certification

Furnish a certificate to the Contracting Officer with each payment request, signed by the QC Manager, attesting that as-built Drawings are current and attesting that the work for which payment is requested, including stored material, is in compliance with contract requirements.

1.12.3 Completion Certification

Upon completion of work under this Contract, the QC Manager shall furnish a certificate to the Contracting Officer attesting that "the work has been completed, inspected, tested, and is in compliance with the Contract."

1.13 DOCUMENTATION

Maintain current and complete records of on-site and off-site QC program operations and activities.

1.13.1 Contractor Production Report

Reports are required for each day that work is performed and shall be attached to the Contractor Quality Control Report prepared for the same day. Account for each calendar day throughout the life of the Contract. The reporting of work shall be identified by terminology consistent with the construction schedule. Contractor Production Reports are to be prepared, signed, and dated by the project superintendent and shall contain the following information:

a. Date of report, report number, name of contractor, Contract number, title and location of Contract, and superintendent present.

b. Weather conditions in the morning and in the afternoon including maximum and minimum temperatures.

c. A list of Contractor and subcontractor personnel on the work site, their trades, employer, work location, description of work performed, and hours worked.

d. A list of job safety actions taken and safety inspections conducted. Indicate that safety requirements have been met including the results on the following:

- Attach a copy of the meeting minutes from the daily job safety meeting.

- Were there any lost time accidents? (If YES, attach a copy of the completed Occupational Safety and Health Administration report.)

- Was crane/trenching/scaffold/high voltage electrical/high work done? (If YES, attach a statement or checklist showing inspection performed.)

- Was hazardous material/waste released into the environment? (If YES, attach a description of meetings held and accidents that happened.)

e. A list of equipment/material received each day that is incorporated into the job.

f. A list of construction and plant equipment on the work site including the number of hours used, idle, and down for repair.

g. Include a "remarks" section in this report which will contain pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the Drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered, and a record of visitors to the work site.

1.13.2 Contractor Quality Control Report

Reports are required for each day that work is performed and for every 7 consecutive calendar days of no work and on the last day of a no-work period. Account for each calendar day throughout the life of the Contract. The reporting of work shall be identified by terminology consistent with the construction schedule. Contractor Quality Control Reports are to be prepared, signed, and dated by the QC Manager, and shall contain the following information:

a. Identify the control phase and the definable feature of work.

b. Results of the Preparatory Phase meetings held including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that, for this definable feature of work, the Drawings and specifications have been reviewed, submittals have been approved, materials comply with approved submittals, materials are stored properly, preliminary work was done correctly, the testing plan has been reviewed, and work methods and schedule have been discussed.

c. Results of the Initial Phase meetings held including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that for this definable feature of work the preliminary work was done correctly, samples have been prepared and approved, the workmanship is satisfactory, test results are acceptable, work is in compliance with the Contract, and the required testing has been performed, and include a list of who performed the tests.

d. Results of the Follow-up Phase inspections held including the location of the definable feature of work. Indicate in the report for this definable feature of work that the work complies with the Contract as approved in the Initial Phase, and that required testing has been performed, and include a list of who performed the tests.

e. Results of the three phases of control for off-site work, if applicable, including actions taken.

f. List the rework items identified, but not corrected, by close of business.

g. List the rework items corrected from the rework items list along with the corrective action taken.

h. Include a "remarks" section in this report that will contain pertinent information including directions received, quality control problem areas, deviations from the QC plan, construction deficiencies encountered, QC meetings held, acknowledgment that as-built Drawings have been updated, corrective direction given by the QC Organization, and corrective action taken by the Contractor.

i. Contractor Quality Control Report certification.

1.13.3 Testing Plan and Log

As tests are performed, the QC Manager shall record on the "Testing Plan and Log" the date the test was conducted, the date the test results were forwarded to the Contracting Officer, remarks, and acknowledgment that an accredited or Contracting Officer-approved testing laboratory was used. Attach a copy of the updated "Testing Plan and Log" to the last daily Contractor Quality Control Report of each month.

1.13.4 Rework Items List

The QC Manager shall maintain a list of work that does not comply with the Contract, identifying what items need to be reworked, the date the item was originally discovered, and the date the item was corrected. There is no requirement to report a rework item that is corrected the same day it is discovered. Attach a copy of the "Contractor Rework Items List" to the last daily Contractor Quality Control Report of each month. The Contractor shall be responsible for including on this list items needing rework, including those identified by the Contracting Officer.

1.13.5 As-Built Drawings

The QC Manager is required to review the as-built Drawings to ensure that as-built Drawings are kept current on a daily basis and marked to show deviations that have been made from the Contract Drawings. The QC Manager shall initial each deviation and each revision. Upon completion of work, the QC Manager shall furnish a certificate attesting to the accuracy of the as-built Drawings prior to submission to the Contracting Officer.

1.13.6 Report Forms

The following forms, which are attached at the end of this section, are acceptable for providing the information required by the paragraph titled "Documentation." While use of these specific formats is not required, any other format used shall contain the same information:

a. Combined Contractor Production Report and Contractor Quality Control Report (1 sheet), with separate continuation sheet

b. Testing Plan and Log

c. Rework Items List

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

CONTRACTOR QUALITY CONTROL REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE	Enter (DD/MMM/YY)
REPORT NO	Enter Rpt # Here

PHASE	CONTRACT NO Enter Cnt# Here	CONTRACT TITLE Enter Title and Location of Construction Contract Here

PREPARATORY

WAS PREPARATORY PHASE WORK PREFORMED TODAY? YES ☐ NO ☐

IF YES, FILL OUT AND ATTACH SUPPLEMENTAL PREPARATORY PHASE CHECKLIST.

Schedule Activity No.	Definable Feature of Work	Index #

INITIAL

WAS INITIAL PHASE WORK PREFORMED TODAY? YES ☐ NO ☐

IF YES, FILL OUT AND ATTACH SUPPLEMENTAL INITIAL PHASE CHECKLIST.

Schedule Activity No.	Definable Feature of Work	Index #

FOLLOW-UP

WORK COMPLIES WITH CONTRACT AS APPROVED DURING INITIAL PHASE? YES ☐ NO ☐

WORK COMPLIES WITH SAFETY REQUIREMENTS? YES ☐ NO ☐

Schedule Activity No.	Description of Work, Testing Performed & By Whom, Definable Feature of Work, Specification Section, Location and List of Personnel Present

REWORK ITEMS IDENTIFIED TODAY (NOT CORRECTED BY CLOSE OF BUSINESS)

Schedule Activity No.	Description

REWORK ITEMS CORRECTED TODAY (FROM REWORK ITEMS LIST)

Schedule Activity No.	Description

REMARKS (Also Explain Any Follow-Up Phase Checklist Item From Above That Was Answered "NO"), Manuf. Rep On-Site, etc.

Schedule Activity No.	Description

On behalf of the contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge except as noted in this report.

AUTHORIZED QC MANAGER AT SITE DATE

GOVERNMENT QUALITY ASSURANCE REPORT

DATE

QUALITY ASSURANCE REPRESENTATIVE'S REMARKS AND/OR EXCEPTIONS TO THE REPORT

Schedule Activity No.	Description

GOVERNMENT QUALITY ASSURANCE MANAGER DATE

PREPARATORY PHASE CHECKLIST

(CONTINUED ON SECOND PAGE)

SPEC SECTION	DATE
Enter Spec Section # Here	Enter Date (DD/MMM/YY)

CONTRACT NO	DEFINABLE FEATURE OF WORK	SCHEDULE ACT NO.	INDEX #
Enter Cnt# Here	Enter DFOW Here	Enter Sched Act ID Here	Enter Index# Here

PERSONNEL PRESENT

GOVERNMENT REP NOTIFIED ____ HOURS IN ADVANCE: YES ☐ NO ☐

NAME	POSITION	COMPANY/GOVERNMENT

SUBMITTALS

REVIEW SUBMITTALS AND/OR SUBMITTAL REGISTER. HAVE ALL SUBMITTALS BEEN APPROVED? YES ☐ NO ☐

IF NO, WHAT ITEMS HAVE NOT BEEN SUBMITTED? _____

ARE ALL MATERIALS ON HAND? YES ☐ NO ☐

IF NO, WHAT ITEMS ARE MISSING? _____

CHECK APPROVED SUBMITTALS AGAINST DELIVERED MATERIAL. (THIS SHOULD BE DONE AS MATERIAL ARRIVES.)

COMMENTS: _____

MATERIAL STORAGE

ARE MATERIALS STORED PROPERLY? YES ☐ NO ☐

IF NO, WHAT ACTION IS TAKEN? _____

SPECIFICATIONS

REVIEW EACH PARAGRAPH OF SPECIFICATIONS. _____

DISCUSS PROCEDURE FOR ACCOMPLISHING THE WORK. _____

CLARIFY ANY DIFFERENCES. _____

PRELIMINARY WORK & PERMITS

ENSURE PRELIMINARY WORK IS CORRECT AND PERMITS ARE ON FILE.

IF NOT, WHAT ACTION IS TAKEN? _____

TESTING

IDENTIFY TEST TO BE PERFORMED, FREQUENCY, AND BY WHOM.

WHEN REQUIRED?

WHERE REQUIRED?

REVIEW TESTING PLAN.

HAS TEST FACILITIES BEEN APPROVED?

SAFETY

ACTIVITY HAZARD ANALYSIS APPROVED? YES ☐ NO ☐

REVIEW APPLICABLE PORTION OF EM 385-1-1.

MEETING COMMENTS

NAVY/ROICC COMMENTS DURING MEETING.

OTHER ITEMS OR REMARKS

OTHER ITEMS OR REMARKS:

QC MANAGER DATE

CONTRACTOR PRODUCTION REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE	Enter Date (DD/MMM/YY)
REPORT NO	Enter Report # Here

CONTRACT NO	TITLE AND LOCATION
Enter Cnt# Here	Enter Title and Location of Construction Contract Here

CONTRACTOR	SUPERINTENDENT
Enter The Contractor's Company Name Here	Enter Superintendent's Name Here

AM WEATHER	PM WEATHER	MAX TEMP (F)	MIN TEMP (F)
Enter AM Weather Data Here	Enter PM Weather Data Here	Enter Max Temp Here	Enter Min Temp Here

WORK PERFORMED TODAY

Schedule Activity No.	WORK LOCATION AND DESCRIPTION	EMPLOYER	NUMBER	TRADE	HRS

JOB SAFETY					
	WAS A JOB SAFETY MEETING HELD THIS DATE? (If YES attach copy of the meeting minutes)	☐ YES	☐ NO	TOTAL WORK HOURS ON JOB SITE, THIS DATE, INCL CON'T SHEETS	
	WERE THERE ANY LOST TIME ACCIDENTS THIS DATE? (If YES attach copy of completed OSHA report)	☐ YES	☐ NO	CUMULATIVE TOTAL OF WORK HOURS FROM PREVIOUS REPORT	
	WAS CRANE/MANLIFT/TRENCHING/SCAFFOLD/HV ELEC/HIGH WORK/ HAZMAT WORK DONE? (If YES attach statement or checklist showing inspection performed.)	☐ YES	☐ NO		
	WAS HAZARDOUS MATERIAL/WASTE RELEASED INTO THE ENVIRONMENT? (If YES attach description of incident and proposed action.)	☐ YES	☐ NO	TOTAL WORK HOURS FROM START OF CONSTRUCTION	

Schedule Activity No.	LIST SAFETY ACTIONS TAKEN TODAY/SAFETY INSPECTIONS CONDUCTED	☐ SAFETY REQUIREMENTS HAVE BEEN MET.

EQUIPMENT/MATERIAL RECEIVED TODAY TO BE INCORPORATED IN JOB (INDICATE SCHEDULE ACTIVITY NUMBER)

Schedule Activity No.	Submittal #	Description of Equipment/Material Received

CONSTRUCTION AND PLANT EQUIPMENT ON JOB SITE TODAY. INDICATE HOURS USED AND SCHEDULE ACTIVITY NUMBER.

Schedule Activity No.	Owner	Description of Construction Equipment Used Today (incl Make and Model)	Hours Used

Schedule Activity No.	REMARKS

CONTRACTOR/SUPERINTENDENT DATE

INITIAL PHASE CHECKLIST

SPEC SECTION	DATE
Enter Spec Section # Here	Enter Date (DD/MMM/YY)

CONTRACT NO	DEFINABLE FEATURE OF WORK	SCHEDULE ACT NO.	INDEX #
Enter Cnt# Here	Enter DFOW Here	Enter Sched Act ID Here	Enter Index# Here

PERSONNEL PRESENT

GOVERNMENT REP NOTIFIED _____ HOURS IN ADVANCE: YES ☐ NO ☐

NAME	POSITION	COMPANY/GOVERNMENT

PROCEDURE COMPLIANCE

IDENTIFIY FULL COMPLIANCE WITH PROCEDURES IDENTIFIED AT PREPARATORY. COORDINATE PLANS, SPECIFICATIONS, AND SUBMITTALS.

COMMENTS:

PRELIMINARY WORK

ENSURE PRELIMINARY WORK IS COMPLETE AND CORRECT. IF NOT, WHAT ACTION IS TAKEN?

WORKMANSHIP

ESTABLISH LEVEL OF WORKMANSHIP.

WHERE IS WORK LOCATED?

IS SAMPLE PANEL REQUIRED? YES ☐ NO ☐

WILL THE INIITAL WORK BE CONSIDERED AS A SAMPLE? YES ☐ NO ☐

(IF YES, MAINTAIN IN PRESENT CONDITION AS LONG AS POSSIBLE AND DESCRIBE LOCATION OF SAMPLE)

RESOLUTION

RESOLVE ANY DIFFERENCES.

COMMENTS:

CHECK SAFETY

REVIEW JOB CONDITIONS USING EM 385-1-1 AND JOB HAZARD ANALYSIS

COMMENTS:

OTHER

OTHER ITEMS OR REMARKS

QC MANAGER _____ DATE _____

REWORK ITEMS LIST

Contract No. and Title: Enter Contract # and Title Here

Contractor: Enter Contractor's Company Name Here

NUMBER	DATE IDENTIFIED	DESCRIPTION	CONTRACT REQUIREMENT (Spec. Section and Par. No., Drawing No. and Detail No., etc.)	ACTION TAKEN BY QC MANAGER	RESOLUTION	DATE COMPLETED

TESTING PLAN AND LOG

CONTRACT NUMBER			PROJECT TITLE AND LOCATION							CONTRACTOR	
Enter Contract # Here			Enter Contract Title and Location Here							Enter Contractor's Company Name Here	
SPECIFICATION SECTION AND PARAGRAPH NUMBER	ITEM OF WORK	TEST REQUIRED	ACCREDITED/ APPROVED LAB		SAMPLED BY	TESTED BY	LOCATION OF TEST		DATE COMPLETED	DATE FORWARDED TO CONTR. OFF.	REMARKS
			YES	NO			ON SITE	OFF SITE			

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 REFERENCES

FEDERAL HIGHWAY ADMINISTRATION (FHWA)

Manual on Uniform Traffic Control Devices (FHWA MUTCD) (1988)

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 Submittal Procedures.

1.2.1 SD-02 Drawings

a. Traffic control plan; G
b. Project sign

1.3 TEMPORARY UTILITIES

The Contractor shall coordinate any utility hookups that may be needed for the project, including water, electricity, and telephone services.

1.4 TEMPORARY SANITARY FACILITIES

Provide adequate sanitary conveniences of a type approved for the use of persons employed on the work, properly secluded from public observation, and maintained in such a manner as required or approved by the Contracting Officer. Maintain these conveniences at all times without nuisance. Upon completion of the work, remove the conveniences from the premises, leaving the premises clean and free from nuisance.

1.5 TEMPORARY BUILDINGS AND CONSTRUCTION EQUIPMENT

Locations of the Contractor staging area shall be approved by the Contracting Officer. The trailers or storage buildings shall be suitably painted and kept in a good state of repair. A sign not smaller than 24 inches by 24 inches shall be conspicuously placed on the trailer depicting the company name, business phone number, and emergency phone number. Trailers shall be anchored to resist high winds and seismic loads, and must meet applicable state or local standards for anchoring mobile trailers.

1.6 IDENTIFICATION OF CONTRACTOR VEHICLES

Each Contractor-provided vehicle and towed trailer shall show the Contractor's name so that it is clearly visible from at least 100 feet on both front doors of the vehicle and both sides of a towed trailer. Removable company identification is acceptable. Contractor-provided vehicle shall at all times display a valid state license plate and safety inspection sticker. Contractor vehicles operated on Government property shall be maintained in a good state of repair.

1.7 PROJECT SIGN

Within 15 days after the commencement of work, provide one project identification sign at a location indicated by the Contracting Officer. Construct the sign in accordance with project sign detail attached at the end of this section. Maintain sign throughout the life of the project. Upon completion of the project, remove the sign from the site.

1.7.1 Project Identification Signboard

A project identification signboard shall be provided in accordance with attached Plate 1, except the word "ARCHITECT" shall be replaced by the word "ENGINEER." The signboard shall be provided at a conspicuous location on or near the job site where directed by the Contracting Officer. Construct signboard in accordance with project identification signboard Plates 3 and 4.

a. The field of the sign shall consist of a 4- by 8- foot sheet of grade B-B, medium-density overlaid exterior plywood.

b. Lumber shall be B or better Southern pine, pressure-preservative treated with pentachlorophenol. Nails shall be aluminum or galvanized steel.

c. The entire signboard and supports shall be given one coat of exterior alkyd primer and two coats of exterior alkyd enamel paint. The lettering and sign work shall be performed by a skilled sign painter using paint known in the trade as bulletin colors. The colors, lettering sizes, and lettering styles shall be as indicated. Where preservative-treated lumber is required, use only cured pressure-treated wood that has had the chemicals leached from the surface of the wood prior to painting.

d. The high-gloss acrylic gold enamel paint used as background for the Department of the Navy-applied sticker shall be spray applied automotive quality paint. The 18-inch diameter applied sticker shall be a silkscreened image in the design indicated, painted on a 2 millimeter transparent polyester film. The weather resistant, self-adhering film shall be rated for a minimum of 2 years of exterior vertical exposure and be mounted to the sign with pressure-sensitive, permanent acrylic adhesive. Shop cut sticker to round shape and provide pull-off backing sheet on adhesive side of design sticker for shipping. Provide applied design sticker in accordance with attached detail.

e. Sign paint colors (numbers listed below for color identification only)

   (1) Blue = Benjamin Moore Paints No. 826.

   (2) White = Benjamin Moore Paints No. 873.

   (3) Gold = Dupont No. B8014, Metallic gold.

1.8 STATION OPERATION AFFECT ON CONTRACTOR OPERATIONS

1.8.1 Interruption of Vehicular Traffic

If, during the performance of work, it becomes necessary to modify vehicular traffic patterns at any locations, notify the Contracting Officer at least 15 calendar days prior to the proposed modification date, and provide a Traffic Control Plan detailing the proposed controls to traffic movement for approval. The plan shall be in accordance with State and local regulations and the FHWA MUTCD, Part VI. Provide cones, signs, barricades, lights, and other traffic control devices and personnel required to control traffic.

1.9 UNAUTHORIZED ACCESS

Ensure that the public and other unauthorized personnel do not have access to the area during the construction period.

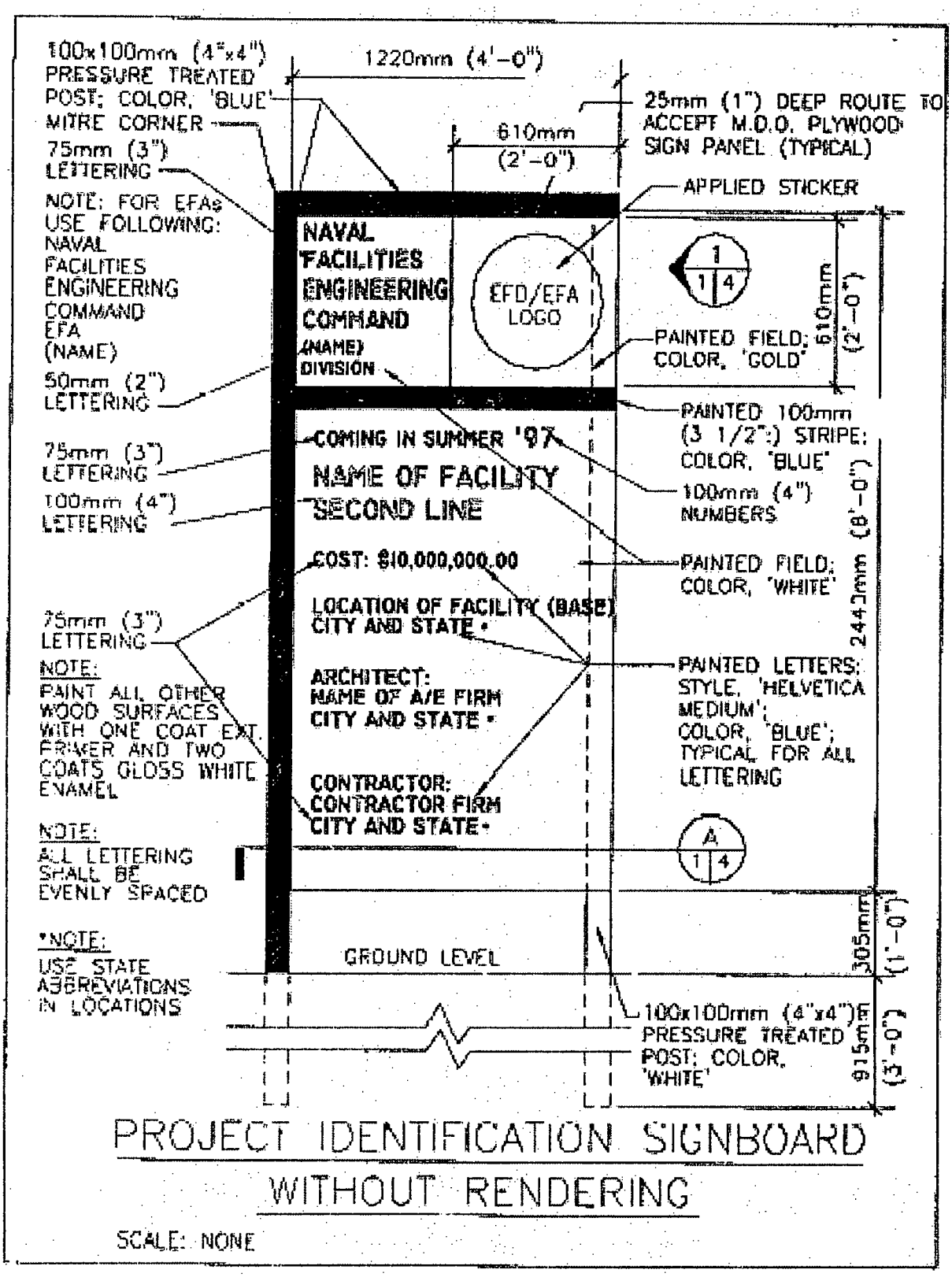
PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

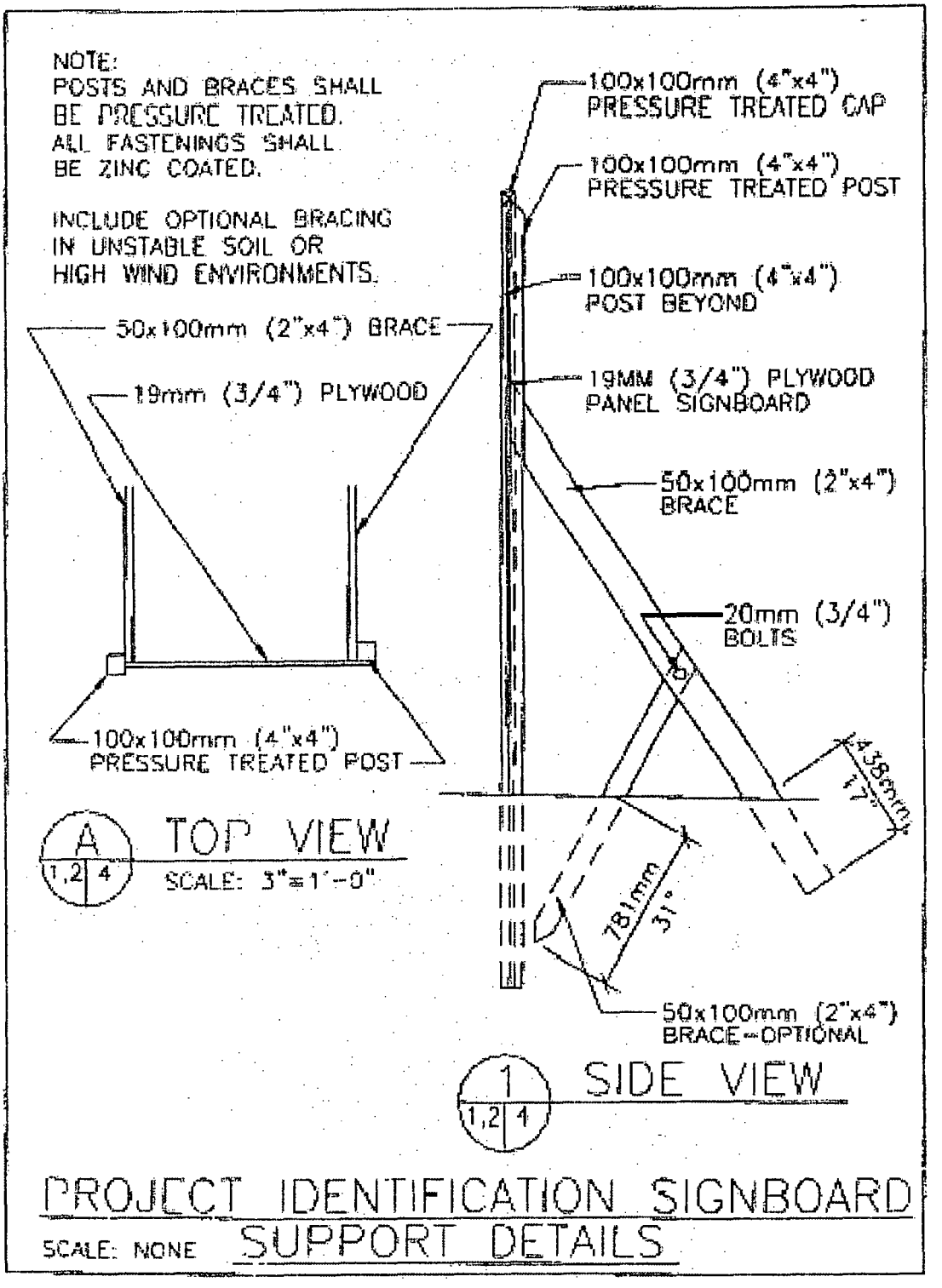
END OF SECTION

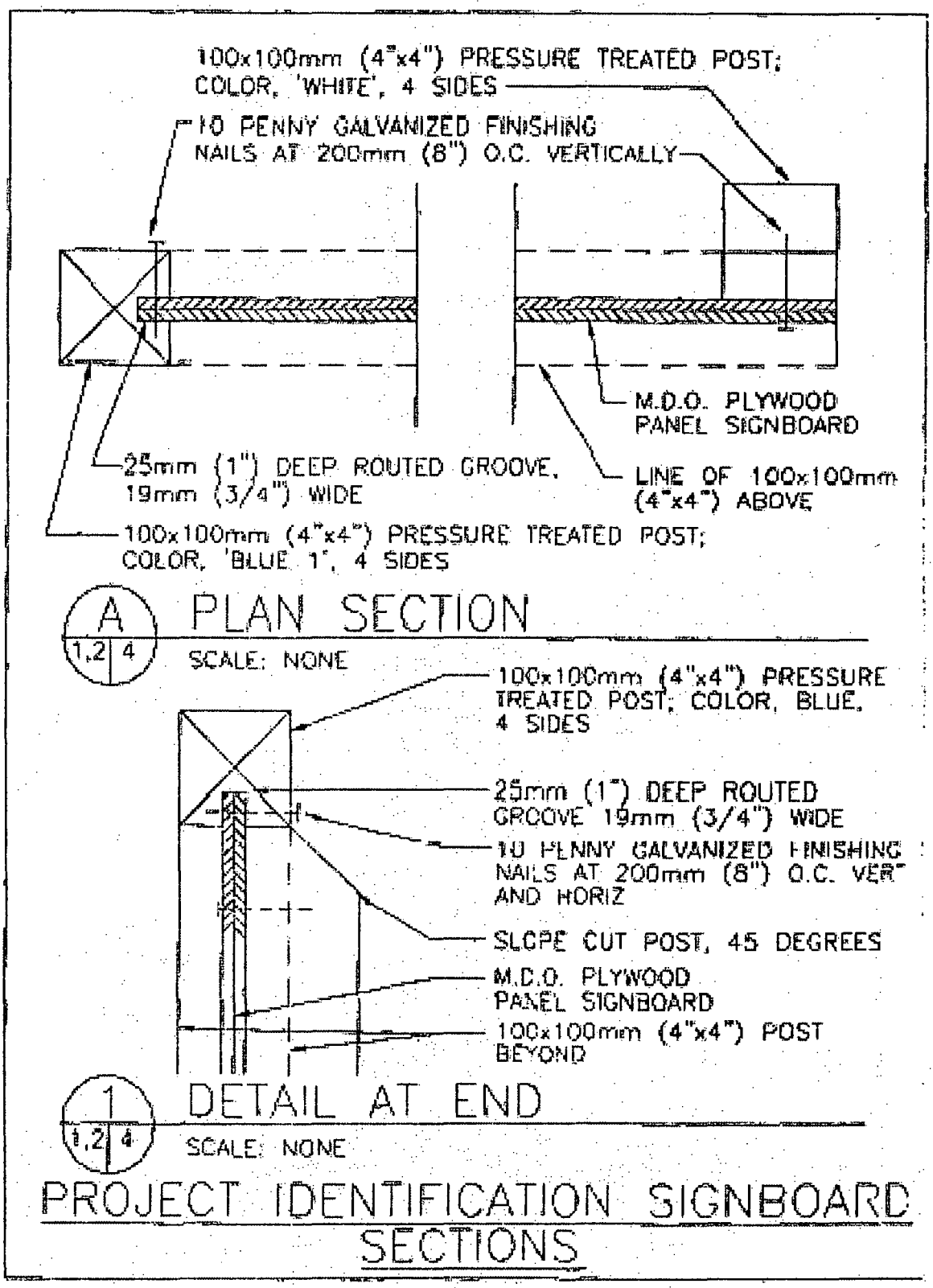


PROJECT IDENTIFICATION SIGNBOARD

WITHOUT RENDERING

SCALE: NONE


NOTE:
POSTS AND BRACES SHALL BE PRESSURE TREATED.
ALL FASTENINGS SHALL BE ZINC COATED.
INCLUDE OPTIONAL BRACING IN UNSTABLE SOIL OR HIGH WIND ENVIRONMENTS.
50x100mm (2"x4") BRACE
19mm (3/4") PLYWOOD
100x100mm (4"x4") PRESSURE TREATED POST
A
1,2 4
TOP VIEW
SCALE: 3"=1'-0"
100x100mm (4"x4") PRESSURE TREATED CAP
100x100mm (4"x4") PRESSURE TREATED POST
100x100mm (4"x4") POST BEYOND
19MM (3/4") PLYWOOD PANEL SIGNBOARD
50x100mm (2"x4") BRACE
20mm (3/4") BOLTS
438mm
17°
781mm
31°
50x100mm (2"x4") BRACE-OPTIONAL
1
1,2 1
SIDE VIEW
PROJECT IDENTIFICATION SIGNBOARD
SCALE: NONE
SUPPORT DETAILS


100x100mm (4"x4") PRESSURE TREATED POST; COLOR, 'WHITE', 4 SIDES
10 PENNY GALVANIZED FINISHING NAILS AT 200mm (8") O.C. VERTICALLY
M.D.O. PLYWOOD PANEL SIGNBOARD
25mm (1") DEEP ROUTED GROOVE, 19mm (3/4") WIDE
LINE OF 100x100mm (4"x4") ABOVE
100x100mm (4"x4") PRESSURE TREATED POST; COLOR, 'BLUE 1', 4 SIDES
A
1,2 4
PLAN SECTION
SCALE: NONE
100x100mm (4"x4") PRESSURE TREATED POST; COLOR, BLUE, 4 SIDES
25mm (1") DEEP ROUTED GROOVE 19mm (3/4") WIDE
10 PENNY GALVANIZED FINISHING NAILS AT 200mm (8") O.C. VER AND HORIZ
SLOPE CUT POST, 45 DEGREES
M.D.O. PLYWOOD PANEL SIGNBOARD
100x100mm (4"x4") POST BEYOND
1
1,2 4
DETAIL AT END
SCALE: NONE
PROJECT IDENTIFICATION SIGNBOARD SECTIONS

SECTION 01 57 19.00 20
TEMPORARY ENVIRONMENTAL CONTROLS

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 the basic designation only.

CODE OF FEDERAL REGULATIONS (CFR)

29 CFR 1910	Occupational Safety and Health Administration Standards
40 CFR 261	Identification and Listing of Hazardous Waste
40 CFR 262	Generators of Hazardous Waste
40 CFR 263	Transporters of Hazardous Waste
40 CFR 264	Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 265	Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities
40 CFR 300	National Oil and Hazardous Substances Pollution Contingency Plan
49 CFR 171	General Information, Regulations, and Definitions
49 CFR 172	Hazardous Materials, Tables, and Hazardous Materials Communications Regulations
49 CFR 178	Shipping Container Specifications

CALIFORNIA STATE WATER RESOURCES CONTROL BOARD

Construction General Permit Order 99-08-DWQ National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction Activity

BAY AREA AIR QUALITY MANAGEMENT DISTRICT (BAAQMD)

Regulation 6, Rule 1-302	Particulate Matter General Requirements – Opacity
Regulation 6, Rule 1-305	Particulate Matter General Requirements – Visible Particles
Regulation 8, Rule 40	Aeration of Contaminated Soil and Removal of Underground Storage Tanks

1.2 CONTRACTOR LIABILITIES FOR ENVIRONMENTAL PROTECTION

Contractors shall complete and provide documentation of environmental training for training required by Federal, State, and local regulations.

1.3 DEFINITIONS

1.3.1 Sediment

Soil and other debris that has eroded and have been transported by runoff water or wind.

1.3.2 Solid Waste

Rubbish, debris, garbage, and other discarded solid materials, except hazardous waste as defined in Paragraph 1.3.7 Hazardous Waste, resulting from industrial, commercial, and agricultural operations and from community activities.

1.3.3 Sanitary Wastes

Wastes characterized as domestic sanitary sewage.

1.3.4 Rubbish

Combustible and noncombustible wastes such as paper, boxes, glass, crockery, metal, lumber, cans, and bones.

1.3.5 Debris

Combustible and noncombustible wastes such as ashes and waste materials resulting from construction or maintenance and repair work, leaves, and tree trimmings.

1.3.6 Garbage

Refuse and scraps resulting from preparation, cooking, dispensing, and consumption of food.

1.3.7 Hazardous Waste

Hazardous substances as defined in 40 CFR 261 or as defined by applicable State and local regulations.

1.3.8 Hazardous Materials

Hazardous materials as defined in 49 CFR 171 and listed in 49 CFR 172.

1.3.9 Oily Waste

Petroleum products and bituminous materials.

1.3.10 Dust

Any particulate matter emitted as liquid or solid particles.

1.3.11 Storm Water

Water discharged with possible sheeting action and subsequent soil erosion; that may terminate in drainage ditches, storm sewers,creeks, and/or "waters of the United States."

1.4 SUBMITTALS

Submit the following in accordance with Section 01 33 00 Submittal Procedures.

1.4.1 SD-01, Preconstruction Submittals

a. Environmental Protection Plan; G
b. Preconstruction Survey Report; G
c. Site health and safety plan. Submit in accordance with the requirements contained in Section C, Part 3 of the Response Action Contractor (RAC) Contract (29 CFR 1910).

1.4.2 SD-07, Certificates

a. Solid waste disposal permit/manifests; G
b. Disposal permit/manifests for hazardous waste; G
c. Erosion and Sediment Control Inspection Reports; G

Submit to the Contracting Officer once every 7 calendar days and within 24 hours of a storm event that produces 0.5 inch of rain or greater.

1.5 ENVIRONMENTAL PROTECTION REGULATORY REQUIREMENTS

Provide and maintain, during the life of the contract, environmental protection as defined in this Section. Plan for and provide environmental protective measures to control pollution that develops during normal construction practice. Plan for and provide environmental protective measures required to correct conditions that develop during the construction of permanent or temporary environmental features associated with the project. Comply with Federal, State, and local regulations pertaining to the environment, including but not limited to water, air, solid waste, and noise pollution.

1.6 ENVIRONMENTAL PROTECTION PLAN

1.6.1 Contents of Environmental Protection Plan

a. Any hazardous materials (HM) planned for use on the station shall be included in the station HM Tracking Program maintained by the Safety Department. To assist this effort, the Contractor shall submit a list (including quantities) of HM to be brought to the station and copies of the corresponding Material Safety Data Sheets (MSDS). Submit this list to the Contracting Officer. At project completion, remove any hazardous material brought onto the station. Account for the quantity of HM brought to the station, the quantity used or expended during the job, and the leftover quantity that (1) may have additional useful life as a HM and shall be removed by the Contractor, or (2) may be a hazardous waste, which shall then be removed as specified herein.

b. The Environmental Protection Plan shall list and quantify any Hazardous Waste (HW) to be generated during the project.

c. In accordance with station regulations, store HW near the point of generation up to a total quantity of one quart of toxic waste or 55 gallons of hazardous waste. Move any volume that exceeds these quantities to a HW-permitted area within 3 days. Prior to generation of HW, contact the Contracting Officer for labeling requirements for storage of hazardous wastes.

d. In accordance with station regulations, substitute materials as necessary to reduce the generation of HW and include a statement to that effect in the Environmental Protection Plan.

e. Contact Contracting Officer for conditions in the area of the project that may be subject to special environmental procedures. Include this information in the Preconstruction Survey. Describe in the Environmental Protection Plan any permits required prior to working in the area, and contingency plans in case an unexpected environmental condition is discovered.

f. Obtain permits for handling HW, and deliver completed documents to Contracting Officer for review. File the documents with the appropriate agency, and complete disposal with the approval of the Contracting Officer. Deliver correspondence with the State concerning the environmental permits and completed permits to Contracting Officer.

1.6.2 Preconstruction Site Inspection

Perform a preconstruction inspection of the project site with the Contracting Officer, and take photographs showing existing environmental conditions in and adjacent to the site.

PART 2 PRODUCTS

2.1 The contractor shall provide appropriate spill response materials including, but not limited to the following: containers, adsorbents, shovels, and personal protective equipment. Spill response materials shall be available at all times when contaminated or potentially contaminated materials are being handled or transported. Spill response materials shall be compatible with the type of materials and contaminants being handled.

PART 3 EXECUTION

3.1 PROTECTION OF NATURAL RESOURCES

Preserve the natural resources within the project boundaries and outside the limits of permanent work. Restore to an equivalent or improved condition upon completion of work. Confine construction activities to within the limits of the work indicated or specified.

3.1.1 Water Resources

Prevent oily or other hazardous substances from entering the ground, drainage areas, wetlands or local bodies of water. Surround all temporary fuel oil or petroleum storage tanks with a temporary earthen berm of sufficient size and strength to contain the contents of the tanks in the event of leakage or spillage.

3.1.2 Fish and Wildlife Resources

Do not unnecessarily disturb fish or wildlife. Do not alter water flows or otherwise significantly disturb the native habitat adjacent to the project, except as indicated or specified.

3.2 HISTORICAL AND ARCHAEOLOGICAL RESOURCES

Carefully protect in-place and report immediately to the Contracting Officer historical and archaeological items or human skeletal remains discovered in the course of work. Stop work in the immediate area of the discovery until directed by the Contracting Officer to resume work. The Government retains ownership and control over historical and archaeological resources.

3.3 NOISE

Make the maximum use of low-noise emission products, as certified by the U.S. Environmental Protection Agency (EPA). Blasting or use of explosives will not be permitted without written permission from the Contracting Officer, and then only during designated times.

3.4 EROSION AND SEDIMENT CONTROL MEASURES

3.4.1 Burnoff

Burnoff of the ground cover is not permitted.

3.4.2 Protection of Erodible Soils

Immediately finish earthwork brought to a final grade, as indicated or specified. Protect side and back slopes upon completion of rough grading. Plan and conduct earthwork to minimize the duration of exposure of unprotected soils.

3.4.3 Temporary Protection of Erodible Soils

Use the following methods to prevent erosion and control sedimentation:

3.4.3.1 Mechanical Retardation and Control of Runoff

Mechanically retard and control the rate of runoff from the construction site. Controls include construction of diversion ditches, benches, berms, and use of silt fences and strawbales to retard and divert runoff to protected drainage courses.

3.4.4 Construction Stormwater Permit

Follow procedures in the storm water pollution prevention plan as required under the Construction General Permit Order 2009-0009-DWQ. Submit the plan as a preconstruction submittal according to 01 30 00 Administrative Requirements.

3.5 CONTROL AND DISPOSAL OF CONTRACTOR-GENERATED SOLID WASTES

Pick up solid wastes and place them in covered containers that are regularly emptied. Do not prepare or cook food on the project site. Prevent contamination of the site or other areas when handling and disposing of wastes. At project completion, leave the areas clean.

3.5.1 Disposal of Rubbish and Debris

Dispose of rubbish and debris in accordance with the requirements specified below:

3.5.1.1 Removal From Government Property

Remove and dispose of rubbish and debris from Government property.

3.5.2 Garbage Disposal

Place garbage in approved containers, and move to a pickup point or disposal area, where directed.

3.6 CONTROL AND DISPOSAL OF HAZARDOUS WASTE

3.6.1 Hazardous Waste Generation

Handle generated hazardous waste in accordance with 40 CFR 262.

3.6.2 Hazardous Waste Disposal

Dispose of hazardous waste in accordance with Federal, State, and local regulations, especially 40 CFR 263, 40 CFR 264, and 40 CFR 265. Removal of hazardous waste from Government property shall not occur without prior notification and coordination with the Contracting Officer. Transport hazardous waste by a permitted, licensed, or registered hazardous waste transporter to a treatment, storage, and disposal (TSD) facility. Hazardous waste shall be properly identified, packaged, and labeled in accordance with 49 CFR 172. Provide completed manifests for hazardous waste disposed of off-site to the Contracting Officer within 7 days of disposal. Hazardous waste shall not be brought onto the base.

3.6.3 Hazardous Waste Storage

Store hazardous waste in containers in accordance with 49 CFR 178. Identify hazardous waste in accordance with 40 CFR 261 and 40 CFR 262. Identify hazardous waste generated within the confines of the station by the station's EPA generator identification number.

3.6.4 Spills of Oil and Hazardous Materials

Take precautions to prevent spills of oil and hazardous material. In the event of a spill, immediately notify the Contracting Officer. Spill response shall be in accordance with 40 CFR 300 and applicable State regulations.

3.6.5 Petroleum Products

Protect against spills and evaporation during fueling and lubrication of equipment and motor vehicles. Properly dispose of lubricants and excess oil.

3.7 DUST CONTROL

Control dust at all times, including during nonworking periods. Sprinkle or treat, with approved dust suppressants, the soil at the site, haul roads, and other areas disturbed by operations. Dry power brooming will not be permitted. Instead, use vacuuming, wet mopping, wet sweeping, or wet power brooming. If street sweepers are used, brooms shall not be wire. Comply with BAAQMD Regulation 6, Rule 1, Particulate Matter General Requirements for opacity and visible particles; and Regulation 8, Rule 40, for storage piles of contaminated soils, if applicable.

3.8 METHANE GAS

Take precautions to avoid all ignition sources on the site during construction due to potentially explosive concentrations of methane gas.

END OF SECTION

SECTION 02 41 00
SITE DEMOLITION

PART 1 GENERAL

1.1 GENERAL REQUIREMENTS

Remove rubbish and debris from the project site; do not allow accumulations. Store materials that cannot be removed daily in areas specified by the Contracting Officer. Field verify topographical and survey information. Relocate and consolidate rubbish, debris, and surface soils, as indicated on the Drawings. Remove existing fencing as shown in the drawings.

All existing groundwater monitoring wells and methane monitoring probes within the site boundary are to be preserved. Refer to Section 33 24 13 MONITORING WELLS for additional information.

1.2 SUBMITTALS

1.2.1 SD-01, Preconstruction Submittal

a. Demolition Plan; G

Submit proposed demolition and removal procedures to the Contracting Officer for approval before work is started.

1.3 DUST AND DEBRIS CONTROL

Prevent the spread of dust and debris and avoid the creation of a nuisance or hazard in the surrounding area. Do not use water if it results in hazardous or objectionable conditions such as, but not limited to, ice, flooding, or pollution.

1.4 PROTECTION

Protect existing work that is to remain in place, this includes but is not limited to all groundwater monitoring wells and methane monitoring probes as shown in the drawings. Repair items that are to remain and that are damaged during performance of the work to their original condition, or replace with new. Do not overload structural elements. Provide new supports and reinforcement for existing construction weakened by demolition or removal work. Repairs, reinforcement, or structural replacement must have Contracting Officer approval.

1.5 BURNING

Burning will not be permitted.

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

3.1 REFUSE DISPOSAL

All refuse generated by construction will be controlled such that it is not carried off site by wind or water and does not constitute a hazard to worker safety or construction equipment. Refuse may be collected in construction dumpsters contracted through a local municipal waste hauler.

Remove and transport refuse in a manner that will prevent spillage on pavements, streets, or adjacent areas. Clean up spillage from pavements, streets, and adjacent areas to prevent potential damage by foreign objects.

3.2 CLEARING AND GRUBBING

The boundaries for clearing and grubbing and removal of surface waste are provided on the Drawings. Excavation of subsurface soil and wastes are also shown on the Drawings. Cleared vegetation will be disposed of off-site.

3.2.1 Organic Material (Green Waste)

Remove all trees and other woody debris that is practicable. All organic debris hauled off base shall be recycled at a local composting facility.

3.2.2 Surface Waste, Non-Organic Material

Monolithic inorganic trash or debris, such as waste concrete, pipe, abandoned equipment, or asphaltic pavement, located on the surface of the site within the boundary delineated on the Drawings may be incorporated into the waste layer if particle size does not exceed 3 inches in the largest dimension. Larger pieces may be broken down to achieve this requirement. All other pieces shall be characterized and disposed of or recycled off-base at the appropriate landfill or facility. Contractor shall minimize the generation of waste, inorganic trash, or debris whenever possible, recycle as much material as possible, and utilize the many waste recovery sites available in the area.

END OF SECTION

SECTION 03 30 00
CONCRETE

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 the basic designation only.

AMERICAN CONCRETE INSTITUTE (ACI)

ACI 201.2R	(2008) Durable Concrete
ACI 301	(2005) Standard Specification for Structural Concrete
ACI 304R	(2000) Guide for Measuring, Mixing, Transporting, and Placing Concrete
ACI 308	(2001) Curing Concrete
ACI 315	(1999) ACI Detailing Manual

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 933	(2007) Standard Specification for Vinyl (PVC) Coated Steel Wire and Welded Wire Fabric for Reinforcement
ASTM C 33	(2008) Specification for Concrete Aggregates
ASTM C 94	(2009) Specification for Ready-Mixed Concrete
ASTM C 143	(2008) Test Method for Slump of Hydraulic Cement Concrete
ASTM C 150	(2007) Specification for Portland Cement
ASTM C 1107	(2008) Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
ASTM D 1557	(2008) Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3)
ASTM D 1751	(2008) Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
ASTM D 1752	(2008) Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 Submittal Procedures.

1.2.1 SD-02 Shop Drawings

a. Welded Wire Fabric; G

ACI 315. Indicate bending diagrams, assembly diagrams, splicing and laps of fabric. Do not use project Drawings as Drawings or scale project Drawings to determine the length of reinforcing fabric. Indicate the type and location of anchorage for welded wire fabric.

1.2.2 SD-05 Design Data

a. Concrete Mix Design for 4,000 pounds per square inch (psi); G

1.2.3 SD-07 Certificates

a. Cement
b. Aggregate
c. Admixtures
d. Welded Wire Fabric

1.3 CONCRETE DELIVERY, STORAGE, AND HANDLING

Do not deliver concrete until ready for concrete placement. Store concrete aggregates to prevent contamination or segregation. Store reinforcement of different sizes and shapes in separate piles or racks raised above the ground to avoid excessive rusting. Protect from contaminants such as grease, oil, and dirt. Provide for accurate identification after bundles are broken and tags removed.

PART 2 PRODUCTS

2.1 CONCRETE

2.1.1 Contractor Mix Design

ACI 301, except as modified herein. Concrete shall have a minimum of 28-day compressive strength of 3,000 psi. Slump shall be between 4 and 6 inches in accordance with ASTM C 143. Provide ASTM C 33 aggregate Size No. 57 or 67.

2.1.2 Ready-Mixed Concrete

ASTM C 94, except as modified herein. Ready-mixed concrete is defined in this specification as concrete produced regularly by a commercial establishment and delivered to the purchaser in the plastic state.

2.2 NON-SHRINKING CEMENT GROUT

ASTM C 1107.

2.3 MATERIALS

2.3.1 Cement

ASTM C 150, Type I.

2.3.2 Aggregates

ASTM C 33. Obtain aggregates for exposed concrete surfaces from one source. Aggregates shall not contain any substance that may be deleteriously reactive with the alkalis in the cement.

2.3.3 Water

Water shall be free from injurious amounts of oil, acids, alkalis, salts, organic materials, or other substances deleterious to concrete.

2.3.4 Admixtures

Provide only when approved. Calcium chloride shall not be used as an admixture.

2.3.5 Welded Wire Fabric

ASTM A 933, Class A, 6-inch by 6-inch, 10 gauge.

2.4 JOINTS

2.4.1 Expansion Joints

Expansion joint filler, premolded, shall conform to ASTM D 1751 or ASTM D 1752, 3/8 inch thick.

2.4.2 Contraction (Control) Joints

Contraction joint filler for curb and gutter shall consist of hard-pressed fiberboard.

PART 3 EXECUTION

3.1 SURFACE PREPARATION

Bring to grade and compact in 6-inch lifts to 95 percent of maximum dry density as determined by ASTM D 1557. Predampen prior to placement. Do not place concrete or shotcrete on frozen surfaces.

3.2 PLACING AGGREGATE BASE COURSE

Compact aggregate base course material in 6-inch lifts to 95 percent of maximum dry density as determined by ASTM D 1557.

3.3 PLACING REINFORCEMENT AND MISCELLANEOUS MATERIALS

Provide bars, wire fabric, and other reinforcing materials indicated or specified. In addition, provide wire ties, supports, and other devices required to install and secure the reinforcement at depths shown on the Drawings. Reinforcement shall not contain rust, scale, oil, grease, dirt, and other foreign substances that would reduce or destroy the bond. Minor rusting of uncoated reinforcement shall not be a basis of rejection, provided rusting has not reduced the effective cross sectional area of the reinforcement below the minimum diameter allowed by the applicable reinforcement standard, and that loose rust has been removed prior to placing.

3.3.1 Welded Wire Fabric

Place and secure as specified for reinforcing bars. Extend reinforcement to within 4 inches of edges.

3.3.2 Splicing

Welded wire fabric shall be overlapped 1 1/2 squares in all directions.

3.3.3 Anchorage

Anchor blocks and staples 36 inches on center maximum. Install blocks to maintain required cover over both sides of reinforcement.

3.4 FORMS

Provide as required to receive and shape shotcrete or concrete. Forms shall withstand pressures encountered during placement and maintain specified tolerances for formed surfaces. Forms shall prevent mortar leakage but permit escape of air and rebound. Construct forms to allow removal without damage to cured concrete or shotcrete. Place chamfer strips in forms to bevel salient edges and corners, except tool the top edges of walls and slabs. Chamfer 3/4 inch unless indicated otherwise. Where exposed to weather, provide nonrusting materials on formwork accessories that will contact the shotcrete.

3.4.1 Coating

Do not use mineral oil to coat forms.

3.5 MEASURING, MIXING, TRANSPORTING, AND PLACING CONCRETE

ACI 304R, except as modified herein. ASTM C 94; machine mix concrete and provide mandatory batch ticket information for each load of ready-mix concrete. Begin mixing within 30 minutes after the cement has been added to the aggregates. Place concrete within 90 minutes of either addition of mixing water to cement and aggregates or addition of cement to aggregates if the air temperature is less than 85 degrees F. Reduce mixing time to 60 minutes if the air temperature is greater than 85 degrees F. Additional water may be added, provided that both the specified maximum slump and water-cement ratio are not exceeded.

Place concrete as soon as practicable after the forms and the reinforcement have been inspected and approved. Do not place concrete when weather conditions prevent proper placement and consolidation; in uncovered areas during periods of precipitation; or in standing water prior to placing concrete. Remove dirt, construction debris, water, snow, and ice from within forms.

3.6 CONCRETE SURFACE FINISHES

ACI 315 for repair and finish, unless otherwise specified.

3.6.1 Defects

Repair formed surfaces by removing minor honeycombs, pits greater than 1 square inch surface area or 0.25 inch maximum depth, or otherwise defective areas. Provide edges perpendicular to the surface and patch with nonshrink grout. Patch tie holes and defects when the forms are removed. Concrete with extensive honeycomb (including exposed steel reinforcement, cold joints, entrapped debris, separated aggregate, or other defects) that affects the serviceability or structural strength will be rejected, unless correction of defects is approved. Obtain approval of corrective action prior to repair. The surface of the concrete shall not vary more than the allowable tolerances of ACI 301. Exposed surfaces shall be uniform in appearance and finished to a smooth form finish, unless otherwise specified.

3.6.2 Floated Finish

All concrete work shall have a floated finish. Place, consolidate, and immediately strike off concrete to obtain proper contour, grade, and elevation before bleedwater appears. Permit concrete to attain a set sufficient for floating and supporting the weight of the finisher and equipment. If bleedwater is present prior to floating the surface, drag the excess water off or remove by absorption with porous materials.

3.7 CURING AND PROTECTION

Cure concrete in accordance with ACI 308, except as modified. Throughout curing process, maintain in moist condition and at a minimum temperature of 40 degrees F.

3.7.1 Initial Curing

Continuously moisten concrete and shotcrete for at least 24 hours after placement. Use one of the following methods:

a. Absorptive mat or fabric, sand, or other covering kept continuously wet.

b. Curing compound: Use only on the finish coat. Do not use on surfaces to be bonded. Double the normal application rate on natural gun finishes. When a layer of shotcrete is to be covered by a succeeding layer of shotcrete, or other cementitious finishing materials are to be bonded, remove the curing compound completely by sandblasting prior to application of additional materials.

3.7.2 Final Curing

Continue initial curing methods for the first 7 days after placing.

3.8 JOINTS

Joints shall be constructed to divide the surface into rectangular areas. Transverse contraction joints shall be spaced at 10 feet. Expansion joints shall be placed in the transverse direction instead of contraction joints every 40 feet using joint filler of the type, thickness, and width indicated. Joints surrounding structures and features within the sidewalk may consist of preformed filler material conforming to ASTM D 1752 or building paper.

3.8.1 Expansion Joints

Expansion joints shall be formed with 3/8-inch joint filler strips. Joint filler shall be placed with top edge 1/4-inch below the surface and shall be held in place with steel pins or other devices to prevent warping of the filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/8 inch, and concrete over the joint filler shall be removed. At the end of the curing period, expansion joints shall be cleaned and filled with joint sealant. The joint opening shall be thoroughly cleaned before the sealing material is placed. Sealing material shall not be spilled on exposed surfaces of the concrete. Concrete at the joint shall be surface dry and atmospheric and concrete temperatures shall be above 50 degrees F at the time of application of joint sealing material. Excess material on exposed surfaces of the concrete shall be removed immediately and concrete surfaces cleaned.

3.8.2 Contraction (Control) Joints

The contraction joints shall be formed in the fresh concrete by cutting a groove in the top portion of the poured concrete to a depth of at least 1/8 inch using a jointer to cut the groove, or by sawing a groove in the hardened concrete with a power-driven saw, unless otherwise approved. Sawed joints shall be constructed by sawing a groove in the concrete with a 1/8 inch blade to the depth indicated. An ample supply of saw blades shall be available on the job before concrete placement is started, and at least one standby sawing unit in good working order shall be available at the jobsite at all times during the sawing operations.

3.9 FINISH EARTHWORK

After final curing is completed, backfill voids left by formwork and site preparation to match surrounding grades. Compact with pneumatic tamper.

END OF SECTION

SECTION 10 14 01
SIGNS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

AMERICAN NATIONAL STANDARD (ANS)

ANS 253.1	(1967) Fundamental Specification of Safety Colors

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123	(2008) Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
ASTM A 307	(2007b) Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 449	(2007b) Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM B 209	(2007) Specification for Aluminum and Aluminum-Alloy Sheet and Plate

1.2 SUBMITTALS

Submit the following in accordance with Section 01330 Submittal Procedures.

1.2.1 SD-02, Drawings

a. Warning sign; G

One shop drawing of sign indicated on the Drawings for approval from the Contracting Officer.

PART 2 PRODUCTS

2.1 SIGNS

2.1.1 Substrate

Conform to ASTM B 209 for aluminum sheet plate requirements. Provide caution or warning signs from aluminum plate with the thickness of at least 1.3 mm. Appropriate sign mounting hardware shall be fastened to back of substrate by rivets or welding to allow mounting of sign on post.

2.1.2 Paint

Use the opaque glossy sample colors as specified in Table 1 of Fundamental Specification of Safety Colors for Commercial Item Description, Standard Source "C" ANS 253.1-1967. Unless directed by the Contracting Officer, standard color of the background shall be yellow with black letters.

2.1.3 Posts

Signposts shall be of the U-channel type, 3 lbs/ft nominal, fabricated of hot rolled carbon steel bars. Finish shall be galvanized according to ASTM A 123. Posts shall have a uniform hole pattern.

The post shall consist of two parts, a signpost and a base post. The base post shall be identical to the signpost except having a pointed and sharpened-edge end for post driving. Holes between the base post and signpost shall be of identical pattern.

2.1.4 Anchors

Metal fasteners shall conform to ASTM A 307. All other hardware shall be Society of Automotive Engineers (SAE) Grade 5 or ASTM Grade A 449 hardness minimum. Threaded components shall use either nylon inserts or a chemical thread lock compound to prevent self-loosening. Where appropriate signs may be fastened to fencing based on approval from the Contracting Officer.

2.1.5 Signs

Provide signs around the boundary of the site according to the Drawings.

Sign shall be furnished with rounded or blunt corners and shall be free from sharp edges, burrs, splinters, or other sharp projections. The ends or heads of bolts or other fastening devices shall be located in such a way that they do not constitute a hazard.

The wording of the sign should be easy to read, concise, and as indicated on the Drawings.

PART 3 EXECUTION

3.1 SIGN INSTALLATION

Embedded metals shall be given a primer coat of the required paint on all surfaces prior to installation. Install posts to dimensions as designated on the Drawings. Signs can be attached to fence at locations designated on the Drawings using appropriate anchors. Do not damage coating before or during installation.

END OF SECTION

SECTION 31 00 00
EARTHWORK

PART 1 GENERAL

A soil cover of clean imported soil is the selected remedy to prevent contact with contaminants that may be present on the landward portion of the site. These chemicals may include metals, organic chemicals, and radionuclides. The cover components vary over the site as follows: The final cover for the radiologically impacted area at IR Sites 7 and 18 will consist of a 3 foot cover layer of clean imported soil and a demarcation layer. The final cover for the non-radiologically impacted area at IR Sites 7 and 18 will consist of a 2 foot cover of clean imported soil. Refer to SECTION 35 31 19 Revetment for specifications relating to construction of the revetment section.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1556	(2007) Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2007) Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3)
ASTM D 2216	(2005) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 2487	(2006) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 6938	(2008) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(2005) Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 5199	(2006) Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
ASTM D 1777	(2007) Standard Test Method for Thickness of Textile Materials
ASTM D 792	Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
ASTM D 5261	(2009) Standard Test Method for Measuring Mass Per Unit Area of Geotextiles
ASTM D 1388	Standard Test Method for Stiffness of Fabrics

ASTM D 5035	(2008) Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
ASTM D 4355	Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc Type Apparatus
ASTM D 2974	(2007a) Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
ASTM D 422	(1963; R 2007) Particle-Size Analysis of Soils
ASTM D 4972	(2001; R 2007) pH of Soils
ASTM D 698	(2007e1) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (EPA)

SW 846	(2008) Test Methods for Evaluating Solid Waste

EROSION CONTROL TECHNOLOGY COUNCIL

ECTC Guidelines	Erosion Control Technology Council (ECTC) Standard Guidelines

1.2 DEFINITIONS

1.2.1 Solid Waste

Rubbish, debris, garbage, and other discarded solid non-inert materials resulting from industrial, commercial, and agricultural operations and from community activities.

1.2.2 Excavation Spoils

Excavated soil and sediment from shoreline and boundaries of the site will be placed on the site and compacted to form the subgrade. The compacted cover will be constructed above the placed excavated spoils.

1.2.3 Compacted Cover

The soil cover layer is the primary cover layer and consists of imported materials to 0.5 foot from the final cover surface.

1.2.4 Erosion Resistant Layer

The upper 0.5 foot of the soil cover is the erosion resistant layer and consists of imported material and vegetative cover.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 Submittal Procedures.

1.3.1 SD-01, Preconstruction Submittals

a. Sampling and Analysis Plan; G

b. Materials Handling Plan

Materials Handling Plan describing placement and compaction procedures. The plan shall also describe equipment to be used (including ground pressures).

1.3.2 SD-03, Product Data

a. Composite Turf Reinforcement Matting

1.3.3 SD-04 Samples

a. Select Fill

A minimum of 50 pounds of select fill from each proposed borrow source to the Government's designated laboratory at least 15 days prior to placement.

1.3.4 SD-06, Field Test Reports

a. Select Fill Material Tests; G

See Paragraph 3.6.4 Construction Tests for testing frequency and type. Submit raw data as available and summarize weekly.

b. Confirmation Screening Sampling Results; G

See Paragraph 2.3 Sub Grade for testing requirements. Submit raw data and weekly.

c. Borrow Source Assessment; G

See Paragraph 3.6.1 Borrow Source Assessment for testing requirements. Submit raw data as available and summarize weekly.

1.3.5 SD-07, Certificates

a. California Registered Civil Engineer or Geologist certification

1.3.6 SD-11, Closeout Submittals

a. Final soil cover survey with As-Built Drawings

b. Survey information on permanent local site monuments

1.4 DELIVERY, STORAGE, AND HANDLING

Perform in a manner to prevent contamination or segregation of materials.

1.5 EQUIPMENT

Equipment used to place the select fill layers shall be as described in the approved Materials Handling Plan. Equipment shall not accelerate or brake suddenly, turn sharply, or be operated at speeds exceeding 5.0 miles per hour.

PART 2 PRODUCTS

2.1 COMPACTED COVER MATERIAL AND EROSION RESISTANT LAYER MATERIAL

Imported material used in the soil cover shall conform to specifications of 2.1.1 of this section. The soil shall be free of debris, roots, wood, scrap metal, vegetation, refuse, soft unsound particles, and deleterious or objectionable materials.

2.1.1 Soil Classification

The soil cover below 12 inches depth shall be ASTM D 2487-06e1, classification SM, SC, CL, or ML, with a maximum liquid limit of 45 percent and a maximum plasticity index of 25 percent per ASTM D 4318-05. The maximum particle size shall be 3 inches in its largest dimension with at least 90 percent passing a ¾-inch sieve, and at least 60 percent passing the No. 4 sieve, and not more than 60% passing a No. 200 sieve.

The soil in the upper 12 inches of the soil cover shall be ASTM D 2487-06e1, classification SM or SC, with a maximum liquid limit of 35 percent and a maximum plasticity index of 15 percent per ASTM D 4318-05. The maximum particle size shall be 3 inches in its largest dimension with at least 90 percent passing a ¾-inch sieve, at least 60 percent passing the No. 4 sieve, and not more than 30 percent passing a No. 200 sieve.

Refer to Section 35 31 19 Coastal Protection for fill material to be used under the revetment and below the high water elevation.

2.2 COMPOSITE TURF REINFORCED MATTING (CTRM)

The composite turf reinforcement mat (CTRM) shall be a machine-produced mat of 100 percent natural fiber matrix incorporated into a permanent three-dimensional netting structure. The matrix shall be stitch bonded between a heavy duty ultraviolet (UV) stabilized bottom net, crimped intermediate netting, and a heavy-duty, UV-stabilized top net. The crimped netting shall form prominent, closely spaced ridges across the entire width of the mat. The three nettings shall be stitched together with UV-stabilized polypropylene thread to form a permanent three-dimensional structure. Matting shall be three-dimensional geomatrix of heavy nylon monofilaments fused at their intersections. Ninety percent of the geomatrix shall be open space available for soil and root interaction with filaments. Matting shall have three-dimensional strength without laminated or stitched layers. The matting shall be a minimum weight of 8 ounces per square yard with a minimum thickness of 0.4 inches. In accordance with ASTM D 5034, the matting shall have a minimum tensile strength of 85 pounds per foot in each direction. The matting shall be for permanent service.

The permanent composite turf reinforcement mat shall have the following physical properties:

COMPOSITE STRUCTURE			
Property (min)	**Test Method**	**Typical**	**MARV***
Thickness	ASTM D5199	0.60 in	0.58 in
Resiliency	ASTM D1777	88%	86%
Density	ASTM D792	0.48 oz/in^3	0.46 oz/in^3
Mass/Unit Area	ASTM D5261	12.00 oz/yd^2	10 oz/yd^2
Porosity	ECTC Guidelines	95.0%	92.0%
Open Volume per Area	ECTC Guidelines	800 in^3/yd^2	750 in^3/yd^2
Stiffness	ASTM D1388	3.7 oz-in	3.1 oz-in
Light Penetration	ECTC Guidelines	5.0%	4.5%
MD Tensile Strength	ASTM D5035	640 lbs/ft	450 lbs/ft
MD Elongation (max)	ASTM D5035	14.0%	18.0%
TD Tensile Strength	ASTM D5035	890 lbs/ft	700 lbs/ft
TD Elongation (max)	ASTM D5035	11.0%	13.0%
Tensile Strength at 10% Elongation			
MD Tensile Strength	ASTM D5035	320 lbs/ft	200 lbs/ft
TD Tensile Strength	ASTM D5035	520 lbs/ft	420 lbs/ft

NET STRUCTURE			
Property (min)	**Test Method**	**Typical**	**MARV***
Thickness	ASTM D5199	0.50 in	0.42 in
Resiliency	ECTC Guidelines	65%	60%
UV Stability	ASTM D4355**	80%	N/A
MD Tensile Strength	ASTM D5035	500 lbs/ft	300 lbs/ft
MD Elongation (max)	ASTM D5035	30%	52%
TD Tensile Strength	ASTM D5035	800 lbs/ft	620 lbs/ft
TD Elongation (max)	ASTM D5035	15%	17%

*Minimum average roll values (MARV) are calculated as the typical plus or minus two standard deviations. Statistically, this calculation yields a 97.7 percent degree of confidence that any samples collected will exceed the value reported. "Typical" indicates the mean or average.

**ASTM D5035 (4 inch strip) Tensile Strength and % Strength Retention of material following 1,000 hours exposure in Xenon-Arc Weatherometer.

MD – Machine direction TD – Transverse direction

2.3 SUB GRADE

Excavation spoils for the preparation of the site from the site boundary and shoreline will be reused on site to the extent possible. Refer to the Drawings for placement location. Excavated material will be screened for low level radionuclide at the designated screening area and only uncontaminated soil will be used for fill as needed below the cover.

2.4 CRUSHED ROCK FOR DRAINAGE SWALE

Crushed rock will be used for the apron area where the drainage swale ends at the cover and flow discharges off site. Refer to the Drawings for placement location. Place rock in layer of thickness not less than the median rock diameter. Use excess gravel, sand, or other similar materials from the site as bedding.

The rock shall be composed of tough, durable particles, adequately free from thin, flat and elongated pieces, and shall contain no organic matter or soft, friable particles in quantities considered objectionable by the Contracting Officer. Grading shall conform to the following requirements:

PERMISSIBLE LIMITS
U.S. STANDARD SIEVE PERCENT BY WEIGHT, PASSING

Diameter	% Passing
10 in.	95%
8 in.	50%
6 in.	5%

2.5 ROAD BASE FOR SITE ENTRY POINT

Road base material will be used for the construction of a designated vehicle entry point in accordance with the Drawings to reduce vehicle traffic impact to the cover. Place rock in a layer of thickness not less than 3 in.

The rock shall be composed of tough, durable particles, adequately free from thin, flat and elongated pieces, and shall contain no organic matter or soft, friable particles in quantities considered objectionable by the Contracting Officer.

At the contractor's discretion, either 37.5 mm Class 2 Aggregate base shall be used, or aggregate with the following gradation.

PERMISSIBLE LIMITS
U.S. STANDARD SIEVE PERCENT BY WEIGHT, PASSING

Sieve Sizes	% Passing Operating Range
55 mm	100%
37.5 mm	85-100%
19 mm	45-80
4.75 mm	5-40
75 µm	<10

PART 3 EXECUTION

3.1 SCHEDULE

Contractor is responsible for maintaining completed work and environmental controls (see Section 01 57 19.00 20 Temporary Environmental Controls) at all times, including gaps in construction activity.

3.2 SURFACE AND SUBGRADE PREPARATION

Grading and preparation of the surface for construction should follow the drawings.

3.2.1 Stockpile Excavated Spoils

Materials removed from excavations and intended to be reused as fill below cover later shall be stockpiled at an on-site location designated by the Contracting Officer.

3.3 PROTECTION

3.3.1 Drainage and Dewatering

Provide for the collection and disposal of surface and subsurface water encountered during construction as described in the following sections.

3.3.1.1 Drainage

Drain the site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish storm drainage features at the earliest stages of site development. Throughout construction, grade the construction area to provide positive surface water runoff away from the construction activity or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. The Contractor is responsible for assessing the conditions of soil and groundwater presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.4 EXCAVATION

Excavate to depths and dimensions indicated on the Drawings. Reuse excavated, screened, and uncontaminated materials to the extent possible in the areas below cover. Soil disturbed or weakened by Contractor's operations and soils softened or made unsuitable for subsequent construction caused by exposure to weather shall be removed and replaced. Excavated soil shall be stockpiled when necessary in the immediate area or at an on-site location as directed by the Contracting Officer. Keep excavations free from water while construction is in progress. Notify the Contracting Officer immediately in writing if it becomes necessary to remove rock or hard, unstable, or otherwise unsatisfactory material. Blasting will not be permitted.

Excavated material from the shoreline and upland areas will be transported to the designated screening area following excavation. Material failing screening will not be used on site and will be disposed of appropriately. Compaction should follow the same provisions as for the soil covers.

3.5 MATERIAL STORAGE

Excavated material shall be placed in either temporary storage or transported directly for screening following the excavation. Storage units shall be in good condition and construction of materials that are compatible with the material to be stored. If multiple units are required for segregation, each unit shall be clearly labeled with an identification number and a written log shall be kept to track the material.

3.6 SOIL COVER

Soil cover shall be constructed to the elevations and slopes indicated on the Drawings. The soil cover, shall be compacted in 6-inch lifts to no less than 90 percent of maximum dry density at ± 3 percent of optimum moisture content. The top 6 inches shall be subject to one pass with a field packer resulting in a compaction to not greater than 85 percent of maximum dry density.

During construction, placement of select fill shall conform to the following requirements:

a. The minimum allowable dry density shall be no less than 90 percent of maximum dry density for the base layers and no greater than 85 percent of maximum dry density for the top 6 inches.

b. The allowable moisture content range shall be ± 3 percent of optimum.

3.6.1 Borrow Source Assessment

Complete the Borrow Source Assessment Report at least 15 days prior to select fill placement. No select fill shall be placed until the Borrow Source Assessment Report is approved. The report shall include the following: location of each borrow source; estimated quantity of borrow available; logs of subsurface explorations; and laboratory test results.

3.6.1.1 Select Fill

Classification Testing

Borrow source assessment tests shall be performed on each principal type or combination of materials proposed for use in the select fill layer to ensure compliance with specified requirements. At least one set of borrow assessment tests shall be performed on each borrow source proposed for use. A set of borrow source assessment tests shall consist of Atterberg limits (ASTM D 4318), particle size analysis (ASTM D 422), and moisture content (ASTM D 2216). Based on borrow source assessment testing, soils shall be classified in accordance with ASTM D 2487.

Moisture-Density (Compaction) Testing

A representative sample from each principal type or combination of borrow materials shall be tested to establish compaction curves using ASTM D 698. At least one compaction test shall be performed on each borrow source proposed. A minimum of 5 points shall be used to develop each compaction curve.

Chemical Contamination Testing

Borrow used for the select fill layers shall be free of contamination. Each proposed borrow source shall be sampled and analyzed for chemical contamination.

3.6.2 Installation

3.6.2.1 Select Fill Placement

No equipment shall be operated directly on the top surface of geosynthetics without permission from the Contracting Officer. Select fill shall be pushed out over geosynthetics in an upward tumbling motion so that wrinkles in geosynthetics do not fold over. Soil shall not be dropped directly onto geosynthetics from a height greater than 3 feet. On slopes, select fill shall be placed from the bottom of the slope upward.

3.6.2.2 Initial Lift of Select Fill Placed Over Geosynthetics

The first lift of soil placed over geosynthetics shall be a minimum of 12 inches in loose thickness. Equipment with ground pressures less than 7 psi shall be used to place and traffic compact the first lift of select fill. Traffic compaction shall consist of a minimum of 2 passes over all areas.

3.6.2.3 Subsequent Lifts of Select Fill

The loose lift thickness of each subsequent lift shall be no greater than 8 inches. Full scale placement and compaction equipment shall be allowed on areas underlain by geosynthetics after the first loose lift of soil has been placed. Compaction shall consist of a minimum of 2 passes over all areas.

3.6.3 Construction Tolerances

Finished surfaces shall be uniformly graded and shall be free from depressions, mounds, or windrows. The top surface of the select fill layer shall be no greater than 3 inches above the lines and grades shown on the drawings. No minus tolerance will be permitted. Rigid grade stakes shall not be driven into the select fill layer to control placement.

3.6.4 Construction Tests

3.6.4.1 Select Fill Material

During construction of the select fill layer, representative samples shall be taken for testing at the frequencies listed in the table below from the borrow source prior to placement. Test results must comply with the requirements listed in Part 2 Products or the material will be rejected for use.

SELECT FILL MATERIAL TESTING FREQUENCIES		
Test	Frequency	Method
Grain size analysis	2,000 cubic yards	ASTM D 422
Atterberg limits	2,000 cubic yards	ASTM D 4318
Compaction	5,200 cubic yards	ASTM D 698

(Note 1)

Note 1: Compaction test results shall be compared with the results obtained during the borrow source assessment. When there are significant differences, adjustments to the acceptable moisture content or density ranges shall be proposed by the Contractor for approval.

3.6.4.2 Moisture Content and Density Tests of In-Place Select Fill

Follow guidance from the manufacturer for protecting the geosynthetic demarcation layer from potential tearing from heavy equipment for the first lift above the material. Take precautions to ensure that the layer is not ruptured during construction and repair or replace as necessary.

SOIL COVER TESTING REQUIREMENTS AND FREQUENCY

Test	ASTM Method	Frequency	Required Minimum Criteria
Density & Moisture	Nuclear gauge D 6938-08a	One per 10,000 s.f.	See SOIL COVER COMPACTION Table
Density	Sand Cone D1556-07	One per 150,000 s.f. (minimum one per day)	See SOIL COVER COMPACTION Table
Moisture	Oven D2216-05 (with cor. to Nuclear gauge D 6938-08a)	One per 150,000 s.f. (minimum one per day)	Based on compaction curves
Compaction Curves	Mod. Proctor D1557-07	One per change in material	n/a
Identification of Soils	D 2487-06e1	One per change in material	GW, GP, GM, SW, SP, SM (bottom 6" per manufacturer's recommendation)

SOIL COVER COMPACTION

Fill Type	Maximum Loose Lift Thickness[1] (in.)	Moisture Content	Lift Density	Method of Test
All material greater than 0.5 foot from final cover elevation	6	± 3% of optimum	90% min	ASTM D 6938-08a and ASTM D1557-07
All material less than 0.5 foot from final cover elevation	6	± 3% of optimum	85% max	ASTM D 6938-08a and ASTM D1557-07

Note
Thinner lifts may be required to obtain adequate compaction.

Test Frequencies and Locations

Each day that select fill is placed, a minimum of one set of standard moisture content and density tests shall be performed. Nuclear density and moisture content tests shall be checked at the frequencies shown in the tables above. Standard tests shall be performed at locations which are as close as possible to the locations of the nuclear tests being checked.

Nuclear Density and Moisture Content Tests

Nuclear density readings shall be taken in the direct transmission mode. When ASTM D 6938 is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in ASTM D 1556. ASTM D 6938 results in a wet unit weight of soil and when using this method ASTM D 6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 6938; the calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer.

Test Results

Field moisture content and density test results shall be compared to the compaction curve for the appropriate material type being tested. If test results are not within the acceptable range for moisture content or density, as described in subparagraph Moisture-Density (Compaction) Testing, 3 additional tests shall be performed near the location of the failed parameter. If all retests pass, no additional action shall be taken. If any of the retests fail, the lift of soil shall be repaired out to the limits defined by passing tests for that parameter. The area shall then be retested as directed.

3.6.5 Protection

3.6.5.1 Damage

Erosion rills or other damage that occurs shall be repaired and grades re-established. Repairs to the select fill layer shall be documented including location and volume of soil affected, corrective action taken, and results of retests.

3.6.5.2 Stockpiles

Storage or stockpiling of material on the completed surface of the select fill layers will not be permitted.

3.7 GRASSED WATERWAY

Grade waterways as indicated on the Drawings. Vegetate grassed waterway as shown on the Drawings and in accordance with Section 32 92 19 Seeding before placing CTRM.

3.8 COMPOSITE TURF REINFORCED MATTING (CTRM)

Install matting in areas indicated on the Drawings and in accordance to manufacturer's instructions.

3.8.1 Slopes

Prepare soil before installing matting, including any necessary application of lime, fertilizer, and seed.

Begin at the top of the slope by anchoring the matting in a 6-inch deep by 6-inch wide trench with approximately 12 inches of matting extended beyond the up-slope portion of the trench. Anchor the matting with a row of staples/stakes approximately 12 inches apart in the bottom of the trench. Backfill and compact the trench after stapling. Apply seed to compacted soil and fold remaining 12-inch portion of matting back over seed and compacted soil. Secure matting over compacted soil with a row of staples/stakes spaced approximately 12 inches apart across the width of the matting.

Roll the matting down the slope. Matting will unroll with appropriate side against soil surface. All matting must be securely fastened to soil surface by placing staples/stakes in appropriate locations according to manufacturer's recommendations.

The edges of parallel matting must be stapled with approximately 2 inch to 5 inch overlap depending on manufacturer's recommendation. Consecutive matting spliced down the slope face must be placed end over end (shingle style) with an approximate 3-inch overlap. Shingle all layers of CTRM such that upgradient panels overlay downgradient panels along slope transverse. Staple through overlapped area, approximately 12 inches apart across entire matting width.

3.8.2 Grassed Channel

Prepare soil and topsoil before installing matting, including any necessary application of lime, fertilizer, and seed.

Shingle all layers of CTRM such that upgradient panels overlay downgradient panels.

Begin at the top of the channel by anchoring the matting in a 6-inch deep by 6-inch wide trench with approximately 12 inches of matting extended beyond the upslope portion of the trench. Anchor the matting with a row of staples/stakes approximately 12 inches apart in the bottom of the trench. Backfill and compact the trench after stapling. Apply seed to compacted soil and fold remaining 12-inch portion of matting back over seed and compacted soil. Secure matting over compacted soil with a row of staples/stakes spaced approximately 12 inches apart across the width of the matting.

Roll center matting in direction of water flow in bottom of channel. Matting will unroll with appropriate side against the soil surface. All matting must be securely fastened to soil surface by placing staples/stakes in appropriate locations according to manufacturer's recommendation.

Place consecutive matting end over end (shingle style) with a 4 inch to 6 inch overlap. Use a double row of staples staggered 4 inches apart and 4 inches on center to secure matting. Full-length edge of matting at top of side slopes must be anchored with a row of staples/stakes approximately 12 inches apart in a 6- inch deep by 6- inch wide trench. Backfill and compact the trench after stapling.

Adjacent matting must be overlapped approximately 2 inches to 5 inches, depending on manufacturer's recommendations and stapled. Install staple check slots at 30 to 40 foot intervals. Use a double row of staples staggered 4 inches apart and 4 inches on center over entire width of the channel.

The terminal end of the matting must be anchored with a row of staples/stakes approximately 12 inches apart in a 6-inchdeep by 6-inch wide trench. Backfill and compact the trench after stapling.

Horizontal staple spacing should be altered if necessary to allow staples to secure the critical points along the channel surface.

Place riprap armoring along spillway of cover side slope as shown in Drawings.

3.9 FINISHING OPERATIONS

3.9.1 Grading

Finish grades as indicated within plus or minus one tenth (0.1) of one foot. Grade smooth existing surfaces that are to remain but have been disturbed by the Contractor's operations. Final grading shall not take place without subsequent placement of erosion resistant seeding layer within 2 calendar days or as weather conditions dictate. Grid spacing shall be 20-foot by 20-foot or smaller for survey verification of thickness and grade.

3.9.2 Seeding

Provide as specified in Section 32 92 19 Seeding.

3.9.3 Protection of Surfaces

Protect newly graded areas from traffic, erosion (see Section 01 57 19.00 20 Temporary Environmental Controls), and settlement that may occur. Repair or re-establish damaged grades, elevations, or slopes.

3.10 DISPOSAL OF SURPLUS MATERIAL

Dispose of all surplus materials or other non-suitable material, including brush, refuse, stumps, roots, and timber into an appropriate off-site disposal facility. All organic debris hauled off base shall be recycled at a local composting facility. Contractor shall minimize the generation of waste, inorganic trash, or debris whenever possible, recycle as much material as possible, and utilize local waste recovery sites available in the area.

3.11 FIELD QUALITY CONTROL

3.11.1 Sampling

Collect the number and size of samples required to perform the specified tests of source materials.

3.11.2 Source Testing

Determine laboratory compaction characteristics and soil classification for each material used. Provide additional tests for every source change.

Sample all imported materials for the soil cover and topsoil layers once per source. Collect samples according to laboratory instruction. The laboratory shall analyze samples according to U.S. Environmental Protection Agency SW 846.

3.11.3 Field Density Tests

If a test location fails, the surrounding area shall be reworked up to at least half the distance to all nearby test locations that passed. Then, a new location within 10 feet of the previous test location shall be retested. Repeat until test location area passes.

Nuclear gauge results (ASTM D 6938-08a) shall be compared with and calibrated to oven-dried water content (ASTM D 2216-05) and sand cone (ASTM D 1556-07) tests according to the larger of the frequencies of the oven-dried water content and sand cone tests.

3.11.4 Oversight

All earthwork will be overseen by a California Registered Geologist or Civil Engineer.

3.12 FINAL COVER SURVEY

Perform a final cover survey of the cover once construction is complete. Include the final survey information on the as-built Drawings.

3.12.1 Permanent Local Site Monuments

Install two permanent monuments on the final cover and two local monuments as designated on the Drawings.

END OF SECTION

SECTION 31 05 22
GEOTEXTILES

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 within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 123	(2007) Terminology Relating to Textiles
ASTM D 4354	(1999; R 2004) Sampling of Geosynthetics for Testing
ASTM D 4355	(2007) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D 4491	(1999a; R 2004e1) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(2004) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(2008) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4759	(2002; R 2007) Determining the Specification Conformance of Geosynthetics
ASTM D 4751	(2004) Determining Apparent Opening Size of a Geotextile
ASTM D 4833	(2007) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 4873	(2002) Identification, Storage, and Handling of Geosynthetic Rolls and Samples
ASTM D 4884	(1996; R 2003) Strength of Sewn or Thermally Bonded Seams of Geotextiles
ASTM D 882	(2009) Standard Test Method for Tensile Properties of Thin Plastic Sheeting
ASTM D 2103	(2008) Standard Specification for Polyethylene Film and Sheeting

U.S. ARMY CORPS OFENGINEERS (USACE)

EM 1110-2-1601	(1994; Change 1) Hydraulic Design of Flood Control Channels

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1.2.1 SD-03 Product Data

a. Thread

A minimum of 7 days prior to scheduled use, proposed thread type for sewn seams along with data sheets showing the physical properties of the thread.

b. Manufacturing Quality Control Sampling and Testing

A minimum of 7 days prior to scheduled use, manufacturer's quality control manual.

1.2.2 SD-04 Samples

a. Geotextile

Geotextile samples for testing, if requested, to determine compliance with the requirements in this specification, a minimum of 60 days prior to the beginning of installation of the same textile. Upon delivery of the geotextile, submit duplicate copies of the written certificate of compliance signed by a legally authorized official of the manufacturer. The certificate shall state that the geotextile shipped to the site meets the chemical requirements and exceeds the minimum average roll value listed in Table 1. Upon request, supply quality control and quality assurance tests for the geotextile. Provide all samples from the same production lot as will be supplied for the contract, of the full manufactured width of the geotextile by at least 10 feet long, except that samples for seam strength may be a full width sample folded over and the edges stitched for a length of at least 5 feet. Samples submitted for testing shall be identified by manufacturers lot designation. For needle punched geotextile, the manufacturer shall certify that the geotextile has been inspected using permanent on-line metal detectors and does not contain any needles.

1.2.3 SD-07 Certificates

SD-07 Certificates
a. Geotextile

Manufacturer's certification of the geotextile material. All brands of geotextile and all seams to be used will be accepted on the basis of mill certificates or affidavits. Submit duplicate copies of the mill certificate or affidavit signed by a legally authorized official from the company manufacturing the geotextile. The mill certificate or affidavit shall attest that the geotextile meets the chemical, physical and manufacturing requirements stated in this specification.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver only approved geotextile rolls to the project site. All geotextile shall be labeled, shipped, stored, and handled in accordance with ASTM D 4873. No hooks, tongs, or other sharp instruments shall be used for handling geotextile.

PART 2 PRODUCTS

1.4 MATERIALS

1.4.1 Filter Layer Geotextile

1.4.1.1 General

Provide geotextile that is a woven pervious sheet of plastic yarn as defined by ASTM D 123 matching or exceeding the minimum average roll values listed in Table 1. Strength values indicated in the table are for the weaker principal direction.

TABLE 1
MINIMUM PHYSICAL REQUIREMENTS FOR DRAINAGE GEOTEXTILE

Property	Acceptable Values	Units	Test Method
Grab Strength	250	lb	ASTM D 4632
Puncture	120	lb	ASTM D 4833
Trapezoid Tear	60	lb	ASTM D 4533
Apparent Opening	70	U.S. Sieve	ASTM D 4751
Permittivity	0.28	sec -1	ASTM D 4491
Ultraviolet Degradation	90	Percent at 500 Hrs ASTM D 4355	ASTM D 4355

Obtain a guarantee from the selected manufacturer against failure of the geotextile material resulting from piping and subgrade erosion based on the existing subgrade conditions and the revetment material to be used.

1.4.1.2 Geotextile Fiber

Fibers used in the manufacturing of the geotextile shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of polyolefins, polyesters, or polamides. Add stabilizers and/or inhibitors to the base polymer, if necessary to make the filaments resistant to deterioration caused by ultraviolet light and heat exposure. Reclaimed or recycled fibers or polymer shall not be added to the formulation. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. Finish the edges of the geotextile to prevent the outer fiber from pulling away from the geotextile.

1.4.1.3 Securing Pins

Secure the geotextile to the embankment or foundation soil by pins to prevent movement prior to placement of revetment materials. Other appropriate means to prevent movement such as staples, sand bags, and stone could also be used. Insert securing pins through both strips of overlapped geotextile along the line passing through midpoints of the overlap. Remove securing pins as placement of revetment materials are placed to prevent tearing of geotextile or enlarging holes. Maximum spacing between securing pins depends on the steepness of the embankment slope. The maximum pins spacing shall be equal to or less than the values listed in Table 2. When windy conditions prevail at the construction site, increase the number of pins upon the demand of the Contracting Officer. Anchor terminal ends of the geotextile with key trench or apron at crest, toe of the slope and upstream and downstream limits of installation.

TABLE 2:
MAXIMUM SPACING FOR SECURING PINS

Embankment Slope	Spacing
Steeper Than 1v on 3h,	2 feet
1v on 3h to 1v on 4h,	3 feet
Flatter than 1v on 4h,	5 feet

1.4.2 DEMARCATION LAYER GEOTEXTILE

Provide demarcation layer geotextile that is a nonwoven pervious sheet of polymeric material consisting of long-chain synthetic polymers composed of at least 95 percent by weight polyolefins, polyesters, or polyamides. The use of woven slit film geotextiles (i.e. geotextiles made from yarns of a flat, tape-like character) will not be allowed. Add stabilizers and/or inhibitors to the base polymer, as needed, to make the filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure. Regrind material, which consists of edge trimmings and other scraps that have never reached the consumer, may be used to produce the geotextile. Post-consumer recycled material may also be used. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. Geotextiles shall meet the requirements specified in Table 3. Where applicable, Table 3 property values represent minimum average roll values (MARV) in the weakest principal direction. Values for AOS represent maximum average roll values.

TABLE 3
MINIMUM PHYSICAL REQUIREMENTS FOR DEMARCATION GEOTEXTILE

Property	Acceptable Values	Units	Test Method
GRAB STRENGTH	90	LBS	ASTM D 4632
TRAPEZOID TEAR	40	lbs	ASTM D 4533
APPARENT OPENING SIZE	60	U.S. SIEVE	ASTM D 4751
PERMITTIVITY	2	SEC -1	ASTM D 4491
ULTRAVIOLET DEGRADATION	70	PERCENT AT 500 HRS	ASTM D 4355
COLORATION	BRIGHT ORANGE		AS APPROVED BY CONTRACT OFFICER

Detectable Marking Tape

Detectable underground marking tape consist of a maximum 5.0 Mil overall thickness, with a (0.00035") solid aluminum foil core. Construction is 0.8 Mil clear film, making the film permanently printed. The suggested print will read "CAUTION DO NOT DIG BELOW" and including a Spanish translation upon approval by Contract Officer. Table 2 property values represent minimum average roll values. The tape shall be placed in a grid pattern with 10-foot spacing over the demarcation fabric. Refer to drawings for placement.

TABLE 4

MINIMUM PHYSICAL REQUIREMENTS FOR DETECTABLE MARKING TAPE			
Property	**Acceptable Values**	**Units**	**Test Method**
THICKNESS	5	Mil	ASTM D 2103
TENSILE STRENGTH	35	lbs/inch	ASTM D 882
ELONGATION	80%		ASTM D 882-75B
BOND STRENGTH	5 Hours without Peel Boiling Water		

1.5 INSPECTIONS, VERIFICATIONS, AND TESTING

1.5.1 Manufacturing and Sampling

Geotextiles and factory seams shall meet the requirements specified in Table 1. Randomly sample geotextiles in accordance with ASTM D 4354 (Procedure Method A).

1.5.2 Site Verification and Testing

Collect samples at approved locations upon delivery to the site in accordance with ASTM D 4354 (Procedure Method B) at a frequency of once per 100,000 square feet. Test samples to verify that the geotextile meets the requirements specified in Table 1. Identify samples by manufacturers name, type of geotextile, lot number, roll number, and machine direction. Perform testing at an approved laboratory. Submit test results from the lot under review for approval prior to deployment of that lot of geotextile. Rolls which are sampled shall be immediately rewrapped in their protective covering.

1.6 SURFACE PREPERATION

Prepare surface, on which the geotextile will be placed, to a relatively smooth surface condition in accordance with the applicable portion of this specification and shall be free from obstruction, debris, depressions, erosion feature, or vegetation. Remove any irregularities so as to ensure continuous, intimate contact of the geotextile with all the surface. Any loose material, soft or low density pockets of material, shall be removed; erosion features such as rills, gullies etc. shall be graded out of the surface before geotextile placement.

1.7 INSTALLATION OF THE GEOTEXTILE

1.7.1 General

Place the geotextile in the manner and at the locations shown. At the time of installation, reject the geotextile if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacture, transportation or storage.

1.7.2 Placement

Place the geotextile with the long dimension perpendicular to the shoreline and lay smooth and free of tension, stress, folds, wrinkles, or creases. Place the strips to provide a minimum width of 24 inches of overlap for each joint of the demarcation geotextile. Adjust the actual length of the geotextile used based on initial installation experience. Temporary pinning of the geotextile to help hold it in place until the filter rock layer is placed will be allowed. Remove the temporary pins as the granular material is placed to relieve high tensile stress which may occur during placement of material on the geotextile. Design protection of riprap shall be in compliance with EM 1110-2-1601. Perform trimming in such a manner that the geotextile is not damaged in any way.

Geotextile should be secured within the revetment rock at both the crest and the toe of the structure as shown in the drawings. Not less than 5 feet of additional material should be per anchoring location. Anchoring method should be approved by the Contracting Officer.

1.8 PROTECTION

Protect the geotextile at all times during construction from contamination by surface runoff; remove any geotextile so contaminated and replace with uncontaminated geotextile. Replace any geotextile damaged during its installation or during placement of bedding materials or riprap at no cost to the Government. Schedule the work so that the covering of the geotextile with a layer of the specified material is accomplished within 7 calendar days after placement of the geotextile. Failure to comply shall require replacement of geotextile. Protect the geotextile from damage prior to and during the placement of riprap or other materials. Before placement of riprap or other materials, demonstrate that the placement technique will not cause damage to the geotextile. In no case shall any type of equipment be allowed on the unprotected geotextile.

1.9 PLACEMENT OF FILTER ROCK MATERIAL

Perform placing of filter material in a manner to ensure intimate contact of the geotextile with the prepared surface. The placement shall also be performed in a manner that will not damage the geotextile including tear, puncture, or abrasion. On sloping surfaces place the filter material from the bottom of the slopes upward. During placement, the height of the drop of riprap material shall not be greater than 12 inches or as specified in Section 35 31 19 REVETMENT. Uncover any geotextile damaged beneath the filter material, as necessary, and replaced at no cost to the Government.

Refer to Section 35 31 19 REVETMENT for additional information concerning the filter rock and its placement.

END OF SECTION

SECTION 32 31 26
FENCING AND GATES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

FEDERAL SPECIFICATIONS (FS)

FS RR-F-191	(Rev. J) Fencing, Wire and Post Metal (and Gates, Chain-Link Fence Fabric, and Accessories) (General Specification)
FS RR-F-191/1D	(Rev. C) Fencing, Wire and Post, Metal (Chain-Link Fence Fabric) (Detail Specification)
FS RR-F-191/2D	(Rev. C) Fencing, Wire and Post, metal (Chain-Link Fence Gates) (Detail Specification)
FS RR-F-191/3D	(Rev. C) Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces) (Detail Specification)
FS RR-F-191/4D	(Rev. C) Fencing, Wire and Post, Metal (Chain-Link Fence Accessories) (Detail Specification)

1.2 DESCRIPTION

This section covers the requirements for both temporary and permanent chain link fencing for the site. Further details on the placement of the fencing and the construction details are shown the Drawings. Existing fence should be used in the temporary fencing of the site to the extent practical where it will not be obstructive to the work area. Reuse temporary fence materials where practical for the construction of the final fence.

1.3 RELATED SECTIONS

Section 31 00 00 General Earthwork.

1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 Submittal Procedures.

1.4.1 SD-03, Manufacturer's Catalog Data

a. Fencing components
b. Accessories

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

PART 2 PRODUCTS

2.1 Gates

FS RR-F-191/2; Type I, single swing or Type II, double swing, as indicated on the drawings. Gate dimensions shall be as indicated on the drawings. Framing and bracing members, round or square of steel alloy. PVC-coated over zinc- or aluminum-coated steel. Use minimum sizes for gate frames and braces listed in FS RR-F-191/3D for each Class and Grade. Coating for steel latches, stops, hinges, keepers, and accessories, PVC-coated over zinc- or aluminum-coated steel. Gate latches, fork type. For double swing gate, drive 1-foot of 3/4-inch nominal diameter galvanized water pipe flush to ground surface to receive vertical slider. Attach gate fabric to gate frame in accordance with manufacturer's standards, except that welding will not be permitted.

Arrange padlocking latches to be accessible from both sides of gate, regardless of latching arrangement. Padlocks shall have case-hardened shackles with bodies of a nonferrous alloy. Ten padlock keys shall be provided for each padlock, sequentially numbered and reading "DO NOT DUPLICATE."

2.1.3 Posts and Braces

FS RR-F-191/3D line posts; Class 1, steel pipe, Grade A or B. End, corner, and pull posts; Class 1, steel pipe, Grade A or B. Braces and rails; Class 1, steel pipe, Grade A or B, in minimum sizes listed in FS RR-F-191/3 for each class and grade. Provide PVC color coating, minimum thickness, 0.10 inch.

2.1.4 Fencing Accessories

Shall conform to the requirements of FS RR-F-191/4D. Provide wire ties constructed of the same material as the fencing fabric. Provide accessories with polyvinyl (PVC) coatings similar to that specified for chain-link fabric or framework.

2.1.5 Concrete

Shall conform to the requirements of Section 03 30 00 Cast-in-Place Concrete.

PART 3 EXECUTION

3.1 SITE PREPARATION

3.1.1 Excavation

Excavate to dimensions indicated for concrete-embedded items as shown on the drawings. Follow excavation procedures as specified in Section 31 00 00 Earthwork.

3.2 FENCE INSTALLATION

Consult Contracting Officer before construction of fence to determine which fences to install.

Install fence to line as indicated on the drawings, a four-sided square enclosure. Install fence in accordance with fence manufacturer's written installation instructions except as modified herein.

3.2.1 Post Setting

Set post plumb. Provide concrete bases of dimensions as indicated on the drawings. Compact concrete to eliminate voids and finish to a dome shape. Allow concrete to cure a minimum of 72 hours before performing other work on posts.

3.2.2 Bracing

Brace gate with a diagonal truss rod and truss tightener used as a tension member.

3.2.3 Fabric

Pull fabric taught and secure fabric to tension wire and posts. Secure fabric to posts using stretcher bars, ties, or clips spaced 15 inches on center, or by integrally weaving to integral fastening loops of end, corner, pull, and gate posts for full length of each post.

Install fabric on opposite side of posts from area being secured. Install fabric so that bottom of fabric is minimum 2 inches above ground level.

3.3 FENCE ACCESSORIES INSTALLATION

3.3.1 Post Caps

Install post caps as recommended by the manufacturer.

3.3.2 Gates

Install gates on side of enclosure that allows gate to swing open at least 135 degrees in a direction away from gas vent. Provide Contracting Officer with padlocks and keys.

3.4 CLEANUP

Remove waste fencing materials and other debris from the site.

END OF SECTION

SECTION 32 92 19
SEEDING

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 within the text by the basic designation only.

CALIFORNIA STATUTES

Division 18 - Field Crops, Seeds, Seed Potatoes, One-Variety Cotton Districts, and Nursery Stock Grades and Standards; Chapter 2 (§§ 52251 - 52515) – California Seed Law

Division 7 - Agricultural Chemicals, Livestock Remedies, and Commercial Feeds; Chapter 5 (§§ 14501 - 14682) – Fertilizing Materials

ASSOCIATION OF OFFICIAL SEED ANALYSTS (AOSA)

Rules for Testing Seeds (2009)

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1.2.1 SD-01 Preconstruction Submittal

a. Vegetation Establishment Plan

1.2.2 SD-03 Product Data

a. Seed Mixes (or individual items)

Mixture, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, date tested, and state certification (California Seed Law).

b. Fertilizer

Chemical analysis, composition percent if used.

c. Straw mulch

Weight receipts from scales shall be required.

d. Lime

Calcium carbonate equivalent and sieve analysis if used.

1.2.3 SD-06 Test Reports

a. Soil composition tests (reports and recommendations).

1.2.4 SD-07 Certificates

a. State certification and approval for seed (California Seed Law)

1.3 WORK SCHEDULE

The work shall progress as soon as the site becomes available consistent with normal seasonal limitations. The optimal seeding periods are between October 15th April 15th.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

1. All products shall be delivered to the site in manufacturer's unopened standard containers bearing original labels showing quantity, analysis and name of manufacturer.

2. All materials shall be stored in designated areas and in such a manner as to protect them from weather or other conditions that might demage or impair the effectiveness of the product.

1.5 ANALYSIS OF SAMPLES AND TESTS

1. Samples: The owner reserves the right to take and analyze samples of materials for conformity to the specifications at any time. On request, seed shall delivered to owner 30 days prior to seeding so seed can be tested. Seed samples shall be drawn in accordance with procedures outlined in AOSA, Association of Official Seed Analysts.

2. Rejected material: Rejected materials shall be removed immediately from the site at Contractor's expense. Contractor shall pay the cost of testing replacement materials.

1.6 FINAL ACCEPTANCE AND WARRANTY PERIOD

Upon completion of each 25% of the specified work, the owner shall accept each area. The contractor shall not provide warranty beyond those granted by any of the material manufacturers. It shall be the right of the owner to inspect work for compliance to the specifications and advise the contractor, in writing, of any work that is found to deviate from specifications.

PART 2 PRODUCTS

2.1 GENERAL

All products shall be in conformance with the specifications listed below. Any changes to products to be used shall be approved, in writing, by the owner or owner's representative prior to job site delivery.

2.2 SEED MIX

1. Composition: Seed Mixture by Weight

45 Total Pounds/Acre			
Pounds/Acre	**Species**	**Common Name**	**% by Weight**
25	*Bromus carinatus*	California Brome	53.8%
10	*Hordeum brachyantherum*	Meadow Barley	21.5%
6	*Vulpia microstachys*	Small Fescue	12.9%
4	*Trifolium wildenovii or obtusiflorum*	Tomcat or Clammy Clover	8.6%
1.5	*Eschscholzia californica*	California Poppy	3.2%

2. Quality:

All seed shall be in conformance with the California State Seed Law of the Department of Agriculture. Each seed bag shall be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. In addition, the container shall be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained. Prior to seeding at the request of the owner, the contractor shall provide a letter of certification, original Association of Official Seed Analysts (AOSA) seed test results, and calculations of PLS content.

Seed shall not exceed 0.5 percent weed content by weight. If seed available on the market does not meet the minimum purity and germination percentages specified, the Contractor must compensate for a lesser percentage of purity or germination by furnishing sufficient additional seed to equal the specified product. Product comparison shall be made on the basis of pure live seed in pounds. The formula used for determining the quantity of pure live seed shall be: Pounds of seed x (Purity x Germination) = pounds of Pure Live Seed. Samples may be drawn by the Engineer for testing.

2.3 SOIL AMENDMENTS

Fertilizer shall be of commercial quality, conform to the requirements of the California Food and Agriculture Code, shall have a guaranteed analysis for nitrogen, phosphorus and potassium of 6-24-24. Fertilizer or lime application rates shall be determined from the soil test laboratory recommendations.

2.4 STRAW MULCH

Straw shall be derived from irrigated wheat or barley fields or from rice straw. The contractor shall furnish evidence that clearance has been obtained from the County Agricultural Commissioner, as required by law, before straw from outside the county in which it is to be used is delivered to the site of the work. Straw that has been used for bedding is prohibited.

2.5 MULCHING EQUIPMENT

Contractor shall use a commercial type mulcher for the application of slurry or loose broadcast. The areas to be seeded shall be mulched so as to provide uniform distribution of mulch without waste.

2.6 WATER

Irrigation water shall not contain a total dissolved solids level of greater than the salt tolerance of the plant species for any growth regime, irrigation practice used, and local climate. Water shall be applied at rate such that seeding machinery operates smoothly, but that minimizes surface runoff and leaching once applied.

PART 3 EXECUTION

3.1 SOIL PREPARATION

1. Verify that all areas to receive seed are free of vegetation and other objectionable material.
2. Verify that grades are final for permanently treated areas and within reasonable standard for temporary treatments.
3. All sloped areas will be uniformly compacted.

3.2 SEEDING, TIMES AND CONDITIONS

3.2.1 Seeding Time

Seed shall be sown according to supplies instructions. Seeding shall take place as soon as final grade has been achieved and heavy equipment has been retired from the project. If seeding is performed outside the preferred seeding times shown in Paragraph 1.3 Work Schedule, provide water, as needed according to supplier instruction.

3.2.2 Planting Conditions

Planting operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the planting operations, proposed times shall be submitted to and approved by the Contracting Officer.

3.3 SITE PREPARATION

3.3.1 Finish Grading

3.3.1.1 Preparation

Drainage patters shall be maintained as indicated on Drawings. Apply soil amendments, if required, according to soil test laboratory recommendations. When applying amendments by spreading or broadcasting, irrigate and allow 1 week for incorporation into soil before seeding. In this case, ensure no soil erosion takes place during the waiting period. Alternatively, the contractor may incorporate amendments into top 6 inches of soil by tilling prior to establishing final grade and proof rolling.

Scarify to minimum depth of 1 inch all surfaces to be seeded. Prior to scarifying, proof roll final grade with a field packer, not exceeding compaction limitation for the final 0.5 feet of cover as specified in Section 31 00 00 Earthwork.. Areas designated for seed that have been compacted by construction operation, including the roadways shall be scarified to a minimum depth of 2 inches. In all cases, scarify sufficiently to allow proper disc penetration of the seed drill. Soil used for repair of erosion or grade deficiencies shall conform to topsoil requirements specified in Section 31 00 00 Earthwork. New surfaces shall be blended to existing areas.

Use landscape rake for areas inaccessible to machinery.

3.3.1.2 Debris

All areas for seeding shall have debris and stones larger than 3 inches in any dimension removed from the surface.

3.3.1.3 Protection

Finished graded areas shall be protected from damage by vehicular or pedestrian traffic and erosion.

3.4 SEEDING

3.4.1 General

Seeding shall be in all areas over the constructed soil cover and any areas disturbed during construction. Previously prepared seedbed areas compacted or damaged by interim rain, traffic or other cause, shall be reworked to restore the ground condition previously specified. When possible, use low contact pressure tires on vehicles. Seeding operation shall not take place when the wind velocity will prevent uniform seed distribution.

3.4.2 Application

Proportion seed mixtures by weight. Apply specified seed at the specified seeding rate with a seed drill. Ensure proper disc settings, seed depth, and crimping. Apply straw mulch immediately after seeding and crimp with a field packer. Straw mulch application shall just cover all seeded areas completely prior to crimping. Do not exceed 1 inch thickness of loose straw mulch after crimping..

Use hand broadcast methods with landscape rake and roller for areas inaccessible to seed drill and crimper.

3.5 PROTECTION OF SEEDED AREAS

Once seeding has taken place, care shall be taken to avoid damage to the surface until soil is firm and more than 80 percent of plants have germinated. Avoid vehicular traffic, especially that which creates depressions or ruts. Keep foot traffic to a minimum and, in all cases, avoid repeat traffic over the same area.

3.6 CLEAN-UP

1. General: Erosion control work areas shall be maintained in a neat and orderly condition. Keep paved area free of soil
2. Boundary: Installing contractor is responsible for washing or otherwise cleaning excess material off all area not intended to receive treatment.
3. Debris: Clean up and remove erosion control associated materials and debris from project site before Final Acceptance.

3.7 VEGETATION ESTABLISHMENT PERIOD

3.7.1 Commencement

The Vegetation Establishment Period for this Delivery Order for establishing healthy vegetation shall begin on the first day of seeding operation under this contract and shall end 3 months after the last day of seeding operations required by this contract. Written calendar time shall be furnished to the Contracting Officer for the Vegetation Establishment Period.

3.7.2 Satisfactory Stand of Vegetation

A satisfactory stand of vegetation from the seeding operation is defined as a minimum of 10 plants per square foot for hydroseeded and groundcover areas. The total bare spots in plan view shall not exceed 3 percent of the total seeded area.

3.7.3 Maintenance During Establishment Period

3.7.3.1 General

Maintenance of the seeded areas shall include controlling insects, weeds, and diseases below levels that are detrimental to plant health. In addition, the Contractor shall protect embankments and ditches from erosion, maintain erosion control materials and mulch, protect vegetated areas from traffic, and water and fertilize as needed.

3.7.3.2 Watering

Watering shall be at intervals to obtain a moist soil condition to a minimum depth of 1 inch for hydroseeded areas or groundcover. Frequency of watering and quantity of water shall be adjusted in accordance with the growth of the vegetation. Run-off, run-on, puddling, and wilting shall be prevented.

3.7.3.3 Post-Fertilization

Nitrogen carrier fertilizer shall be applied at the rate of no more than 0.5 pounds per 1,000 square feet for hydroseeded areas or groundcover after the first month and again prior to the final acceptance. The application shall be timed prior to the advent of winter dormancy and shall avoid excessively high nitrogen levels.

3.7.3.4 Repair

The Contractor shall re-establish, as specified herein, eroded, damaged, or barren areas or plants, including seed and topsoil.

3.7.3.5 Maintenance Report

A written record shall be furnished to the Contracting Officer of the maintenance work performed.

3.8 FINAL ACCEPTANCE OF VEGETATION

3.8.1 Preliminary Inspection

Not less than 21 days prior to the completion of the Vegetation Establishment Period, a preliminary inspection will be held by the Contracting Officer. Date and time for the inspection will be established in writing and will be communicated to the Contractor 14 days prior to the inspection date. The acceptability of the vegetation in accordance with the Vegetation Establishment Period shall be determined. An unacceptable stand of vegetation shall be repaired as soon as conditions permit.

3.8.2 Final Inspection

Within 7 days of the end of the Vegetation Establishment Period, a final inspection will be held by the Contracting Officer to determine that deficiencies noted in the preliminary inspection have been corrected. Date and time for the inspection will be established in writing and communicated to the Contractor 14 days prior to the inspection date.

END OF SECTION

SECTION 33 24 13
MONITORING WELLS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136	(1996) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 150	(2000) Standard Specification for Portland Cement
ASTM D 5088	(1990) Decontamination of Field Equipment Used at Nonradioactive Waste Sites
ASTM D 5092	(1995) Design and Installation of Groundwater Monitoring Wells in Aquifers
ASTM D 5299	(2005) Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities
ASTM D 5521	(1994) Guide for Development of Ground-Water Monitoring Wells in Granular Aquifers
ASTM D 5608	(2006) Decontamination of Field Equipment Used at Low Level Radioactive Waste Sites
ASTM D 5784	(2000) Standard Guide for Use of Hollow Stem Auger for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Wells
ASTM F 480	(2000) Standard Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), SCH 40 and SCH 80
ASTM D 2855	(2002) Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.

CITY AND COUNTY OF SAN FRANCISCO DEPARTMENT OF PUBLIC HEALTH

Article 12 B	San Francisco Health Code. Soil Boring and Well Regulations

1.2 SUBMITTALS

Submit the following in accordance with Section 01330 Submittal Procedures.

1.2.1 SD-03, Product Data

a. Casing
b. Screen
c. Filter Pack
d. Bentonite
e. Cement
f. Protective Cover

1.2.2 SD-11, Closeout Submittal

Provide a survey report with the following data for each well:

a. Horizontal location (northing and easting)
b. Top of casing (TOC) elevation
c. Adjacent ground elevation

1.3 FIELD QUALITY CONTROL

The Contractor shall provide a field geologist to inspect all material and equipment to be used in borehole drilling, well construction, and well extension for conformance with the specifications stated herein.

The Contractor's field geologist may request minor modifications to the well construction as necessary. The need for any major modifications shall be negotiated with the Contracting Officer and the Contractor.

The Contractor shall provide at least 14 calendar days notice to the Contracting Officer before any drilling well construction commences.

1.4 WELL CONSTRUCTION PERMITS

The Contractor shall comply with construction permits from the City and County of San Francisco Department of Public Health and in accordance with Health Code Article 12B. Well construction shall adhere to permit conditions.

1.5 DELIVERY, STORAGE, AND HANDLING

The contractor shall deliver materials in an undamaged condition. All well materials shall be stored and maintained in a clean, uncontaminated condition throughout the course of the project.

PART 2 PRODUCTS

Provide all first-quality new materials, free from any defects and suitable for the intended use. Provide materials and equipment that are products of manufacturers regularly engaged in the production of such materials and equipment. Furnish and install all incidental items not specifically shown or specified that are required by good practice to provide the complete systems specified herein.

2.1 WELL CASING

2.1.1 Groundwater Monitoring Wells

Schedule 40 polyvinyl chloride (PVC), dimensions and lengths as indicated on Drawings, flush-joint threaded with O-ring seals. Use solvent welded slip-fit PVC coupling joints at the point of extension according to ASTM D2855 for wells being extended. All materials must be manufactured to meet the requirements of ASTM F 480.

Provide slip-fit PVC top end caps for groundwater wells.

Extend existing monitoring well and methane monitoring probe casing using like materials and construction.

2.1.2 Methane Probe

Use like materials as existing for newly installed replacement methane probes and probe extensions consisting of ¼ inch sampling tubing. Confirm existing materials and manufacturers.

2.2 WELL SCREEN

2.2.1 Groundwater Monitoring Wells

Schedule 40 PVC, dimensions and lengths as indicated on Drawings, flush-joint threaded with O-ring seals, machine slotted 0.020 inches, manufactured to meet the requirements of ASTM F 480.

Provide flush threaded PVC silt trap for groundwater monitoring wells and a flush threaded PVC bottom end cap for methane monitoring probes.

2.2.2 Methane Probe

If existing methane probes are removed and replaced following construction, install like intake screens and materials as existing in the replacement probes. Refer to Drawings.

2.3 FILTER PACK

Nominal U.S. Standard sieve size range 8-20 when tested by ASTM C 136.

2.4 BENTONITE SEAL

Pelletized or chipped sodium montmorillanite.

2.5 CEMENT AND BENTONITE GROUT

Type I or II Portland cement manufactured to meet the requirements of ASTM C 150.

Powered sodium montmorillanite.

Grout to be mixed in a ratio of 95 percent by weight cement and 5 percent by weight powdered sodium montmorillanite.

2.6 CONCRETE

A 3,000 pound per square inch (psi) concrete mix. Maximum aggregate size ¾-inch. Cement in mix shall be Type I, II, or III Portland cement according to ASTM C 150.

2.7 PROTECTIVE COVER

Provide steel or aluminum lockable protective cover set over the well casing. Paint the casing with a weather-resistant paint.

Provide weather-resistant keyed alike padlocks with minimum shackle clearance of 2 inches vertical and ¾ inch horizontal.

Use an appropriate well marking extending at least 3 feet above the final ground elevation to identify the well location and facilitate relocation of the well. Materials used must be approved by the Contracting Officer.

PART 3 EXECUTION

All monitoring wells and probes at the site are to be extended to meet the elevation of the final cover. Monitoring wells and probes that can not be extended or are destroyed during site activities will be replaced in accordance with this specification. The anticipated extents of the revetment at the site will obstruct monitoring wells IR07MW20A1 and IR07P20A. Well IR07MW20A1 is to be replaced with a newly constructed well. IR07P20A is to be abandoned if obstructed by the revetment. No other wells at the site are to be abandoned without approval from the Contracting Officer.

3.1 GROUNDWATER MONITORING WELL AND METHANE PROBE EXTENSIONS

Existing groundwater monitoring wells and methane probes at the site are to be extended when possible to meet the final elevation of the soil cover using like materials and construction as the existing wells and probes. Refer to the Drawings for final elevations and construction details. Provisions for protection of the wells and probes will be necessary during construction of the soil cover.

During construction of the extended wells and probes care should be taken to prevent contamination of the interior of the well from any solvents or other chemicals being used. This could be accomplished through use of well plugs or other materials.

3.2 BOREHOLE DRILLING

Wells and probes that are not extended will be replaced. All boreholes shall be constructed using techniques that conform to ASTM D 5784.

Complete all boreholes for monitoring wells and probes using a 10-inch diameter hollow stem auger. Monitoring wells and probes that are replacing existing wells and monitoring probes will be competed to the same depth as the wells and probes that are being replaced. Depths are shown on the Drawings. Any modification to the borehole, and ultimate well depth, must be approved by the Contracting Officer.

Wells and probes that are replaced with new wells and probes shall be placed as near to the original location as feasible. Any new well or probe location greater than 5 ft from the original location must be approved by the Contracting Officer. Refer to the Drawings for final elevations and construction details.

All boreholes shall be continuously sampled for lithologic logging. The Contractor's field geologist will be responsible for completing a log of the borehole lithology.

No drilling fluids shall be added to the borehole other than water from a source approved by the Contractor's field geologist. No lubricants shall be used on downhole drilling equipment other than vegetable-based lubricants on auger flight and drill rod joints.

Drill cuttings shall be handled according to the construction sequence and screened for radionuclide contamination. Non-radiologically impacted drill cuttings may be spread over the site within the boundary and under the 3 ft soil cover over the site. Otherwise, provide equipment to containerize all drill cuttings for disposal.

3.3 WELL AND PROBE INSTALLATION

All wells and probes shall be constructed or extended using techniques that conform to ASTM D 5092.

All annular materials shall be installed to the approximate depths of the wells and probes being replaced as shown on the Drawings. Contracting Officer approval is necessary for any modification to the depth and the construction of the wells and probes. Depths to the top of filter pack and bentonite seal materials shall be directly measured using a weighted tape measure to confirm installation to appropriate depths. Screen and blank casing lengths shall be measured to the nearest 0.01 foot as well as total installed length.

Bentonite seal materials shall be added either by tremie pipe or gravity fall from the surface. The bentonite pellets shall be installed in 1-foot lifts, hydrated with at least 5 gallons of water, and allowed to cure for 10 minutes before adding the next lift. The final bentonite lift shall be allowed to cure for at least 30 minutes before installing the cement and bentonite grout. Water for hydration is to be obtained from a source approved by the Contractor's field geologist.

The cement and bentonite grout shall be placed in one continuous operation into the annulus above the bentonite seal to the depth shown in the Drawings by use of tremie pipe or grout pump.

Protective casings shall be installed to protect the monitoring wells and probes. Compact concrete to eliminate voids and finish to a slope as specified in the Drawings to divert water runoff away from the well casing.

Construction information shall be included on well construction forms.

3.4 WELL DEVELOPMENT

All newly construction groundwater monitoring wells shall be developed using either mechanical surging and bailing or pumping, or overpumping and backwashing that conforms to ASTM D 5521. Groundwater monitoring wells that are extended do not require development provided they are adequately protected and sealed during construction..

Well development shall not begin until the cement and bentonite grout has cured a minimum of 48 hours.

Development shall be considered complete when:

There is no change in the appearance of the discharge water

A minimum of 3 times the casing and borehole volume of water in the well has been removed plus the volume of any water added during drilling

Temperature, specific conductivity, and pH readings, measured before, at least twice during, and after development have stabilized. Stabilization shall mean a variation of plus or minus less than 10 percent between three consecutive temperature, specific conductivity, and pH readings.

Monitoring well development will be overseen by the Contractor's field geologist.
The Contractor's field geologist will supply all equipment to measure temperature, specific conductivity, and pH in the field, will complete all measurements, and will document the progress and results of the development procedures.

Development wastewater shall be handled according to the construction sequence. Provide equipment to containerize all water generated during development. The field geologist will determine which development wastewater shall be containerized and which shall be spread at the borehole location. Approval from the Contracting Officer necessary prior to discharge of water generated during well development.

3.5 DECONTAMINATION

Decontamination procedures shall conform to ASTM D 5088 and ASTM D 5608 in addition to site specific practices including practices.

All drill rods, drill bits, augers, tremie pipes, grout pumping lines, well development equipment, and other associated equipment shall be cleaned with a portable, high-pressure steam cleaner prior to drilling at each well location. Soil sampling equipment such as split spoons shall be washed with detergent solution and rinsed with approved water prior to collecting each soil sample.

Provide equipment to capture and containerize all decontamination fluids. Otherwise, wash water may be discharged to the surface in such a manner to avoid erosion and runoff off site with approval from the Contracting Officer.

3.6 FINISHING WELL HEAD

Finish wellhead as shown on the Drawings. Cover concrete apron with topsoil and compact with pneumatic tamper. Install an identification marker extending to at least 2 feet above the elevation of the final cover to facilitate locating the wells within the vegetative cover.

3.7 SURVEYING

Provide a California-licensed surveyor to survey horizontal and vertical coordinates for location (northing and easting), the top of casing (TOC) elevation, and adjacent ground surface elevation for each well constructed.

All northing and easting coordinates shall be based on control points shown on the Drawings. Horizontal coordinates shall be measured within 0.1-foot accuracy.

All elevation measurements shall be based upon the elevation of the monument established on site during construction shown on the drawings. All elevation measurements shall be measured within 0.01-foot accuracy. The TOC elevation shall be measured by placing the surveying rod directly on top of the north side of the well casing. The TOC elevation measuring point shall be marked with a 1/8-inch deep sawcut.

3.8 WELL DESTRUCTION

Any well disapproved by the Contracting Officer, or any well destruction shall be done according to the requirements of the City and County of San Francisco Department of Public Health in accordance with Health Code Article 12B and the requirements of these specifications.

Well destruction includes the removal of all materials left in the well and borehole, excluding the filter pack, and including backfill materials, casing, screen, and any other material placed into the hole. Grout old boring from the bottom to within 1 foot of the top of ground surface according to the protocol for grout/bentonite placement established in paragraph CEMENT AND BENTONITE GROUT. Backfill the top 1 foot with fill material to the ground surface. No well may be destroyed without the approval of the Contracting Officer.

END OF SECTION

SECTION 35 31 19
COASTAL PROTECTION

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 within the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 127	(2007) Standard Test Method for Density
ASTM C 136	Standard Test Method for Sieve Analysis of Fine and Course Aggregates
ASTM C 33	(2007) Standard Specification for Concrete Aggregates
ASTM C 295	(2008) Petrographic Examination of Aggregates for Concrete
ASTM D 3370	(2008) Sampling Water from Closed Conduits
ASTM D 1429	(2008) Specific Gravity of Water and Brine
ASTM D 2487	(2006e1) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 3740	(2008) 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	(2005e1) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D 4992	(2007) Evaluation of Rock to be Used for Erosion Control
ASTM D 5312	(2004) Evaluation of Durability of Rock for Erosion Control Under Freezing and Thawing Conditions
ASTM D 5313	(2004) Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditions
ASTM D 5519	(2007) Particle Size Analysis of Natural and Man-Made Riprap Materials
ASTM D 75	(2003) Standard Practice for Sampling Aggregates

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44	(2007) NIST Handbook 44: Specifications, Tolerances, and other Technical Requirements for Weighing and Measuring Devices

U.S. ARMY CORPS OF ENGINEERS (COE)

COE CRD-C 144	(1992) Standard Test Method for Resistance of Rock to Freezing and Thawing
COE CRD-C 148	(1969) Method of Testing Stone for Expansive Breakdown on Soaking in Ethylene Glycol
COE CRD-C 169	(1997) Standard Test Method for Resistance of Rock to Wetting and Drying
EM 1110-2-1601	(1994; Change 1) Hydraulic Design of Flood Control Channels
EM 1110-2-1906	(1970; Change 1 and 2) Laboratory Soils Testing

1.2 DEFINITIONS

1.2.1 Revetments

The term "revetment" applies to various types of stabilization structures that are constructed along shorelines. The revetments are constructed of stone or piling.

1.2.2 Stone Protection

Stone Protection is defined as a system which includes a layer of bedding material or layers of filter material beneath a layer or layers of riprap.

1.2.3 Riprap

Riprap is defined as a material having a gradation band similar to those specified in EM 1110-2-1601, Chapter 3, uniform graded material. Riprap is normally produced by mechanical methods, with a jaw crusher and grizzly after the stone has been mined by blasting in a quarry. Riprap gradations have a maximum top size of 3.5 tons.

1.2.4 Graded Stone

Graded Stone is defined as material with gradations that are produced by the mining technique and minimal additional processing other than the use of a skeleton bucket or a bar grizzly. The gradation band have more fines than riprap and have gradations with top size up to 3.5 tons and could be classified as being well graded.

1.2.5 Shoreline Protection

Shoreline Protection is defined as a system of bedding or filter materials and stone used to protect coastlines of lakes and oceans and for harbor protection.

1.3 BULK SPECIFIC GRAVITY OF STONE REDESIGN

If the Contractor, after award of the contract, requests approval of stone from a source(s) which has a range of bulk specific gravity (SSD), whose limits are lower or higher than the specified design range of 2.5 to 2.9 as specified in paragraph MATERIAL QUALITY, consideration will be given to revising the project design through modification of the design range under the following conditions:

a. Only one (1) such proposal for modification will be allowed. In addition, the required completion time shall not be extended more than thirty (30) calendar days as a result of redesign for any reason, including acts of the Government.

b. The modified design range of bulk specific gravity (SSD) to be used shall not have a lower limit of less than 2.30 nor higher than 3.50.

c. The stone sections of the required structure are to be redesigned by the Government. Such redesign will be based upon the Contractor's proposed modifications to the specified design range of bulk specific gravity (SSD) and will include any required revisions to allowable tolerances. Only one such redesign will be made. A charge of $5,000 will be assessed the Contractor whether the redesign is used or not.

d. Any proposal to modify the specified design range shall be submitted within fifteen (15) calendar days after receipt of the Government's redesign and shall include a statement as to the savings which will result from the modification. If a formal proposal is not submitted within the time limit, the work shall be performed in accordance with the specified design, in which case the Contractor shall not be allowed to use stone having a bulk specific gravity (SSD) less than the specified design range.

f. If the Contractor elects to perform the work in accordance with the redesign, the estimated quantities to be shown in the BIDDING SCHEDULE will be the quantities derived from the Government's redesign.

1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1.4.1 SD-03 Product Data

a. Riprap; G

b. Filter Material; G

c. Filter Rock

Stone hauling vessel gaging tables and a copy of the data and calculations used for the preparation of the tables.

d. Bulk Specific Gravity of Stone and Redesign; G

A formal proposal to perform the work in accordance with the redesign, within fifteen (15) calendar days after receipt of the Government's redesign; if the Contractor proposes to utilize stone having a specific gravity outside of the specific design range, and as a result thereof, the Government provides the Contractor with a redesign. The submittal shall include a statement of the direct savings to the Government and tabulation in the form of a revised BIDDING SCHEDULE showing unchanged unit prices for the revised quantities.

1.4.2 SD-04 Samples

a. Stone; G

Suitable stone samples prior to delivery of any such material to the worksite if stone is not from an approved vendor.

1.4.3 SD-07 Certificates

a. Rip Rap Specific Gravity

b. Filter Fabric

c. Filter Rock

Certificates of compliance attesting that the materials meet specification requirements.

1.5 QUALITY ASSURANCE

1.5.1 Stone

1.5.1.1 General

All stone shall be durable material as approved by the Contracting Officer. Selected stone from the required excavation may be used if it satisfies all requirements as to quality and dimensions. Show that an adequate quantity of material is available from the source area and provide quality test data. Stone shall be of a suitable quality to ensure permanence in the structure and in the climate in which it is to be used. It 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 20 percent or more of the stone produced contains hairline cracks, then all stone 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 4 mil and shall be continuous for one-third the dimension of at least two sides of the stone. The stone shall be clean and reasonably free from soil, quarry fines, and shall contain no refuse. The stone shall be clean and adequately free from all foreign matter. Any foreign material adhering to or combined with the stone as a result of stockpiling shall be removed prior to placement.

1.5.1.2 Sources

Stone shall be furnished from any source designated by the Contractor and accepted by the Contracting Officer, subject to the conditions herein stated. In order for stone to be acceptable on the basis of service records, stone of a similar size must have been placed in a similar thickness and exposed to weathering under similar conditions as are anticipated for this contract, and must have satisfactorily withstood such weathering for a minimum of 20 years. In addition to an acceptable 5 year service record, the Contracting Officer has the option to elect to have representative samples taken and tested.

a. List of Sources

(1) Category I Sources: Category I sources have been inspected and evaluated within the last five years by the Government and have produced stone materials of acceptable quality from satisfactory geological formations. The Category I sources have previously demonstrated effective quality control programs at the source and the test results of the materials furnished have been verified that some material are of satisfactory quality. In a like manner, the source would be capable of providing the quality, quantity, and gradation of required stone materials. Further evaluation and testing of the source will not be required unless the preparation of the required demonstration stockpile reveals an adverse condition not previously taken into account.

(2) Category II Sources: Category II sources either have not been inspected or evaluated within the past five years or have had a deficiency in the past which may or may not affect its qualifications to provide stone materials for this project. Deficiencies may include, but are not limited to: ineffective quality control program; unsatisfactory production techniques; unacceptable quality of material in the geological formation being quarried; insufficient quantities of required materials; or unsatisfactory durability of stone materials previously furnished. These factors of this kind do not disqualify the source for this project. A current inspection and evaluation of the source by the Contractor would be necessary to determine whether acceptable stone can be produced from the proposed source before allowing the source to proceed with preparation of demonstration stockpiles. Disapproval of a proposed Category II source based on the inspection and evaluation would necessitate having the Contractor name a replacement source.

b. Selection of Source. Designate in writing only one source or one combination of sources from which he proposes to furnish stone. He shall notify the Contracting Officer at least 60 workdays before the stone leaves the quarry. It is the Contractor's responsibility to determine that the stone 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.

c. Acceptance of Materials. Acceptance of a source of stone 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 stone 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 stone may be tested by the Government, if the Contracting Officer determines that testing is necessary. If such tests are determined necessary, the testing will be

done in the Government's testing laboratory or commercial laboratory selected by the Government. Materials produced shall meet all the requirements herein. During the contract period, both prior to and after materials are delivered to the job site, visual inspections and measurements of the stone materials may be performed by the Contracting Officer. If the Contracting Officer, during the inspections, finds that the stone 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 stone 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.

1.6 CONSTRUCTION TOLERANCES

The finished surface and stone layer thickness shall not deviate from the lines and grades shown by more than the tolerances listed below. Tolerances are measured perpendicular to the indicated neatlines. Extreme limits of the tolerances given shall not be continuous in any direction for more than five (5) times the nominal stone dimension nor for an area greater than 200 square feet of the structure surface.

NEATLINE TOLERANCES
ABOVE NEATLINE BELOW NEATLINE

Material	Inches Above Neatline	Below Neatline
Filter Layer:	+3 inches	-2 inches
Riprap:	+8 inches	-4 inches
Base:	+2 inches	-1 inch

The intention is that the work shall be built generally to the required elevations, slope and grade and that the outer surfaces shall be even and present with a neat appearance. Placed material not meeting these limits shall be removed or reworked as directed by the Contracting Officer. Payment will not be made for excess material which the Contracting Officer permits to remain in place.

PART 2 PRODUCTS

2.1 FILTER MATERIAL

Filter material shall consist of Filter Stone and Geotextile. Geotextile shall be as specified in Section 31 05 22 GEOTEXTILES.

The rock shall be composed of tough, durable particles, adequately free from thin, flat and elongated pieces, and shall contain no organic matter nor soft, friable particles in quantities considered objectionable by the Contracting Officer. The aggregate shall meet the quality requirements of ASTM C 33. Grading shall conform to the following requirements:

PERMISSIBLE LIMITS
U.S. STANDARD SIEVE PERCENT BY WEIGHT,
PASSING FILTER STONE

6 in.	95%
3 in.	50%
1 in.	5%

The filter materials shall be well-graded between the limits shown. At least one test shall be performed on material placed for each specified gradation in accordance with ASTM C 136. A representative sample weighing not less than 100 pounds shall be removed from the filter layer placed at locations directed by the Contracting Officer. All points on individual grading curves obtained from representative samples of filter material shall lie between the boundary limits as defined by smooth curves drawn through the tabulated gradation limits plotted on ENG FORM 2087 or similar form. The individual gradation curves within these limits shall not exhibit abrupt changes in slope denoting either gap grading or scalping of certain sizes or other irregularities which would be detrimental to the proper functioning of the filter.

2.2 STONE

2.2.1 General

2.2.1.1 Evaluation Testing of Stone

In lieu of vendor certifications for the same properties listed below the Contractor shall have evaluation tests performed on stone samples collected from the proposed source, or at the request of the Contracting Officer. The quarry investigation shall be performed by a registered geologist or registered engineer. The tests to which the stone shall be subjected include petrographic examination (ASTM C 295), bulk specific gravity (SSD), unit weight, absorption (ASTM C 127), resistance of stone to freezing and thawing (COE CRD-C 144 or ASTM D 5312), and if argillaceous limestone and sandstone are used, resistance to wetting and drying (COE CRD-C 169 or ASTM D 5313). The laboratory to perform the required testing shall be validated based on relevant paragraphs of ASTM D 3740, and no work requiring testing shall be permitted until the laboratory has been inspected and validated. The first inspection of the facilities shall be at the expense of the Government and any subsequent inspections required because of failure of the first inspection shall be at the expense of the Contractor.

a. Bulk Specific Gravity Range. All stone shall have a minimum bulk specific gravity, saturated surface dry (SSD), of 2.50 and a maximum bulk specific gravity of not more than 2.90 based upon water having a unit weight of 62.4 pounds per cubic foot. The method of test for bulk specific gravity (SSD) shall be ASTM C 127.

b. Petrographic Examination. Stone 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.

d. Samples. Samples of stone shall be taken by a representative of the Quarry under the supervision of the Contracting Officer for testing and acceptance prior to delivery of any stone from this source to the site of the work. Information provided with the samples shall include the location within the quarry from which the sample was taken along with a field examination of the quarry. The field examination shall include the information outline in ASTM D 4992, paragraph 7.

Samples shall consist of at least three pieces of stone, roughly cubical in shape and weighing not less than 150 pounds each from each unit that shall be used in the production of the required stone. If the source is an undeveloped quarry, or if the operation has been dormant for more than one year such that fresh samples are not available, the Contractor shall expose fresh rock for 20 feet horizontally and for the full height of the face proposed for production, prior to the field evaluation.

The Contracting Officer may also require documentation of subsurface exploration of an undeveloped quarry in order to determine whether or not sufficient reserves are available. The samples shall be shipped at the Contractor's expense to a laboratory validated by the government to perform the required tests.

e. Tests. Conduct the tests in accordance with applicable ASTM and Corps of Engineers methods of tests, given in the Handbook for Concrete and Cement, in a laboratory validated by the government. The cost of testing shall be borne by the Contractor.

2.2.1.2 Gradation Tests for Stone

To be performed if testing from the vendor is not performed or deemed adequate by the Contracting Officer.

a. Gradation Test Method for Riprap. Gradation tests shall be performed in accordance with ASTM D 5519.

b. Standard Test Method for Gradation of Riprap, Graded Stone, and Filter Stone

(1) Select a representative sample (Note No. 1), weigh and dump on hard stand.

(2) Select specific sizes (see example) on which to run "individual weight larger than" test. (See Note No. 2). Procedure is similar to the standard aggregate gradation test for "individual weight retained".

(3) Determine the largest size stone in the sample. (100 percent size)

(4) Separate by "size larger than" the selected weights, starting with the larger sizes. Use reference stones, with identified weights, for visual comparison in separating the obviously "larger than" stones. Stones that appear close to the specific weight must be individually weighed to determine size grouping. Weigh each size group, either individually or cumulatively.

(5) Paragraph d above will result in "individual weight retained" figures. Calculate individual percent retained (heavier than), cumulative percent retained, and cumulative percent passing (lighter than). Plot percent passing, along with the specification curve on ENG Form 4794-RM 4794-R.

NOTE NO. 1: Sample Selection: The most important part of the test and the least precise is the selection of a representative sample. No "standard" can be devised; larger quarry run stone is best sampled at the shot or stockpile by given direction to the loader; small graded stone is best sampled by random selection from the transporting vehicles. If possible, all parties should take part in the sample selection and agree before the sample is run that the sample is representative.

NOTE NO. 2: Selection of Size for Separation: It is quite possible and accurate to run a gradation using any convenient sizes for the separation, without reference to the specifications. After the test is plotted on a curve, then the gradation limits may be plotted. Overlapping gradations with this method are no problem. However, it is usually more convenient to select points from the gradation limits, such as the minimum 50 percent size, the minimum 15 percent size, and one or two others, as separation points. For these types of stone gradations the separation points need to be selected as the smallest size stone at each break in the gradation specified.

2.2.1.3 Riprap Stockpile

Storage of riprap, stone, or filter stone at the worksite is not to be confused with off-site stockpiling of riprap, stone, or filter stone. If the Contractor elects to provide off-site stockpiling areas, the Contracting Officer shall be notified of all such areas. The Contractor's stockpile shall be a maximum of 12 feet high and formed by a series of layers of truckload dumps, where the rock essentially remains where it is placed. Subsequent layers shall be started 10 feet from the edge of the previous layer so that the rock will not roll down the edges of the previous layers. The first layer shall be a maximum of 6 feet high. After being stockpiled, any riprap, stone, or filter stone which has become contaminated with soil or refuse shall not be put into the work unless the contaminating material has been removed from the riprap, stone, or filter stone prior to placement.

a. Worksite Stockpile. Riprap, stone, or filter stone delivered to the work sites, which requires temporary storage landward of top of slope, shall be placed in a container suitable for storing the riprap, stone, or filter stone without waste, or a sand-clay-gravel or crushed stone pad may be constructed for the storage area and removed upon completion of the work. If the sand-clay-gravel or crushed stone pad method is used, the pad shall have a minimum thickness of at least 6 inches. The container or sand-clay-gravel or crushed stone pad method shall be subject to approval prior to delivery of the riprap, stone, or filter stone. Upon completion of the work, the storage areas shall be cleaned of all storage residues and returned to their natural condition. Temporary storage of riprap, stone, or filter stone at the worksite will be allowed, provided the stockpile toe of the riprap, stone, or filter stone be no closer than 60 linear feet from the closest edge of the shoreline's upper top slope, and the amount shall not exceed 200 tons unless otherwise approved.

b. Off-site Stockpile. In areas where riprap, stone, or filter stone is stockpiled for placement, the area shall have excess rock removed prior to completion of work. All rock and spalls greater than 3 inches in diameter shall be removed. Where rocks may have become buried due to soft ground or operation of the equipment, the rock shall be disposed of as directed. After the rock has been removed, the storage area shall be graded, dressed, and filled to return the ground surface as near as practical to the condition that existed prior to construction.

2.2.2 Riprap

Stone shall be well graded and shall conform to the table(s) below.

TABLE 1
(FOR RIPRAP "1/4 Ton")

Percent Lighter Limits of Stone by Weight (SSD)	**Weight, lb.**
95-100%	1,000
0-50%	500
0-5%	75

All points on individual grading curves obtained from representative samples of riprap material shall lie between the boundary limits as defined by smooth curves drawn through the tabulated gradation limits plotted on ENG FORM 2087 or similar form. The individual gradation curves within these limits shall not exhibit abrupt changes in slope denoting either gap grading or scalping of certain sizes or other irregularities.

2.2.3 Filter Fabric

See SECTION 31 05 22 GEOTEXTILES for filter fabric.

PART 3 EXECUTION

3.1 DEMONSTRATION SECTION

Prior to placement of stone, construct a section of stone protection consisting of toe stone, riprap, and filter layers to demonstrate his proposed operations for production placement. The section shall demonstrate procedures and capability of grading, placing toe stone and bank protection within the tolerances specified. The demonstration section shall be 100 feet in length and shall conform to all applicable specifications.

3.1.1 Method and Equipment

Methods and equipment employed for placement shall demonstrate the adequacy for use in placement of toe stone, riprap, and filter layers and shall conform with the requirements specified. The quantities of all materials placed within the section shall be accurately tabulated and provided immediately to the Contracting Officer for comparison with computed quantities.

3.1.2 Demonstration Section Evaluation

Do not proceed with placing stone protection prior to the approval of the demonstration section. Within a period of 7 days after completion of the section, the Contracting Officer shall determine the adequacy of the section to function as part of the permanent construction. The Contractor will be notified as to the acceptability of the section and may be directed to modify methods of construction and remove the section if necessary.

3.1.3 Removal of Demonstration Section

If removal of the demonstration section is required, it shall be conducted in such a manner as to maintain the integrity of the underlying subgrade. The Contractor shall make arrangements for disposal in areas not located on the site.

3.2 BASE PREPARATION

Areas on which filter layers and riprap are to be placed shall be graded and/or dressed to conform to cross sections shown on the contract Drawings within an allowable tolerance of plus 2 inches and minus 1 inches from the theoretical slope lines and grades. The prepared base shall be approved by the Contracting Officer.

Where such areas are below the allowable minus tolerance limit they shall be brought to grade by fill with earth similar to the adjacent material or with sand fill and then compacted to a density equal to the adjacent in place material. Subaqueous areas on which filter materials and riprap are to be placed shall be graded and/or dressed to conform to cross sections shown on the contract drawings within an allowable tolerance of plus 1 foot and minus 2 feet from the specified slope line and grades.

Where such areas are below the allowable minus tolerance limit they shall be filled with sand. As an alternative, these areas may be filled with filter rock material.

Immediately prior to placing the geotextile and filter stone, the prepared base will be inspected by the Contracting Officer and no material shall be placed thereon until that area has been approved. Prepared base layer shall not be exposed to incoming water unless authorized by the Contracting Officer.

3.3 PLACEMENT OF FILTER LAYERS

3.3.1 General

Filter layers, composed of geotextile and a 6-inch layer of filter stone shall be placed on the prepared base as described below, in accordance with the details shown on the contract Drawings, and within the limits either shown on the contract drawings or staked in the field. A tolerance of plus 3 inches and minus 2 inch from the slope lines and grades shown on the contract drawings will be allowed in the finished surface of the filter layers, except that the extreme of this tolerance shall not be continuous over an area greater than 200 square feet.

3.3.2 Geotextile

Installation of geotextile shall be as specified in Section 31 05 22 GEOTEXTILES USED AS FILTERS.

3.3.3 Placement of Filter Material on Geotextile

Filter material shall be spread uniformly on the geotextile to the slope lines and grades as indicated on the contract drawings and in such manner as to avoid damage to the geotextile. Loads of material shall be placed against previously placed material in such a manner as to ensure a relatively homogenous mass. Placing of filter stone by methods which tend to segregate the particle sizes within the filter layer will not be permitted.

Any damage to the surface of the geotextile during placement of filter stone shall be repaired before proceeding with the work. Compaction of material placed on the geotextile will not be required, but shall be finished to present an adequately even surface, free from mounds or windrows.

3.4 PLACEMENT OF RIPRAP

3.4.1 General

Riprap shall be placed on the filter layers specified in paragraph FILTER MATERIAL within the limits shown on the contract drawings.

3.4.2 Placement

Under water placement rates shall be used when the top of the layer to be placed is covered by more than 3 feet of water.

3.4.2.1 Above Water

Riprap shall be placed in such manner as to produce a well graded mass of rock with the minimum practicable percentage of voids, and shall be constructed within the specified tolerances to the lines and grades shown on the drawings. Placement shall begin at the bottom of the area to be covered and continue up slope. Subsequent loads of material shall be placed against previously placed material in such a manner as to ensure a relatively homogenous mass. The desired distribution of the various sizes of stones throughout the mass shall be obtained by selective loading of the material at the quarry or other source, by controlled dumping of successive loads during final placing, or by other methods of placement which will produce the specified results.

Rearranging of individual stones will be required to the extent necessary to obtain a well-graded distribution of stone sizes as specified above. Maintain the stone protection until accepted by the Contracting Officer; any material displaced by any cause shall be replaced, with no additional payment, to the lines and grades shown on the drawings.

A tolerance of plus 8 inches or minus 4 inches from the slope lines and grades shown on the Drawings will be allowed in the finished neatline surface of the riprap, except that either extreme of such tolerance shall not be continuous over an area greater than 200 square feet. The average tolerance of the entire job shall have no more than 50 percent of the tolerance specified above.

No stone shall be dropped through air from a height greater than 3 feet. The drop height of riprap with a top size greater than 500 pounds shall be less than 1 foot, but can be increased by placing a cushioning layer of sand or other protective material on top of the geotextile before placing the riprap, or other methods deemed necessary if demonstrated in the field to not damage the geotextile.

The larger stones shall be well distributed and the entire mass of stones in their final position shall be roughly graded to conform to the gradation specified in Paragraph 2.2.2 Riprap. The finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones.

Placing riprap in layers will not be permitted. Placing riprap by dumping into chutes or by similar methods likely to cause segregation of the various sizes will not be permitted. Placing riprap by dumping it at the top of the slope and pushing it down the slope will not be permitted. No equipment shall be operated directly on the completed stone protection system.

All dump trucks used in placing the riprap shall be equipped with bottom hinged tailgates. The gate releasing mechanism shall be arranged so that it may be operated only from, at, or near the front of the truck.

3.4.2.2 Under Water

Prior to starting work, submit the proposed method of placing riprap under water. Riprap to be placed in the wet if necessary shall be done during periods of low water levels. The riprap shall be placed in two passes, with the second pass perpendicular to the first pass.

3.5 PLACEMENT OF HAND-PLACED RIPRAP

3.5.1 General

Hand-placed riprap shall be placed on the filter material specified in paragraph FILTER MATERIAL within the limits shown. Stone shall conform to the requirements of paragraph RIPRAP. Except for spalls for wedging, stone shall be roughly rectangular in shape of which the least dimension shall be not less than one-third the length.

3.5.2 Placement

The riprap shall be carefully placed by hand in such a manner that adjacent stones are in close contact and, in general, have their greatest dimensions across the slope. "Through stones" shall be well-distributed throughout the mass and the sum of their cross sections, parallel to the slope being protected, shall be not less than two-thirds of such area. As used in this specification a "through stone" is defined as a stone whose dimension normal to the surface being riprapped is not less than the full depth of the riprap. Placement shall begin at the bottom of the area to be covered and continue up slope. Subsequent loads of material shall be placed against previously placed material in such a manner as to ensure a relatively homogenous mass. Placement shall begin at the bottom of the area to be covered and continue up slope. Subsequent loads of material placed on the slope shall be immediately adjacent to previously placed material in such a manner to ensure a relatively homogenous mass. The riprap along the lower edge of an area shall consist of the largest stones set in a trench so as to form a band. Except for spalls used to fill voids between larger stone, no stone shall be used in the exposed face of the riprap which will extend less than one-half the thickness of the riprap. Spaces between the larger stones shall be filled with spalls and smaller stones of the largest feasible size to form a compact mass. Spalls and small stone shall not be place in nests in lieu of larger size stone. A tolerance of plus or minus 6 inches from the slope lines and grades shown will be allowed in the finished surface of the riprap paving, except that the extreme of this tolerance shall not be continuous over an area greater than 200 square feet.

3.6 CORRECTIVE EARTHWORK

3.6.1 Grading

Grading shall consist of the sloping of banks damaged by failures and the preparation of the subgrade. Most of the grading will be in areas where mechanical equipment can be used, but some hand grading may be required. All grading and filling shall be done to the lines and grades as staked in the field or as specified. Material used in making fills or restoring the subgrade shall be free from roots, brush or other debris. Each layer shall be thoroughly compacted to a density at least equal to that of the adjacent undisturbed earth.

3.6.2 Excavation

Excavation shall be required in some failures where protrusion of stone above adjacent surface is objectionable. Where excavation is specified, the subgrades shall be excavated to the extent necessary. Large areas may not require excavating throughout, but excavation to the depths specified above will be required only for a distance of 5 feet inside the perimeter of the failure. Most of the excavation can be accomplished by mechanical means, but some hand work around the edges will be required. All work shall be to the lines and grades as staked in the field or as specified. Material resulting from the operation shall be used for making fills where required as specified in paragraph GRADING.

3.7 TESTS AND INSPECTIONS

Surveys made by the Contractor are required on each material placed for determining that the materials are acceptably placed in the work. Make checks as the work progresses to verify lines, grades and thicknesses established for completed work. At least one (1) check survey as specified below shall be made for each twenty-five (25) foot section as shown as practicable after completion. Following placement of each type of material, the cross section of each step of the work shall be approved by the Contracting Officer before proceeding with the next step of the work.

Approval of cross sections based upon check surveys shall not constitute final acceptance of the work. Cross sections shall be taken on lines 25 feet apart, measured along the structure reference line, with readings at 5-foot intervals and at beaks along the lines. However, other cross section spacing and reading intervals may be used if determined appropriate by the Contracting Officer.

Additional elevations and soundings shall be taken as the Contracting Officer may deem necessary or advisable. The surveys shall be conducted in the presence of an authorized representative of the Contracting Officer, unless this requirement is waived by the Contracting Officer.

a. Above Water: The elevation of stone above the water surface shall be determined by the use of a leveling instrument and a rod having a base 12 inches in diameter. If approved by the Contracting Officer other means may also be used.

b. Below Water: For portions of the work that are under water, sounding surveys shall be performed either by means of a sounding pole or a sounding basket weighing about 8 1/2 pounds, each of which has a base measuring 12 inches in diameter.

c. Gage Board: The gage shall be checked prior to any survey. The Contractor shall install a gage board at the project site.

d. Electronic Depth Recorder Method: When using an electronic depth recorder the following procedures shall be used.

(1) The depth recorder shall be calibrated and adjusted for the gage, with check bar, at least six (6) times within a normal eight (8) hour work day.

(2) Normal calibration times shall be at the beginning of the work day, mid-morning, close of morning's work, start of afternoon's work, mid-afternoon, and the end of the day.

(3) Further calibrations shall be performed whenever there is any malfunction within the depth recorder or transducer which might affect the soundings, a major gage change, or change in water temperature due to industrial discharge or other causes.

(4) The check bar shall be set at approximately the deepest sounding in the area to be sounded.

(5) The depth recorder shall be calibrated to read at low water datum.

(6) When checking the calibration at mid-morning, end of morning, mid-afternoon and end of work, the same setting used for the previous calibration shall be used.

(7) If the calibration check does not agree with the previous calibration, the depth recorder shall be calibrated to the proper setting.

(8) Under no circumstances shall the setting of the depth recorder be changed between calibrations.

e. Electronic Depth Recorder: The survey depth recorder used must be a standard model acceptable to the Contracting Officer using a sounding chart that can be read directly to the nearest foot and estimated to the nearest tenth (0.1) of a foot. Accuracy shall be better than 1/2 of 1 percent.

f. Tagline Method of Horizontal Location Along Station: If a tagline is used with a depth recorder, the soundings shall be marked with a fix every 5 feet.

g. Predetermined Transit Angle Method or Ranges Method: The interval between predetermined angles or ranges along a sounding line shall not exceed 200 feet along the entire length of the sounding line. No predetermined angle shall form an intersection with the sounding line of less than 45 degrees.

h. Speed of the Sounding Boat: When sounding, the speed of the sounding boat shall be as constant as possible, preferably between 180 and 220 feet per minute.

i. Checking Gage: The gage shall be checked prior to each calibration and recorded on the sounding chart or in the field notes.

EXAMPLE GRADATION
SPECIFICATIONS

PERCENT LIGHTER BY WEIGHT	STONE WEIGHT IN LBS.
100	400 - 160
50	160 - 80
15	80 - 30

EXAMPLE WORKSHEET

STONE SIZE LBS.	INDIVIDUAL WT. RETAINED	INDIVIDUAL PERCENT RETAINED	CUMULATIVE RETAINED	PERCENT PASSING
400	0	0	0	100
160	9,600	30	30	70
80	11,200	35	65	35
30	8,000	25	90	10
<30	3,200	10	100	-
TOTAL	32,000 pounds			

NOTE: Largest stone 251 pounds

GRADATION TEST DATA SHEET

Quarry _____ Type of Stone Tested _____

Date of Test _____ Testing Rate _____

TEST REPRESENTS

Contract No.	District	Tons
	TOTAL	

GRADATION

Stone Size (lbs)	Weight Retained	Individual % Retained	Cumulative % Ret.	Cumulative % Pass	Specification % Finer by wt
Total Weight					
Max Size Stone =					

Remarks:

_____

I certify that the above stone sample is representative of the total tonnage covered by this test report.

Contractor Representative _____

Government Representative _____

STONE SOURCES

LATITUDE/ LONGITUDE	QUARRY LOCATION, ADDRESS, & TELEPHONE NUMBER	MAIN OFFICE ADDRESS & TELEPHONE NUMBER
	[STATE]	
[_____]	[_____]	[_____]
	[_____]	[_____]
	[_____]	[_____]
	[_____]	[_____]
[_____]	[_____]	[_____]
	[_____]	[_____]
	[_____]	[_____]
	[_____]	[_____]
	[STATE]	
[_____]	[_____]	[_____]
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	[_____]	[_____]
	[_____]	[_____]
	[_____]	[_____]

END OF SECTION

ATTACHMENT 3
STABILITY EVALUATION REPORT

TETRA TECH

November 4, 2009

FINAL MEMORANDUM

From John Bosche
(510) 302-6295

RE: Stability Evaluation of Soil Cover and Shoreline Rip-Rap Revetment Parcel B, Hunters Point

This letter presents Tetra Tech EM Inc.'s final technical memorandum for evaluation of the static and seismic stability of the soil cover and shoreline rip-rap revetment slope to be constructed at the water's edge at Installation Restoration Site 7 (IR-07) within Parcel B at Hunters Point Shipyard. Tetra Tech previously issued this Technical Memorandum on April 9, 2009. After that, the State of California Department of Toxic Substances Control and the City of San Francisco issued comments regarding the prior technical memorandum. As a result, Tetra Tech EM Inc. performed some additional analysis and added to the description of the work performed and technical assumptions.

Objective

Perform an evaluation of static and dynamic (earthquake) stability of the soil cover and rip-rap shoreline protection at Hunters Point Parcel B.

Information Sources:

1. Soil boring logs IR07MW20A2, IR07MW21A2, IR07MW24A, IR07MW25A, IR07MW26A, IR07MWP-1, IR07MWP-2, IR07MWS-3, and IR07MWS-4 (Figure 3). The borings locations were determined from a copy of the 2008 Land Survey, IR Sites and Restrictions Related to Radionuclides, Prepared by Kurt Cholak, Tetra Tech EM Inc. dated 12/12/08. Borings were dated from 1986, 1990 and 2000. Borings reviewed are included in Appendix 3A.

2. Figures dated 9/30/09 including: Figure 5, Existing Topography and Cross Section Locations, Figure 7, Cross Sections A-A' and B-B', and Figure 8, Proposed Cover Contours.

3. Drawings of shoreline cross sections dated 7/31/09: C-5, C-6, and C-7. These 3 drawings contain the following cross sections: A, B, C, D, E, F, G, H, I, and J.

4. Tetra Tech EM Inc. 2004. "Internal Final, Parcel E Nonstandard Data Gaps Investigation, Landfill Liquefaction Potential, Hunters Point Shipyard." August 12.

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Work Performed:

1. Reviewed soil boring logs for material type and properties. Material type and property review was conducted to determine appropriate strength properties and to assess if liquefiable sands are present at the site. Reviewed the liquefaction study performed at the Parcel E landfill.

2. Prepared cross section of proposed ground surface including revetment. Where soil data was not available near the toe of slope, assumed that the subsurface material consists of weak bay mud. Assigned assumed strength parameters. The location of the design cross section is illustrated on Figure 1 and the vertically exaggerated cross section itself is illustrated on Figure 2. The soil parameters used in the analysis are discussed in the section which follows below.

3. Conducted a long-term effective stress analysis of the static slope conditions using the computer program WINSTABL which is a modification of the computer program PSSTABL6. PCSTABL6 was developed by Purdue University and WINSTABL was a modification prepared by Peter J. Bosscher of University Wisconsin-Madison.

4. Conducted short-term total stress analysis of the dynamic slope conditions using the computer program WINSTABL. The dynamic analysis was performed to determine the slope yield acceleration where the factor of safety during constant acceleration is reduced to unity. The yield acceleration determined in this evaluation is one of the input parameters for the Newmark analysis described below.

5. Conducted a variety of Newmark analyses to evaluate possible earthquake movements of the proposed slope. The Newmark analysis used the yield acceleration determined in Step 2 above and earthquake shaking parameters from the Parcel E Landfill liquefaction study. The design earthquake parameters were 0.5g peak ground surface acceleration and moment magnitude of 7.9 (as suggested by the City of San Francisco in their review of the draft technical memorandum). Three different Newmark methods of analysis were performed using these input parameters. As suggested by the City of San Francisco reviewer, Tetra Tech also evaluated the displacement using the method of Bray and Travasarou. The Bray and Travasarou method is a simplified semiempirical method for estimating permanent displacements due to earthquake-induced shaking. The model utilizes a nonlinear fully coupled stick-slip sliding block model. The methods of analysis included the following:

Newmark Analysis Method 1:	Simplified rigid block analysis
Newmark Analysis Method 2:	Simplified decoupled analysis
Newmark Analysis Method 3:	Rigorous rigid block analysis
Analysis Method 4:	Method of Bray and Travasarou 2007

The rigorous rigid block analysis uses representative earthquake time histories that are scaled to match the peak ground acceleration of 0.5g. Because the earthquake records are real records that are modified to match the selected peak ground acceleration, they vary in frequency content. The analysis included the scaling of 11 different strong motion recording stations for their North/South and East/West components. The rigorous rigid block analysis was thus repeated 22 times for different scaled earthquake time histories.

Stability Analysis Input Parameters:

An effective stress analysis of the slope was conducted to evaluate the long-term stability conditions. Total stress analysis was conducted to evaluate short term earthquake loading conditions. The materials included in the analysis are listed below with the material properties indicated. An idealized cross section of the design slope analyzed is presented in Figure 2.

TABLE 1
SOIL PROFILE INPUT PARAMETERS

Layer Number	Material Description	Saturated Unit Weight (pcf)	Effective Stress Analysis Long-Term Conditions		Total Stress Analysis Short-Term Seismic Conditions	
			Angle of Internal Friction (degrees)	Cohesion (pcf)	Angle of Internal Friction (degrees)	Cohesion (pcf)
1	San Francisco bay mud	115 29.5		0	0	400
2	Quarry rip-rap stone	135	40	0 40 0		
3	Clayey sands	120	30	0 30 0		

References:

Bonaparte, R. and Mitchell, J.K. "The Properties of San Francisco Bay Mud at Hamilton Air Force Base, CA" Department of Civil Engineering University of California, Berkeley. April, 1979.

Terzaghi, L. and Peck, R. "Soil Mechanics in Engineering Practice". 1967.

Discussion and Results:

1. The borings were each located near the top of the existing shoreline embankment. A variety of materials were logged in the borings although most materials logged were sands and gravels. Materials above the water table, cohesive materials, cobbles and gravels were not generally considered to be susceptible to liquefaction during earthquakes. No grain size distribution or minus 200 sieve grain sized information was available. Soil strength tests were not available.

2. There are some layers of soil below the groundwater table that may be susceptible to soil liquefaction. SM and SP layers that may be most susceptible to liquefaction were identified in the boring logs from soil borings IR07MW20A2 and IR07MW21A2. The soils at the site are variable, so the SM and SP layers observed in these two borings do not appear to be continuous. Most of the soil in the borings reviewed was fill material. Below the fill, bay mud was present in one of the borings (IR07MW21A2) at a depth of 34 feet below grade.

3. The 4:1 (horizontal to vertical) rip-rap slope is not steep and the analytical results indicate that it is inherently stable under static loading conditions. The long-term effective stress analysis factor of safety result is 2.65. The results of the effective stress analysis are presented in Appendix 3B.

4. A yield acceleration was calculated for the purpose of evaluating potential slope movements during earthquake shaking. The yield acceleration for the 4:1 rip-rap slope is 0.2g. The yield acceleration was calculated using a short-term total stress analysis and the analytical results are presented in Appendix 3C.

5. Four separate analytical methods were used to evaluate displacements which may occur during earthquakes. The results are presented in the following table and in Appendix 3D.

TABLE 2
DISPLACEMENT PREDICTION RESULTS

Method Number	Description Predicted	Displacement
Newmark Method 1	Simplified rigid block analysis	6 cm (2 in)
Newmark Method 2	Simplified decoupled analysis	33 cm (13 in)
Newmark Method 3	Rigorous rigid block analysis (analysis performed for 22 strong motion records from 11 recording stations.	Maximum 44 cm (17 in) Minimum 3 cm (1 in) Mean: 13 cm (5 in) Median: 7 cm (3 in) Standard Deviation: 13 cm (5 in)
Method 4	Method developed by Bray and Travasarou 2007	• 84% probability of exceeding 5.2 cm (2 in) due to 7.9 magnitude earthquake with a spectral acceleration of 0.75g for degraded fundamental period of 0.11 seconds. • 50% probability of exceeding 10.1 cm (4 in). • 16% probability of exceeding 19.5 cm (8 in).

Conclusions

The conclusions and recommendations of this evaluation are as follows:

1. The proposed revetment and soil cover slope will be stable under static loading.

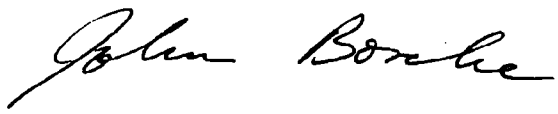
2. Under earthquake shaking with a design earthquake magnitude of 7.9, permanent deformation of the ground surface will likely occur. Based on the variety of analyses performed, it is likely that the ground surface displacement will be less than 12 inches. Deformation such as this (or greater amplitude) might disrupt the soil cover. Permanent deformations, should they occur, are not considered a threat to human health because structures will not be allowed on site and the impact of such displacements are expected to be minor and easily repairable.

3. Based on the geotechnical data reviewed, most of the soils are not expected to be highly susceptible to soil liquefaction during earthquake shaking. Because liquefaction causes extreme loss of soil strength, if soil liquefaction occurs, settlement and perhaps lateral movement could occur. Permanent deformations due to liquefaction at the site would be unlikely. Such deformations would not be considered a threat to human health because structures will not be allowed on site and any potential impacts would be expected to be minor and easily repairable.

4. Because structural improvements will not be allowed on the cover surface in the future, any ground displacements that might occur due to earthquake slope movements or liquefaction are expected to be easily and economically repaired by surface regrading or placement of additional material with earthmoving equipment. These efforts would be expected to much less costly than ground improvement or design mitigation measures to reduce the likelihood of earthquake-induced ground surface movements.

If you have any questions regarding this memo, please contact me at (510) 302-6295.

Sincerely,
TETRA TECH EM INC.

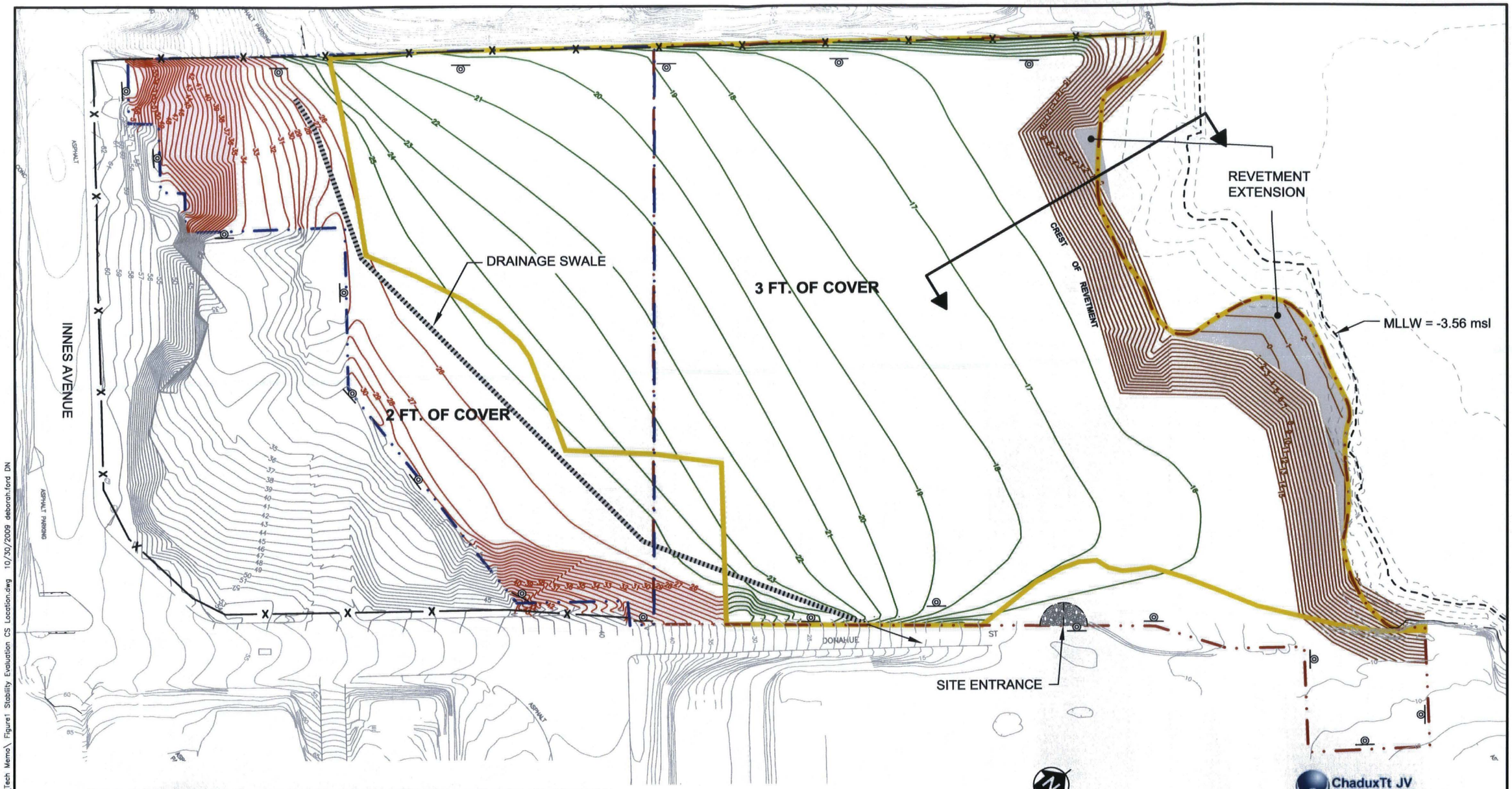


John Bosche
California Civil (#30241)
California Geotechnical Engineer (#156)

Appendix 3A: Boring Logs
Appendix 3B: Static Stability Analysis Results
Appendix 3C: Dynamic Stability Analysis Results
Appendix 3D: Newmark Analysis Results

FIGURES

(3 pages)



SURVEY CONTROL DATUM

HORIZONTAL (BASIS OF BEARINGS): NAD27 ZONE-III (HUNTERS POINT WEST 1 PID HT0613) USFT.

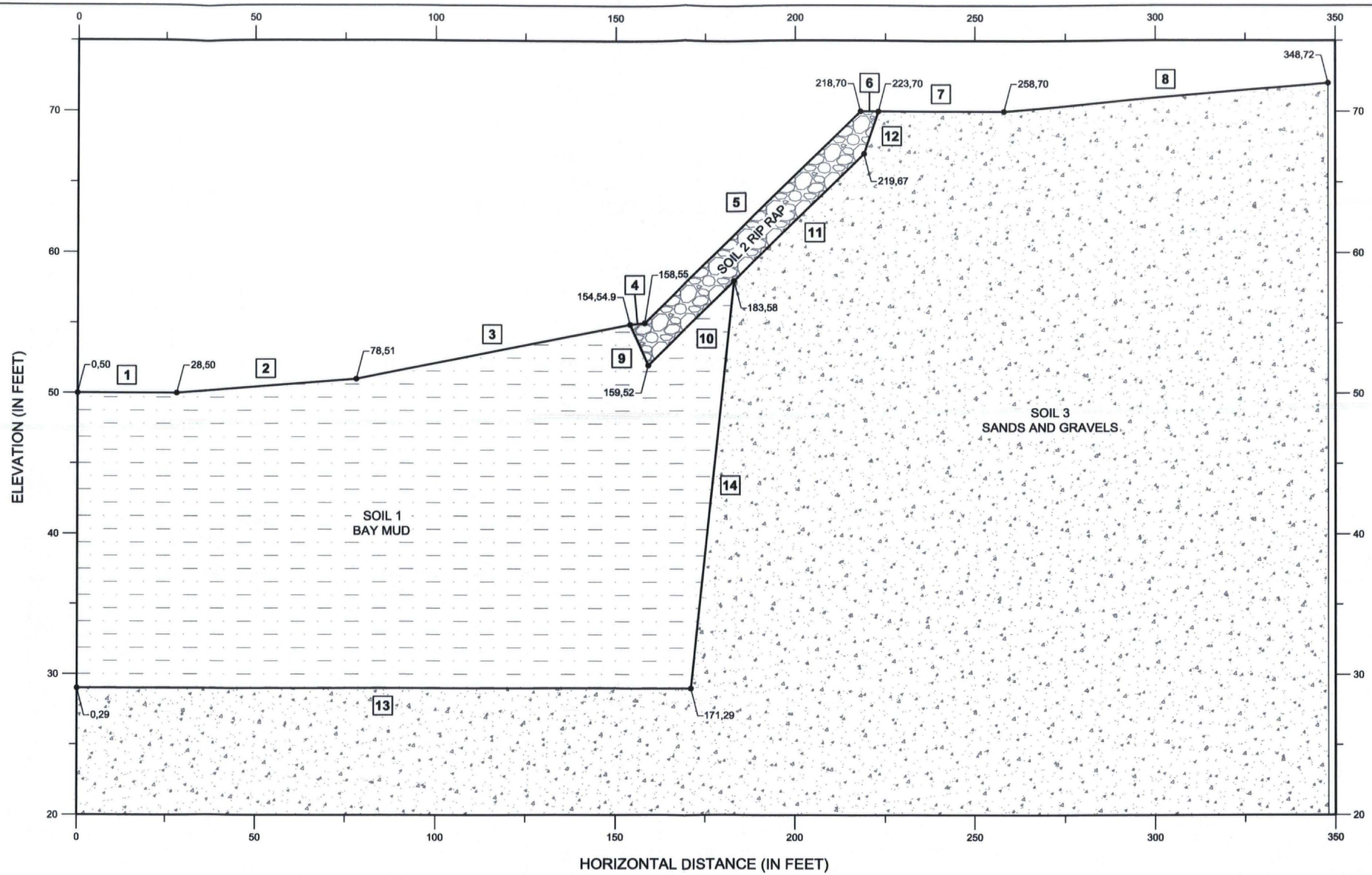
VERTICAL (BENCH MARK): NGVD 29 LESS CORRECTION 7.76 FEET MSL

Hunters Point Shipyard, San Francisco, California
Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 1
SLOPE STABILITY EVALUATION CROSS-SECTION LOCATION

IR7 Parcel B - Technical Memorandum

R:\Navy\Hunters-Pt\Parcel B\ir07_ir08\Tech Memo\ Figure1 Stability Evaluation CS Location.dwg 10/30/2009 deborah.ford DN



1 LINE SEGMENT NUMBER

0,50 LINE SEGMENT END POINT COORDINATES

NOTES:

1) ELEVATION AND HORIZONTAL DISTANCE ARE ASSIGNED ARBITRARILY FOR THE MATHEMATICAL MODEL ONLY.

2) CROSS SECTION VERTICAL EXAGGERATION = 4X

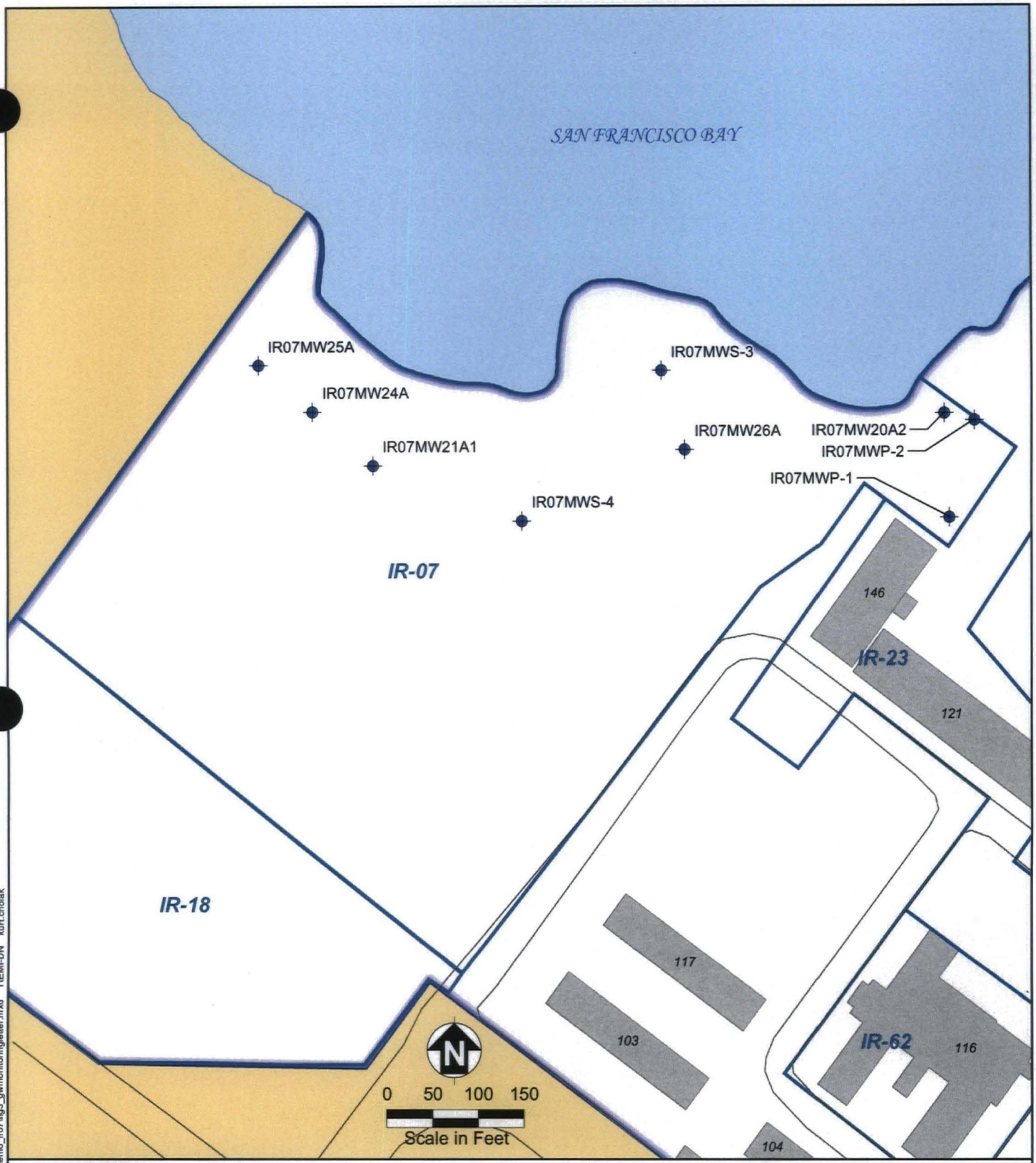
3) CROSS SECTION HAS BEEN USED FOR MATHEMATICAL MODELING OF SLOPE STABILITY AND IS NOT INTENDED FOR CONSTRUCTION.

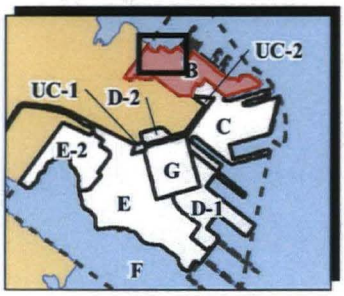
ChaduxTt JV
Consulting Engineers and Scientists

Hunters Point Shipyard, San Francisco, California
Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 2
SLOPE STABILITY ANALYSIS
DESIGN CROSS SECTION
PROPOSED RIP RAP REVETMENT
IR 7 PARCEL B - TECHNICAL MEMORANDUM

Proposed Rip Rap Revetment-Cross Section.dwg - DWH - 10/21/2009





Location Map

- Groundwater Monitoring Well
- Road
- IR or SI Site
- Parcel B Boundary
- Building
- San Francisco Bay
- Non-Navy Property

ChaduxTt JV
Consulting Engineers and Scientists

Hunters Point Shipyard, San Francisco, California
Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 3
GROUNDWATER MONITORING WELL LOCATION MAP

IR 7 Parcel B - Technical Memorandum

2009-12-23 o:\int\projects\parcel_b\tech_memo_ir07\fig3_gwmonitoringletter.mxd TIEMI-DN kurt.cholak

APPENDIX 3A

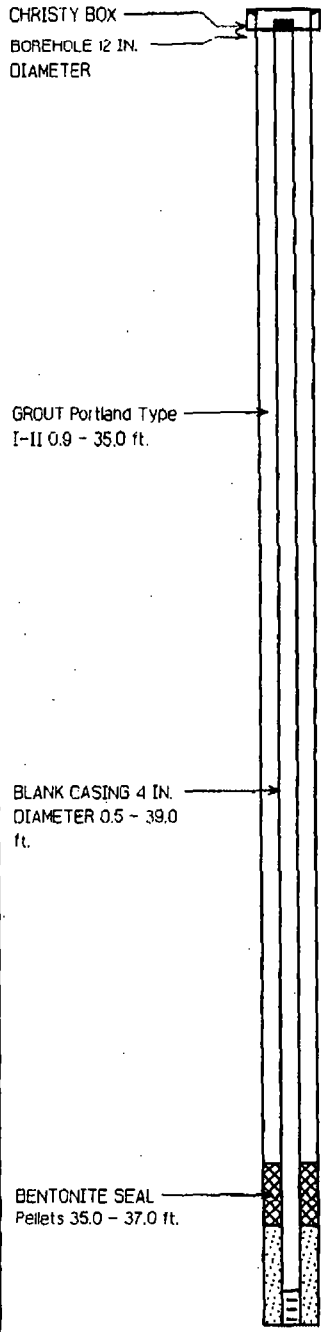
BORING LOGS

(9 pages)

PRC Environmental Management, Inc.

Adapted from Harding Lawson Associates

LOG OF BORING IR07MW20A2



Blows/3 in.	OVA (ppm)	Sample No.
16, 21, 22	1	9049G575
16, 21, 27	1	9049G576
7, 7, 6	0	9049G577
6, 5, 4	0	9049G578
6, 6, 8	0	9049G579
6, 8, 9	0	9049G580
11, 8, 11	1	
6, 8, 9	3	9049G581
11, 8, 12	3	
11, 8		

Depth (ft): 0, 5, 10, 15, 20, 25, 30, 35, 40

Samples / Symbols

Materials Description

ASPHALT

DARK BROWN GRAVELLY SILT WITH SAND (ML) 7.5YR3/2, stiff, moist, 40-45% silt, 30-35% fine to coarse serpentinite gravel, 15% sand, fill

GREENISH GRAY SERPENTINITE COBBLE FILL 5G5/2, dense, moist, 80-85% serpentinite cobbles, 15-20% sandy silt

OLIVE BROWN WELL-GRADED GRAVEL WITH SAND (GW) 2.5Y4/2, loose, wet, 70-75% fine to coarse gravel, 20-25% fine- to coarse-grained sand, trace silt, fill

STRONG BROWN SILTY GRAVEL WITH SAND (GM) 7.5YR4/6, loose, wet, 60-70% fine to coarse gravel, 15-20% sand, 15% silt, fill

OLIVE WELL-GRADED SAND (SW) 5Y4/3, loose, wet, 95% fine- to coarse-grained sand, trace silt and serpentinite gravel, fill

RED SANDY SILT WITH GRAVEL (ML) 2.5YR4/8, medium stiff, wet, 50-55% silt, 20-25% sand, 20-25% fine gravel, fill

RED SILTY GRAVEL WITH SAND (GM) 2.5YR4/8, loose, wet, 40-50% fine gravel, 20-30% sand, 15-25% silt, trace clay, fill

DARK GREENISH GRAY GRAVELLY FAT CLAY WITH SAND (CH) 5G4/1, medium stiff, moist, 50-55% clay, 15-20% fine to coarse serpentinite gravel, 15% sand, 10% silt, fill

OLIVE GRAY CLAYEY SAND WITH GRAVEL (SC) 5Y4/2, loose, moist, 65-70% fine- to coarse-grained sand, 15-20% fine serpentinite gravel, 15% clay, trace black woody fiberous material, fill

GREENISH GRAY GRAVELLY FAT CLAY WITH SAND (CH) 5G5/1, soft to medium stiff, moist, 40-45% clay, 20-25% gravel, 15-20% sand, 10-15% silt, fill

DARK GRAYISH BROWN SILTY SAND WITH GRAVEL (SM) 2.5Y4/2, medium dense, wet, 60-70% medium- to coarse-grained sand, 15-20% silt, 15-20% fine gravel, fill

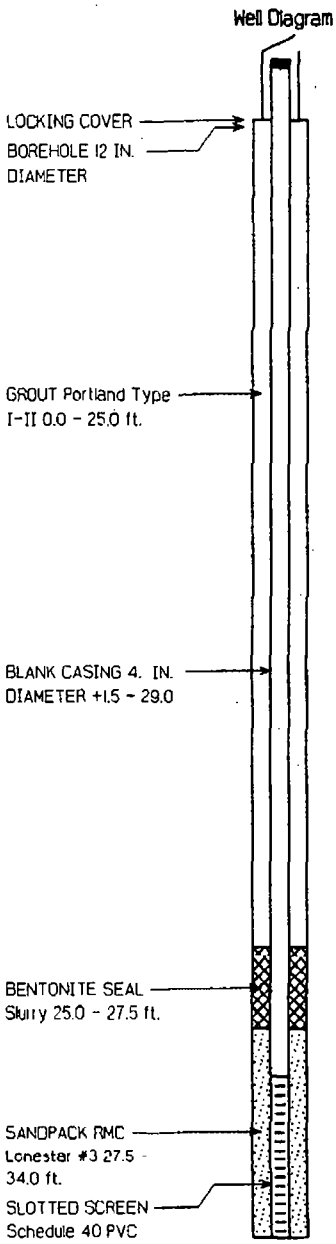
Project Number		Date Drilled	12/07/1990
Project Name	Parcel B RI Report	GS Elevation	10.23 ft.
Project Task	Hunters Point Annex	Water Level	8.5 ft.
Project Location	San Francisco, California	Total Depth Of Hole	45 ft.
Equipment	CME 55 (HSA) 12 in. diam.		

Figure

PRC Environmental Management, Inc.

Adapted from Harding Lawson Associates

LOG OF BORING IR07MW21A2



Blows/6 in.	OVA (ppm)	Sample No.	Depth (ft)	Materials Description
8, 6, 13, 14, 14	10	9049G548	0	GREENISH GRAY SILTY GRAVEL (GM) 5G5/1, medium dense, moist, 65-75% serpentinite gravel, 15-20% silt, 10% sand, trace clay, fill
8, 12, 14	0	9049G549	5	BROWNISH YELLOW WELL-GRADED GRAVEL (GW) 10YR6/8, medium dense, moist, 85-90% coarse gravel, trace silt, sand and clay, fill
15, 16, 9	1	9049G550	10	OLIVE BROWN POORLY GRADED SAND (SP) 2.5Y4/4, medium dense, moist, 100% fine- to medium-grained sand, fill
7, 7, 8	3	9049G551	15	OLIVE GRAY WELL-GRADED SAND (SW) 5Y4/2, medium dense, wet, 90-95% very fine- to coarse-grained sand, trace silt Trace gravel at 15 ft.
8, 6, 6	1	9049G552	20	
3, 7, 7			25	
2, 3, 5	40	9049G553	30	DARK BROWN POORLY GRADED SAND (SP) 10YR3/3, loose, wet, 95% very fine- to fine-grained sand, trace silt and shell fragments Undifferentiated Upper Sand Deposits
3, 3, 3, 2, 2, 2	400, 350	9049G554	35	DARK GREENISH GRAY FAT CLAY (CH) 5G5/1, soft, moist, 70-75% clay, 15-20% silt, trace shell fragments, Bay Mud Deposits Bottom of boring at 37.5 feet. Boring backfilled with bentonite pellets from 34 to 37.5 feet.
			40	

Project Number		Date Drilled	12/04/1990
Project Name	Parcel B RI Report	GS Elevation	12.89 ft.
Project Task	Hunters Point Annex	Water Level	12.5 ft.
Project Location	San Francisco, California	Total Depth Of Hole	37.5 ft.
Equipment	CME 55 (HSA) 12 in. diam.		

Figure

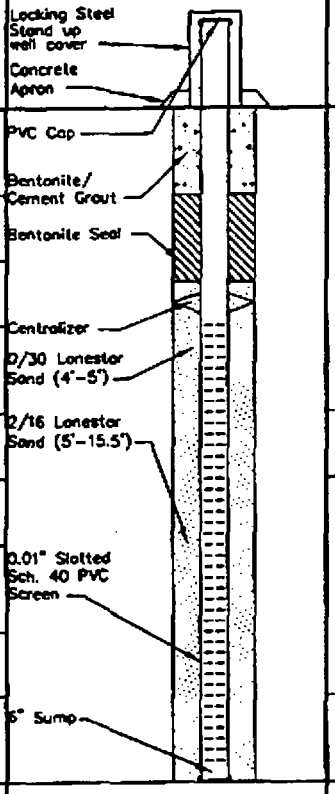
MONITORING WELL IR07MW24A

COORDINATES: N. 453956.67
E 1459700.59

FIELD GEOLOGIST M. Geisler / J. Soiz — DATE BEGAN 5/3/99
CHECKED BY W. Akiyama — DATE FINISHED 5/4/99
APPROVED BY – — SURFACE ELEV. 9.91 ft.
TOTAL DEPTH 15.5 ft. — T.O.C. ELEV. 13.56 ft.

DEPTH IN FEET	SAMPLE NUMBER	BLOWS ON SAMPLER (in)	RECOVERY (%)	USCS	DESCRIPTION
0	1	N/A	50	sw	GRAVELLY COARSE SAND with CLAY; dark grayish brown, (10yr 4/3), loose, (fill) dry (75%–85% sand, 10%–15% 1/4" angular gravel, 5% clay), brick fragments.
	2	N/A	40		Brick fragments 1/2" to 1".
	3	N/A	30		
5	4	N/A	50		50%–60% coarse sand, 30%–40% 1/4" to 1/2" gravel, 5% clay, brick fragments, moist. 7.0'
	5	N/A	50	sc	Groundwater encountered at 7.5'. SANDY CLAY with GRAVEL; dark grayish brown, medium to coarse, 60%–70% clay, 20%–30% sand, 5%–10% gravel, wet. 8.5'
	6	N/A	80	gm	SANDY GRAVEL; gray, medium to coarse (60%–70% 1/2"–1/4" angular gravel, 30%–40% sand), dense.
10	7	N/A	10		
	8	N/A	10		Becoming clayey, poor recovery, wet. 13.5'
	9	N/A	10	cl	SILTY CLAY with SAND and GRAVEL; grayish brown, (60%–70% coarse sand, 20%–25% clay, 5%–10% gravel), stiff.
15					TOTAL DEPTH 15.5 FEET
20					
25					
30					
35					

WELL CONSTRUCTION DETAILS



DRILLER : B. Deason
DRILLING CO. : Gregg Drilling and Testing Inc.
DRILLING METHOD : 8" O.D. Hollow Stem Auger, Reamed to 10" O.D.
SAMPLING METHOD : Continuous Core
PROJECT NAME: D.O. 109
LOCATION : Hunters Point Shipyard
PROJECT NO. : 773247

DRAWN BY	T.R.S.	CHECKED BY	W.S.A.	FILE NAME & DISK NUMBER	HP-7MW24A
DATE	2/24/00	APPROVED BY	–		

INTERNATIONAL TECHNOLOGY CORPORATION

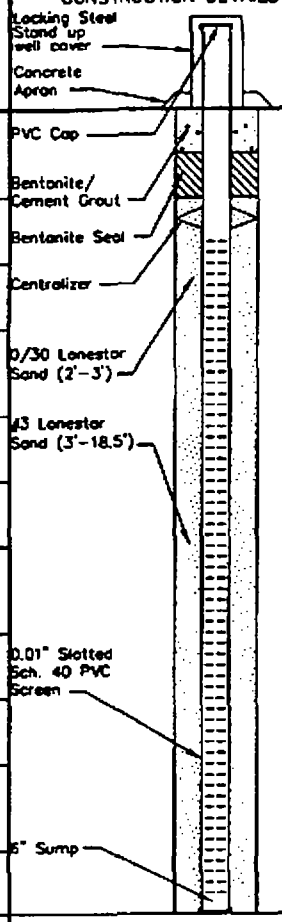
MONITORING WELL IR07MW25A

COORDINATES: N. 454016.43
E. 1459635.38

FIELD GEOLOGIST M. Geisler / J. Soiz — DATE BEGAN 5/3/99
CHECKED BY W. Akiyama — DATE FINISHED 5/6/99
APPROVED BY – — SURFACE ELEV. 8.70 ft.
TOTAL DEPTH 18.5 ft. — T.O.C. ELEV. 11.91 ft.

DEPTH IN FEET	SAMPLE NUMBER	BLOWS ON SAMPLER (in)	RECOVERY (%)
0	1	N/A	25
	2	N/A	35
5	3	N/A	100
	4	N/A	0
	5	N/A	50
10	6	N/A	100
	7	N/A	100
	–	N/A	–
	–	N/A	–
15	8	N/A	20
	–	N/A	–
20			
25			
30			
35			

WELL CONSTRUCTION DETAILS



USCS	PROFILE	DESCRIPTION	
ml		CLAYEY SILT with GRAVEL; very dark gray. (5yr 3/1). (70%-80% silt, 20% clay, 10%-15% gravel). (fill), moist.	3.5'
sp		SAND with SILT; yellowish brown, (10yr 5/4). (85%-95% coarse sand, 5%-10% silt), (fill), moist, dense. Groundwater encountered at 6'.	7.0'
sw		GRAVELLY SAND; dark brown, (10yr 4/3), medium grained, (75%-85% coarse sand, 15%-20% gravel), gravel is angular and ~1/2" (fill), wet, dense. No gravel present. 3" of brick material (11'-8" to 12') observed (fill), at this depth (12' bgs).	15.0'
		GRAVELLY SAND with CLAY; dark brown, (10yr 4/3), (fill) (70%-80% sand, 10%-15% gravel, 10% clay), gravel is 1/8", fine sand. Brick fragments.	
		TOTAL DEPTH 18.5 FEET	

PAGE 1 OF 1

DRILLER : B. Deason
DRILLING CO. : Gregg Drilling and Testing, Inc.
DRILLING METHOD : 8" O.D. Hollow Stem Auger, Reamed to 10" O.D.
SAMPLING METHOD : Split-spoon Sampler (Push)
PROJECT NAME: D.O. 109
LOCATION : Hunters Point Shipyard
PROJECT NO. : 773247

DRAWN BY	T.R.S.	CHECKED BY	W.S.A.	FILE NAME & DISK NUMBER	HP-7MW25A
DATE	2/24/00	APPROVED BY	–		

INTERNATIONAL TECHNOLOGY CORPORATION

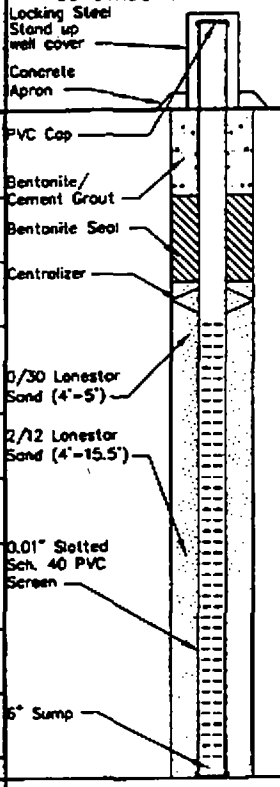
MONITORING WELL IR07MW26A

COORDINATES: N. 453980.66
E 1460074.64

FIELD GEOLOGIST M. Geisler / J.Soiz DATE BEGAN 5/3/99
CHECKED BY W. Akiyama DATE FINISHED 5/4/99
APPROVED BY – SURFACE ELEV. 9.77 ft.
TOTAL DEPTH 15.5 ft. T.O.C. ELEV. 12.69 ft.

DEPTH IN FEET	SAMPLE NUMBER	BLOWS ON SAMPLER (in)	RECOVERY (%)	USCS	DESCRIPTION
0	1	N/A	40	sw	GRAVELLY SAND with CLAY; brown, (10yr 5/3), medium to coarse grained, (60%–70% sand, 20% gravel, 10% clay), dry. 3.0'
	2	N/A	50		
	3	N/A	80	cl	SILTY CLAY with GRAVEL; dark grayish brown, (10yr 4/2), (60%–70% clay, 15%–20% silt, 10% gravel), moist, contains serpeninite (4").
5	4	N/A	100		
	5	N/A	0		Groundwater encountered at 7.5'. 8.5'
	6	N/A	60	sm	SILTY SAND with GRAVEL; brown, (10yr 5/3), (65%–75% sand, 15%–20% silt, 5%–10% gravel), 1/4" gravel, wet, dense. 12.0'
10	7	N/A	25		
	8	N/A	70	cl	SILTY CLAY with SAND; olive gray, (5y 4/2), 75%–85% clay, 15%–20% silt, 5%–10% sand), serpentinite observed, moist, stiff.
	9	N/A	100		
15	–	–	–		TOTAL DEPTH 15.5 FEET
20					
25					
30					
35					

WELL CONSTRUCTION DETAILS



PROFILE

DRILLER : B. Deason
DRILLING CO. : Gregg Drilling and Testing, Inc.
DRILLING METHOD : 8" O.D. Hollow Stem Auger, Reamed to 10" O.D.
SAMPLING METHOD : Split-spoon Sampler (Push)
PROJECT NAME: D.O. 109
LOCATION : Hunters Point Shipyard
PROJECT NO. : 773247

DRAWN BY	T.R.S.	CHECKED BY	W.S.A.	FILE NAME & DISK NUMBER	HP-7MW26A
DATE	2/24/00	APPROVED BY	–		

INTERNATIONAL TECHNOLOGY CORPORATION

LOG OF EXPLORATORY BORING

PROJECT NUMBER 365-02.02 BORING NO. PØ1

PROJECT NAME HPNS-Painting Area PAGE 1 OF 1

BY JDB DATE 9/5/86, 9/9/86 SURFACE ELEV. *113.41'

PHOTO-VAC (ppm)	POCKET PENETRO-METER (TSF)	PENETRA-TION (Blows/Ft.)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	LITHO-GRAPHIC COLUMN	DESCRIPTION
						GP	ASPHALT AND COARSE GRAVEL-FILL.
	2.5	38		v,s g,m d	1	CL	GRAVELLY CLAY TO CLAYEY GRAVEL-FILL; light olive brown (2.5Y, 5/4); 35-55% low-plasticity fines; 10-20% fine to coarse sand; 35-45% fine and coarse gravel; dense to very stiff; damp.
		32			2		
	1.5	22		5	3	CL	@5': dark brown (10YR, 3/3); 60-75% low-plasticity fines; 10-20% fine to coarse sand; 15-30% fine and coarse gravel; stiff; damp.
		15		g d,m v,s	4		
	0.75	12	▽ ▼	v,s	5		@8': light yellowish brown (2.5Y, 6/4); 65-85% low-plasticity fines; 10-20% fine to coarse sand; 5-15% fine gravel; wet.
		7		g,m d	6		
				10			@8.5': 25-45% fine to coarse gravel.
	1.0	14			7		@10': 10-20% fine to coarse gravel. @11': grayish brown (2.5Y, 5/2); 80-90% moderate-plasticity fines; 10-20% fine to coarse sand; <5% fine and coarse gravel; stiff; wet.
	0.0	6			8		
				15			
	1.5	25			9		@19': 15-30% fine and coarse gravel; stiff; wet.
				20			BOTTOM OF BORING AT 19.5 FEET.

REMARKS

Drilled with 8-inch hollow-stem auger; sampled with 2-inch I.D. California modified split-spoon sampler fitted with stainless steel liners. Boring was converted to a 2-inch ground-water monitoring well as detailed on Plate A94.
*Surface elevation is relative to Navy datum.

LOG OF EXPLORATORY BORING

PROJECT NUMBER 365-02.02 BORING NO. P02

PROJECT NAME HPNS-Painting Area PAGE 1 OF 1

BY JDB DATE 9/05/86 SURFACE ELEV. *113.34'

PHOTO-VAC (ppm)	POCKET PENETROMETER (TSF)	PENETRATION (Blows/Ft.)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	LITHOGRAPHIC COLUMN	DESCRIPTION
						GP CL-GC	ASPHALT AND COARSE GRAVEL-FILL.
	1.5	22		v,s g,m d	1		GRAVELLY CLAY-FILL to CLAYEY GRAVEL; dark brown (7.5YR, 3/2) to very dark grayish brown (2.5Y, 3/2); 45-70% low-plasticity fines; 10-20% fine to coarse sand; 20-35% fine and coarse gravel; very stiff; dry.
		32			2		
		33		5	3		
		15			4		@6': damp.
		6			5		
	1.0	12	▼ ▽	v,s m 10	6		
		19			7	GW	@10': dark brown (7.5YR, 3/2); stiff; wet (unsaturated).
				v,s g,m			SANDY GRAVEL-FILL; olive (5Y, 4/3); <5% low-plasticity fines; 30-45% fine to coarse sand; 55-70% fine and coarse gravel; medium dense; wet (saturated).
		11		d	8		
	0.25	30		15	9	CL	SILTY CLAY TO GRAVELLY CLAY-FILL; dark gray (5Y, 4/1); 55-85% low-plasticity fines; 10-20% fine to coarse sand; 5-25% fine and coarse gravel; soft; wet.
	0.5	18			10		@18': 15-30% fine to coarse sand; soft.
				20			BOTTOM OF BORING AT 19.5 FEET.

REMARKS

Drilled with 8-inch hollow-stem auger; sampled with 2-inch I.D. California modified split-spoon sampler fitted with stainless steel liners. Boring was converted to a 2-inch ground-water monitoring well as detailed on Plate A96.
*Surface elevation is relative to Navy datum.

LOG OF EXPLORATORY BORING

PROJECT NUMBER 365-02.02 BORING NO. S03

PROJECT NAME HPNS-Sub-Base Sandblast Fill Area PAGE 1 OF 2

BY JDB DATE 9/03/86 SURFACE ELEV. *113.36'

PHOTO-VAC (ppm)	POCKET PENETRO-METER (TSF)	PENETRA-TION (Blows/Ft.)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	LITHO-GRAPHIC COLUMN	DESCRIPTION
		40			1	GC	CLAYEY GRAVEL-FILL; grayish brown (2.5Y, 5/2); 10-25% low-plasticity fines; 20-30% fine to coarse sand; 45-70% fine and coarse gravel; dense to very dense; dry.
		72			2		
		29	v,s g,m d	5	3	SW	SAND-FILL; light yellowish brown (10YR, 6/4); 5-10% low-plasticity fines; 75-90% fine to coarse sand; 5-15% fine gravel; wood fragments; dense; damp.
	2.0	27			4	CL-GC	GRAVELLY CLAY TO CLAYEY GRAVEL-FILL; brown (7.5YR, 4/2); 20-60% low-plasticity fines; 10-20% fine to coarse sand; 30-60% fine and coarse gravel; very stiff to medium dense; moist.
		18	d		5	SM	
	1.0		g,m v,s			CL	
		14		10	6		SILTY SAND-FILL; grayish brown (2.5Y, 5/2); 10-15% low-plasticity fines; 70-85% fine to coarse sand; 5-15% fine gravel; medium dense; damp.
		13			7	SC-GC	GRAVELLY CLAY-FILL; dark olive gray (5Y, 3/2); 50-75% low-plasticity fines; 10-20% fine to coarse sand; 15-30% fine and coarse gravel; stiff; damp.
		10	v,s g,m		8		
		8			9		CLAYEY SAND TO CLAYEY GRAVEL-FILL; dark grayish brown (2.5Y, 4/2); 10-30% low-plasticity fines; 35-45% fine to coarse sand; 35-45% fine and coarse gravel; medium dense; wet (unsaturated). @14': loose, saturated.
		3	d	15	10	SC	
	1.0						SANDY CLAY-FILL; dark greenish gray (5Y, 4/1); 30-60% low-plasticity fines; 30-45% fine to coarse sand; 10-25% fine gravel; stiff; wet.
				20			

REMARKS

Drilled with 8-inch hollow-stem auger; sampled with 2-inch I.D. California modified split-spoon sampler fitted with stainless steel liners. Boring was converted to a 2-inch ground-water monitoring well as detailed on Plate A108.

*Casing elevation is relative to Navy datum.

LOG OF EXPLORATORY BORING

PROJECT NUMBER 365-02.02 BORING NO. S04

PROJECT NAME HPNS-Sub-Base Sandblast Fill Area PAGE 1 OF 2

BY JDB DATE 9/04/86 SURFACE ELEV. *116.83'

PHOTO-VAC (ppm)	POCKET PENETRO-METER (TSF)	PENETRA-TION (Blows/Ft.)	GROUND WATER LEVELS	DEPTH IN FT.	SAMPLES	LITHO-GRAPHIC COLUMN	DESCRIPTION
						GP	GRAVEL-FILL; very coarse baserock.
		44		v,s g,m d	1	GC	CLAYEY GRAVEL-FILL; dark grayish brown (2.5Y, 5/2); 15-25% low-plasticity fines; 10-20% fine to coarse sand; 55-75% fine and coarse gravel; dense; damp. @4.5-5': brick.
		46			2		
				5			
		17			3		
		25			4	SC	CLAYEY SAND-FILL; dark grayish brown (2.5Y, 4/2); 15-20% low-plasticity fines; 55-75% fine to coarse sand; 5-15% fine gravel; 5-10% brick fragments; dense; dry.
		8		d g,m	5	GC	CLAYEY GRAVEL-FILL; dark grayish brown (2.5Y, 4/2); 15-25% low-plasticity fines; 10-20% fine to coarse sand; 55-75% fine and coarse gravel; loose; moist. @11': 15-30% low-plasticity fines; wet.
		6		10 v,s	6		
		21		v,s	7		
		22		g,m	8		@13.5': 30-40% fine to coarse sand; 40-60% fine and coarse gravel.
		14		d 15	9	GC	CLAYEY GRAVEL-FILL; dark grayish brown (2.5Y, 4/2); 15-25% low-plasticity fines; 25-45% fine to coarse sand; 30-60% fine and coarse gravel; loose; wet.
		6			10		
				20			

REMARKS

Drilled with 8-inch hollow-stem auger; sampled with 2-inch I.D. California modified split-spoon sampler fitted with stainless steel liners. Boring was converted to a 2-inch ground-water monitoring well as detailed on Plate A111.

*Casing elevation is relative to Navy datum.

APPENDIX 3B

STATIC STABILITY ANALYSIS RESULTS

(10 pages)

Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION Effective Stress Static Analysis

BOUNDARY COORDINATES

8 Top Boundaries
14 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	50.00	28.00	50.00	1
2	28.00	50.00	78.00	51.00	1
3	78.00	51.00	154.00	54.90	1
4	154.00	54.90	158.00	55.00	2
5	158.00	55.00	218.00	70.00	2
6	218.00	70.00	223.00	70.00	2
7	223.00	70.00	258.00	70.00	3
8	258.00	70.00	348.00	72.00	3
9	153.00	54.90	159.00	52.00	1
10	159.00	52.00	183.00	58.00	1
11	183.00	58.00	219.00	67.00	3
12	219.00	67.00	223.00	70.00	3
13	0.00	29.00	171.00	29.00	3
14	171.00	29.00	183.00	58.00	3

ISOTROPIC SOIL PARAMETERS

3 Type(s) of Soil

Soil Type	Total Unit Wt.	Saturated Unit Wt.	Cohesion Intercept	Friction Angle	Pore Pressure	Pressure Constant	Piez. Surface

Input parameters

Profile.out

No.	(pcf)	(pcf)	(psf)	(deg)	Param.	(psf)	No.
1	115.0	115.0	0.0	29.5	0.00	0.0	0
2	135.0	135.0	0.0	40.0	0.00	0.0	0
3	120.0	120.0	0.0	30.0	0.00	0.0	0

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 6 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	50.00
2	28.00	50.00
3	78.00	51.00
4	153.00	54.90
5	230.00	55.50
6	348.00	60.00

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

400 Trial Surfaces Have Been Generated.

20 Surfaces Initiate From Each Of 20 Points Equally Spaced Along The Ground Surface Between X = 80.00 ft.
and X = 158.00 ft.

Each Surface Terminates Between X = 180.00 ft.
and X = 340.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation At Which A Surface Extends Is Y = 10.00 ft.

4.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation. The Angle Has Been Restricted Between The Angles Of -90.0 And 5.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial Failure Surfaces Examined. They Are Ordered - Most Critical First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 20 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	145.68	54.47
2	149.64	53.85
3	153.61	53.38
4	157.60	53.08
5	161.59	52.94
6	165.59	52.97
7	169.59	53.16
8	173.57	53.51
9	177.54	54.03
10	181.48	54.71
11	185.39	55.55
12	189.27	56.55
13	193.10	57.70
14	196.87	59.02
15	200.59	60.48
16	204.25	62.10
17	207.84	63.87
18	211.35	65.78
19	214.79	67.84
20	218.08	70.00

Circle Center At X = 163.0 ; Y = 150.5 and Radius, 97.6

*** 2.648 ***

Minimum factor of safety for static analysis

Failure Surface Specified By 22 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	141.58	54.26
2	145.49	53.43
3	149.44	52.77
4	153.41	52.28
5	157.39	51.96
6	161.39	51.81
7	165.39	51.84
8	169.39	52.04
9	173.37	52.41
10	177.33	52.95
11	181.27	53.66
12	185.17	54.54
13	189.03	55.59
14	192.84	56.80
15	196.60	58.18
16	200.29	59.72
17	203.91	61.41
18	207.46	63.26

19	210.92	65.26
20	214.30	67.41
21	217.58	69.70
22	217.94	69.99

Circle Center At X = 162.8 ; Y = 144.6 and Radius, 92.8

*** 2.655 ***

Failure Surface Specified By 19 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	149.79	54.68
2	153.76	54.19
3	157.75	53.87
4	161.74	53.71
5	165.74	53.73
6	169.74	53.91
7	173.72	54.25
8	177.69	54.77
9	181.63	55.45
10	185.54	56.30
11	189.41	57.31
12	193.24	58.48
13	197.01	59.81
14	200.72	61.30
15	204.37	62.95
16	207.94	64.74
17	211.44	66.69
18	214.85	68.78
19	215.87	69.47

Circle Center At X = 163.5 ; Y = 148.8 and Radius, 95.1

*** 2.655 ***

Failure Surface Specified By 18 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	149.79	54.68
2	153.72	53.92
3	157.68	53.36
4	161.66	53.01
5	165.66	52.87
6	169.66	52.94
7	173.65	53.22
8	177.62	53.71
9	181.56	54.41
10	185.45	55.31
11	189.30	56.42
12	193.08	57.72

13	196.79	59.22
14	200.41	60.92
15	203.94	62.80
16	207.37	64.86
17	210.68	67.11
18	212.78	68.70

Circle Center At X = 166.3 ; Y = 129.1 and Radius, 76.2

*** 2.662 ***

Failure Surface Specified By 21 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	141.58	54.26
2	145.51	53.52
3	149.47	52.93
4	153.44	52.51
5	157.44	52.26
6	161.43	52.17
7	165.43	52.24
8	169.43	52.48
9	173.41	52.88
10	177.37	53.45
11	181.30	54.18
12	185.20	55.08
13	189.06	56.13
14	192.87	57.34
15	196.63	58.71
16	200.33	60.23
17	203.96	61.90
18	207.52	63.72
19	211.01	65.69
20	214.40	67.80
21	217.44	69.86

Circle Center At X = 161.6 ; Y = 149.1 and Radius, 96.9

*** 2.663 ***

Failure Surface Specified By 24 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	141.58	54.26
2	145.56	53.83
3	149.54	53.51
4	153.54	53.30
5	157.54	53.20
6	161.54	53.21
7	165.53	53.33
8	169.53	53.56

9	173.51	53.89
10	177.49	54.34
11	181.45	54.90
12	185.39	55.56
13	189.32	56.34
14	193.22	57.22
15	197.10	58.21
16	200.94	59.30
17	204.76	60.50
18	208.54	61.80
19	212.29	63.21
20	215.99	64.72
21	219.65	66.33
22	223.27	68.04
23	226.83	69.85
24	227.10	70.00

Circle Center At X = 159.2 ; Y = 198.7 and Radius, 145.5

*** 2.709 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	149.79	54.68
2	153.58	53.41
3	157.45	52.41
4	161.39	51.70
5	165.37	51.29
6	169.37	51.17
7	173.36	51.35
8	177.34	51.82
9	181.26	52.59
10	185.12	53.64
11	188.89	54.97
12	192.55	56.58
13	196.09	58.46
14	199.47	60.59
15	202.69	62.97
16	205.72	65.57
17	207.54	67.39

Circle Center At X = 169.0 ; Y = 105.3 and Radius, 54.1

*** 2.730 ***

Failure Surface Specified By 16 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	149.79	54.68
2	153.70	53.84

3	157.66	53.25
4	161.64	52.91
5	165.64	52.82
6	169.64	52.98
7	173.62	53.40
8	177.56	54.06
9	181.46	54.98
10	185.28	56.13
11	189.03	57.53
12	192.69	59.15
13	196.23	61.01
14	199.65	63.08
15	202.93	65.37
16	204.51	66.63

Circle Center At X = 165.1 ; Y = 116.2 and Radius, 63.4

*** 2.735 ***

Failure Surface Specified By 25 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	129.26	53.63
2	133.18	52.83
3	137.13	52.17
4	141.09	51.64
5	145.07	51.25
6	149.06	50.99
7	153.06	50.88
8	157.06	50.90
9	161.06	51.06
10	165.05	51.36
11	169.02	51.79
12	172.98	52.36
13	176.92	53.07
14	180.83	53.92
15	184.71	54.90
16	188.55	56.01
17	192.35	57.25
18	196.11	58.62
19	199.82	60.13
20	203.47	61.76
21	207.06	63.51
22	210.60	65.39
23	214.06	67.39
24	217.45	69.51
25	218.19	70.00

Circle Center At X = 154.4 ; Y = 166.8 and Radius, 115.9

*** 2.874 ***

Failure Surface Specified By 17 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	149.79	54.68
2	153.39	52.93
3	157.13	51.53
4	160.99	50.48
5	164.93	49.79
6	168.92	49.48
7	172.92	49.54
8	176.90	49.98
9	180.81	50.79
10	184.64	51.96
11	188.34	53.48
12	191.88	55.34
13	195.23	57.53
14	198.36	60.02
15	201.24	62.79
16	203.85	65.82
17	204.41	66.60

Circle Center At X = 170.3 ; Y = 92.1 and Radius, 42.7

*** 2.908 ***

```
            Y            A     X     I     S            F     T

            0.00      43.50     87.00    130.50    174.00    217.50

X       0.00 +------*--+*--------+---------+---------+---------+
             -
             -
             -
             -          *
             -
      43.50 +
             -
             -
             -
             -
             -          ..*
A     87.00 +      ......
             -    ........
             -   .........
             -  ..........
             -  ..........
             - ...........
X    130.50 + ..........9
             - ..........9
             - ..........21
             - ..........1*
             - ..........**
             -  ........01.
I    174.00 + .....*...01.
             - ..........2*.
             - ..........71..
```

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                - ...........11.
                - ............17
                - ............614
S     217.50 + .............**
                -  .............*
                -  ..........W...
                -  ..............
                -   .............
                -   .............
      261.00 +    ...........*
                -    ............
                -     ...........
                -      ..........
                -       .........
                -        ........
F     304.50 +          .......
                -          ......
                -           .....
                -            ....
                -              ..
                -               ..
T     348.00 +             W  *
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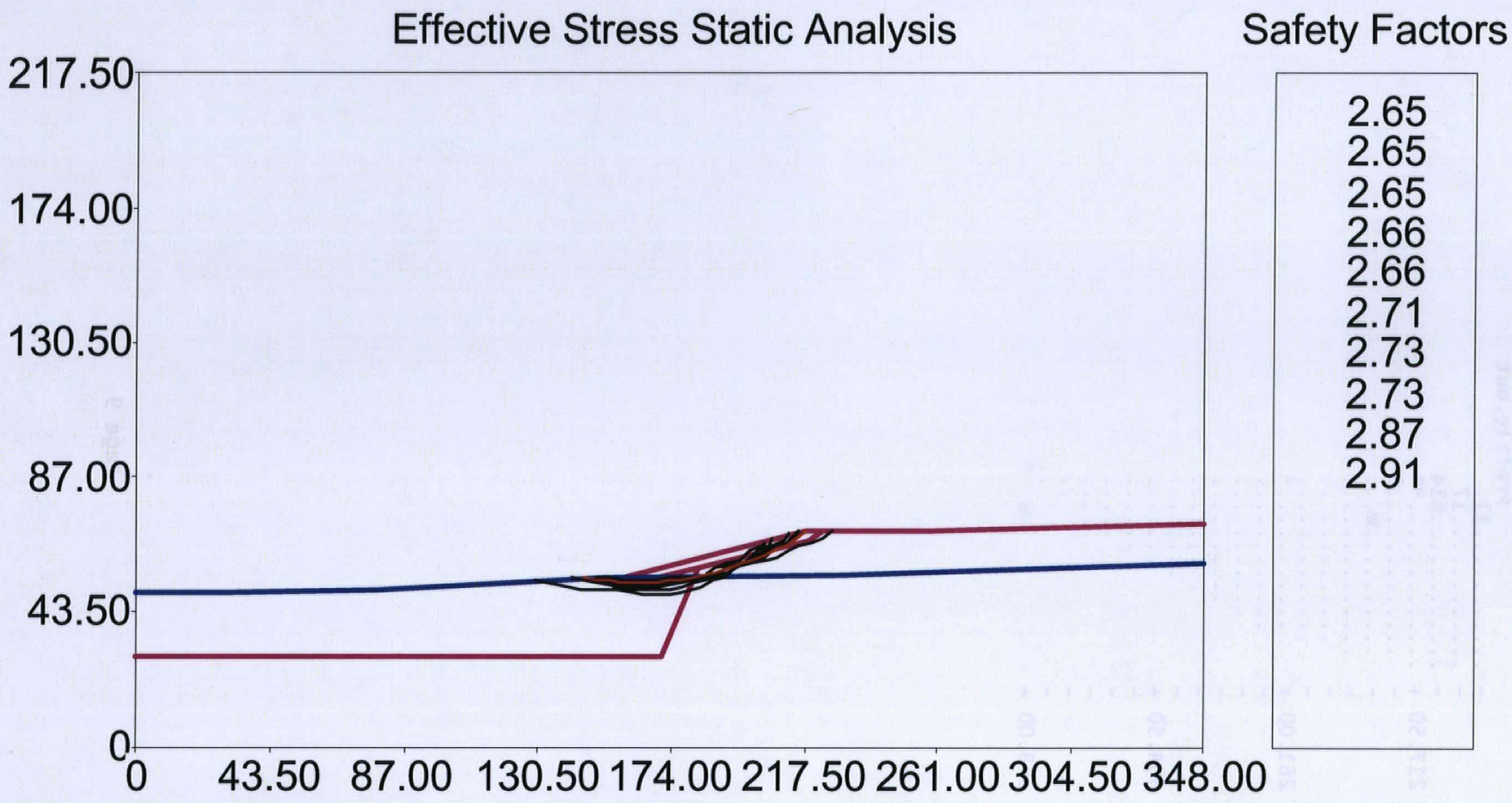

Effective Stress Static Analysis
Safety Factors
2.65
2.65
2.65
2.66
2.66
2.71
2.73
2.73
2.87
2.91
217.50
174.00
130.50
87.00
43.50
0
0
43.50
87.00
130.50
174.00
217.50
261.00
304.50
348.00

APPENDIX 3C

DYNAMIC STABILITY ANALYSIS RESULTS

(12 pages)

Profile.out
** PCSTABL6 **

by
Purdue University

modified by
Peter J. Bosscher
University of Wisconsin-Madison

--Slope Stability Analysis--
Simplified Janbu, Simplified Bishop
or Spencer`s Method of Slices

PROBLEM DESCRIPTION Dynamic with Assumed Parameters

BOUNDARY COORDINATES

8 Top Boundaries
14 Total Boundaries

Boundary No.	X-Left (ft)	Y-Left (ft)	X-Right (ft)	Y-Right (ft)	Soil Type Below Bnd
1	0.00	50.00	28.00	50.00	1
2	28.00	50.00	78.00	51.00	1
3	78.00	51.00	154.00	54.90	1
4	154.00	54.90	158.00	55.00	2
5	158.00	55.00	218.00	70.00	2
6	218.00	70.00	223.00	70.00	2
7	223.00	70.00	258.00	70.00	3
8	258.00	70.00	348.00	72.00	3
9	153.00	54.90	159.00	52.00	1
10	159.00	52.00	183.00	58.00	1
11	183.00	58.00	219.00	67.00	3
12	219.00	67.00	223.00	70.00	3
13	0.00	29.00	171.00	29.00	3
14	171.00	29.00	183.00	58.00	3

ISOTROPIC SOIL PARAMETERS

3 Type(s) of Soil

Soil Type	Total Unit Wt.	Saturated Unit Wt.	Cohesion Intercept	Friction Angle	Pore Pressure	Pressure Constant	Piez. Surface

Input Parameters

No.	(pcf)	(pcf)	Profile.out (psf)	(deg)	Param.	(psf)	No.
1	115.0	115.0	400.0	0.0	0.00	0.0	0
2	135.0	135.0	0.0	40.0	0.00	0.0	0
3	120.0	120.0	0.0	30.0	0.00	0.0	0

1 PIEZOMETRIC SURFACE(S) HAVE BEEN SPECIFIED

Unit Weight of Water = 62.40

Piezometric Surface No. 1 Specified by 6 Coordinate Points

Point No.	X-Water (ft)	Y-Water (ft)
1	0.00	50.00
2	28.00	50.00
3	78.00	51.00
4	153.00	54.90
5	230.00	55.50
6	348.00	60.00

A Horizontal Earthquake Loading Coefficient
Of 0.200 Has Been Assigned

A Vertical Earthquake Loading Coefficient
Of 0.000 Has Been Assigned

Cavitation Pressure = 0.0 psf

Yield acceleration = 0.2g
Calculated by trial and error to achieve a factor of safety of 1.
See the following output pages.

A Critical Failure Surface Searching Method, Using A Random Technique For Generating Circular Surfaces, Has Been Specified.

400 Trial Surfaces Have Been Generated.

20 Surfaces Initiate From Each Of 20 Points Equally Spaced
Along The Ground Surface Between X = 80.00 ft.
and X = 158.00 ft.

Each Surface Terminates Between X = 180.00 ft.
and X = 340.00 ft.

Unless Further Limitations Were Imposed, The Minimum Elevation
At Which A Surface Extends Is Y = 10.00 ft.

4.00 ft. Line Segments Define Each Trial Failure Surface.

Restrictions Have Been Imposed Upon The Angle Of Initiation.
The Angle Has Been Restricted Between The Angles Of -90.0
And 5.0 deg.

Following Are Displayed The Ten Most Critical Of The Trial
Failure Surfaces Examined. They Are Ordered - Most Critical
First.

* * Safety Factors Are Calculated By The Modified Bishop Method * *

Failure Surface Specified By 35 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	51.10
2	83.09	48.57
3	86.31	46.19
4	89.64	43.97
5	93.07	41.92
6	96.61	40.04
7	100.23	38.34
8	103.93	36.82
9	107.70	35.49
10	111.53	34.34
11	115.41	33.39
12	119.34	32.62
13	123.30	32.06
14	127.28	31.69
15	131.28	31.51
16	135.28	31.54
17	139.27	31.76
18	143.25	32.18
19	147.20	32.79
20	151.12	33.60
21	154.99	34.60
22	158.81	35.80
23	162.57	37.18
24	166.25	38.74
25	169.85	40.48
26	173.36	42.40
27	176.77	44.49
28	180.07	46.75
29	183.26	49.17
30	186.32	51.74
31	189.25	54.46
32	192.05	57.32
33	194.70	60.32
34	197.20	63.44
35	198.39	65.10

Circle Center At X = 132.8 ; Y = 112.4 and Radius, 80.9

*** 0.971 *** Factor of safety

Failure Surface Specified By 32 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	88.21	51.52
2	91.24	48.91
3	94.41	46.47
4	97.71	44.21
5	101.13	42.13
6	104.66	40.26
7	108.29	38.58
8	112.01	37.11
9	115.81	35.85
10	119.67	34.81
11	123.58	33.99
12	127.54	33.38
13	131.52	33.00
14	135.52	32.84
15	139.52	32.91
16	143.51	33.20
17	147.47	33.72
18	151.40	34.45
19	155.29	35.41
20	159.11	36.58
21	162.87	37.96
22	166.54	39.56
23	170.11	41.35
24	173.58	43.35
25	176.93	45.53
26	180.15	47.90
27	183.23	50.45
28	186.17	53.16
29	188.95	56.04
30	191.57	59.07
31	194.01	62.24
32	195.46	64.37

Circle Center At X = 136.3 ; Y = 104.1 and Radius, 71.3

*** 1.015 ***

Failure Surface Specified By 34 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	88.21	51.52
2	91.48	49.22
3	94.85	47.07
4	98.33	45.08
5	101.89	43.26
6	105.53	41.61
7	109.25	40.13
8	113.03	38.83
9	116.87	37.71
10	120.76	36.77

11	124.69	36.02
12	128.65	35.45
13	132.63	35.07
14	136.62	34.87
15	140.62	34.87
16	144.62	35.05
17	148.60	35.42
18	152.56	35.98
19	156.49	36.72
20	160.38	37.65
21	164.23	38.76
22	168.01	40.05
23	171.73	41.52
24	175.38	43.16
25	178.95	44.97
26	182.42	46.95
27	185.80	49.09
28	189.08	51.38
29	192.24	53.83
30	195.29	56.42
31	198.21	59.16
32	200.99	62.03
33	203.64	65.02
34	205.04	66.76

Circle Center At X = 138.7 ; Y = 119.7 and Radius, 84.9

*** 1.043 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	96.42	51.95
2	99.35	49.22
3	102.45	46.69
4	105.71	44.38
5	109.12	42.28
6	112.66	40.42
7	116.31	38.79
8	120.06	37.40
9	123.90	36.27
10	127.80	35.39
11	131.75	34.78
12	135.74	34.42
13	139.74	34.33
14	143.73	34.50
15	147.71	34.94
16	151.65	35.64
17	155.53	36.59
18	159.35	37.80
19	163.07	39.26
20	166.69	40.96
21	170.19	42.90
22	173.55	45.06
23	176.77	47.45
24	179.82	50.03
25	182.69	52.82

26	185.37	55.79
27	187.85	58.92
28	190.12	62.22
29	190.69	63.17

Circle Center At X = 139.1 ; Y = 94.9 and Radius, 60.6

*** 1.086 ***

Failure Surface Specified By 32 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.53	52.16
2	103.33	49.30
3	106.30	46.62
4	109.44	44.14
5	112.72	41.86
6	116.15	39.79
7	119.69	37.94
8	123.35	36.32
9	127.10	34.93
10	130.93	33.78
11	134.83	32.87
12	138.77	32.22
13	142.75	31.81
14	146.75	31.65
15	150.75	31.74
16	154.73	32.09
17	158.69	32.69
18	162.60	33.53
19	166.45	34.62
20	170.22	35.95
21	173.90	37.51
22	177.48	39.30
23	180.93	41.32
24	184.25	43.55
25	187.43	45.98
26	190.44	48.61
27	193.29	51.42
28	195.95	54.41
29	198.42	57.55
30	200.68	60.85
31	202.74	64.28
32	203.86	66.46

Circle Center At X = 147.3 ; Y = 95.1 and Radius, 63.5

*** 1.094 ***

Failure Surface Specified By 32 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)

1	100.53	52.16
2	103.20	49.18
3	106.07	46.39
4	109.11	43.79
5	112.31	41.40
6	115.67	39.22
7	119.16	37.26
8	122.77	35.54
9	126.48	34.06
10	130.29	32.82
11	134.16	31.84
12	138.10	31.11
13	142.07	30.64
14	146.06	30.43
15	150.06	30.48
16	154.05	30.80
17	158.01	31.37
18	161.92	32.21
19	165.77	33.30
20	169.54	34.63
21	173.21	36.21
22	176.78	38.03
23	180.21	40.08
24	183.51	42.35
25	186.65	44.82
26	189.62	47.50
27	192.41	50.37
28	195.00	53.41
29	197.39	56.62
30	199.57	59.98
31	201.52	63.47
32	202.82	66.21

Circle Center At X = 147.3 ; Y = 91.5 and Radius, 61.1

*** 1.102 ***

Failure Surface Specified By 40 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	80.00	51.10
2	83.60	49.36
3	87.26	47.74
4	90.96	46.22
5	94.71	44.82
6	98.49	43.54
7	102.32	42.37
8	106.18	41.32
9	110.07	40.39
10	113.99	39.58
11	117.93	38.89
12	121.89	38.32
13	125.86	37.87
14	129.85	37.54
15	133.84	37.34
16	137.84	37.26

17	141.84	37.30
18	145.84	37.47
19	149.83	37.75
20	153.81	38.16
21	157.77	38.70
22	161.72	39.35
23	165.64	40.12
24	169.54	41.02
25	173.41	42.03
26	177.25	43.16
27	181.05	44.41
28	184.81	45.78
29	188.52	47.26
30	192.19	48.85
31	195.81	50.55
32	199.38	52.37
33	202.88	54.29
34	206.33	56.32
35	209.71	58.46
36	213.03	60.69
37	216.27	63.03
38	219.44	65.47
39	222.54	68.00
40	224.84	70.00

Circle Center At X = 138.5 ; Y = 167.6 and Radius, 130.3

*** 1.109 ***

Failure Surface Specified By 36 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	96.42	51.95
2	99.20	49.07
3	102.14	46.35
4	105.23	43.81
5	108.45	41.45
6	111.81	39.27
7	115.29	37.29
8	118.87	35.51
9	122.55	33.94
10	126.31	32.58
11	130.14	31.44
12	134.03	30.52
13	137.97	29.82
14	141.94	29.35
15	145.94	29.10
16	149.94	29.08
17	153.93	29.29
18	157.91	29.73
19	161.85	30.39
20	165.75	31.28
21	169.60	32.39
22	173.37	33.71
23	177.06	35.25
24	180.66	37.00
25	184.15	38.94

26	187.53	41.09
27	190.78	43.42
28	193.89	45.94
29	196.85	48.62
30	199.66	51.48
31	202.29	54.48
32	204.76	57.64
33	207.03	60.93
34	209.12	64.34
35	211.01	67.86
36	211.21	68.30

Circle Center At X = 148.3 ; Y = 99.2 and Radius, 70.1

*** 1.114 ***

Failure Surface Specified By 29 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	92.32	51.73
2	94.90	48.68
3	97.71	45.83
4	100.71	43.19
5	103.90	40.77
6	107.25	38.59
7	110.76	36.67
8	114.39	35.00
9	118.14	33.61
10	121.98	32.49
11	125.89	31.65
12	129.86	31.10
13	133.85	30.85
14	137.85	30.88
15	141.84	31.21
16	145.79	31.82
17	149.68	32.73
18	153.50	33.91
19	157.23	35.37
20	160.84	37.10
21	164.31	39.09
22	167.63	41.32
23	170.77	43.79
24	173.73	46.49
25	176.48	49.39
26	179.01	52.48
27	181.32	55.76
28	183.37	59.19
29	184.62	61.65

Circle Center At X = 135.4 ; Y = 85.6 and Radius, 54.8

*** 1.118 ***

Failure Surface Specified By 32 Coordinate Points

Point No.	X-Surf (ft)	Y-Surf (ft)
1	100.53	52.16
2	103.89	50.00
3	107.36	48.00
4	110.92	46.18
5	114.57	44.53
6	118.29	43.07
7	122.08	41.78
8	125.92	40.69
9	129.82	39.78
10	133.75	39.06
11	137.72	38.54
12	141.71	38.20
13	145.70	38.07
14	149.70	38.13
15	153.70	38.38
16	157.67	38.83
17	161.62	39.47
18	165.53	40.30
19	169.40	41.32
20	173.21	42.53
21	176.96	43.93
22	180.64	45.50
23	184.23	47.25
24	187.74	49.18
25	191.15	51.27
26	194.45	53.53
27	197.64	55.95
28	200.70	58.52
29	203.64	61.23
30	206.44	64.09
31	209.10	67.07
32	209.81	67.95

Circle Center At X = 146.5 ; Y = 120.1 and Radius, 82.0

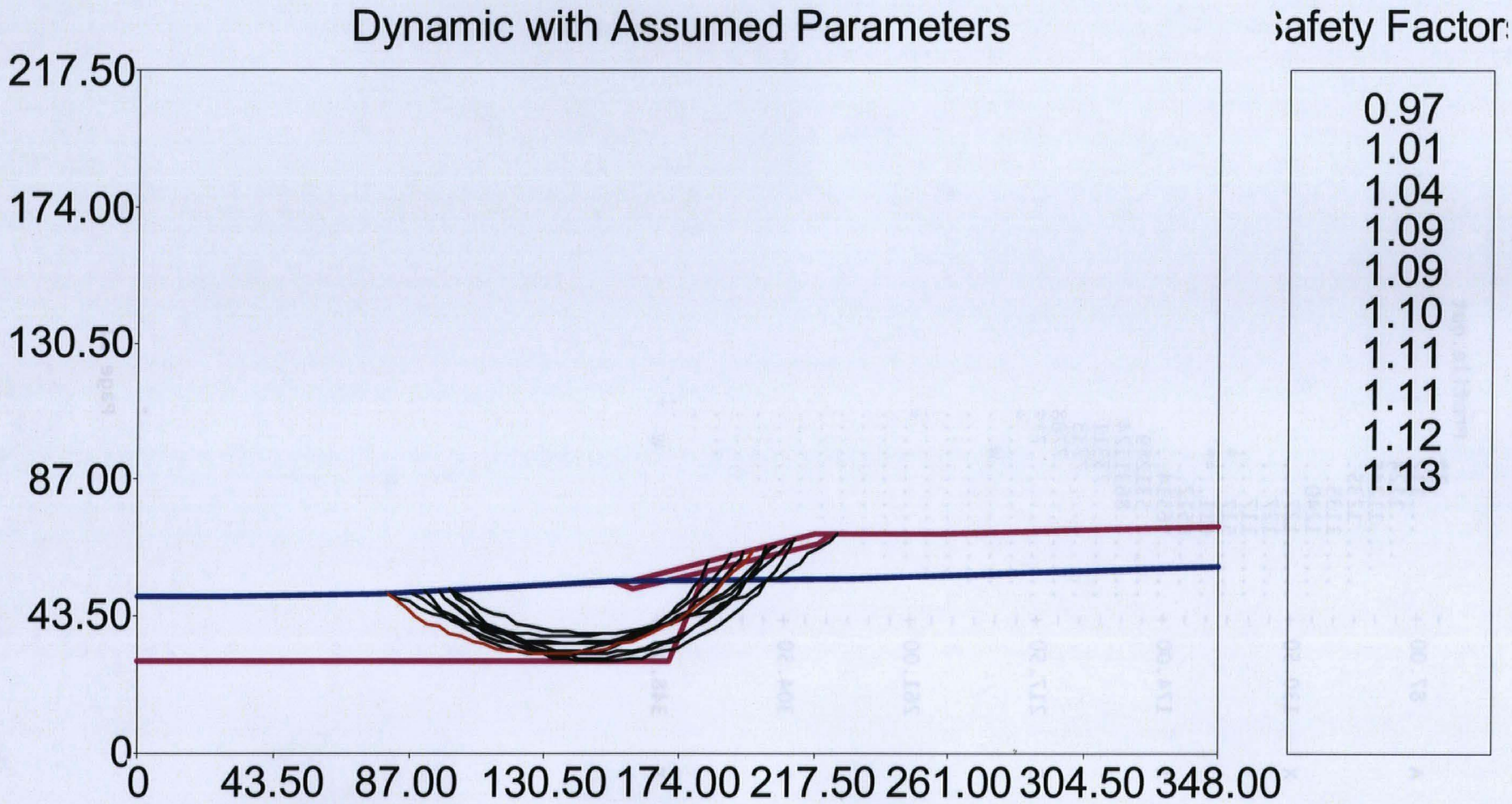
*** 1.131 ***

```
            Y            A     X     I     S            F     T

            0.00      43.50     87.00    130.50    174.00    217.50

X       0.00 +------*--+*--------+---------+---------+---------+
             -
             -
             -
             -          *
             -
       43.50 +
             -
             -
             -
             -
```

```
                 -          .1*
A     87.00 +       ...112
                 -    ....1124
                 -   ....11245
                 -  .....1235.
                 -  ....1135..
                 - .....1240..
X    130.50 + .....127...
                 - .....127...
                 - .....117....
                 - .....517...*
                 - .....611..**
                 -  ....8512...
I    174.00 + .....*6514..
                 - .......5312*9
                 - .......8631124
                 - .........73311
                 - ..........7733
                 - ...........7788
S    217.50 + ............7**
                 -  ............*
                 -  ..........W...
                 -  ..............
                 -   .............
                 -   .............
     261.00 +    ...........*
                 -    ............
                 -     ...........
                 -      ..........
                 -       .........
                 -        ........
F    304.50 +         .......
                 -          ......
                 -           .....
                 -            ....
                 -              ..
                 -               ..
T    348.00 +             W  *
```


Dynamic with Assumed Parameters
Safety Factor
0.97
1.01
1.04
1.09
1.09
1.10
1.11
1.11
1.12
1.13
217.50
174.00
130.50
87.00
43.50
0
0
43.50
87.00
130.50
174.00
217.50
261.00
304.50
348.00

APPENDIX 3D

DISPLACEMENT PREDICTIONS DUE TO EARTHQUAKE SHAKING ANALYSIS RESULTS BY 4 METHODS

(12 pages)

Newmark Method 1 Calculation (1 page)

Newmark

Getting Started | Rigorous Rigid-Block Analysis | Simplified Analyses | Record Manager | Utilities | Help

Rigid-Block Analysis | Decoupled Analysis

◉ Ambraseys and Menu ○ Jibson and Others ○ Probability of Failure

What is the critical (yield) acceleration (in g's)?

0.2 g

Calculated in the previous dynamic analysis

What is the peak ground acceleration (in g's)?

0.5 g

Perform Analysis

Estimated Newmark Displacement (in cm)

5.9

Result = 5.9 cm

This program estimates rigid-block Newmark displacement as a function of the critical acceleration and peak ground acceleration using the following equation as explained in Ambraseys and Menu (1988):

$$\log D_n = 0.90 + \log[\,(1 - a_c / a_{max})^{2.53} (a_c / a_{max})^{-1.09}\,]$$

where D_n is Newmark displacement in centimeters, a_c is critical (yield) acceleration in g's, and a_{max} is the peak horizontal ground acceleration in g's.

Newmark Method 2
Calculation (1 page)

Newmark

Getting Started | Rigorous Rigid-Block Analysis | Simplified Analyses | Record Manager | Utilities | Help

Rigid-Block Analysis | Decoupled Analysis

Input parameters:

Critical (yield) acceleration, Ac (g):	.2
Vertical thickness, h (m):	15
Shear-wave velocity, Vs (m/s):	1500
Earthquake magnitude, M:	7.9
Peak bedrock acceleration, MHA (g):	.5
Earthquake distance, r (km):	12

Compute | Clear fields

Calculations:

Site period, Ts (s):	0.040
Mean shaking period, Tm (s):	0.541
Period ratio, Ts/Tm:	0.074
Duration, D(5-95%) (s):	30.775
Non-linear response factor (NRF):	0.921
Max. hor. equiv. acc. (MHEA), Amax (g):	0.461
MHEA/(MHA*NRF):	1.000
Ac/Amax:	0.434
Normalized displacement (cm/s):	2.294

Results:

Estimated displacement (cm):	32.5
Estimated displacement (in):	12.8

Standard deviations (sigma), if known:

Normalized MHEA:	0
Mean Period:	0
Significant duration:	0
Normalized displacement:	0

Site screening procedure (optional):

Allowable displacement (cm):	
Median Feq for screen procedure:	
Seismic coefficient for screen procedure:	

Newmark

Getting Started | Rigorous Rigid-Block Analysis | Simplified Analyses | Record Manager | Utilities | Help

Step 1: Select Records | Step 2: Perform Rigid-Block Analysis | Step 3: View Results

Search records by properties | Select individual records

Newmark Method 3 Calculation (5 pages)

Step 1: Selected earthquake records that are strike-slip and soft soil.

	Greater than or equal to:	Less than or equal to:
Moment Magnitude		
Arias Intensity (m/s)		
Duration (5-95%) (s)		
Peak Acceleration (g)		
Mean Period (s)		
Epicentral Distance (km)		
Focal Distance (km)		
Rupture Distance (km)		

Search for records

Clear all search fields

Search complete. 22 records found.

Focal Mechanism: ☐ All ☑ Strike-slip ☐ Normal ☐ Reverse ☐ Oblique normal ☐ Oblique reverse

Site Classification: ☐ All ☐ Hard rock ☐ Soft rock ☐ Stiff soil ☑ Soft soil

Records selected (units as indicated above):

Select all for analysis | Deselect all for analysis

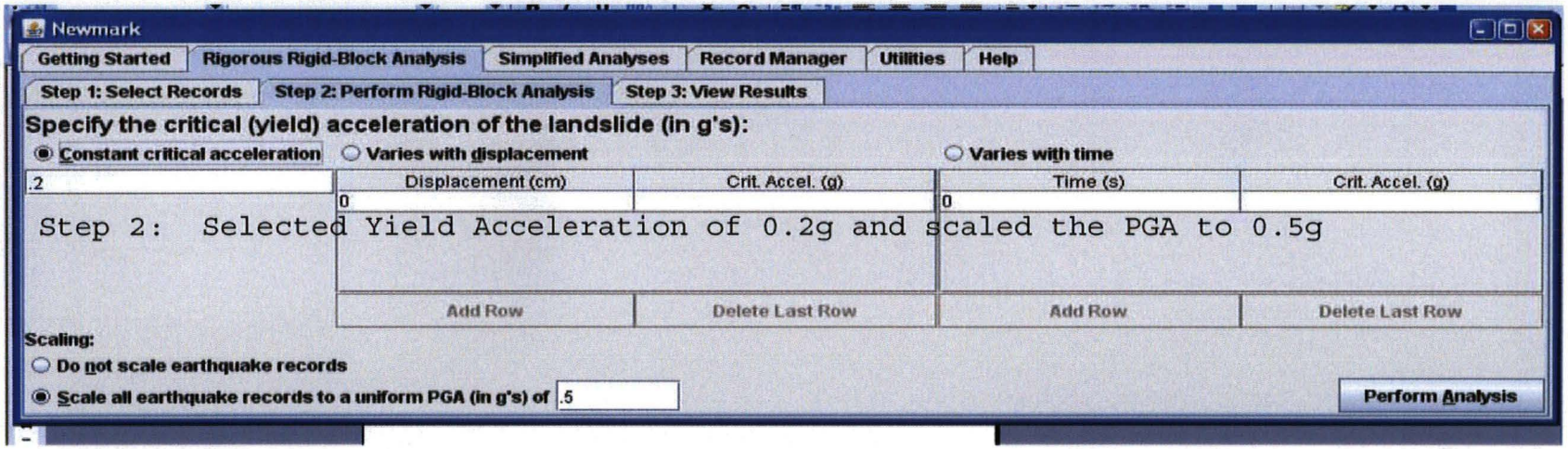
Sort by Earthquake then Record A/A

Display properties of: ◉ Records ○ Stations

Earthquake	Record	Magnitude	Arias Int.	Duration	PGA	Mean Per.	Epi. Dist.	Focal Dist.	Rup. Dist	Foc. Mech.	Analyze
Imperial Valley ...	EC3-140	6.5	1.145	11.7	0.267	0.63	28.0	30.0	11.9	Strike-slip	✔
Imperial Valley ...	EC3-230	6.5	0.694	14.2	0.222	0.48	28.0	30.0	11.9	Strike-slip	✔
Kobe, Japan 19...	KAK-000	6.9	1.031	13.2	0.251	0.48	26.1	33.5	26.4	Strike-slip	✔
Kobe, Japan 19...	KAK-090	6.9	1.688	12.9	0.345	0.54	26.1	33.5	26.4	Strike-slip	✔
Kobe, Japan 19...	NIS-000	6.9	3.353	9.7	0.509	0.49	10.6	23.5	11.1	Strike-slip	✔
Kobe, Japan 19...	NIS-090	6.9	2.270	11.2	0.503	0.53	10.6	23.5	11.1	Strike-slip	✔
Kobe, Japan 19...	OSA-000	6.9	0.230	58.3	0.079	1.24	44.6	49.3	8.5	Strike-slip	✔
Kobe, Japan 19...	OSA-090	6.9	0.195	70.5	0.064	1.43	44.6	49.3	8.5	Strike-slip	✔
Kobe, Japan 19...	SHI-000	6.9	0.827	10.3	0.243	0.76	48.7	53.0	15.5	Strike-slip	✔
Kobe, Japan 19...	SHI-090	6.9	0.639	11.8	0.212	0.73	48.7	53.0	15.5	Strike-slip	✔
Kobe, Japan 19...	TAK-000	6.9	8.700	11.3	0.611	1.13	13.3	24.9	0.3	Strike-slip	✔
Kobe, Japan 19...	TAK-090	6.9	8.134	9.9	0.616	0.99	13.3	24.9	0.3	Strike-slip	✔
Kobe, Japan 19...	TAZ-000	6.9	3.071	4.6	0.693	0.80	39.1	44.4	1.2	Strike-slip	✔
Kobe, Japan 19...	TAZ-090	6.9	3.937	3.7	0.694	0.63	39.1	44.4	1.2	Strike-slip	✔
Kocaeli, Turkey ...	ATS-000	7.4	1.007	36.6	0.249	0.87	101.7	103.1	78.9	Strike-slip	✔
Kocaeli, Turkey ...	ATS-090	7.4	1.240	37.2	0.185	0.98	101.7	103.1	78.9	Strike-slip	✔
Morgan Hill 1984	A01-040	6.2	0.065	21.3	0.046	0.52	55.4	56.1	54.1	Strike-slip	✔
Morgan Hill 1984	A01-310	6.2	0.076	19.0	0.068	0.49	55.4	56.1	54.1	Strike-slip	✔
Superstition Hill...	SSW-225	6.5	0.264	12.9	0.137	0.47	18.0	21.0	25.6	Strike-slip	✔
Superstition Hill...	SSW-315	6.5	0.381	14.1	0.143	0.68	18.0	21.0	25.6	Strike-slip	✔
Westmorland 1...	SSW-225	5.8	0.523	8.4	0.199	0.40	5.9	7.1		Strike-slip	✔
Westmorland 1...	SSW-315	5.8	0.513	9.2	0.176	0.39	5.9	7.1		Strike-slip	✔

Manage groups... | Clear table | Delete highlighted record(s) | Go to Perform Rigid-Block Analysis page

22 of 22 records selected for analysis


Newmark
Getting Started
Rigorous Rigid-Block Analysis
Simplified Analyses
Record Manager
Utilities
Help
Step 1: Select Records
Step 2: Perform Rigid-Block Analysis
Step 3: View Results
Specify the critical (yield) acceleration of the landslide (in g's):
Constant critical acceleration
Varies with displacement
Varies with time
.2
Displacement (cm)
Crit. Accel. (g)
Time (s)
Crit. Accel. (g)
0
0
Step 2: Selected Yield Acceleration of 0.2g and scaled the PGA to 0.5g
Add Row
Delete Last Row
Add Row
Delete Last Row
Scaling:
Do not scale earthquake records
Scale all earthquake records to a uniform PGA (in g's) of
.5
Perform Analysis

Newmark

Getting Started | Rigorous Rigid-Block Analysis | Simplified Analyses | Record Manager | Utilities | Help

Step 1: Select Records | Step 2: Perform Rigid-Block Analysis | Step 3: View Results

Perform Analysis | Clear output

Earthquake	Record	Displacement 1 (cm)	Displacement 2 (cm)	Average Disp. (cm)
Imperial Valley 1979	EC3-140	4.3	13.6	9.0
Imperial Valley 1979	EC3-230	5.0	3.5	4.2
Morgan Hill 1984	A01-040	16.2	11.6	13.9
Morgan Hill 1984	A01-310	1.8	4.8	3.3
Superstition Hills 1987	SSW-225	1.7	3.4	2.6
Superstition Hills 1987	SSW-315	12.2	7.9	10.0
Westmorland 1981	SSW-225	3.4	3.4	3.4
Westmorland 1981	SSW-315	7.4	6.8	7.1
Kobe, Japan 1995	KAK-000	5.3	3.7	4.5
Kobe, Japan 1995	KAK-090	6.4	2.7	4.6
Kobe, Japan 1995	NIS-000	7.0	6.3	6.6
Kobe, Japan 1995	NIS-090	2.5	3.4	3.0
Kobe, Japan 1995	OSA-000	32.0	55.8	43.9
Kobe, Japan 1995	OSA-090	34.7	27.0	30.8
Kobe, Japan 1995	SHI-000	15.5	11.1	13.3
Kobe, Japan 1995	SHI-090	13.5	8.5	11.0
Kobe, Japan 1995	TAK-000	37.7	29.5	33.6
Kobe, Japan 1995	TAK-090	34.5	24.9	29.7
Kobe, Japan 1995	TAZ-000	0.3	8.2	4.2
Kobe, Japan 1995	TAZ-090	7.0	4.5	5.8
Kocaeli, Turkey 1999	ATS-000	7.3	4.8	6.0
Kocaeli, Turkey 1999	ATS-090	35.8	39.4	37.6

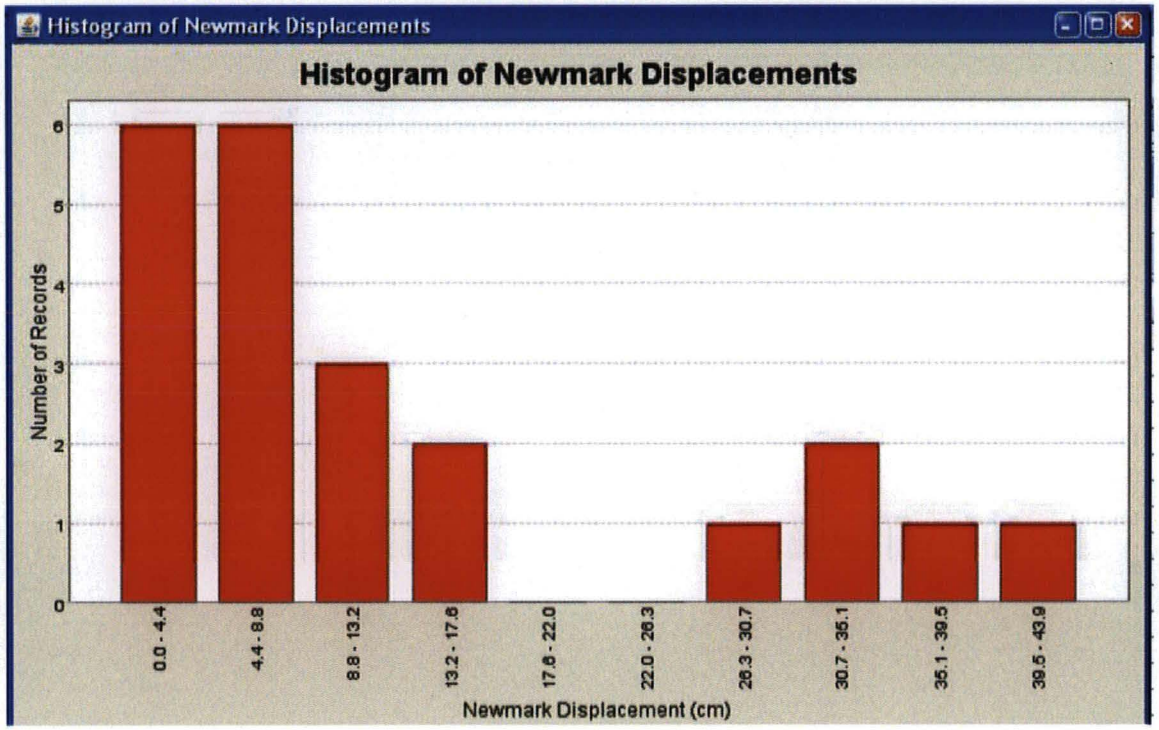
Step 3: Conduct analysis and display histogram and also displacements VS time.

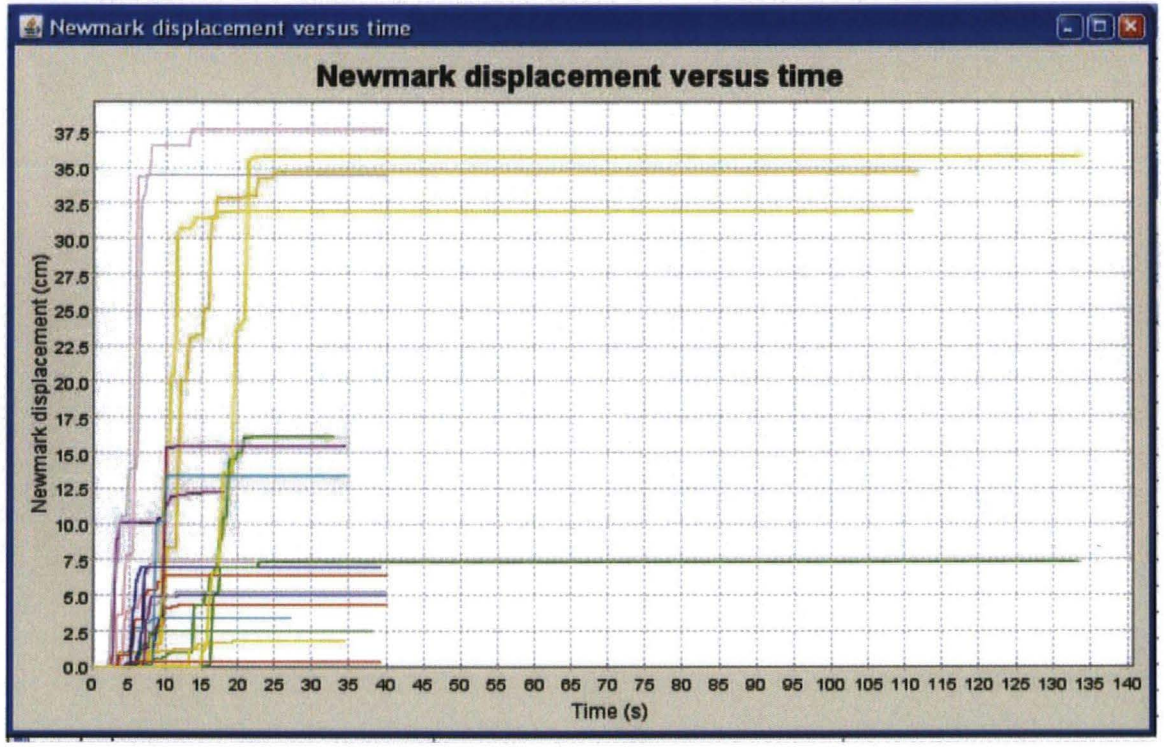
Save output | tab delimited | space delimited | comma delimited

Mean value is: 13.1 cm
Median value is: 7.1 cm
Standard Deviation is: 12.9 cm

Plot histogram of Newmark displacements | Plot with 10 bins

Plot Newmark displacements versus time | Display legend


Histogram of Newmark Displacements
Histogram of Newmark Displacements
Number of Records
0
1
2
3
4
5
6
0.0 - 4.4
4.4 - 8.8
8.8 - 13.2
13.2 - 17.6
17.6 - 22.0
22.0 - 26.3
26.3 - 30.7
30.7 - 35.1
35.1 - 39.5
39.5 - 43.9
Newmark Displacement (cm)


Newmark displacement versus time
Newmark displacement versus time
Newmark displacement (cm)
37.5
35.0
32.5
30.0
27.5
25.0
22.5
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140
Time (s)

In this example, you can calculate several horizontal ground motion parameters at a site using attenuation relationships by Sadigh *et al.* The relationships for PGA, PGV, and PGD are from Sadigh and Egan, 1998, and the relationships for psuedospectral acceleration are from Sadigh, *et al.*, 1997. Note that the site-to-fault distance is the closest distance to the rupture surface and the relationship is valid over the range of 0 to 100 km only. The valid range of magnitudes is 4 < Mw < 8. Links to tables of coefficients can be found in Appendix A. Interactive examples for all attenuation relationships can be found in Attenuate©.

Type of analysis: Spectral Acceleration

Select the parameters you wish to use:

Fault Type: Strike-slip

Soil Conditions: Soil

Site to fault distance (km): 12

Moment magnitude (Mw): 7.9

Calculate

Spectral Acceleration Analysis for Bray and Travasarou Method

Data Inputs include fault type, soil type, distance to fault, and design earthquake moment magnitude.

See next page for plot of this data.

Results

back to input

Parameter	Period (s)	Ln median	median	median + σ
PGA (g)	-			
PGV (cm/s)	-			
PGD (cm)	-			
Sa (g)	0.075	-0.524	0.592	0.78
	0.1	-0.342	0.71	0.936
	0.2	-0.065	0.937	1.266
	0.3	-0.032	0.968	1.328
	0.4	-0.065	0.937	1.305
	0.5	-0.143	0.867	1.225
	0.75	-0.296	0.744	1.078
	1	-0.435	0.647	0.962
	1.5	-0.685	0.504	0.772
	2	-0.913	0.401	0.621

to index

modify spectrum

to Newmark-Hall

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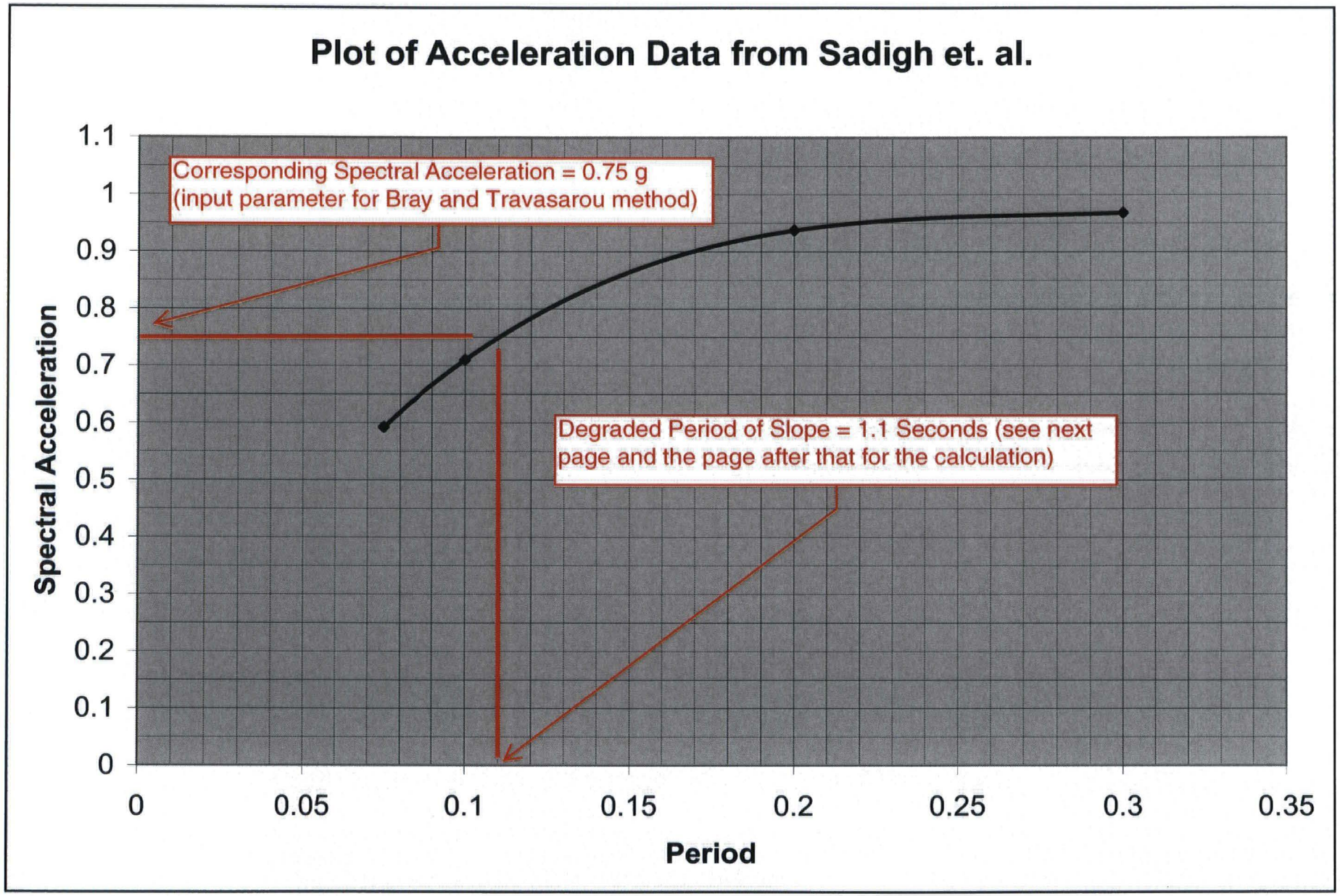

Plot of Acceleration Data from Sadigh et. al.
Corresponding Spectral Acceleration = 0.75 g
(input parameter for Bray and Travasarou method)
Degraded Period of Slope = 1.1 Seconds (see next page and the page after that for the calculation)
Spectral Acceleration
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
Period

Calculation of initial fundamental period of slope for Bray and Travasarou analysis based on slope height and shear wave velocity.

Calculate Initial Fundamenttal Period Parcel B Revetment				
H (ft)	4H	Vs (m/s)	Vs (ft/s)	Ts
15	60	250	820	0.07317073

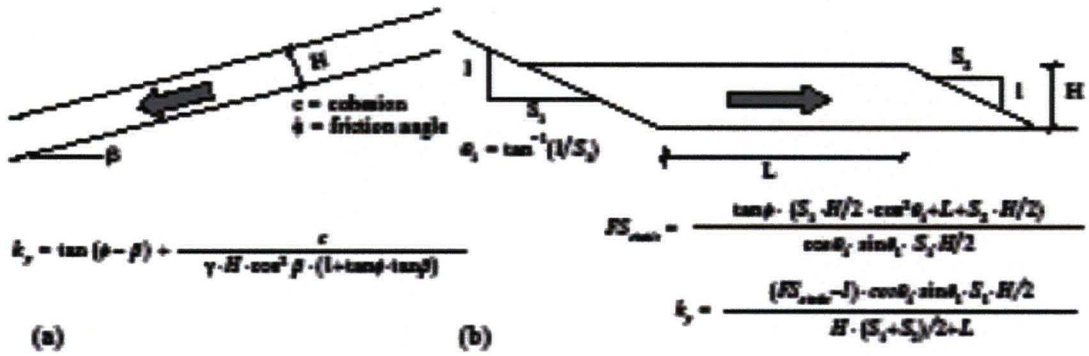


Fig. 14.1. Simplified estimates of the yield coefficient: (a) shallow sliding and (b) deep sliding

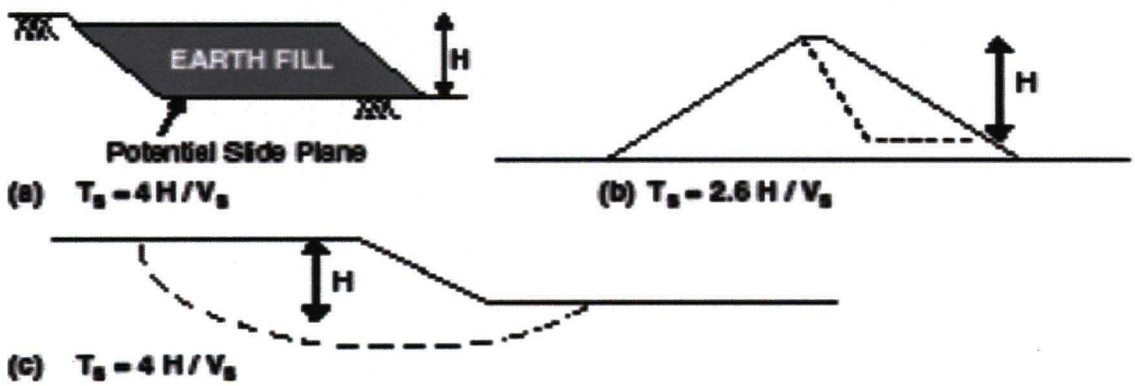


Fig. 14.4. Estimating the initial fundamental period of potential sliding blocks

Figures from Bray, J.D. (2007) "Chapter 14: Simplified Seismic Slope Displacement Procedures," Earthquake Geotechnical Engineering, 4th Inter. Conf. on Earthquake Geotechnical Engineering - Invited Lectures, in Geotechnical, Geological, and Earthquake Engineering Series, Vol. 6, Pitilakis, Kyriazis D., Ed., Springer, Vol. 6, pp. 327-353.

Simplified Procedure for Estimating Earthquake Induced Deviatoric Slope Displacements
by Jonathan D. Bray and Thaleia Travasarou
Journal of Geotechnical and Geonvironmental Engineering, Vol 133, No. 4, pp. 381-392, April 2007

Analysis using method of Bray and Travasarou

Fundamental period (Ts) calculation formula on prior page

Simplified Procedure for Estimating Earthquake Induced Deviatoric Slope Displacements
by Jonathan D. Bray and Thaleia Travasarou
Journal of Geotechnical and Geonvironmental Engineering, ASCE, V. 133(4), pp. 381-392, April 2007

SEE NOTES BELOW FOR GUIDANCE IN THE USE OF SPREADSHEET

Degraded Period, calculated from Ts and used to determine Sa (see chart Sadigh et. al.)

Input Parameters			
Yield Coefficient (ky)	0.2		Based on pseudostatic analysis
Initial Fundamental Period (Ts)	0.07	seconds	1D: Ts=4H/Vs 2D: Ts=2.6H/Vs
Degraded Period (1.5Ts)	0.11	seconds	
Moment Magnitude (Mw)	7.9		
Spectral Acceleration (Sa(1.5Ts))	0.75	g	

Design Earthquake

Spectral Acceleration (Sa) (see chart Sadigh et. al.)

Additional Input Parameters		
Probability of Exceedance #1 (P1)	84	%
Probability of Exceedance #2 (P2)	50	%
Probability of Exceedance #3 (P3)	16	%
Displacement Threshold (d_threshold)	5	cm

Intermediate Calculated Parameters			
Non-Zero Seismic Displacement Est (D)	10.17	cm	eq. (5) or (6)
Standard Deviation of Non-Zero Seismic D	0.66		

Results			
Probability of Negligible Displ. (P(D=0))	0.007		eq. (3)
D1 for P1 = 84%	5.19	cm	calc. using eq. (7)
D2 for P2 = 50%	10.11	cm	calc. using eq. (7)
D3 for P2 = 16%	19.54	cm	calc. using eq. (7)
P(D>d_threshold)	0.853		eq. (7)

Notes

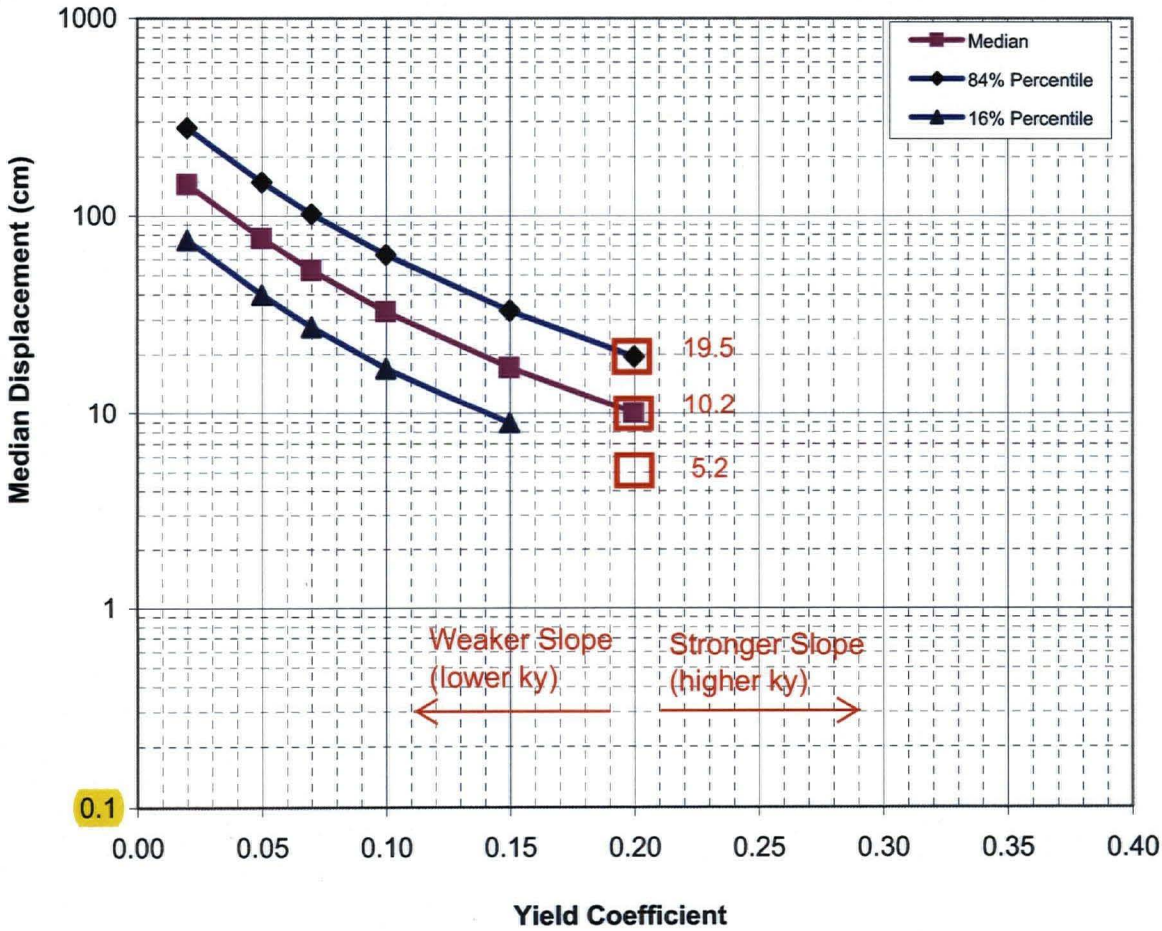
1. Values highlighted in blue are input parameters
2. Probability of Exceedance is the desired probability of exceeding a particular displacement value.
3. Displacements D1, D2, and D3 correspond to P1, P2, and P3, respectively.
   (e.g., the probability of exceeding displacement D1 is P1)
4. Calculated seismic displacements are due to deviatoric deformation only (add in volumetrically induced movement).
5. ky may range between 0.01 and 0.5, Ts between 0 and 2 s, Sa between 0.002 and 2.7 g, M between 4.5 and 9
6. Rigid slope is assumed for Ts < 0.05 s
7. When a value for D is not calculated, D is < 1cm
8. ky may be estimated using the simplified equations shown below.
9. Examples of how Ts is estimated are shown below.
10. Vs = weighted avg. shear wave velocity for the sliding mass, e.g., for 2 layers, Vs = [(h1)(Vs1) + (h2)(Vs2)]/(h1 + h2)

Interpreting the results:
For a 7.9 magnitude earthquake, there is an 84% chance of 5.19 cm displacement, 50% chance of 10.11 cm displacement, 16% chance of 19.54 cm displacement.

IR Site 7 yield acceleration (ky) was 0.2 with displacements shown to right. Higher and lower yield accelerations are also shown showing the effect of a more or less stable slope on the predicted displacement at this site for the design earthquake in question.

Dependence on ky

ky	P(D="0")	D (cm)	Dmedian (cm)	D1 (cm)	D3 (cm)
0.020	0.00	145.0	145.0	279.5	75.2
0.05	0.00	76.9	76.9	148.2	39.9
0.07	0.00	52.9	52.9	102.0	27.5
0.1	0.00	32.8	32.8	63.2	17.0
0.15	0.00	17.2	17.2	33.1	8.9
0.2	0.01	10.2	10.1	19.5	5.2
0.3	0.13	4.4	3.9	8.0	1.4
0.4	0.42	2.3	1.1	3.4	<1



Simplified Procedure for Estimating Earthquake Induced Deviatoric Slope Displacements
by Jonathan D. Bray and Thaleia Travasarou
Journal of Geotechnical and Geonvironmental Engineering, Vol 133, No. 4, pp. 381-392, April 2007

Final

Remedial Action Monitoring Plan
Installation Restoration Sites 7 and 18
Parcel B

Hunters Point Shipyard
San Francisco, California

January 8, 2010

Prepared for:
Base Realignment and Closure
Program Management Office West
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Naval Facilities Engineering Command
Contract Number N62473-04-D-3213
Contract Task Order 0019

CHAD-3213-0019-0050

Final

Remedial Action Monitoring Plan
Installation Restoration Sites 7 and 18
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Hunters Point Shipyard
San Francisco, California

Contract Number N62473-04-D-3213
Contract Task Order 0019

PREPARED FOR:

DEPARTMENT OF THE NAVY

REVIEW AND APPROVAL

Project Manager: Timothy E. Mower Date: January 8, 2010
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ACRONYMS AND ABBREVIATIONS

µg/L	Microgram per liter
COC	Chemical of concern
FFA	Federal facility agreement
HGAL	Hunters Point groundwater ambient level
HHRA	Human health risk assessment
HPS	Hunters Point Shipyard
IR	Installation Restoration
RAMP	Remedial action monitoring plan
RD	Remedial design
ROD	Record of decision
TCRA	Time-critical removal action
TMSRA	Technical memorandum in support of a record of decision amendment

EXECUTIVE SUMMARY

This remedial action monitoring plan (RAMP) presents the approach for monitoring groundwater and methane at Installation Restoration (IR) Program Sites 7 and 18 in Parcel B at Hunters Point Shipyard (HPS) in San Francisco, California. The objectives of the RAMP are (1) to monitor the potential migration of chemicals of concern (COC) in groundwater into previously uncontaminated areas and potential migration toward San Francisco Bay, and (2) to observe the potential presence of methane in the area of the methane source removal excavation at IR Site 7. This plan describes the strategy for monitoring and reporting on groundwater elevations and concentrations of COCs in groundwater at IR Sites 7 and 18 as well as for monitoring for methane at IR Site 7. This RAMP also updates the evaluation of concentrations of metals in groundwater against trigger levels for protection of ecological receptors in San Francisco Bay.

The plan for groundwater monitoring described in this RAMP is part of the amended remedy for Parcel B selected in the amended record of decision (ROD). This RAMP includes groundwater elevation monitoring at 17 wells at IR Sites 7 and 18 on a quarterly basis to monitor fluctuations in groundwater elevations and changes in the magnitude and direction of groundwater flow. The COCs at IR Sites 7 and 18, as identified in the amended ROD, include the four radionuclides strontium-90, cesium-137, radium-226, and plutonium-239. This RAMP includes sampling two wells for the radionuclide COCs. This RAMP also includes sampling at two "guard" wells located in IR Site 7 near the bay for selected metals (chromium VI, copper, lead, mercury, nickel, and selenium) to monitor for potential changes in concentrations in the event that groundwater conditions change during redevelopment.

The plan also describes presentation of the results of monitoring in semiannual and annual reports and discusses changes to this RAMP. Groundwater elevations will be measured and groundwater will be sampled, to the extent possible, in conjunction with the routine monitoring conducted for other areas of Parcel B and HPS and using similar procedures to promote collection of data that are comparable across HPS.

This RAMP is one component of the overall remedial design (RD) for IR Sites 7 and 18. The other components include design of a soil cover and shoreline revetment, a land use control RD, an operation and maintenance plan, and a cost opinion. These other components of the RD are also included in this binder with the RAMP.

1.0 INTRODUCTION

This remedial action monitoring plan (RAMP) presents the approach for monitoring groundwater and methane at Installation Restoration (IR) Program Sites 7 and 18 at Parcel B at Hunters Point Shipyard (HPS) in San Francisco, California (see Figure 1). Parcel B includes about 54 acres on the northern side of HPS; IR Sites 7 and 18 include about 14 acres on the western side of Parcel B (see Figure 2).

This RAMP is the next step in the process of monitoring groundwater at IR Sites 7 and 18 that the Navy began in 1999. The Navy developed a RAMP in 1999 to describe the groundwater monitoring for Parcel B, including IR Sites 7 and 18, as part of the remedial design (RD) (Tetra Tech EM Inc. and Morrison Knudsen Corporation 1999) which, in turn, was prepared according to the 1997 record of decision (ROD) (Navy 1997). The 1999 RAMP originally included 24 wells at Parcel B (12 at IR Sites 7 and 18). The Navy currently monitors 36 wells at Parcel B (12 at IR Sites 7 and 18) and has collected samples for 38 quarters as of July 2009.

An amended ROD was prepared for Parcel B (ChaduxTt 2009) because the Navy concluded that the remedy selected in the 1997 ROD needed to be amended to be protective of human health and the environment in the long term and that the proposed amendments to the remedy would fundamentally alter its basic features. The Navy prepared this RAMP for IR Sites 7 and 18 to address the requirements of the amended ROD. Groundwater monitoring requirements for other areas of Parcel B identified in the amended ROD will be addressed by a separate RAMP.

The hydrostratigraphic units at IR Sites 7 and 18 include (1) the A-aquifer, (2) the aquitard, (3) the B-aquifer, and (4) the deep bedrock water-bearing zone (see Figure 3). The A-aquifer consists mainly of unconsolidated Artificial Fill that overlies the aquitard and bedrock and forms a continuous zone of unconfined groundwater across the parcel. Alluvium and colluvium, Undifferentiated Upper Sand Deposits, and shallow bedrock also are part of the A-aquifer at various locations across IR Sites 7 and 18. The B-aquifer consists mainly of Undifferentiated Sedimentary Deposits that overlie bedrock or are contained within the Bay Mud Deposits at a few locations near the bay margin. The B-aquifer is not continuous across IR Sites 7 and 18, however. Bay Mud Deposits act as an aquitard that separates the A- and B-aquifers over most of IR Sites 7 and 18, except for a small area in the west-central portion of IR Site 18, where the Bay Mud is absent and the A- and B-aquifers are adjacent. The bedrock water-bearing zone is not considered an aquifer because of its low capacity for water production (primarily from fractures). In general, groundwater flows from south to north, toward San Francisco Bay.

1.1 PURPOSE AND OBJECTIVES

This section presents the purpose and objectives of this RAMP.

1.1.1 Purpose

This RAMP serves three purposes. The first purpose is to monitor the groundwater in the A-aquifer at IR Sites 7 and 18 for chemicals of concern (COC) identified in the amended ROD and for selected metals at locations near the bay. The second purpose of the RAMP is to evaluate groundwater data collected since 2004 from selected wells against trigger levels established for protection of the beneficial uses of the bay, including ecological receptors. Results of the updated trigger level analysis may be used to add monitoring wells and chemicals to the RAMP. The third purpose of the RAMP is to monitor for the potential presence of methane in the area of the methane source removal excavation at IR Site 7.

1.1.2 Objectives

The following are the general objectives, as described in the amended ROD, for monitoring groundwater at Parcel B, including IR Sites 7 and 18:

1. To monitor the potential migration of COCs into previously uncontaminated areas and potential migration toward San Francisco Bay (including potential migration of metals from upgradient areas);
2. To monitor the changes in concentrations within a plume, including the effects of remedial actions and previous treatability studies;
3. To monitor concentrations of COCs in groundwater in and near individual wells where the human health risk assessment (HHRA) indicated potential risk.

However, only the first objective applies at IR Sites 7 and 18 because there are no groundwater plumes and no individual wells where the HHRA indicated potential risk at IR Sites 7 and 18.

The remedial action objective for methane included in the amended ROD is to reduce the presence of methane in soil gas such that concentrations do not accumulate and become explosive in structures. The Navy concluded that an organic layer located at about 23 to 25 feet below ground surface on top of the Bay Mud was the likely source of methane. The Navy removed more than 17,000 cubic yards of soil and debris to a maximum depth of 27 feet at IR Site 7 during August and September 2008 to remove the methane source. Details of the removal action are included in removal action completion report (SES-TECH 2009), work plan (SES-TECH 2008b), sampling and analysis plan (SES-TEC 2008a), and action memorandum (Navy 2008). The objective of this RAMP is to monitor any methane concentrations that may remain in the removal area.

1.2 REPORT ORGANIZATION

This document is divided into the following sections:

- Section 1.0, Introduction
- Section 2.0, Evaluation of Groundwater Versus Trigger Levels
- Section 3.0, Monitoring Plan
- Section 4.0, Reporting
- Section 5.0, Changes to this RAMP
- Section 6.0, References

Figures and tables are presented following Section 6.0.

2.0 EVALUATION OF GROUNDWATER VERSUS TRIGGER LEVELS

Groundwater at Parcel B is in contact with the surface water of the bay; however, the 1997 ROD did not evaluate potential interactions between groundwater and the surface water of the bay. Therefore, the Navy performed a screening evaluation to assess whether the concentrations of chemicals detected in groundwater could affect the surface water of the bay. This evaluation involved comparison of surface water quality criteria with detected concentrations in the groundwater at Parcel B and included a point-by-point evaluation of the analytical history where concentrations in groundwater exceeded the surface water quality criteria. Appendix I of the Technical Memorandum in Support of a ROD Amendment (TMSRA) (ChaduxTt 2007) presents the details of this screening evaluation. Groundwater data for radionuclides were not available; consequently, the screening evaluation in the TMSRA did not consider radionuclides. However, screening criteria for surface water of the bay have not been established for radionuclides. Therefore, radionuclides are eliminated from consideration in the evaluation for trigger levels, similar to other chemicals that do not have screening criteria for surface water.

The data set for the evaluation included data from the most recent 12 samples from each well at Parcel B using samples collected through November 2004. The evaluation included 118 wells (including wells in both the A- and B-aquifers) at Parcel B, 28 of which were located at IR Sites 7 and 18. The screening evaluation identified 17 chemicals in 44 wells throughout Parcel B (19 wells at IR Sites 7 and 18) where at least one sample contained a detected result that exceeded the screening criterion. Those data were further evaluated to focus on trends in detections—especially consistent detections and whether the most recent samples from a well exceeded the surface water quality criterion. This further evaluation found 12 chemicals were not consistently detected. Detections for these 12 chemicals were isolated and infrequent and were followed by at least one sample (but often several samples) that did not exceed the surface water quality criterion. Table I-6 in Appendix I of the TMSRA presents this detailed evaluation.

The screening evaluation at Parcel B indicated that the remaining five chemicals (chromium VI, copper, lead, mercury, and nickel) in the A-aquifer consistently exceeded the screening criteria and, therefore, could affect the bay. The results of the screening evaluation were used to identify

trigger levels for individual metals at unique well locations. Trigger levels were derived by multiplying an attenuation factor (based on the distance from each well to the bay) by the surface water quality criterion, or the Hunters Point groundwater ambient level (HGAL), whichever was higher. Two metals, copper and lead, were of concern in groundwater at two wells at IR Sites 7 and 18: IR07MW20A2 (copper) and IR07MWS-2 (lead). However, neither well is proposed for further sampling in this RAMP, as is described below.

The amended ROD for Parcel B required that the wells identified by the trigger level evaluation be included in development of the groundwater monitoring program during the RD (that is, this RAMP). According to the amended ROD, inclusion of these wells in the groundwater monitoring program was to be based on the concentrations observed in groundwater at these wells when the design is prepared (in addition to the data set ending in November 2004 that was used for the trigger level evaluation presented in the TMSRA). Furthermore, wells that were installed and sampled after November 2004 would also be included in the assessment during the RD. These evaluations are presented below.

The surface water quality evaluation in the TMSRA identified copper in well IR07MW20A2 and lead in well IR07MWS-2 for potential concern for migration to the bay. Table 1 presents the data collected from these wells through November 2004 as presented in the TMSRA (ChaduxTt 2007) and new data collected through April 2008 (CE2-Kleinfelder 2008c). The data collected for each well are discussed below.

IR07MW20A2. The trigger level identified for copper at well IR07MW20A2 was the HGAL of 28.04 micrograms per liter (µg/L). Well IR07MW20A2 was selected during the trigger level evaluation because the last sample collected at that well (30.25 µg/L in June 1992) exceeded the trigger level; no subsequent sample was collected. Well IR07MW20A2 was decommissioned in 1992; therefore, adjacent well IR07MW20A1 was used as a substitute. Of 35 samples (including duplicates) collected since 1999 from well IR07MW20A1, the result for only one sample (32.2 µg/L in August 2006) slightly exceeded the trigger level. However, the subsequent six samples did not exceed the trigger level. The data from well IR07MW20A1 do not indicate that copper in groundwater poses a risk to aquatic life in the bay.

IR07MWS-2. The trigger level identified for lead at well IR07MWS-2 was the HGAL of 14.44 µg/L. Well IR07MWS-2 was selected during the trigger level evaluation because the last sample collected at that well (114 µg/L in September 2004) exceeded the trigger level and was the final sample in the data set. None of the results for the 17 samples collected before September 2004 exceeded the trigger level. Likewise, none of the 13 samples collected after September 2004 exceeded the trigger level. The data from well IR07MWS-2 do not indicate that lead in groundwater poses a risk to aquatic life in the bay.

Consequently, neither well IR07MW20A1 nor well IR07MWS-2 is included for further monitoring for chemical concentrations in this RAMP.

No new wells have been installed and sampled at IR Sites 7 and 18 since November 2004.

3.0 MONITORING PLAN

This section discusses the approach for monitoring groundwater elevations and concentrations of COCs in groundwater at IR Sites 7 and 18 and for monitoring methane in soil gas at IR Site 7. Procedures for measuring groundwater elevations and collecting groundwater samples are in place for the basewide groundwater monitoring program at HPS (CE2-Kleinfelder 2008a). The groundwater monitoring described in this RAMP will follow the procedures accepted for the basewide monitoring program. Appendix A of this report contains well construction details for the wells selected for monitoring.

3.1 GROUNDWATER ELEVATION MONITORING

Groundwater elevations will be measured at the selected wells at IR Sites 7 and 18 to monitor fluctuations in the groundwater elevations and changes in the magnitude and direction of groundwater flow. Groundwater elevations will be measured quarterly at the wells listed in Table 2. The wells listed in Table 2 were selected to allow preparation of representative potentiometric surface elevation contour maps. Figure 4 shows the potentiometric surface elevation of the A-aquifer in May 2009. Figure 5 presents the locations of the wells to be monitored.

Groundwater elevations will be measured, to the extent possible, in conjunction with the routine monitoring conducted for other areas of Parcel B and HPS and using similar measurement procedures (CE2-Kleinfelder 2008a) to promote collection of data that are comparable across HPS.

3.2 GROUNDWATER CHEMICAL CONCENTRATION MONITORING

The following sections discuss monitoring groundwater for radionuclides and selected metals. Groundwater will be sampled, to the extent possible, in conjunction with the routine monitoring conducted for other areas of Parcel B and HPS and using similar procedures (CE2-Kleinfelder 2008a) to promote collection of data that are comparable across HPS.

3.2.1 Radionuclides

The amended ROD for Parcel B (ChaduxTt 2009) identified four radionuclides as potential COCs for groundwater at IR Sites 7 and 18: strontium-90, cesium-137, radium-226, and plutonium-239. The area at IR Sites 7 and 18 was used as a disposal site for excess large-scale shipyard debris as part of specific engineered fill operations conducted in that area to expand the shoreline. The Navy had limited controls for disposal of certain types of radioactive materials in place at the time of the shoreline expansion, which may have allowed for land disposal of certain types of radioactive materials (such as sandblast grit used in decontamination of ships that participated in atomic weapons testing and radioluminescent dials and gauges). Table 3 lists the wells proposed for monitoring for radionuclides. These wells were selected to monitor the downgradient portion of IR Sites 7 and 18.

Samples will be collected semiannually, beginning after the RAMP is approved until at least 2 years after redevelopment. Continued collection of samples will be contingent on the results of these samples. Concentrations of radionuclides will be compared with the remediation goals established in the amended ROD for Parcel B (see Table 4). Data review procedures and adjustments to the frequency of sampling (including cessation of sampling) will be evaluated consistent with the current procedures at HPS, as discussed in Section 5.0.

3.2.2 Selected Metals at Guard Wells

This RAMP also includes sampling at two guard wells located in IR Site 7 near the bay for selected metals to monitor for potential changes in concentrations in the event that groundwater conditions change during redevelopment. Sampling is proposed for a suite of six metals (chromium VI, copper, lead, mercury, nickel, and selenium) that were found to pose a potential risk to aquatic life in the bay based on the surface water quality screening evaluation (ChaduxTt 2007). Table 3 lists the wells proposed for monitoring for selected metals.

Samples will be collected semiannually, beginning after RAMP is approved until at least 2 years after redevelopment. Concentrations of metals will be compared with the trigger levels established in the TMSRA for Parcel B (see Table 5). Data review procedures and adjustments to the frequency of sampling (including cessation of sampling) will be evaluated consistent with the current procedures at HPS, as discussed in Section 5.0, that provide a dynamic process based on EPA's Triad approach.

3.2.3 Comparison to Benchmarks

The Navy will notify the FFA signatories when chemical concentrations exceed a comparison benchmark (that is, remediation goals for radionuclides or trigger levels for metals). Consistent with current procedures at HPS, the Navy will send the notification after validated data have been received (about 3 months after samples were collected). The following additional evaluations may occur for the cases where data indicate concentrations consistently exceed a comparison benchmark:

- Increasing the frequency of monitoring in the well where the comparison benchmark was exceeded to evaluate whether the elevated level is persistent;
  - Evaluation of whether an elevated level is persistent may include statistical analysis of trends and multiple verification of statistically significant exceedances;
- Monitoring groundwater at a location farther downgradient to evaluate whether the attenuation estimated in establishing the trigger level has occurred;
  - Downgradient monitoring may include evaluation of plume stability;
- Using site-specific detailed information to more accurately estimate attenuation (including processes such as adsorption and degradation); or
- Implementing a selected remediation alternative for groundwater treatment.

3.3 METHANE MONITORING

This RAMP includes monitoring of the five methane monitoring probes installed after the methane source removal excavation (Figure 6). The extent of the excavation for methane source removal was based on the locations of methane detections in soil gas at IR Site 7 (SES-TECH 2008b). The five methane monitoring probes installed after the excavation was backfilled were located to provide a uniform distribution across the excavated area (SES-TECH 2009). The Navy began monitoring these probes after their installation, and the on-going monitoring proposed in this RAMP will use similar measurement procedures to promote collection of data that are comparable. Field monitoring procedures for the methane probes will follow the procedures approved for the methane time-critical removal action (TCRA) (SES-TECH 2008a). Briefly, the probes will be monitored for methane in the field using a Landtec GEM 2000 portable gas analyzer and then a sample will be collected in a Summa canister for laboratory analysis; detailed procedures are included in the methane TCRA sampling and analysis plan (SES-TECH 2008a).

Monitoring will be conducted semiannually for 2 years. Table 6 lists the probes proposed for monitoring for methane. The Navy will notify the federal facility agreement (FFA) signatories of the results of the methane monitoring after laboratory analytical data have been received (about 1 month after samples were collected). The Navy will report the results of methane monitoring as described below in Section 4.0. Future actions will depend on the results of monitoring and will be planned in consultation with the regulatory agencies. However, extending the monitoring period could be proposed if methane data do not indicate subsurface conditions are stable at the end of 2 years. The amended ROD considered methane venting as an option if the methane source removal did not permanently eliminate the methane source.

4.0 REPORTING

The Navy will present the results of groundwater monitoring in semiannual or annual reports. Groundwater monitoring reports will be similar to reports prepared previously for Parcel B and for other areas at HPS (for example, CE2-Kleinfelder 2008b) for consistency and comparability across HPS. The following sections discuss these reports.

4.1 SEMIANNUAL REPORTS

Semiannual reports will summarize basic monitoring data and analytical results. Each report will include the following information:

- Tabulated groundwater levels for wells monitored; figures showing the locations of monitoring points and the groundwater potentiometric surface
- Tabulated analytical results for each monitoring well and methane monitoring probe sampled; figures showing the extent of chemicals in groundwater or soil gas
- Copies of sample chain-of-custody forms, field sampling forms and notes, laboratory analytical and data validation reports, including quality assurance and quality control information, and other associated forms

- Comparison of analytical results with remediation goals for radionuclides and with trigger levels for metals
- Description of deviations from this RAMP
- Identification of damage to monitoring wells or methane monitoring probes and recommendations for corrective action
- Recommendations for adjustments to this RAMP

4.2 ANNUAL REPORTS

Annual reports will provide evaluation and interpretation of the data collected over the previous year in addition to summarizing basic monitoring data and analytical results from the preceding 6 months.

Objectives for annual reports include:

- Evaluate groundwater and methane data obtained during the past year to identify significant trends
- Evaluate COC concentrations in monitoring wells and methane in monitoring probes
- Describe deviations from this RAMP
- Discuss analytical data quality
- Recommend adjustments to this RAMP

5.0 CHANGES TO THIS RAMP

The Navy intends the groundwater and methane monitoring strategy presented in this RAMP to be adaptable based on the data collected, in accordance with the U.S. Environmental Protection Agency's Triad approach, to allow flexibility to optimize monitoring. The Navy will discuss the results of groundwater and methane monitoring with the FFA signatories (and the California Department of Public Health for radionuclides). The Navy may revise the list of wells or probes to be sampled, the analytes measured, or the frequency of sampling based on the results of this RAMP, with the approval of the FFA signatories. The process for changing the RAMP, including procedures for data review and modification of plans for groundwater or methane sampling, will follow the process described in the basewide groundwater monitoring program (CE2-Kleinfelder 2008a).

Section 3.2 describes the initial monitoring period for this RAMP. The need for monitoring beyond the initial period will be evaluated based on the results of the initial period. Results of groundwater and methane monitoring will be used during 5-year reviews required under the Comprehensive Environmental Response, Compensation, and Liability Act to assess the monitoring program, adjust the data collection and analysis requirements, and evaluate the need for other response actions.

6.0 REFERENCES

CE2-Kleinfelder. 2008a. "Draft Final Sampling and Analysis Plan (Field Sampling Plan and Quality Assurance Project Plan) for Basewide Groundwater Monitoring Program, Hunters Point Shipyard, San Francisco, California." June.

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FIGURES

Location Map

AREA OF DETAIL

N

5 2.5 0 5

Miles

ChaduxTt JV

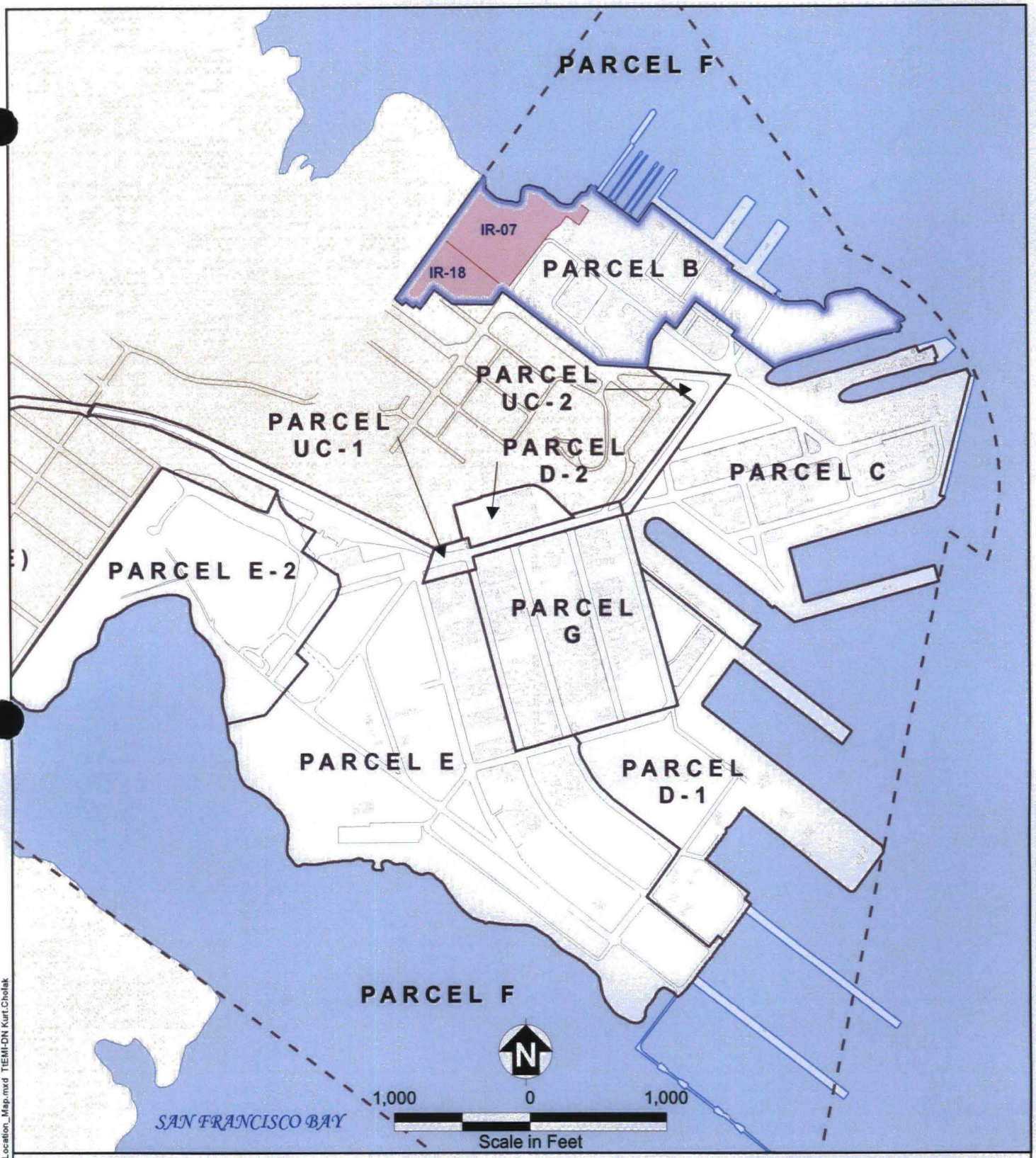
Hunters Point Shipyard, San Francisco, California

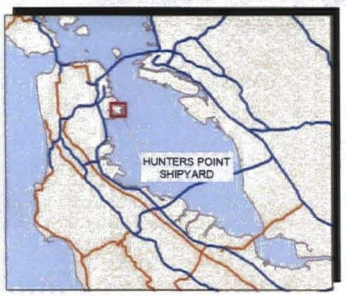
Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 1
HUNTERS POINT SHIPYARD
LOCATION MAP

RAMP for IR Sites 7 and 18

2008-12-02 O:\...PointProjects\Parcel_BIRAMP\HPS_location_map.mxd TiEMI-DN kurt.cholak





Location Map

- Installation Restoration Sites 7 and 18
- Parcel B Boundary
- Parcel Boundary
- Parcel F Boundary
- Building
- Non-Navy Property
- Road

ChaduxTt JV

Hunters Point Shipyard, San Francisco, California

Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 2

FACILITY LOCATION MAP

RAMP for IR Sites 7 and 18

05/18/2009 O:\PointProjects\RAMP\Facility_Location_Map.mxd TtEMI-DN Kurt.Cholak

PARTIALLY SCANNED
OVERSIZE ITEM(S)

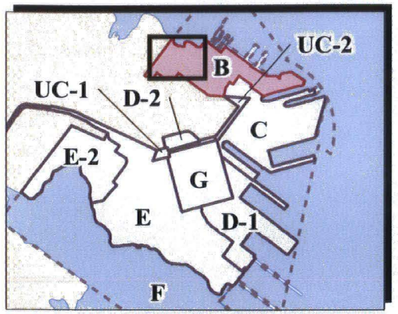
See document # 2253538
for partially scanned image(s).

FIGURE 3

For complete hardcopy version of the oversize document
contact the Region IX Superfund Records Center

SAN FRANCISCO BAY

IR07MW28A (2.26)
IR07MW25A (1.88)
IR07MW20A1 (0.36)
IR-23
IR07MW24A (NM)
IR07MW26A (1.80)
IR07MWS-2 (1.95)
IR07MWS-4 1.76
IR07MW95A (2.49)
IR07MW94A (NM)
IR-07
IR07MW23A (NM)
IR18MW200A (3.18)
IR18MW21A (NM)
IR18MW101B (NM)
IR18MW100B (NM)
IR07MW93A (3.04)
IR18MW92A (3.14)
IR18MW91A (3.96)
IR-18
Parcel B
146
121
117
103
116
115
IR-62
1
2
3
4
5



Location Map

Groundwater Monitoring Well (Groundwater Elevation)

Potentiometric Surface Contours

- Groundwater Elevation Contour
- Inferred Depression
- A-Aquifer Groundwater Flow Direction
- Road
- Parcel B Boundary
- Other Parcel Boundary
- Building
- San Francisco Bay
- Non-Navy Property

Note:

IR Installation Restoration
NM Not measured

Groundwater elevations are relative to mean sea level.

Source: CE2-Kleinfelder Data Portal

N

0 100 200
Scale in Feet

ChaduxTt JV
Consulting Engineers and Scientists

Hunters Point Shipyard, San Francisco, California
Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 4
GROUNDWATER ELEVATION
A-AQUIFER
MAY 2009

RAMP for IR Sites 7 and 18

2009-12-02 o:\hunters_point\projects\parcel_b\ramp\fig4_gwmay2009.mxd TtEMI-DN kurt.cholak

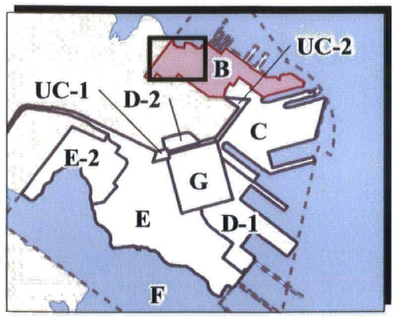
SAN FRANCISCO BAY

IR07MW25AD
IR07MW25A
IR07MW24AD
IR07MW28A
IR07MW21A1
IR07MW21A2
IR07MW21A1D
IR07MW24A
IR07MWS-3
IR07MW26AD
IR07MW26A
IR07MW20A1
IR07MW20A2
IR07P20A
IR07MWP-2
IR07MWS-2
IR07MWS-2D
IR07MWP-1
IR07MWS-4D
IR07MWS-4DD
IR07MWS-4
IR07MW95A
IR07MW94A
IR07MW23A
IR07MW93A
IR18MW200A
IR18MW21A
IR18MW21AD
PA18MW09A
IR18P21A1
IR18MW101B
IR18MW100B
IR18P21A2
IR18MW22A
IR18MW92A
IR18MW91A

IR-07
IR-23
IR-18
IR-62

Parcel B

146
121
117
103
116
115



Location Map

- Well for Chemical Concentration Monitoring and for Groundwater Elevation Monitoring
- Well for Groundwater Elevation Monitoring Only
- Other Groundwater Monitoring Well
- Decommissioned Monitoring Well
- Road
- Parcel B Boundary
- Building
- San Francisco Bay
- Non-Navy Property

Note:

IR Installation Restoration

N

0 100 200

Scale in Feet

ChaduxTt JV

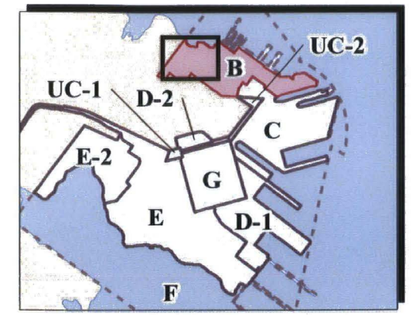
Hunters Point Shipyard, San Francisco, California

Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 5
GROUNDWATER MONITORING WELL LOCATION MAP

RAMP for IR Sites 7 and 18

2009-12-01 o:\hunters_point\projects\parcel_b\ramp\fig5_gwmonitoring.mxd TtEMI-DN kurt.cholak



Location Map

- Methane Monitoring Probe
- Excavation for Methane Source
- Road
- Parcel B Boundary
- Other Parcel Boundary
- Building
- San Francisco Bay
- Non-Navy Property

Note:

IR Installation Restoration

N

0 100 200

Scale in Feet

ChaduxTt JV

Hunters Point Shipyard, San Francisco, California

Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 6
METHANE MONITORING PROBE LOCATION MAP

RAMP for IR Sites 7 and 18

2009-12-01 o:\hunters_point\projects\parcel_b\ramp\fig6_methaneprobes.mxd TtEMI-DN kurt.cholak

TABLES

TABLE 1: EVALUATION OF SELECTED GROUNDWATER SAMPLES

Remedial Action Monitoring Plan, IR Sites 7 and 18, Parcel B
Hunters Point Shipyard, San Francisco, California

Sampling Location	Sample Date	Result (µg/L)	Qualifier	Exceed Criterion?
Wells that Exceeded Trigger Levels Based on Data through November 2004				
Trigger Level -- Copper HGAL = 28.04 µg/L at IR07MW20A2				
IR07MW20A2	**29-Jul-91**	**40.6**		YES
IR07MW20A2	04-Dec-91	13.5	J	NO
IR07MW20A2	**04-Jun-92**	**30.25**		YES
Well IR07MW20A2 was decommissioned in 1992. Adjacent well IR07MW20A1 was used as a replacement.				
IR07MW20A1	25-Jul-91	11.3	U	NO
IR07MW20A1	02-Dec-91	3	U	NO
IR07MW20A1	01-Jun-92	4.4	U	NO
IR07MW20A1	03-Sep-99	2.9	U	NO
IR07MW20A1	13-Jan-00	6.1	U	NO
IR07MW20A1	25-Apr-00	2.1	UJ	NO
IR07MW20A1	10-Jul-00	1.9	UJ	NO
IR07MW20A1	11-Oct-00	1	U	NO
IR07MW20A1	16-Jan-01	5.7	U	NO
IR07MW20A1	30-Apr-01	1	U	NO
IR07MW20A1	23-Jul-01	2	U	NO
IR07MW20A1	14-Mar-02	11.9	J	NO
IR07MW20A1	04-Jun-02	2	UJ	NO
IR07MW20A1	29-Aug-02	3.1	U	NO
IR07MW20A1	14-Nov-02	2.1	U	NO
IR07MW20A1	05-Mar-03	5	U	NO
IR07MW20A1	21-May-03	0.9	U	NO
IR07MW20A1	14-Aug-03	4.1	U	NO
IR07MW20A1	04-Nov-03	2.5		NO
IR07MW20A1	24-Mar-04	50	U	Limit > criterion
IR07MW20A1	02-Jun-04	25	U	NO
IR07MW20A1	31-Aug-04	5.2	U	NO
IR07MW20A1	16-Nov-04	4.8	U	NO
IR07MW20A1	02-Mar-05	125	U	Limit > criterion
IR07MW20A1	28-Jun-05	25	U	NO
IR07MW20A1	15-Dec-05	25	U	NO
IR07MW20A1	13-Mar-06	4.6	J	NO
IR07MW20A1	23-May-06	25	U	NO
IR07MW20A1	**23-Aug-06**	**32.2**		YES
IR07MW20A1	15-Nov-06	16.4	J	NO
IR07MW20A1	26-Feb-07	1.7	U	NO
IR07MW20A1	16-May-07	25	U	NO
IR07MW20A1	11-Oct-07	25	UJ	NO
IR07MW20A1	03-Mar-08	25	U	NO
IR07MW20A1	16-Apr-08	25	U	NO

TABLE 1: EVALUATION OF SELECTED GROUNDWATER SAMPLES (CONTINUED)
Remedial Action Monitoring Plan, IR Sites 7 and 18, Parcel B
Hunters Point Shipyard, San Francisco, California

Sampling Location	Sample Date	Result (µg/L)	Qualifier	Exceed Criterion?
Trigger Level -- Lead HGAL = 14.44 µg/L at IR07MWS-2				
IR07MWS-2	03-Sep-99	0.8	UJ	NO
IR07MWS-2	13-Jan-00	1.3	U	NO
IR07MWS-2	25-Apr-00	2.3	U	NO
IR07MWS-2	10-Jul-00	1.7	UJ	NO
IR07MWS-2	17-Jan-01	1	U	NO
IR07MWS-2	27-Apr-01	2	UJ	NO
IR07MWS-2	19-Jul-01	2	U	NO
IR07MWS-2	13-Mar -02	0.9	U	NO
IR07MWS-2	04-Jun-02	2.4	U	NO
IR07MWS-2	28-Aug-02	1.4	U	NO
IR07MWS-2	19-Nov-02	0.7	U	NO
IR07MWS-2	04-Mar-03	0.9	U	NO
IR07MWS-2	20-May-03	2	U	NO
IR07MWS-2	12-Aug-03	6.2	UJ	NO
IR07MWS-2	04-Nov-03	2.1	U	NO
IR07MWS-2	29-Mar-04	50	U	Limit > criterion
IR07MWS-2	07-Jun-04	10	UJ	NO
IR07MWS-2	**01-Sep-04**	**114**		YES
IR07MWS-2	07-Mar-05	50	UJ	Limit > criterion
IR07MWS-2	14-Jun-05	10	U	NO
IR07MWS-2	19-Dec-05	10	UJ	NO
IR07MWS-2	13-Mar-06	10	UJ	NO
IR07MWS-2	23-May-06	10	UJ	NO
IR07MWS-2	24-Aug-06	10	U	NO
IR07MWS-2	16-Nov-06	7	J	NO
IR07MWS-2	22-Feb-07	10	U	NO
IR07MWS-2	14-May-07	10	U	NO
IR07MWS-2	15-Aug-07	100	U	Limit > criterion
IR07MWS-2	11-Oct-07	10.9	J	NO
IR07MWS-2	03-Mar-08	10	UJ	NO
IR07MWS-2	16-Apr-08	10	UJ	NO

Notes:

Bold results indicate the concentration exceeds the criterion.

µg/L Microgram gram per liter
HGAL Hunters Point groundwater ambient level
J Estimated detected result
U Nondetected result

TABLE 2: WELLS FOR GROUNDWATER ELEVATION MONITORING
Remedial Action Monitoring Plan, IR Sites 7 and 18, Parcel B
Hunters Point Shipyard, San Francisco, California

Monitoring Wells for Groundwater Elevations
IR07MW20A1
IR07MW23A
IR07MW24A
IR07MW25A
IR07MW26A
IR07MW28A
IR07MW93A
IR07MW94A
IR07MW95A
IR07MWS-2
IR07MWS-4
IR18MW21A
IR18MW91A
IR18MW92A
IR18MW200A
IR18MW100B
IR18MW101B

Note:

Groundwater elevations will be measured quarterly.

TABLE 3: WELLS FOR CHEMICAL CONCENTRATION MONITORING

Remedial Action Monitoring Plan, IR Sites 7 and 18, Parcel B
Hunters Point Shipyard, San Francisco, California

Well	Analysis
IR07MW24A	Radionuclides[a] and Metals[b]
IR07MW26A	Radionuclides[a] and Metals[b]

Notes:

Groundwater samples will be collected semiannually.

a Radionuclides: cesium-137, plutonium-239, radium-226 and strontium-90

b Metals: chromium VI, copper, lead, mercury, nickel, and selenium

TABLE 4: REMEDIATION GOALS FOR RADIOLOGICALLY IMPACTED WATER

Remedial Action Monitoring Plan, IR Sites 7 and 18, Parcel B
Hunters Point Shipyard, San Francisco, California

Radionuclide	Remediation Goal for Water[a] (picocuries per liter)
Cesium 137	119
Plutonium 239	15
Radium 226	5.0[b]
Strontium 90	8.0

Notes:

a Remediation goals from the amended ROD for Parcel B (ChaduxTt 2009).

b Goal is for total radium concentration. This goal is based on the federal maximum contaminant level, which applies to the sum of radium 226 and radium 228.

Reference:

ChaduxTt. 2009. "Final Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California." January 26.

TABLE 5: TRIGGER LEVELS FOR SELECTED METALS IN GROUNDWATER
Remedial Action Monitoring Plan, IR Sites 7 and 18, Parcel B
Hunters Point Shipyard, San Francisco, California

Metal	Trigger Level[a] (micrograms per liter)
Chromium VI	50
Copper	28.04
Lead	14.44
Mercury	0.6
Nickel	96.48
Selenium	14.5

Notes:

a Trigger levels from TMSRA for Parcel B (ChaduxTt 2007) assuming an attenuation factor of 1.0.

TMSRA Technical memorandum in support of a record of decision amendment

Reference:

ChaduxTt. 2007. "Final Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California." December 12.

TABLE 6: PROBES FOR METHANE MONITORING
Remedial Action Monitoring Plan, IR Sites 7 and 18, Parcel B
Hunters Point Shipyard, San Francisco, California

Probe	Analysis
SG-PT15	Methane
SG-PT16	Methane
SG-PT17	Methane
SG-PT18	Methane
SG-PT19	Methane

Note:
Monitoring will be conducted semiannually.

APPENDIX A
MONITORING WELL AND METHANE PROBE INFORMATION

TABLE A-1: GROUNDWATER MONITORING WELL CONSTRUCTION INFORMATION, IR SITES 7 AND 18

Remedial Action Monitoring Plan, IR Sites 7 and 18, Parcel B
Hunters Point Shipyard, San Francisco, California

Well_ID	Parcel	IR Site	Aquifer	Northing	Easting	Ground Surface Elevation (ft MSL)	TOC Elevation (ft MSL)	Casing Stickup (ft)	Top of Screen (ft bgs)	Base of Screen (ft bgs)	Total Depth (ft bgs)	Top of Screen (ft below TOC)	Base of Screen (ft below TOC)	Casing Diameter (in)	Casing Type	Installation Date	Decommission Date	Measure Depth to Water ?	Sampling Required ?
IR07MW20A1	B	IR-07	A	453944.26	1460379.24	10.26	9.26	-0.99	6.0	24.0	24.0	5.2	23.2	4	PVC	12/10/90		Y	N
IR07MW20A2	B	IR-07	A	453938.37	1460378.90	10.23	9.27	-0.96	39.0	44.0	44.0	38.0	43.0	4	PVC	12/7/90		N	N
IR07MW21A1	B	IR-07	A	453941.51	1459683.70	14.01	13.89	-0.12	6.0	16.0	16.5	5.9	15.9	4	PVC	3/3/04		N	N
IR07MW21A2	B	IR-07	A	453898.24	1459758.30	13.24	14.42	1.18	29.0	34.0	34.0	30.5	35.5	4	PVC	12/4/90	3/14/01	N	N
IR07MW23A	B	IR-07	A	453693.82	1459476.14	16.40	15.76	-0.64	7.0	17.0	17.0	6.4	16.4	4	PVC	12/6/90		Y	N
IR07MW24A	B	IR-07	A	453884.37	1459749.67	12.70	16.26	2.83	5.0	15.0	15.0	5.0	15.0	4	PVC	3/3/04		Y	Y
IR07MW25A	B	IR-07	A	453990.88	1459624.70	9.40	12.67	2.92	8.0	18.0	18.0	8.0	18.0	4	PVC	3/3/04		Y	N
IR07MW26A	B	IR-07	A	453900.68	1460093.30	11.30	14.50	3.45	5.0	15.0	15.0	5.0	15.0	4	PVC	3/3/04		Y	Y
IR07MW27A	B	IR-07	A	453649.86	1459864.33	16.42	16.15	-0.27	11.0	21.0	21.5	10.7	20.7	4	PVC	4/8/99	8/08	N	N
IR07MW28A	NNP	IR-07	A	453984.94	1459539.08	9.17	12.03	2.86	5.0	15.0	15.5	7.9	17.9	4	PVC	5/11/99		Y	N
IR07MW93A	B	IR-07	A	453533.20	1459686.30	19.60	19.53	-0.07	19.0	29.0	29.0	18.9	28.9	2	PVC	6/20/01		Y	N
IR07MW94A	B	IR-07	A	453749.30	1459659.70	15.20	15.15	-0.05	14.0	24.0	25.0	14.0	24.0	2	PVC	6/20/01		Y	N
IR07MW95A	NNP	IR-18	A	453827.30	1459415.20	13.90	16.60	2.70	11.0	21.0	21.0	13.7	23.7	2	PVC	6/19/01		Y	N
IR07MWP-1	B	IR-07	A	453827.39	1460384.54	9.85	9.87	0.02	4.0	19.0	19.0	4.0	19.0	2	SS	9/5/86	7/23/98	N	N
IR07MWP-2	B	IR-07	A	453930.86	1460411.98	10.04	9.77	-0.27	4.0	19.0	19.0	3.7	18.7	2	SS	9/5/86	7/23/98	N	N
IR07MWS-2	B	IR-07	A	453860.98	1460286.15	10.09	12.71	2.62	5.5	15.5	15.5	8.1	18.1	4	PVC	6/28/99		Y	N
IR07MWS-2D	B	IR-07	A	453866.69	1460298.25	9.68	9.13	-0.55	3.0	18.0	20.5	2.5	17.5	2	SS	9/2/86	8/12/98	N	N
IR07MWS-3	B	IR-07	A	453983.55	1460068.55	10.31	9.75	-0.56	5.0	20.0	20.0	4.4	19.4	2	SS	9/3/86	8/19/98	N	N
IR07MWS-4	B	IR-07	A	453825.23	1459913.20	13.30	16.78	3.50	6.0	16.0	16.0	6.0	16.0	4	PVC	3/3/04		Y	N
IR07MWS-4D	B	IR-07	A	453864.34	1459924.22	13.25	13.22	-0.03	6.0	21.0	21.0	6.0	21.0	2	SS	9/4/86	7/23/98	N	N
IR07P20A	B	IR-07	A	453927.21	1460374.65	10.25	9.57	-0.68	5.0	25.0	25.0	4.3	24.3	2	PVC	1/29/92		N	N
IR18MW100B	B	IR-18	B	453579.54	1459329.10	18.25	17.94	-0.31	40.0	45.0	47.0	39.7	44.7	4	PVC	6/26/98		Y	N
IR18MW101B	B	IR-18	B	453573.70	1459432.00	18.96	18.89	-0.07	37.0	42.0	45.0	36.9	41.9	4	PVC	6/24/98		Y	N
IR18MW200A	NNP	IR-18	A	453615.58	1459217.80	25.34	26.96	1.62	18.0	33.0	33.0	19.6	34.6	4	PVC	5/13/99		Y	N
IR18MW21A	B	IR-18	A	453595.74	1459304.90	17.83	17.56	-0.26	10.0	20.0	20.0	9.8	19.8	4	PVC	5/6/99		Y	N
IR18MW21AD	B	IR-18	A	453595.53	1459305.05	17.69	17.11	-0.58	12.0	27.0	27.0	11.4	26.4	4	PVC	4/20/93	8/12/98	N	N
IR18MW22A	B	IR-07	A	453556.56	1459572.98	18.80	18.11	-0.69	12.0	27.0	27.0	11.3	26.3	4	PVC	4/19/93	7/22/98	N	N
IR18MW91A	NNP	IR-07	A	453502.40	1459168.30	17.10	18.75	1.65	13.0	23.0	23.5	14.7	24.7	2	PVC	6/19/01		Y	N
IR18MW92A	B	IR-18	A	453446.90	1459396.70	20.90	20.70	-0.20	17.0	27.0	27.0	16.8	26.8	2	PVC	6/19/01		Y	N
IR18P21A1	B	IR-18	A	453588.53	1459299.65	17.77	17.52	-0.25	12.0	27.0	27.0	11.8	26.8	2	PVC	9/27/93	8/19/98	N	N
IR18P21A2	B	IR-18	A	453586.71	1459319.01	17.82	17.12	-0.70	12.0	27.5	27.5	11.3	26.8	2	PVC	9/27/93	8/12/98	N	N
PA18MW08A	NNP	IR-18	A	453293.88	1459336.46	25.12	24.67	-0.45	10.0	25.0	25.0	9.6	24.6	4	PVC	1/31/91		N	N
PA18MW09A	B	IR-18	A	453628.25	1459405.47	18.03	17.66	-0.37	10.0	25.0	25.0	9.6	24.6	4	PVC	1/30/91		N	N

Notes: Blank cells indicate no data available or not applicable

bgs	Below ground surface
ft	Feet
in	Inch
IR	Installation Restoration
MSL	Mean sea level
NNP	Not Navy property
PVC	Polyvinyl chloride
SS	Stainless steel
TOC	Top of casing

TABLE A-2: METHANE MONITORING PROBE CONSTRUCTION INFORMATION, IR SITE 7

Remedial Action Monitoring Plan, IR Sites 7 and 18, Parcel B
Hunters Point Shipyard, San Francisco, California

Probe_ID	Northing	Easting	Ground Surface Elevation (ft MSL)	Total Depth (ft bgs)	Installation Date	Sampling Required?
SG-PT15	453673.40	1459922.63	15.5	3.0	8/14/08	Y
SG-PT16	453632.67	1459939.27	16.2	3.0	8/14/08	Y
SG-PT17	453601.10	1459917.88	16.8	3.0	8/12/08	Y
SG-PT18	453623.16	1459880.20	16.5	3.0	8/12/08	Y
SG-PT19	453660.16	1459884.61	15.9	3.0	8/12/08	Y

Notes:

bgs	Below ground surface
ft	Feet
IR	Installation Restoration
MSL	Mean sea level
Y	Yes

Final

Land Use Control Remedial Design Installation Restoration Sites 7 and 18 Parcel B

Hunters Point Shipyard
San Francisco, California

January 8, 2010

Prepared for:
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Program Management Office West
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Land Use Control Remedial Design
Installation Restoration Sites 7 and 18
Parcel B
Hunters Point Shipyard
San Francisco, California

Contract Number N62473-04-D-3213
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Prepared for:

DEPARTMENT OF THE NAVY

REVIEW AND APPROVAL

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Date: January 8, 2010

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1 Hunters Point Shipyard Location Map

2 Facility Location Map

3 Area Requiring Institutional Controls

ATTACHMENTS

A Interested Parties for Land Use Control Remedial Design Report

B IR Sites 7 and 18 IC Compliance Monitoring Report and Annual IC Compliance Certificate

C Land Use Control Checklist

ACRONYMS AND ABBREVIATIONS

§	Section
ARIC	Area requiring institutional controls
Cal/EPA	California Environmental Protection Agency
CDPH	California Department of Public Health
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
DTSC	Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
ETCA	Early transfer cooperative agreement
FFA	Federal facility agreement
GIS	Geographic information system
HPS	Hunters Point Shipyard
IC	Institutional control
IR	Installation Restoration
LUC	Land use control
MOA	Memorandum of agreement
msl	Mean sea level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
O&M	Operation and maintenance
RD	Remedial design
RMP	Risk management plan
ROD	Record of decision
VOC	Volatile organic compound
Water Board	San Francisco Bay Regional Water Quality Control Board

1.0 PURPOSE

This Land Use Control (LUC) Remedial Design (RD) report for Installation Restoration (IR) Sites 7 and 18 at Parcel B at Hunters Point Shipyard (HPS) in San Francisco, California addresses the institutional controls (IC) and land use restrictions required by Section 12.2.1.5 of the amended Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Record of Decision (ROD) for Parcel B issued on January 26, 2009. The amended ROD requires implementation of land use restrictions to limit exposure of future landowners or users of the property to hazardous substances and to maintain the integrity of the remedy.

This LUC RD report is a component of the RD for IR Sites 7 and 18, which is a primary document under the HPS federal facility agreement (FFA). This report was prepared in accordance with the "Navy Principles and Procedures for Specifying Monitoring and Enforcement of Land Use Controls and Other Post-ROD Actions" attached to the January 16, 2004 Department of Defense Memorandum titled "Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Record of Decision (ROD) and Post-ROD Policy."

FFA signatories include the Department of the Navy, the U.S. Environmental Protection Agency (EPA), the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC), and the San Francisco Bay Regional Water Quality Control Board (Water Board). The California Department of Public Health (CDPH) regulates activities related to remediation of radionuclides and, therefore, is also involved in oversight of actions at the portion of IR Sites 7 and 18 that is radiologically impacted. All references in this document to CDPH including, but not limited to, requirements for approvals and reviews by CDPH, are intended to refer to and apply only within the area requiring institutional controls (ARIC) for radionuclides.

The inspections and reporting requirements described in this report will be effective upon approval of the LUC RD report. The property in IR Sites 7 and 18 is currently owned by the Navy and is not subject to a lease. The LUC objectives will be met by access control until the time of transfer. The activity and land use restrictions described in this LUC RD report will be incorporated into the Quitclaim Deed and Covenant to Restrict Use of Property and will take effect upon transfer and issuance of those documents.

2.0 DESCRIPTION OF THE SITE

This report addresses IR Sites 7 and 18 at Parcel B at HPS in San Francisco, California (see Figure 1). Hunters Point Shipyard includes about 866 acres (420 acres on land and 446 acres under water in San Francisco Bay). Parcel B includes about 54 acres on the northern side of HPS. IR Sites 7 and 18 include about 14 acres on the western side of Parcel B (see Figure 2). IR Site 7 includes a shoreline of approximately 950 feet along San Francisco Bay.

The majority of the land surface at IR Sites 7 and 18 slopes gently from southwest to northeast toward the bay. Ground surface elevations in the broad central area range from about 25 feet above mean sea level (msl) in the southwest to 10 feet above msl in the northeast, where the land

surface drops more sharply to the shoreline. The southwestern section of IR Site 18 includes a steep hillside where the ground surface elevation ranges from 25 to 55 feet above msl. The northeastern portion of IR Site 7 includes the shoreline with the bay and extends bayward to the mean lower low water elevation (about 3 feet below msl). There are no structures on IR Site 7 or 18, and what little vegetation exists is located near the edges of the site.

Small portions of the area that are now identified as IR Sites 7 and 18 were in existence when the property was purchased by the Navy in 1939. The Navy significantly expanded the original area during development of the shipyard to its present configuration; the majority of the land area at IR Sites 7 and 18 was created by depositing fill into the bay. The expansion of the current location of IR Sites 7 and 18 was primarily through the use of engineered fill materials that were derived by quarrying the local bedrock. Some of the fill included construction debris. Although most of expansion of Parcel B had been completed before 1946, much of the land area of IR Sites 7 and 18 was created during the 1950s and 1960s.

The Navy used HPS starting around 1939 for shipbuilding, repair, and maintenance. After World War II, activities at HPS shifted to submarine maintenance and repair. However, the Navy continued to operate carrier overhaul and ship maintenance and repair facilities through the 1960s. Other significant activities after World War II included decontamination of ships used during atomic weapons testing in the South Pacific and operation of the Naval Radiological Defense Laboratory from the late 1940s until 1969. Navy ships that participated in atomic and nuclear weapons testing were brought back to HPS for decontamination from 1946 through the 1960s. HPS was deactivated in 1974 and remained largely unused until 1976. Between 1976 and 1986, the Navy leased most of HPS to Triple A Machine Shop, Inc., a private ship repair company. The Navy resumed occupancy of HPS in 1987. Most of Parcel B was formerly part of the industrial support area and was used for shipping, ship repair, training, barracks, and offices. Activities at IR Site 7 included painting, disposal of waste sandblast grit, and disposal of waste oil. Activities at IR Site 18 included disposal of waste oil and use of the area as a parking lot. Chemicals released from these activities included metals, volatile organic compounds, semivolatile organic compounds, pesticides, polychlorinated biphenyls, and radionuclides.

3.0 AREA REQUIRING INSTITUTIONAL CONTROLS

Figure 3 shows the ARICs at IR Sites 7 and 18. The ARIC is the same as shown on Figure 12-2 of the final amended ROD for Parcel B at HPS dated January 26, 2009 (ChaduxTt 2009). The entire area of IR Sites 7 and 18 (about 14 acres) will be subject to ICs. A portion of that area, about 11 acres, will be subject to additional ICs related to radionuclides (see Figure 3).

4.0 INSTITUTIONAL CONTROLS PERFORMANCE OBJECTIVES AND LAND USE RESTRICTIONS

The following sections describe the IC performance objectives for IR Sites 7 and 18 and the legal mechanisms that will be used to implement the objectives.

4.1 IC PERFORMANCE OBJECTIVES

IC performance objectives were developed and presented in the amended ROD and are intended to limit exposure of future users of the property to hazardous substances and to maintain the integrity of the remedy. The IC performance objectives to be implemented through land use restrictions for the site include the following:

1. The following activities are prohibited throughout IR Sites 7 and 18:
   a. Growing vegetables or fruits in native soil for human consumption.
   b. Use of groundwater.
2. Use of the portion of IR Sites 7 and 18 within the ARIC for radionuclides is restricted to open space and recreational uses, unless prior written approval for other uses is granted by the FFA signatories and CDPH. In addition, the following land uses are specifically prohibited within the ARIC for radionuclides unless prior written approval for these uses is granted by the FFA signatories and CDPH:
   a. A residence, including any mobile home or factory-built housing, constructed or installed for use as residential human habitation,
   b. A hospital for humans,
   c. A school for persons under 21 years of age, or
   d. A day care facility for children.
3. The following activities are restricted throughout IR Sites 7 and 18 unless prior written approval for these activities is granted by the FFA signatories (and CDPH within the ARIC for radionuclides):
   a. "Land disturbing activity," which includes, but is not limited to: (1) excavation of soil, (2) construction of roads, utilities, facilities, structures, and appurtenances of any kind, (3) demolition or removal of "hardscape" (for example, concrete roadways, parking lots, foundations, and sidewalks), (4) any activity that involves movement of soil to the surface from below the surface of the land, and (5) any other activity that causes or facilitates movement of known contaminated groundwater. Land disturbing activities are not intended to include placement of additional clean, imported fill on top of the soil cover that the Navy will construct at IR Sites 7 and 18.
   b. Alteration, disturbance, or removal of any component of a response or cleanup action (including but not limited to revetment walls and shoreline protection and soil cap/containment systems); groundwater extraction, injection, and monitoring wells and associated piping and equipment; or associated utilities.
   c. Extraction of groundwater and installation of new groundwater wells with the exception of environmental sampling and monitoring requirements as described in the Remedial Action Monitoring Plan for IR Sites 7 and 18.

d. Removal of or damage to security features (for example, locks on monitoring wells, survey monuments, fencing, signs, or monitoring equipment and associated pipelines and appurtenances).

e. Construction of enclosed structures. Risk to human health may exist from potential intrusion of volatile organic compound (VOC) vapors into structures built at IR Sites 7 and 18. Consequently, IR Sites 7 and 18 are included in the ARIC for VOC vapors at Parcel B. The reduction in potential risk can be achieved through engineering controls or other design alternatives that meet the specifications set forth in the amended ROD or RD report. Alternatively, the ARIC for VOC vapors may be modified by the FFA signatories and CDPH as the soil contamination areas that are producing unacceptable vapor inhalation risks are reduced over time or in response to further soil, vapor, and groundwater sampling and analysis for VOCs that establishes that areas now included in the ARIC for VOC vapors do not pose an unacceptable potential exposure risk due to VOC vapors.

4. The following activities are restricted within the ARIC for radionuclides at IR Sites 7 and 18 unless prior written approval for these activities is granted by the FFA signatories and CDPH:

   a. Excavation below the demarcation layer.

      i. The demarcation layer is a visual cue to identify the potential presence of radionuclides to anyone excavating into the soil cover in the ARIC for radionuclides. The demarcation layer will provide an additional warning beyond the other ICs. The demarcation layer will have two components: an orange-colored geotextile and a marking tape with the message "Caution Do Not Dig Below." The geotextile will cover the entire ARIC for radionuclides; the marking tape will be secured on top of the geotextile in a rectangular grid pattern on a 10-foot by 10-foot spacing. Refer to the remedial design for details of the demarcation layer and the soil cover in general.

      ii. Any proposed excavation shall be required to be described in a work plan that will include but not be limited to a radiological work plan, the identification of a radiological safety specialist, a soil management plan, soil sampling and analysis requirements, and a plan for off-site disposal of any excavated radionuclides in accordance with federal and state law. This work plan must be submitted to and approved in writing by the FFA signatories and CDPH in accordance with procedures and timeframes that are set forth in Section 6.0 of this LUC RD. The integrity of the cover/cap must be restored upon completion of excavation as provided in the IR Sites 7 and 18 Operation and Maintenance Plan. A completion report describing the details of the implementation of the work plan, the sampling and analysis, the off-site disposal, and the restoration of the integrity of the cover/cap must be submitted to and approved in writing by the FFA signatories and CDPH in accordance with procedures and timeframes that are set forth in Section 6.0 of this LUC RD.

b. Installation of water lines, storm drains or sanitary sewers above the demarcation layer.

5. The Parcel B risk management plan (RMP) for areas not covered by the ARIC for radionuclides, if it is prepared, will set forth certain requirements or protocols that, if followed, will allow certain activities that are otherwise restricted to be performed without additional approval by the FFA signatories. A separate RMP for the portions of IR Sites 7 and 18 covered by the radionuclide ARIC, if prepared, will also set forth certain requirements or protocols that, if followed, will allow certain activities that are otherwise restricted to be performed without additional approval by the FFA signatories and CDPH.

The IC objectives and land use restrictions will be implemented through different legal mechanisms after conveyance of the property containing IR Sites 7 and 18 to a non-federal entity, as described in the next section.

4.2 LEGAL MECHANISMS FOLLOWING CONVEYANCE

Each transfer of fee title from the United States to a non-federal entity will include a description of the residual contamination on the property and the environmental use restrictions, expressly prohibiting activities inconsistent with the performance measure goals and objectives. Each deed will also contain a reservation of access to the property for the Navy, the FFA signatories, and CDPH within the ARIC for radionuclides, and their respective officials, agents, employees, contractors, and subcontractors for purposes consistent with the Navy IR Program or the FFA. The deed will contain appropriate provisions to ensure that the restrictions continue to run with the land and are enforceable by the Navy. The Navy will meet the statutory requirements of CERCLA Section (§) 120(h)(3) for any transfer of fee title. The property in IR Sites 7 and 18 is currently owned by the Navy and is not subject to a lease. The LUC objectives will be met by access control until the time of transfer.

The Navy has determined that it will rely on proprietary controls in the form of environmental restrictive covenants, as provided in the "Memorandum of Agreement between the United States Department of the Navy and the California Department of Toxic Substances Control" and attached covenant model (Navy and DTSC 2000) (the "Navy/DTSC MOA"). The following two proprietary legal mechanisms will incorporate and be relied upon to implement the IC objectives and land use restrictions when the property is conveyed to a non-federal entity and shall remain in effect until terminated as provided below in Section 5.1 (Item 11):

1. Restrictive covenants included in one or more Quitclaim Deeds from the Navy to the property recipient.

2. Restrictive covenants included in one or more Covenants to Restrict Use of Property entered into by the Navy, DTSC, and CDPH, as provided in the Navy/DTSC MOA and consistent with the substantive provisions of California Code of Regulations Title 22 § 67391.1.

The Covenant to Restrict Use of Property will incorporate the land use restrictions into environmental restrictive covenants that run with the land and that are enforceable by DTSC and

any other signatory state entity (such as CDPH) against future transferees and users. The Quitclaim Deed will include the identical land use and activity restrictions in environmental restrictive covenants that run with the land and that will be enforceable by the Navy against future transferees.

ICs will remain in place until remediation goals have been achieved and the ICs have been terminated as provided below in Section 5.1 (Item 11).

5.0 REMEDY IMPLEMENTATION ACTIONS

This section describes the responsibilities of the Navy and future property owners for implementing land use controls.

5.1 NAVY RESPONSIBILITIES

The Navy is responsible for implementing, maintaining, reporting on, and enforcing the land use controls described in Section 4.1. Although the Navy will later transfer these procedural responsibilities to the San Francisco Redevelopment Agency via an early transfer cooperative agreement (ETCA) or other agreement, the Navy will retain ultimate responsibility as provided in the future FFA amendment associated with the ETCA for remedy integrity. It is the Navy's intent to later transfer these procedural responsibilities to the San Francisco Redevelopment Agency. Agreement on the details of the transfer responsibilities will be subject of future negotiation. Should any IC objectives fail, the Navy will ensure that appropriate actions are taken to re-establish protectiveness of the remedy and may initiate legal action to either compel action by a third party or to recover the Navy's costs for mitigating any discovered actions inconsistent with selected restrictions.

The Navy will undertake the following IC implementation actions to ensure that the IC objectives and land use restrictions for IR Sites 7 and 18 are met and maintained:

1. **LUC RD Distribution**: Within 30 days of receiving approval of this LUC RD report from the FFA signatories and CDPH, the Navy will place the LUC RD report in the information repositories for HPS. A copy of the LUC RD report will also be sent to the following interested parties. Attachment A includes a table with mailing addresses for these entities.
    a. U.S. Environmental Protection Agency
    b. Cal/EPA Department of Toxic Substances Control
    c. San Francisco Bay Regional Water Quality Control Board
    d. City of San Francisco Redevelopment Agency
    e. California Department of Public Health

2. **Site Access**: Each deed will contain a reservation of access to the property for the Navy, the FFA signatories, and CDPH within the ARIC for radionuclides and their respective officials, agents, employees, contractors, and subcontractors for purposes consistent with the Navy IR Program or the FFA.

3. **Site Inspections**: The Navy will undertake annual site inspections to ensure that all IC objectives and land use restrictions are complied with as long as it owns the property. At the time of conveyance of the site, the Navy and DTSC will require, via appropriate provisions to be placed in the ETCA and/or the Navy's Quitclaim Deed of conveyance and DTSC's Covenant to Restrict Use of Property, that the landowner and subsequent transferees undertake continuing annual site inspections to ensure that all IC objectives and land use restrictions are complied with by all future users as provided in Section 5.2 (Item 1) below.

4. **Compliance Reporting**: Beginning upon approval of this LUC RD and continuing until the effective date of property conveyance, the Navy will provide to the other FFA signatories and CDPH an annual IC Compliance Monitoring Report and Certificate for IR Sites 7 and 18 consistent with the form attached to this report as Attachment B. The annual IC Compliance Monitoring Report will address, among other things, whether the use restrictions and controls were communicated in the deed, whether the owners and state and local agencies were notified of the use restrictions and controls affecting the property, whether use of the property has conformed with such restrictions and controls, and will evaluate the status of the ICs. In addition, should any deficiencies be found during the annual inspection, the Navy will provide the FFA signatories and CDPH with a separate written explanation to accompany the IC Compliance Certificate indicating the specific deficiencies found and what efforts or measures have been or will be taken to correct those deficiencies. Copies of the completed and signed IC Compliance Monitoring Report and Certificate will be sent to the FFA signatories and CDPH by certified mail, return receipt requested, annually. Upon conveyance of fee title for the site to a non-federal entity, the Navy will require, via appropriate provisions to be placed in its deed of conveyance, that the landowner(s) and subsequent transferees respond to IC violations as provided below in Section 5.2 and provide to the Navy and other FFA signatories an annual IC Compliance Monitoring Report and Certificate for IR Sites 7 and 18 consistent with the form attached hereto as Attachment B unless and until all ICs are terminated at the site. If the transferee fails to provide an annual compliance monitoring report as described above to the Navy, the Navy will notify the FFA signatories and CDPH as soon as practicable. If any of the FFA signatories or CDPH does not receive the annual monitoring report from the transferee, it will notify the Navy as soon as practicable. The Navy will ensure appropriate measures have been taken to verify the status of the ICs and that an annual compliance monitoring report is submitted to the FFA signatories and CDPH within 90 days after the report's due date.

5. **CERCLA 5-Year Reviews**: The Navy will conduct 5-year reviews of the remedy for IR Sites 7 and 18 as required by CERCLA § 121(c) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The 5-year review will evaluate implementation and compliance with the ICs to assess whether the remedy is or will be protective of human health and the environment in the future. The annual compliance monitoring reports prepared by the transferee will be used in preparation of the 5-year review reports to evaluate the effectiveness of the remedy.

6. **Notice of Planned Property Conveyance**: The Navy will provide notice to the FFA signatories and CDPH at least 6 months prior to any transfer or sale of IR Sites 7 and 18 by the Navy so that all FFA signatories and CDPH can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective ICs. If it is not possible for the facility to notify the FFA signatories and CDPH at least 6 months prior to any transfer or sale, then the facility will notify them as soon as possible but no later than 45 days prior to the transfer or sale of any property by the Navy subject to ICs. In addition to the land transfer notice and discussion provisions in this LUC RD report, the Navy further agrees to provide the FFA signatories and CDPH with similar notice, within the same time frames, as to federal-to-federal transfer of property. The Navy will provide a copy of the executed deed of conveyance to the FFA signatories and CDPH.

7. **Opportunity to Review the Text of Intended Deed Restrictions**: Prior to conveyance of the site, the FFA signatories and CDPH will be given reasonable opportunity to review and comment on the applicable language in the Quitclaim Deed and Covenant to Restrict Use of Property related to all ICs and associated rights of entry for the FFA signatories and CDPH for purposes of IC oversight and enforcement. The provisions in that deed or other enforceable documents will be consistent with the IC objectives in Section 4.1 of this LUC RD report.

8. **Notification should Actions that Interfere with IC Effectiveness be Discovered**: The Navy or transferee will notify the FFA signatories and CDPH as soon as practicable, but no longer than 10 working days after the Navy's or transferee's discovery of any activity that is inconsistent with the IC objectives or use restrictions or any other action that may interfere with the effectiveness of the ICs. The Navy or transferee will notify the FFA signatories and CDPH regarding how a breach will be addressed or has been addressed as soon as practicable, but no more than 10 working days after notification of the breach. This reporting requirement does not preclude the Navy from taking immediate action pursuant to its CERCLA authorities to prevent any actual or perceived risks to human health or the environment.

9. **IC Enforcement**: Any activity that is inconsistent with the IC objectives or use restrictions, or any other action that may interfere with the effectiveness of the ICs will be addressed by the Navy or designee as soon as practicable, but in no case will the process be initiated later than 60 days after the Navy becomes aware of the breach. If a violation of a land use restriction is identified or documented by the FFA signatories (or CDPH for ICs related to radionuclides within the ARIC for radionuclides), or in a transferee's or owner's annual IC compliance monitoring report, the entity identifying the violation will notify the others within 10 working days of identifying the violation. The FFA signatories and CDPH will then consult

to evaluate what, if any, action should be taken, who shall take the action, and when it shall be undertaken. These actions may range from informal resolution with the owner or violator of an IC provision as described in this LUC RD report, to the pursuit of legal remedies or enforcement action under the auspices of state property law or CERCLA. Alternatively, the Navy may choose to exercise its response authorities under CERCLA and seek cost recovery from the person or entity that violates a given IC objective or land use restriction. Should the Navy become aware that any future owner or user of the property has violated any IC requirement over which a local agency may have independent jurisdiction, the Navy will notify these agencies of the violation and work cooperatively with them to re-achieve owner or user compliance with the ICs.

10. **Modification of Restrictions in Quitclaim Deed and DTSC Covenant to Restrict Use of Property**: Modifications to the ICs may be required based on changes in site conditions (for example, reduction in area requiring institutional controls) during the expected duration for the ICs. When the Navy determines, with FFA signatory (and CDPH within the ARIC for radionuclides) concurrence, that modifications to the ICs are necessary, the IC modifications will be documented in accordance with procedures consistent with applicable laws and regulations. The Navy or future property owner shall be responsible for providing pertinent information on the IC modifications to the interested parties listed in Section 5.1 (Item 1). The Navy and FFA signatories shall determine whether a ROD amendment or explanation of significant differences, or some other procedure consistent with the NCP, is required to support the modification of the IC. The Navy shall not modify or terminate ICs, implementation actions, or modify land use without prior approval by the FFA signatories and CDPH. The Navy or transferee shall obtain prior concurrence before any anticipated action by the Navy or transferee that may disrupt the effectiveness of the ICs or any action that may alter or negate the need for ICs.

11. **Termination of ICs**: When the Navy determines, with FFA signatory (and CDPH within the ARIC for radionuclides) concurrence, that one or more of the ICs at IR Sites 7 and 18 is no longer needed for protection of human health and the environment because the remediation goals have been achieved, the Navy and DTSC shall provide to the current landowner of the property an appropriate release of the restriction (Navy for the deed and DTSC for the Covenant to Restrict Use of Property) in accordance with state law for recordation with the deed pertaining to the site. The Navy will also advise the interested parties listed in Item 1 of Section 5.1 of that action in a timely manner. Termination of ICs may be possible for some ICs (for example, ICs related to vapor intrusion). However, most ICs (such as those requiring protection of the soil cover) will continue in perpetuity to provide protection of human health and the environment.

12. **Survey Plat**: Prior to transfer, the Navy will survey the ARICs at IR Sites 7 and 18 to define the legal metes and bounds for inclusion in the property transfer documents. The Navy will forward copies of the survey to the FFA signatories and CDPH and will place a copy in the administrative record.

5.2 PROPERTY OWNER RESPONSIBILITIES

The Navy will include appropriate provisions in the ETCA—if there is an early transfer—and/or Quitclaim Deed or other enforceable documents pertaining to the conveyance of fee title to the site to a non-federal entity, that will cause the future property owners and successors to assume the following IC implementation responsibilities upon the Navy's conveyance of the property to ensure that the IC objectives and land use restrictions for IR Sites 7 and 18 are complied with after property transfer:

1. **Site Inspections**: The property owner will conduct annual physical inspections of the site to confirm continued compliance with all IC objectives and land use restrictions in the Quitclaim Deed and Covenant to Restrict Use of the Property unless and until all ICs at the site are terminated with approval of the FFA signatories and CDPH.

2. **Compliance Reporting**: The property owner will notify the FFA signatories and CDPH within 5 working days of the property owner's discovery of any actions inconsistent with selected restrictions and include in the notification a written explanation indicating the specific actions inconsistent with selected restrictions found and what efforts or measures have been or will be taken to correct those actions. The property owner will also provide the FFA signatories and CDPH with an annual compliance monitoring report and IC compliance certificate for IR Sites 7 and 18 consistent with the form attached to this report as Attachment B unless and until all ICs are terminated at the site. In addition, should any actions inconsistent with selected restrictions be discovered during the annual site inspection, the property owner will provide to the FFA signatories and CDPH, along with the required IC compliance monitoring report certificate, a separate written explanation indicating the specific actions inconsistent with selected restrictions found and what efforts or measures have been or will be taken to correct those actions. The annual compliance monitoring report and certificate shall continue to be sent to the Navy, FFA signatories, and CDPH by certified mail, return receipt requested, annually unless the FFA signatories agree to change this requirement. The need to continue to provide such inspections and certifications on an annual basis will be re-evaluated every 5 years by the FFA signatories. Monitoring of the environmental use restrictions and controls will be conducted annually by the property owner. The monitoring results will be included in a separate report or as a section of another environmental report, if appropriate, and provided to EPA and the other FFA signatories. The annual monitoring reports will be used in preparation of the 5-year review to evaluate the effectiveness of the remedy. The annual monitoring report, submitted to the regulatory agencies by the property owner, will evaluate the status of the ICs and how any IC deficiencies or inconsistent uses have been addressed. The annual evaluation will address whether the use restrictions and controls referenced above were communicated in the deed(s), whether the owners and state and local agencies were notified of the use restrictions and controls affecting the property, and whether use of the property has conformed with such restrictions and controls.

3. **Monitoring Well Protection**: In order to preclude damage to the monitoring well network at IR Sites 7 and 18, the property owner and other entities responsible for planning and development of future projects within the area requiring ICs shall be required to add the well coordinates to their geographic information systems (GIS) databases and applicable maps and drawings. The future property owner, or other entity responsible for review and approval of civil plans prepared for projects within the area requiring institutional controls shall, identify any potential for the project to impact the IC effectiveness and coordinate with the Navy, FFA signatories, and CDPH to prevent interference with the IC effectiveness. The Navy and FFA signatories reserve the right to deny approval of projects within the area requiring institutional controls deemed to interfere with IC effectiveness. This process will be reviewed during the 5-year review to evaluate whether any changes need to be implemented.

4. **Notification of Proposed Changes in Land Use**: Prior to seeking approval from the FFA signatories (and CDPH within the ARIC for radionuclides), the recipient of the property must notify and obtain approval from the Navy of any proposals for a land use change at a site inconsistent with the use restrictions and assumptions described in the final amended ROD.

6.0 REVIEW OF DOCUMENTS

As described above, various documents may be prepared by the Navy or the transferee during the implementation of ICs. These documents will be subject to review and approval by the Navy and FFA signatories (and CDPH for the documents that may affect the ARIC for radionuclides).

Draft documents will be subject to a review period of 45 days. Reviewing parties may request extension of the review period for up to an additional 45 days from the party submitting the document. The party submitting the document will have 45 days to revise the document to address the comments received.

Draft final documents will be subject to a review period of 30 days. Reviewing parties may request extension of the review period for up to an additional 30 days from the party submitting the document. The party submitting the document will have 45 days to revise the document to address the comments received. Draft final documents will be considered to be final if no comments are received within the 30-day comment period.

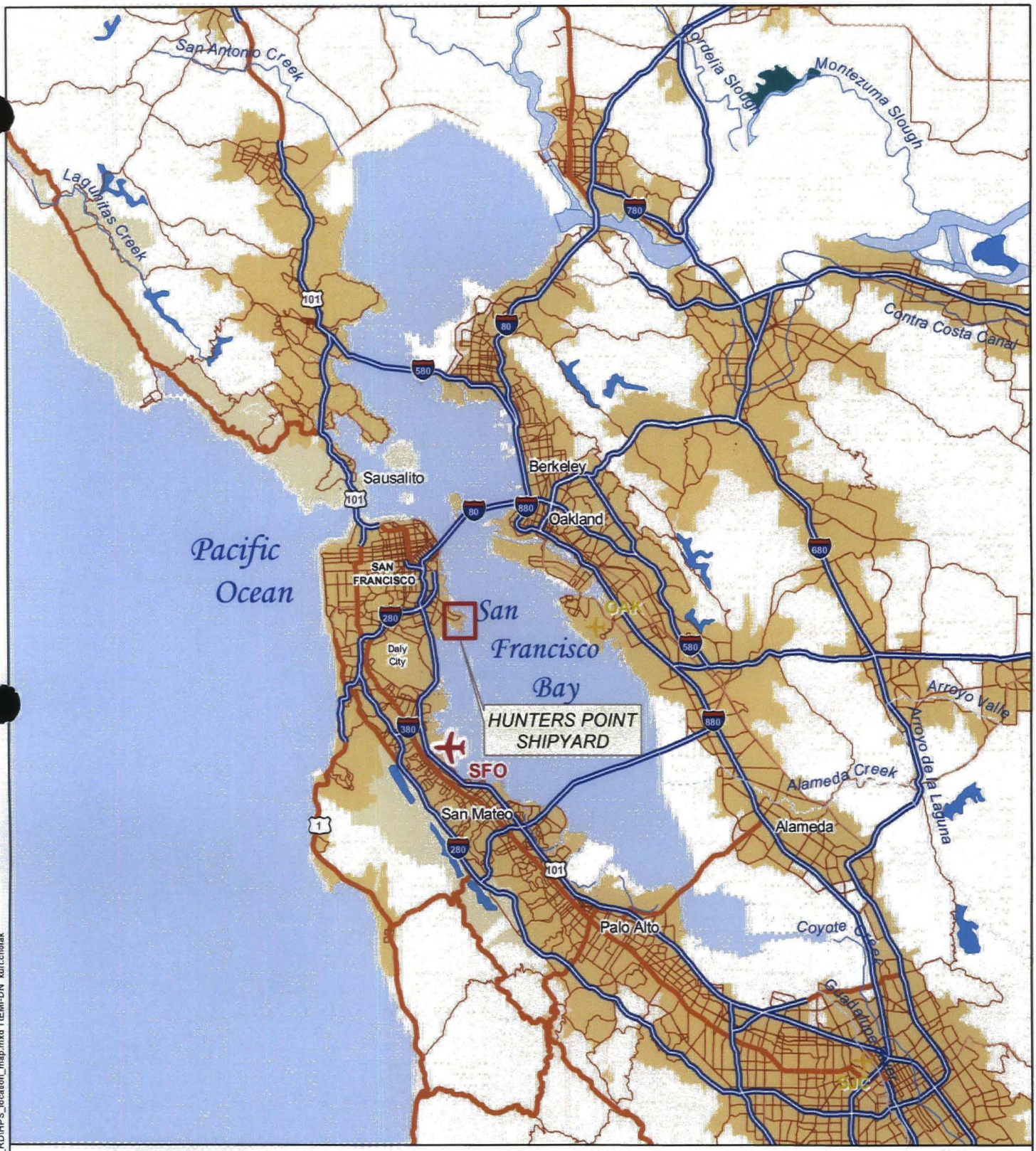
All parties preparing or reviewing documents will adhere to the scheduled document preparation and review times to the maximum extent practicable.

7.0 REFERENCES

ChaduxTt. 2009. "Final Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California." January 26.

Department of the Navy and California Department of Toxic Substances Control. 2000. "Memorandum of Agreement Between the United States Department of the Navy and the California Department of Toxic Substances Control." Use of model Covenant to Restrict Use of Property at installations being closed and transferred by the Department of the Navy.

FIGURES



Location Map

AREA OF DETAIL

N

5 2.5 0 5 Miles

ChaduxTt JV

Hunters Point Shipyard, San Francisco, California

Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 1
HUNTERS POINT SHIPYARD
LOCATION MAP

LUC RD for IR Sites 7 and 18

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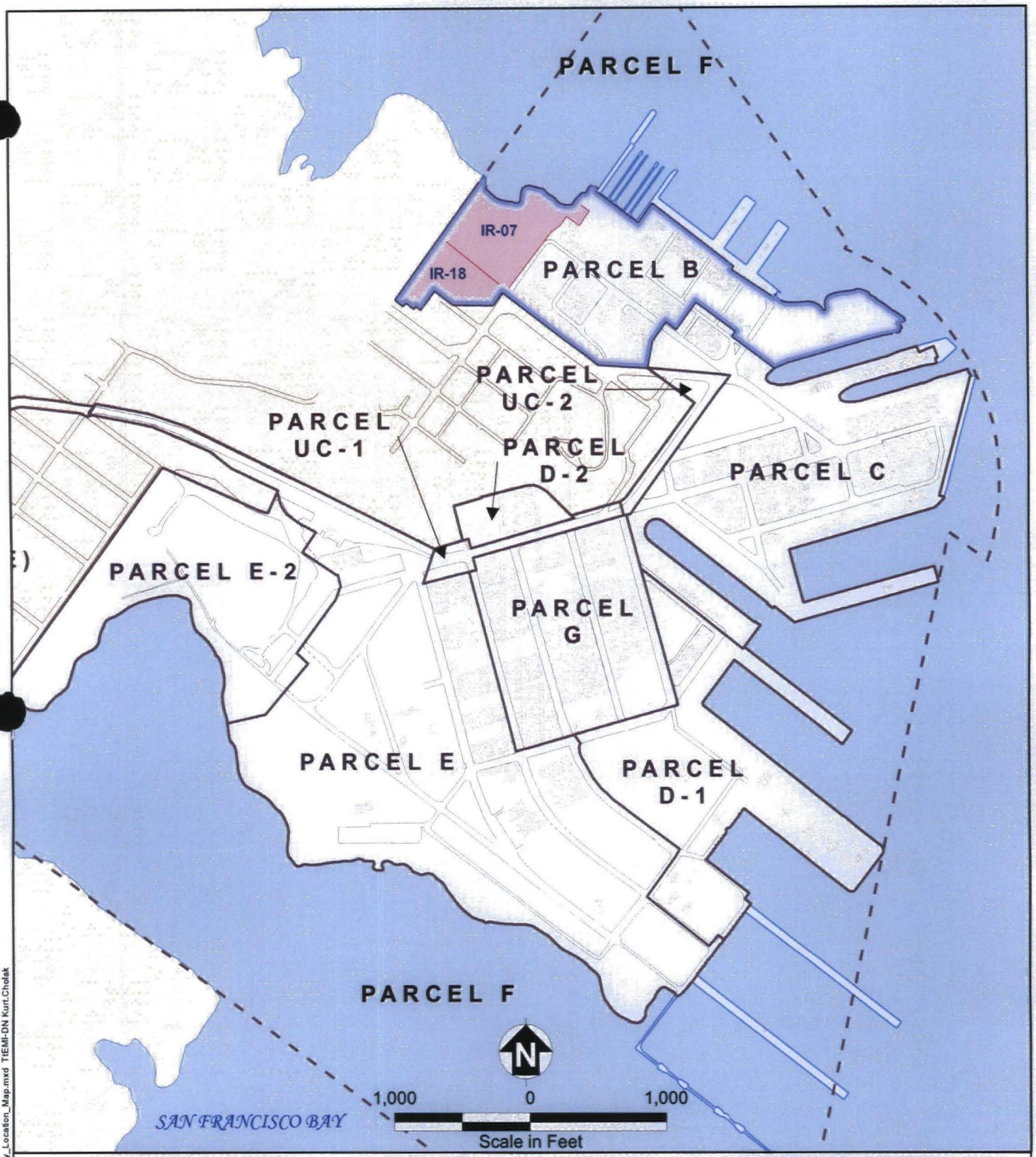
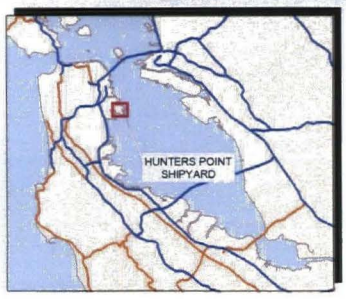




Location Map

- Installation Restoration Sites 7 and 18
- Parcel B Boundary
- Parcel Boundary
- Parcel F Boundary
- Building
- Non-Navy Property
- Road

ChaduxTt JV

Hunters Point Shipyard, San Francisco, California

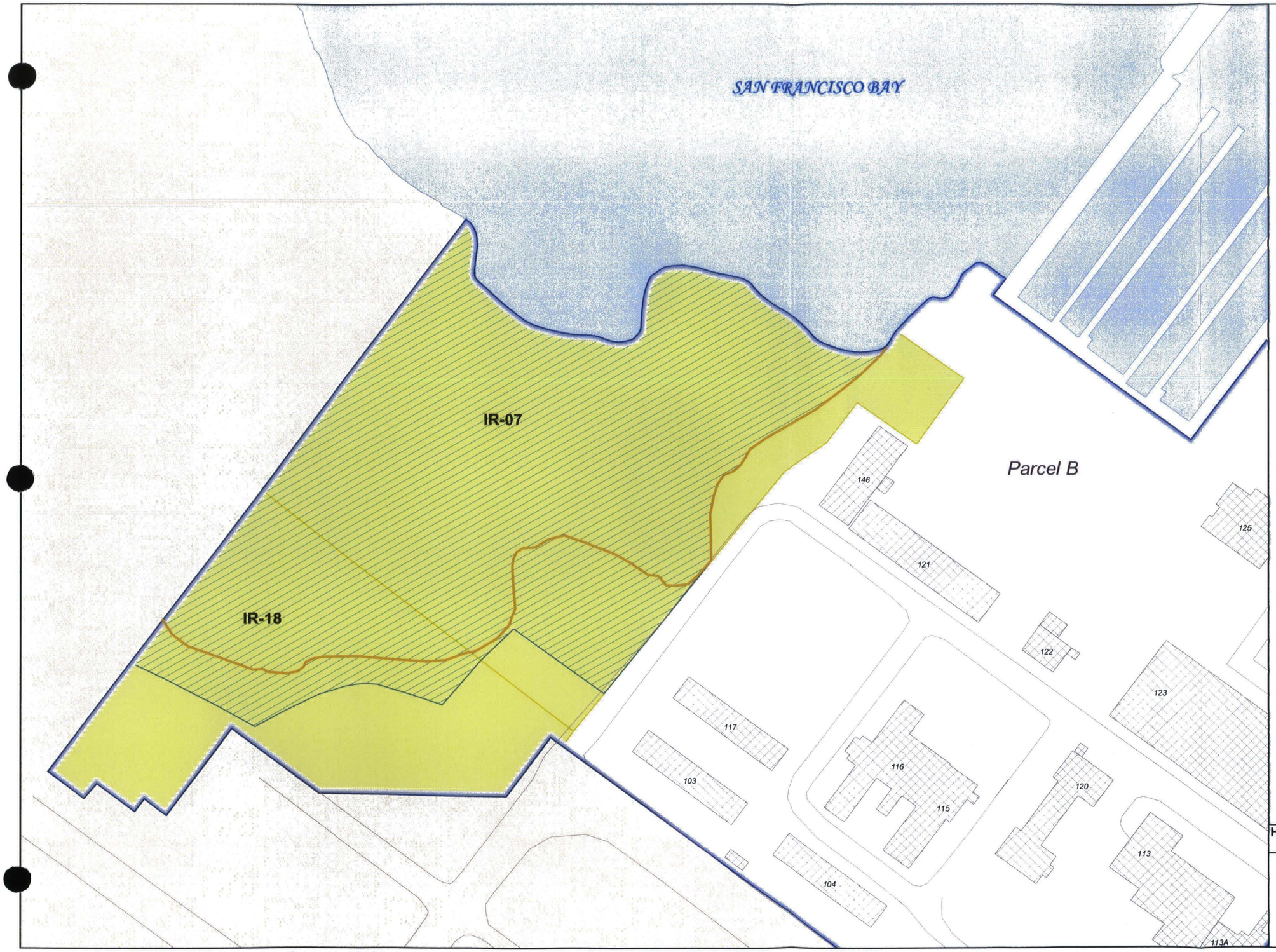
Department of the Navy, BRAC PMO West, San Diego, California

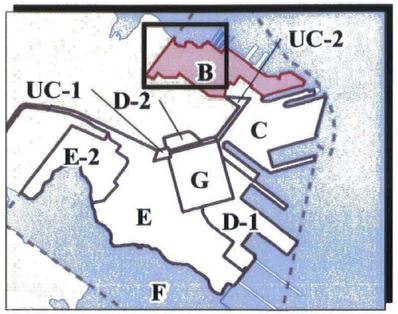
FIGURE 2

FACILITY LOCATION MAP

LUC RD for IR Sites 7 and 18

05/18/2009 O:\H...ntProjects\LUC_RD\Facility_Location_Map.mxd TtEMI-DN Kurt.Cholak





Location Map

1946 Shoreline
Road
Area for Restrictions Related to Radionuclides
Area for All Other Restrictions
Parcel B Boundary
Other Parcel Boundary
122 Building
San Francisco Bay
Non-Navy Property

Note:

IR Installation Restoration

N

0 150 300

Scale in Feet

ChaduxTt JV
Consulting Engineers and Scientists

Hunters Point Shipyard, San Francisco, California

Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 3
AREA REQUIRING
INSTITUTIONAL CONTROLS

LUC RD for IR Sites 7 and 18

01/19/2009 O:\Hunters_Point\Projects\Parcel_B\LUC_RD\Fig3_InstitutionalControls.mxd TtEMI-DN Kurt.Cholak

ATTACHMENT A
INTERESTED PARTIES FOR LAND USE CONTROL REMEDIAL DESIGN REPORT

INTERESTED PARTIES FOR
IR SITES 7 AND 18 LAND USE CONTROL REMEDIAL DESIGN REPORT

U.S. Environmental Protection Agency, Region 9
75 Hawthorne Street
San Francisco, CA 94105-3901

Department of Toxic Substances Control
700 Heinz Avenue, Bldg. F, Suite 200
Berkeley, CA 94710-2737

San Francisco Bay Regional Water Quality Control Board
1515 Clay Street, Suite 1400
Oakland, CA 94612

Department of Public Health
Environmental Management Branch
1616 Capitol Ave., MS 7405
Sacramento, CA 95899-7377

City of San Francisco Redevelopment Agency
1 South Van Ness Avenue
San Francisco, CA 94103

ATTACHMENT B
IR SITES 7 AND 18 IC COMPLIANCE MONITORING REPORT AND IC COMPLIANCE CERTIFICATE

Attachment B

IR Sites 7 and 18 IC Compliance Monitoring Report
Parcel B, Hunters Point Shipyard, San Francisco, California

EPA I.D. CA1170090087

Property Owner: _____

This evaluation is the final Navy certification just prior to site conveyance (yes or no)

_____

If for an annual inspection, this evaluation covers the period from_____ through _____.

Certification Checklist

		In Compliance	Non-Compliance	See Comment
1)	No use of IR Sites 7 and 18 for a residence, including any mobile home or factory-built housing, constructed or installed for use as residential human habitation, a hospital for humans, a school for persons under 21 years of age, or a day care facility for children.[a]	☐	☐	☐
2)	No growing of vegetables or fruits in native soil for human consumption.	☐	☐	☐
3)	No groundwater use for any purpose (No evidence of tampering with existing wells or evidence of new wells)	☐	☐	☐
4)	No land-disturbing activity[a] (excavation; construction of roads, utilities, or structures; demolition of hardscape; movement of soil from below ground surface to the surface; or activity that facilitates movement of known contaminated groundwater)	☐	☐	☐
5)	No installation of new groundwater wells of any type[a].	☐	☐	☐
6)	No altering, disturbing, or removing components of the remedy including revetment, soil cover/cap, or groundwater monitoring wells and associated equipment[a].	☐	☐	☐
7)	No construction of enclosed structures[a].	☐	☐	☐
8)	No excavation beneath the demarcation layer in the area requiring institutional controls for radionuclides[a].	☐	☐	☐

9)	No installation of water lines, storm drains, or sanitary sewers above the demarcation layer in the area requiring institutional controls for radionuclides[a].	☐	☐	☐
10)	No removal or damage to security features (such as locks on monitoring wells, site fencing, or signs) or to survey monuments, monitoring equipment, piping or other appurtenances.	☐	☐	☐
11)	Notification provided for any unauthorized change in land use.	☐	☐	☐
12)	Any violations of these LUCs were reported within 10 business days of discovery and an explanation provided of those actions taken or to be taken was provided within 10 days of notification of discovery.	☐	☐	☐

I, the undersigned, hereby certify that the above-described land use restrictions have been complied with for the period noted. Alternately, any known deficiencies and completed or planned actions to address such deficiencies are described in the attached explanation of deficiencies.

_____ _____

Signature Date

Notes and Comments:

a These prohibited or restricted activities may be conducted provided that the requirements in the LUC RD are followed. If the inspector finds that a prohibited or restricted activity has occurred, the inspector shall check whether the activity was conducted in accordance with approved plans for that activity. Activities that are conducted in accordance with the approved plans will be considered "in compliance." Comments should be attached to the compliance checklist to describe how the requirements in the plans were adhered to. Activities that are not conducted in accordance with the approved plans would be considered "non-compliance."

Photographs, in addition to other notes and forms, to document the conditions certified in this checklist should be provided.

Send the completed form and all accompanying information by certified mail, return receipt requested, to the Navy, EPA, DTSC, Water Board, and CDPH each calendar year.

IR SITES 7 AND 18 ANNUAL IC COMPLIANCE CERTIFICATE

Parcel B
Hunters Point Shipyard, San Francisco, California
EPA I.D. CA1170090087

I _____ hereby certify that the attached IR Sites 7 and 18 Institutional Control Compliance Monitoring Report is complete and accurate. The requirements of LUC RD report Section 4.0 have been met. I further certify that a copy of this compliance certificate and the attached IR Sites 7 and 18 Institutional Control Compliance Monitoring Report have been sent to the following addressees:

_____
(Name and title)

ATTACHMENT C
LAND USE CONTROL CHECKLIST

LAND USE CONTROLS CHECKLIST

LUC RD, IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Item Number	Checklist Item	Location and Notes
10	Commitment by federal agency to address any situation that may interfere with the effectiveness of LUC	Section 5.1 (Item 8)
11	Commitment by federal agency to notify EPA of and address any situation that may interfere with the effectiveness of LUC	Section 5.1 (Item 8)
12	Notification to EPA and the state regarding land use changes	Section 5.2 (Item 4)
13	Notification regarding transfers and federal-to-federal transfers	Section 5.1 (Item 6)
14	Concurrence language	Section 5.1 (Item 10)
15	Monitoring and reporting language	Section 5.1 (Item 4)
16	Comprehensive list of LUCs	Section 4.1
17	For active facilities, a description of the internal procedures for implementing the LUCs (e.g., orders, instructions, Base Master Plan) and a commitment by the [federal agency] to notify EPA in advance of any changes to the internal procedures that would affect the LUCs.	Not applicable; not an active facility
18	Other property transfer language (deed restrictions, lease restrictions, and notices)	Section 4.2
19	Ensure that the document adequately describes pre-transfer LUCs, not just post-transfer LUCs	Section 4.2

Notes: Items 1 through 9 of the land use controls (LUC) checklist are included in the amended record of decision for Parcel B.

Reference:

ChaduxTt. 2009. "Final Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California." January 26.

Final

Preconstruction Operation and Maintenance Plan
Installation Restoration Sites 7 and 18
Parcel B

Hunters Point Shipyard
San Francisco, California

January 8, 2010

Prepared for:
Base Realignment and Closure
Program Management Office West
San Diego, California

Prepared by:
ChaduxTt, A Joint Venture of St. George Chadux Corp.
and Tetra Tech EM Inc.
1230 Columbia Street, Suite 1000
San Diego, California 92101

Prepared under:
Naval Facilities Engineering Command
Contract Number N62473-04-D-3213
Contract Task Order 0019

CHAD-3213-0019-0038

Final

Preconstruction Operation and Maintenance Plan
Installation Restoration Sites 7 and 18
Parcel B

Hunters Point Shipyard
San Francisco, California

Contract Number N62473-04-D-3213
Contract Task Order 0019

Prepared For:

DEPARTMENT OF THE NAVY

REVIEW AND APPROVAL

Project Manager: Timothy E. Mower Date: January 8, 2010
Tim Mower, ChaduxTt

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APPENDIX

A Inspection Item Checklists, Procedures, and Frequency

ATTACHMENTS

1 List of Manufacturers Cut Sheets

2 Design Drawings

3 Repair and Maintenance Specifications

FIGURES

1 Hunters Point Shipyard Location Map

2 Facility Location Map

3 Site Location and Design Overview

4 Groundwater Monitoring Well and Methane Monitoring Probe Location Map

5 Cover Components

6 Proposed Cover Contours

7 Typical Revetment Cross Section

TABLES

1 Applicable or Relevant and Appropriate Requirements for Soil Cover and Revetment

2 Operation and Maintenance Oversight Personnel

3 Emergency Responses

ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or relevant and appropriate requirement
ARIC	Area requiring institutional controls
CDPH	California Department of Public Health
COC	Chemical of concern
DBR	Design basis report
DTSC	California Environmental Protection Agency Department of Toxic Substances Control
EPA	U.S. Environmental Protection Agency
FFA	Federal facility agreement
HHRA	Human health risk assessment
HPS	Hunters Point Shipyard
IR	Installation restoration
LUC	Land use control
msl	Mean sea level
O&M	Operation and maintenance
PCB	Polychlorinated biphenyl
RAMP	Remedial action monitoring plan
RD	Remedial design
ROD	Record of decision
SLERA	Screening-level ecological risk assessment
SVOC	Semivolatile organic compound
VOC	Volatile organic compound

EXECUTIVE SUMMARY

This operation and maintenance (O&M) plan describes the long-term maintenance and monitoring requirements for the soil cover and shoreline revetment at Installation Restoration (IR) Program Sites 7 and 18 in Parcel B at Hunters Point Shipyard in San Francisco, California. This report is intended to fulfill the substantive portions of the O&M requirements identified in the applicable or relevant and appropriate requirements for soil covers and the shoreline revetment in the amended record of decision (ROD) for Parcel B. This report includes:

- A description of inspection, maintenance, and repair of the soil cover and shoreline revetment at IR Sites 7 and 18
- A list of the likely manufacturers' cut sheets
- Design construction drawings and O&M related specifications
- A maintenance schedule
- Guidance for inspection of signs, drainage features, erosion control, final grade, and the condition of the soil cover and shoreline revetment
- Potential repair procedures that may be necessary during the life of the cover and revetment
- Reporting requirements

A list of the inspection items, inspection procedures, and inspection frequency is included as Appendix A. This appendix includes generalized repair procedures. Attachment 1 includes a list of the expected manufacturers' cut sheets for the materials used. A copy of the design drawings is included as Attachment 2. Applicable construction specifications for O&M activities have been included as Attachment 3. These appendices and attachments will be supplemented or replaced following the construction of the project based on the actual construction of the soil cover and revetment remedy and the materials and manufacturers used.

This O&M plan is one component of the overall remedial design (RD) for IR Sites 7 and 18. The other components include the design of a soil cover and shoreline revetment, a land use control RD, a remedial action monitoring plan for groundwater and methane, and an engineer's opinion of probable cost. These other components of the RD are also included in this binder with the O&M plan.

1.0 INTRODUCTION AND BACKGROUND

The U.S. Navy is installing a soil cover and shoreline revetment at Installation Restoration (IR) Program Sites 7 and 18 in Parcel B at Hunters Point Shipyard (HPS) in San Francisco, California, in accordance with the amended record of decision (ROD) for Parcel B (ChaduxTt 2009). The design basis report (DBR), also located in this binder, contains the details of the remedial design (RD). Inspection, maintenance, and monitoring of the cover and revetment are required and are the responsibility of the owner. The Navy is the current owner; however, the Navy plans to transfer IR Sites 7 and 18 to the City and County of San Francisco in the future. The details of inspection and maintenance required of the owner are provided in this operation and maintenance (O&M) plan.

Some details in this O&M plan may change after construction is completed. Consequently, this plan is considered the "preconstruction" O&M plan to highlight the fact that some items in the plan may change in the future. Likewise, changes to the O&M plan may be needed in the future to address changes in design standards or improved materials. In both cases, revisions to the O&M plan will be subject to review and approval by the federal facility agreement (FFA) signatories and the California Department of Public Health (CDPH) for the area requiring institutional controls (ARIC) for radionuclides. FFA signatories include the Department of the Navy, the U.S. Environmental Protection Agency (EPA), the California Environmental Protection Agency Department of Toxic Substances Control (DTSC), and the San Francisco Bay Regional Water Quality Control Board (Water Board). CDPH regulates activities related to remediation of radionuclides and, therefore, is also involved in oversight of actions at the portion of IR Sites 7 and 18 that is radiologically impacted.

1.1 SITE BACKGROUND

This report addresses IR Sites 7 and 18 in Parcel B at HPS in San Francisco, California (Figure 1). HPS includes about 866 acres (420 acres on land and 446 acres under water in San Francisco Bay). Parcel B includes about 54 acres on the northern side of HPS (Figure 2). IR Sites 7 and 18 include about 14 acres on the western side of Parcel B (Figure 3).

The majority of the land surface at IR Sites 7 and 18 slopes gently from southwest to northeast toward the bay. Ground surface elevations in the broad central area range from about 25 feet above mean sea level (msl) in the southwest to 10 feet above msl in the northeast where the land surface drops more sharply to the shoreline. The southwestern section of IR Site 18 includes a steep hillside where the ground surface elevation ranges from 25 to 55 feet above msl. The northeastern portion of IR Site 7 includes the shoreline with the bay and extends bayward to the mean lower low water elevation (about 3 feet below msl). There are no structures on IR Sites 7 and 18, and what little vegetation exists is located near the edges of the site.

Portions of the area that are now identified as IR Sites 7 and 18 were in existence when the property was purchased by the Navy in 1939. The Navy significantly expanded the original area during development of the shipyard to its present configuration. The expansion of the current location of IR Sites 7 and 18 was primarily through the use of engineered fill materials that were derived by quarrying the local bedrock. Some of the fill included construction debris. Although most of expansion of Parcel B had been completed before 1946, much of the land area of IR Sites 7 and 18 was created during the 1950s and 1960s.

1.2 NATURE AND EXTENT OF CONTAMINATION

Results of the previous investigations indicated IR Sites 7 and 18 pose a potential risk to human health and the environment based on current and reasonably anticipated future land and groundwater uses. The human health risk assessment (HHRA) identified the following chemicals of concern (COC) in soil as posing risk to human health: metals, volatile organic compounds (VOC), semivolatile organic compounds (SVOC), pesticides, polychlorinated biphenyls (PCB), and radionuclides. The HHRA did not identify risks to human health from exposure to groundwater at IR Sites 7 and 18.

The screening-level ecological risk assessment (SLERA) identified a potential risk to saltwater aquatic organisms from concentrations of copper and lead in groundwater at IR Sites 7 and 18 that could discharge into San Francisco Bay. However, as described in the remedial action monitoring plan (RAMP) (located in this binder), results from more recent samples do not indicate that copper or lead pose a risk to ecological receptors in the bay. Figure 4 shows the monitoring well locations over the site.

1.3 DESIGN COMPONENTS

The RD for IR Sites 7 and 18 includes features to address COCs in soil, sediment, and groundwater as well as land use controls (LUC) to limit access and protect the integrity of the remedy.

1.3.1 Soil Cover and Revetment

The RD for IR Sites 7 and 18 includes two primary components to protect human health and the environment from exposure to COCs in soil and shoreline sediment: a soil cover and a shoreline revetment. The extents of the remedy components are shown in Figure 3. The soil cover and the revetment will, together, cover all of IR Sites 7 and 18. The DBR presents the details of the RD for the soil cover and revetment.

The soil cover addresses the landward portion of IR Sites 7 and 18. The cover includes 2 feet of clean soil over areas that are not radiologically impacted (see Figure 3, 5, and 6). In areas that are radiologically impacted, the cover includes 3 feet of clean soil and a demarcation layer that will provide a visual warning against digging.

The revetment addresses the shoreline at IR Site 7 and is a facing of armor material (riprap) that is designed to protect the shoreline sediment and landward soil from erosion (see Figure 7). In addition to the armor facing, a geotextile filter fabric beneath the revetment will allow water to pass while preventing the migration of fine sediment. The revetment extends bayward to the boundary of IR Site 7; portions of the revetment will be submerged, depending on the tide stage, or buried in sediment.

1.3.2 Groundwater and Methane Monitoring

The remedy for groundwater at IR Sites 7 and 18 includes monitoring groundwater elevations and sampling groundwater for COCs at selected wells (see Figure 4). The remedy also includes monitoring methane probes in the area of the methane source removal. The RAMP presents the details of the proposed monitoring.

1.3.3 Land Use Controls

The amended ROD requires the implementation of land use restrictions to limit exposure of future landowners or users of the property to hazardous substances and to maintain the integrity of the remedy. The LUC RD report presents the details of these restrictions. Inspections are also required to ensure that LUCs are implemented effectively. Attachment B of the LUC RD report contains the checklist that applies to inspections related to LUCs. Any future changes to land use would result in revision of the O&M plan to account for them. The O&M contractor must consult the LUC RD for allowed and prohibited activities and land uses, both for itself and other users of the site.

1.4 REGULATORY FRAMEWORK

The applicable or relevant and appropriate requirements (ARAR) that apply to maintenance of the soil cover and shoreline revetment are identified in the amended ROD for Parcel B (ChaduxTt 2009). The general categories of requirements include:

- Maintain integrity of the final cover by repairing the cover to correct the effects of settling
- Maintain integrity of the final cover by preventing erosion from drainage (runon and runoff)
- Protect and maintain surveyed benchmarks.

Table 1 follows the text of the O&M plan and summarizes the ARARs related to the soil cover and revetment. The amended ROD (ChaduxTt 2009) contains detailed information on all the ARARs for the remedial action.

The effectiveness of operation and maintenance activities will be overseen by the FFA signatories (and CDPH for the ARIC for radionuclides). FFA signatories include the Navy, EPA, DTSC, and the Water Board. CDPH regulates activities related to remediation of radionuclides and, therefore, is also involved in oversight of actions at the portion of IR Sites 7 and 18 that is radiologically impacted. EPA is the lead oversight agency for the federal government. DTSC is the lead oversight agency for the State of California. Any additions or modifications to the O&M plan including the appendices and attachments must be approved by the FFA signatories (and CDPH for the ARIC for radionuclides).

2.0 INSPECTION, MAINTENANCE, AND REPAIR

Inspection, maintenance, and repair schedules and practices will follow the ARARs identified in the amended ROD for Parcel B (see summary in Table 1). A clear delineation of responsibilities is crucial to the success of O&M in cases where the owner may contract certain responsibilities for maintenance to either internal or external organizations. The owner may modify the inspection materials in this O&M plan or the appendices to customize for individual organizations or contractors that may be responsible for specific components of the remedy. For example, a checklist for inspection of monitoring wells for a contractor and a checklist for inspecting the soil cover for an internal department within the City and County of San Francisco. Overall, the Navy will be responsible for inspection, maintenance, and repair until IR Sites 7 and 18 are transferred to the City and County of San Francisco and the city will be responsible after transfer.

Recording the inspection through forms, note taking, and photographs is a necessary part of the inspection. An O&M logbook should be maintained and include field notes recorded during inspections. The list of inspection items, procedures, and frequency is included as Appendix A to this O&M plan which will be modified as necessary following construction and during O&M. Attachment 1 provides a list of the manufacturers' cut sheets, which will include technical information and inspection information specific to the material used for construction when inserted following construction. Attachment 2 provides a copy of the design drawings which will be replaced with record drawings following construction. Attachment 3 provides applicable construction specifications which should be followed when repairs to the remedy are needed beyond general maintenance tasks. Attachment 3 of this O&M plan should be updated with as-built information from construction when it becomes available. Materials selected in the actual construction of the revetment and the soil cover may differ slightly from the design, and the specifications of the O&M plan should be revised to reflect these changes, or if any changes are made during the O&M period.

Generalized repair procedures are included in Appendix A. Soil covers and revetments require minimal maintenance and vandalism and theft is anticipated to be the most significant long-term issue at the site. In cases where repairs to the soil cover or revetment are needed, the guidelines and specifications included in this O&M plan should be followed. The construction specifications from the design that pertain to potential O&M tasks have been included as Attachment 3. In cases where damages to the constructed remedy are being addressed, primarily the soil cover and the revetment, the repair should be completed by qualified contractors and under the supervision of a licensed professional engineer.

Following the completion of the construction of the project, record drawings will replace the design drawings included as Attachment 2. These drawing will include at least final elevations and extents of the remedy components and will include significant information necessary for maintaining the site in the same condition as it will be constructed. Additionally, the materials cut sheets from actual manufacturers and vendors of the materials ultimately used in the project will be included as contractors are selected and included as Attachment 1. The materials cut sheets provide information concerning repair and replacement, inspection frequencies, etc., and will be included for the vegetative cover, demarcation fabric, the demarcation warning tape, the revetment geotextile fabric, and the security fence and signage. This O&M plan should be

modified appropriately as the appropriate materials are selected and construction is completed. Any additions or modifications to the O&M plan including the appendices and attachments must be approved by the FFA signatories (and CDPH for the ARIC for radionuclides) as previously listed in Section 1.4.

Emergency response activities related to O&M of the site are summarized in Section 4.0 of this O&M plan.

O&M Personnel

It is essential that qualified personnel and contractors are used to perform O&M activities at the site to provide adequate long-term support for the remedy. Table 2 of this O&M plan summarizes general qualifications that should be followed for the supervisory personnel responsible for oversight of the O&M-related work at the site. These qualifications may change following the transfer of the site and should be adapted for the specific site conditions as they change over time.

2.1 INSPECTION, MAINTENANCE, AND REPAIR OF COVER AND REVETMENT

The following sections describe the procedures for inspection, maintenance, and repair for each component of the cover and revetment. The O&M plan will be revised when experience shows a deficiency in the identification, frequency, or adequacy of repair of inspected items. In general, any deficiencies that require repair will be corrected promptly to protect the integrity of the cover or revetment. In some cases (for examples, see subsections below), damaged areas may need to be secured to prevent access by the public while repairs are planned and implemented. The owner will evaluate the need for, and type of security appropriate in relation to the repairs needed.

Any repair to the soil cover and revetment must be approved by the FFA signatories (and CDPH within the ARIC for radionuclides) by submitting work plans.

A full inspection of the site should be conducted following an earthquake of magnitude 6.0 or greater within a 40-mile radius of the site. Based on the stability analysis competed during the design of the remedy, damages from earthquake shaking are anticipated to be negligible given the site slopes and the conditions at the site.

2.1.1 Signs

Signs are the primary means of informing the public of the potential hazards associated with the cover and revetment. Signs will be located around the site where appropriate. Refer to the attached design drawings provided as Attachment 2 of this O&M plan and construction specifications for the message and the construction of the sign. The sign locations are included in both Figure 6 and on the design drawings. The sign should read in English as follows in black capital letters on a yellow background as shown on the construction drawings:

CAUTION

POTENTIAL BURIED HAZARDOUS MATERIALS
NO GROUND DISTURBANCE
ALLOWED WITHOUT
APPROVAL
CONTACT (619) 532-0913

The signs must include a Spanish translation as shown in the construction drawings.

2.1.1.1 Inspection of Signs

Signs will be inspected quarterly for the first year and semiannually thereafter for presence, legibility, vandalism, or other inadequacies. The effectiveness of the signs in restricting access to the site will be evaluated. Damage to signs could result from weathering or vandalism. The locations of the signs along the perimeter of the property are included in Figure 6 and in the included design drawings.

2.1.1.2 Maintenance of Signs

Signs typically require no maintenance. However, the sign will be cleaned or replaced if legibility at a distance of 5 feet is impaired as a result of dirt or faded colors.

2.1.1.3 Repair of Signs

Replacement of signs is recommended in place of repair and will be carried out as necessary to restore the legibility of the signs. Refer to the design drawings and specifications included with this O&M plan for the wording and the construction of the sign.

2.1.2 Site Security Fencing

Fencing along the publically accessible boundaries of the site is intended to restrict access to the site and prevent damage. The effectiveness of the fence will need to be assessed based on inspections, and modifications may be necessary over time. Figure 6 and the design drawings, included as Attachment 2 of this O&M plan, shows the extents of the fence as designed and will be updated with record construction drawings when construction is completed.

2.1.2.1 Inspection of the Fence

The fence will be inspected quarterly for the first year and semiannually thereafter for damages both natural and human. These damages could include cut holes in the material, eroding soil from under the fence, digging under the fence, or natural corrosion and degradation of the materials. Inspection of the fence would include walking along the perimeter of the fence and assessing and recording damages.

2.1.2.2 *Maintenance of the Fence*

Fence typically requires little routine maintenance. Damage to the fence over time can be expected from vandalism and tampering. Promptly remove graffiti within the time frame set by the city. Remove blown trash or debris from along and lodged in fencing.

2.1.2.3 *Repair of the Fence*

Sections of the fence may need to be replaced over time and should be replaced using the same material from the same manufacturer when available and cost effective. The manufacturer's information and cut sheet will be included as an attachment to this O&M plan. Repair work should follow the construction specifications included with this O&M plan in Attachment 3.

2.1.3 Groundwater Monitoring Wells and Methane Monitoring Probes

The objectives of the groundwater monitoring well network are (1) to observe the potential migration of COCs into previously uncontaminated areas and potential migration toward San Francisco Bay, and (2) to identify the levels of radionuclides present in groundwater. Groundwater monitoring wells used for the measurement of groundwater elevations and collection of chemical samples are identified in the RAMP. Similarly, the objective of methane monitoring probes is to detect the potential presence of methane in the area of the methane source removal excavation at IR Site 7. Figure 4 shows the locations of groundwater monitoring wells and methane monitoring probes identified for monitoring in the RAMP. The O&M contractor must maintain communication with the property owner concerning detections of COCs in groundwater that exceed the remediation goals established in the amended ROD for Parcel B or soil gas monitoring detections for methane and adjust site activities accordingly.

2.1.3.1 *Inspection of Groundwater Monitoring Wells and Methane Monitoring Probes*

The groundwater monitoring wells and methane monitoring probes will be inspected during all sampling events and semiannually for damage. Damage to the locks, wells, and well labels could result from vandalism or weathering. Wells will be monitored for accumulation of silt and sand by measuring the total depth during sampling and comparing these depths with previous or original depths. The wells will be visually inspected for signs of grout or concrete stress or failure, and watertight locking caps will be inspected for cracked or torn rubber seals. Methane monitoring probes will be visually inspected for damage.

2.1.3.2 *Maintenance and Repair of Groundwater Monitoring Wells and Methane Monitoring Probes*

Any damage that may limit the effectiveness of the groundwater or methane monitoring network will be repaired or the well or probe replaced in a timely manner. If locks have rusted and do not function properly, they will be replaced. All maintenance of the groundwater monitoring well and methane monitoring probe system will be documented in a field log book or on maintenance forms. Any repair work should follow the construction specification included as Attachment 3 to this O&M plan.

2.1.4 Soil Cover

The soil cover is designed to prevent contact and release of the COCs in soil at the site. The remedy consists of either a 2-foot soil cover over the non-radiologically impacted area or a demarcation layer and 3-foot soil cover over the radiologically impacted area. Applicable O&M-related documentation for the soil cover components are included in Appendix A of this O&M plan and will be updated following construction of the project. The design components of the soil cover and cover contours are included as Figure 5 and 6 of this O&M plan. Additionally, a copy of the design drawings is included as Attachment 2 and construction specifications as Attachment 3.

Grading

The soil cover will be installed directly on the existing grade nearly maintaining current slopes. A demarcation layer also will be installed in the ARIC for radionuclides. A final survey will be conducted after installation to measure as-built elevations. The elevations of settlement monuments will be established during the survey. Little settlement of the cover is anticipated because the existing land at IR Sites 7 and 18 has been in place since the 1960s or earlier and the cover to be installed will be only 2 to 3 feet thick at most locations.

Drainage

Rainfall will run off as sheet flow over the cover surface. The primary objective of the cover is to prevent human contact with the underlying materials; consequently, prevention of infiltration is not a concern.

A drainage swale is located along the southwestern portion of the soil cover and is intended to divert storm water from draining onto the site as shown in Figure 6. The swale drains a small area and flow will be minimal even during very large storm events. Drainage features adjacent to the site should be inspected for proper function and condition and any deficiencies reported to their owner. Future development of the surrounding area could affect drainage to the site and should be addressed through revisions to the O&M plan if necessary.

Erosion

The vegetated surface of the cover will: (1) protect the surface of the cover from erosion by wind and water, (2) improve the stability of the cover slopes, (3) help ensure the integrity of the final cover, and (4) improve aesthetics.

An area is considered bare if healthy vegetation is not covering the soil. Bare spots shall not exceed 2 percent of the total cover area and 30 percent of any individual 100-square-foot area. These areas must be reseeded or planted according to the attached specification for seeding. Cutting or mowing vegetation must occur when it would promote a healthier stand of vegetation or when desired to prevent creation of wildlife habitat. Mowing of the site semiannually should be sufficient to maintain the health of the cover but the frequency may need to be altered depending on future use. Vegetation should not require irrigation once established because it is of drought-tolerant varieties. Loss of vegetation caused by lack of water is a trigger to consider establishment or re-establishment of more drought-tolerant plant species.

The following is the seed mix used in the design of the remedy which should be used for any additional reseeding that may be necessary during O&M as it has been selected specifically for the conditions at the IR 7 and 18 sites Additionally, the seeding specification has been included as Attachment 3 to this O&M plan.

SEED MIX

Scientific Name	Common Name	Pounds/Acre
Bromus carinatus	California Brome	25
Hordeum brachyantherum	Meadow Barley	10
Vulpia microstachys	Small Fescue	6
Trifolium wildenovii	Tomcat Clover	4
Eschscholzia californica	California Poppy	1.5

Species not included in the seed mix should be controlled to the greatest extent possible. Any species that grows to a height greater than the predominant grass species could have the potential for root depths of greater than 2 feet, which could breach the demarcation layer. Vegetation, especially tree species, that grows to a height greater than the predominant grasses must be removed from the site. Tree removal must be conducted in a manner to prevent exposing subsoil and an herbicide should be applied as necessary to prevent future growth.

2.1.4.1 Inspection of Soil Cover

A site walk will be conducted on a quarterly basis for the first year of O&M activities and semiannually thereafter, as well as after major storms to check for the formation of rills or gullies on the cover. The cover will also be inspected after earthquakes for settling, cracking, or other breaches. Refer to Appendix A for inspection tasks and procedures. Items to note during inspections include:

- Evidence of erosion
- Visible depressions
- Proper surface water drainage – swale not obstructed
- Cracks
- Settlement and subsidence
- Slope failure
- Vandalism
- Demarcation layer inspection – layer not exposed
- Evidence of burrowing pests
- Evidence of wildlife

The vegetation on the cover will be inspected for signs of stress, stunted growth, wilting, changes in color, and bare spots. Areas of significantly healthier or sickly growth will be noted, as well as the dominance of a particular plant species. Chronic deficiencies may require selecting and planting species better adapted to the environment.

The drainage swale on the southwestern portion of the cover is the only constructed drainage feature associated with the remedy. The swale should be inspected for efficient drainage and that the water course is free of obstructions. If there is evidence of erosion over the site or failure of the drainage swale, an inspection during a storm event may be necessary to isolate the cause of the problem.

2.1.4.2 Maintenance of Soil Cover

Vegetation on the cover will be maintained in a manner to minimize erosion from wind and water. The prescribed seeding over the site requires mowing semiannually, or as needed based on future use of the site.

2.1.4.3 Repair of Soil Cover

Deficiencies, damage, and failure of the final grade will be repaired and the cover restored to constructed conditions based on the record drawings. Temporary repairs will be made, if necessary, until permanent repairs can be scheduled. Damage to vegetation or insufficient stands will also be repaired in a timely manner. When damage includes loss of soil cover, the cover will be repaired to the design thickness. Cracks in the final cover will be sealed with similar soil. Erosion that results from heavy rainfall will be repaired. Temporary berms, ditches, and straw mulch will be used to minimize further erosion damage until site conditions permit re-establishment of the final cover and vegetation.

Areas where damage to the soil cover results in a breach in the demarcation layer the site will be secured to prevent access by the public. The owner will notify the FFA signatories and CDPH of such damage as soon as practicable, but not later than 24 hours after discovery. The soil cover will be repaired and the cover restored to design conditions as soon as practicable, but no later than 45 days after the owner becomes aware of the breach. Any repairs to the soil cover should follow the site drawings included as Attachment 2 and the construction specifications included as Attachment 3.

2.1.5 Revetment

The revetment protects the shoreline from eroding into the bay and prevents the release of COCs into the San Francisco Bay. The revetment is designed to be a sloped stone structure that prevents wave overtopping onto the cover and bank erosion. Figure 6 shows the extent of the revetment along the shore. A typical cross section of the revetment is included as Figure 7 of this O&M Plan and shows the revetment components. A set of the design drawings is included as Attachment 2. Applicable construction specifications are included as Attachment 3 which should be followed when repair work is necessary. Refer to Appendix A for inspection tasks and procedures.

2.1.5.1 Inspection of Revetment

The revetment will be inspected quarterly for the first year and semiannually thereafter and will include observations for settlement, vandalism, and displacement of the riprap. The toe of the revetment will be closely inspected at low tidal stages for any signs of undercutting. The crest of the structure should be inspected and the original elevation maintained. The filter

fabric underlying the structure should not be exposed and if exposed is a trigger for repair work to be initiated.

2.1.5.2 Maintenance of Revetment

The revetment is not expected to require major maintenance. Trash should be cleared from the face of the revetment and disposed of properly. Nuisance vegetation along the revetment is not expected to be a significant issue but should be removed if present.

2.1.5.3 Repair of Revetment

Any missing stones on the revetment face should be promptly replaced with similar size stones. Gaps caused by settlement should be filled with appropriate sized rocks. Areas of undercutting at the toe of the structure should be monitored and repaired when the integrity of the structure could be compromised. The toe should be submerged in sediment and recorded and monitored if not. Similar consideration should be given to the ends or the flanks of the structure.

Areas where damage to the revetment results in a breach in the filter layer the site will be secured to prevent access by the public. The owner will notify the FFA signatories and CDPH of such damage as soon as practicable, but not later than 24 hours after discovery. The revetment will be repaired to design conditions as soon as practicable, but no later than 45 days after the owner becomes aware of the breach. Any repairs to the revetment should follow the site drawings included as Attachment 2 and the construction specifications included as Attachment 3.

2.1.6 Radiological Considerations

Some maintenance activities (for example, replacement of a groundwater monitoring well or major repair work to the soil cover or revetment) within the ARIC for radionuclides may require excavation of native soil that was not screened for radioactivity during the construction of the soil cover. This unscreened, native soil is present at depths that are more than 2 feet below the demarcation layer, or 4 feet from the cover surface, and 3.5 feet from the revetment surface. Activities that will involve movement of soil from below the demarcation layer or the revetment to the surface will follow the soil screening, handling, health and safety, and disposal procedures described in a prepared task specific work plan, which will be subject to regulatory review. Procedures for excavation below the demarcation layer and revetment must also follow the requirements in the Land Use Control RD report.

3.0 REPORTING

An annual inspection report will be prepared to summarize the inspections for each year; this report will be forwarded for review and approval by the FFA signatories and CDPH. The annual inspection report will include, at a minimum, the results of the inspections and a summary of all repair and maintenance activities conducted. The report will be certified by a professional engineer registered in California. Annual inspection reports will support the on-going 5-year review reports that will be prepared under the Comprehensive Environmental Response, Compensation, and Liability Act.

Additional reporting may be necessary following significant repair of the cover or revetment and following inspections triggered by an earthquake or other natural event. Additional reporting requirements and procedures should be assessed following the selection of an O&M contractor.

4.0 EMERGENCY RESPONSE PLAN

This section describes the emergency response plan for the site in the event of potential emergencies, failure, or breakdown of the components of the remedy. The updated O&M plan and its emergency response plan will be maintained at a location designated for the site at all times.

4.1 POTENTIAL EMERGENCIES

Although the Navy and future owners will take action to reduce the potential for emergencies it is possible for events to occur at the site that cannot be prevented. This plan provides response procedures for the following occurrences:

- Vandalism
- Fires
- Earthquakes
- Floods
- Surface drainage problems
- Release of potentially contaminated soil

Equipment and materials required to mitigate the emergency may include portable berms, absorbency media or blankets, loaders and backhoes, clean fill soil, waste receptacles, cordon tape, sandbags, erosion control blankets or media, bulldozers, compactors, sand, chain-link fencing, bailing wire, and straw bales. These equipment and materials are commonly available commercial items. The O&M contractor must ensure that these items are available on an immediate basis when needed through prompt delivery or storage.

4.2 EMERGENCY RESPONSE PROCEDURES

Table 3 follows the text of this document and provides recommended responses for the above situations and occurrences. This plan is intended to address contingencies that are reasonably foreseeable, but will be amended when appropriate as follows:

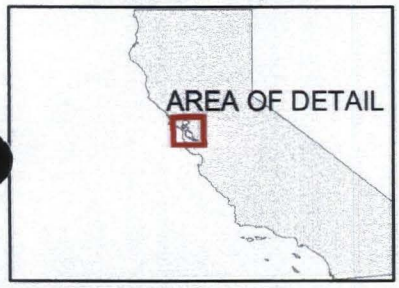
- Whenever a failure or release occurs and the O&M contractor did not account for an appropriate response.
- Whenever the use of the site changes in ways that are not addressed in the existing O&M contract.
- If the local enforcement agency notifies the operator in writing that the current emergency response plan is inadequate.

5.0 REFERENCE

ChaduxTt. 2009. "Final Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California." January 26.

FIGURES

Location Map



N

5 2.5 0 5 Miles

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FIGURE 1
HUNTERS POINT SHIPYARD
LOCATION MAP

O & M Plan for IR Sites 7 and 18

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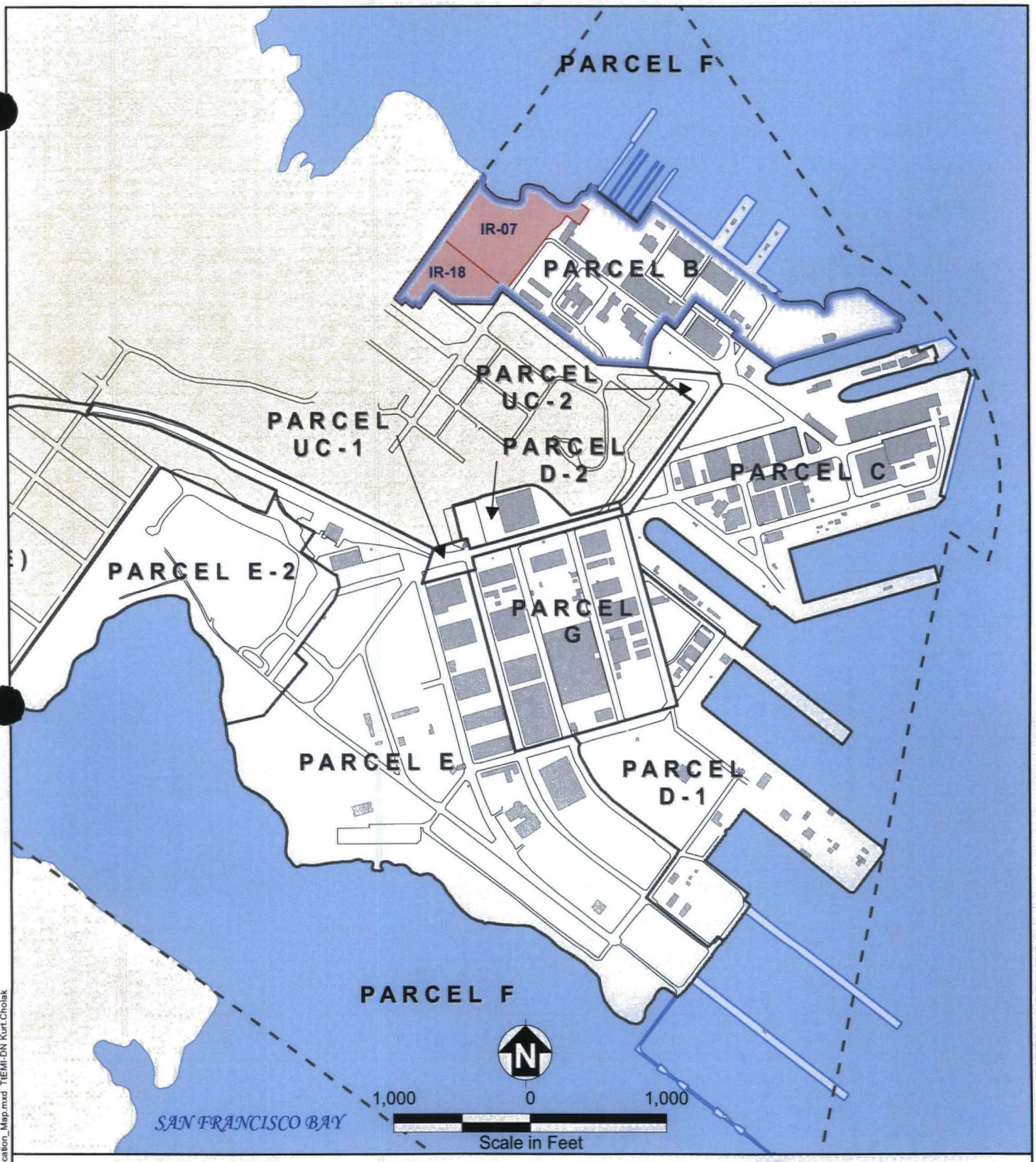

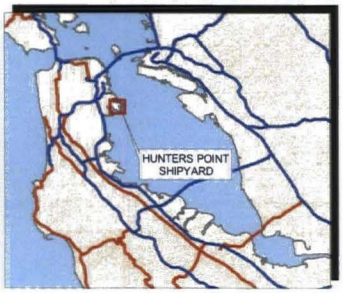

Location Map

- Installation Restoration Sites 7 and 18
- Parcel B Boundary
- Parcel Boundary
- Parcel F Boundary
- Building
- Non-Navy Property
- Road

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FIGURE 2

FACILITY LOCATION MAP

O & M Plan for IR Sites 7 and 18

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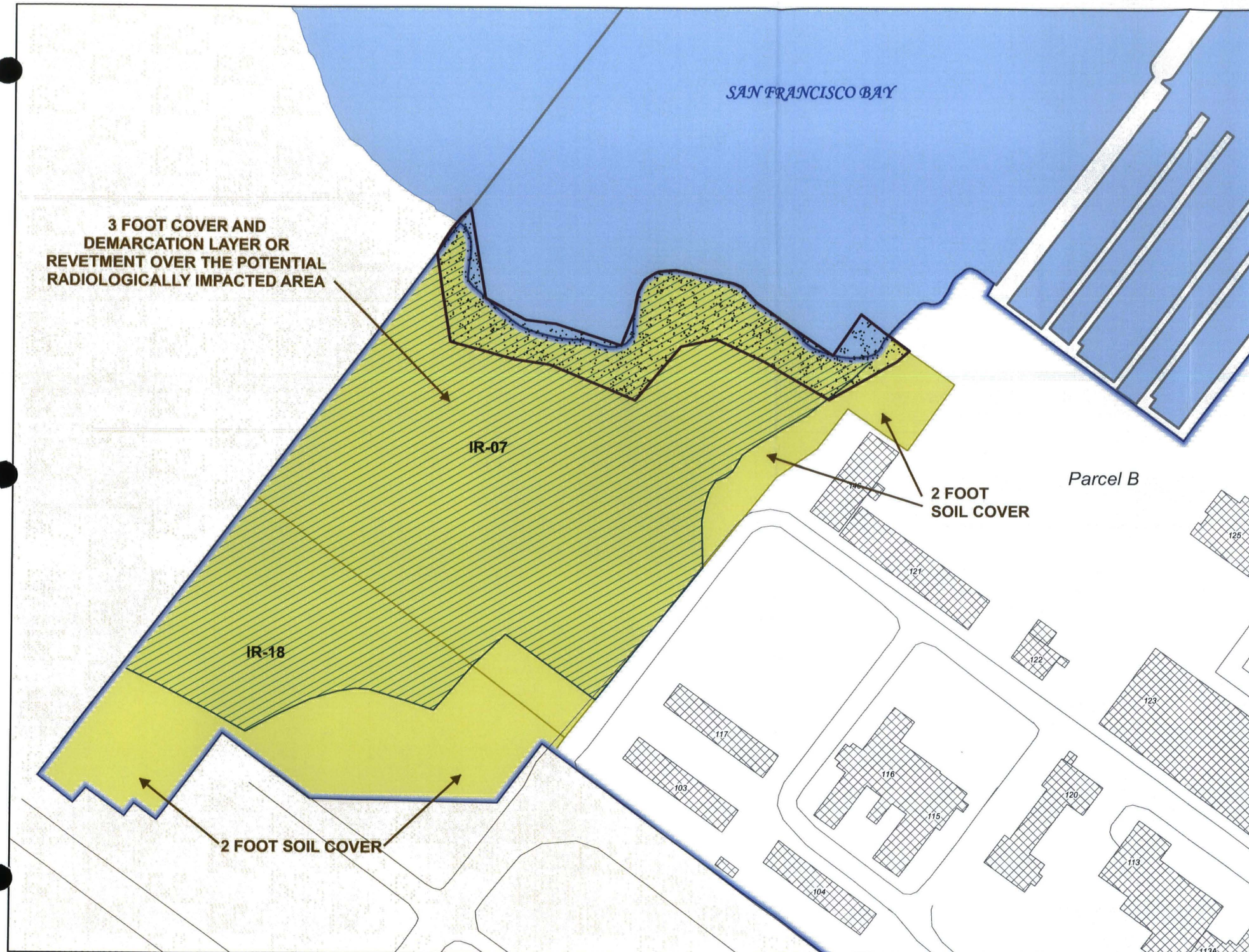

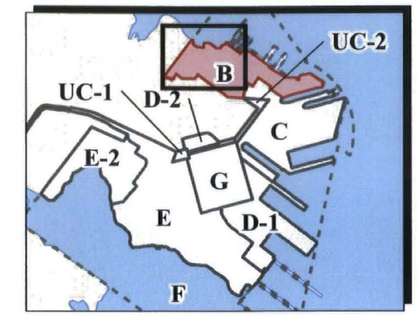

Location Map

- Road
- Revetment
- Potential Radiologically Impacted Area
- IR Sites 7 and 18
- Parcel B Boundary
- Other Parcel Boundary
- Building
- San Francisco Bay
- Non-Navy Property

Notes:

Refer to drawing C11 for details of the cover components. The cover in the potentially radiologically impacted area will include, from the top down, 2 feet of clean imported fill, a demarcation layer, and 1 foot of clean imported fill.

IR Installation Restoration

N

0 150 300

Scale in Feet

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Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 3
SITE LOCATION AND DESIGN OVERVIEW

O & M Plan for IR Sites 7 and 18

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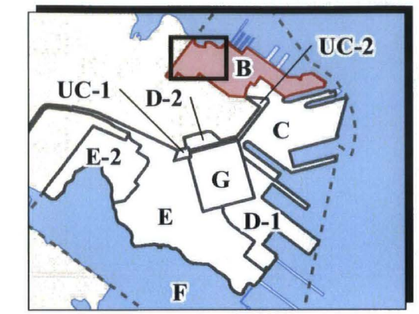

Location Map

- Well for Chemical Concentration Monitoring and for Groundwater Elevation Monitoring
- Well for Groundwater Elevation Monitoring Only
- Other Groundwater Monitoring Well
- Methane Monitoring Probe
- 1946 Shoreline
- Road
- Parcel B Boundary
- Other Parcel Boundary
- Building
- San Francisco Bay
- Non-Navy Property

Note:

IR Installation Restoration

0 100 200

Scale in Feet

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FIGURE 4
GROUNDWATER MONITORING WELL AND METHANE MONITORING PROBE LOCATION MAP

O & M Plan for IR Sites 7 and 18

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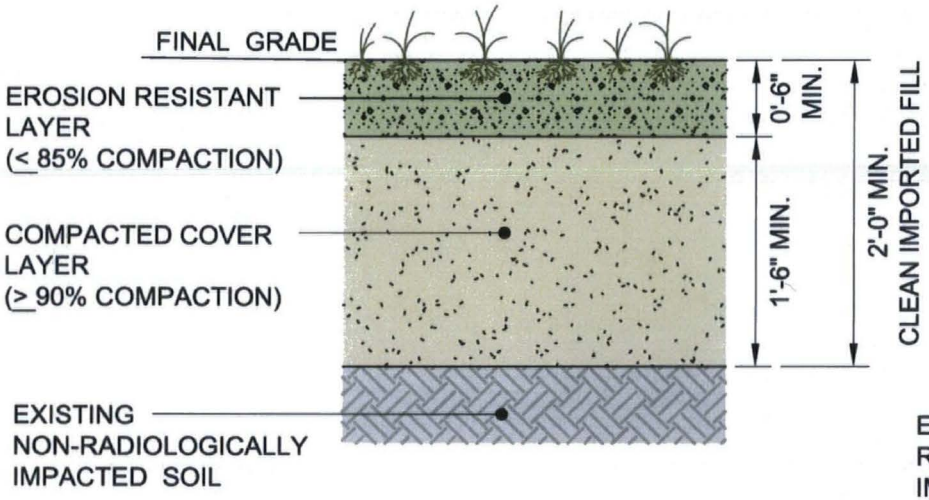
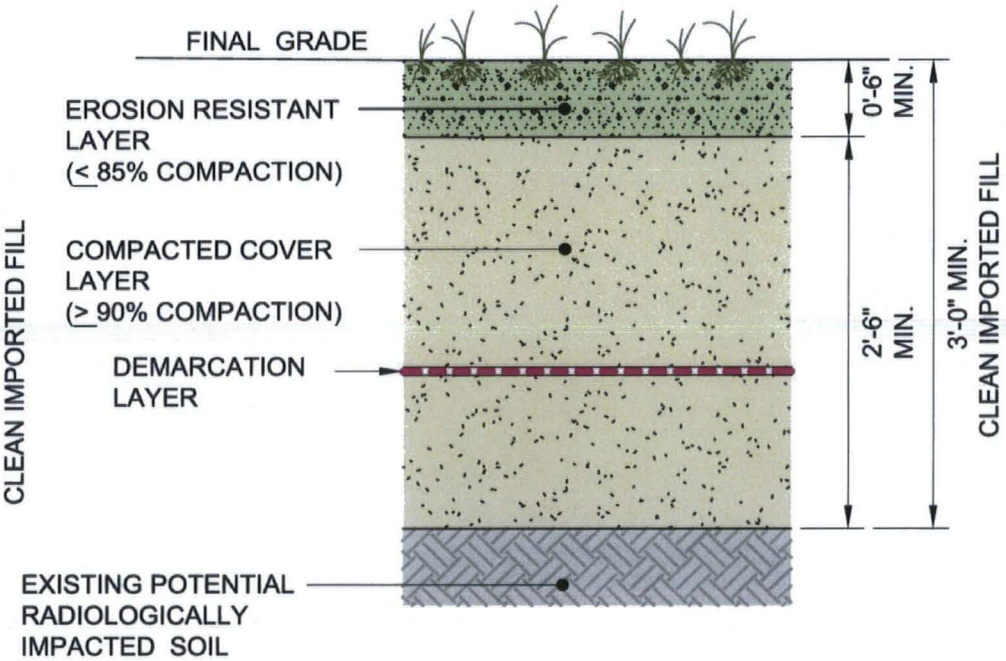


COVER OVER NON-RADIOLOGICALLY IMPACTED AREA (2 FOOT COVER)



COVER OVER POTENTIAL RADIOLOGICALLY IMPACTED AREA (3 FOOT COVER)

ChaduxTt JV

NOTE:
EXCAVATED NON-RADIOLOGICALLY IMPACTED SOIL TO BE PLACED UNDER COMPACTED COVER LAYER.

NOT TO SCALE

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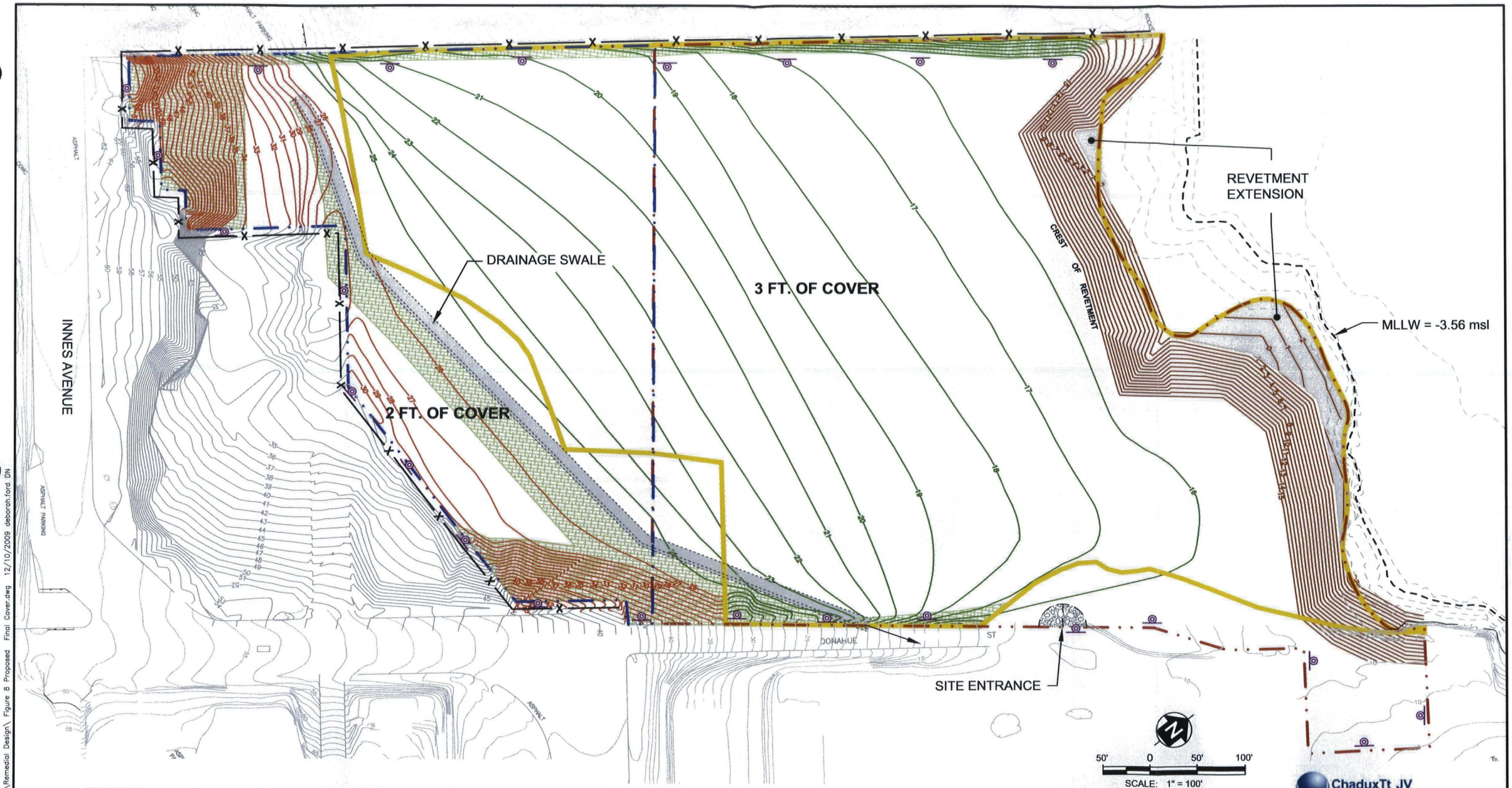
FIGURE 5
COVER COMPONENTS

O & M Plan for IR Sites 7 and 18



IR07 BOUNDARY
IR18 BOUNDARY
RESTRICTIONS RELATED TO RADIONUCLIDES
EXISTING CONTOUR
SIGN
PROPOSED CONTOUR 3 FT. COVER
PROPOSED CONTOUR 2 FT. COVER
PROPOSED OFFSHORE CONTOUR
DRAINAGE SWALE
PERMANENT FENCE
COMPOSITE TURF REINFORCED MATTING (CTRM)

SURVEY CONTROL DATUM

HORIZONTAL (BASIS OF BEARINGS): NAD27 ZONE-III (HUNTERS POINT WEST 1 PID HT0613) USFT.

VERTICAL (BENCH MARK): NGVD 29 LESS CORRECTION 7.76 FEET MSL

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Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 6
PROPOSED COVER CONTOURS

O & M Plan for IR Sites 7 and 18

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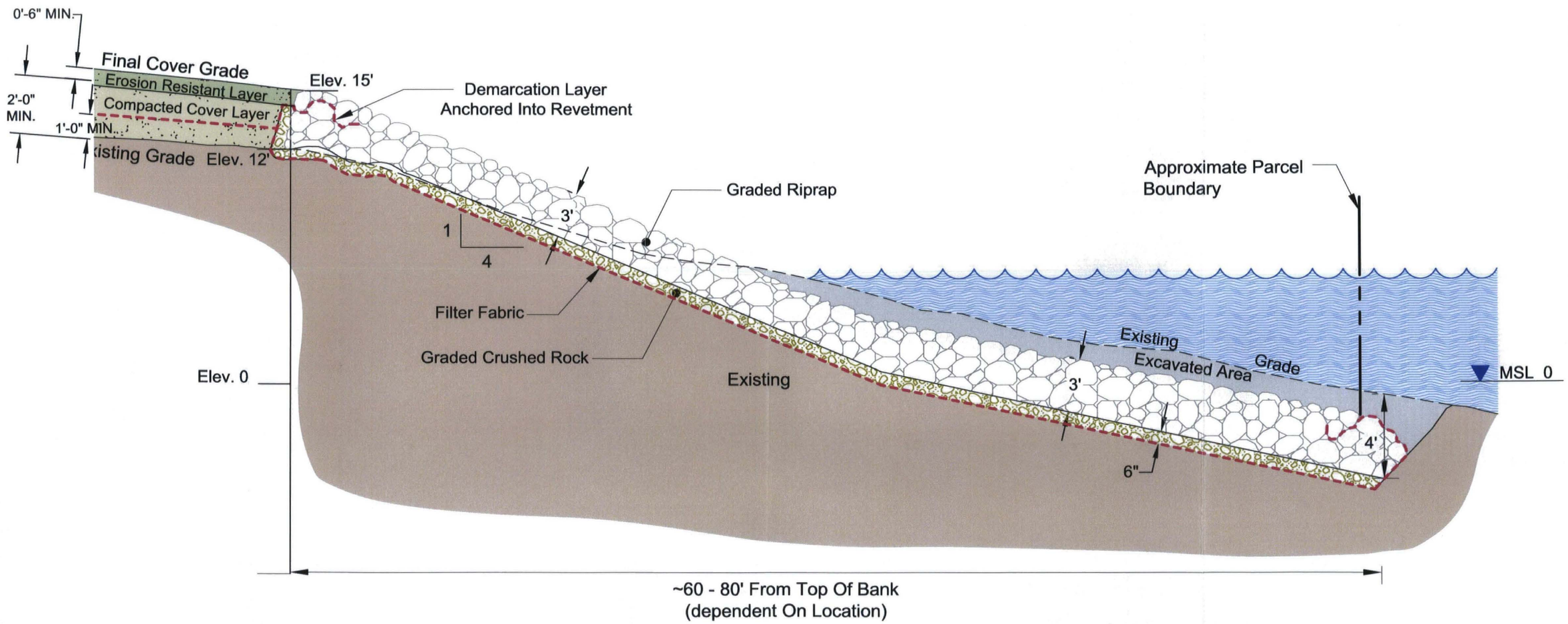


LEGEND

	RIPRAP		APPROXIMATE PARCEL BOUNDARY
	GRADED CRUSHED ROCK		APPROXIMATE EXISTING GRADE
	EXISTING MATERIAL	Elev.	ELEVATION
	SAN FRANCISCO BAY	MSL	MEAN SEA LEVEL
	EXCAVATED GRADE	MHHW	MEAN HIGHER HIGH WATER
	FILTER FABRIC	MLLW	MEAN LOWER LOW WATER

NOTES:

1. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.
2. FOLLOWING THE COMPLETION OF THE REVETMENT IT IS ANTICIPATED THAT DEPOSITION OF SEDIMENT WILL FILL IN THE EXCAVATED AREA ABOVE THE REVETMENT. THE AMOUNT OF DEPOSITION IS UNKNOWN.

NOT TO SCALE

ChaduxTt JV
Consulting Engineers and Scientists

Hunters Point Shipyard, San Francisco, California
Department of the Navy, BRAC PMO West, San Diego, California

FIGURE 7
TYPICAL REVETMENT CROSS SECTION

O & M Plan for IR Sites 7 and 18

R:\Navy\Hunters-Pt\Parcel B\r07_r08\Remedial Design\ Figure 9 Shoreline Revetment Wall.dwg 12/10/2009 deborah.ford DN

TABLES

TABLE 1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SOIL COVER AND REVETMENT

Operation and Maintenance Plan for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL – CONSTRUCTION OF SOIL COVER AND SHORELINE REVETMENT					
FEDERAL					
Resource Conservation and Recovery Act (42 U.S.C., Chapter 82, §§ 6901-6991[i])[a]					
Construct a shoreline revetment or soil cover.	The final cover must accommodate lateral and vertical shear forces generated by the maximum credible earthquake so that the integrity of the final cover is maintained.	RCRA hazardous waste management unit.	Cal. Code Regs. tit. 22, § 66264.310(a)(5)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Construct a shoreline revetment or soil cover.	Maintain the integrity and effectiveness of the final cover, including making repairs to the cover as necessary to correct the effects of settling, subsidence, erosion, or other events throughout the post-closure period. Prevent runon and runoff from eroding or otherwise damaging the final cover throughout the post-closure period.	RCRA hazardous waste management unit.	Cal Code Regs. tit. 22, § 66264.310(b)(1) and (4)	Relevant and appropriate	The Navy has determined that these requirements are potential ARARs for constructing a shoreline revetment and covers for the soil. These requirements are relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Construct a shoreline revetment or soil cover.	Protect and maintain surveyed benchmarks throughout the post-closure period.	RCRA hazardous waste management unit.	Cal. Code Regs. tit. 22, § 66264.310(b)(5)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Clean Water Act					
Construct a shoreline revetment or soil cover.	Owners and operators of construction activities must be in compliance with discharge standards.	Construction activities at least 1 acre in size.	Clean Water Act § 402 40 CFR § 122.44(k)(2) and (4)	Applicable	The Navy anticipates disturbing more than 1 acre in the alternatives that involve excavation and off-site disposal of soil and constructing soil covers. The Navy will use the requirements of state general storm water discharge permit, Order 99-08-DWQ, as TBCs for complying with the storm water discharge requirements under the Clean Water Act.

TABLE 1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SOIL COVER AND REVETMENT (CONTINUED)
Operation and Maintenance Plan for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL – CONSTRUCTION OF SOIL COVER AND SHORELINE REVETMENT (Continued)					
FEDERAL (Continued)					
Clean Air Act					
Construct a shoreline revetment or soil cover.	Prohibits emission equal or greater to 20 percent opacity.	Emission from a source.	BAAQMD Rule 6-302	Applicable	This requirement is applicable to excavation.
STATE					
State Water Resources Control Board					
Construct a shoreline revetment or soil cover.	Alternatives to construction or prescriptive standards contained in the SWRCB-promulgated regulations of this subdivision may be considered.	Waste management unit. Cal. Code Regs. tit. 27 requirements are only applicable for waste discharged after 18 July 1997 unless otherwise noted.	Cal. Code Regs. tit. 27 § 20080(b)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
State Water Resources Control Board[a]					
Construct a shoreline revetment or soil cover.	Actions taken by or at the direction of public agencies to clean up or abate conditions of pollution or nuisance resulting from unintentional or unauthorized releases of waste or pollutants to the environment; provided that wastes, pollutants, or contaminated materials removed from the immediate place of release shall be discharged according to the SWRCB-promulgated sections of Article 2, Subchapter 2, Chapter 3, Subdivision 1 of this division (§ 20200 et seq.); and further provided that remedial actions intended to contain the wastes at the place of release shall implement applicable SWRCB-promulgated provisions of this division to the extent feasible.	Action taken by or at the direction of a public agency to cleanup release of pollutant.	Cal. Code Regs. tit. 27, § 20090(d)	Relevant and appropriate	This requirement is a potential ARAR for the Navy's response actions.

TABLE 1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SOIL COVER AND REVETMENT (CONTINUED)
Operation and Maintenance Plan for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL – CONSTRUCTION OF SOIL COVER AND SHORELINE REVETMENT (Continued)					
STATE (Continued)					
State Water Resources Control Board[a] (Continued)					
Construct a shoreline revetment or soil cover.	Closed units shall be provided with at least two permanent monuments installed by a licensed land surveyor or a registered civil engineer, from which the location and elevation of containment structures can be determined throughout the post-closure maintenance period.	Waste management unit.	Cal. Code Regs. tit. 27 § 20950(d)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Constructing a shoreline revetment and soil covers.	In spite of differential settlement, the final cover of closed landfills (including waste piles and surface impoundments closed as landfills) shall be designed, graded, and maintained to prevent ponding and to prevent soil erosion caused by high run-off velocities. All portions of the final cover shall have a slope of at least three percent unless Water Board allows portions of the final cover to be built with slopes of less than three percent when the discharger proposes an effective system for diverting surface drainage from laterally adjacent areas and preventing ponding in the allowed flatter portion. The final grading design shall be designed and approved by a registered civil engineer or certified engineering geologist taking into consideration pertinent natural and constructed topographic features (including any related to the proposed post-closure land use), and climate.	Waste management unit.	Cal. Code Regs. tit. 27, § 21090(b)(1)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.

TABLE 1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SOIL COVER AND REVETMENT (CONTINUED)
Operation and Maintenance Plan for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL – CONSTRUCTION OF SOIL COVER AND SHORELINE REVETMENT (Continued)					
STATE (Continued)					
State Water Resources Control Board[a] (Continued)					
Constructing a shoreline revetment and soil covers.	Throughout post-closure maintenance period, the discharger shall prevent erosion and related damage of the final cover caused by drainage.	Waste management unit.	Cal. Code Regs. tit. 27, § 21090(c)(4)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Constructing a shoreline revetment and soil covers.	For a closed landfill, when all closure activities are complete for the unit, the discharger shall conduct an aerial photographic survey, or alternative survey under (e)(3), of the closed portions of the unit and of its immediate surrounding area, including at least the surveying monuments [of § 20950(d)]. The data obtained shall be used to produce a topographic map of the site at a scale and contour interval sufficient to depict the as-closed topography of each portion of the unit, and to allow the early identification of any differential settlement. The map produced pursuant to this paragraph shall act as a baseline against which to measure the total settlement, through time, of all portions of the final cover since the date when that landfill, or portion thereof, was closed.	Waste management unit.	Cal. Code Regs. tit. 27, § 21090(e)(1) and (3)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.

TABLE 1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SOIL COVER AND REVETMENT (CONTINUED)
Operation and Maintenance Plan for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL – CONSTRUCTION OF SOIL COVER AND SHORELINE REVETMENT (Continued)					
STATE (Continued)					
State Water Resources Control Board[a] (Continued)					
Constructing a shoreline revetment and soil covers.	The final cover shall function with minimum maintenance and shall be compatible with post-closure land use. Alternative final cover designs shall meet the performance requirements of paragraph (a). The local enforcement agency may require additional thickness, quality, and type of final cover depending on, but not limited to the future reuse of the site.	Waste management unit.	Cal. Code Regs. tit. 27, § 21140	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Constructing a shoreline revetment and soil covers.	The operator shall ensure the integrity of final slopes under both static and dynamic conditions to protect public health and safety and prevent damage to post-closure land uses, roads, structures, utilities, and to prevent exposure of waste.	Waste management unit.	Cal. Code Regs. tit. 27, §21145(a)	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.
Constructing a shoreline revetment and soil covers.	The drainage and erosion control system shall be designed and maintained to ensure integrity of post-closure land uses, roads, and structures; to prevent public contact with waste; to prevent safety hazards; and to prevent exposure of waste. Slopes not underlain by waste shall be stabilized to prevent soil erosion. Methods used to protect slopes and control erosion shall include, but are not limited to, terracing, contour furrows, and trenches.	Waste management unit.	Cal. Code Regs. tit. 27, § 21150	Relevant and appropriate	The Navy has determined that this regulation is a potential ARAR for constructing a shoreline revetment and covers for the soil. This regulation is relevant and appropriate because the revetment and covers will not be constructed as landfill waste management units. Instead, the revetment and covers will be constructed solely to prevent exposure to contaminants in the soil.

TABLE 1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SOIL COVER AND REVETMENT (CONTINUED)
Operation and Maintenance Plan for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL – CONSTRUCTION OF SOIL COVER AND SHORELINE REVETMENT (Continued)					
STATE (Continued)					
Air Resources Board[a]					
Excavating soil, constructing a shoreline revetment, and constructing soil covers.	No person shall engage in any construction or grading operation on property where the area to be disturbed is greater than 1 acre unless an asbestos dust mitigation plan for the operation has been submitted to and approved by the district before the start of any construction or grading; and the provisions of that dust mitigation plan are implemented at the beginning and maintained throughout the duration of the construction or grading. Further, upon completion of project, the disturbed areas must be stabilized using one of the following methods: (1) vegetative cover, (2) placement of at least 3 inches of non-asbestos-containing material; (3) paving; (4) any other measure deemed sufficient to prevent wind speeds of 10 miles per hour or greater from causing visible dust emissions.	Construction and grading activities in an ultramafic rock unit; or naturally occurring asbestos, serpentine, or ultramafic rock.	Cal. Code Regs. tit. 17, § 93105	Applicable	The Navy has determined that this regulation is a potential ARAR for maintained landscaping, excavating, constructing a shoreline revetment, and soil covers.
SOIL – CONSTRUCTION OF SHORELINE REVETMENT ONLY					
FEDERAL					
Resource Conservation and Recovery Act (42 U.S.C., Chapter 82, §§ 6901-6991[i])[a]					
Construct a shoreline revetment.	Alternative requirements that are protective of human health or the environment may replace design, operating, or closure standards for temporary tanks and container storage areas.	Temporary storage of RCRA hazardous waste.	Cal Code Regs. tit. 22, § 66264.553(b), (d), (e), and (f)	Applicable or relevant and appropriate	These requirements are applicable for the temporary storage of dredged material that meets the definition of RCRA hazardous waste or non-RCRA, state regulated hazardous waste under Cal. Code Regs. tit. 22, including sediment with TTLC wet weight concentrations of PCBs greater than or equal to 50 mg/kg. Concentrations of PCBs equal to or greater than 50 mg/kg have been measured in the sediment along the shoreline of IR-07. These requirements are relevant and appropriate for dredged material that does not meet the definition of RCRA hazardous waste.

TABLE 1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SOIL COVER AND REVETMENT (CONTINUED)
Operation and Maintenance Plan for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL – CONSTRUCTION OF SHORELINE REVETMENT ONLY (Continued)					
FEDERAL (Continued)					
Resource Conservation and Recovery Act (42 U.S.C., Chapter 82, §§ 6901-6991[i])[a] (Continued)					
Stockpile soil for off-site disposal.	Allows generators to accumulate solid remediation waste in an EPA-designated pile for storage only up to 2 years during remedial operations without triggering land disposal restrictions.	RCRA hazardous remediation waste temporarily stored in piles.	40 CFR § 264.554(d)(1)(i) through (ii), (d)(2), (e), (f), (h), (i), (j), and (k)	Applicable or relevant and appropriate	The Navy will temporarily stockpile soil in staging piles for off-site disposal. The Navy will characterize the soil, but does not anticipate that all soil will be RCRA hazardous waste, in which case the requirements will be relevant and appropriate. These requirements would be applicable to stockpiled soil that meets the definition of RCRA hazardous waste. Therefore, the Navy will identify these requirements as either applicable or relevant and appropriate, depending on the results of sampling and analysis for waste characterization.
Clean Water Act, as Amended (33 U.S.C., ch. 26, §§ 1251–1387)[a]					
Construct a shoreline revetment.	Action to prohibit discharge of dredged or fill material into waters of the United States without permit.	Waters of the United States.	33 U.S.C. § 1344 40 CFR § 230.10; 230.11; 230.20 through 230.25; 230.31; 230.32; 230.41; 230.42; 230.53	Applicable	The soil remedy includes construction of a shoreline revetment that will result in the discharge of fill material into a wetland sufficiently connected to the bay to be regulated under the Clean Water Act. This discharge will be in compliance with the substantive provisions of Nationwide General Permit 38. The Navy is not required to obtain a permit or submit notification that it will discharge in compliance with Nationwide General Permit 38; however, the Navy will use the substantive requirements of this permit as a means to comply with these potential ARARs. In addition, the Navy will mitigate the loss of the wetland.

TABLE 1: APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS FOR SOIL COVER AND REVETMENT (CONTINUED)

Operation and Maintenance Plan for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Action	Requirement	Prerequisite	Citation	ARAR Determination	Comments
SOIL – CONSTRUCTION OF SHORELINE REVETMENT ONLY (Continued)					
FEDERAL (Continued)					
Resource Conservation and Recovery Act (42 U.S.C., Chapter 82, §§ 6901-6991[i])[a]					
Construct a shoreline revetment.	U.S. Army Corps of Engineers requirements for permitting discharges of dredged material into waters of the United States.	Discharge of dredged material into waters of the United States.	33 CFR § 320.4 and 323	Applicable	The soil remedy includes construction of a shoreline revetment that will result in the discharge of fill material into a wetland sufficiently connected to the bay to be regulated under the Clean Water Act. This discharge will be in compliance with the substantive provisions of Nationwide General Permit 38. The Navy is not required to obtain a permit or submit notification that it will discharge in compliance with Nationwide General Permit 38; however, the Navy will use the substantive requirements of this permit as a means to comply with these potential ARARs. In addition, the Navy will mitigate the loss of the wetland.

Notes:

a Statutes and policies, and their citations, are provided as headings to identify general categories of potential ARARs for the convenience of the reader; listing the statutes and policies does not indicate that the Navy "accepts the entire statutes or policies as potential ARARs." Specific potential ARARs follow each general heading, and only substantive requirements of the specific citations are considered potential ARARs.

§ Section
§§ Sections
ARAR Applicable or relevant and appropriate requirement
BAAQMD Bay Area Air Quality Management District
Cal. Code Regs. *California Code of Regulations*
CFR *Code of Federal Regulations*
EPA U.S. Environmental Protection Agency
IR Installation Restoration
mg/kg Milligram per kilogram
PCB Polychlorinated biphenyl
RCRA Resource Conservation and Recovery Act
SWRCB State Water Resources Control Board
TBC To be considered
TTLC Total threshold limit concentration
U.S.C. *United States Code*

TABLE 2: OPERATION AND MAINTENANCE OVERSIGHT PERSONNEL
Operation and Maintenance Plan for IR Sites 7 and 18, Parcel B
Hunters Point Shipyard, San Francisco, California

General O&M Item	Qualifications
Maintain Updated O&M Plan	Authorized Property Owner Representative
Financial Responsibility	Authorized Property Owner Representative
Bookkeeping	Authorized Property Owner Representative
Institutional Controls	
Site Security	Property Owner and O&M Contractor
Signs and Gates	O&M Contractor
Site Access	O&M Contractor
Land Use	Authorized Property Owner Representative
Final Cover	
Vegetative Cover	CPESC or Civil P.E. (O&M Contractor)
Final Grading	CPESC or Civil P.E. (O&M Contractor)
Demarcation Layer	R.G. or Civil P.E. (O&M Contractor)
Methane Monitoring Probes	R.G. or Civil P.E. (O&M Contractor)
Groundwater Monitoring Wells	R.G. or Civil P.E. (O&M Contractor)
Drainage	CPESC or Civil P.E. (O&M Contractor)
Revetment	
Armoring Material	Civil P.E. (O&M Contractor)
Filter Layer	R.G. or Civil P.E. (O&M Contractor)
Final Grading	CPESC or Civil P.E. (O&M Contractor)
Scour and Erosion Impacts	CPESC or Civil P.E. (O&M Contractor)
Emergency Response	O&M Contractor
Wildlife	Biologist with California Species of Special Concern proficiency

Notes:

CPESC Certified Professional in Erosion and Sediment Control
O&M Operation and Maintenance
P.E. Professional Engineer
R.G. Registered Geologist

TABLE 3: EMERGENCY RESPONSES
Operation and Maintenance Plan for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Occurrence	Threat Posed	Response
Vandalism	Monitoring systems rendered inoperative Site security compromised Health or safety hazards, or both Damage to cover, revetment, or its components	1. Immediately conduct visual inspection of vandalism to assess damage and potential impacts. 2. In the event of a safety hazard, immediately cordon off the affected area. 3. Notify Police Department, property owner representative. 4. Notify the City of San Francisco if conditions dictate. 5. For damage or potential damage to other components that affect site integrity, security, or safety, arrange immediate temporary repairs (if necessary) and arrange repair or restoration within 2 weeks (weather and conditions permitting) to design conditions and in accordance with construction specifications. 6. Recommend preventive measures. 7. Notify Water Board, CIWMB, ROICC, DTSC, and CDPH. -- **Required Equipment**: erosion control blankets or media, bulldozer, loader, compactor, sand, clean fill, chain-link fencing, bailing wire, cordon tape.
Fire	Health and safety hazards Damage to monitoring systems Damage to cover or its components	1. Notify City of San Francisco Fire Department, property owner representative. 2. Immediately conduct visual inspection of area to assess damage and potential impact. 3. Immediately cordon off affected area. 4. For damage or potential damage to other components that affect site integrity, security, or safety, arrange immediate temporary repairs (if necessary) and arrange repair or restoration within 2 weeks (weather and conditions permitting) to design conditions and in accordance with construction specifications. 5. Notify Water Board, CIWMB, ROICC, and DPH. -- **Required Equipment**: erosion control blankets or media, silt fencing, straw bales, sandbags, bulldozer, loader, compactor, sand, clean fill, cordon tape.

TABLE 3: EMERGENCY RESPONSES (CONTINUED)
Operation and Maintenance Plan for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Occurrence	Threat Posed	Response
Earthquake, including liquefaction (Richter Magnitude 6.0 or greater within 40-mile radius)	Health and safety hazards Damage to monitoring systems Slope failure Damage to cover or its components	1. Immediately conduct visual inspection of area to assess damage and potential impact. 2. In the event of safety hazards, immediately cordon off area. 3. In the event of damage to monitoring systems, contact maintenance contractor to facilitate repairs. 4. Resurvey the area and increase the frequency of inspection and maintenance of final cover, drainage system, vegetative cover, and final grading to quarterly for a period of 1 year. 5. In the event of apparent slope failure, surface cracking, or similar damage, contact the contracted geotechnical consultant, as appropriate, to participate in an evaluation of problem areas within 48 hours of notice. If necessary, perform a geotechnical investigation of failure to develop a corrective action plan. 6. For damage or potential damage to other components that affect site integrity, security or safety, arrange immediate temporary repairs (if necessary) and arrange repair or restoration within 2 weeks (weather and conditions permitting) to design conditions in accordance with construction specifications. 7. Notify Water Board, CIWMB, ROICC, and CDPH. -- **Required Equipment**: erosion control blankets or media, bulldozer, loader, compactor, sand, clean fill, cordon tape.
Flooding	Excessive erosion of surface Slope failure Health and safety hazards Damage to cover or its components	1. Immediately conduct visual inspection of area to assess damage and potential impact. 2. In the event of safety hazard, immediately cordon off the affected area. 3. In the event of slope failure, contact contracted geotechnical consultant, as appropriate, to participate in an evaluation of problem area with 48 hours. If necessary, conduct a geotechnical investigation of the failure in order to develop a corrective action plan. 4. For damage or potential damage to components that affect site integrity, security, or safety, arrange repair or restoration within 2 weeks (weather and conditions permitting) to design conditions and in accordance with construction specifications. 5. Investigate preventive measures. 6. Notify Water Board, CIWMB, ROICC, and CDPH. -- **Required Equipment**: erosion control blankets or media, bulldozer, loader, compactor, sand, clean fill, cordon tape.

TABLE 3: EMERGENCY RESPONSES (CONTINUED)
Operation and Maintenance Plan for IR Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Occurrence	Threat Posed	Response
Release of potentially contaminated soils	Health and safety hazards	1. Immediately conduct visual inspection of area to assess damage and potential impact. 2. In the event of safety hazards, immediately cordon off area. 3. Notify appropriate property owner representative. 4. Identify the discharged material, if possible. If hazardous or toxic, contact a licensed company that handles hazardous or toxic waste disposal to remove the waste. 5. Use necessary heavy equipment to restore area. 6. Notify Water Board, CIWMB, ROICC, and CDPH. -- **Required Equipment:** portable berm, absorbency media or blankets, loader/backhoe, clean fill soil, high-solids-passing explosion-proof portable pump, Baker tank or waste receptacles, cordon tape, sandbags.

Notes:

CDPH	California Department of Public Health
CIWMB	California Integrated Waste Management Board
ROICC	Resident Officer in Charge of Construction
Water Board	San Francisco Bay Regional Water Quality Control Board

APPENDIX A
INSPECTION ITEM CHECKLISTS, PROCEDURES, AND FREQUENCY

INSPECTION SUMMARY AND FREQUENCY (AREA WITHIN ARIC FOR RADIONUCLIDES)

	Inspection Item	Frequency
General Site Conditions	Security of area not breached	Quarterly for the first year and semiannually thereafter
	Access and roads	
	Vandalism	
	Fencing intact	
Site Signage	Presence of signs	Quarterly for the first year and semiannually thereafter
	Legibility of wording	
	Vandalism	
	Inadequacy – structural issues, age, etc.	
Groundwater Monitoring Wells	Obstructions	During all sampling events and at least semiannually
	Security	
	Seals	
	Damage	
	Vandalism	
Methane Monitoring Probes	Obstructions	During all sampling events and at least semiannually
	Security	
	Seals	
	Damage	
	Vandalism	
Soil Cover	Drainage – on and off site	Quarterly for the first year and semiannually thereafter
	Prevention of erosion	
	Vegetation	
	Invasive deep-rooted species	
	Vandalism or excessive traffic	
	Burrowing pests	
	Depressions	
	Slope Failure	
Demarcation Layer	Not exposed	Quarterly for the first year and semiannually thereafter
	Degradation (investigation through excavation)	Every 5 to 10 years or as specified by the manufacturer
Revetment	Toe scour	Quarterly for the first year and semiannually thereafter
	Flank scour	
	Changes to the bay slope / evidence of erosion	
	Displacement or sinking of structure	
	Structural damage	
	Evidence of excessive overtopping by waves	
	Trash and vegetation removal	
	Filter fabric remains in place/ not exposed	
	Vandalism and theft	

Notes: Complete inspections should be conducted following earthquakes of magnitude 6.0 or greater within 40 miles of the site. Conduct inspections following hurricane-level storm events and adjust the trigger level based on site experience.

Mowing the vegetative cover is not part of the inspection but should be completed semiannually or as needed based on future site use.

INSPECTION SUMMARY AND FREQUENCY (AREA OUTSIDE ARIC FOR RADIONUCLIDES)

	Inspection Item	Frequency
General Site Conditions	Security of area not breached	At least semiannually
	Access and roads	
	Vandalism	
	Fencing intact	
Site Signage	Presence of signs	At least semiannually
	Legibility of wording	
	Vandalism	
	Inadequacy – structural issues, age, etc.	
Groundwater Monitoring Wells	Obstructions	During all sampling events and at least semiannually
	Security	
	Seals	
	Damage	
	Vandalism	
Soil Cover	Drainage – on and off site	Quarterly for the first year and semiannually thereafter
	Prevention of erosion	
	Vegetation	
	Vandalism or excessive traffic	
	Burrowing pests	
	Depressions	
	Slope Failure	

Notes: Complete inspections should be conducted following earthquakes of magnitude 6.0 or greater within 40 miles of the site. Conduct inspections following hurricane-level storm events and adjust the trigger level based on site experience.

Mowing the vegetative cover is not part of the inspection but should be completed semiannually or as needed based on future site use.

INSPECTION RECORD (PRELIMINARY)
IR SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA

Date and time of inspection:	**Inspector name and organization:**
Weather and tidal conditions – include details of most recent rain event:	
Reason for inspection (circle one): **Scheduled** **Emergency response**	**If inspection is uninitiated by a response explain condition:**

GENERAL SITE CONDITION (APPLIES TO ALL AREAS OF SITE)

ITEM	INSPECTION FREQUENCY	ACTION/ INSPECTION ITEM	COMMENTS — INCLUDING EXPLANATION IF NOT COMPLETED. INCLUDE ANY PHOTO DESCRIPTIONS
Security of area	Every inspection (at least semiannual)	Assess condition of fence – repair as necessary	
		Condition of locks and gates – repair and replace as necessary	
		Note signs of vandalism	
		Assess condition of access roads and gates	
		Note evidence of unauthorized access	
Trash removal	Every inspection (at least semiannual)	Remove trash and debris from area	
Site signage	Every inspection (at least semiannual	All signs in place and secure – repair and replace as necessary	
		Wording legible – replace and repair as necessary or document degradation	
		Note signs of vandalism	

Groundwater monitoring wells	During all sampling events and every inspection (at least semiannually)	Security (locks intact) – Repair and replace as necessary	
		Vandalism/signs of unauthorized access	
		Well box is free of obstructions	
		Well casing is free of obstruction	
		Seals not damaged	
Methane monitoring probes	During all sampling events and every inspection (at least semiannually)	Check security (locks intact or replace)	
		Note vandalism/signs of unauthorized access	
		Remove obstructions from well box	
		Well casing is free of obstruction	
		Seals not damaged – replace if necessary	
SOIL COVER			
ITEM	**INSPECTION FREQUENCY**	**ACTION/ INSPECTION ITEM**	**COMMENTS — INCLUDING EXPLANATION IF NOT COMPLETED. INCLUDE ANY PHOTO DESCRIPTIONS**
Vegetation	Quarterly 1st year and semiannually thereafter	Assessment of unhealthy/bare areas (not to exceed 2% of total area or >30% of any 100 ft^2 area.	
		Note evidence of burrowing pests	
		Assess adequacy of mowing and watering	
		Remove vegetative species that grow to heights greater than the predominant grasses	
		Note signs of excessive traffic	
		Note signs of unauthorized access	

Stormwater drainage	Quarterly 1st year and semiannually thereafter	Remove obstructions from drainage channels and swale	
		Note evidence of overflow	
		Note any change in condition of drainage contributing areas	
		Check for evidence of erosion along water flow path	
		Maintain erosion control measures – riprap, gravel, and composite turf reinforced matting	
Soil cover	Quarterly 1st year and semiannually thereafter	Note evidence of cover settlement	
		Evidence of slope failure along boundaries and slope transition areas	
		Evidence of cracking or soil movement	
Demarcation layer (ARIC for radionuclides only)	Quarterly 1st year and semiannually thereafter	Inspect over cover area	
		Inspect along boundary for exposure	
		Remove trees or other deeply rooted vegetation	
	Every 5 to 10 years or as specified by manufacturer	Degradation (investigation through excavation	

REVETMENT (Inspection to be conducted during low tide conditions)			
ITEM	INSPECTION FREQUENCY	ACTION/ INSPECTION ITEM	COMMENTS — INCLUDING EXPLANATION IF NOT COMPLETED. INCLUDE ANY PHOTO DESCRIPTIONS
General condition	Quarterly 1st year and semiannually thereafter	Remove trash and other debris from structure	
		Remove vegetation	
		Note presence of pests	
		Note evidence of excessive traffic	
		Note evidence of vandalism and theft of armoring	
Crest inspection	Quarterly 1st year and semiannually thereafter	Note evidence of settlement or movement	
		Note evidence of wave overtopping	
		Inspect transition from cover to revetment	
		Assess any areas of erosion	
		Inspect for proper placement of filter fabric	
Armoring inspection	Quarterly 1st year and semiannually thereafter	Note evidence of settlement or movement	
		Inspect for proper placement of filter fabric and filter layer	
Toe and flank inspection	Quarterly 1st year and semiannually thereafter	Note areas of scour and erosion	
		Inspect for proper placement of filter fabric and filter layer	
		Note changes in the bay slope	

INSPECTION RECORD (PRELIMINARY) (CONTINUED)
IR SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA

OTHER OBSERVATIONS:

FOLLOW-UP ACTIONS (Include area requiring further action):

Signature and Date _____

Note: Complete inspections should be conducted following earthquakes of magnitude 6.0 or greater. Inspections following hurricane-level storm events should be conducted and adjust the trigger level over time based on site experience.

Mowing the vegetative cover is not part of the inspection but should be completed semiannually or as needed based on future site use.

Inspection and Repair Procedures

The site will be visited quarterly for the first year and semiannually thereafter – or as necessary based on the results of the inspections. Some items will not be inspected during every site visit — for instance, subsurface geofabrics. At a minimum, the following materials should be brought to the site for each site visit and this list should be adapted over time based on previous inspections conducted by the contractor:

- Camera
- O&M plan
- LUC RD report
- Appropriate documentation materials including any inspection checklists
- Copies of appropriate maps and figures
- O&M logbook
- Telephone and contact list
- Common items requiring replacement (locks, well caps, well seals, and similar equipment)
- Previous inspection reports and photos of concern – as necessary

Inspection reports summarizing the findings of the inspections should be filed promptly with the property owner following the inspection and in cases where significant damage has been observed the property owner should be notified as soon as possible. The format of reporting documents, scheduling, and timing of this communication will be determined when an O&M contractor is identified.

Significant issues of vandalism and theft, especially when recurring, should be reported to police and may result in increased inspection frequency.

Basic repairs can be conducted on site at the time of inspections. The kinds of repairs may include but are not limited to: replacement of signage, replacement of monitoring well locks and protective caps, filling in of small gullies caused by water erosion, and replanting of small areas. Significant repairs may include but are not limited to: addition of revetment armoring material, filling of areas over the soil cover, repairs associated with the exposure of the demarcation layer or the revetment filter fabric. This level of repair will require specialized equipment and materials and should be conducted by an appropriate contractor in accordance with the design and construction related documents including the record drawings and the construction specifications. Repairs such as these will have a potential impact to the protectiveness of the remedy and should be conducted under the supervision of a licensed professional engineer and in accordance with a work plan approved by the FFA signatories and CDPH for the ARIC for radionuclides.

The following is a general list of procedures to be used during the site inspection process and should be adapted based on site conditions as they evolve over time. The list is based on the above Inspection Summary and Inspection Frequency table.

General Site Conditions

- The perimeter of the site should be walked and the fence and boundary conditions inspected for signs of breaching, vandalism, and degradation. Issues should be documented in inspection summary reports and photographs should be taken of any areas of concern and the exact location documented.
- The revetment portion of the site should be inspected during low tide so the full extent of the structure can be viewed.
- The condition of any designated access points to the site should be inspected for damages.
- Any trash, debris, or other materials should be removed from the site and disposed of properly. This also includes debris that may wash up onto the revetment and vegetation along the revetment.
- Any issues of concern should be reported to the property owners as necessary. Repairs to the fence should be scheduled with an appropriate contractor.
- Any unauthorized digging on the site should be recorded and excavated areas filled and compacted as necessary as summarized in other portions of this procedures list.

Site Signage

- Each sign should be inspected for integrity and vandalism. Structural issues should be dealt with appropriately during the inspection when possible or scheduled with an appropriate contractor.
- If the signs begin to visually degrade, photographs should be taken to document and monitor degradation and signs should be replaced promptly when necessary.
- Any stolen signs should be replaced promptly.

Groundwater Monitoring Wells and Methane Monitoring Probes

- Protective materials (casing, pads, etc) should be inspected for integrity. Damages should be documented through photographs. Slight damages can be monitored over time but damages that may jeopardize the functionality of the well or probe should be reported and repaired promptly.
- Vandalism and theft of any materials related to the wells or probes should be remedied promptly. Repair may include replacing locks, caps, and other items or covering vandalized items with paint.
- The probes and wells should be inspected to insure that they are free of obstructions. This is especially important in situations where locks or well caps are missing or when there are other signs that the well has been breached. Appropriate probes can be used to check that obstructions do not exist within the well itself.
- Any issues should be recorded through photographs and written descriptions, and the well locations recorded.

- Any repair needing immediate attention should be promptly reported to the property owner for scheduling with appropriate contractors.

Soil Cover

- The cover should be walked systematically to inspect the complete extent of the cover. Particular attention should be given to the side slopes, drainage areas, and the portion where the soil cover meets the crest of the revetment.
- Areas where vegetation has been damaged should be documented, photographed, and monitored. The vegetative cover should naturally regenerate without additional seeding. If the damaged areas do not regenerate or are extensive, the seeding mix provided in this O&M plan should be consulted when replanting.
- The record drawings should serve as the basis of comparison to document changes in the cover.
- Areas of settlement should be recorded. Minor settlement is not an immediate concern but should be monitored over time. Major settlement could require specialized labor and personnel for repair.
- Areas of erosion or soil displacement by slumping should be recorded and repaired promptly. These repairs, when minor, could be completed during the inspection. Use of appropriate contractors and equipment may be necessary.
- Evidence of burrowing pests should be noted and monitored over time. Pest control measures may be necessary if damage to the cover occurs.
- The roots of any species outgrowing the predominant grasses could breach the demarcation layer and must be promptly removed. Prevent exposure of underlying soils beneath trees and apply herbicide as necessary.
- Repairs to the soil cover should follow the procedures outlined in the design and construction reports and the included construction specifications, and should be based on the record drawings.
- Mowing should be conducted when grasses are greater than 2 feet in height. Do not remove more than 1/3 total height within 1 week period. Maintain a minimum grass height of 6 inches.

Demarcation Layer

- The boundaries or extent of the 3-foot soil cover should be inspected for the exposure of the demarcation fabric. The sloped portion of the cover where the cover meets the existing grade will be more susceptible to erosion and the potential exposure of the demarcation layer.
- Any exposure should be documented and the soil repaired based on procedures listed in other portions of the O&M plan.

- Based on the recommendation of the material manufacturer, the demarcation fabric may require inspection. Any necessary inspection would require excavation above the demarcation layer to allow visual inspection of the material. The frequency is expected to be every 5 or 10 years; however, individual manufacturers have varying recommendations.

Revetment

- The limits of the revetment should be inspected for vandalism or theft of materials and documented or replaced accordingly. The revetment should be compared to the record drawings.
- Any shifting of materials or settlement should be recorded. This should be done through comparison to previous inspections. Shifting and settling is anticipated to occur and does not impact the integrity of the structure, but should be monitored.
- The toe portion of the revetment should be walked during low tide so that the entire extent of the structure can be properly observed. Photos of the revetment should be taken as necessary.
- Trash or debris that may have accumulated on the revetment should be removed and disposed of properly. Excessive nuisance vegetation should be removed from the structure.
- The toe portion and the flanks of the revetment should be inspected for signs of settlement, changes in slope, and undercutting and erosion. The toe portion should be fully covered by sediment and any exposure of rocks should be recorded. Exposure of the armoring material does not jeopardize the integrity of the structure but should be monitored over time.
- Exposure of the filter fabric indicates that the revetment armoring has been displaced. This exposure should be recorded and repairs made through the addition of material. Inspect integrity and consistency of subgrade.
- Areas where additional revetment armoring rock may be necessary should be replaced promptly. Procedures summarized in the design and construction documents should be followed, and repair should be made based on the record construction drawings and the construction specifications provided.
- The crest of the revetment should be inspected for degradation and the movement of rock.
- Any signs of wave overtopping of the revetment should be documented and monitored over time.

ATTACHMENT 1
LIST OF MANUFACTURERS CUT SHEETS

LIST OF POTENTIAL CUT SHEETS

Cut sheets are prepared by the manufacturer and are specific to the supplied material. Cut sheets include information concerning inspection, repair, and replacement. The appropriate cut sheet should be added to the O&M plan sometime after the manufacturers have been selected but prior to the O&M of the remedy.

Demarcation Fabric

Demarcation Warning Tape

Security Fence

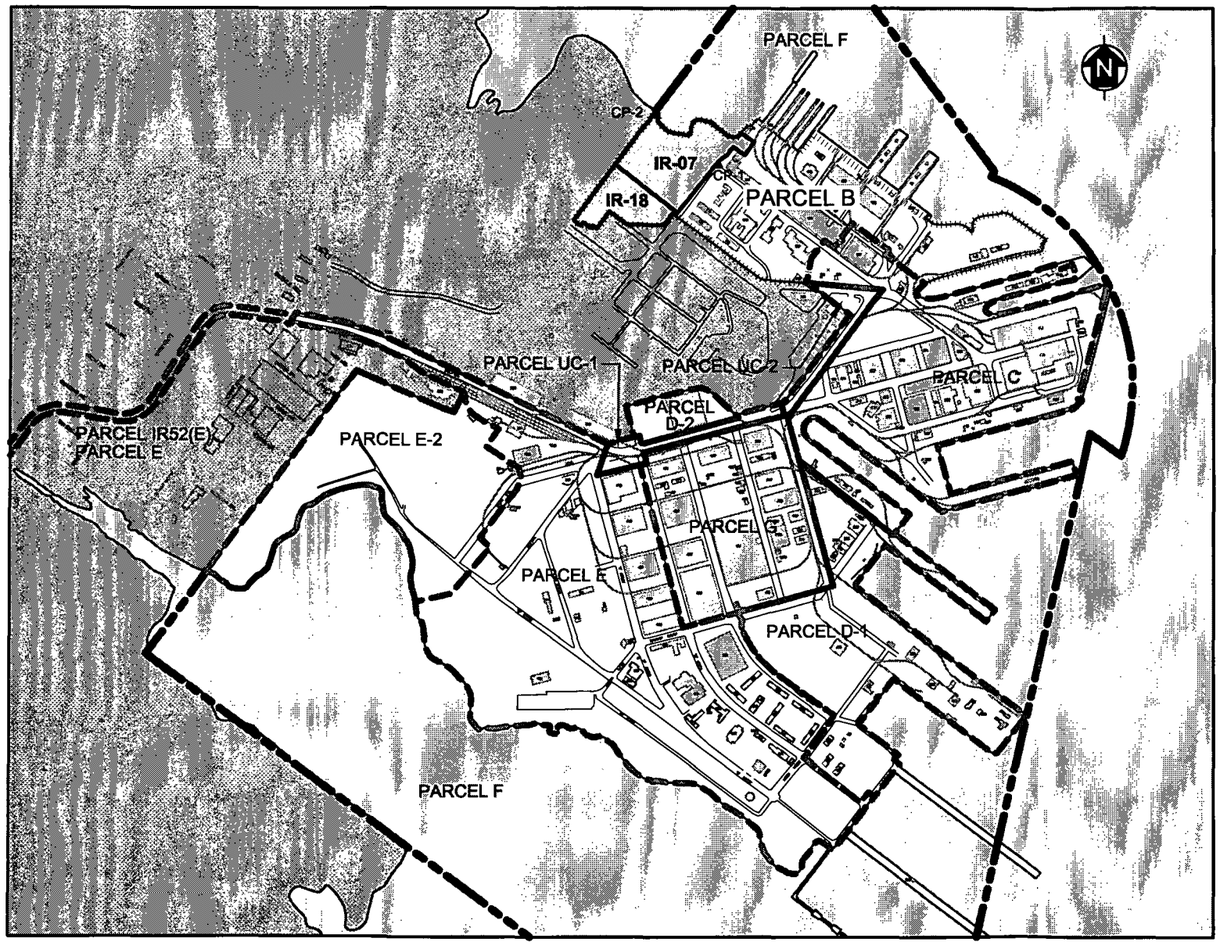
Vegetative Cover/Seeding

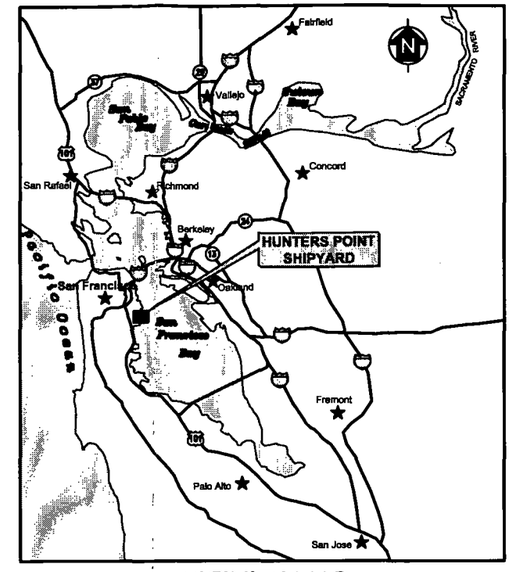
Composite Turf-reinforced Matting

Revetment Geotextile Filter Fabric

ATTACHMENT 2
DESIGN DRAWINGS

HUNTERS POINT SHIPYARD
SAN FRANCISCO, CALIFORNIA
INSTALLATION RESTORATION SITES 7 AND 18
SOIL COVER AND SHORELINE REVETMENT
DESIGN DRAWINGS





VICINITY MAP
NOT TO SCALE

INDEX OF DRAWINGS

DWG	DESCRIPTION
G1	VICINITY MAP, LOCATION MAP, AND SHEET INDEX
C1	SITE PLAN - CLEARING, GRUBBING, SURFACE DEBRIS REMOVAL AND WELL AND PROBE EXTENSIONS
C2	SOIL COVER AND REVETMENT SUBGRADE PLAN
C3	SOIL COVER AND SHORELINE REVETMENT FINAL GRADING PLAN
C4	CONTROL POINTS
C5	SHORELINE AND REVETMENT CROSS-SECTIONS A, B, AND C
C6	SHORELINE AND REVETMENT CROSS-SECTIONS D, E, AND F
C7	SHORELINE AND REVETMENT CROSS-SECTIONS G, H, I, AND J
C8	SOIL COVER BOUNDARY CROSS-SECTIONS DETAILS A, B, C, AND D
C9	SOIL COVER CROSS-SECTIONS DETAILS A-A' AND B-B'
C10	MONITORING WELL AND METHANE MONITORING PROBE EXTENSION DETAILS
C11	DETAILS I
C12	DETAILS II

SURVEY CONTROL POINTS

Control Point	Easting	Northing	Elevation
CP-1	1460168.99	453718.89	11.76
CP-2	1459671.50	454121.67	5.81

NOTE: OFF-SITE TOPOGRAPHY HAS BEEN SHOWN AS REFERENCED BUT HAS NOT BEEN TIED TO THE SITE TOPOGRAPHY. EXISTING TOPOGRAPHY ESTIMATED PRECISION ± 1' DUE TO MINOR REGRADING OF THE SITE FOLLOWING AS SHOWN BASELINE SURVEY.

LOCATION MAP

600' 0 600' 1200'

SCALE: 1" = 600'

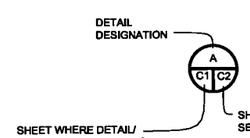
BASIS OF BEARINGS AND ELEVATION

HORIZONTAL: NAD 1927 ZONE-III (HUNTERS POINT WEST 1 PID HT0613) USFT.

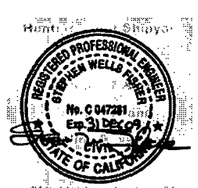
VERTICAL :
NGVD 29 LESS CORRECTION 7.76 FEET MSL

LIMITS OF RESPONSIBILITY

THE DESIGNER AND ITS SUBCONTRACTORS SHALL NOT BE RESPONSIBLE FOR VARIANCES FROM THE CONSTRUCTION SPECIFICATIONS, DESIGN DRAWINGS, AND OTHER REQUIREMENTS AND RECOMMENDATIONS UNAPPROVED BY THE DESIGNER.



NOTE: SECTION DETAILS ARE DESIGNATED BY A LETTER AND PLAN DETAILS ARE DESIGNATED BY A NUMBER.



SYMBOL	DESCRIPTION	PREP.BY	DATE	APPROVED

REVISIONS

PREPARED BY: ChadwXTt JV

DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RE-CHECKED BY:
APPROVED BY:
DATE: 12/09/2009

SIZE D
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT
SCALE REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
VICINITY MAP, LOCATION MAP, AND SHEET INDEX

CODE IDENT. NO.

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

CONSTR. CONTR. NO.
N62473-09-D-2608

SPECIFICATION
(D.O. –)

NAVFAC DWG. NO.

DWG. NO.
G1

SHEET 1 OF 13

R:\Navy\Hunters-PR\Parcel B\r07_r08\Preliminary Design\ G1_Hunters Point IR7-18 Location Map.dwg 12/09/2009 deborah.ford DN

NOTES:

1. REMOVE EXISTING FENCE WHERE FENCE IS OBSTRUCTIVE TO THE WORK AREA. REPLACE REMOVED FENCE WITH A TEMPORARY FENCE OFFSET AS NEEDED TO ALLOW WORK ALONG THE BOUNDARY.
2. USE EXISTING FENCE ALONG SOUTHWESTERN BOUNDARY AS TEMPORARY FENCE. USE EXISTING FENCE AND FENCE MATERIALS AS APPROPRIATE IN CONSTRUCTION OF THE TEMPORARY FENCE.
3. REMOVE ALL FENCING, ASPHALT CURB, AND OTHER OBSTRUCTIVE OBJECTS FROM WITHIN THE WORK AREA. REMOVE SIGNS AND OTHER MATERIALS FROM THE SHORELINE WHERE THEY OBSTRUCT THE WORK AREA. CLEAR AND GRUB EXISTING VEGETATION.
4. BOULDERS REMOVED FROM THE SHORELINE DURING DEBRIS REMOVAL ARE TO BE STOCKPILED FOR USE AS ADDITIONAL ARMORING ON THE COMPLETED REVETMENT. OTHER DEBRIS (CONCRETE, METAL, WOOD, ETC.) IS TO BE DISPOSED.
5. ALL GROUNDWATER MONITORING WELLS AND METHANE MONITORING PROBES ARE TO BE EXTENDED AS NEEDED OR REPLACED TO MEET THE FINAL COVER SURFACE GRADE WITH LIKE MATERIALS. CONCRETE PADS CAN REMAIN IN PLACE IF NOT OBSTRUCTIVE TO THE EXTENSION. REMOVE ALL WELL COMPLETIONS ABOVE GROUND AND PROTECTIVE BOLLARDS. CONSTRUCT NEW WELL HEAD BOXES TO MATCH EXISTING WELL HEAD BOXES' INTERNAL DIAMETER AT A MINIMUM.
6. OBTAIN CONTRACTING OFFICER'S APPROVAL IF PERMANENT SURFACE FEATURES MUST BE REMOVED FROM THIS AREA FOR CONSTRUCTABILITY
7. EXISTING TOPOGRAPHY ESTIMATED PRECISION +/- 1 FT DUE TO SITE ACTIVITIES FOLLOWING COMPLETION OF THE TOPOGRAPHIC SURVEY.
8. SURROUNDING AREA CONTOURS HAVE NOT BEEN TIED INTO SITE CONTOURS.
9. REMOVE ALL EXISTING UTILITY FEATURES FROM WITHIN SITE BOUNDARY. PROTECT EXISTING UTILITY FEATURES OUTSIDE THE SITE BOUNDARY AS NECESSARY.
10. EXISTING FENCE WAS CONSTRUCTED AFTER THE SITE SURVEY AND LOCATION IS APPROXIMATE.

LEGEND

- IR SITE BOUNDARY
- EXTENT OF RESTRICTIONS RELATED TO RADIONUCLIDES
- EXISTING MAJOR CONTOUR (5 FT.)
- EXISTING MINOR CONTOUR (1 FT.)
- ASPHALT CURB (REMOVE)
- OH — OVERHEAD POWER LINE (PROTECT DURING CONSTRUCTION)
- OH — OVERHEAD POWER LINE (REMOVE)
- X — EXISTING FENCE (APPROXIMATE LOCATION)
- X — EXISTING FENCE (REMOVE)
- TEMPORARY FENCE (TO BE INSTALLED DURING CONSTRUCTION)
- SURVEY CONTROL POINT
- UTILITY FEATURE (REMOVE)
- UTILITY POLE APPROX. LOCATION (REMOVE)
- UTILITY FEATURE (PROTECT AND LEAVE IN PLACE)
- UTILITY POLE (PROTECT AND LEAVE IN PLACE)
- WATER FEATURE
- MONITORING WELL (PROTECT AND EXTEND)
- METHANE MONITORING PROBE (PROTECT AND EXTEND)
- GB-5 ● GRUBBING BOUNDARY CONTROL POINT
- FN-6 ● TEMPORARY FENCE CONTROL POINT
- MEAN SEA LEVEL (MSL)
- MEAN LOWER LOW WATER (-3.56 MSL)
- APPROXIMATE LIMITS OF CLEARING AND GRUBBING AND DEBRIS REMOVAL

50' 0 50' 100'
SCALE: 1" = 50'

SYMBOL	DESCRIPTION	PREP.BY	DATE	APPROVED

REVISIONS

PREPARED BY: ChaduxTt JV

DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RE-CHECKED BY:
APPROVED BY:
DATE: 12/09/2009

SIZE D
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DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
SAN DIEGO, CALIFORNIA

BRAC PMO WEST

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
SITE PLAN - CLEARING, GRUBBING, SURFACE DEBRIS REMOVAL AND WELL AND PROBE EXTENSIONS

CODE IDENT. NO.

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

CONSTR. CONTR. NO.
N62473-09-D-2608

SPECIFICATION
(D.O. –)

NAVFAC DWG. NO.

DWG. NO.
C1

SHEET 2 OF 13

REGISTERED PROFESSIONAL ENGINEER
STEPHEN WELLS FISHER
No. C 047281
Exp. 31 Dec 09
CIVIL
STATE OF CALIFORNIA

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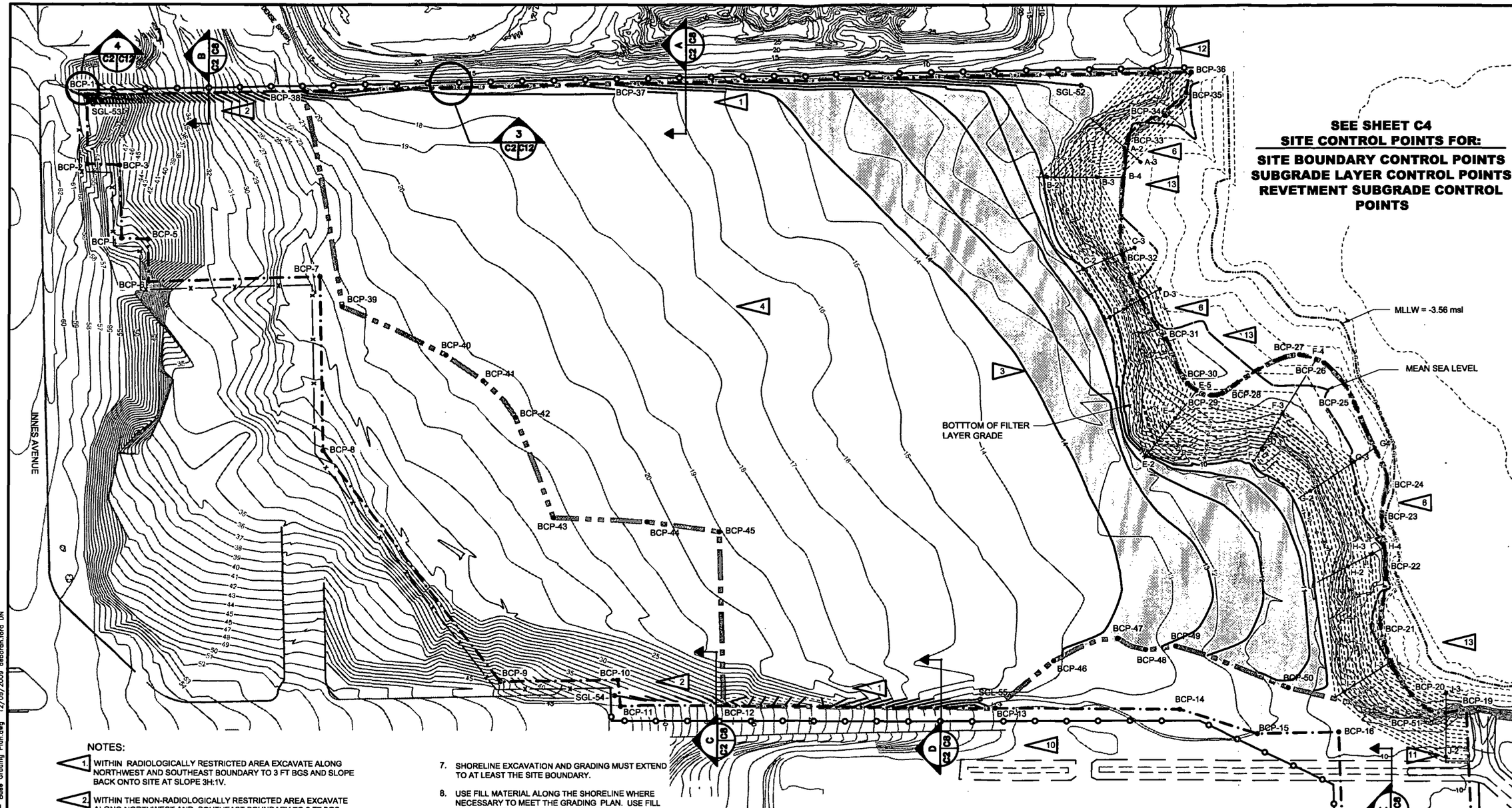

NOTES:

1. WITHIN RADIOLOGICALLY RESTRICTED AREA EXCAVATE ALONG NORTHWEST AND SOUTHEAST BOUNDARY TO 3 FT BGS AND SLOPE BACK ONTO SITE AT SLOPE 3H:1V.
2. WITHIN THE NON-RADIOLOGICALLY RESTRICTED AREA EXCAVATE ALONG NORTHWEST AND SOUTHEAST BOUNDARY TO 2 FT BGS AND SLOPE BACK ONTO SITE AT 3H:1V.
3. EXCAVATED SOIL AND SEDIMENT PLACEMENT ZONE. GRADING BASED ON ESTIMATED VOLUME OF MATERIAL REMOVED FROM ALONG THE SITE BOUNDARY AND SHORELINE. VOLUME VARIABLE AS CONTAMINATED MATERIAL WILL BE REMOVED AND DISPOSED OF OFF SITE. COMPACTION 90% OR GREATER OF MAXIMUM DENSITY BASED ON MODIFIED PROCTOR TESTING. GRADE AT DISCRETION OF CONTRACTOR TO BEST ACHIEVE FINAL GRADE (SHEET C3).
4. GRADE AND COMPACT EXCAVATION SPOILS OVER THE EXISTING GRADE TO THE EXTENT POSSIBLE WITH CONSIDERATION TO THE FINAL COVER GRADE. FINISHED SURFACE GRADE AS SHOWN CONSTITUTES BOTTOM OF COVER .
5. EXCAVATED SOIL AND SEDIMENT REQUIRES SCREENING FOR RADIONUCLIDES PRIOR TO PLACEMENT ON SITE. MINIMIZE EXCAVATION VOLUMES TO THE EXTENT POSSIBLE.
6. GRADE UPPER SHORELINE TO 4H:1V. BREAK IN SLOPE AT POINTS B3, E4, F3, G3, AND H3 AND THEN FOLLOW EXISTING GRADE.
7. SHORELINE EXCAVATION AND GRADING MUST EXTEND TO AT LEAST THE SITE BOUNDARY.
8. USE FILL MATERIAL ALONG THE SHORELINE WHERE NECESSARY TO MEET THE GRADING PLAN. USE FILL SIMILAR TO EXISTING SHORELINE MATERIAL OR FILTER LAYER CRUSHED ROCK.
9. SHORELINE EXCAVATIONS ARE NOT TO BE EXPOSED TO INCOMING TIDAL WATER WITHOUT STABILIZATION.
10. GRADE AREA OFF SITE AS NECESSARY TO PREVENT SURFACE WATER PONDING.
11. DIVERT EXISTING DRAINAGE AS NECESSARY TO ACCOMMODATE EXCAVATION ALONG SHORE AND CONSIDERING FINAL ELEVATION.
12. EXTEND TEMPORARY FENCE TO SHORELINE.
13. USE SILT CURTAIN OFFSHORE TO CONTROL SEDIMENT MIGRATION.

LEGEND

- EXTENT OF COVER BOUNDARY
- EXTENT OF RESTRICTIONS RELATED TO RADIONUCLIDES
- EXISTING CONTOUR
- EXISTING FENCE (APPROXIMATE)
- TEMPORARY FENCE (DURING CONSTRUCTION)
- SUBGRADE CONTOUR
- SUBGRADE CONTOUR INDICATING AREA TO PLACE EXCAVATED SOIL AND ANTICIPATED FILL AREA
- REVETMENT SUBGRADE CONTOUR (SEE SHEET C4 FOR CONTROL COORDINATES)
- BCP-15 ● SITE CONTROL POINT
- SGL-53 ● SUBGRADE EXCAVATION CONTROL POINT
- MEAN SEA LEVEL (MSL)
- MEAN LOWER LOW WATER (-3.56 MSL)

50' 0 50' 100'
SCALE: 1" = 50'

REGISTERED PROFESSIONAL ENGINEER STEPHEN WELLS FISHER No. C 047281 Exp. 31 DEC 09 CIVIL STATE OF CALIFORNIA

SYMBOL	DESCRIPTION	PREP.BY	DATE	APPROVED

REVISIONS

PREPARED BY: ChaduxTt JV

DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RECHECKED BY:
APPROVED BY:
DATE: 12/09/2009

SIZE D
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT
SCALE REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
SOIL COVER AND REVETMENT SUBGRADE PLAN

CODE IDENT. NO.

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

CONSTR. CONTR. NO.
N62473-09-D-2608

SPECIFICATION
(D.O. –)

NAVFAC DWG. NO.

DWG. NO.
C2

SHEET 3 OF 13

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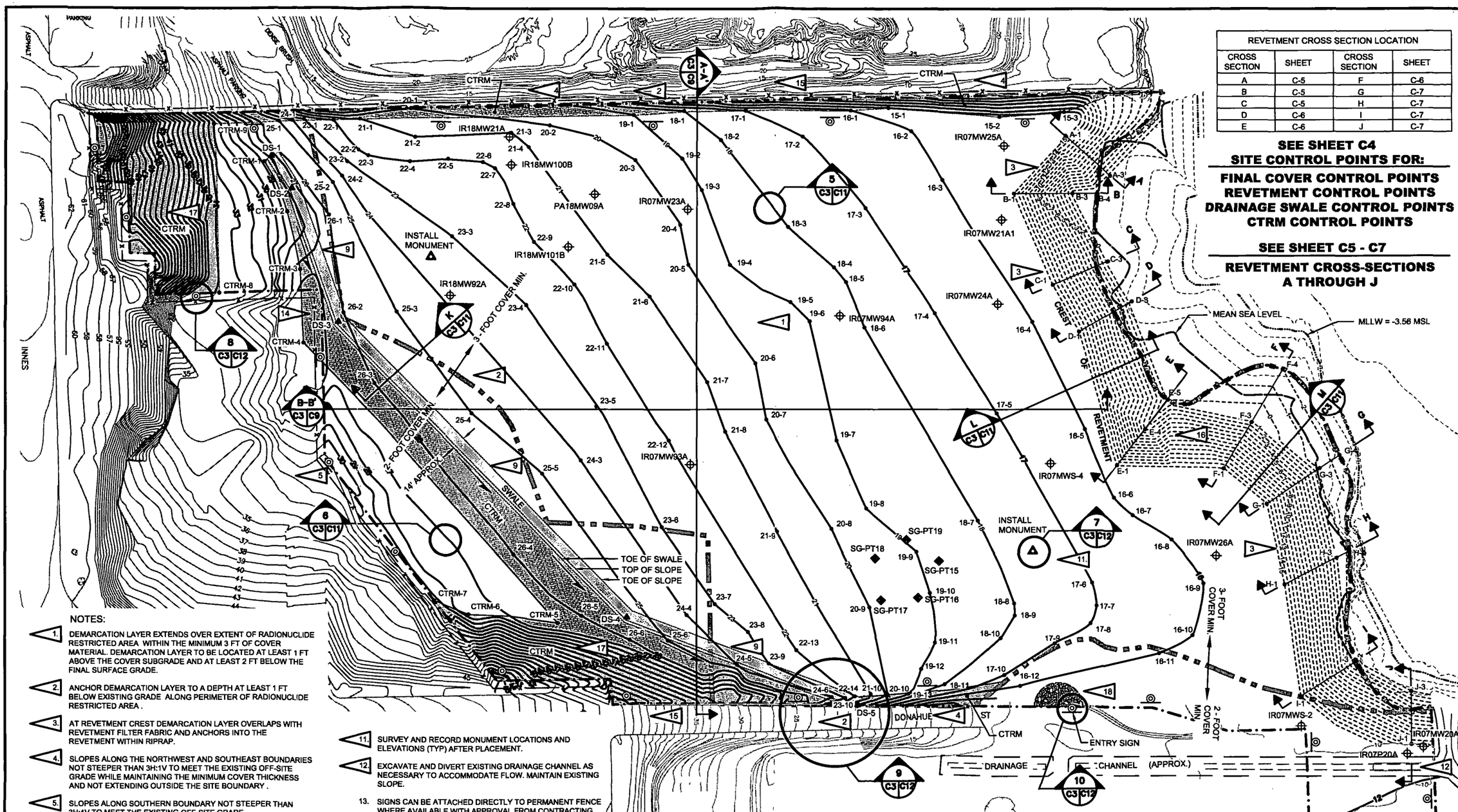


REVETMENT CROSS SECTION LOCATION			
CROSS SECTION	SHEET	CROSS SECTION	SHEET
A	C-5	F	C-6
B	C-5	G	C-7
C	C-5	H	C-7
D	C-6	I	C-7
E	C-6	J	C-7

SEE SHEET C4
SITE CONTROL POINTS FOR:

FINAL COVER CONTROL POINTS
REVETMENT CONTROL POINTS
DRAINAGE SWALE CONTROL POINTS
CTRM CONTROL POINTS

SEE SHEET C5 - C7
REVETMENT CROSS-SECTIONS A THROUGH J

NOTES:

1. DEMARCATION LAYER EXTENDS OVER EXTENT OF RADIONUCLIDE RESTRICTED AREA WITHIN THE MINIMUM 3 FT OF COVER MATERIAL. DEMARCATION LAYER TO BE LOCATED AT LEAST 1 FT ABOVE THE COVER SUBGRADE AND AT LEAST 2 FT BELOW THE FINAL SURFACE GRADE.
2. ANCHOR DEMARCATION LAYER TO A DEPTH AT LEAST 1 FT BELOW EXISTING GRADE ALONG PERIMETER OF RADIONUCLIDE RESTRICTED AREA .
3. AT REVETMENT CREST DEMARCATION LAYER OVERLAPS WITH REVETMENT FILTER FABRIC AND ANCHORS INTO THE REVETMENT WITHIN RIPRAP.
4. SLOPES ALONG THE NORTHWEST AND SOUTHEAST BOUNDARIES NOT STEEPER THAN 3H:1V TO MEET THE EXISTING OFF-SITE GRADE WHILE MAINTAINING THE MINIMUM COVER THICKNESS AND NOT EXTENDING OUTSIDE THE SITE BOUNDARY .
5. SLOPES ALONG SOUTHERN BOUNDARY NOT STEEPER THAN 3H:1V TO MEET THE EXISTING OFF-SITE GRADE.
6. ELEVATIONS ALONG SHORELINE CORRESPOND TO FINAL REVETMENT GRADE .
7. COMPACTION OF COVER 90% OR GREATER OF MAXIMUM DENSITY BASED ON MODIFIED PROCTOR TESTING TO 0.5 FT BELOW FINAL COVER GRADE. COMPACTION OF FINAL 0.5 FT NOT TO EXCEED 85%.
8. USE MATERIALS FROM THE TEMPORARY FENCE IN THE CONSTRUCTION OF THE PERMANENT FENCE AS APPROPRIATE .
9. DRAINAGE SWALE SLOPES 3H:1V ON SIDE FACING UPGRADIENT AND 10H:1V ON SIDE FACING DOWNGRADIENT. PLACE COMPOSITE TURF REINFORCED MATTING (CTRM) ALONG WATERCOURSE TO ELEVATION 1 FT ABOVE WATER COURSE.
10. REFER TO C5 THROUGH C7 FOR SHORELINE CROSS SECTIONS A THROUGH J
11. SURVEY AND RECORD MONUMENT LOCATIONS AND ELEVATIONS (TYP) AFTER PLACEMENT.
12. EXCAVATE AND DIVERT EXISTING DRAINAGE CHANNEL AS NECESSARY TO ACCOMMODATE FLOW. MAINTAIN EXISTING SLOPE.
13. SIGNS CAN BE ATTACHED DIRECTLY TO PERMANENT FENCE WHERE AVAILABLE WITH APPROVAL FROM CONTRACTING OFFICER.
14. REMOVE AND REPLACE FENCE AS NECESSARY FOR PLACEMENT OF CTRM.
15. INSTALL CTRM ALONG PROPERTY BOUNDARY WHERE SLOPED PORTION OF COVER MEETS EXISTING GRADE OFF SITE.
16. TRANSITION GRADE BETWEEN ADJACENT CROSS-SECTIONS A THROUGH J.
17. SOIL COVER CONSTRUCTED AS MIN. 2 FT CLEAN IMPORTED FILL OVER EXISTING GRADE.
18. INSTALL ROAD BASE AS ENTRY POINT TO DIRECT AND DISPERSE TRAFFIC OVER FINAL COVER. INSTALL ROAD BASE IN 25 FT RADIAL ARC AND INSTALL ENTRY SIGN AT SITE BOUNDARY.

LEGEND

- EXTENT OF COVER BOUNDARY
- EXTENT OF RESTRICTIONS RELATED TO RADIONUCLIDES
- EXISTING CONTOUR
- FINAL COVER CONTOUR
- REVETMENT CONTOUR
- PERMANENT FENCE
- COMPOSITE TURF REINFORCED MATTING (CTRM)
- A-1 • REVETMENT CONTROL POINT (SEE SHEET C4 FOR COORDINATES)
- 22-5 • FINAL COVER CONTROL POINT (SEE SHEET C4 FOR COORDINATES)
- MONITORING WELL
- METHANE MONITORING PROBE
- DRAINAGE SWALE
- SIGN (STANDARD)
- SURVEY MONUMENT
- DS-1▲ DRAINAGE CONTROL POINT (SEE SHEET C4 FOR COORDINATES)

50' 0 50' 100'
SCALE: 1" = 50'

REGISTERED PROFESSIONAL ENGINEER STEPHEN WELLS FISHER No. C 047281 Exp. 31 DEC 09 CIVIL STATE OF CALIFORNIA

SYMBOL	DESCRIPTION	PREP.BY	DATE	APPROVED

REVISIONS

PREPARED BY: ChaduxTt JV

DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RE-CHECKED BY:
APPROVED BY:
DATE: 12/09/2009

SIZE D
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT
SCALE REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY — NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
SOIL COVER AND SHORELINE REVETMENT
FINAL GRADING PLAN

CODE IDENT. NO.

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

CONSTR. CONTR. NO.
N62473-09-D-2606

SPECIFICATION
(D.O. –)

NAVFAC DWG. NO.

DWG. NO.
C3

SHEET 4 OF 13

SHEET C1 CONTROL POINTS

EXISTING GROUNDWATER MONITORING WELLS AND METHANE MONITORING PROBES EXTENSION SCHEDULE

Well ID	Easting	Northing	Well Depth (ft. bgs)	Casing Dia. (in.)	Stick-Up Construction	TOS ft BGS Well Log	BOS ft BGS Well Log
IR07MW20A1	1460379.24	453944.26	24.00	4	NO	6.00	24.00
IR07MW21A1	1459683.70	453941.51	16.50	4	NO	6.00	16.00
IR07MW23A	1459476.14	453693.82	17.00	4	NO	7.00	17.00
IR07MW24A	1459749.67	453884.37	15.00	4	YES	5.00	15.00
IR07MW25A	1459624.70	453990.88	18.00	4	YES	8.00	18.00
IR07MW26A	1460093.30	453900.68	15.00	4	YES	5.00	15.00
IR07MW93A	1459686.30	453533.20	29.00	2	NO	19.00	29.00
IR07MW94A	1459659.70	453749.30	25.00	2	NO	14.00	24.00
IR07MWS-2	1460286.15	453860.98	15.50	4	YES	5.50	15.50
IR07MWS-4	1459913.20	453825.23	16.00	4	YES	6.00	16.00
IR07P20A	1460374.65	453927.21	25.00	2	NO	5.00	25.00
IR18MW100B	1459329.10	453579.54	47.00	4	NO	40.00	45.00
IR18MW101B	1459432.00	453573.70	45.00	4	NO	37.00	42.00
IR18MW21A	1459304.90	453595.74	20.00	4	NO	10.00	20.00
IR18MW92A	1459396.70	453446.90	27.00	2	NO	17.00	27.00
PA18MW09A	1459405.47	453628.25	25.00	4	NO	10.00	25.00
SG-PT15	1459922.63	453673.40	3.00	TUBE	NO	–	–
SG-PT16	1459939.27	453632.67	3.00	TUBE	NO	–	–
SG-PT17	1459917.88	453601.10	3.00	TUBE	NO	–	–
SG-PT18	1459880.20	453623.16	3.00	TUBE	NO	–	–
SG-PT19	1459884.61	453660.16	3.00	TUBE	NO	–	–

CLEARING AND GRUBBING CONTROL POINTS

Point ID	Easting	Northing
GB-1	1458996.94	453244.69
GB-2	1459116.91	453154.18
GB-3	1459419.24	453219.12
GB-4	1459764.15	453204.97
GB-5	1460273.78	453857.25
GB-6	1460376.47	453777.02
GB-7	1460484.04	453914.71
GB-8	1460366.54	454006.50
GB-9	1460335.57	454014.91
GB-10	1460270.80	453980.39
GB-11	1460196.05	454003.03
GB-12	1460105.13	454074.42
GB-13	1459990.79	454103.70
GB-14	1459916.77	454008.96
GB-15	1459703.93	454091.38
GB-16	1459696.86	454165.65
GB-17	1459661.06	454150.64
GB-18	1459351.58	453728.48

TEMPORARY FENCE CONTROL POINTS

Point ID	Easting	Northing
FN-1	1459017.62	453272.42
FN-2	1459082.63	453223.10
FN-3	1459102.71	453247.39
FN-4	1459161.41	453204.17
FN-5	1459177.80	453223.76
FN-6	1459212.11	453197.62
FN-7	1459312.53	453335.49
FN-8	1459447.51	453234.19
FN-9	1459745.12	453231.37
FN-10	1459813.18	453321.25
FN-11	1459839.64	453301.58
FN-12	1460198.00	453760.27
FN-13	1460329.59	453825.86
FN-14	1460381.11	453787.53
FN-15	1460469.00	453901.98
FN-16	1459678.38	454157.90

DRAINAGE SWALE CONTROL POINT COORDINATES

POINT	EASTING	NORTHING	ELEVATION FT.
DS-1	1459169.98	453390.68	27.40
DS-2	1459209.43	453386.50	27.43
DS-3	1459347.70	453339.84	26.00
DS-4	1459771.01	453384.65	25.51
DS-5	1459988.70	453515.24	20.00

SHEET C2 CONTROL POINTS

REVETMENT CONTROL POINT COORDINATES

POINT	EASTING	NORTHING	ELEVATION (FT.)
A-2	1459672.54	454113.72	5.04
A-3	1459706.42	454126.26	-3.88
B-2	1459674.56	453974.29	9.36
B-3	1459706.81	454015.55	-3.50
B-4	1459722.49	454035.63	-4.42
C-2	1459770.28	453946.01	10.00
C-3	1459784.90	454001.11	-3.90
D-2	1459824.09	453936.29	10.40
D-3	1459832.53	453995.31	-4.21
E-2	1459956.37	453879.30	11.06
E-4	1459944.99	453923.84	-1.26
E-5	1459935.47	453961.05	-3.50
F-2	1460021.68	453975.56	8.00
F-3	1460006.79	454014.55	2.02
F-4	1459983.97	454074.31	-5.77
G-2	1460084.02	453985.89	8.00
G-3	1460087.85	454040.56	-0.46
G-4	1460087.85	454065.03	-5.93
H-2	1460165.87	453968.07	3.47
H-3	1460171.19	453997.18	-3.50
H-4	1460173.69	454010.87	-4.69
I-2	1460262.82	453889.47	9.00
I-3	1460268.13	453946.18	-5.15
J-2	1460356.91	453946.56	8.15
J-3	1460299.59	453991.73	-8.54

SUBGRADE LAYER CONTROL POINT COORDINATES

CONTROL POINT	EASTING	NORTHING	ELEV. (FT.)
SGL-52	1459624.74	454059.46	7.00
SGL-53	1459037.27	453275.10	58.00
SGL-54	1459821.66	453319.71	36.00
SGL-55	1460046.84	453602.85	13.00

SITE BOUNDARY CONTROL POINT COORDINATES

CONTROL POINT	EASTING	NORTHING
BCP-1	1459026.47	453275.75
BCP-2	1459081.35	453234.11
BCP-3	1459101.36	453258.32
BCP-4	1459160.10	453215.07
BCP-5	1459176.57	453234.76
BCP-6	1459210.46	453208.94
BCP-7	1459310.84	453346.76
BCP-8	1459450.21	453242.17
BCP-9	1459741.14	453239.37
BCP-10	1459811.27	453331.97
BCP-11	1459833.74	453317.59
BCP-12	1459896.48	453401.49
BCP-13	1460063.06	453608.80
BCP-14	1460176.75	453751.84
BCP-15	1460243.50	453798.03
BCP-16	1460291.50	453862.25
BCP-17	1460383.75	453795.81
BCP-18	1460457.50	453900.59
BCP-19	1460352.74	453975.89
BCP-20	1460306.13	453942.47
BCP-21	1460232.38	453960.75
BCP-22	1460194.37	453997.75
BCP-23	1460148.13	454028.06
BCP-24	1460124.63	454053.06
BCP-25	1460041.38	454077.34
BCP-26	1459991.75	454078.34
BCP-27	1459970.62	454064.34
BCP-28	1459953.38	453979.91
BCP-29	1459947.75	453969.75
BCP-30	1459923.88	453958.75
BCP-31	1459875.75	453969.34

SITE BOUNDARY CONTROL POINT COORDINATES

CONTROL POINT	EASTING	NORTHING
BCP-32	1459783.63	453987.34
BCP-33	1459695.62	454062.34
BCP-34	1459698.63	454106.06
BCP-35	1459694.00	454137.00
BCP-36	1459681.00	454153.72
BCP-37	1459359.41	453722.67
BCP-38	1459154.98	453448.28
SLF-39	1459348.36	453345.68
BCP-40	1459450.19	453397.33
BCP-41	1459492.98	453410.62
BCP-42	1459541.68	453413.57
BCP-43	1459643.51	453381.10
BCP-44	1459704.01	453451.94
BCP-45	1459755.66	453502.11
BCP-46	1460061.58	453683.68
BCP-47	1460082.98	453747.32
BCP-48	1460108.60	453761.74
BCP-49	1460124.07	453787.53
BCP-50	1460226.16	453850.62
BCP-51	1460327.73	453936.20

COMPOSITE TURF REINFORCED MATTING (CTRM) CONTROL POINT COORDINATES

POINT	EASTING	NORTHING	ELEVATION
CTRM-1	1459169.91	453381.59	28.68
CTRM-2	1459225.64	453368.16	28.68
CTRM-3	1459280.57	453342.21	26.83
CTRM-4	1459342.85	453298.45	26.00
CTRM-5	1459732.40	453325.43	26.72
CTRM-6	1459669.03	453258.57	26.00
CTRM-7	1459635.72	453239.71	23.30
CTRM-8	1459248.98	453261.82	23.30
CTRM-9	1459107.38	453365.05	23.30

SHEET C3 CONTROL POINTS

FINAL COVER CONTROL POINT COORDINATES

POINT	EASTING	NORTHING	ELEVATION
15-1	1459520.68	453921.63	15.00
15-2	1459598.04	454005.55	15.00
15-3	1459635.06	454060.88	15.00
16-1	1459498.70	453889.15	16.00
16-2	1459554.22	453925.04	16.00
16-3	1459613.74	453919.42	16.00
16-4	1459786.16	453901.18	16.00
16-5	1459906.78	453874.85	16.00
16-6	1459981.12	453855.29	16.00
16-7	1460007.31	453859.17	16.00
16-8	1460051.68	453874.67	16.00
16-9	1460107.81	453872.50	16.00
16-10	1460143.12	453830.20	16.00
16-11	1460136.64	453791.86	16.00
16-12	1460075.35	453658.66	16.00
17-1	1459432.35	453803.90	17.00
17-2	1459490.07	453833.78	17.00
17-3	1459588.62	453838.87	17.00
17-4	1459717.87	453827.97	17.00
17-5	1459837.97	453813.87	17.00
17-6	1460036.90	453782.85	17.00
17-7	1460058.39	453771.68	17.00
17-8	1460068.91	453755.49	17.00
17-9	1460062.66	453714.03	17.00
17-10	1460056.49	453652.90	17.00
18-1	1459393.06	453753.40	18.00
18-2	1459440.56	453765.03	18.00
18-3	1459554.91	453764.43	18.00
18-4	1459616.37	453775.43	18.00
18-5	1459635.96	453775.82	18.00
18-6	1459685.03	453761.97	18.00
18-7	1459914.16	453730.30	18.00
18-8	1460004.30	453706.46	18.00
18-9	1460014.51	453699.19	18.00
18-10	1460024.20	453673.62	18.00
18-11	1460026.72	453599.13	18.00
19-1	1459365.11	453710.21	19.00
19-2	1459431.29	453721.67	19.00
19-3	1459469.25	453717.55	19.00
19-4	1459548.38	453692.75	19.00
19-5	1459617.53	453718.29	19.00
19-6	1459645.26	453721.69	19.00
19-7	1459759.20	453667.09	19.00
19-8	1459833.70	453647.61	16.00
19-9	1459900.66	453660.58	16.00
19-10	1459943.02	453645.25	19.00
19-11	1459986.87	453617.86	19.00
19-12	1459999.44	453589.74	19.00
19-13	1460011.65	453563.23	19.00
20-1	1459220.06	453534.21	20.00
20-2	1459320.94	453636.06	20.00
20-3	1459403.04	453682.77	20.00
20-4	1459484.04	453677.73	17.00
20-5	1459521.74	453658.93	20.00
20-6	1459645.07	453650.75	20.00
20-7	1459697.86	453623.49	20.00
20-8	1459828.08	453606.59	20.00
20-9	1459916.56	453586.96	20.00
20-10	1459999.24	453546.18	20.00
21-1	1459195.51	453486.80	21.00
21-2	1459245.79	453519.42	21.00
21-3	1459302.75	453599.82	21.00
21-4	1459325.50	453605.21	21.00
21-5	1459462.80	453600.02	21.00
21-6	1459522.97	453607.41	21.00
21-7	1459629.73	453599.63	21.00
21-8	1459681.53	453582.40	21.00
21-9	1459796.10	453561.37	21.00
21-10	1459988.09	453532.65	21.00
22-1	1459160.07	453483.88	22.00
22-2	1459219.98	453466.07	22.00
22-3	1459231.06	453470.39	22.00
22-4	1459262.99	453499.76	22.00
22-5	1459284.18	453532.40	22.00
22-6	1459308.88	453558.49	22.00
22-7	1459321.61	453564.32	22.00

FINAL COVER CONTROL POINT COORDINATES

POINT	EASTING	NORTHING	ELEVATION
22-8	1459361.98	453556.14	22.00
22-9	1459406.12	453549.08	22.00
22-10	1459466.24	453554.57	19.00
22-11	1459535.33	453543.17	22.00
22-12	1459652.98	453531.18	19.00
22-13	1459905.43	453501.33	22.00
22-14	1459979.74	453518.09	22.00
23-1	1459160.56	453440.29	23.00
23-2	1459222.40	453448.89	20.00
23-3	1459350.00	453486.20	23.00
23-4	1459452.78	453502.33	20.00
23-5	1459589.51	453494.86	23.00
23-6	1459719.27	453470.25	23.00
23-7	1459816.09	453464.19	23.00
23-8	1459859.93	453473.09	23.00
23-9	1459898.63	453469.99	23.00
23-10	1459975.16	453509.34	23.00
24-1	1459153.99	453430.19	24.00
24-2	1459230.88	453435.41	24.00
24-3	1459602.59	453448.26	24.00
24-4	1459806.98	453434.21	24.00
24-5	1459879.87	453443.41	24.00
24-6	1459985.77	453499.12	24.00
25-1	1459145.58	453418.93	25.00
25-2	1459230.41	453423.80	25.00
25-3	1459377.01	453393.57	25.00
25-4	1459506.31	453389.36	25.00
25-5	1459600.62	453408.34	25.00
25-6	1459815.85	453402.89	25.00
26-1	1459254.10	453391.12	26.00
26-2	1459343.27	453349.78	26.00
26-3	1459421.08	453330.25	26.00
26-4	1459648.81	453333.20	26.00
26-5	1459741.55	453348.98	26.00
26-6	1459791.40	453372.70	26.00

REVETMENT CONTROL POINT COORDINATES

POINT	EASTING	NORTHING	TOP OF RIPRAP ELEVATION (FT.)
A-1	1459648.27	454104.74	15.00
A-3	1459706.42	454126.26	-0.38
B-1	1459669.87	453968.27	15.00
B-3	1459706.81	454015.55	0.00
B-4	1459722.49	454035.63	-0.92
C-1	1459769.00	453941.19	15.00
C-3	1459784.90	454001.11	-0.40
D-1	1459823.63	453933.06	15.00
D-3	1459832.53	453995.31	-0.71
E-1	1459956.62	453878.33	15.00
E-4	1459944.99	453923.84	2.23
E-5	1459935.47	453961.05	0.00
F-1	1460026.69	453962.45	15.00
F-3	1460006.79	454014.55	1.02
F-4	1459983.97	454074.31	-2.27
G-1	1460083.25	453974.91	15.00
G-3	1460087.85	454040.56	-1.48
G-4	1460087.85	454065.03	-2.43
H-1	1460160.41	453938.16	15.00
H-3	1460171.19	453997.18	0.00
H-4	1460173.69	454010.87	-1.19
I-1	1460261.91	453879.72	15.00
I-3	1460268.13	453946.18	-1.65
J-1	1460369.67	453936.62	11.00
J-3	1460326.49	453970.55	-2.87

Hunters Point Shipyard
REGISTERED PROFESSIONAL ENGINEER
STEPHEN WELLS FOSTER
No. C 047281
Exp. 31 DEC 09
CIVIL
STATE OF CALIFORNIA
DCN: CHAD-[illegible]-0024

SYMBOL	DESCRIPTION	PREP.BY	DATE	APPROVED

REVISIONS

PREPARED BY: ChaduxTt JV
DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RE-CHECKED BY:
APPROVED BY:
DATE: 12/09/2009

SIZE D
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT
SCALE REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND CONTROL POINTS

CODE IDENT. NO.

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

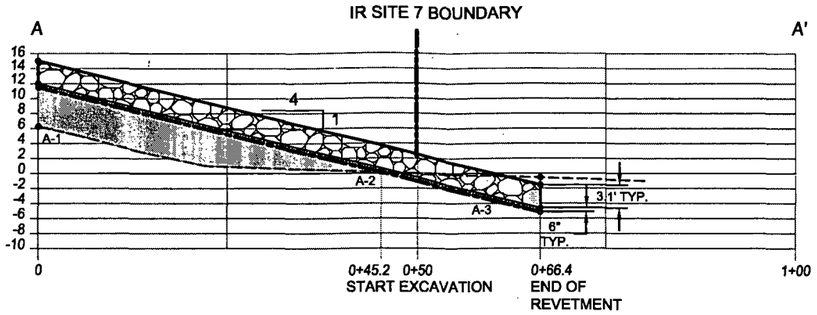
CONSTR. CONTR. NO.
N62473-09-D-2606

SPECIFICATION
(D.O. –)

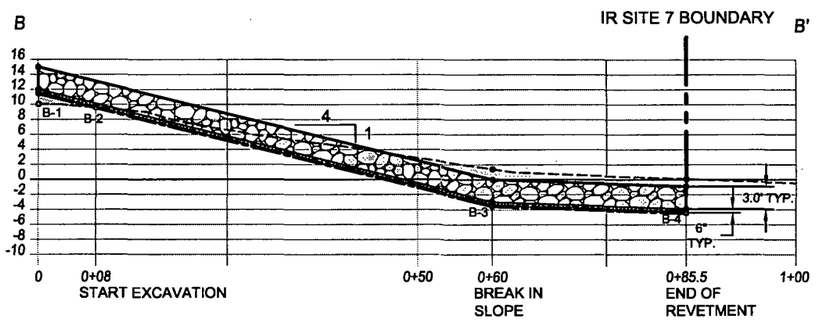
NAVFAC DWG. NO.

DWG. NO.
C4

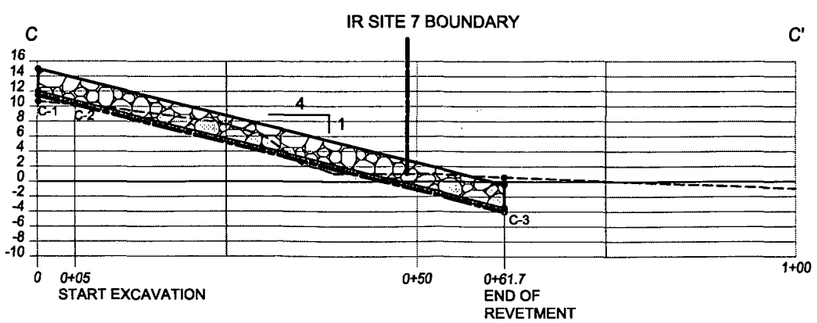
SHEET 5 OF 13



POINT	EASTING	NORTHING	ELEVATION			
			EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
A-1	1459655.37	454046.72	6.26	15.00	12.00	11.50
A-2	1459699.86	454054.86	0.14	–	–	–
A-3	1459720.69	454058.67	-0.56	-1.56	-4.56	-4.06



POINT	EASTING	NORTHING	ELEVATION			
			EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
B-1	1459669.87	453968.27	10.04	15.00	12.00	11.50
B-2	1459674.56	453974.29	9.36	–	–	–
B-3	1459706.81	454015.55	1.41	0.00	-3.00	-3.50
B-4	1459722.49	454035.63	0.08	-0.92	-3.92	-4.42



POINT	EASTING	NORTHING	ELEVATION			
			EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
C-1	1459769.00	453941.19	10.67	15.00	12.00	11.50
C-2	1459770.28	453946.01	10.00	–	–	–
C-3	1459784.90	454001.11	0.60	-0.40	-3.40	-3.90

NOTE:
ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.

NOTES:

1. POINTS A-2, B-2, AND C-2 CORRESPOND TO SHORELINE EXCAVATION START. GRADE ACCORDINGLY SLOPE 4H:1V.
2. AT ELEVATIONS ABOVE MHHW COVER FILL MATERIAL TO BE USED.
3. COMPACT FILL UNDER REVETMENT TO AT LEAST 90% OF MAX. DRY DENSITY BASED ON PROCTOR ASTM D1557.
4. GRADE UPPER BANK OF SHORELINE TO A SLOPE OF 4H:1V AND EXTEND GRADE OFF SHORE TO A POINT WHERE THE COMPLETED REVETMENT TOE WILL BE AT LEAST 1 FT BELOW THE EXISTING GRADE. WHERE NECESSARY EXTEND THE EXCAVATION TO THE PROPERTY BOUNDARY FOLLOWING THE *EXISTING GRADE TO A DEPTH SO THAT THE COMPLETED* REVETMENT TOE WILL BE AT LEAST 1 FT BELOW THE EXISTING GRADE AT THE PROPERTY BOUNDARY.
5. AT ELEVATIONS LESS THAN MHHW FILL MATERIAL USED TO MEET THE PRESCRIBED GRADE SHOULD BE OF SIMILAR MATERIAL AS EXISTING OR FILTER ROCK MAY BE USED. IF FILTER ROCK IS USED COMPACTION IS NOT NECESSARY.
6. EXCAVATED SOIL AND SEDIMENT REQUIRES SCREENING FOR RADIONUCLIDES PRIOR TO PLACEMENT ON SITE. MINIMIZE EXCAVATION VOLUMES TO THE EXTENT POSSIBLE.
7. SHORELINE EXCAVATIONS ARE NOT TO BE EXPOSED TO INCOMING TIDAL WATER WITHOUT STABILIZATION.
8. CONSTRUCT REVETMENT OFF SHORE AND ALONG SHORE TO AT LEAST THE PROPERTY BOUNDARY.
9. CREST OF REVETMENT MEETS THE FINAL COVER GRADE AT ELEVATION +15 FT MSL.

TIDAL RANGES AND ELEVATION DATUMS

Tidal Datum	Reference Datum		
	MLLW	NGVD 1929	MSL
Extreme	+9.7	+6.58	+6.14
MHHW	+6.73	+3.61	+3.17
MHW	+6.10	+2.98	+2.54
MSL	+3.56	+0.44	0
NGVD	+3.12	0	-0.44
MLW	+1.12	-2.06	-2.44
MLLW	0	-3.12	-3.56

EXAMPLE: MSL = MLLW + 3.56 (REF: MLLW)

LEGEND

- TOP OF RIPRAP
- EXISTING GRADE
- GEOTEXTILE FILTER FABRIC
- EXCAVATION AREA
- CLEAN FILL AREA
- RIPRAP (3' THICK)
- 6" FILTER ROCK

MHHW	MEAN HIGHER HIGH WATER
MHW	MEAN HIGH WATER
MSL	MEAN SEA LEVEL
NGVD	NATIONAL GEODETIC VERTICAL DATUM
MLW	MEAN LOW WATER
MLLW	MEAN LOWER LOW WATER

10' 0 10' 20'
SCALE IN FEET

SYMBOL	DESCRIPTION	PREP. BY	DATE	APPROVED

REVISIONS

PREPARED BY: Chaduxtt JV
DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RE-CHECKED BY:
APPROVED BY:
DATE: 12/09/2009

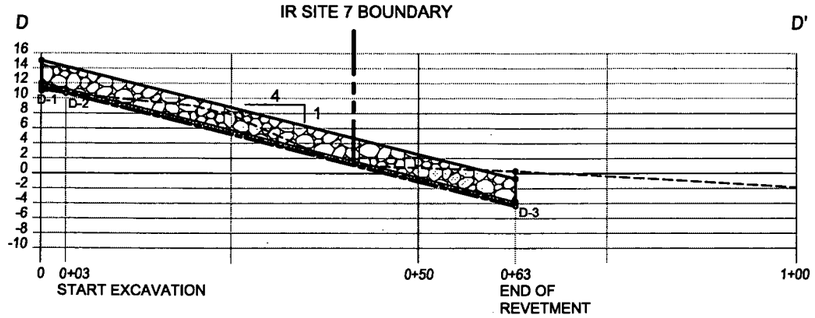
SIZE D
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT
SCALE REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
SAN DIEGO, CALIFORNIA
BRAC PMO WEST

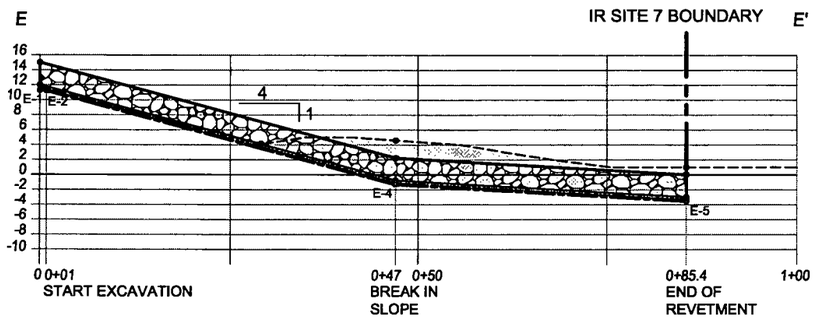
IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
CROSS-SECTIONS A, B, AND C

CODE IDENT. NO.
PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California
CONSTR. CONTR. NO.
N62473-09-D-2608
SPECIFICATION
(D.O. –)
NAVFAC DWG. NO.
DWG. NO.
C5
SHEET 6 OF 13

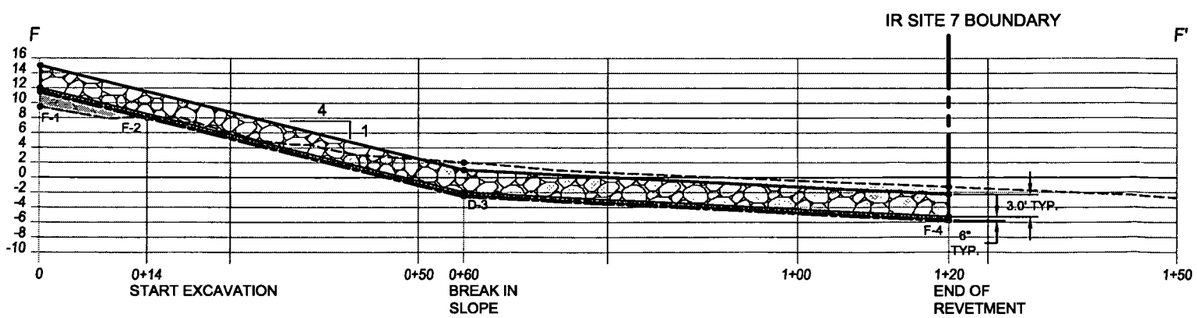
R:\Navy\Hunters-Pt\Parcel B\107_108\Preliminary Design\ C5-6-7- Shore Line Cross Sections.dwg 12/09/2009 deborah.ford DN



POINT	EASTING	NORTHING	ELEVATION			
			EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
D-1	1459823.63	453933.06	11.00	15.00	12.00	11.50
D-2	1459824.09	453936.29	10.40	–	–	–
D-3	1459832.53	453995.31	0.30	-0.71	-3.71	-4.21



POINT	EASTING	NORTHING	ELEVATION			
			EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
E-1	1459956.62	453878.33	11.28	15.00	12.00	11.50
E-2	1459956.37	453879.30	11.06	–	–	–
E-3	1459949.41	453908.53	4.16	–	–	–
E-4	1459944.99	453923.84	4.59	2.23	-0.76	-1.26
E-5	1459935.47	453961.05	1.00	0.00	-3.00	-3.50



POINT	EASTING	NORTHING	ELEVATION			
			EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
F-1	1460026.69	453962.45	9.46	15.00	12.00	11.50
F-2	1460021.68	453975.56	8.00	–	–	–
F-3	1460006.79	454014.55	2.02	1.02	-1.98	-2.52
F-4	1459983.97	454074.31	-1.27	-2.27	-5.27	-5.77

NOTE:
ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.

10' 0 10' 20'
SCALE IN FEET

TIDAL RANGES AND ELEVATION DATUMS

Tidal Datum	Reference Datum		
	MLLW	NGVD.1929	MSL
Extreme	+9.7	+6.58	+6.14
MHHW	+6.73	+3.61	+3.17
MHW	+6.10	+2.98	+2.54
MSL	+3.56	+0.44	0
NGVD	+3.12	0	-0.44
MLW	+1.12	-2.08	-2.44
MLLW	0	-3.12	-3.58

EXAMPLE: MSL = MLLW + 3.56 (REF: MLLW)

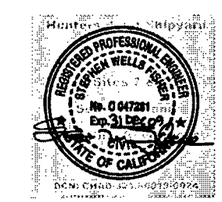
NOTES:

1. POINTS D-2, E-2, AND F-2 CORRESPOND TO SHORELINE EXCAVATION START. GRADE ACCORDINGLY SLOPE 4H:1V.
2. AT ELEVATIONS ABOVE MHHW COVER FILL MATERIAL TO BE USED.
3. COMPACT FILL UNDER REVETMENT TO AT LEAST 90% OF MAX. DRY DENSITY BASED ON PROCTOR ASTM D1557.
4. GRADE UPPER BANK OF SHORELINE TO A SLOPE OF 4H:1V AND EXTEND GRADE OFF SHORE TO A POINT WHERE THE COMPLETED REVETMENT TOE WILL BE AT LEAST 1 FT BELOW THE EXISTING GRADE. WHERE NECESSARY EXTEND THE EXCAVATION TO THE PROPERTY BOUNDARY FOLLOWING THE EXISTING GRADE TO A DEPTH SO THAT THE COMPLETED REVETMENT TOE WILL BE AT LEAST 1 FT BELOW THE EXISTING GRADE AT THE PROPERTY BOUNDARY.
5. AT ELEVATIONS LESS THAN MHHW FILL MATERIAL USED TO MEET THE PRESCRIBED GRADE SHOULD BE OF SIMILAR MATERIAL AS EXISTING OR FILTER ROCK MAY BE USED. IF FILTER ROCK IS USED COMPACTION IS NOT NECESSARY.
6. EXCAVATED SOIL AND SEDIMENT REQUIRES SCREENING FOR RADIONUCLIDES PRIOR TO PLACEMENT ON SITE. MINIMIZE EXCAVATION VOLUMES TO THE EXTENT POSSIBLE.
7. SHORELINE EXCAVATIONS ARE NOT TO BE EXPOSED TO INCOMING TIDAL WATER WITHOUT STABILIZATION.
8. CONSTRUCT REVETMENT OFF SHORE AND ALONG SHORE TO AT LEAST THE PROPERTY BOUNDARY.
9. CREST OF REVETMENT MEETS THE FINAL COVER GRADE AT ELEVATION +15 FT MSL.

LEGEND

- TOP OF RIPRAP
- EXISTING GRADE
- GEOTEXTILE FILTER FABRIC
- EXCAVATION AREA
- CLEAN FILL AREA
- RIPRAP (3' THICK)
- 6" FILTER ROCK

MHHW	MEAN HIGHER HIGH WATER
MHW	MEAN HIGH WATER
MSL	MEAN SEA LEVEL
NGVD	NATIONAL GEODETIC VERTICAL DATUM
MLW	MEAN LOW WATER
MLLW	MEAN LOWER LOW WATER



SYMBOL	DESCRIPTION	PREP.BY	DATE	APPROVED

REVISIONS

PREPARED BY: ChaduxTt JV

DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RE-CHECKED BY:
APPROVED BY:
DATE: 12/09/2009

SIZE D
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT
SCALE REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
SHORELINE AND REVETMENT CROSS-SECTIONS D, E, AND F

CODE IDENT. NO.
———

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

CONSTR. CONTR. NO.
N62473-09-D-2608

SPECIFICATION
——— (D.O. –)

NAVFAC DWG. NO.
———

DWG. NO.
C6

SHEET 7 OF 13

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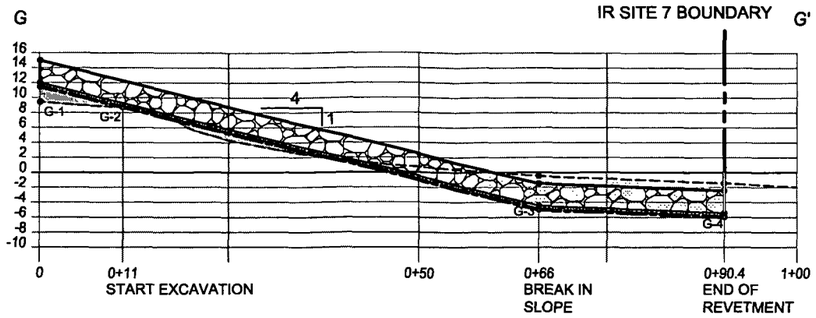
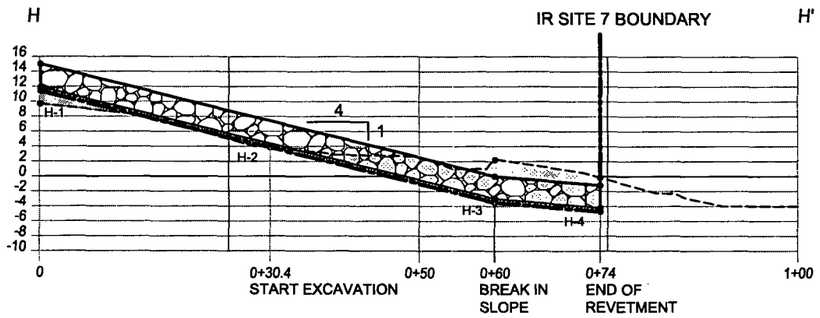
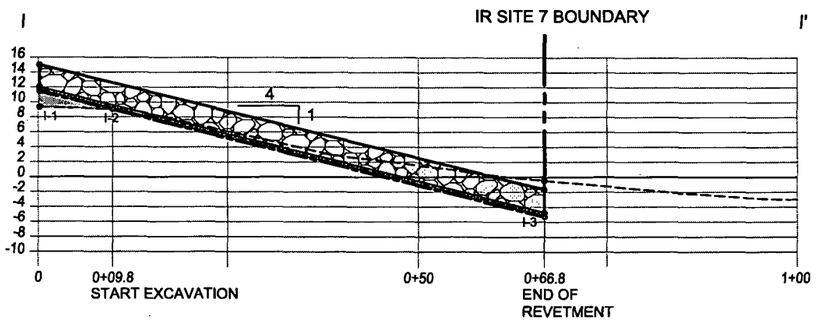


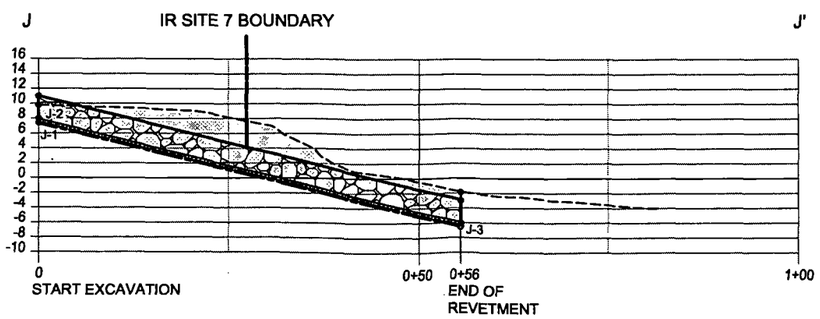
POINT	EASTING	NORTHING	EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
G-1	1460083.25	453974.91	9.45	15.00	12.00	11.50
G-2	1460084.02	453985.89	8.76	–	–	–
G-3	1460087.85	454040.56	-0.46	-1.46	-4.46	-4.96
G-4	1460087.85	454065.03	-1.43	-2.43	-5.43	-5.93



POINT	EASTING	NORTHING	ELEVATION: EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
H-1	1460160.41	453938.16	9.67	15.00	12.00	11.50
H-2	1460165.87	453968.07	3.47	–	–	–
H-3	1460171.19	453997.18	2.21	0.00	-3.00	-3.50
H-4	1460173.69	454010.87	-0.19	-1.19	-4.19	-4.69



POINT	EASTING	NORTHING	ELEVATION: EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
I-1	1460261.91	453879.72	9.35	15.00	12.00	11.50
I-2	1460262.82	453889.47	9.00	–	–	–
I-3	1460268.13	453946.18	-0.65	-1.65	-4.65	-5.15



POINT	EASTING	NORTHING	ELEVATION: EXISTING GRADE	TOP OF RIPRAP	TOP OF FILTER LAYER	BOTTOM OF FILTER LAYER
J-1	1460369.67	453936.62	9.79	11.00	8.00	7.50
J-2	1460369.67	453936.62	9.79	–	–	–
J-3	1460326.49	453970.55	-1.87	-2.87	--5.87	-5.37

NOTE:
ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.

10' 0 10' 20'
SCALE IN FEET

NOTES:

1. POINTS G-2, H-2, I-2, AND J-2 CORRESPOND TO SHORELINE EXCAVATION START. GRADE ACCORDINGLY SLOPE 4H:1V.
2. AT ELEVATIONS ABOVE MHHW COVER FILL MATERIAL TO BE USED.
3. COMPACT FILL UNDER REVETMENT TO AT LEAST 90% OF MAX. DRY DENSITY BASED ON PROCTOR ASTM D1557.
4. GRADE UPPER BANK OF SHORELINE TO A SLOPE OF 4H:1V AND EXTEND GRADE OFF SHORE TO A POINT WHERE THE COMPLETED REVETMENT TOE WILL BE AT LEAST 1 FT BELOW THE EXISTING GRADE. WHERE NECESSARY EXTEND THE EXCAVATION TO THE PROPERTY BOUNDARY FOLLOWING THE EXISTING GRADE TO A DEPTH SO THAT THE COMPLETED REVETMENT TOE WILL BE AT LEAST 1 FT BELOW THE EXISTING GRADE AT THE PROPERTY BOUNDARY.
5. AT ELEVATIONS LESS THAN MHHW FILL MATERIAL USED TO MEET THE PRESCRIBED GRADE SHOULD BE OF SIMILAR MATERIAL AS EXISTING OR FILTER ROCK MAY BE USED. IF FILTER ROCK IS USED COMPACTION IS NOT NECESSARY.
6. EXCAVATED SOIL AND SEDIMENT REQUIRES SCREENING FOR RADIONUCLIDES PRIOR TO PLACEMENT ON SITE. MINIMIZE EXCAVATION VOLUMES TO THE EXTENT POSSIBLE.
7. SHORELINE EXCAVATIONS ARE NOT TO BE EXPOSED TO INCOMING TIDAL WATER WITHOUT STABILIZATION.
8. CONSTRUCT REVETMENT OFF SHORE AND ALONG SHORE TO AT LEAST THE PROPERTY BOUNDARY.
9. CREST OF REVETMENT MEETS THE FINAL COVER GRADE AT ELEVATION +15 FT MSL.

TIDAL RANGES AND ELEVATION DATUMS

Tidal Datum	Reference Datum: MLLW	NGVD 1929	MSL
Extreme	+9.7	+6.58	+6.14
MHHW	+6.73	+3.61	+3.17
MHW	+6.10	+2.98	+2.54
MSL	+3.56	+0.44	0
NGVD	+3.12	0	-0.44
MLW	+1.12	-2.06	-2.44
MLLW	0	-3.12	-3.56

EXAMPLE: MSL = MLLW + 3.56 (REF: MLLW)

LEGEND

- TOP OF RIPRAP
- EXISTING GRADE
- GEOTEXTILE FILTER FABRIC
- EXCAVATION AREA
- CLEAN FILL AREA
- RIPRAP (3' THICK)
- 6" FILTER ROCK

MHHW	MEAN HIGHER HIGH WATER
MHW	MEAN HIGH WATER
MSL	MEAN SEA LEVEL
NGVD	NATIONAL GEODETIC VERTICAL DATUM
MLW	MEAN LOW WATER
MLLW	MEAN LOWER LOW WATER

SYMBOL	DESCRIPTION	PREP.BY	DATE	APPROVED

REVISIONS

PREPARED BY: ChaduxTt JV
DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RE-CHECKED BY:
APPROVED BY:
DATE: 12/09/2009

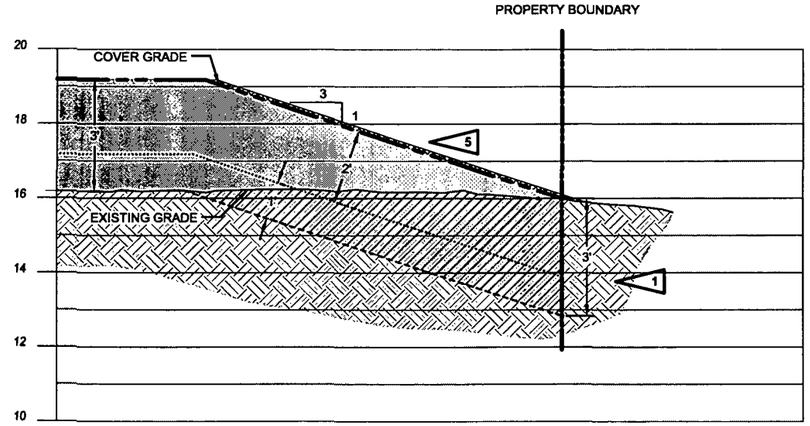
SIZE D
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT
SCALE REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
SHORELINE AND REVETMENT CROSS-SECTIONS G, H, I, AND J

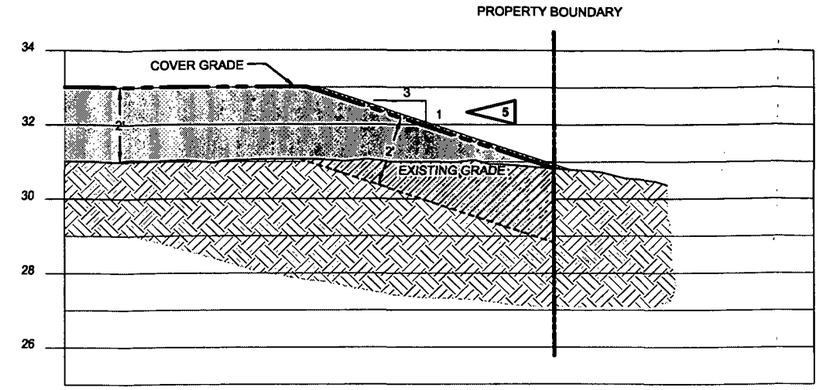
CODE IDENT. NO.
PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California
CONSTR. CONTR. NO.
N62473-09-D-2608
SPECIFICATION
(D.O. –)
NAVFAC DWG. NO.
DWG. NO.
C7
SHEET 8 OF 13

R:\Navy\Hunters-Pt\Parcel B\Ir07_Ir08\Preliminary Design\ C5-6-7- Shore Line Cross Sections.dwg 12/09/2009 deborah.ford DN



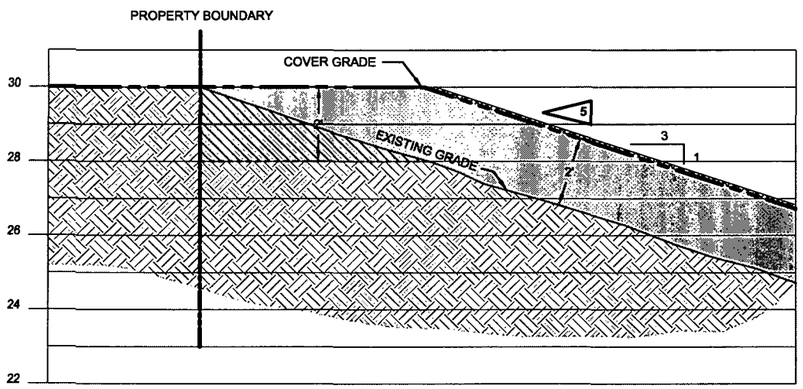
A C2 C8 WEST BOUNDARY 3 FT. COVER CROSS-SECTION (TYP.)

SCALE: 1" = 2'-0"



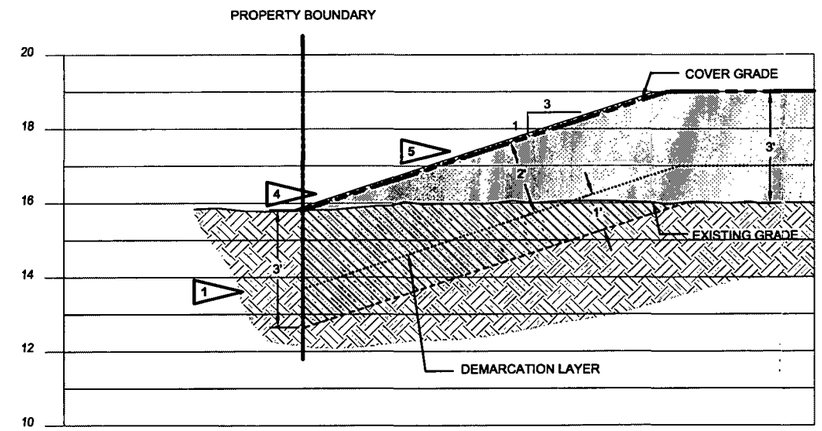
B C2 C8 WEST BOUNDARY 2 FT. COVER CROSS-SECTION (TYP.)

SCALE: 1" = 2'-0"



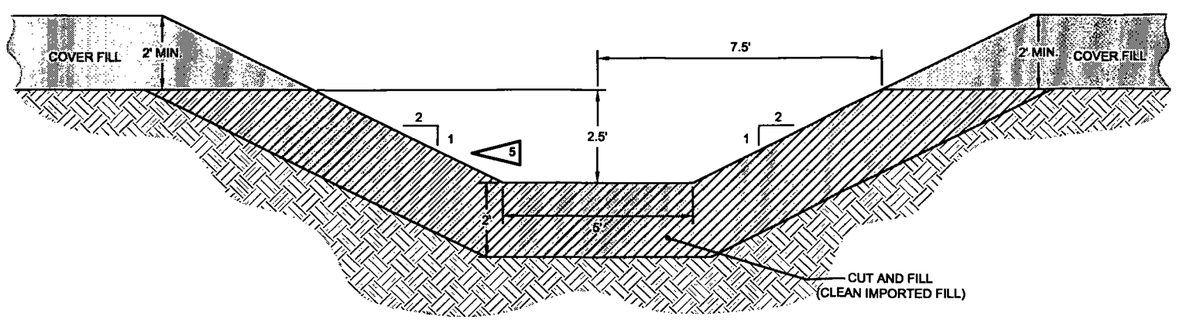
C C2 C8 EAST BOUNDARY 2 FT. COVER CROSS-SECTION (TYP.)

SCALE: 1" = 2'-0"



D C2 C8 EAST BOUNDARY 3 FT. COVER CROSS-SECTION (TYP.)

SCALE: 1" = 2'-0"



E C2 C8 CHANNEL CROSS-SECTION

SCALE: 1" = 2'-0"

NOTE:

ALL DIMENSIONS APPROXIMATE.

2' 0 2' 4'

SCALE: 1" = 2'-0"

NOTE:

1. DEMARCATION LAYER TO EXTEND TO SITE BOUNDARY.
2. COVER FILL COMPOSED OF COMPACTED SOIL LAYER AND EROSION RESISTANT LAYER.
3. OFF-SITE BOUNDARY ELEVATIONS ARE APPROXIMATE.
4. UTILIZE EXCESS GRAVEL, CRUSHED ROCK, AND OTHER MATERIAL AND EXISTING SIMILAR SITE MATERIAL AS EROSION RESISTANT ARMORING ALONG SIDE SLOPE FOR THE NORTHERN PORTION OF THE SOUTHEAST PROPERTY BOUNDARY.
5. INSTALL CTRM ON SLOPED PORTION OF COVER TO OFF-SITE BOUNDARY.
6. MAINTAIN EXISTING CHANNEL BED SLOPE AND CROSS-SECTION GEOMETRY. REPLACE EXISTING ARMORING MATERIAL WITH SIMILAR MATERIAL OR REUSE EXISTING.

LEGEND

- EXISTING SURFACE
- DEMARCATION LAYER
- FINAL COVER SURFACE
- EXCAVATION SURFACE
- CTRM
- EXISTING
- PROPOSED COVER FILL
- PROPOSED EXCAVATION

TIDAL RANGES AND ELEVATION DATUMS

Tidal Datum	Reference Datum		
	MLLW	NGVD 1929	MSL
Extreme	+9.7	+6.58	+6.14
MHHW	+6.73	+3.61	+3.17
MHW	+6.10	+2.98	+2.54
MSL	+3.56	+0.44	0
NGVD	+3.12	0	-0.44
MLW	+1.12	-2.06	-2.44
MLLW	0	-3.12	-3.56

ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.

SYMBOL	DESCRIPTION	PREP BY	DATE	APPROVED

REVISIONS

PREPARED BY: ChaduxTt JV

DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RE-CHECKED BY:
APPROVED BY:
DATE: 12/09/2009

SIZE D
IF SHEET IS LESS THAN 22" X 34" IT IS A REDUCED PRINT
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DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
SOIL COVER BOUNDARY CROSS-SECTIONS
DETAILS A, B, C, AND D

CODE IDENT. NO.

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

CONSTR. CONTR. NO.
N62473-09-D-2608

SPECIFICATION
(D.O. –)

NAVFAC DWG. NO.

DWG. NO.
C8

SHEET 9 OF 13

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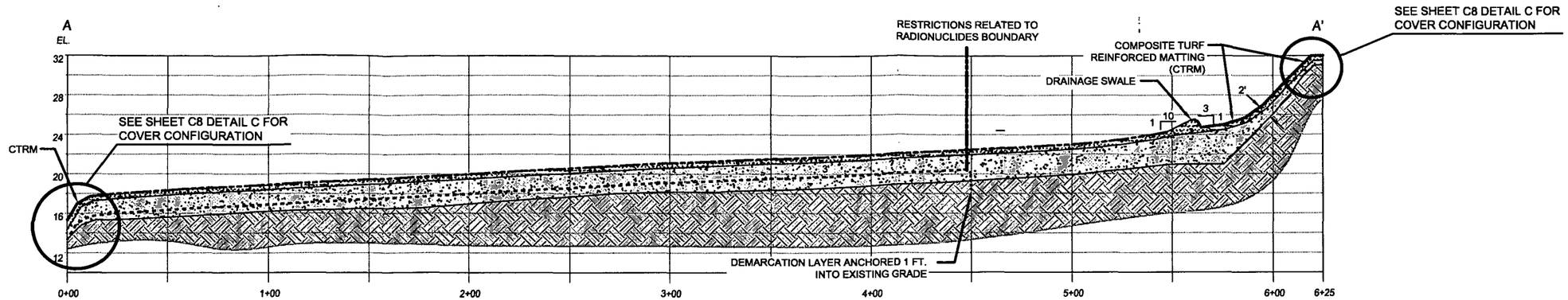
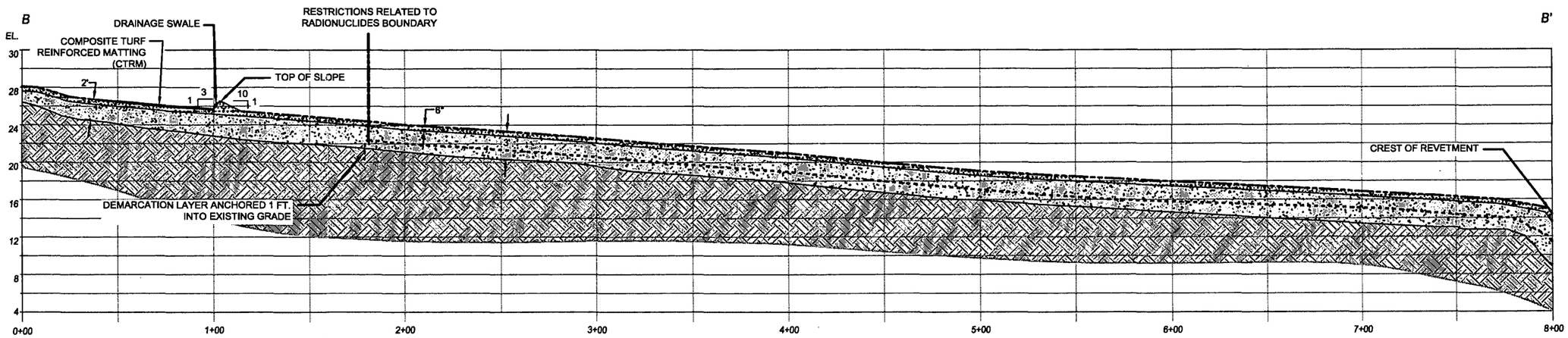


A–A' / C3 C9 COVER CROSS SECTION A-A' (TYP.)

HORIZONTAL SCALE: 1" = 30'
VERTICAL SCALE: 1" = 6'



B–B' / C3 C9 COVER CROSS SECTION B-B' (TYP.)

HORIZONTAL SCALE: 1" = 30'
VERTICAL SCALE: 1" = 6'

LEGEND

- PROPOSED EROSION RESISTANT LAYER
- PROPOSED COMPACTED COVER LAYER
- EXISTING SURFACE
- DEMARCATION LAYER
- COMPOSITE TURF REINFORCED MATTING
- EL. ELEVATION

NOTE:

1. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.
2. COVER FILL COMPOSED OF COMPACTED SOIL LAYER AND EROSION RESISTANT LAYER.

6' 0 6' 12'
SCALE: 1" = 6'
VERTICAL

30' 0 30' 60'
SCALE: 1" = 30'
HORIZONTAL

Hunters Point Shipyard
REGISTERED PROFESSIONAL ENGINEER STEPHEN WELLS FISHER No. C 047281 Exp. 31 DEC 09 CIVIL STATE OF CALIFORNIA

SYMBOL	DESCRIPTION	PREP.BY	DATE	APPROVED

REVISIONS

PREPARED BY: ChadwickTt_JV

DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RE-CHECKED BY:
APPROVED BY:
DATE: 12/09/2009

SIZE D
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SCALE REDUCED ACCORDINGLY

DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
SOIL COVER CROSS SECTIONS DETAILS
A-A' AND B-B'

CODE IDENT. NO.

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

CONSTR. CONTR. NO.
N62473-09-D-2608

SPECIFICATION
(D.O. –)

NAVFAC DWG. NO.

DWG. NO.
C9

SHEET 10 OF 13

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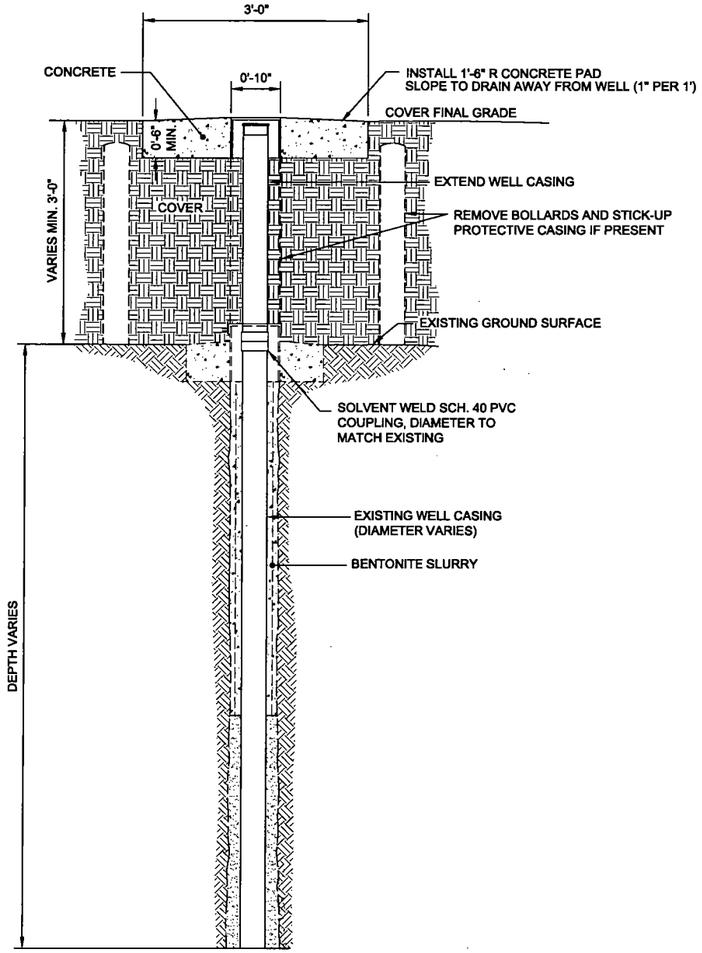
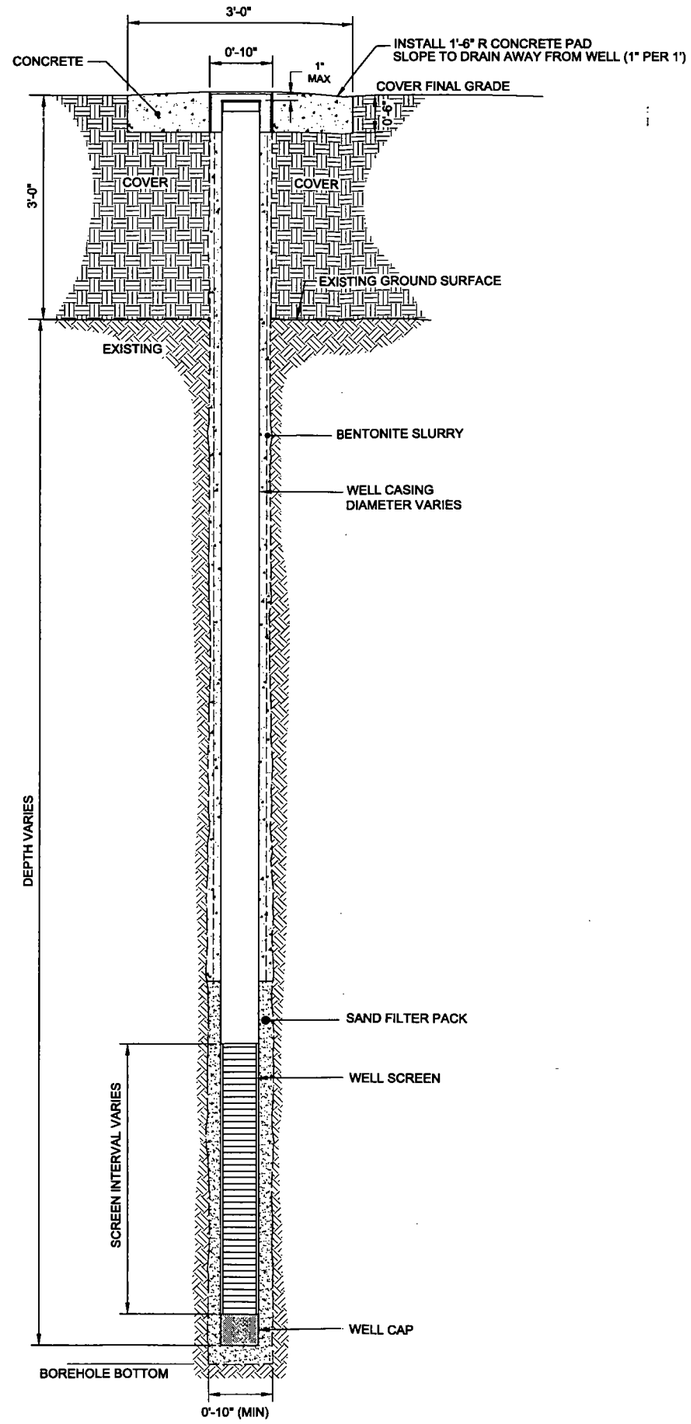


1 C1 C10 FLUSH MOUNTED MONITORING WELL EXTENSION (TYP.)

FOR ALL EXISTING WELLS IRXXMWXX

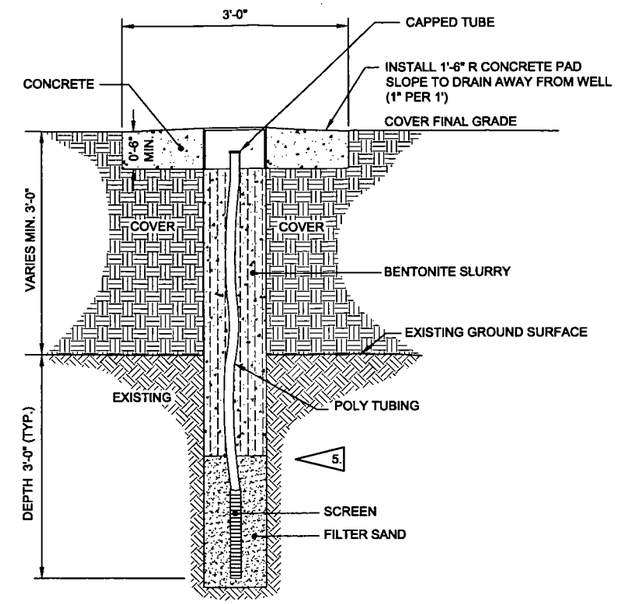
SCALE: 1" = 1'-0"



1 C1 C10 NEW FLUSH MOUNTED MONITORING WELL (TYP.)

FOR ALL REPLACEMENT WELLS IRXXMWXX

SCALE: 1" = 1'-0"



2 C1 C10 NEW FLUSH MOUNTED METHANE PROBE (TYP.)

FOR ALL PROBES SG-XX

NOT TO SCALE

NOTE:

1. PROTECT GROUNDWATER MONITORING WELLS AND METHANE MONITORING PROBES AS NECESSARY DURING CONSTRUCTION OF THE COVER.
2. REMOVE CONCRETE PADS AND/OR FLUSH MOUNTED PROTECTIVE CASING IF OBSTRUCTIVE TO THE EXTENSION COUPLING.
3. INSTALL AT ALL WELLS AND PROBES A PERMANENT IDENTIFICATION MARKER TO FACILITATE LOCATING WELLS. MARKER HEIGHT OF AT LEAST 3 FT ABOVE FINAL WELL ELEVATION.
4. SEE C4 FOR EXISTING MONITORING WELL AND METHANE PROBE SCHEDULE.

5. INSTALL FILTER SAND TO 6" ABOVE TOP OF SCREEN

1' 0 1' 2'

SCALE: 1" = 1'-0"

SYMBOL	DESCRIPTION	PREP BY	DATE	APPROVED

REVISIONS

PREPARED BY: ChaduxTt JV

DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RE-CHECKED BY:
APPROVED BY:
DATE: 12/11/2009

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NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT
MONITORING WELL AND METHANE MONITORING PROBE EXTENSION DETAILS

CODE IDENT. NO.

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

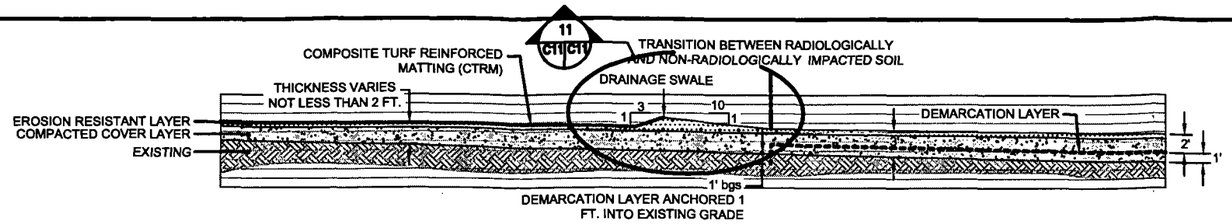
CONSTR. CONTR. NO.
N62473-09-D-2808

SPECIFICATION
(D.O. –)

NAVFAC DWG. NO.

DWG. NO.
C10

SHEET 11 OF 13

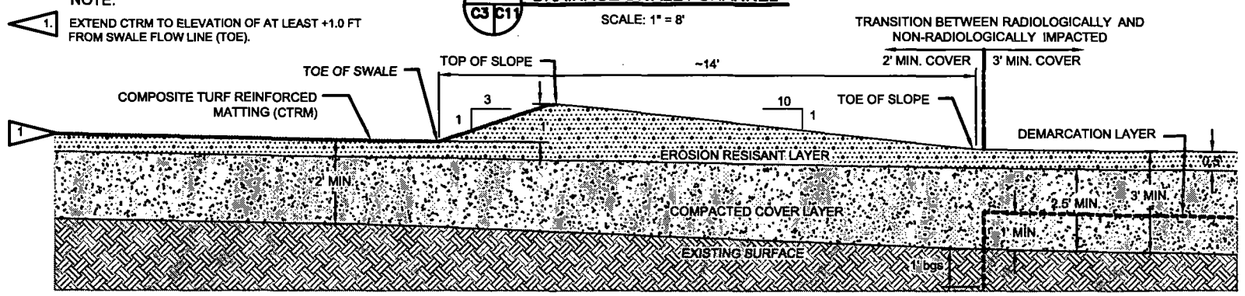


K C3 C11 DRAINAGE SWALE / CHANNEL

SCALE: 1" = 8'

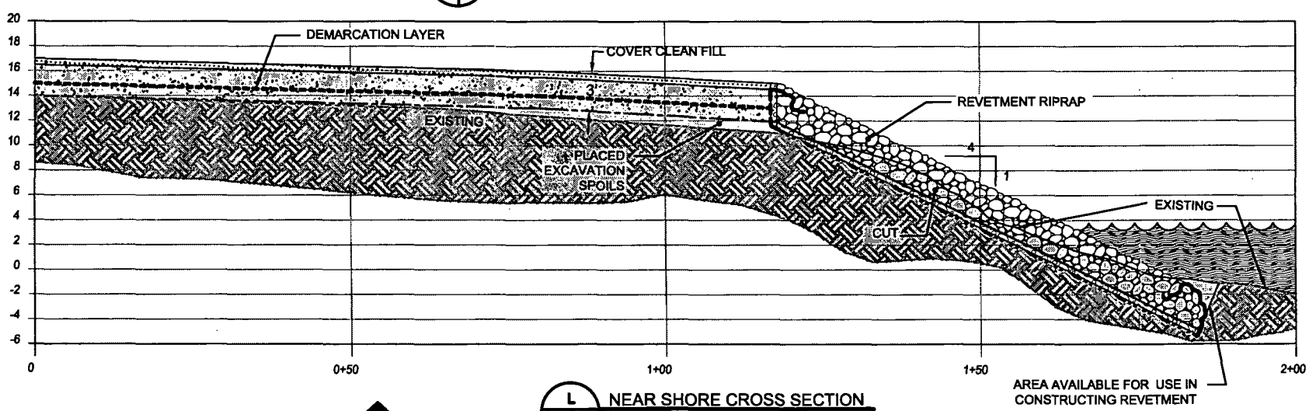
NOTE:

1. EXTEND CTRM TO ELEVATION OF AT LEAST +1.0 FT FROM SWALE FLOW LINE (TOE).



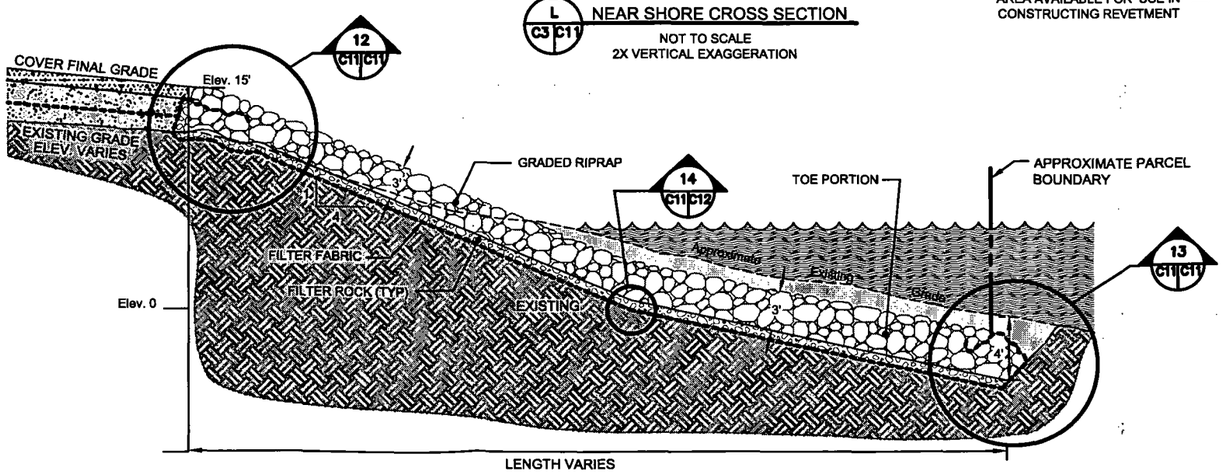
11 C11 C11 DRAINAGE SWALE / CHANNEL DETAIL

SCALE: 1" = 2'



L C3 C11 NEAR SHORE CROSS SECTION

NOT TO SCALE
2X VERTICAL EXAGGERATION

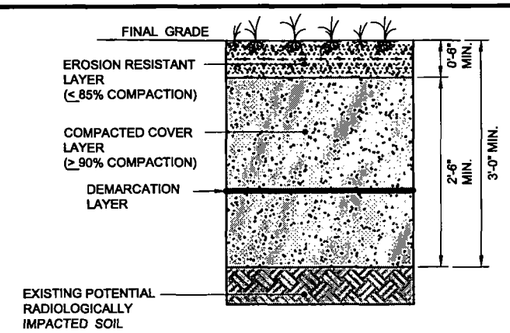


M C3 C11 GENERALIZED REVETMENT CROSS SECTION

NOT TO SCALE

NOTE:

ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.



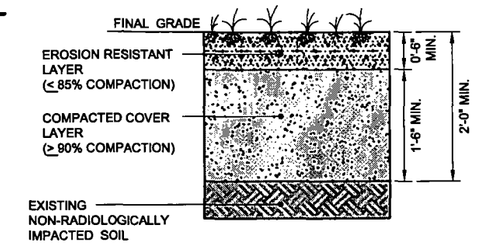
COVER OVER POTENTIAL RADIOLOGICALLY IMPACTED AREA

5 C3 C11 COVER COMPONENTS

SCALE: 1" = 1'-0"

NOTE:

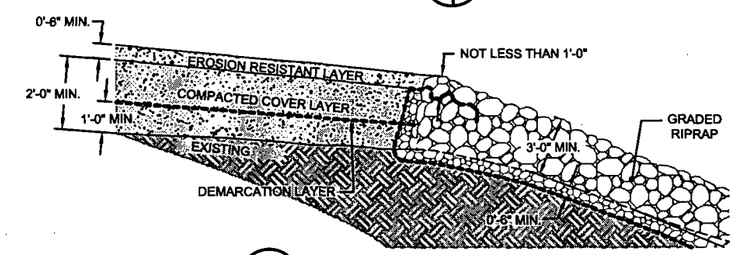
EXCAVATED NON-RADIOLOGICALLY IMPACTED SOIL TO BE PLACED UNDER COMPACTED COVER LAYER.



COVER OVER NON-RADIOLOGICALLY IMPACTED AREA

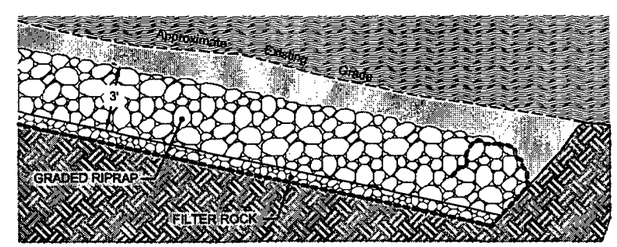
6 C3 C11 COVER COMPONENTS

SCALE: 1" = 1'-0"



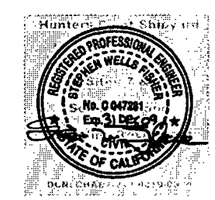
12 C11 C11 TIE IN OF FILTER FABRIC AT CREST

SCALE: 1" = 3'-0"



13 C11 C11 TIE IN OF FILTER FABRIC AT TOE

SCALE: 1" = 3'-0"



3' 0 3' 6'
SCALE: 1" = 3'

1' 0 1' 2'
SCALE: 1" = 1'

2' 0 2' 4'
SCALE: 1" = 2'

8' 0 8' 16'
SCALE: 1" = 8'

SYMBOL	DESCRIPTION	PREP.BY	DATE	APPROVED

REVISIONS

PREPARED BY: ChaduxTt JV

DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RE-CHECKED BY:
APPROVED BY:
DATE: 12/09/2009

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DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT DETAILS I

CODE IDENT. NO.

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

CONSTR. CONTR. NO.
N62473-09-D-2608

SPECIFICATION
(D.O. –)

NAVFAC DWG. NO.

DWG. NO.
C11

SHEET 12 OF 13

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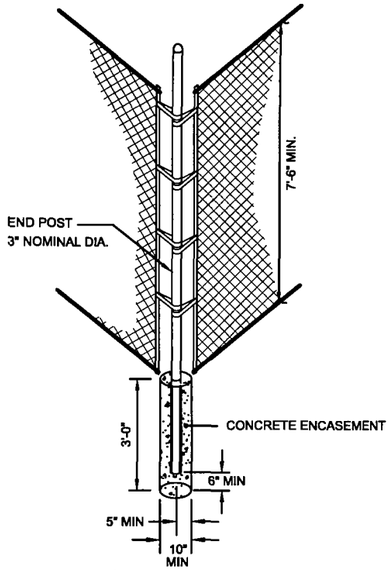
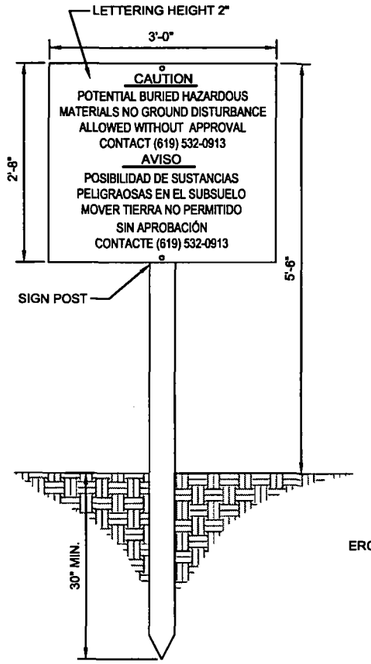
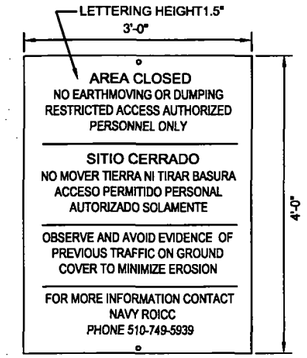


4 C3 C12 FENCE POST DETAIL
SCALE: ½" = 1'-0"

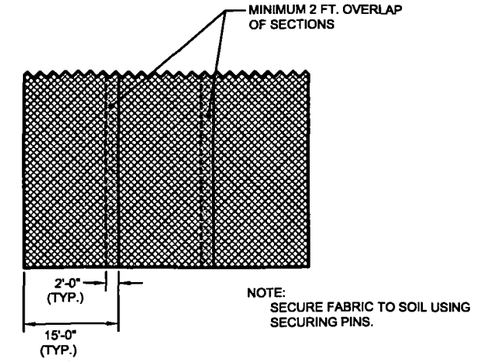
NOTE:
CONCRETE ENCASEMENT OF FENCE POST NOT NECESSARY FOR TEMPORARY FENCE. REMOVE ANY CONCRETE USED OFF NAVY PROPERTY.



8 C3 C12 WARNING SIGN
SCALE: 1" = 1'-0"

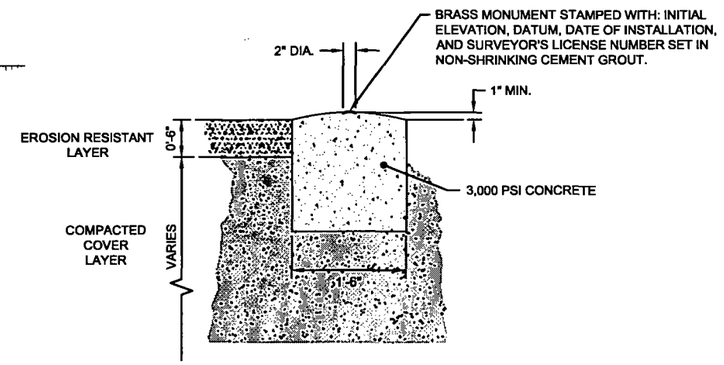


10 C3 C12 ENTRANCE SIGN
SCALE: 1" = 1'-0"

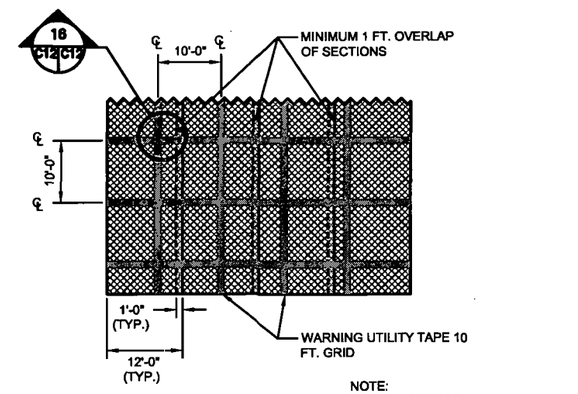


NOTE:
SECURE FABRIC TO SOIL USING SECURING PINS.

14 C12 C12 FILTER FABRIC DETAIL - REVETMENT
SCALE = 1'-0"

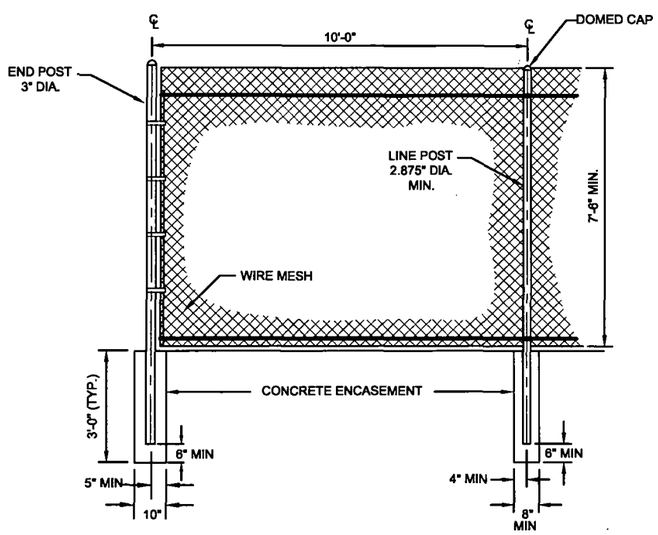


7 C3 C12 MONUMENT (TYP.)
SCALE: 1" = 1'-0"



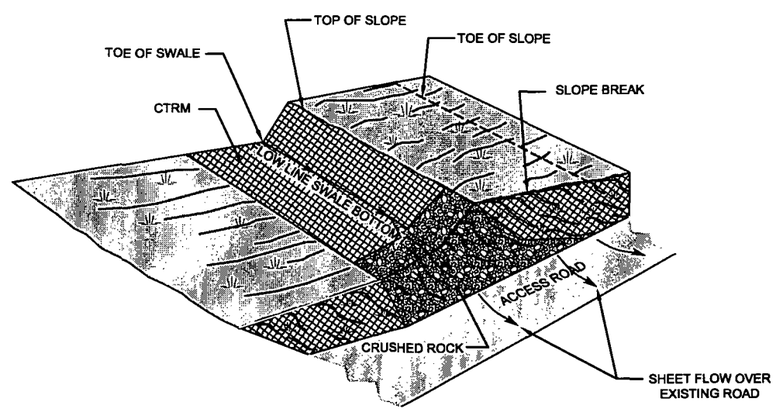
NOTE:
SECURE FABRIC AND UTILITY TAPE TO SOIL USING SECURING PINS.

15 C11 C12 DEMARCATON LAYER - EXTENT OF RESTRICTIONS RELATED TO RADIONUCLIDES
SCALE = 1'-0"



3 C2 C12 FENCE DETAIL
SCALE: ½" = 1'-0"

NOTE:
CONCRETE ENCASEMENT OF FENCE POST NOT NECESSARY FOR TEMPORARY FENCE. REMOVE ANY CONCRETE USED OFF NAVY PROPERTY.



9 C3 C12 SWALE OUTLET
NOT TO SCALE

16 C12 C12 UTILITY WARNING TAPE
NOT TO SCALE

8' 0 8' 16'
SCALE: 1" = 8'

SYMBOL	DESCRIPTION	PREP.BY	DATE	APPROVED

REVISIONS

PREPARED BY: ChadwXTt JV

DESIGNED BY: JBL
DRAWN BY: DMF
CHECKED BY: SWF
RE-CHECKED BY:
APPROVED BY:
DATE: 12/09/2009

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DEPARTMENT OF THE NAVY
NAVAL FACILITIES ENGINEERING COMMAND
BRAC PMO WEST
SAN DIEGO, CALIFORNIA

IR SITES 7 & 18 SOIL COVER AND SHORELINE REVETMENT DETAILS II

CODE IDENT. NO.

PROJECT LOCATION
Hunters Point Shipyard
San Francisco, California

CONSTR. CONTR. NO.
N62473-09-D-2608

SPECIFICATION
(D.O. --)

NAVFAC DWG. NO.

DWG. NO.
C12

SHEET 13 OF 13

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ATTACHMENT 3
REPAIR AND MAINTENANCE SPECIFICATIONS

SUMMARY OF SPECIFICATIONS PERTAINING TO SITE O&M

Section	Title
01 45 02	Quality Control
10 14 01	Signs
31 00 00	Earthwork
31 05 22	Geotextiles
32 31 26	Fencing and Gates
32 92 19	Seeding
33 24 13	Monitoring Wells
35 31 19	Coastal Protection

SECTION 01 45 02
QUALITY CONTROL

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 the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 3740	(2008) Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
ASTM E 329	(2008) Agencies Engaged in the Testing and/or Inspection of Materials used on Construction

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 Submittal Procedures.

1.2.1 SD-01, Preconstruction Submittal

a. Quality Control (QC) plan; G

1.3 INFORMATION FOR THE CONTRACTING OFFICER

Deliver the following to the Contracting Officer:

a. Combined Contractor Production Report/Contractor Quality Control Report (1 sheet): Original and 1 copy by 10:00 a.m. the next working day after each day that work is performed;

b. QC Specialist Reports: Originals and 1 copy by 10:00 a.m. the next working day after each day that work is performed, attached to the Contractor Quality Control Report;

c. Field Test Reports: 2 copies, within 2 working days after the test is performed, attached to the Contractor Quality Control Report;

d. Monthly Summary Report of Tests: 2 copies attached to the Contractor Quality Control Report;

e. Testing Plan and Log, 2 copies, at the end of each month;

f. Rework Items List: 2 copies, by the last working day of the month

g. QC Meeting Minutes: 2 copies, within 2 working days after the meeting and;

h. QC Certifications: As required by the paragraph titled "QC Certifications."

1.4 QC PROGRAM REQUIREMENTS

The QC program requirements are contained in the Remedial Action Contract (RAC).

1.5 QC ORGANIZATION

1.5.1 QC Manager

1.5.1.1 Duties

Provide a QC Manager at the work site to implement and manage the QC program. In addition to implementing and managing the QC program, the QC Manager may perform the duties of project superintendent.

The QC Manager is required to attend the Coordination and Mutual Understanding Meeting, conduct the QC meetings, perform the three phases of control, perform submittal review, perform submittal approval, ensure testing is performed, and provide QC certifications and documentation required in this Contract. The QC Manager is responsible for managing and coordinating the three phases of control and documentation performed by Testing Laboratory personnel and any other inspection and testing personnel required by this contract.

1.5.1.2 Qualifications

An individual with a minimum of 5 years experience as a superintendent, inspector, QC Manager, project manager, or construction manager on similar size and type construction contracts that included the major trades that are part of this Contract.

1.6 QUALITY CONTROL (QC) PLAN

1.6.1 Requirements

Provide for approval by the Contracting Officer, a QC plan submitted in accordance with the requirements of the RAC.

1.7 COORDINATION AND MUTUAL UNDERSTANDING MEETING

After submission of the QC Plan and prior to the start of construction, meet with the Contracting Officer to present the QC program required by this Contract. The purpose of this meeting is to develop a mutual understanding of the QC details, including documentation, administration for on-site and off-site work, and the coordination of the Contractor's management, production, and QC personnel. At the meeting, the Contractor will be required to explain in detail how the three phases of control will be implemented for each definable feature of work. As a minimum, the Contractor's personnel required to attend shall include an officer

of the firm, the project manager, project superintendent, QC Manager, Architectural Engineering (A/E) Firm, and subcontractor representatives. Each subcontractor who will be assigned QC responsibilities shall have a principal of the firm at the meeting. Minutes of the meeting will be prepared by the QC Manager and signed by the Contractor, the A/E, and the Contracting Officer. A copy of the signed minutes shall be provided to all attendees by the Contractor.

1.8 QC MEETINGS

After the start of construction, the QC Manager shall conduct weekly QC meetings at the work site with the project superintendent. The QC Manager shall prepare the minutes of the meeting and provide a copy to the Contracting Officer within 2 working days after the meeting. The Contracting Officer may attend these meetings. The QC Manager shall notify the Contracting Officer at least 48 hours in advance of each meeting. As a minimum, the following shall be accomplished at each meeting:

a. Review the minutes of the previous meeting;

b. Review the schedule and the status of work:

- Work or testing accomplished since last meeting;
- Rework items identified since last meeting;
- Rework items completed since last meeting;

c. Review the status of submittals:

- Submittals reviewed and approved since last meeting;
- Submittals required in the near future;

d. Review the work to be accomplished in the next 2 weeks and the documentation required:

- Establish completion dates for rework items
- Update the schedule showing planned and actual dates of the preparatory, initial, and follow-up phases, including testing and any other inspection required by this Contract
- Discuss construction methods and the approach that will be used to provide quality construction by planning ahead and identifying potential problems for each definable feature of work
- Discuss status of off-site work or testing
- Documentation required;

e. Resolve QC and production problems:

- Assist in resolving Request for Information issues; and

f. Address items that may require revising the QC plan:

- Changes in QC organization personnel
- Changes in procedures.

1.9 THREE PHASES OF CONTROL

The three phases of control shall adequately cover both on-site and off-site work and shall include the following for each definable feature of work.

1.9.1 Preparatory Phase

Notify the Contracting Officer at least 1 work day in advance of each preparatory phase. Conduct the preparatory phase with the superintendent and the foreman responsible for the definable feature. Document the results of the preparatory phase actions in the daily Contractor Quality Control Report and in the Quality Control Checklist. Perform the following prior to beginning work on each definable feature of work:

a. Review each paragraph of the applicable specification sections;

b. Review the Contract Drawings;

c. Verify that appropriate shop Drawings and submittals have been submitted and approved. Verify receipt of approved factory test results, when required;

d. Review the testing plan and ensure that provisions have been made to provide the required QC testing;

e. Examine the work area to ensure that the required preliminary work has been completed;

f. Examine the required materials, equipment, and sample work to ensure that they are on hand and conform to the approved shop Drawings and submitted data;

g. Review the safety plan and appropriate activity hazard analysis to ensure that applicable safety requirements are met, and that required Material Safety Data Sheets (MSDS) are submitted; and

h. Discuss construction methods and the approach that will be used to provide quality construction for each definable feature of work.

1.9.2 Initial Phase

Notify the Contracting Officer at least 1 work day in advance of each initial phase. When construction crews are ready to start work on a definable feature of work, conduct the initial phase with the superintendent and the foreman responsible for that definable feature of work. Observe the initial segment of the definable feature of work to ensure that the work complies with Contract requirements. Document the results of the initial phase in the daily Contractor Quality Control Report and in the Quality Control Checklist. Repeat the initial phase for each new crew to work on site, or when acceptable levels of specified quality are not being met. Perform the following for each definable feature of work:

a. Establish the quality of workmanship required;

b. Resolve conflicts;

c. Review the Safety Plan and the appropriate activity hazard analysis to ensure that applicable safety requirements are met; and

d. Ensure that testing is performed.

1.9.3 Follow-up Phase

Perform the following for on-going work daily, until the completion of each definable feature of work and document in the daily Contractor Quality Control Report and in the Quality Control Checklist:

a. Ensure the work is in compliance with Contract requirements;

b. Maintain the quality of workmanship required;

c. Ensure that testing is performed; and

d. Ensure that rework items are being corrected.

1.10 SUBMITTAL REVIEW AND APPROVAL

Procedures for submission, review, and approval of submittals are described in the RAC.

1.11 TESTING

Except as stated otherwise in the specification sections, perform sampling and testing required under this Contract.

1.11.1 Testing Laboratory Requirements

Provide an independent testing laboratory qualified to perform sampling and tests required by this Contract. When the proposed testing laboratory is not accredited by an acceptable accreditation program as described by the paragraph titled "Accredited Laboratories," submit to the Contracting Officer for approval, certified statements signed by an official of the testing

laboratory attesting that the proposed laboratory meets or conforms to the following requirements:

a. Laboratories engaged in testing of construction materials shall meet the requirements of ASTM E 329.

b. Laboratories engaged in testing of soil and rock, as used in engineering design and construction, shall meet the requirements of ASTM D 3740.

1.11.2 Accredited Laboratories

In addition to applicable U.S. Navy approval through the Naval Facilities Engineering Service Center (NFESC), acceptable accreditation programs are the National Institute of Standards and Technology (NIST)/National Voluntary Laboratory Accreditation Program (NVLAP), the American Association of State Highway and Transportation Officials (AASHTO) program, and the American Association for Laboratory Accreditation (A2LA) program. Furnish to the Contracting Officer a copy of the Certificate of Accreditation and Scope of Accreditation and latest directory of the accrediting organization for accredited laboratories. The scope of the laboratory's accreditation shall include the test methods required by the Contract.

1.11.3 Inspection of Testing Laboratories

Prior to approval of non-accredited laboratories, the proposed testing laboratory facilities and records may be subject to inspection by the Contracting Officer. Records subject to inspection include equipment inventory, equipment calibration dates and procedures, library of test procedures, audit and inspection reports by agencies conducting laboratory evaluations and certifications, testing and management personnel qualifications, test report forms, and the internal QC procedures.

1.11.4 Capability Check

The Contracting Officer retains the right to check laboratory equipment in the proposed laboratory and the laboratory technician's testing procedures, techniques, and other items pertinent to testing, for compliance with the standards set forth in this Contract.

1.11.5 Test Results

Cite applicable Contract requirements, tests, or analytical procedures used. Provide actual results and include a statement that the item tested or analyzed conforms or fails to conform to specified requirements. If item fails to conform, notify Contracting Officer immediately. Conspicuously stamp the cover sheet for each report in large red letters "CONFORMS" or "DOES NOT CONFORM" to the specification requirements, whichever is applicable. Test results shall be signed by a testing laboratory representative authorized to sign certified test reports. Furnish the signed reports, certifications, and other documentation to the Contracting Officer via the QC Manager. Furnish a summary report of field tests at the end of each month. Attach a copy of the summary report to the last daily Contractor Quality Control Report of each month.

1.11.6 Test Reports and Monthly Summary Report of Tests

The QC Manager shall furnish the signed reports, certifications, and a summary report of field tests at the end of each month to the Contracting Officer. Attach a copy of the summary report to the last daily Contractor Quality Control Report of each month.

1.12 QC CERTIFICATIONS

1.12.1 Contractor Quality Control Report Certification

Each Contractor Quality Control Report shall contain the following statement: "On behalf of the Contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract Drawings and specifications to the best of my knowledge, except as noted in this report."

1.12.2 Invoice Certification

Furnish a certificate to the Contracting Officer with each payment request, signed by the QC Manager, attesting that as-built Drawings are current and attesting that the work for which payment is requested, including stored material, is in compliance with contract requirements.

1.12.3 Completion Certification

Upon completion of work under this Contract, the QC Manager shall furnish a certificate to the Contracting Officer attesting that "the work has been completed, inspected, tested, and is in compliance with the Contract."

1.13 DOCUMENTATION

Maintain current and complete records of on-site and off-site QC program operations and activities.

1.13.1 Contractor Production Report

Reports are required for each day that work is performed and shall be attached to the Contractor Quality Control Report prepared for the same day. Account for each calendar day throughout the life of the Contract. The reporting of work shall be identified by terminology consistent with the construction schedule. Contractor Production Reports are to be prepared, signed, and dated by the project superintendent and shall contain the following information:

a. Date of report, report number, name of contractor, Contract number, title and location of Contract, and superintendent present.

b. Weather conditions in the morning and in the afternoon including maximum and minimum temperatures.

c. A list of Contractor and subcontractor personnel on the work site, their trades, employer,

work location, description of work performed, and hours worked.

d. A list of job safety actions taken and safety inspections conducted. Indicate that safety requirements have been met including the results on the following:

- Attach a copy of the meeting minutes from the daily job safety meeting.
- Were there any lost time accidents? (If YES, attach a copy of the completed Occupational Safety and Health Administration report.)
- Was crane/trenching/scaffold/high voltage electrical/high work done? (If YES, attach a statement or checklist showing inspection performed.)
- Was hazardous material/waste released into the environment? (If YES, attach a description of meetings held and accidents that happened.)

e. A list of equipment/material received each day that is incorporated into the job.

f. A list of construction and plant equipment on the work site including the number of hours used, idle, and down for repair.

g. Include a "remarks" section in this report which will contain pertinent information including directions received, problems encountered during construction, work progress and delays, conflicts or errors in the Drawings or specifications, field changes, safety hazards encountered, instructions given and corrective actions taken, delays encountered, and a record of visitors to the work site.

1.13.2 Contractor Quality Control Report

Reports are required for each day that work is performed and for every 7 consecutive calendar days of no work and on the last day of a no-work period. Account for each calendar day throughout the life of the Contract. The reporting of work shall be identified by terminology consistent with the construction schedule. Contractor Quality Control Reports are to be prepared, signed, and dated by the QC Manager, and shall contain the following information:

a. Identify the control phase and the definable feature of work.

b. Results of the Preparatory Phase meetings held including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that, for this definable feature of work, the Drawings and specifications have been reviewed, submittals have been approved, materials comply with approved submittals, materials are stored properly, preliminary work was done correctly, the testing plan has been reviewed, and work methods and schedule have been discussed.

c. Results of the Initial Phase meetings held including the location of the definable feature of work and a list of personnel present at the meeting. Indicate in the report that for this definable feature of work the preliminary work was done correctly, samples have been prepared and approved, the workmanship is satisfactory, test results are acceptable, work is in compliance with the Contract, and the required testing has been performed, and include a list of who performed the tests.

d. Results of the Follow-up Phase inspections held including the location of the definable feature of work. Indicate in the report for this definable feature of work that the work complies with the Contract as approved in the Initial Phase, and that required testing has been performed, and include a list of who performed the tests.

e. Results of the three phases of control for off-site work, if applicable, including actions taken.

f. List the rework items identified, but not corrected, by close of business.

g. List the rework items corrected from the rework items list along with the corrective action taken.

h. Include a "remarks" section in this report that will contain pertinent information including directions received, quality control problem areas, deviations from the QC plan, construction deficiencies encountered, QC meetings held, acknowledgment that as-built Drawings have been updated, corrective direction given by the QC Organization, and corrective action taken by the Contractor.

i. Contractor Quality Control Report certification.

1.13.3 Testing Plan and Log

As tests are performed, the QC Manager shall record on the "Testing Plan and Log" the date the test was conducted, the date the test results were forwarded to the Contracting Officer, remarks, and acknowledgment that an accredited or Contracting Officer-approved testing laboratory was used. Attach a copy of the updated "Testing Plan and Log" to the last daily Contractor Quality Control Report of each month.

1.13.4 Rework Items List

The QC Manager shall maintain a list of work that does not comply with the Contract, identifying what items need to be reworked, the date the item was originally discovered, and the date the item was corrected. There is no requirement to report a rework item that is corrected the same day it is discovered. Attach a copy of the "Contractor Rework Items List" to the last daily Contractor Quality Control Report of each month. The Contractor shall be responsible for including on this list items needing rework, including those identified by the Contracting Officer.

1.13.5 As-Built Drawings

The QC Manager is required to review the as-built Drawings to ensure that as-built Drawings are kept current on a daily basis and marked to show deviations that have been made from the Contract Drawings. The QC Manager shall initial each deviation and each revision. Upon completion of work, the QC Manager shall furnish a certificate attesting to the accuracy of the as-built Drawings prior to submission to the Contracting Officer.

1.13.6 Report Forms

The following forms, which are attached at the end of this section, are acceptable for providing the information required by the paragraph titled "Documentation." While use of these specific formats is not required, any other format used shall contain the same information:

a. Combined Contractor Production Report and Contractor Quality Control Report (1 sheet), with separate continuation sheet

b. Testing Plan and Log

c. Rework Items List

PART 2 PRODUCTS

Not used.

PART 3 EXECUTION

Not used.

END OF SECTION

CONTRACTOR QUALITY CONTROL REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE	Enter (DD/MMM/YY)
REPORT NO	Enter Rpt # Here

PHASE	CONTRACT NO	Enter Cnt# Here	CONTRACT TITLE	Enter Title and Location of Construction Contract Here

PREPARATORY

WAS PREPARATORY PHASE WORK PREFORMED TODAY? YES ☐ NO ☐

IF YES, FILL OUT AND ATTACH SUPPLEMENTAL PREPARATORY PHASE CHECKLIST.

Schedule Activity No.	Definable Feature of Work	Index #

INITIAL

WAS INITIAL PHASE WORK PREFORMED TODAY? YES ☐ NO ☐

IF YES, FILL OUT AND ATTACH SUPPLEMENTAL INITIAL PHASE CHECKLIST.

Schedule Activity No.	Definable Feature of Work	Index #

FOLLOW-UP

WORK COMPLIES WITH CONTRACT AS APPROVED DURING INITIAL PHASE? YES ☐ NO ☐

WORK COMPLIES WITH SAFETY REQUIREMENTS? YES ☐ NO ☐

Schedule Activity No.	Description of Work, Testing Performed & By Whom, Definable Feature of Work, Specification Section, Location and List of Personnel Present

REWORK ITEMS IDENTIFIED TODAY (NOT CORRECTED BY CLOSE OF BUSINESS)

Schedule Activity No.	Description

REWORK ITEMS CORRECTED TODAY (FROM REWORK ITEMS LIST)

Schedule Activity No.	Description

REMARKS (Also Explain Any Follow-Up Phase Checklist Item From Above That Was Answered "NO"), Manuf. Rep On-Site, etc.

Schedule Activity No.	Description

On behalf of the contractor, I certify that this report is complete and correct and equipment and material used and work performed during this reporting period is in compliance with the contract drawings and specifications to the best of my knowledge except as noted in this report.

AUTHORIZED QC MANAGER AT SITE DATE

GOVERNMENT QUALITY ASSURANCE REPORT

DATE

QUALITY ASSURANCE REPRESENTATIVE'S REMARKS AND/OR EXCEPTIONS TO THE REPORT

Schedule Activity No.	Description

GOVERNMENT QUALITY ASSURANCE MANAGER DATE

PREPARATORY PHASE CHECKLIST

(CONTINUED ON SECOND PAGE)

SPEC SECTION	DATE
Enter Spec Section # Here	Enter Date (DD/MMM/YY)

CONTRACT NO	DEFINABLE FEATURE OF WORK	SCHEDULE ACT NO.	INDEX #
Enter Cnt# Here	Enter DFOW Here	Enter Sched Act ID Here	Enter Index# Here

PERSONNEL PRESENT

GOVERNMENT REP NOTIFIED _____ HOURS IN ADVANCE: YES ☐ NO ☐

NAME	POSITION	COMPANY/GOVERNMENT

SUBMITTALS

REVIEW SUBMITTALS AND/OR SUBMITTAL REGISTER. HAVE ALL SUBMITTALS BEEN APPROVED? YES ☐ NO ☐

IF NO, WHAT ITEMS HAVE NOT BEEN SUBMITTED? _____

ARE ALL MATERIALS ON HAND? YES ☐ NO ☐

IF NO, WHAT ITEMS ARE MISSING? _____

CHECK APPROVED SUBMITTALS AGAINST DELIVERED MATERIAL. (THIS SHOULD BE DONE AS MATERIAL ARRIVES.)

COMMENTS: _____

MATERIAL STORAGE

ARE MATERIALS STORED PROPERLY? YES ☐ NO ☐

IF NO, WHAT ACTION IS TAKEN? _____

SPECIFICATIONS

REVIEW EACH PARAGRAPH OF SPECIFICATIONS. _____

DISCUSS PROCEDURE FOR ACCOMPLISHING THE WORK. _____

CLARIFY ANY DIFFERENCES. _____

PRELIMINARY WORK & PERMITS

ENSURE PRELIMINARY WORK IS CORRECT AND PERMITS ARE ON FILE.

IF NOT, WHAT ACTION IS TAKEN? _____

TESTING	IDENTIFY TEST TO BE PERFORMED, FREQUENCY, AND BY WHOM.
	WHEN REQUIRED?
	WHERE REQUIRED?
	REVIEW TESTING PLAN.
	HAS TEST FACILITIES BEEN APPROVED?
SAFETY	ACTIVITY HAZARD ANALYSIS APPROVED? YES ☐ NO ☐
	REVIEW APPLICABLE PORTION OF EM 385-1-1.
MEETING COMMENTS	NAVY/ROICC COMMENTS DURING MEETING.
OTHER ITEMS OR REMARKS	OTHER ITEMS OR REMARKS:

QC MANAGER DATE

CONTRACTOR PRODUCTION REPORT

(ATTACH ADDITIONAL SHEETS IF NECESSARY)

DATE	Enter Date (DD/MMM/YY)
CONTRACT NO	Enter Cnt# Here
TITLE AND LOCATION	Enter Title and Location of Construction Contract Here
REPORT NO	Enter Report # Here
CONTRACTOR	Enter The Contractor's Company Name Here
SUPERINTENDENT	Enter Superintendent's Name Here
AM WEATHER	Enter AM Weather Data Here
PM WEATHER	Enter PM Weather Data Here
MAX TEMP (F)	Enter Max Temp Here
MIN TEMP (F)	Enter Min Temp Here

WORK PERFORMED TODAY

Schedule Activity No.	WORK LOCATION AND DESCRIPTION	EMPLOYER	NUMBER	TRADE	HRS

JOB SAFETY

WAS A JOB SAFETY MEETING HELD THIS DATE? (If YES attach copy of the meeting minutes)	☐ YES	☐ NO	TOTAL WORK HOURS ON JOB SITE, THIS DATE, INCL CON'T SHEETS
WERE THERE ANY LOST TIME ACCIDENTS THIS DATE? (If YES attach copy of completed OSHA report)	☐ YES	☐ NO	CUMULATIVE TOTAL OF WORK HOURS FROM PREVIOUS REPORT
WAS CRANE/MANLIFT/TRENCHING/SCAFFOLD/HV ELEC/HIGH WORK/ HAZMAT WORK DONE? (If YES attach statement or checklist showing inspection performed.)	☐ YES	☐ NO	
WAS HAZARDOUS MATERIAL/WASTE RELEASED INTO THE ENVIRONMENT? (If YES attach description of incident and proposed action.)	☐ YES	☐ NO	TOTAL WORK HOURS FROM START OF CONSTRUCTION

Schedule Activity No.	LIST SAFETY ACTIONS TAKEN TODAY/SAFETY INSPECTIONS CONDUCTED	☐ SAFETY REQUIREMENTS HAVE BEEN MET.

EQUIPMENT/MATERIAL RECEIVED TODAY TO BE INCORPORATED IN JOB (INDICATE SCHEDULE ACTIVITY NUMBER)

Schedule Activity No.	Submittal #	Description of Equipment/Material Received

CONSTRUCTION AND PLANT EQUIPMENT ON JOB SITE TODAY. INDICATE HOURS USED AND SCHEDULE ACTIVITY NUMBER.

Schedule Activity No.	Owner	Description of Construction Equipment Used Today (incl Make and Model)	Hours Used

Schedule Activity No.	REMARKS

CONTRACTOR/SUPERINTENDENT DATE

INITIAL PHASE CHECKLIST

SPEC SECTION	DATE
Enter Spec Section # Here	Enter Date (DD/MMM/YY)

CONTRACT NO	DEFINABLE FEATURE OF WORK	SCHEDULE ACT NO.	INDEX #
Enter Cnt# Here	Enter DFOW Here	Enter Sched Act ID Here	Enter Index# Here

PERSONNEL PRESENT

GOVERNMENT REP NOTIFIED _____ HOURS IN ADVANCE: YES ☐ NO ☐

NAME	POSITION	COMPANY/GOVERNMENT

PROCEDURE COMPLIANCE

IDENTIFIY FULL COMPLIANCE WITH PROCEDURES IDENTIFIED AT PREPARATORY. COORDINATE PLANS, SPECIFICATIONS, AND SUBMITTALS.

COMMENTS:

PRELIMINARY WORK

ENSURE PRELIMINARY WORK IS COMPLETE AND CORRECT. IF NOT, WHAT ACTION IS TAKEN?

WORKMANSHIP

ESTABLISH LEVEL OF WORKMANSHIP.

WHERE IS WORK LOCATED?

IS SAMPLE PANEL REQUIRED? YES ☐ NO ☐

WILL THE INIITAL WORK BE CONSIDERED AS A SAMPLE? YES ☐ NO ☐

(IF YES, MAINTAIN IN PRESENT CONDITION AS LONG AS POSSIBLE AND DESCRIBE LOCATION OF SAMPLE)

RESOLUTION

RESOLVE ANY DIFFERENCES.

COMMENTS:

CHECK SAFETY

REVIEW JOB CONDITIONS USING EM 385-1-1 AND JOB HAZARD ANALYSIS

COMMENTS:

OTHER

OTHER ITEMS OR REMARKS

QC MANAGER _____ DATE _____

REWORK ITEMS LIST

Contract No. and Title: Enter Contract # and Title Here

Contractor: Enter Contractor's Company Name Here

NUMBER	DATE IDENTIFIED	DESCRIPTION	CONTRACT REQUIREMENT (Spec. Section and Par. No., Drawing No. and Detail No., etc.)	ACTION TAKEN BY QC MANAGER	RESOLUTION	DATE COMPLETED

TESTING PLAN AND LOG

CONTRACT NUMBER			PROJECT TITLE AND LOCATION							CONTRACTOR	
Enter Contract # Here			Enter Contract Title and Location Here							Enter Contractor's Company Name Here	
SPECIFICATION SECTION AND PARAGRAPH NUMBER	ITEM OF WORK	TEST REQUIRED	ACCREDITED/ APPROVED LAB		SAMPLED BY	TESTED BY	LOCATION OF TEST		DATE COMPLETED	DATE FORWARDED TO CONTR. OFF.	REMARKS
			YES	NO			ON SITE	OFF SITE			

SECTION 10 14 01
SIGNS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

AMERICAN NATIONAL STANDARD (ANS)

ANS 253.1	(1967) Fundamental Specification of Safety Colors

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM A 123	(2008) Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products
ASTM A 307	(2007b) Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength
ASTM A 449	(2007b) Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use
ASTM B 209	(2007) Specification for Aluminum and Aluminum-Alloy Sheet and Plate

1.2 SUBMITTALS

Submit the following in accordance with Section 01330 Submittal Procedures.

1.2.1 SD-02, Drawings

a. Warning sign; G

One shop drawing of sign indicated on the Drawings for approval from the Contracting Officer.

PART 2 PRODUCTS

2.1 SIGNS

2.1.1 Substrate

Conform to ASTM B 209 for aluminum sheet plate requirements. Provide caution or warning signs from aluminum plate with the thickness of at least 1.3 mm. Appropriate sign mounting hardware shall be fastened to back of substrate by rivets or welding to allow mounting of sign on post.

2.1.2 Paint

Use the opaque glossy sample colors as specified in Table 1 of Fundamental Specification of Safety Colors for Commercial Item Description, Standard Source "C" ANS 253.1-1967. Unless directed by the Contracting Officer, standard color of the background shall be yellow with black letters.

2.1.3 Posts

Signposts shall be of the U-channel type, 3 lbs/ft nominal, fabricated of hot rolled carbon steel bars. Finish shall be galvanized according to ASTM A 123. Posts shall have a uniform hole pattern.

The post shall consist of two parts, a signpost and a base post. The base post shall be identical to the signpost except having a pointed and sharpened-edge end for post driving. Holes between the base post and signpost shall be of identical pattern.

2.1.4 Anchors

Metal fasteners shall conform to ASTM A 307. All other hardware shall be Society of Automotive Engineers (SAE) Grade 5 or ASTM Grade A 449 hardness minimum. Threaded components shall use either nylon inserts or a chemical thread lock compound to prevent self-loosening. Where appropriate signs may be fastened to fencing based on approval from the Contracting Officer.

2.1.5 Signs

Provide signs around the boundary of the site according to the Drawings.

Sign shall be furnished with rounded or blunt corners and shall be free from sharp edges, burrs, splinters, or other sharp projections. The ends or heads of bolts or other fastening devices shall be located in such a way that they do not constitute a hazard.

The wording of the sign should be easy to read, concise, and as indicated on the Drawings.

PART 3 EXECUTION

3.1 SIGN INSTALLATION

Embedded metals shall be given a primer coat of the required paint on all surfaces prior to installation. Install posts to dimensions as designated on the Drawings. Signs can be attached to fence at locations designated on the Drawings using appropriate anchors. Do not damage coating before or during installation.

END OF SECTION

SECTION 31 00 00
EARTHWORK

PART 1 GENERAL

A soil cover of clean imported soil is the selected remedy to prevent contact with contaminants that may be present on the landward portion of the site. These chemicals may include metals, organic chemicals, and radionuclides. The cover components vary over the site as follows: The final cover for the radiologically impacted area at IR Sites 7 and 18 will consist of a 3 foot cover layer of clean imported soil and a demarcation layer. The final cover for the non-radiologically impacted area at IR Sites 7 and 18 will consist of a 2 foot cover of clean imported soil. Refer to SECTION 35 31 19 Revetment for specifications relating to construction of the revetment section.

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM D 1556	(2007) Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(2007) Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3)
ASTM D 2216	(2005) Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
ASTM D 2487	(2006) Classification of Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 6938	(2008) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 4318	(2005) Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 5199	(2006) Standard Test Method for Measuring the Nominal Thickness of Geosynthetics
ASTM D 1777	(2007) Standard Test Method for Thickness of Textile Materials
ASTM D 792	Standard Test Method for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
ASTM D 5261	(2009) Standard Test Method for Measuring Mass Per Unit Area of Geotextiles

ASTM D 1388	Standard Test Method for Stiffness of Fabrics
ASTM D 5035	(2008) Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method)
ASTM D 4355	Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc Type Apparatus
ASTM D 2974	(2007a) Moisture, Ash, and Organic Matter of Peat and Other Organic Soils
ASTM D 422	(1963; R 2007) Particle-Size Analysis of Soils
ASTM D 4972	(2001; R 2007) pH of Soils
ASTM D 698	(2007e1) Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu. ft. (600 kN-m/cu. m.))

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY (EPA)

SW 846	(2008) Test Methods for Evaluating Solid Waste

EROSION CONTROL TECHNOLOGY COUNCIL

ECTC Guidelines	Erosion Control Technology Council (ECTC) Standard Guidelines

1.2 DEFINITIONS

1.2.1 Solid Waste

Rubbish, debris, garbage, and other discarded solid non-inert materials resulting from industrial, commercial, and agricultural operations and from community activities.

1.2.2 Excavation Spoils

Excavated soil and sediment from shoreline and boundaries of the site will be placed on the site and compacted to form the subgrade. The compacted cover will be constructed above the placed excavated spoils.

1.2.3 Compacted Cover

The soil cover layer is the primary cover layer and consists of imported materials to 0.5 foot from the final cover surface.

1.2.4 Erosion Resistant Layer

The upper 0.5 foot of the soil cover is the erosion resistant layer and consists of imported material and vegetative cover.

1.3 SUBMITTALS

Submit the following in accordance with Section 01 33 00 Submittal Procedures.

1.3.1 SD-01, Preconstruction Submittals

a. Sampling and Analysis Plan; G

b. Materials Handling Plan

Materials Handling Plan describing placement and compaction procedures. The plan shall also describe equipment to be used (including ground pressures).

1.3.2 SD-03, Product Data

a. Composite Turf Reinforcement Matting

1.3.3 SD-04 Samples

a. Select Fill

A minimum of 50 pounds of select fill from each proposed borrow source to the Government's designated laboratory at least 15 days prior to placement.

1.3.4 SD-06, Field Test Reports

a. Select Fill Material Tests; G

See Paragraph 3.6.4 Construction Tests for testing frequency and type. Submit raw data as available and summarize weekly.

b. Confirmation Screening Sampling Results; G

See Paragraph 2.3 Sub Grade for testing requirements. Submit raw data and weekly.

c. Borrow Source Assessment; G

See Paragraph 3.6.1 Borrow Source Assessment for testing requirements. Submit raw data as available and summarize weekly.

1.3.5 SD-07, Certificates

a. California Registered Civil Engineer or Geologist certification

1.3.6 SD-11, Closeout Submittals

a. Final soil cover survey with As-Built Drawings

b. Survey information on permanent local site monuments

1.4 DELIVERY, STORAGE, AND HANDLING

Perform in a manner to prevent contamination or segregation of materials.

1.5 EQUIPMENT

Equipment used to place the select fill layers shall be as described in the approved Materials Handling Plan. Equipment shall not accelerate or brake suddenly, turn sharply, or be operated at speeds exceeding 5.0 miles per hour.

PART 2 PRODUCTS

2.1 COMPACTED COVER MATERIAL AND EROSION RESISTANT LAYER MATERIAL

Imported material used in the soil cover shall conform to specifications of 2.1.1 of this section. The soil shall be free of debris, roots, wood, scrap metal, vegetation, refuse, soft unsound particles, and deleterious or objectionable materials.

2.1.1 Soil Classification

The soil cover below 12 inches depth shall be ASTM D 2487-06e1, classification SM, SC, CL, or ML, with a maximum liquid limit of 45 percent and a maximum plasticity index of 25 percent per ASTM D 4318-05. The maximum particle size shall be 3 inches in its largest dimension with at least 90 percent passing a ¾-inch sieve, and at least 60 percent passing the No. 4 sieve, and not more than 60% passing a No. 200 sieve.

The soil in the upper 12 inches of the soil cover shall be ASTM D 2487-06e1, classification SM or SC, with a maximum liquid limit of 35 percent and a maximum plasticity index of 15 percent per ASTM D 4318-05. The maximum particle size shall be 3 inches in its largest dimension with at least 90 percent passing a ¾-inch sieve, at least 60 percent passing the No. 4 sieve, and not more than 30 percent passing a No. 200 sieve.

Refer to Section 35 31 19 Coastal Protection for fill material to be used under the revetment and below the high water elevation.

2.2 COMPOSITE TURF REINFORCED MATTING (CTRM)

The composite turf reinforcement mat (CTRM) shall be a machine-produced mat of 100 percent natural fiber matrix incorporated into a permanent three-dimensional netting structure. The matrix shall be stitch bonded between a heavy duty ultraviolet (UV) stabilized bottom net, crimped intermediate netting, and a heavy-duty, UV-stabilized top net. The crimped netting shall form prominent, closely spaced ridges across the entire width of the mat. The three nettings shall be stitched together with UV-stabilized polypropylene thread to form a permanent three-dimensional structure. Matting shall be three-dimensional geomatrix of heavy nylon monofilaments fused at their intersections. Ninety percent of the geomatrix shall be open space available for soil and root interaction with filaments. Matting shall have three-dimensional strength without laminated or stitched layers. The matting shall be a minimum weight of 8 ounces per square yard with a minimum thickness of 0.4 inches. In

accordance with ASTM D 5034, the matting shall have a minimum tensile strength of 85 pounds per foot in each direction. The matting shall be for permanent service.

The permanent composite turf reinforcement mat shall have the following physical properties:

COMPOSITE STRUCTURE			
Property (min)	**Test Method**	**Typical**	**MARV***
Thickness	ASTM D5199	0.60 in	0.58 in
Resiliency	ASTM D1777	88%	86%
Density	ASTM D792	0.48 oz/in^3	0.46 oz/in^3
Mass/Unit Area	ASTM D5261	12.00 oz/yd^2	10 oz/yd^2
Porosity	ECTC Guidelines	95.0%	92.0%
Open Volume per Area	ECTC Guidelines	800 in^3/yd^2	750 in^3/yd^2
Stiffness	ASTM D1388	3.7 oz-in	3.1 oz-in
Light Penetration	ECTC Guidelines	5.0%	4.5%
MD Tensile Strength	ASTM D5035	640 lbs/ft	450 lbs/ft
MD Elongation (max)	ASTM D5035	14.0%	18.0%
TD Tensile Strength	ASTM D5035	890 lbs/ft	700 lbs/ft
TD Elongation (max)	ASTM D5035	11.0%	13.0%
Tensile Strength at 10% Elongation			
MD Tensile Strength	ASTM D5035	320 lbs/ft	200 lbs/ft
TD Tensile Strength	ASTM D5035	520 lbs/ft	420 lbs/ft

NET STRUCTURE			
Property (min)	**Test Method**	**Typical**	**MARV***
Thickness	ASTM D5199	0.50 in	0.42 in
Resiliency	ECTC Guidelines	65%	60%
UV Stability	ASTM D4355**	80%	N/A
MD Tensile Strength	ASTM D5035	500 lbs/ft	300 lbs/ft
MD Elongation (max)	ASTM D5035	30%	52%
TD Tensile Strength	ASTM D5035	800 lbs/ft	620 lbs/ft
TD Elongation (max)	ASTM D5035	15%	17%

*Minimum average roll values (MARV) are calculated as the typical plus or minus two standard deviations. Statistically, this calculation yields a 97.7 percent degree of confidence that any samples collected will exceed the value reported. "Typical" indicates the mean or average.

**ASTM D5035 (4 inch strip) Tensile Strength and % Strength Retention of material following 1,000 hours exposure in Xenon-Arc Weatherometer.

MD – Machine direction TD – Transverse direction

2.3 SUB GRADE

Excavation spoils for the preparation of the site from the site boundary and shoreline will be reused on site to the extent possible. Refer to the Drawings for placement location. Excavated material will be screened for low level radionuclide at the designated screening area and only uncontaminated soil will be used for fill as needed below the cover.

2.4 CRUSHED ROCK FOR DRAINAGE SWALE

Crushed rock will be used for the apron area where the drainage swale ends at the cover and flow discharges off site. Refer to the Drawings for placement location. Place rock in layer of thickness not less than the median rock diameter. Use excess gravel, sand, or other similar materials from the site as bedding.

The rock shall be composed of tough, durable particles, adequately free from thin, flat and elongated pieces, and shall contain no organic matter or soft, friable particles in quantities considered objectionable by the Contracting Officer. Grading shall conform to the following requirements:

PERMISSIBLE LIMITS
U.S. STANDARD SIEVE PERCENT BY WEIGHT, PASSING

Diameter	% Passing
10 in.	95%
8 in.	50%
6 in.	5%

2.5 ROAD BASE FOR SITE ENTRY POINT

Road base material will be used for the construction of a designated vehicle entry point in accordance with the Drawings to reduce vehicle traffic impact to the cover. Place rock in a layer of thickness not less than 3 in.

The rock shall be composed of tough, durable particles, adequately free from thin, flat and elongated pieces, and shall contain no organic matter or soft, friable particles in quantities considered objectionable by the Contracting Officer.

At the contractor's discretion, either 37.5 mm Class 2 Aggregate base shall be used, or aggregate with the following gradation.

PERMISSIBLE LIMITS
U.S. STANDARD SIEVE PERCENT BY WEIGHT, PASSING

Sieve Sizes	% Passing Operating Range
55 mm	100%
37.5 mm	85-100%
19 mm	45-80
4.75 mm	5-40
75 µm	<10

PART 3 EXECUTION

3.1 SCHEDULE

Contractor is responsible for maintaining completed work and environmental controls (see Section 01 57 19.00 20 Temporary Environmental Controls) at all times, including gaps in construction activity.

3.2 SURFACE AND SUBGRADE PREPARATION

Grading and preparation of the surface for construction should follow the drawings.

3.2.1 Stockpile Excavated Spoils

Materials removed from excavations and intended to be reused as fill below cover later shall be stockpiled at an on-site location designated by the Contracting Officer.

3.3 PROTECTION

3.3.1 Drainage and Dewatering

Provide for the collection and disposal of surface and subsurface water encountered during construction as described in the following sections.

3.3.1.1 Drainage

Drain the site during periods of construction to keep soil materials sufficiently dry. The Contractor shall establish storm drainage features at the earliest stages of site development. Throughout construction, grade the construction area to provide positive surface water runoff away from the construction activity or provide temporary ditches, swales, and other drainage features and equipment as required to maintain dry soils. When unsuitable working platforms for equipment operation and unsuitable soil support for subsequent construction features develop, remove unsuitable material and provide new soil material as specified herein. The Contractor is responsible for assessing the conditions of soil and groundwater presented by the plans and specifications and to employ necessary measures to permit construction to proceed.

3.4 EXCAVATION

Excavate to depths and dimensions indicated on the Drawings. Reuse excavated, screened, and uncontaminated materials to the extent possible in the areas below cover. Soil disturbed or weakened by Contractor's operations and soils softened or made unsuitable for subsequent construction caused by exposure to weather shall be removed and replaced. Excavated soil shall be stockpiled when necessary in the immediate area or at an on-site location as directed by the Contracting Officer. Keep excavations free from water while construction is in progress. Notify the Contracting Officer immediately in writing if it becomes necessary to remove rock or hard, unstable, or otherwise unsatisfactory material. Blasting will not be permitted.

Excavated material from the shoreline and upland areas will be transported to the designated screening area following excavation. Material failing screening will not be used on site and will be disposed of appropriately. Compaction should follow the same provisions as for the soil covers.

3.5 MATERIAL STORAGE

Excavated material shall be placed in either temporary storage or transported directly for screening following the excavation. Storage units shall be in good condition and construction of materials that are compatible with the material to be stored. If multiple units are required for segregation, each unit shall be clearly labeled with an identification number and a written log shall be kept to track the material.

3.6 SOIL COVER

Soil cover shall be constructed to the elevations and slopes indicated on the Drawings. The soil cover, shall be compacted in 6-inch lifts to no less than 90 percent of maximum dry density at ± 3 percent of optimum moisture content. The top 6 inches shall be subject to one pass with a field packer resulting in a compaction to not greater than 85 percent of maximum dry density.

During construction, placement of select fill shall conform to the following requirements:

a. The minimum allowable dry density shall be no less than 90 percent of maximum dry density for the base layers and no greater than 85 percent of maximum dry density for the top 6 inches.

b. The allowable moisture content range shall be ± 3 percent of optimum.

3.6.1 Borrow Source Assessment

Complete the Borrow Source Assessment Report at least 15 days prior to select fill placement. No select fill shall be placed until the Borrow Source Assessment Report is approved. The report shall include the following: location of each borrow source; estimated quantity of borrow available; logs of subsurface explorations; and laboratory test results.

3.6.1.1 Select Fill

Classification Testing

Borrow source assessment tests shall be performed on each principal type or combination of materials proposed for use in the select fill layer to ensure compliance with specified requirements. At least one set of borrow assessment tests shall be performed on each borrow source proposed for use. A set of borrow source assessment tests shall consist of Atterberg limits (ASTM D 4318), particle size analysis (ASTM D 422), and moisture content (ASTM D 2216). Based on borrow source assessment testing, soils shall be classified in accordance with ASTM D 2487.

Moisture-Density (Compaction) Testing

A representative sample from each principal type or combination of borrow materials shall be tested to establish compaction curves using ASTM D 698. At least one compaction test shall be performed on each borrow source proposed. A minimum of 5 points shall be used to develop each compaction curve.

Chemical Contamination Testing

Borrow used for the select fill layers shall be free of contamination. Each proposed borrow source shall be sampled and analyzed for chemical contamination.

3.6.2 Installation

3.6.2.1 Select Fill Placement

No equipment shall be operated directly on the top surface of geosynthetics without permission from the Contracting Officer. Select fill shall be pushed out over geosynthetics in an upward tumbling motion so that wrinkles in geosynthetics do not fold over. Soil shall not be dropped directly onto geosynthetics from a height greater than 3 feet. On slopes, select fill shall be placed from the bottom of the slope upward.

3.6.2.2 Initial Lift of Select Fill Placed Over Geosynthetics

The first lift of soil placed over geosynthetics shall be a minimum of 12 inches in loose thickness. Equipment with ground pressures less than 7 psi shall be used to place and traffic compact the first lift of select fill. Traffic compaction shall consist of a minimum of 2 passes over all areas.

3.6.2.3 Subsequent Lifts of Select Fill

The loose lift thickness of each subsequent lift shall be no greater than 8 inches. Full scale placement and compaction equipment shall be allowed on areas underlain by geosynthetics after the first loose lift of soil has been placed. Compaction shall consist of a minimum of 2 passes over all areas.

3.6.3 Construction Tolerances

Finished surfaces shall be uniformly graded and shall be free from depressions, mounds, or windrows. The top surface of the select fill layer shall be no greater than 3 inches above the lines and grades shown on the drawings. No minus tolerance will be permitted. Rigid grade stakes shall not be driven into the select fill layer to control placement.

3.6.4 Construction Tests

3.6.4.1 Select Fill Material

During construction of the select fill layer, representative samples shall be taken for testing at the frequencies listed in the table below from the borrow source prior to placement. Test results must comply with the requirements listed in Part 2 Products or the material will be rejected for use.

SELECT FILL MATERIAL TESTING FREQUENCIES		
Test	Frequency	Method
Grain size analysis	2,000 cubic yards	ASTM D 422
Atterberg limits	2,000 cubic yards	ASTM D 4318
Compaction	5,200 cubic yards	ASTM D 698

(Note 1)

Note 1: Compaction test results shall be compared with the results obtained during the borrow source assessment. When there are significant differences, adjustments to the acceptable moisture content or density ranges shall be proposed by the Contractor for approval.

3.6.4.2 Moisture Content and Density Tests of In-Place Select Fill

Follow guidance from the manufacturer for protecting the geosynthetic demarcation layer from potential tearing from heavy equipment for the first lift above the material. Take precautions to ensure that the layer is not ruptured during construction and repair or replace as necessary.

SOIL COVER TESTING
REQUIREMENTS AND FREQUENCY

Test	ASTM Method	Frequency	Required Minimum Criteria
Density & Moisture	Nuclear gauge D 6938-08a	One per 10,000 s.f.	See SOIL COVER COMPACTION Table
Density	Sand Cone D1556-07	One per 150,000 s.f. (minimum one per day)	See SOIL COVER COMPACTION Table
Moisture	Oven D2216-05 (with cor. to Nuclear gauge D 6938-08a)	One per 150,000 s.f. (minimum one per day)	Based on compaction curves
Compaction Curves	Mod. Proctor D1557-07	One per change in material	n/a
Identification of Soils	D 2487-06e1	One per change in material	GW, GP, GM, SW, SP, SM (bottom 6" per manufacturer's recommendation)

SOIL COVER COMPACTION

Fill Type	Maximum Loose Lift Thickness[1] (in.)	Moisture Content	Lift Density	Method of Test
All material greater than 0.5 foot from final cover elevation	6	± 3% of optimum	90% min	ASTM D 6938-08a and ASTM D1557-07
All material less than 0.5 foot from final cover elevation	6	± 3% of optimum	85% max	ASTM D 6938-08a and ASTM D1557-07

Note
Thinner lifts may be required to obtain adequate compaction.

Test Frequencies and Locations

Each day that select fill is placed, a minimum of one set of standard moisture content and density tests shall be performed. Nuclear density and moisture content tests shall be checked at the frequencies shown in the tables above. Standard tests shall be performed at locations which are as close as possible to the locations of the nuclear tests being checked.

Nuclear Density and Moisture Content Tests

Nuclear density readings shall be taken in the direct transmission mode. When ASTM D 6938 is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in ASTM D 1556. ASTM D 6938 results in a wet unit weight of soil and when using this method ASTM D 6938 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gauges shall also be checked along with density calibration checks as described in ASTM D 6938; the calibration checks of both the density and moisture gauges shall be made at the beginning of a job on each different type of material encountered and at intervals as directed by the Contracting Officer.

Test Results

Field moisture content and density test results shall be compared to the compaction curve for the appropriate material type being tested. If test results are not within the acceptable range for moisture content or density, as described in subparagraph Moisture-Density (Compaction) Testing, 3 additional tests shall be performed near the location of the failed parameter. If all retests pass, no additional action shall be taken. If any of the retests fail, the lift of soil shall be repaired out to the limits defined by passing tests for that parameter. The area shall then be retested as directed.

3.6.5 Protection

3.6.5.1 Damage

Erosion rills or other damage that occurs shall be repaired and grades re-established. Repairs to the select fill layer shall be documented including location and volume of soil affected, corrective action taken, and results of retests.

3.6.5.2 Stockpiles

Storage or stockpiling of material on the completed surface of the select fill layers will not be permitted.

3.7 GRASSED WATERWAY

Grade waterways as indicated on the Drawings. Vegetate grassed waterway as shown on the Drawings and in accordance with Section 32 92 19 Seeding before placing CTRM.

3.8 COMPOSITE TURF REINFORCED MATTING (CTRM)

Install matting in areas indicated on the Drawings and in accordance to manufacturer's instructions.

3.8.1 Slopes

Prepare soil before installing matting, including any necessary application of lime, fertilizer, and seed.

Begin at the top of the slope by anchoring the matting in a 6-inch deep by 6-inch wide trench with approximately 12 inches of matting extended beyond the up-slope portion of the trench. Anchor the matting with a row of staples/stakes approximately 12 inches apart in the bottom of the trench. Backfill and compact the trench after stapling. Apply seed to compacted soil and fold remaining 12-inch portion of matting back over seed and compacted soil. Secure matting over compacted soil with a row of staples/stakes spaced approximately 12 inches apart across the width of the matting.

Roll the matting down the slope. Matting will unroll with appropriate side against soil surface. All matting must be securely fastened to soil surface by placing staples/stakes in appropriate locations according to manufacturer's recommendations.

The edges of parallel matting must be stapled with approximately 2 inch to 5 inch overlap depending on manufacturer's recommendation. Consecutive matting spliced down the slope face must be placed end over end (shingle style) with an approximate 3-inch overlap. Shingle all layers of CTRM such that upgradient panels overlay downgradient panels along slope transverse. Staple through overlapped area, approximately 12 inches apart across entire matting width.

3.8.2 Grassed Channel

Prepare soil and topsoil before installing matting, including any necessary application of lime, fertilizer, and seed.

Shingle all layers of CTRM such that upgradient panels overlay downgradient panels.

Begin at the top of the channel by anchoring the matting in a 6-inch deep by 6-inch wide trench with approximately 12 inches of matting extended beyond the upslope portion of the trench. Anchor the matting with a row of staples/stakes approximately 12 inches apart in the bottom of the trench. Backfill and compact the trench after stapling. Apply seed to compacted soil and fold remaining 12-inch portion of matting back over seed and compacted soil. Secure matting over compacted soil with a row of staples/stakes spaced approximately 12 inches apart across the width of the matting.

Roll center matting in direction of water flow in bottom of channel. Matting will unroll with appropriate side against the soil surface. All matting must be securely fastened to soil surface by placing staples/stakes in appropriate locations according to manufacturer's recommendation.

Place consecutive matting end over end (shingle style) with a 4 inch to 6 inch overlap. Use a double row of staples staggered 4 inches apart and 4 inches on center to secure matting. Full-length edge of matting at top of side slopes must be anchored with a row of staples/stakes approximately 12 inches apart in a 6- inch deep by 6- inch wide trench. Backfill and compact the trench after stapling.

Adjacent matting must be overlapped approximately 2 inches to 5 inches, depending on manufacturer's recommendations and stapled. Install staple check slots at 30 to 40 foot intervals. Use a double row of staples staggered 4 inches apart and 4 inches on center over entire width of the channel.

The terminal end of the matting must be anchored with a row of staples/stakes approximately 12 inches apart in a 6-inchdeep by 6-inch wide trench. Backfill and compact the trench after stapling.

Horizontal staple spacing should be altered if necessary to allow staples to secure the critical points along the channel surface.

Place riprap armoring along spillway of cover side slope as shown in Drawings.

3.9 FINISHING OPERATIONS

3.9.1 Grading

Finish grades as indicated within plus or minus one tenth (0.1) of one foot. Grade smooth existing surfaces that are to remain but have been disturbed by the Contractor's operations. Final grading shall not take place without subsequent placement of erosion resistant seeding layer within 2 calendar days or as weather conditions dictate. Grid spacing shall be 20-foot by 20-foot or smaller for survey verification of thickness and grade.

3.9.2 Seeding

Provide as specified in Section 32 92 19 Seeding.

3.9.3 Protection of Surfaces

Protect newly graded areas from traffic, erosion (see Section 01 57 19.00 20 Temporary Environmental Controls), and settlement that may occur. Repair or re-establish damaged grades, elevations, or slopes.

3.10 DISPOSAL OF SURPLUS MATERIAL

Dispose of all surplus materials or other non-suitable material, including brush, refuse, stumps, roots, and timber into an appropriate off-site disposal facility. All organic debris hauled off base shall be recycled at a local composting facility. Contractor shall minimize the generation of waste, inorganic trash, or debris whenever possible, recycle as much material as possible, and utilize local waste recovery sites available in the area.

3.11 FIELD QUALITY CONTROL

3.11.1 Sampling

Collect the number and size of samples required to perform the specified tests of source materials.

3.11.2 Source Testing

Determine laboratory compaction characteristics and soil classification for each material used. Provide additional tests for every source change.

Sample all imported materials for the soil cover and topsoil layers once per source. Collect samples according to laboratory instruction. The laboratory shall analyze samples according to U.S. Environmental Protection Agency SW 846.

3.11.3 Field Density Tests

If a test location fails, the surrounding area shall be reworked up to at least half the distance to all nearby test locations that passed. Then, a new location within 10 feet of the previous test location shall be retested. Repeat until test location area passes.

Nuclear gauge results (ASTM D 6938-08a) shall be compared with and calibrated to oven-dried water content (ASTM D 2216-05) and sand cone (ASTM D 1556-07) tests according to the larger of the frequencies of the oven-dried water content and sand cone tests.

3.11.4 Oversight

All earthwork will be overseen by a California Registered Geologist or Civil Engineer.

3.12 FINAL COVER SURVEY

Perform a final cover survey of the cover once construction is complete. Include the final survey information on the as-built Drawings.

3.12.1 Permanent Local Site Monuments

Install two permanent monuments on the final cover and two local monuments as designated on the Drawings.

END OF SECTION

SECTION 31 05 22
GEOTEXTILES

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 within the text by the basic designation only.

ASTM INTERNATIONAL (ASTM)

ASTM D 123	(2007) Terminology Relating to Textiles
ASTM D 4354	(1999; R 2004) Sampling of Geosynthetics for Testing
ASTM D 4355	(2007) Deterioration of Geotextiles from Exposure to Light, Moisture and Heat in a Xenon-Arc Type Apparatus
ASTM D 4491	(1999a; R 2004e1) Water Permeability of Geotextiles by Permittivity
ASTM D 4533	(2004) Trapezoid Tearing Strength of Geotextiles
ASTM D 4632	(2008) Grab Breaking Load and Elongation of Geotextiles
ASTM D 4759	(2002; R 2007) Determining the Specification Conformance of Geosynthetics
ASTM D 4751	(2004) Determining Apparent Opening Size of a Geotextile
ASTM D 4833	(2007) Index Puncture Resistance of Geotextiles, Geomembranes, and Related Products
ASTM D 4873	(2002) Identification, Storage, and Handling of Geosynthetic Rolls and Samples
ASTM D 4884	(1996; R 2003) Strength of Sewn or Thermally Bonded Seams of Geotextiles
ASTM D 882	(2009) Standard Test Method for Tensile Propertiels of Thin Plastic Sheeting
ASTM D 2103	(2008) Standard Specification for Polyethylene Film and Sheeting

U.S. ARMY CORPS OFENGINEERS (USACE)

EM 1110-2-1601 (1994; Change 1) Hydraulic Design of Flood Control Channels

1.2 SUBMITTALS

Submit the following in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1.2.1 SD-03 Product Data

a. Thread

A minimum of 7 days prior to scheduled use, proposed thread type for sewn seams along with data sheets showing the physical properties of the thread.

b. Manufacturing Quality Control Sampling and Testing

A minimum of 7 days prior to scheduled use, manufacturer's quality control manual.

1.2.2 SD-04 Samples

a. Geotextile

Geotextile samples for testing, if requested, to determine compliance with the requirements in this specification, a minimum of 60 days prior to the beginning of installation of the same textile. Upon delivery of the geotextile, submit duplicate copies of the written certificate of compliance signed by a legally authorized official of the manufacturer. The certificate shall state that the geotextile shipped to the site meets the chemical requirements and exceeds the minimum average roll value listed in Table 1. Upon request, supply quality control and quality assurance tests for the geotextile. Provide all samples from the same production lot as will be supplied for the contract, of the full manufactured width of the geotextile by at least 10 feet long, except that samples for seam strength may be a full width sample folded over and the edges stitched for a length of at least 5 feet. Samples submitted for testing shall be identified by manufacturers lot designation. For needle punched geotextile, the manufacturer shall certify that the geotextile has been inspected using permanent on-line metal detectors and does not contain any needles.

1.2.3 SD-07 Certificates

a. Geotextile

Manufacturer's certification of the geotextile material. All brands of geotextile and all seams to be used will be accepted on the basis of mill certificates or affidavits. Submit duplicate copies of the mill certificate or affidavit signed by a legally authorized official from the company manufacturing the geotextile. The mill certificate or affidavit shall attest that the geotextile meets the chemical, physical and manufacturing requirements stated in this specification.

1.3 DELIVERY, STORAGE, AND HANDLING

Deliver only approved geotextile rolls to the project site. All geotextile shall be labeled, shipped, stored, and handled in accordance with ASTM D 4873. No hooks, tongs, or other sharp instruments shall be used for handling geotextile.

PART 2 PRODUCTS

2.1 MATERIALS

2.1.1 Filter Layer Geotextile

2.1.1.1 General

Provide geotextile that is a woven pervious sheet of plastic yarn as defined by ASTM D 123 matching or exceeding the minimum average roll values listed in Table 1. Strength values indicated in the table are for the weaker principal direction.

TABLE 1
MINIMUM PHYSICAL REQUIREMENTS FOR DRAINAGE GEOTEXTILE

Property	Acceptable Values	Units	Test Method
Grab Strength	250	lb	ASTM D 4632
Puncture	120	lb	ASTM D 4833
Trapezoid Tear	60	lb	ASTM D 4533
Apparent Opening	70	U.S. Sieve	ASTM D 4751
Permittivity	0.28	sec -1	ASTM D 4491
Ultraviolet Degradation	90	Percent at 500 Hrs ASTM D 4355	ASTM D 4355

Obtain a guarantee from the selected manufacturer against failure of the geotextile material resulting from piping and subgrade erosion based on the existing subgrade conditions and the revetment material to be used.

2.1.1.2 Geotextile Fiber

Fibers used in the manufacturing of the geotextile shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of polyolefins, polyesters, or polamides. Add stabilizers and/or inhibitors to the base polymer, if necessary to make the filaments resistant to deterioration caused by ultraviolet light and heat exposure. Reclaimed or recycled fibers or polymer shall not be added to the formulation. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. Finish the edges of the geotextile to prevent the outer fiber from pulling away from the geotextile.

2.1.1.3 Securing Pins

Secure the geotextile to the embankment or foundation soil by pins to prevent movement prior to placement of revetment materials. Other appropriate means to prevent movement such as staples, sand bags, and stone could also be used. Insert securing pins through both strips of overlapped geotextile along the line passing through midpoints of the overlap. Remove securing pins as placement of revetment materials are placed to prevent tearing of geotextile or enlarging holes. Maximum spacing between securing pins depends on the steepness of the embankment slope. The maximum pins spacing shall be equal to or less than the values listed in Table 2. When windy conditions prevail at the construction site, increase the number of pins upon the demand of the Contracting Officer. Anchor terminal ends of the geotextile with key trench or apron at crest, toe of the slope and upstream and downstream limits of installation.

TABLE 2:
MAXIMUM SPACING FOR SECURING PINS

Embankment Slope	Spacing
Steeper Than 1v on 3h,	2 feet
1v on 3h to 1v on 4h,	3 feet
Flatter than 1v on 4h,	5 feet

2.1.2 DEMARCATION LAYER GEOTEXTILE

Provide demarcation layer geotextile that is a nonwoven pervious sheet of polymeric material consisting of long-chain synthetic polymers composed of at least 95 percent by weight polyolefins, polyesters, or polyamides. The use of woven slit film geotextiles (i.e. geotextiles made from yarns of a flat, tape-like character) will not be allowed. Add stabilizers and/or inhibitors to the base polymer, as needed, to make the filaments resistant to deterioration by ultraviolet light, oxidation, and heat exposure. Regrind material, which consists of edge trimmings and other scraps that have never reached the consumer, may be used to produce the geotextile. Post-consumer recycled material may also be used. Geotextile shall be formed into a network such that the filaments or yarns retain dimensional stability relative to each other, including the edges. Geotextiles shall meet the requirements specified in Table 3. Where applicable, Table 3 property values represent minimum average roll values (MARV) in the weakest principal direction. Values for AOS represent maximum average roll values.

TABLE 3
MINIMUM PHYSICAL REQUIREMENTS FOR DEMARCATION GEOTEXTILE

PROPERTY	ACCEPTABLE VALUES	UNITS	TEST METHOD
GRAB STRENGTH	90	LBS	ASTM D 4632
TRAPEZOID TEAR	40	lbs	ASTM D 4533
APPARENT OPENING SIZE	60	U.S. SIEVE	ASTM D 4751
PERMITTIVITY	2	SEC -1	ASTM D 4491
ULTRAVIOLET DEGRADATION	70	PERCENT AT 500 HRS	ASTM D 4355
COLORATION	BRIGHT ORANGE		AS APPROVED BY CONTRACT OFFICER

Detectable Marking Tape

Detectable underground marking tape consist of a maximum 5.0 Mil overall thickness, with a (0.00035") solid aluminum foil core. Construction is 0.8 Mil clear film, making the film permanently printed. The suggested print will read "CAUTION DO NOT DIG BELOW" and including a Spanish translation upon approval by Contract Officer. Table 2 property values represent minimum average roll values. The tape shall be placed in a grid pattern with 10-foot spacing over the demarcation fabric. Refer to drawings for placement.

TABLE 4

MINIMUM PHYSICAL REQUIREMENTS FOR DETECTABLE MARKING TAPE			
PROPERTY	**ACCEPTABLE VALUES**	**UNITS**	**TEST METHOD**
THICKNESS	5	Mil	ASTM D 2103
TENSILE STRENGTH	35	lbs/inch	ASTM D 882
ELONGATION	80%		ASTM D 882-75B
BOND STRENGTH	5 Hours without Peel Boiling Water		

2.2 INSPECTIONS, VERIFICATIONS, AND TESTING

2.2.1 Manufacturing and Sampling

Geotextiles and factory seams shall meet the requirements specified in Table 1. Randomly sample geotextiles in accordance with ASTM D 4354 (Procedure Method A).

2.2.2 Site Verification and Testing

Collect samples at approved locations upon delivery to the site in accordance with ASTM D 4354 (Procedure Method B) at a frequency of once per 100,000 square feet. Test samples to verify that the geotextile meets the requirements specified in Table 1. Identify samples by manufacturers name, type of geotextile, lot number, roll number, and machine direction. Perform testing at an approved laboratory. Submit test results from the lot under review for approval prior to deployment of that lot of geotextile. Rolls which are sampled shall be immediately rewrapped in their protective covering.

PART 3 EXECUTION

3.1 SURFACE PREPERATION

Prepare surface, on which the geotextile will be placed, to a relatively smooth surface condition in accordance with the applicable portion of this specification and shall be free from obstruction, debris, depressions, erosion feature, or vegetation. Remove any irregularities so as to ensure continuous, intimate contact of the geotextile with all the surface. Any loose material, soft or low density pockets of material, shall be removed; erosion features such as rills, gullies etc. shall be graded out of the surface before geotextile placement.

3.2 INSTALLATION OF THE GEOTEXTILE

3.2.1 General

Place the geotextile in the manner and at the locations shown. At the time of installation, reject the geotextile if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacture, transportation or storage.

3.2.2 Placement

Place the geotextile with the long dimension perpendicular to the shoreline and lay smooth and free of tension, stress, folds, wrinkles, or creases. Place the strips to provide a minimum width of 24 inches of overlap for each joint of the demarcation geotextile. Adjust the actual length of the geotextile used based on initial installation experience. Temporary pinning of the geotextile to help hold it in place until the filter rock layer is placed will be allowed. Remove the temporary pins as the granular material is placed to relieve high tensile stress which may occur during placement of material on the geotextile. Design protection of riprap shall be in compliance with EM 1110-2-1601. Perform trimming in such a manner that the geotextile is not damaged in any way.

Geotextile should be secured within the revetment rock at both the crest and the toe of the structure as shown in the drawings. Not less than 5 feet of additional material should be per anchoring location. Anchoring method should be approved by the Contracting Officer.

3.3 PROTECTION

Protect the geotextile at all times during construction from contamination by surface runoff; remove any geotextile so contaminated and replace with uncontaminated geotextile. Replace any geotextile damaged during its installation or during placement of bedding materials or riprap at no cost to the Government. Schedule the work so that the covering of the geotextile with a layer of the specified material is accomplished within 7 calendar days after placement of the geotextile. Failure to comply shall require replacement of geotextile. Protect the geotextile from damage prior to and during the placement of riprap or other materials. Before placement of riprap or other materials, demonstrate that the placement technique will not cause damage to the geotextile. In no case shall any type of equipment be allowed on the unprotected geotextile.

3.4 PLACEMENT OF FILTER ROCK MATERIAL

Perform placing of filter material in a manner to ensure intimate contact of the geotextile with the prepared surface. The placement shall also be performed in a manner that will not damage the geotextile including tear, puncture, or abrasion. On sloping surfaces place the filter material from the bottom of the slopes upward. During placement, the height of the drop of riprap material shall not be greater than 12 inches or as specified in Section 35 31 19 REVETMENT. Uncover any geotextile damaged beneath the filter material, as necessary, and replaced at no cost to the Government.

Refer to Section 35 31 19 REVETMENT for additional information concerning the filter rock and its placement.

END OF SECTION

SECTION 32 31 26
FENCING AND GATES

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

FEDERAL SPECIFICATIONS (FS)

FS RR-F-191	(Rev. J) Fencing, Wire and Post Metal (and Gates, Chain-Link Fence Fabric, and Accessories) (General Specification)
FS RR-F-191/1D	(Rev. C) Fencing, Wire and Post, Metal (Chain-Link Fence Fabric) (Detail Specification)
FS RR-F-191/2D	(Rev. C) Fencing, Wire and Post, metal (Chain-Link Fence Gates) (Detail Specification)
FS RR-F-191/3D	(Rev. C) Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces) (Detail Specification)
FS RR-F-191/4D	(Rev. C) Fencing, Wire and Post, Metal (Chain-Link Fence Accessories) (Detail Specification)

1.2 DESCRIPTION

This section covers the requirements for both temporary and permanent chain link fencing for the site. Further details on the placement of the fencing and the construction details are shown the Drawings. Existing fence should be used in the temporary fencing of the site to the extent practical where it will not be obstructive to the work area. Reuse temporary fence materials where practical for the construction of the final fence.

1.3 RELATED SECTIONS

Section 31 00 00 General Earthwork.

1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 Submittal Procedures.

1.4.1 SD-03, Manufacturer's Catalog Data

a. Fencing components
b. Accessories

1.5 DELIVERY, STORAGE, AND HANDLING

Deliver materials to site in an undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

PART 2 PRODUCTS

2.1 Gates

FS RR-F-191/2; Type I, single swing or Type II, double swing, as indicated on the drawings. Gate dimensions shall be as indicated on the drawings. Framing and bracing members, round or square of steel alloy. PVC-coated over zinc- or aluminum-coated steel. Use minimum sizes for gate frames and braces listed in FS RR-F-191/3D for each Class and Grade. Coating for steel latches, stops, hinges, keepers, and accessories, PVC-coated over zinc- or aluminum-coated steel. Gate latches, fork type. For double swing gate, drive 1-foot of 3/4-inch nominal diameter galvanized water pipe flush to ground surface to receive vertical slider. Attach gate fabric to gate frame in accordance with manufacturer's standards, except that welding will not be permitted.

Arrange padlocking latches to be accessible from both sides of gate, regardless of latching arrangement. Padlocks shall have case-hardened shackles with bodies of a nonferrous alloy. Ten padlock keys shall be provided for each padlock, sequentially numbered and reading "DO NOT DUPLICATE."

2.1.3 Posts and Braces

FS RR-F-191/3D line posts; Class 1, steel pipe, Grade A or B. End, corner, and pull posts; Class 1, steel pipe, Grade A or B. Braces and rails; Class 1, steel pipe, Grade A or B, in minimum sizes listed in FS RR-F-191/3 for each class and grade. Provide PVC color coating, minimum thickness, 0.10 inch.

2.1.4 Fencing Accessories

Shall conform to the requirements of FS RR-F-191/4D. Provide wire ties constructed of the same material as the fencing fabric. Provide accessories with polyvinyl (PVC) coatings similar to that specified for chain-link fabric or framework.

2.1.5 Concrete

Shall conform to the requirements of Section 03 30 00 Cast-in-Place Concrete.

PART 3 EXECUTION

3.1 SITE PREPARATION

3.1.1 Excavation

Excavate to dimensions indicated for concrete-embedded items as shown on the drawings. Follow excavation procedures as specified in Section 31 00 00 Earthwork.

3.2 FENCE INSTALLATION

Consult Contracting Officer before construction of fence to determine which fences to install.

Install fence to line as indicated on the drawings, a four-sided square enclosure. Install fence in accordance with fence manufacturer's written installation instructions except as modified herein.

3.2.1 Post Setting

Set post plumb. Provide concrete bases of dimensions as indicated on the drawings. Compact concrete to eliminate voids and finish to a dome shape. Allow concrete to cure a minimum of 72 hours before performing other work on posts.

3.2.2 Bracing

Brace gate with a diagonal truss rod and truss tightener used as a tension member.

3.2.3 Fabric

Pull fabric taught and secure fabric to tension wire and posts. Secure fabric to posts using stretcher bars, ties, or clips spaced 15 inches on center, or by integrally weaving to integral fastening loops of end, corner, pull, and gate posts for full length of each post.

Install fabric on opposite side of posts from area being secured. Install fabric so that bottom of fabric is minimum 2 inches above ground level.

3.3 FENCE ACCESSORIES INSTALLATION

3.3.1 Post Caps

Install post caps as recommended by the manufacturer.

3.3.2 Gates

Install gates on side of enclosure that allows gate to swing open at least 135 degrees in a direction away from gas vent. Provide Contracting Officer with padlocks and keys.

3.4 CLEANUP

Remove waste fencing materials and other debris from the site.

END OF SECTION

SECTION 32 92 19
SEEDING

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 within the text by the basic designation only.

CALIFORNIA STATUTES

Division 18 - Field Crops, Seeds, Seed Potatoes, One-Variety Cotton Districts, and Nursery Stock Grades And Standards; Chapter 2 (§§ 52251 - 52515) – California Seed Law

Division 7 - Agricultural Chemicals, Livestock Remedies, and Commercial Feeds; Chapter 5 (§§ 14501 - 14682) – Fertilizing Materials

ASSOCIATION OF OFFICIAL SEED ANALYSTS (AOSA)

Rules for Testing Seeds (2009)

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1.2.1 SD-01 Preconstruction Submittal

a. Vegetation Establishment Plan

1.2.2 SD-03 Product Data

a. Seed Mixes (or individual items)

Mixture, percent pure live seed, minimum percent germination and hard seed, maximum percent weed seed content, date tested, and state certification (California Seed Law).

b. Fertilizer

Chemical analysis, composition percent if used.

c. Straw mulch

Weight receipts from scales shall be required.

d. Lime

Calcium carbonate equivalent and sieve analysis if used.

1.2.3 SD-06 Test Reports

a. Soil composition tests (reports and recommendations).

1.2.4 SD-07 Certificates

a. State certification and approval for seed (California Seed Law)

1.3 WORK SCHEDULE

The work shall progress as soon as the site becomes available consistent with normal seasonal limitations. The optimal seeding periods are between October 15th April 15th.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

1. All products shall be delivered to the site in manufacturer's unopened standard containers bearing original labels showing quantity, analysis and name of manufacturer.

2. All materials shall be stored in designated areas and in such a manner as to protect them from weather or other conditions that might demage or impair the effectiveness of the product.

1.5 ANALYSIS OF SAMPLES AND TESTS

1. Samples: The owner reserves the right to take and analyze samples of materials for conformity to the specifications at any time. On request, seed shall delivered to owner 30 days prior to seeding so seed can be tested. Seed samples shall be drawn in accordance with procedures outlined in AOSA, Association of Official Seed Analysts.

2. Rejected material: Rejected materials shall be removed immediately from the site at Contractor's expense. Contractor shall pay the cost of testing replacement materials.

1.6 FINAL ACCEPTANCE AND WARRANTY PERIOD

Upon completion of each 25% of the specified work, the owner shall accept each area. The contractor shall not provide warranty beyond those granted by any of the material manufacturers. It shall be the right of the owner to inspect work for compliance to the specifications and advise the contractor, in writing, of any work that is found to deviate from specifications.

PART 2 PRODUCTS

2.1 GENERAL

All products shall be in conformance with the specifications listed below. Any changes to products to be used shall be approved, in writing, by the owner or owner's representative prior to job site delivery.

2.2 SEED MIX

1. Composition: Seed Mixture by Weight

45 Total Pounds/Acre			
Pounds/Acre	**Species**	**Common Name**	**% by Weight**
25	*Bromus carinatus*	California Brome	53.8%
10	*Hordeum brachyantherum*	Meadow Barley	21.5%
6	*Vulpia microstachys*	Small Fescue	12.9%
4	*Trifolium wildenovii or obtusiflorum*	Tomcat or Clammy Clover	8.6%
1.5	*Eschscholzia californica*	California Poppy	3.2%

2. Quality:
All seed shall be in conformance with the California State Seed Law of the Department of Agriculture. Each seed bag shall be delivered to the site sealed and clearly marked as to species, purity, percent germination, dealer's guarantee, and dates of test. In addition, the container shall be labeled to clearly reflect the amount of Pure Live Seed (PLS) contained. Prior to seeding at the request of the owner, the contractor shall provide a letter of certification, original Association of Official Seed Analysts (AOSA) seed test results, and calculations of PLS content.

Seed shall not exceed 0.5 percent weed content by weight. If seed available on the market does not meet the minimum purity and germination percentages specified, the Contractor must compensate for a lesser percentage of purity or germination by furnishing sufficient additional seed to equal the specified product. Product comparison shall be made on the basis of pure live seed in pounds. The formula used for determining the quantity of pure live seed shall be: Pounds of seed x (Purity x Germination) = pounds of Pure Live Seed. Samples may be drawn by the Engineer for testing.

2.3 SOIL AMENDMENTS

Fertilizer shall be of commercial quality, conform to the requirements of the California Food and Agriculture Code, shall have a guaranteed analysis for nitrogen, phosphorus and potassium of 6-24-24. Fertilizer or lime application rates shall be determined from the soil test laboratory recommendations.

2.4 STRAW MULCH

Straw shall be derived from irrigated wheat or barley fields or from rice straw. The contractor shall furnish evidence that clearance has been obtained from the County Agricultural Commissioner, as required by law, before straw from outside the county in which it is to be used is delivered to the site of the work. Straw that has been used for bedding is prohibited.

2.5 MULCHING EQUIPMENT

Contractor shall use a commercial type mulcher for the application of slurry or loose broadcast. The areas to be seeded shall be mulched so as to provide uniform distribution of mulch without waste.

2.6 WATER

Irrigation water shall not contain a total dissolved solids level of greater than the salt tolerance of the plant species for any growth regime, irrigation practice used, and local climate. Water shall be applied at rate such that seeding machinery operates smoothly, but that minimizes surface runoff and leaching once applied.

Part 3 EXECUTION

3.1 SOIL PREPARATION

1. Verify that all areas to receive seed are free of vegetation and other objectionable material.
2. Verify that grades are final for permanently treated areas and within reasonable standard for temporary treatments.
3. All sloped areas will be uniformly compacted.

3.2 SEEDING, TIMES AND CONDITIONS

3.2.1 Seeding Time

Seed shall be sown according to supplies instructions. Seeding shall take place as soon as final grade has been achieved and heavy equipment has been retired from the project. If seeding is performed outside the preferred seeding times shown in Paragraph 1.3 Work Schedule, provide water, as needed according to supplier instruction.

3.2.2 Planting Conditions

Planting operations shall be performed only during periods when beneficial results can be obtained. When drought, excessive moisture, or other unsatisfactory conditions prevail, the work shall be stopped when directed. When special conditions warrant a variance to the planting operations, proposed times shall be submitted to and approved by the Contracting Officer.

3.3 SITE PREPARATION

3.3.1 Finish Grading

3.3.1.1 Preparation

Drainage patters shall be maintained as indicated on Drawings. Apply soil amendments, if required, according to soil test laboratory recommendations. When applying amendments by spreading or broadcasting, irrigate and allow 1 week for incorporation into soil before seeding. In this case, ensure no soil erosion takes place during the waiting period. Alternatively, the contractor may incorporate amendments into top 6 inches of soil by tilling prior to establishing final grade and proof rolling.

Scarify to minimum depth of 1 inch all surfaces to be seeded. Prior to scarifying, proof roll final grade with a field packer, not exceeding compaction limitation for the final 0.5 feet of cover as specified in Section 31 00 00 Earthwork.. Areas designated for seed that have been compacted by construction operation, including the roadways shall be scarified to a minimum depth of 2 inches. In all cases, scarify sufficiently to allow propoer disc penetration of the seed drill. Soil used for repair of erosion or grade deficiencies shall conform to topsoil requirements specified in Section 31 00 00 Earthwork. New surfaces shall be blended to existing areas.

Use landscape rake for areas inaccessible to machinery.

3.3.1.2 Debris

All areas for seeding shall have debris and stones larger than 3 inches in any dimension removed from the surface.

3.3.1.3 Protection

Finished graded areas shall be protected from damage by vehicular or pedestrian traffic and erosion.

3.4 SEEDING

3.4.1 General

Seeding shall be in all areas over the constructed soil cover and any areas disturbed during construction. Previously prepared seedbed areas compacted or damaged by interim rain, traffic or other cause, shall be reworked to restore the ground condition previously specified. When possible, use low contact pressure tires on vehicles. Seeding operation shall not take place when the wind velocity will prevent uniform seed distribution.

3.4.2 Application

Proportion seed mixtures by weight. Apply specified seed at the specified seeding rate with a seed drill. Ensure proper disc settings, seed depth, and crimping. Apply straw mulch immediately after seeding and crimp with a field packer. Straw mulch application shall just cover all seeded areas completely prior to crimping. Do not exceed 1 inch thickness of loose straw mulch after crimping..

Use hand broadcast methods with landscape rake and roller for areas inaccessible to seed drill and crimper.

3.5 PROTECTION OF SEEDED AREAS

Once seeding has taken place, care shall be taken to avoid damage to the surface until soil is firm and more than 80 percent of plants have germinated. Avoid vehicular traffic, especially that which creates depressions or ruts. Keep foot traffic to a minimum and, in all cases, avoid repeat traffic over the same area.

3.6 CLEAN-UP

1. General: Erosion control work areas shall be maintained in a neat and orderly condition. Keep paved area free of soil
2. Boundary: Installing contractor is responsible for washing or otherwise cleaning excess material off all area not intended to receive treatment.
3. Debris: Clean up and remove erosion control associated materials and debris from project site before Final Acceptance.

3.7 VEGETATION ESTABLISHMENT PERIOD

3.7.1 Commencement

The Vegetation Establishment Period for this Delivery Order for establishing healthy vegetation shall begin on the first day of seeding operation under this contract and shall end 3 months after the last day of seeding operations required by this contract. Written calendar time shall be furnished to the Contracting Officer for the Vegetation Establishment Period.

3.7.2 Satisfactory Stand of Vegetation

A satisfactory stand of vegetation from the seeding operation is defined as a minimum of 10 plants per square foot for hydroseeded and groundcover areas. The total bare spots in plan view shall not exceed 3 percent of the total seeded area.

3.7.3 Maintenance During Establishment Period

3.7.3.1 General

Maintenance of the seeded areas shall include controlling insects, weeds, and diseases below levels that are detrimental to plant health. In addition, the Contractor shall protect embankments and ditches from erosion, maintain erosion control materials and mulch, protect vegetated areas from traffic, and water and fertilize as needed.

3.7.3.2 Watering

Watering shall be at intervals to obtain a moist soil condition to a minimum depth of 1 inch for hydroseeded areas or groundcover. Frequency of watering and quantity of water shall be adjusted in accordance with the growth of the vegetation. Run-off, run-on, puddling, and wilting shall be prevented.

3.7.3.3 Post-Fertilization

Nitrogen carrier fertilizer shall be applied at the rate of no more than 0.5 pounds per 1,000 square feet for hydroseeded areas or groundcover after the first month and again prior to the final acceptance. The application shall be timed prior to the advent of winter dormancy and shall avoid excessively high nitrogen levels.

3.7.3.4 Repair

The Contractor shall re-establish, as specified herein, eroded, damaged, or barren areas or plants, including seed and topsoil.

3.7.3.5 Maintenance Report

A written record shall be furnished to the Contracting Officer of the maintenance work performed.

3.8 FINAL ACCEPTANCE OF VEGETATION

3.8.1 Preliminary Inspection

Not less than 21 days prior to the completion of the Vegetation Establishment Period, a preliminary inspection will be held by the Contracting Officer. Date and time for the inspection will be established in writing and will be communicated to the Contractor 14 days prior to the inspection date. The acceptability of the vegetation in accordance with the Vegetation Establishment Period shall be determined. An unacceptable stand of vegetation shall be repaired as soon as conditions permit.

3.8.2 Final Inspection

Within 7 days of the end of the Vegetation Establishment Period, a final inspection will be held by the Contracting Officer to determine that deficiencies noted in the preliminary inspection have been corrected. Date and time for the inspection will be established in writing and communicated to the Contractor 14 days prior to the inspection date.

END OF SECTION

SECTION 33 24 13
MONITORING WELLS

PART 1 GENERAL

1.1 REFERENCES

The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 136	(1996) Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM C 150	(2000) Standard Specification for Portland Cement
ASTM D 5088	(1990) Decontamination of Field Equipment Used at Nonradioactive Waste Sites
ASTM D 5092	(1995) Design and Installation of Groundwater Monitoring Wells in Aquifers
ASTM D 5299	(2005) Decommissioning of Ground Water Wells, Vadose Zone Monitoring Devices, Boreholes, and Other Devices for Environmental Activities
ASTM D 5521	(1994) Guide for Development of Ground-Water Monitoring Wells in Granular Aquifers
ASTM D 5608	(2006) Decontamination of Field Equipment Used at Low Level Radioactive Waste Sites
ASTM D 5784	(2000) Standard Guide for Use of Hollow Stem Auger for Geoenvironmental Exploration and the Installation of Subsurface Water-Quality Monitoring Wells
ASTM F 480	(2000) Standard Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), SCH 40 and SCH 80
ASTM D 2855	(2002) Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.

CITY AND COUNTY OF SAN FRANCISCO DEPARTMENT OF PUBLIC HEALTH

Article 12 B	San Francisco Health Code. Soil Boring and Well Regulations

1.2 SUBMITTALS

Submit the following in accordance with Section 01330 Submittal Procedures.

1.2.1 SD-03, Product Data

a. Casing
b. Screen
c. Filter Pack
d. Bentonite
e. Cement
f. Protective Cover

1.2.2 SD-11, Closeout Submittal

Provide a survey report with the following data for each well:

a. Horizontal location (northing and easting)
b. Top of casing (TOC) elevation
c. Adjacent ground elevation

1.3 FIELD QUALITY CONTROL

The Contractor shall provide a field geologist to inspect all material and equipment to be used in borehole drilling, well construction, and well extension for conformance with the specifications stated herein.

The Contractor's field geologist may request minor modifications to the well construction as necessary. The need for any major modifications shall be negotiated with the Contracting Officer and the Contractor.

The Contractor shall provide at least 14 calendar days notice to the Contracting Officer before any drilling well construction commences.

1.4 WELL CONSTRUCTION PERMITS

The Contractor shall comply with construction permits from the City and County of San Francisco Department of Public Health and in accordance with Health Code Article 12B. Well construction shall adhere to permit conditions.

1.5 DELIVERY, STORAGE, AND HANDLING

The contractor shall deliver materials in an undamaged condition. All well materials shall be stored and maintained in a clean, uncontaminated condition throughout the course of the project.

PART 2 PRODUCTS

Provide all first-quality new materials, free from any defects and suitable for the intended use. Provide materials and equipment that are products of manufacturers regularly engaged in the production of such materials and equipment. Furnish and install all incidental items not specifically shown or specified that are required by good practice to provide the complete systems specified herein.

2.1 WELL CASING

2.1.1 Groundwater Monitoring Wells

Schedule 40 polyvinyl chloride (PVC), dimensions and lengths as indicated on Drawings, flush-joint threaded with O-ring seals. Use solvent welded slip-fit PVC coupling joints at the point of extension according to ASTM D2855 for wells being extended. All materials must be manufactured to meet the requirements of ASTM F 480.

Provide slip-fit PVC top end caps for groundwater wells.

Extend existing monitoring well and methane monitoring probe casing using like materials and construction.

2.1.2 Methane Probe

Use like materials as existing for newly installed replacement methane probes and probe extensions consisting of ¼ inch sampling tubing. Confirm existing materials and manufacturers.

2.2 WELL SCREEN

2.2.1 Groundwater Monitoring Wells

Schedule 40 PVC, dimensions and lengths as indicated on Drawings, flush-joint threaded with O-ring seals, machine slotted 0.020 inches, manufactured to meet the requirements of ASTM F 480.

Provide flush threaded PVC silt trap for groundwater monitoring wells and a flush threaded PVC bottom end cap for methane monitoring probes.

2.2.2 Methane Probe

If existing methane probes are removed and replaced following construction, install like intake screens and materials as existing in the replacement probes. Refer to Drawings.

2.3 FILTER PACK

Nominal U.S. Standard sieve size range 8-20 when tested by ASTM C 136.

2.4 BENTONITE SEAL

Pelletized or chipped sodium montmorillanite.

2.5 CEMENT AND BENTONITE GROUT

Type I or II Portland cement manufactured to meet the requirements of ASTM C 150.

Powered sodium montmorillanite.

Grout to be mixed in a ratio of 95 percent by weight cement and 5 percent by weight powdered sodium montmorillanite.

2.6 CONCRETE

A 3,000 pound per square inch (psi) concrete mix. Maximum aggregate size ¾-inch. Cement in mix shall be Type I, II, or III Portland cement according to ASTM C 150.

2.7 PROTECTIVE COVER

Provide steel or aluminum lockable protective cover set over the well casing. Paint the casing with a weather-resistant paint.

Provide weather-resistant keyed alike padlocks with minimum shackle clearance of 2 inches vertical and ¾ inch horizontal.

Use an appropriate well marking extending at least 3 feet above the final ground elevation to identify the well location and facilitate relocation of the well. Materials used must be approved by the Contracting Officer.

PART 3 EXECUTION

All monitoring wells and probes at the site are to be extended to meet the elevation of the final cover. Monitoring wells and probes that can not be extended or are destroyed during site activities will be replaced in accordance with this specification. The anticipated extents of the revetment at the site will obstruct monitoring wells IR07MW20A1 and IR07P20A. Well IR07MW20A1 is to be replaced with a newly constructed well. IR07P20A is to be abandoned if obstructed by the revetment. No other wells at the site are to be abandoned without approval from the Contracting Officer.

3.1 GROUNDWATER MONITORING WELL AND METHANE PROBE EXTENSIONS

Existing groundwater monitoring wells and methane probes at the site are to be extended when possible to meet the final elevation of the soil cover using like materials and construction as the existing wells and probes. Refer to the Drawings for final elevations and construction details. Provisions for protection of the wells and probes will be necessary during construction of the soil cover.

During construction of the extended wells and probes care should be taken to prevent contamination of the interior of the well from any solvents or other chemicals being used. This could be accomplished through use of well plugs or other materials.

3.2 BOREHOLE DRILLING

Wells and probes that are not extended will be replaced. All boreholes shall be constructed using techniques that conform to ASTM D 5784.

Complete all boreholes for monitoring wells and probes using a 10-inch diameter hollow stem auger. Monitoring wells and probes that are replacing existing wells and monitoring probes will be competed to the same depth as the wells and probes that are being replaced. Depths are shown on the Drawings. Any modification to the borehole, and ultimate well depth, must be approved by the Contracting Officer.

Wells and probes that are replaced with new wells and probes shall be placed as near to the original location as feasible. Any new well or probe location greater than 5 ft from the original location must be approved by the Contracting Officer. Refer to the Drawings for final elevations and construction details.

All boreholes shall be continuously sampled for lithologic logging. The Contractor's field geologist will be responsible for completing a log of the borehole lithology.

No drilling fluids shall be added to the borehole other than water from a source approved by the Contractor's field geologist. No lubricants shall be used on downhole drilling equipment other than vegetable-based lubricants on auger flight and drill rod joints.

Drill cuttings shall be handled according to the construction sequence and screened for radionuclide contamination. Non-radiologically impacted drill cuttings may be spread over the site within the boundary and under the 3 ft soil cover over the site. Otherwise, provide equipment to containerize all drill cuttings for disposal.

3.3 WELL AND PROBE INSTALLATION

All wells and probes shall be constructed or extended using techniques that conform to ASTM D 5092.

All annular materials shall be installed to the approximate depths of the wells and probes being replaced as shown on the Drawings. Contracting Officer approval is necessary for any modification to the depth and the construction of the wells and probes. Depths to the top of filter pack and bentonite seal materials shall be directly measured using a weighted tape measure to confirm installation to appropriate depths. Screen and blank casing lengths shall be measured to the nearest 0.01 foot as well as total installed length.

Bentonite seal materials shall be added either by tremie pipe or gravity fall from the surface. The bentonite pellets shall be installed in 1-foot lifts, hydrated with at least 5 gallons of water, and allowed to cure for 10 minutes before adding the next lift. The final bentonite lift shall be allowed to cure for at least 30 minutes before installing the cement and bentonite grout. Water for hydration is to be obtained from a source approved by the Contractor's field geologist.

The cement and bentonite grout shall be placed in one continuous operation into the annulus above the bentonite seal to the depth shown in the Drawings by use of tremie pipe or grout pump.

Protective casings shall be installed to protect the monitoring wells and probes. Compact concrete to eliminate voids and finish to a slope as specified in the Drawings to divert water runoff away from the well casing.

Construction information shall be included on well construction forms.

3.4 WELL DEVELOPMENT

All newly construction groundwater monitoring wells shall be developed using either mechanical surging and bailing or pumping, or overpumping and backwashing that conforms to ASTM D 5521. Groundwater monitoring wells that are extended do not require development provided they are adequately protected and sealed during construction..

Well development shall not begin until the cement and bentonite grout has cured a minimum of 48 hours.

Development shall be considered complete when:

There is no change in the appearance of the discharge water

A minimum of 3 times the casing and borehole volume of water in the well has been removed plus the volume of any water added during drilling

Temperature, specific conductivity, and pH readings, measured before, at least twice during, and after development have stabilized. Stabilization shall mean a variation of plus or minus less than 10 percent between three consecutive temperature, specific conductivity, and pH readings.

Monitoring well development will be overseen by the Contractor's field geologist.
The Contractor's field geologist will supply all equipment to measure temperature, specific conductivity, and pH in the field, will complete all measurements, and will document the progress and results of the development procedures.

Development wastewater shall be handled according to the construction sequence. Provide equipment to containerize all water generated during development. The field geologist will determine which development wastewater shall be containerized and which shall be spread at the borehole location. Approval from the Contracting Officer necessary prior to discharge of water generated during well development.

3.5 DECONTAMINATION

Decontamination procedures shall conform to ASTM D 5088 and ASTM D 5608 in addition to site specific practices including practices.

All drill rods, drill bits, augers, tremie pipes, grout pumping lines, well development equipment, and other associated equipment shall be cleaned with a portable, high-pressure steam cleaner prior to drilling at each well location. Soil sampling equipment such as split spoons shall be washed with detergent solution and rinsed with approved water prior to collecting each soil sample.

Provide equipment to capture and containerize all decontamination fluids. Otherwise, wash water may be discharged to the surface in such a manner to avoid erosion and runoff off site with approval from the Contracting Officer.

3.6 FINISHING WELL HEAD

Finish wellhead as shown on the Drawings. Cover concrete apron with topsoil and compact with pneumatic tamper. Install an identification marker extending to at least 2 feet above the elevation of the final cover to facilitate locating the wells within the vegetative cover.

3.7 SURVEYING

Provide a California-licensed surveyor to survey horizontal and vertical coordinates for location (northing and easting), the top of casing (TOC) elevation, and adjacent ground surface elevation for each well constructed.

All northing and easting coordinates shall be based on control points shown on the Drawings. Horizontal coordinates shall be measured within 0.1-foot accuracy.

All elevation measurements shall be based upon the elevation of the monument established on site during construction shown on the drawings. All elevation measurements shall be measured within 0.01-foot accuracy. The TOC elevation shall be measured by placing the surveying rod directly on top of the north side of the well casing. The TOC elevation measuring point shall be marked with a 1/8-inch deep sawcut.

3.8 WELL DESTRUCTION

Any well disapproved by the Contracting Officer, or any well destruction shall be done according to the requirements of the City and County of San Francisco Department of Public Health in accordance with Health Code Article 12B and the requirements of these specifications.

Well destruction includes the removal of all materials left in the well and borehole, excluding the filter pack, and including backfill materials, casing, screen, and any other material placed into the hole. Grout old boring from the bottom to within 1 foot of the top of ground surface according to the protocol for grout/bentonite placement established in paragraph CEMENT AND BENTONITE GROUT. Backfill the top 1 foot with fill material to the ground surface. No well may be destroyed without the approval of the Contracting Officer.

END OF SECTION

SECTION 35 31 19
COASTAL PROTECTION

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 within the text by the basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 127	(2007) Standard Test Method for Density
ASTM C 136	Standard Test Method for Sieve Analysis of Fine and Course Aggregates
ASTM C 33	(2007) Standard Specification for Concrete Aggregates
ASTM C 295	(2008) Petrographic Examination of Aggregates for Concrete
ASTM D 3370	(2008) Sampling Water from Closed Conduits
ASTM D 1429	(2008) Specific Gravity of Water and Brine
ASTM D 2487	(2006e1) Soils for Engineering Purposes (Unified Soil Classification System)
ASTM D 3740	(2008) 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	(2005e1) Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate
ASTM D 4992	(2007) Evaluation of Rock to be Used for Erosion Control
ASTM D 5312	(2004) Evaluation of Durability of Rock for Erosion Control Under Freezing and Thawing Conditions
ASTM D 5313	(2004) Evaluation of Durability of Rock for Erosion Control Under Wetting and Drying Conditions
ASTM D 5519	(2007) Particle Size Analysis of Natural and Man-Made Riprap Materials
ASTM D 75	(2003) Standard Practice for Sampling Aggregates

NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY (NIST)

NIST HB 44	(2007) NIST Handbook 44: Specifications, Tolerances, and other Technical Requirements for Weighing and Measuring Devices

U.S. ARMY CORPS OF ENGINEERS (COE)

COE CRD-C 144	(1992) Standard Test Method for Resistance of Rock to Freezing and Thawing
COE CRD-C 148	(1969) Method of Testing Stone for Expansive Breakdown on Soaking in Ethylene Glycol
COE CRD-C 169	(1997) Standard Test Method for Resistance of Rock to Wetting and Drying
EM 1110-2-1601	(1994; Change 1) Hydraulic Design of Flood Control Channels
EM 1110-2-1906	(1970; Change 1 and 2) Laboratory Soils Testing

1.2 DEFINITIONS

1.2.1 Revetments

The term "revetment" applies to various types of stabilization structures that are constructed along shorelines. The revetments are constructed of stone or piling.

1.2.2 Stone Protection

Stone Protection is defined as a system which includes a layer of bedding material or layers of filter material beneath a layer or layers of riprap.

1.2.3 Riprap

Riprap is defined as a material having a gradation band similar to those specified in EM 1110-2-1601, Chapter 3, uniform graded material. Riprap is normally produced by mechanical methods, with a jaw crusher and grizzly after the stone has been mined by blasting in a quarry. Riprap gradations have a maximum top size of 3.5 tons.

1.2.4 Graded Stone

Graded Stone is defined as material with gradations that are produced by the mining technique and minimal additional processing other than the use of a skeleton bucket or a bar grizzly. The gradation band have more fines than riprap and have gradations with top size up to 3.5 tons and could be classified as being well graded.

1.2.5 Shoreline Protection

Shoreline Protection is defined as a system of bedding or filter materials and stone used to protect coastlines of lakes and oceans and for harbor protection.

1.3 BULK SPECIFIC GRAVITY OF STONE REDESIGN

If the Contractor, after award of the contract, requests approval of stone from a source(s) which has a range of bulk specific gravity (SSD), whose limits are lower or higher than the specified design range of 2.5 to 2.9 as specified in paragraph MATERIAL QUALITY, consideration will be given to revising the project design through modification of the design range under the following conditions:

a. Only one (1) such proposal for modification will be allowed. In addition, the required completion time shall not be extended more than thirty (30) calendar days as a result of redesign for any reason, including acts of the Government.

b. The modified design range of bulk specific gravity (SSD) to be used shall not have a lower limit of less than 2.30 nor higher than 3.50.

c. The stone sections of the required structure are to be redesigned by the Government. Such redesign will be based upon the Contractor's proposed modifications to the specified design range of bulk specific gravity (SSD) and will include any required revisions to allowable tolerances. Only one such redesign will be made. A charge of $5,000 will be assessed the Contractor whether the redesign is used or not.

d. Any proposal to modify the specified design range shall be submitted within fifteen (15) calendar days after receipt of the Government's redesign and shall include a statement as to the savings which will result from the modification. If a formal proposal is not submitted within the time limit, the work shall be performed in accordance with the specified design, in which case the Contractor shall not be allowed to use stone having a bulk specific gravity (SSD) less than the specified design range.

f. If the Contractor elects to perform the work in accordance with the redesign, the estimated quantities to be shown in the BIDDING SCHEDULE will be the quantities derived from the Government's redesign.

1.4 SUBMITTALS

The following shall be submitted in accordance with Section 01 33 00 SUBMITTAL PROCEDURES:

1.4.1 SD-03 Product Data

a. Riprap; G

b. Filter Material; G

c. Filter Rock

Stone hauling vessel gaging tables and a copy of the data and calculations used for the preparation of the tables.

d. Bulk Specific Gravity of Stone and Redesign; G

A formal proposal to perform the work in accordance with the redesign, within fifteen (15) calendar days after receipt of the Government's redesign; if the Contractor proposes to utilize stone having a specific gravity outside of the specific design range, and as a result thereof, the Government provides the Contractor with a redesign. The submittal shall include a statement of the direct savings to the Government and tabulation in the form of a revised BIDDING SCHEDULE showing unchanged unit prices for the revised quantities.

1.4.2 SD-04 Samples

a. Stone; G

Suitable stone samples prior to delivery of any such material to the worksite if stone is not from an approved vendor.

1.4.3 SD-07 Certificates

a. Rip Rap Specific Gravity

b. Filter Fabric

c. Filter Rock

Certificates of compliance attesting that the materials meet specification requirements.

1.5 QUALITY ASSURANCE

1.5.1 Stone

1.5.1.1 General

All stone shall be durable material as approved by the Contracting Officer. Selected stone from the required excavation may be used if it satisfies all requirements as to quality and dimensions. Show that an adequate quantity of material is available from the source area and provide quality test data. Stone shall be of a suitable quality to ensure permanence in the structure and in the climate in which it is to be used. It 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 20 percent or more of the stone produced contains hairline cracks, then all stone 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 4 mil and shall be continuous for one-third the dimension of at least two sides of the stone. The stone shall be clean and reasonably free from soil, quarry fines, and shall contain no refuse. The stone shall be clean and adequately free from all foreign matter. Any foreign material adhering to or combined with the stone as a result of stockpiling shall be removed prior to placement.

1.5.1.2 Sources

Stone shall be furnished from any source designated by the Contractor and accepted by the Contracting Officer, subject to the conditions herein stated. In order for stone to be acceptable on the basis of service records, stone of a similar size must have been placed in a similar thickness and exposed to weathering under similar conditions as are anticipated for this contract, and must have satisfactorily withstood such weathering for a minimum of 20 years. In addition to an acceptable 5 year service record, the Contracting Officer has the option to elect to have representative samples taken and tested.

a. List of Sources

(1) Category I Sources: Category I sources have been inspected and evaluated within the last five years by the Government and have produced stone materials of acceptable quality from satisfactory geological formations. The Category I sources have previously demonstrated effective quality control programs at the source and the test results of the materials furnished have been verified that some material are of satisfactory quality. In a like manner, the source would be capable of providing the quality, quantity, and gradation of required stone materials. Further evaluation and testing of the source will not be required unless the preparation of the required demonstration stockpile reveals an adverse condition not previously taken into account.

(2) Category II Sources: Category II sources either have not been inspected or evaluated within the past five years or have had a deficiency in the past which may or may not affect its qualifications to provide stone materials for this project. Deficiencies may include, but are not limited to: ineffective quality control program; unsatisfactory production techniques; unacceptable quality of material in the geological formation being quarried; insufficient quantities of required materials; or unsatisfactory durability of stone materials previously furnished. These factors of this kind do not disqualify the source for this project. A current inspection and evaluation of the source by the Contractor would be necessary to determine whether acceptable stone can be produced from the proposed source before allowing the source to proceed with preparation of demonstration stockpiles. Disapproval of a proposed Category II source based on the inspection and evaluation would necessitate having the Contractor name a replacement source.

b. Selection of Source. Designate in writing only one source or one combination of sources from which he proposes to furnish stone. He shall notify the Contracting Officer at least 60 workdays before the stone leaves the quarry. It is the Contractor's responsibility to determine that the stone 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.

c. Acceptance of Materials. Acceptance of a source of stone 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 stone 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 stone may be tested by the Government, if the Contracting Officer determines that testing is necessary. If such tests are determined necessary, the testing will be done in the Government's testing laboratory or commercial laboratory selected by the Government. Materials produced shall meet all the requirements herein. During the contract period, both prior to and after materials are delivered to the job site, visual inspections and measurements of the stone materials may be performed by the Contracting Officer. If the Contracting Officer, during the inspections, finds that the stone 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 stone 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.

1.6 CONSTRUCTION TOLERANCES

The finished surface and stone layer thickness shall not deviate from the lines and grades shown by more than the tolerances listed below. Tolerances are measured perpendicular to the indicated neatlines. Extreme limits of the tolerances given shall not be continuous in any direction for more than five (5) times the nominal stone dimension nor for an area greater than 200 square feet of the structure surface.

NEATLINE TOLERANCES
ABOVE NEATLINE BELOW NEATLINE

MATERIAL	inches above neatline	below neatline
Filter Layer:	+3 inches	-2 inches
Riprap:	+8 inches	-4 inches
Base:	+2 inches	-1 inch

The intention is that the work shall be built generally to the required elevations, slope and grade and that the outer surfaces shall be even and present with a neat appearance. Placed material not meeting these limits shall be removed or reworked as directed by the Contracting Officer. Payment will not be made for excess material which the Contracting Officer permits to remain in place.

PART 2 PRODUCTS

2.1 FILTER MATERIAL

Filter material shall consist of Filter Stone and Geotextile. Geotextile shall be as specified in Section 31 05 22 GEOTEXTILES.

The rock shall be composed of tough, durable particles, adequately free from thin, flat and elongated pieces, and shall contain no organic matter nor soft, friable particles in quantities considered objectionable by the Contracting Officer. The aggregate shall meet the quality requirements of ASTM C 33. Grading shall conform to the following requirements:

PERMISSIBLE LIMITS
U.S. STANDARD SIEVE PERCENT BY WEIGHT, PASSING
FILTER STONE

6 in.	95%
3 in.	50%
1 in.	5%

The filter materials shall be well-graded between the limits shown. At least one test shall be performed on material placed for each specified gradation in accordance with ASTM C 136. A representative sample weighing not less than 100 pounds shall be removed from the filter layer placed at locations directed by the Contracting Officer. All points on individual grading curves obtained from representative samples of filter material shall lie between the boundary limits as defined by smooth curves drawn through the tabulated gradation limits plotted on ENG FORM 2087 or similar form. The individual gradation curves within these limits shall not exhibit abrupt changes in slope denoting either gap grading or scalping of certain sizes or other irregularities which would be detrimental to the proper functioning of the filter.

2.2 STONE

2.2.1 General

2.2.1.1 Evaluation Testing of Stone

In lieu of vendor certifications for the same properties listed below the Contractor shall have evaluation tests performed on stone samples collected from the proposed source, or at the request of the Contracting Officer. The quarry investigation shall be performed by a registered geologist or registered engineer. The tests to which the stone shall be subjected include petrographic examination (ASTM C 295), bulk specific

gravity (SSD), unit weight, absorption (ASTM C 127), resistance of stone to freezing and thawing (COE CRD-C 144 or ASTM D 5312), and if argillaceous limestone and sandstone are used, resistance to wetting and drying (COE CRD-C 169 or ASTM D 5313). The laboratory to perform the required testing shall be validated based on relevant paragraphs of ASTM D 3740, and no work requiring testing shall be permitted until the laboratory has been inspected and validated. The first inspection of the facilities shall be at the expense of the Government and any subsequent inspections required because of failure of the first inspection shall be at the expense of the Contractor.

a. Bulk Specific Gravity Range. All stone shall have a minimum bulk specific gravity, saturated surface dry (SSD), of 2.50 and a maximum bulk specific gravity of not more than 2.90 based upon water having a unit weight of 62.4 pounds per cubic foot. The method of test for bulk specific gravity (SSD) shall be ASTM C 127.

b. Petrographic Examination. Stone 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.

d. Samples. Samples of stone shall be taken by a representative of the Quarry under the supervision of the Contracting Officer for testing and acceptance prior to delivery of any stone from this source to the site of the work. Information provided with the samples shall include the location within the quarry from which the sample was taken along with a field examination of the quarry. The field examination shall include the information outline in ASTM D 4992, paragraph 7.

   Samples shall consist of at least three pieces of stone, roughly cubical in shape and weighing not less than 150 pounds each from each unit that shall be used in the production of the required stone. If the source is an undeveloped quarry, or if the operation has been dormant for more than one year such that fresh samples are not available, the Contractor shall expose fresh rock for 20 feet horizontally and for the full height of the face proposed for production, prior to the field evaluation.

   The Contracting Officer may also require documentation of subsurface exploration of an undeveloped quarry in order to determine whether or not sufficient reserves are available. The samples shall be shipped at the Contractor's expense to a laboratory validated by the government to perform the required tests.

e. Tests. Conduct the tests in accordance with applicable ASTM and Corps of Engineers methods of tests, given in the Handbook for Concrete and Cement, in a laboratory validated by the government. The cost of testing shall be borne by the Contractor.

2.2.1.2 Gradation Tests for Stone

To be performed if testing from the vendor is not performed or deemed adequate by the Contracting Officer.

a. Gradation Test Method for Riprap. Gradation tests shall be performed in accordance with ASTM D 5519.

b. Standard Test Method for Gradation of Riprap, Graded Stone, and Filter Stone

(1) Select a representative sample (Note No. 1), weigh and dump on hard stand.

(2) Select specific sizes (see example) on which to run "individual weight larger than" test. (See Note No. 2). Procedure is similar to the standard aggregate gradation test for "individual weight retained".

(3) Determine the largest size stone in the sample. (100 percent size)

(4) Separate by "size larger than" the selected weights, starting with the larger sizes. Use reference stones, with identified weights, for visual comparison in separating the obviously "larger than" stones. Stones that appear close to the specific weight must be individually weighed to determine size grouping. Weigh each size group, either individually or cumulatively.

(5) Paragraph d above will result in "individual weight retained" figures. Calculate individual percent retained (heavier than), cumulative percent retained, and cumulative percent passing (lighter than). Plot percent passing, along with the specification curve on ENG Form 4794-RM 4794-R.

NOTE NO. 1: Sample Selection: The most important part of the test and the least precise is the selection of a representative sample. No "standard" can be devised; larger quarry run stone is best sampled at the shot or stockpile by given direction to the loader; small graded stone is best sampled by random selection from the transporting vehicles. If possible, all parties should take part in the sample selection and agree before the sample is run that the sample is representative.

NOTE NO. 2: Selection of Size for Separation: It is quite possible and accurate to run a gradation using any convenient sizes for the separation, without reference to the specifications. After the test is plotted on a curve, then the gradation limits may be plotted. Overlapping gradations with this method are no problem. However, it is usually more convenient to select points from the gradation limits, such as the minimum 50 percent size, the minimum 15 percent size, and one or two others, as separation points. For these types of stone gradations the separation points need to be selected as the smallest size stone at each break in the gradation specified.

2.2.1.3 Riprap Stockpile

Storage of riprap, stone, or filter stone at the worksite is not to be confused with off-site stockpiling of riprap, stone, or filter stone. If the Contractor elects to provide off-site stockpiling areas, the Contracting Officer shall be notified of all such areas. The Contractor's stockpile shall be a maximum of 12 feet high and formed by a series of layers of truckload dumps, where the rock essentially remains where it is placed. Subsequent layers shall be started 10 feet from the edge of the previous layer so that the rock will not roll down the edges of the previous layers. The first layer shall be a maximum of 6 feet high. After being stockpiled, any riprap, stone, or filter stone which has become contaminated with soil or refuse shall not be put into the work unless the contaminating material has been removed from the riprap, stone, or filter stone prior to placement.

a. Worksite Stockpile. Riprap, stone, or filter stone delivered to the work sites, which requires temporary storage landward of top of slope, shall be placed in a container suitable for storing the riprap, stone, or filter stone without waste, or a sand-clay-gravel or crushed stone pad may be constructed for the storage area and removed upon completion of the work. If the sand-clay-gravel or crushed stone pad method is used, the pad shall have a minimum thickness of at least 6 inches. The container or sand-clay-gravel or crushed stone pad method shall be subject to approval prior to delivery of the riprap, stone, or filter stone. Upon completion of the work, the storage areas shall be cleaned of all storage residues and returned to their natural condition.

   Temporary storage of riprap, stone, or filter stone at the worksite will be allowed, provided the stockpile toe of the riprap, stone, or filter stone be no closer than 60 linear feet from the closest edge of the shoreline's upper top slope, and the amount shall not exceed 200 tons unless otherwise approved.

b. Off-site Stockpile. In areas where riprap, stone, or filter stone is stockpiled for placement, the area shall have excess rock removed prior to completion of work. All rock and spalls greater than 3 inches in diameter shall be removed. Where rocks may have become buried due to soft ground or operation of the equipment, the rock shall be disposed of as directed. After the rock has been removed, the storage area shall be graded, dressed, and filled to return the ground surface as near as practical to the condition that existed prior to construction.

2.2.2 Riprap

Stone shall be well graded and shall conform to the table(s) below.

TABLE 1
(FOR RIPRAP "1/4 Ton")

Percent Lighter Limits of Stone by Weight (SSD)	**Weight, Lb.**
95-100%	1,000
0-50%	500
0-5%	75

All points on individual grading curves obtained from representative samples of riprap material shall lie between the boundary limits as defined by smooth curves drawn through the tabulated gradation limits plotted on ENG FORM 2087 or similar form. The individual gradation curves within these limits shall not exhibit abrupt changes in slope denoting either gap grading or scalping of certain sizes or other irregularities.

2.2.3 Filter Fabric

See SECTION 31 05 22 GEOTEXTILES for filter fabric.

PART 3 EXECUTION

3.1 DEMONSTRATION SECTION

Prior to placement of stone, construct a section of stone protection consisting of toe stone, riprap, and filter layers to demonstrate his proposed operations for production placement. The section shall demonstrate procedures and capability of grading, placing toe stone and bank protection within the tolerances specified. The demonstration section shall be 100 feet in length and shall conform to all applicable specifications.

3.1.1 Method and Equipment

Methods and equipment employed for placement shall demonstrate the adequacy for use in placement of toe stone, riprap, and filter layers and shall conform with the requirements specified. The quantities of all materials placed within the section shall be accurately tabulated and provided immediately to the Contracting Officer for comparison with computed quantities.

3.1.2 Demonstration Section Evaluation

Do not proceed with placing stone protection prior to the approval of the demonstration section. Within a period of 7 days after completion of the section, the Contracting Officer shall determine the adequacy of the section to function as part of the permanent construction. The Contractor will be notified as to the acceptability of the section and may be directed to modify methods of construction and remove the section if necessary.

3.1.3 Removal of Demonstration Section

If removal of the demonstration section is required, it shall be conducted in such a manner as to maintain the integrity of the underlying subgrade. The Contractor shall make arrangements for disposal in areas not located on the site.

3.2 BASE PREPARATION

Areas on which filter layers and riprap are to be placed shall be graded and/or dressed to conform to cross sections shown on the contract Drawings within an allowable tolerance of plus 2 inches and minus 1 inches from the theoretical slope lines and grades. The prepared base shall be approved by the Contracting Officer.

Where such areas are below the allowable minus tolerance limit they shall be brought to grade by fill with earth similar to the adjacent material or with sand fill and then compacted to a density equal to the adjacent in place material. Subaqueous areas on which filter materials and riprap are to be placed shall be graded and/or dressed to conform to cross sections shown on the contract drawings within an allowable tolerance of plus 1 foot and minus 2 feet from the specified slope line and grades.

Where such areas are below the allowable minus tolerance limit they shall be filled with sand. As an alternative, these areas may be filled with filter rock material.

Immediately prior to placing the geotextile and filter stone, the prepared base will be inspected by the Contracting Officer and no material shall be placed thereon until that area has been approved. Prepared base layer shall not be exposed to incoming water unless authorized by the Contracting Officer.

3.3 PLACEMENT OF FILTER LAYERS

3.3.1 General

Filter layers, composed of geotextile and a 6-inch layer of filter stone shall be placed on the prepared base as described below, in accordance with the details shown on the contract Drawings, and within the limits either shown on the contract drawings or staked in the field. A tolerance of plus 3 inches and minus 2 inch from the slope lines and grades shown on the contract drawings will be allowed in the finished surface of the filter layers, except that the extreme of this tolerance shall not be continuous over an area greater than 200 square feet.

3.3.2 Geotextile

Installation of geotextile shall be as specified in Section 31 05 22 GEOTEXTILES USED AS FILTERS.

3.3.3 Placement of Filter Material on Geotextile

Filter material shall be spread uniformly on the geotextile to the slope lines and grades as indicated on the contract drawings and in such manner as to avoid damage to the geotextile. Loads of material shall be placed against previously placed material in such a manner as to ensure a relatively homogenous mass. Placing of filter stone by methods which tend to segregate the particle sizes within the filter layer will not be permitted.

Any damage to the surface of the geotextile during placement of filter stone shall be repaired before proceeding with the work. Compaction of material placed on the geotextile will not be required, but shall be finished to present an adequately even surface, free from mounds or windrows.

3.4 PLACEMENT OF RIPRAP

3.4.1 General

Riprap shall be placed on the filter layers specified in paragraph FILTER MATERIAL within the limits shown on the contract drawings.

3.4.2 Placement

Under water placement rates shall be used when the top of the layer to be placed is covered by more than 3 feet of water.

3.4.2.1 Above Water

Riprap shall be placed in such manner as to produce a well graded mass of rock with the minimum practicable percentage of voids, and shall be constructed within the specified tolerances to the lines and grades shown on the drawings. Placement shall begin at the bottom of the area to be covered and continue up slope. Subsequent loads of material shall be placed against previously placed material in such a manner as to ensure a relatively homogenous mass. The desired distribution of the various sizes of stones throughout the mass shall be obtained by selective loading of the material at the quarry or other source, by controlled dumping of successive loads during final placing, or by other methods of placement which will produce the specified results.

Rearranging of individual stones will be required to the extent necessary to obtain a well-graded distribution of stone sizes as specified above. Maintain the stone protection until accepted by the Contracting Officer; any material displaced by any cause shall be replaced, with no additional payment, to the lines and grades shown on the drawings.

A tolerance of plus 8 inches or minus 4 inches from the slope lines and grades shown on the Drawings will be allowed in the finished neatline surface of the riprap, except that either extreme of such tolerance shall not be continuous over an area greater than 200 square feet. The average tolerance of the entire job shall have no more than 50 percent of the tolerance specified above.

No stone shall be dropped through air from a height greater than 3 feet. The drop height of riprap with a top size greater than 500 pounds shall be less than 1 foot, but can be increased by placing a cushioning layer of sand or other protective material on top of the geotextile before placing the riprap, or other methods deemed necessary if demonstrated in the field to not damage the geotextile.

The larger stones shall be well distributed and the entire mass of stones in their final position shall be roughly graded to conform to the gradation specified in Paragraph 2.2.2 Riprap. The finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones.

Placing riprap in layers will not be permitted. Placing riprap by dumping into chutes or by similar methods likely to cause segregation of the various sizes will not be permitted. Placing riprap by dumping it at the top of the slope and pushing it down the slope will not be permitted. No equipment shall be operated directly on the completed stone protection system.

All dump trucks used in placing the riprap shall be equipped with bottom hinged tailgates. The gate releasing mechanism shall be arranged so that it may be operated only from, at, or near the front of the truck.

3.4.2.2 Under Water

Prior to starting work, submit the proposed method of placing riprap under water. Riprap to be placed in the wet if necessary shall be done during periods of low water levels. The riprap shall be placed in two passes, with the second pass perpendicular to the first pass.

3.5 PLACEMENT OF HAND-PLACED RIPRAP

3.5.1 General

Hand-placed riprap shall be placed on the filter material specified in paragraph FILTER MATERIAL within the limits shown. Stone shall conform to the requirements of paragraph RIPRAP. Except for spalls for wedging, stone shall be roughly rectangular in shape of which the least dimension shall be not less than one-third the length.

3.5.2 Placement

The riprap shall be carefully placed by hand in such a manner that adjacent stones are in close contact and, in general, have their greatest dimensions across the slope. "Through stones" shall be well-distributed throughout the mass and the sum of their cross sections, parallel to the slope being protected, shall be not less than two-thirds of such area. As used in this specification a "through stone" is defined as a stone whose dimension normal to the surface being riprapped is not less than the full depth of the riprap. Placement shall begin at the bottom of the area to be covered and continue up slope. Subsequent loads of material shall be placed against previously placed material in such a manner as to ensure a relatively homogenous mass. Placement shall begin at the bottom of the area to be covered and continue up slope. Subsequent loads of material placed on the slope shall be immediately adjacent to previously placed material in such a manner to ensure a relatively homogenous mass. The riprap along the lower edge of an area shall consist of the largest stones set in a trench so as to form a band. Except for spalls used to fill voids between larger stone, no stone shall be used in the exposed face of the riprap which will extend less than one-half the thickness of the riprap. Spaces between the larger stones shall be filled with spalls and smaller

stones of the largest feasible size to form a compact mass. Spalls and small stone shall not be place in nests in lieu of larger size stone. A tolerance of plus or minus 6 inches from the slope lines and grades shown will be allowed in the finished surface of the riprap paving, except that the extreme of this tolerance shall not be continuous over an area greater than 200 square feet.

3.6 CORRECTIVE EARTHWORK

3.6.1 Grading

Grading shall consist of the sloping of banks damaged by failures and the preparation of the subgrade. Most of the grading will be in areas where mechanical equipment can be used, but some hand grading may be required. All grading and filling shall be done to the lines and grades as staked in the field or as specified. Material used in making fills or restoring the subgrade shall be free from roots, brush or other debris. Each layer shall be thoroughly compacted to a density at least equal to that of the adjacent undisturbed earth.

3.6.2 Excavation

Excavation shall be required in some failures where protrusion of stone above adjacent surface is objectionable. Where excavation is specified, the subgrades shall be excavated to the extent necessary. Large areas may not require excavating throughout, but excavation to the depths specified above will be required only for a distance of 5 feet inside the perimeter of the failure. Most of the excavation can be accomplished by mechanical means, but some hand work around the edges will be required. All work shall be to the lines and grades as staked in the field or as specified. Material resulting from the operation shall be used for making fills where required as specified in paragraph GRADING.

3.7 TESTS AND INSPECTIONS

Surveys made by the Contractor are required on each material placed for determining that the materials are acceptably placed in the work. Make checks as the work progresses to verify lines, grades and thicknesses established for completed work. At least one (1) check survey as specified below shall be made for each twenty-five (25) foot section as shown as practicable after completion. Following placement of each type of material, the cross section of each step of the work shall be approved by the Contracting Officer before proceeding with the next step of the work.

Approval of cross sections based upon check surveys shall not constitute final acceptance of the work. Cross sections shall be taken on lines 25 feet apart, measured along the structure reference line, with readings at 5-foot intervals and at beaks along the lines. However, other cross section spacing and reading intervals may be used if determined appropriate by the Contracting Officer.

Additional elevations and soundings shall be taken as the Contracting Officer may deem necessary or advisable. The surveys shall be conducted in the presence of an authorized representative of the Contracting Officer, unless this requirement is waived by the Contracting Officer.

a. Above Water: The elevation of stone above the water surface shall be determined by the use of a leveling instrument and a rod having a base 12 inches in diameter. If approved by the Contracting Officer other means may also be used.

b. Below Water: For portions of the work that are under water, sounding surveys shall be performed either by means of a sounding pole or a sounding basket weighing about 8 1/2 pounds, each of which has a base measuring 12 inches in diameter.

c. Gage Board: The gage shall be checked prior to any survey. The Contractor shall install a gage board at the project site.

d. Electronic Depth Recorder Method: When using an electronic depth recorder the following procedures shall be used.

(1) The depth recorder shall be calibrated and adjusted for the gage, with check bar, at least six (6) times within a normal eight (8) hour work day.

(2) Normal calibration times shall be at the beginning of the work day, mid-morning, close of morning's work, start of afternoon's work, mid-afternoon, and the end of the day.

(3) Further calibrations shall be performed whenever there is any malfunction within the depth recorder or transducer which might affect the soundings, a major gage change, or change in water temperature due to industrial discharge or other causes.

(4) The check bar shall be set at approximately the deepest sounding in the area to be sounded.

(5) The depth recorder shall be calibrated to read at low water datum.

(6) When checking the calibration at mid-morning, end of morning, mid-afternoon and end of work, the same setting used for the previous calibration shall be used.

(7) If the calibration check does not agree with the previous calibration, the depth recorder shall be calibrated to the proper setting.

(8) Under no circumstances shall the setting of the depth recorder be changed between calibrations.

e. Electronic Depth Recorder: The survey depth recorder used must be a standard model acceptable to the Contracting Officer using a sounding chart that can be read directly to the nearest foot and estimated to the nearest tenth (0.1) of a foot. Accuracy shall be better than 1/2 of 1 percent.

f. Tagline Method of Horizontal Location Along Station: If a tagline is used with a depth recorder, the soundings shall be marked with a fix every 5 feet.

g. Predetermined Transit Angle Method or Ranges Method: The interval between predetermined angles or ranges along a sounding line shall not exceed 200 feet along the entire length of the sounding line. No predetermined angle shall form an intersection with the sounding line of less than 45 degrees.

h. Speed of the Sounding Boat: When sounding, the speed of the sounding boat shall be as constant as possible, preferably between 180 and 220 feet per minute.

i. Checking Gage: The gage shall be checked prior to each calibration and recorded on the sounding chart or in the field notes.

EXAMPLE GRADATION SPECIFICATIONS

PERCENT LIGHTER BY WEIGHT	STONE WEIGHT IN LBS.
100	400 - 160
50	160 - 80
15	80 - 30

EXAMPLE WORKSHEET

STONE SIZE LBS.	INDIVIDUAL WT. RETAINED	INDIVIDUAL PERCENT RETAINED	CUMULATIVE PERCENT RETAINED	PERCENT PASSING
400	0	0	0	100
160	9,600	30	30	70
80	11,200	35	65	35
30	8,000	25	90	10
<30	3,200	10	100	-
TOTAL	32,000 pounds			

NOTE: Largest stone 251 pounds

GRADATION TEST DATA SHEET

Quarry _____ Type of Stone Tested _____

Date of Test _____ Testing Rate _____

TEST REPRESENTS

Contract No.	District	Tons
	TOTAL	

GRADATION

Stone Size (lbs)	Weight Retained	Individual % Retained	Cumulative % Ret.	Cumulative % Pass	Specification % Finer by wt
Total Weight					
Max Size Stone =					

Remarks:

I certify that the above stone sample is representative of the total tonnage covered by this test report.

Contractor Representative _____

Government Representative _____

STONE SOURCES

LATITUDE/ LONGITUDE	QUARRY LOCATION, ADDRESS, & TELEPHONE NUMBER	MAIN OFFICE ADDRESS & TELEPHONE NUMBER
	[STATE]	
[_____]	[_____]	[_____]
	[_____]	[_____]
	[_____]	[_____]
	[_____]	[_____]
[_____]	[_____]	[_____]
	[_____]	[_____]
	[_____]	[_____]
	[_____]	[_____]
	[STATE]	
[_____]	[_____]	[_____]
	[_____]	[_____]
	[_____]	[_____]
	[_____]	[_____]
[_____]	[_____]	[_____]
	[_____]	[_____]
	[_____]	[_____]
	[_____]	[_____]

END OF SECTION

Final

Preconstruction Cost Opinion
Installation Restoration Sites 7 and 18
Parcel B

Hunters Point Shipyard
San Francisco, California

January 8, 2010

Prepared for:
Base Realignment and Closure
Program Management Office West
San Diego, California

Prepared by:
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Prepared under:
Naval Facilities Engineering Command
Contract Number N62473-04-D-3213
Contract Task Order 0019

CHAD-3213-0019-0040

Final

Preconstruction Cost Opinion
Installation Restoration Sites 7 and 18
Parcel B

Hunters Point Shipyard
San Francisco, California

Contract Number N62473-04-D-3213
Contract Task Order 0019

Prepared For:

DEPARTMENT OF THE NAVY

REVIEW AND APPROVAL

Project Manager: _____ Date: January 8, 2010
Tim Mower, ChaduxTt

Project Manager: _____ Date: January 8, 2010
Stephen Fisher, ChaduxTt

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ACRONYMS AND ABBREVIATIONS

ARAR	Applicable or relevant and appropriate requirement
COC	Chemical of concern
DBR	Design basis report
HHRA	Human health risk assessment
HPS	Hunters Point Shipyard
IR	Installation restoration
lcy	Loose cubic yards
O&M	Operation and maintenance
PCB	Polychlorinated biphenyl
PPE	Personal protective equipment
RD	Remedial design
ROD	Record of decision
SVOC	Semivolatile organic compound
VOC	Volatile organic compound

1.0 INTRODUCTION AND BACKGROUND

The U.S. Navy is installing a soil cover and shoreline revetment at Installation Restoration (IR) Program Sites 7 and 18 in Parcel B at Hunters Point Shipyard (HPS) in San Francisco, California in accordance with the amended record of decision (ROD) for Parcel B (ChaduxTt 2009). The design basis report (DBR), also located in this binder, contains the details of the remedial design (RD). The Navy is the current owner; however, the Navy plans to transfer IR Sites 7 and 18 to the City and County of San Francisco in the future.

The following sections of this preconstruction cost opinion summarize the construction costs that are anticipated for the project to this point. Every effort was taken to accurately estimate the costs associated with the project; however, some of the costs may change as specific conditions change and as new design information is obtained. These costs are intended to estimate the foreseen construction costs. There are often differences between the estimated construction costs and actual construction costs.

1.1 SITE BACKGROUND

This cost opinion addresses the remedial approach for IR Sites 7 and 18 in Parcel B at HPS in San Francisco, California. The remedial approach includes a soil cover over the site and revetment for shoreline protection and stabilization, as described in the DBR. IR Sites 7 and 18 include about 14 acres on the western side of Parcel B.

The Navy used HPS starting around 1939 for shipbuilding, repair, and maintenance. However, the Navy continued to operate carrier overhaul and ship maintenance and repair facilities through the 1960s. Other significant activities after World War II included decontamination of ships used during atomic weapons testing in the South Pacific and operation of the Naval Radiological Defense Laboratory from the late 1940s until 1969. Navy ships that participated in atomic and nuclear weapons testing were brought back to HPS for decontamination from 1946 through the 1960s. HPS was deactivated in 1974 and remained largely unused until 1976. Between 1976 and 1986, the Navy leased most of HPS to Triple A Machine Shop, Inc., a private ship repair company. The Navy resumed occupancy of HPS in 1987.

Small portions of the area that are now identified as IR Sites 7 and 18 were in existence when the property was purchased by the Navy. The Navy significantly expanded the original area during development of the shipyard to its present configuration; the majority of the land area at IR Sites 7 and 18 was created by depositing fill into the bay. The expansion of the current location of IR Sites 7 and 18 was primarily through the use of engineered fill materials that were derived by quarrying the local bedrock. Some of the fill included construction debris. Although most of the expansion of Parcel B had been completed before 1946, much of the land area of IR Sites 7 and 18 was created during the 1950s and 1960s.

1.2 NATURE AND EXTENT OF CONTAMINATION

Results of the previous investigations indicated IR Sites 7 and 18 pose a potential risk to human health and the environment based on current and reasonably anticipated future land and groundwater uses. The human health risk assessment (HHRA) identified the following chemicals of concern (COC) in soil as posing risk to human health: metals, volatile organic compounds (VOC), semivolatile organic compounds (SVOC), pesticides, polychlorinated biphenyls (PCB), and radionuclides. The HHRA did not identify risks to human health from exposure to groundwater at IR Sites 7 and 18.

1.3 DESIGN COMPONENTS

A soil cover of clean imported soil is the selected remedy to prevent contact with COCs that may be present on the landward portion of the site. These chemicals may include metals, organic chemicals, and radionuclides. The cover components vary over the site as follows:

- The final cover for the potentially radiologically impacted area at IR Sites 7 and 18 will consist of a minimum 3-foot cover layer of clean imported soil. A demarcation layer will be positioned within the cover; a minimum of 1 foot of clean soil placed below the demarcation layer and a minimum of 2 feet of clean soil will be placed above it.
- The final cover for the non-radiologically impacted area at IR Sites 7 and 18 will consist of a minimum 2-foot cover layer of clean imported soil.

COCs have been identified along the shoreline of the site and extend to the offshore property boundary with Parcel F. COCs along this portion of the property are being addressed through construction of a shoreline riprap revetment to stabilize the shoreline and contain the contaminants in soil and sediment along the shoreline.

For greater detail on the remedial design, refer to the DBR and associated materials that accompany this cost opinion.

2.0 COST OPINION SUMMARY

The following sections and Tables 1 and 2 summarize the cost estimate for the capital costs associated with the construction of the designed remedy for the site. These costs do not include long-term operation and maintenance (O&M) for the remedy.

Costs were derived primarily from vendor quotes and RSMeans (RSMeans 2009). Profit margins and multipliers were assumed for the project based on industry averages for similar projects. A standard union labor rate was assumed and the costs assume national averages.

The estimated costs are summarized as follows:

Site-Wide Costs: **$585,366**

Revetment Costs: **$2,216,539**

Soil Cover Costs: **$2,504,189**

Other Costs: **$28,711**

Subtotal Costs: **$5,334,805**

20% Contingency: **$1,066,961**

Total Estimated Construction Costs: **$6,401,766**

This estimate includes a 20 percent contingency to account for unforeseen factors that could arise during construction, including contingencies for issues relating to construction (assumed 15 percent) and changes in project scope (assumed 5 percent).

2.1 COST OPINION ASSUMPTIONS

The following sections summarize the assumptions that went into the design and the cost assessment for the proposed site remedy. The sections are ordered generally to correspond with the cost assessment table (Table 2) that follows the assumptions.

Project Support Staffing

- It is assumed that staffing for the project will come from local labor and travel and per diem will not be incurred.
- Staffing is based on current estimated hourly rates and staffing support needs for similar projects at the HPS.

Temporary Facilities

- Items are based primarily on the need for a field office for staff and storage trailers for material.
- It is assumed that most major temporary facilities will come from off site.
- It is assumed that minor facilities for water, decontamination, and trash disposal exist and will be available for the project. Additionally, it is assumed that materials staging can occur on Navy property off of IR Sites 7 and 18.
- It is assumed that the radiological screening system and equipment currently used on site will be available for the duration of the construction and will be adequate for the needs of the project.

Mobilization and Demobilization

- Mobilization costs for equipment have assumed that the equipment is locally available.

Site Security

- The current security fence at the site will obstruct construction, especially in the vicinity of the site boundaries and the shoreline. The fence will need to be replaced by a temporary fence.
- A temporary fence will be constructed to provide sufficient access along the site boundaries. The temporary fence will not extend along the shoreline where unobstructed access is needed from the landward portion of the site.
- Signs are assumed to be placed at strategic locations along the boundary warning of construction and health and safety hazards associated with trespassing. Twenty-four signs of 2 square feet have been assumed to be adequate.

2.2 REVETMENT COSTS ASSUMPTIONS

Shoreline Preparation

- The majority of the shoreline is devoid of vegetation. It has been assumed as a conservative measure that 1 acre will need clearing and grubbing.
- The current armoring material (primarily of loose boulders and concrete debris) will need to be removed from the shoreline before construction of the revetment. In all, 1,000 square yards of material to be removed has been assumed along the ground surface.
- A temporary route may be needed to provide access to the shoreline for the construction equipment. This construction would include grading and use of gravel or other materials as a base course.

Materials

- Materials costs of most major items for both the revetment and the soil cover are based on initial correspondence with local vendors.

Construction

The construction of the revetment will occur above the mean low water level; therefore, dewatering the work area will not be necessary, and construction can occur from shore. The existing armoring material consisting of loose boulders and concrete will need to be removed before construction begins.

It is assumed that construction of the revetment will occur in fully completed sections, progressing along the shoreline and depending on the tidal cycles. Three months is estimated necessary for the revetment construction and all work performed using modified Level D PPE. As such, a section of the shoreline will be excavated and graded to the extent of the toe and then the layers of geofabric, gravel, and revetment armoring rock would be placed before construction of the next section begins. The size or width of the sections will depend on the tidal cycle and the site-specific experience gained during the construction.

All excavated material will be screened for radiological contamination. Excavated soil, sediment, existing riprap, and debris that are not radiologically impacted will be placed on the landward portion of the site and will be encapsulated by the soil cover.

Some portions of the shoreline are steeper than the 1V:4H prescribed slope and will require filling to achieve that slope. Based on the length of time necessary for screening the excavated material, it is assumed to be more cost effective to use imported fill under the revetment.

- "On-site transport of excavated material" line item accounts for delivery of revetment excavated material to the screening area and a return trip with the material that has been screened and determined not to be radiologically impacted.
- "Excavate and load fill from stockpile" and "Transport fill and dump along revetment" line items are loading and delivering imported and stockpiled fill to be used along the shoreline for the revetment.
- It has been assumed that compaction of the filled portions of the shoreline will be necessary and that using standard compaction equipment will be sufficient.
- The geofabric will be laid with 2 feet of overlap between sections. This overlap is based on correspondence with manufacturers.
- The crushed stone filter layer will be 6 inches thick minimum and will be spread and graded uniformly along the shoreline under what will be the extent of the revetment. This thickness is based on correspondence with geofabric manufacturers.
- It is assumed that the riprap can be dumped in place and spread or placed where necessary using excavation equipment.
- Seventy percent of rock armoring material originally along the shoreline will be used as supplemental material along the revetment, potentially along the toe or the ends of the structure.
- Erosion controls using hay bales and silt fencing have been assumed to be necessary at various locations along the shoreline during the project. Silt curtains should be provided off shore of the proposed revetment throughout the excavation and revetment construction period.
- Dust control watering trucks have been assumed to be necessary throughout the day to suppress dust along traffic areas and construction areas.

Waste Hauling and Disposal

- It is assumed that 10 percent of the soil and sediment excavated along the shoreline will be determined during screening to be radiologically impacted and disposed of off site at a low level radioactive waste facility. Loads are assumed to be 15 to 20 loose cubic yards (lcy) in volume.
- It is assumed that 30 percent of the debris material along the shoreline consists of concrete, metal, and other debris (not boulders) some of which cannot be screened and would need to be disposed of as radiologically impacted material. Loads are assumed to be 15 to 20 lcy.
- Disposal transport costs are based on 800- to 1,000-mile travel distance.
- Disposal costs are not site specific and are based on industry-wide average values. Actual historical costs for other Hunters Points Shipyard projects may be more appropriate but were not available.
- Chemical characterization has been performed previously throughout the site and will not be repeated.

2.3 SOIL COVER COST ASSUMPTIONS

Site and Foundation Preparation

- Clearing and grubbing and debris removal are assumed to have occurred during the site screening before construction. Some clearing and grubbing of Navy property outside of the site boundary may be necessary to provide access and storage.
- The site boundaries will need to be graded to ensure that the extents of the cover remain within the current Navy property while maintaining the 2 feet and 3 feet cover elevations because of the location of the site boundary in relation to the extents of contamination. This excavated material will be screened at the radiological screening area before it is placed on the site.
- Some grading over the site after the site radionuclide screening will be necessary to achieve a level slope before the excavated material and the soil cover are placed.
- The soil cover will slope to meet the existing grade off site and retaining walls will not be necessary.

Materials

- Materials cost for the imported fill are based on preliminary correspondence with local vendors and includes transportation.

Construction

Construction of the soil cover is assumed to occur in 6-inch lifts until the prescribed elevations are achieved. Three months is estimated necessary for the cover construction and all work performed using modified Level D PPE. All excavated material from within the potential radionuclide impacted areas will be screened for radiological contamination. Compaction will occur based on vegetative needs and the prevention of settling and erosion because infiltration of water through the cover is not a concern.

- Borrowed fill, not radiologically impacted, from the revetment will be placed along the nearshore area of the cover portion of the project.
- Imported clean fill will be placed in 6-inch lifts to the prescribed elevation with consideration given to drainage control or water coming onto the site.
- Final fine grading will be needed before planting and seeding.
- Soil density testing using nuclear method ASTM International D2922-05 will be conducted during the project.
- The demarcation fabric will be placed with 1 foot of overlap between the sections.
- Dust control watering is assumed to be necessary throughout the day in the work areas.
- Laying of utility tape as part of the demarcation layer in a 10-foot grid.
- Based on correspondence with vendors, seeding of the cover should take hold without need for excessive amendments or topsoil. Ten applications of watering are assumed necessary to support the grasses.

Waste Hauling and Disposal

- Ten percent if the excavated soil for the preparation of the boundaries is assumed to be radiologically impacted and will be disposed of off site.
- Other considerations for transport and disposal of the contaminated soil from the cover assume the same costs as were used for the revetment wastes. These costs are not based on historical costs for other similar projects at HPS.
- Chemical characterization has been performed previously throughout the site and will not be repeated.

3.0 REFERENCES

ChaduxTt. 2009. "Final Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California." January 26.

Correspondence with appropriate vendors and contractors as listed in the cost tables.

RSMeans CostWorks Construction Cost Estimator Package. 2009. Available through: http://www.meanscostworks.com/. (Information supplemented with RSMeans, 2008 "Environmental Remediation Cost Data – Unit Price.")

TABLES

TABLE 1: CONSTRUCTION QUANTITIES

Preconstruction Cost Opinion, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Design Element	Description	Quantity	Unit	Assumptions/Comments
Clearing and Grubbing				
Cover portion	Removal of vegetation	1.5	ac	10% of cover area
Revetment portion	Removal of vegetation	1	ac	Minimal vegetation
Green waste	Off-site disposal	50	cy	Contingency disposal
Surface Debris Removal				
Cover portion	Removal of misc. objects - concrete, trash, etc.	0	ac	Assumed cleared during site screening
Revetment portion	Removal of misc. objects - concrete, trash, etc.	1.5	ac	Area of rock and concrete shoreline armoring
Stockpile	Debris to be reused	1050	cy	Assume 0.5 ft average thickness
Disposal	Off-site disposal	450	cy	30% of total volume disposed - remainder reused
Cover Foundation Grading				
Total Boundary Slope	Slope preparation along boundary	430	cy	Boundary side slope 1V:3H
Disposal	Off-site disposal	40	cy	Assume 10% of volume contaminated - remainder reused
Fill	Slope preparation along boundary	0	cy	Not anticipated
Revetment Foundation Grading				
Cut	Total volume excavated to meet required grade	3600	cy	Debris removed
Fill	Volume needed to meet required grade	1261	cy	Imported 1.3 bulking factor
Grading	Grading area along shore	860	sy	Shoreline length by revetment length
Off-site disposal	Contaminated soil/sediment - off site disposal	360	cy	Assume 10% of volume contaminated - remainder reused
Cover Material				
Imported fill	Rad-impacted area	71,500	cy	1.3 bulking factor
Imported fill	Non-rad impacted area	14,560	cy	1.3 bulking factor
Demarcation fabric	Over the rad-impacted area only	60,000	sy	1 ft overlap and 6 ft for anchoring
Vegetation	Cast seeded and prep	16	ac	Entire site with 10% additional for other improvement
Borrowed fill	From revetment and boundary grading	3,630	cy	Placed under cover
Compaction	Borrowed fill	2.25	ac	Assumes 0.5 ft average thickness distributed near shoreline
Compaction	Over entire site 6-inch lifts	15	ac	To meet general landscaping criteria
Revetment Material				
Revetment riprap	Armoring material	13,500	t	1/4 ton riprap
Revetment riprap	Volume of armoring material	9,000	cy	Volume of material including pore space
Drainage gravel	Underlayer for drainage and protection of fabric	2,250	t	less than 3/4 inch crushed rock
Drainage gravel	Underlayer for drainage and protection of fabric	1,500	cy	Volume of material including pore space
Geotextile	Underlayer supporting fabric	10,250	sq yd	2 ft over lap and 10 ft needed for anchoring into revetment
Site Drainage				
Composite turf	Erosion protection of drainage swales	25,000	sq ft	5 ft width along drainage path
Site Security				
Signs - cover	Security and warning	20	ea	Spaced along property boundary
Signs - revetment	Security and warning	10	ea	Spaced along shoreline
Existing fence	Move/remove existing fence	2,500	lf	Surrounds site
Temporary fence	Security off-property boundary	2,500	lf	No fence along shoreline
Permanent fence	Exterior facing boundaries	1,200	lf	Along NW and SW property boundary only
Monitoring Well Modification				
2-inch monitoring wells	3 to 4-foot extension to meet cover grade	6	ea	Extensions needed to meet final grade
4-inch monitoring wells	3 to 4-foot extension to meet cover grade	14	ea	Extensions needed to meet final grade
Bollards	Removal	5	ea	Removal

Notes:

ac	Acre	sq ft	Square feet
cy	Cubic yard	sq yd	Square yard
ea	Each	t	Tons
lf	Linear feet		

TABLE 2: CONSTRUCTION BUDGETARY COST OPINION

Preconstruction Cost Opinion, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

	Description			Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (Including O&P)	Unloaded Equipment Unit Cost	Total Equipment (Including profit)	Unloaded Material Unit Cost	Total Material (Including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (Including profit)	Total Unit Cost (Including O&P)	Total Cost (Including O&P)	Comments
										Site Wide Costs						
	Project Support Staffing[1]															
1	Project Manager		50% on project	540	hr	$ 50.00	$ 48,600.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 90.00	$ 48,600.00	Part time on and off site
1	Site Superintendent		100% on project	1080	hr	$ 40.00	$ 77,760.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 72.00	$ 77,760.00	Full time on site
2	Engineer		100% on project	1080	hr	$ 32.00	$ 62,208.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 58.00	$ 62,208.00	Full time on site, report preparation, sampling, documentation
1	Health & Safety Officer		100% on project	1080	hr	$ 37.00	$ 71,928.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 67.00	$ 71,928.00	Full time on site. H&S Coordination
1	Rad Safety Officer		100% on project	1080	hr	$ 40.00	$ 77,760.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 72.00	$ 77,760.00	Full time on site.
1	Quality Control Officer		100% on project	1080	hr	$ 40.00	$ 77,760.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 72.00	$ 77,760.00	Full time on site. Construction oversight
1	Procurement Specialist		25% on project	270	hr	$ 35.00	$ 17,010.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 63.00	$ 17,010.00	Part time . Off-site primarily
1	Clerical		100% on project	1080	hr	$ 20.00	$ 38,880.00	$ -	$ -	$ -	$ -	$ -	$ -	$ 36.00	$ 38,880.00	Full time on and off site.
														Project Support Staffing Subtotal	**$ 471,906.00**	
	Temporary Facilities															
2	Portable Toilets			6	mo	$ -	$ -	$ -	$ -	$ 185.60	$ 2,695.00	$ -	$ -	$ 449.17	$ 2,695.00	Means 015433406410. Includes servicing
4	Vehicles for Project Staff			6	mo	$ -	$ -	$ -	$ -	$ 923.31	$ 6,094.00	$ -	$ -	$ 1,015.67	$ 6,094.00	Used while on site. Assume monthly enterprise rates for pickup trucks
1	Site Office Trailer (50 ft x 12 ft)			6	mo	$ -	$ -	$ -	$ -	$ 330.00	$ 2,409.00	$ -	$ -	$ 401.50	$ 2,409.00	Means 015213200450. Minimal furnishings no office equipment.
2	Office Equipment (computers, copier, office supplies, etc)			6	mo	$ -	$ -	$ -	$ -	$ 490.00	$ 3,564.00	$ -	$ -	$ 594.00	$ 3,564.00	Means 015213400100 and 015213400120.
2	Equipment Storage Trailers			6	mo	$ -	$ -	$ -	$ -	$ 97.50	$ 1,630.00	$ -	$ -	$ 271.67	$ 1,630.00	Means 015213201350. Secure equipment storage - tools, materials, PPE, etc.
1	Utilities (electricity and telephone)			6	mo	$ -	$ -	$ -	$ -	$ 244.20	$ 1,764.00	$ -	$ -	$ 294.00	$ 1,764.00	Means 015113800100 and 015113800360
2	Decontamination Stations			6	mo	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	Assumed to be available on site
														Temporary Facilities Subtotal	**$ 18,156.00**	
	Mobilization															
1	Office Trailer			50	mi	$ -	$ -	$ -	$ -	$ 4.50	272.25	$ -	$ -	$ 5.00	$ 272.00	Means 015213200800
2	Storage Trailer			50	mi	$ -	$ -	$ -	$ -	$ 4.50	544.5	$ -	$ -	$ 11.00	$ 545.00	Means 015213200800
1	D3 Dozer	Clearing & Fill		3	ea	$ 56.60	$ 97.30	$ 112.00	$ 369.60	$ -	$ -	$ -	$ -	$ 156.00	$ 467.00	Means 023052500020 (includes multiple). Depending on condition of site and amount of prep needed.
1	Crawler Mounted Long Arm Excavator	Shoreline Excavation		3	ea	$ 56.60	$ 97.30	$ 112.00	$ 369.60	$ -	$ -	$ -	$ -	$ 156.00	$ 467.00	Means 023052500020 (includes multiple). Excavation of the shoreline, boundary of cover, and misc other.
2	12-yd Dump Truck	Transport		6	ea	$ 56.60	$ 194.59	$ 112.00	$ 739.20	$ -	$ -	$ -	$ -	$ 156.00	$ 934.00	Means 023052500020 (includes multiple). On-site material transport - fill, riprap, excavated material. Duration of project.
1	Loader	Loading		3	ea	$ 56.60	$ 97.30	$ 112.00	$ 369.60	$ -	$ -	$ -	$ -	$ 156.00	$ 467.00	Means 023052500020 (includes multiple). Loading of riprap and imparted fill. Duration of project.
1	14 ft Blade Grader	Grading		3	ea	$ 56.60	$ 97.30	$ 112.00	$ 369.60	$ -	$ -	$ -	$ -	$ 156.00	$ 467.00	Means 023052500020 (includes multiple). Construction of cover. Cover portion of project.
1	66-in Sheepsfoot	Compaction		3	ea	$ 27.50	$ 47.27	$ 10.65	$ 35.15	$ -	$ -	$ -	$ -	$ 27.00	$ 82.00	Means 023052501100 (includes multiple). Construction of cover. Cover portion of project.
1	66-in Roller Compactor	Compaction		3	ea	$ 56.60	$ 97.30	$ 112.00	$ 369.60	$ -	$ -	$ -	$ -	$ -	$ 467.00	Means 023052500020 (includes multiple). Construction of cover. Cover portion of project.
1	2250 G Water Truck	Dust Control		3	ea	$ 56.60	$ 97.30	$ 113.00	$ 372.90	$ -	$ -	$ -	$ -	$ 157.00	$ 470.00	Means 023052500020 (includes multiple). Dust control and compaction. Duration of project.
1	Mob barge	Riprap delivery		1	ea	$ -	$ -	$ 25,000.00	$ 27,500.00	$ -	$ -	$ -	$ -	$ 27,500.00	$ 27,500.00	Quote from Dutra Group
														Mobilization Subtotal	**$ 32,138.00**	
	Demobilization															
1	Office Trailer			50	mi	$ -	$ -	$ -	$ -	$ 4.50	$ 272.25	$ -	$ -	$ 5.00	$ 272.00	Means 015213200800
2	Storage Trailer			50	mi	$ -	$ -	$ -	$ -	$ 4.50	$ 544.50	$ -	$ -	$ 11.00	$ 545.00	Means 015213200800
1	D3 Dozer			3	ea	$ 56.60	$ 97.30	$ 112.00	$ 369.60	$ -	$ -	$ -	$ -	$ 156.00	$ 467.00	Means 023052500020 (includes multiple). Depending on condition of site and amount of prep needed.
1	Crawler Mounted Long Arm Excavator			3	ea	$ 56.60	$ 97.30	$ 112.00	$ 369.60	$ -	$ -	$ -	$ -	$ 156.00	$ 467.00	Means 023052500020 (includes multiple). Excavation of the shoreline, boundary of cover, and misc other.
2	12-yd Dump Truck			6	ea	$ 56.60	$ 194.59	$ 112.00	$ 739.20	$ -	$ -	$ -	$ -	$ 156.00	$ 934.00	Means 023052500020 (includes multiple). On-site material transport - fill, riprap, excavated material. Duration of project.
1	Loader			3	ea	$ 56.60	$ 97.30	$ 112.00	$ 369.60	$ -	$ -	$ -	$ -	$ 156.00	$ 467.00	Means 023052500020 (includes multiple). Loading of riprap and imparted fill. Duration of project.
1	14 ft Blade Grader			3	ea	$ 56.60	$ 97.30	$ 112.00	$ 369.60	$ -	$ -	$ -	$ -	$ 156.00	$ 467.00	Means 023052500020 (includes multiple). Construction of cover. Cover portion of project.
1	66-in Sheepsfoot			3	ea	$ 27.50	$ 47.27	$ 10.65	$ 35.15	$ -	$ -	$ -	$ -	$ 27.00	$ 82.00	Means 023052501100 (includes multiple). Construction of cover. Cover portion of project.
1	66-in Roller Compactor			3	ea	$ 56.60	$ 97.30	$ 112.00	$ 369.60	$ -	$ -	$ -	$ -	$ -	$ 467.00	Means 023052500020 (includes multiple). Construction of cover. Cover portion of project.
1	Demob barge	Riprap delivery		1	ea	$ -	$ -	$ 25,000.00	$ 27,500.00	$ -	$ -	$ -	$ -	$ 27,500.00	$ 27,500.00	Quote from Dutra Group
1	2250 G Water Truck			3	ea	$ 56.60	$ 97.30	$ 113.00	$ 372.90	$ -	$ -	$ -	$ -	$ 157.00	$ 470.00	Means 023052500020. Dust control and compaction. Duration of project
														Demobilization Subtotal	**$ 32,138.00**	
	Site Security															
	Remove Existing Fence			2,500	ft	$ 1.77	$ 7,606.58	$ -	$ -	$ 0.64	$ 1,760.00	$ -	$ -	$ 4.00	$ 9,367.00	Means 024113601700. Current fence obstructs the work area
	Temporary Fence			2,500	ft	$ 2.40	$ 10,314.00	$ 0.62	$ 1,705.00	$ 3.16	$ 8,696.88	$ -	$ -	$ 8.00	$ 20,716.00	Means 250002 (from 2006). Temporary security fence along boundary except for along shoreline
24	Signs along Shore and Site Perimeter			2	sf ea	$ -	0	$ -	0	$ 17.90	$ 945.12	$ -	$ -	$ 473.00	$ 945.00	Means 015813500020. Warning and H&S signs. 1 sq ft each.
														Site Security Subtotal	**$ 31,028.00**	
	Total Site Wide Capital Coats													**Total Site Wide Capital Costs**	**$ 585,366.00**	

TABLE 2: CONSTRUCTION BUDGETARY COST OPINION (CONTINUED)

Preconstruction Cost Opinion, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

Description	Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (Including O&P)	Unloaded Equipment Unit Cost	Total Equipment (Including profit)	Unloaded Material Unit Cost	Total Material (Including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (Including profit)	Total Unit Cost (Including O&P)	Total Cost (Including O&P)	Comments
Revetment Costs													
Shoreline Preparation													
Clearing and Grubbing	1	ac	$ 1,400.00	$ 2,406.60	$ 3,175.00	$ 3,492.50	$ -	$ -	$ -	$ -	$ 5,899.00	$ 5,899.00	Means 311110100160. Minimal clearing anticipated
Current Armoring Removal	1000	sy	$ 28.00	$ 48,132.00	$ 10.85	$ 11,935.00	$ -	$ -	$ -	$ -	$ 60.00	$ 60,067.00	Means 022003740300. Concrete, rock, and other materials removal from shoreline
1 Temp Equipment Access Road	900	sy	$ 2.14	$ 3,310.79	$ 0.40	$ 396.00	$ 4.73	$ 4,682.70	$ -	$ -	$ 9.00	$ 8,389.00	Means 015523500050. Shoreline access considerations - stabilization
											Shoreline Preparation Subtotal	**$ 74,355.00**	
Materials													
Fill	1260	cy	$ -	$ -	$ -	$ -	$ 16.00	$ 22,176.00	$ -	$ -	$ 18.00	$ 22,176.00	Quote from Dutra Group - includes delivery. Imported fill. 1.3 bulking factor
Riprap	13,500	t	$ -	$ -	$ -	$ -	$ 52.00	$ 772,200.00	$ -	$ -	$ 57.00	$ 772,200.00	Quote from Dutra Group. 30% porosity/ 1/4 ton riprap
Geofabric	10,250	sy	$ -	$ -	$ -	$ -	$ 1.86	$ 20,971.50	$ -	$ -	$ 2.00	$ 20,972.00	Quote from Triumph Geo-Synthetics. 2 ft overlap of layers and 10 ft needed at ends for anchoring
Geofabric delivery	1	ls	$ -	$ -	$ 980.00	$ 1,078.00	$ -	$ -	$ -	$ -	$ 1,078.00	$ 1,078.00	Quote from Triumph Geo-Synthetics.
Crushed Stone Filter	2,250	t	$ -	$ -	$ -	$ -	$ 26.00	$ 64,350.00	$ -	$ -	$ 29.00	$ 64,350.00	Quote from Dutra Group. 30% porosity. Less than 3/4 inch
											Materials Subtotal	**$ 880,776.00**	
Construction													
On-shore Excavation	3600	bcy	$ 6.35	$ 39,296.34	$ 6.10	$ 24,156.00	$ -	$ -	$ -	$ -	$ 18.00	$ 63,452.00	Means 312316166035.
On-Site Transport Excavated Material to and from Screening Area	4680	lcy	$ 2.34	$ 18,825.11	$ 4.78	$ 24,607.44	$ -	$ -	$ -	$ -	$ 9.00	$ 43,433.00	Means 312323180330. Assumes round trip for delivery and staging on site.
Excavate and Load Fill from Stockpile	1261	lcy	$ 0.52	$ 1,134.12	$ 1.49	$ 2,257.78	$ -	$ -	$ -	$ -	$ 3.00	$ 3,392.00	Means 17 03 0422 (02232 0325) Includes adjustment
Transport Fill and Dump along Revetment	1261	lcy	$ 0.22	$ 472.55	$ 0.90	$ 1,254.91	$ -	$ -	$ -	$ -	$ 1.00	$ 1,727.00	Means 17 03 0422 (02234 0610) Includes adjustment
Spread Dumped Fill	1261	lcy	$ 0.88	$ 1,907.54	$ 2.14	$ 2,968.39	$ -	$ -	$ -	$ -	$ 4.00	$ 4,876.00	Means 312323170020. Assume double costs because of non-uniform location and depth.
Compaction of Dumped Fill	1261	lcy	$ 0.14	$ 307.16	$ 0.43	$ 589.66	$ -	$ -	$ -	$ -	$ 1.00	$ 897.00	Means 17 03 0422 (02239 0120) Includes adjustment
Compaction Water	1261	lcy	$ 0.33	$ 708.82	$ 0.35	$ 483.82	$ 0.37	$ -	$ -	$ -	$ 1.00	$ 1,193.00	Means 17 03 0422 (02223 1001) Includes adjustment
On-shore Grading - Dozer Rough Grade Steep Slopes	860	sy	$ 0.97	$ 1,433.99	$ 2.72	$ 2,573.12	$ -	$ -	$ -	$ -	$ 5.00	$ 4,007.00	Means 19 03 0102. Single pass.
Geofabric Application	10,250	sy	$ 0.30	$ 5,285.93	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.00	$ 5,286.00	Means 334626100110
Transport Crushed Stone and Dump along Revetment	1,500	lcy	$ 0.22	$ 562.11	$ 0.90	$ 1,492.76	$ -	$ -	$ -	$ -	$ 1.00	$ 2,055.00	Means 17 03 0422 (02234 0610) Includes adjustment
Spread Dumped Crushed Stone - no-compaction	1,500	lcy	$ 0.44	$ 1,134.54	$ 1.07	$ 1,765.50	$ -	$ -	$ -	$ -	$ 2.00	$ 2,900.00	Means 312323170020. Assume double costs because of non-uniform location and depth.
Crushed Stone Filter Grading	860	sy	$ 0.08	$ 118.27	$ 0.08	$ 75.68	$ -	$ -	$ -	$ -	$ -	$ 194.00	Means 312323170600
Riprap Dumped	9,000	lcy	$ 20.00	$ 309,420.00	$ 13.51	$ 133,749.00	$ -	$ -	$ -	$ -	$ 49.00	$ 443,169.00	Means 18 05 0204
Riprap Placement	215	sy	$ 34.50	$ 12,750.68	$ 14.85	$ 3,512.03	$ -	$ -	$ -	$ -	$ 76.00	$ 16,263.00	Means 313713100200. Assumes that some machine work will be necessary
Replacement of Original Rock onto Revetment	860	sy	$ 5.61	$ 8,293.49	$ 4.44	$ 4,200.24	$ -	$ -	$ -	$ -	$ 15.00	$ 12,494.00	Means 313713100200
Erosion Controls - Polypropylene Fence under Adverse Conditions	950	lf	$ 0.51	$ 832.86	$ -	$ -	$ 0.34	$ 355.30	$ -	$ -	$ 1.00	$ 1,188.00	Means 31251301100. Silt fencing along shoreline. Adverse conditions because of slope and removal and replacement.
Erosion Controls - Hay Bales	200	lf	$ 0.29	$ 99.70	$ 0.07	$ 15.40	$ 6.05	$ 1,331.00	$ -	$ -	$ 7.00	$ 1,446.00	Means 31251301250 Hay bales at drainage channels
Topographic Surveys	10	ea	$ 1,006.50	$ 17,301.74	$ 69.30	$ 762.30	$ 56.10	$ 617.10	$ -	$ -	$ 1,868.00	$ 18,681.00	Means 022113090020. Assumes on site 20% of work days
Dust Control	68	day	$ 254.40	$ 29,737.32	$ 102.27	$ 7,650.00	$ -	$ -	$ -	$ -	$ 550.00	$ 37,387.00	Means 015433406950/Cresco. Water, rental of truck, and operation 100% of work day.
											Construction Subtotal	**$ 664,040.00**	
Waste Hauling and Disposal													
Operation Radiological Screening System	540	hr	$ 105.00	$ 97,467.30	$ -	$ -	$ -	$ -	$ -	$ -	$ 180.00	$ 97,467.00	Means 33 18 0405. 13 Tons per hour capacity.
Haul Rad-Impacted Soil - Minimum Charge	23	ea/load	$ 735.00	$ 29,059.70	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,263.00	$ 29,060.00	Means 33 19 0209.
Haul Rad-Impacted Soil	23000	mi	$ 2.14	$ 84,609.18	$ -	$ -	$ -	$ -	$ -	$ -	$ 4.00	$ 84,609.00	Means 33 19 0213. Assumes 500 mi travel distance
Haul Rad-Impacted Debris - Minimum Charge	23	ea/load	$ 735.00	$ 29,059.70	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,263.00	$ 29,060.00	Means 33 19 0209.
Haul Rad-Impacted Debris	23000	mi	$ 2.14	$ 84,609.18	$ -	$ -	$ -	$ -	$ -	$ -	$ 4.00	$ 84,609.00	Means 33 19 0213. Assumes 500 mi travel distance.
Disposal Rad-Impacted Soil. Disposal Fee	468	lcy	$ -	$ -	$ -	$ -	$ 262.00	$ 134,877.60	$ -	$ -	$ 288.00	$ 134,878.00	Means 33 18 0901
Disposal Rad-Impacted Debris. Disposal Fee	450	lcy	$ -	$ -	$ -	$ -	$ 262.00	$ 129,690.00	$ -	$ -	$ 288.00	$ 129,690.00	Means 33 18 0901
Dry Decontamination	46	ea	$ -	$ -	$ -	$ -	$ 158.00	$ 7,994.80	$ -	$ -	$ 174.00	$ 7,995.00	Means 33 19 0311
											Waste Hauling and Disposal Subtotal	**$ 597,368.00**	
Total Revetment Capital Coats											**Total Revetment Capital Costs**	**$ 2,216,539.00**	

TABLE 2: CONSTRUCTION BUDGETARY COST OPINION (CONTINUED)

Preconstruction Cost Opinion, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California

	Description			Quantity	Unit	Unloaded Labor Unit Cost	Total Labor (including O&P)	Unloaded Equipment Unit Cost	Total Equipment (including profit)	Unloaded Material Unit Cost	Total Material (including profit)	Unloaded Assembly Unit Cost	Total Assembly Cost (including profit)	Total Unit Cost (including O&P)	Total Cost (including O&P)	Comments	
										Soil Cover Costs							
	Site and Foundation Preparation																
	Clearing and Grubbing			1.5	ac	$ 1,400.00	$ 3,609.90	$ 3,175.00	$ 5,238.75	$ -	$ -	$ -	$ -	$ 5,899.00	$ 8,849.00	Means 311110100160. Minimal clearing anticipated.	
	Excavation Boundary			430	bcy	$ 3.74	$ 2,764.50	$ 1.90	$ 898.70	$ -	$ -	$ -	$ -	$ 9.00	$ 3,663.00	Means 312316130053. Assume 1 to 4 ft depth and 3/8 cy excavator.	
	On-Site Transport to Screening Area			559	lcy	$ 2.34	$ 2,248.56	$ 4.78	$ 2,939.22	$ -	$ -	$ -	$ -	$ 9.00	$ 5,188.00	Means 312323180330. Assumes round trip for delivery and staging on site.	
	Rough Grading Over Site and Boundary, 12G Grader			14520	sy	$ 0.18	$ 4,492.78	$ 0.45	$ 7,187.40	$ -	$ -	$ -	$ -	$ 1.00	$ 11,680.00	Means 17 03 0102. Assumed necessary for 1/5 of site area.	
													Site and Foundation Preparation Subtotal		$ 29,380.00		
	Materials																
	Import Fill for 2-ft Cover Portion			14,560	lcy	$ -	$ -	$ -	$ -	$ 16.00	$ 256,256.00	$ -	$ -	$ 18.00	$ 256,256.00	Quote from the Dutra Group including delivery	
	Marking tape			85	rolls	$ -	$ -	$ -	$ -	$ 50.00	$ 4,675.00	$ -	$ -	$ 55.00	$ 4,675.00	Quote from ProLine 10 ft grids	
	Import Fill for 3-ft Cover Portion			71,500	lcy	$ -	$ -	$ -	$ -	$ 16.00	$ 1,258,400.00	$ -	$ -	$ 18.00	$ 1,258,400.00	Quote from the Dutra Group including delivery	
	Demarcation Fabric			60,000	sy	$ -	$ -	$ -	$ -	$ 0.69	$ 45,540.00	$ -	$ -	$ 1.00	$ 45,540.00	Quote from Triumph Geo-Synthetics.	
													Materials Subtotal		$ 1,564,871.00		
	Construction																
	Excavate and Load Fill from Staging Area		Soil from Shoreline	4,719	lcy	$ 0.52	$ 4,244.18	$ 1.49	$ 7,751.57	$ -	$ -	$ -	$ -	$ 2.50	$ 11,996.00	Means 17 03 0422 (02232 0325)	Includes adjustment
	Transport Fill to Cover area		Soil from Shoreline	4,719	lcy	$ 0.22	$ 1,768.41	$ 0.90	$ 4,696.21	$ -	$ -	$ -	$ -	$ 1.40	$ 6,465.00	Means 17 03 0422 (02234 0610)	Includes adjustment
	Spread Dumped Fill - No Compaction		Soil from Shoreline	4,719	lcy	$ 0.44	$ 3,569.26	$ 1.07	$ 5,554.26	$ -	$ -	$ -	$ -	$ 1.90	$ 9,124.00	Means 312323170020.	
	Excavate and Load Fill from Staging Area		Imported Fill - 6 inch lifts	86,060	lcy	$ 0.52	$ 77,400.71	$ 1.49	$ 141,364.74	$ -	$ -	$ -	$ -	$ 2.50	$ 218,765.00	Means 17 03 0422 (02232 0325)	Includes adjustment
	Transport Fill to Cover area		Imported Fill - 6 inch lifts	86,060	lcy	$ 0.22	$ 32,250.30	$ 0.90	$ 85,644.33	$ -	$ -	$ -	$ -	$ 1.40	$ 117,895.00	Means 17 03 0422 (02234 0610)	Includes adjustment
	Spread Dumped Fill		Imported Fill - 6 inch lifts	86,060	lcy	$ 0.44	$ 65,092.34	$ 1.07	$ 101,292.62	$ -	$ -	$ -	$ -	$ 1.90	$ 166,385.00	Means 312323170020.	
	Compaction Water		Imported Fill - 6 inch lifts	86,060	lcy	$ 0.33	$ 48,375.44	$ 0.35	$ 33,019.50	$ 0.37	$ 35,083.22	$ -	$ -	$ 1.40	$ 116,478.00	Means 17 03 0422 (02223 1001)	Includes adjustment
	Spread/Compact with Sheepsfoot Roller		Imported Fill - 6 inch lifts	86,060	lcy	$ 0.14	$ 20,962.69	$ 0.43	$ 40,242.52	$ -	$ -	$ -	$ -	$ 0.70	$ 61,205.00	Means 17 03 0422 (02239 0120)	Includes adjustment
	Fine Grading, 120 Grader, 2 passes			72,600	sy	$ 0.08	$ 9,983.95	$ 0.11	$ 8,784.60	$ -	$ -	$ -	$ -	$ 0.30	$ 18,769.00	Means 17 03 0107	
	Soil Density Testing, Nuclear Method ASTM D2922-71			30	ea	$ 48.03	$ 2,476.67	$ 43.60	$ 1,438.80	$ -	$ -	$ -	$ -	$ 130.50	$ 3,915.00	Means 17 03 0422 (01418 4736)	Includes adjustment
	Application of Demarcation Fabric			60,000	sy	$ 0.20	$ 20,628.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 20,628.00	Means 334626100100. Assume optimal conditions.	
	Dust Control			68	day	$ 254.40	$ 29,518.67	$ 102.27	$ 7,593.75	$ -	$ -	$ -	$ -	$ 550.00	$ 37,112.00	Means 015433406950. Rental of truck and operation 100% of work day.	
	Erosion Controls - Polypropylene Fence Normal Conditions			1500	lf	$ 0.51	$ 1,315.04	$ -	$ -	$ 0.34	$ 561.00	$ -	$ -	$ 1.00	$ 1,876.00	Means 31251301100. Silt fencing along shoreline. Adverse conditions because of removal and replacement.	
	Erosion Controls - Hay Bales			300	lf	$ 0.29	$ 149.55	$ 0.07	$ 23.10	$ 6.05	$ 1,996.50	$ -	$ -	$ 7.00	$ 2,169.00	Means 31251301250 Hay bales at drainage channels.	
	Seeding Application			77440	sy	$ 0.09	$ 11,980.74	$ 0.06	$ 5,111.04	$ 0.16	$ 13,629.44	$ -	$ -	$ 0.40	$ 30,721.00	Means 329219131100. Includes seed, lime, and fertilizer.	
	Topographic surveys			10	ea	$ 1,006.50	$ 17,301.74	$ 69.30	$ 762.30	$ 56.10	$ 617.10	$ -	$ -	$ 1,868.00	$ 18,681.00	Means 022113090020. Assumes on site 20% of work days.	
10	Watering Site (10 applications)			16	ac	$ 287.43	$ 7,905.56	$ 360.57	$ 6,346.07	$ 46.11	$ 811.48	$ -	$ -	$ 941.00	$ 15,063.00	Means 18 05 0413	
													Construction Subtotal		$ 857,247.00		
	Waste Hauling and Disposal																
	Operation Radiological Screening System			100 hrs	hr	$ 114.45	$ 19,673.96	$ -	$ -	$ -	$ -	$ -	$ -	$ 197.00	$ 19,674.00	Means 33 18 0405. 13 Tons per hour capacity.	
	Haul Rad-Impacted Soil - Minimum Charge			3	ea/load	$ 801.15	$ 4,131.53	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,377.00	$ 4,132.00	Means 33 19 0209.	
	Haul Rad-Impacted Soil			3000	mi	$ 2.33	$ 12,029.22	$ -	$ -	$ -	$ -	$ -	$ -	$ 4.00	$ 12,029.00	Means 33 19 0213. Assumes 500 mi travel distance	
	Dispose Rad-Impacted Soil - Disposal Fee			52	cy	$ -	$ -	$ -	$ -	$ 285.58	$ 16,335.18	$ -	$ -	$ 314.00	$ 16,335.00	Means 33 18 0901	
	Dry Decontamination			3	ea	$ -	$ -	$ -	$ -	$ 158.00	$ 521.40	$ -	$ -	$ 174.00	$ 521.00		
													Waste Hauling and Disposal		$ 52,691.00		
	Total Soil Cover Capital Costs												Total Soil Cover Capital Costs		$ 2,504,189.00		
										Monitoring Well Extensions							
	Well Pad and Bollard Removal and Disposal			20	ea	67.75	$ 2,329.25	$ 50.00	$ 1,100.00	$ -	$ -	$ -	$ -	$ 171.00	$ 3,429.00	Assume 1 hr per pad. 2 laborers	
	2-in Wells			6	ea	33.875	$ 349.39	$ -	$ -	$ 12.00	$ 79.20	$ -	$ -	$ 72.00	$ 429.00	Assume 3 ft per well. 2 laborers 1/2 hour per well.	
	4-in Wells			14	ea	33.875	$ 815.24	$ -	$ -	$ 15.00	$ 231.00	$ -	$ -	$ 75.00	$ 1,046.00	Assume 3 ft per well. 2 laborers 1/2 hour per well.	
	Concrete Pads (2' x 2' x 0.5')			20	ea	75.76	$ 2,604.63	$ 2.86	$ 62.92	$ 39.20	$ 862.40	$ -	$ -	$ 177.00	$ 3,530.00	Means 33 23 1504	
													Monitoring Well Extensions Subtotal		$ 8,434.00		
										Final Site Completion							
	Construction Permanent Fence			1,200	lf	$ 2.40	$ 4,950.72	$ 0.62	$ 818.40	$ 3.16	$ 4,174.50	$ -	$ -	$ 8.00	$ 9,944.00	Means 323113202100	
	Survey Monuments			3	ea	$ 200.00	$ 1,031.40	$ 13.80	$ 45.54	$ 60.00	$ 198.00	$ -	$ -	$ 425.00	$ 1,275.00	Means 022113130600 adjusted based on experience	
	Final Site Topographic Survey			16	ac	$ 305.00	$ 8,388.72	$ 21.00	$ 369.60	$ 17.00	$ 299.20	$ -	$ -	$ 566.00	$ 9,058.00	Means 022113090020	
													Final Site Completion Subtotal		$ 20,277.00		

Notes:

1 Project suppot staffing includes estimated costs for production of reports, meeting support, and other tasks associated with the construction of the remedy.

Total Construction Cost $ 5,334,805.00

Total Construction Cost with 20% Contingency $ 6,401,766.00

Project Management Percent of Total Cost **7.4%** Includes contingency

ac	Acre	ls	Lump sum
bcy	Bank cubic yards	mi	Mile
cy	Cubic yard	mo	Month
ea	Each	sf	Square feet
ft	Feet	sf ea	Square feet each
hr	Hour	sy	Square yard
lf	Linear feet	t	Tons

Profit and Overhead Assumptions

Material and equipment profit	10.0%
Labor overhead and profit multiplier	1.719
Professional labor multiplier	1.8

RESPONSE TO COMMENTS
ON
DRAFT FINAL REMEDIAL DESIGN PACKAGE

TABLE 1: RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the response to the comment received from the U.S. Environmental Protection Agency (EPA) on the "Draft Final Design Basis Report, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comment addressed below was received from EPA on July 20, 2009.

No.	Page	Comment	Response
Response to Comment from EPA (Mark Ripperda)			
GENERAL COMMENT			
1.	---	EPA has no comments on the Draft Final Remedial Design for IR 07/18.	Comment noted.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the responses to comments received from the Department of Toxic Substances Control (DTSC) on the "Draft Final Design Basis Report, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comments addressed below were received from DTSC on July 16, 2009. The Navy forwarded draft responses to DTSC on September 11, 2009 for an over-the-shoulder review. DTSC provided additional comments on October 19, 2009. Responses to these additional comments are included following the appropriate comment throughout this table. Throughout this table, *italicized* text represents additions to the document and ~~strikeout~~ text indicates locations of deletions. Also throughout this table, references to page, section, table, and figure numbers pertain to the new document unless indicated otherwise.

No.	Page	Comment	Response
Responses to Comments from DTSC (Ryan Miya)			
GENERAL COMMENT			
1.	---	Table 1 – Groundwater Monitoring Well Extension Schedule. All of the groundwater monitoring wells that currently exist on IR Sites 7 and 18 should be included in the schedule for extension.	Some monitoring wells associated with IR Sites 7 and 18 are located outside the property boundary. These wells will therefore not be extended during the construction of the cover remedy and have not been included in the Groundwater Monitoring Well Extension Schedule. These wells (IR07MW28A, IR07MW95A, IR18MW200A, and IR18MW91A) are located on the property adjacent of and northwest of IR Sites 7 and 18. The following text has been added as a note to the table: *"Some wells associated with the site are located outside of the site boundary along the northwest property boundary (IR07MW28A, IR07MW95A, IR18MW200A, and IR18MW91A). These wells will not be extended and have not been included in the schedule."* Additionally, wells that have been decommissioned from the sites have not been included on the schedule. However, the table was revised to indicate wells that are currently scheduled for decommissioning.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Ram Ramanujam, Engineering Services Unit)			
SPECIFIC COMMENTS			
1.	---	The Draft Final Design Basis Report (Report) proposes that the Construction Quality Assurance (CQA) Plan will be developed for the project after the selection of a construction contractor. The CQA Plan is an important element for the construction phase of the project and the Plan should be consistent with the requirements of California Code of Regulations (CCR) Title 22, Section 66264.19. The Plan shall be developed under the direction of a CQA officer who is a California Registered Professional Engineer (P.E.). The Plan should include an organizational chart indicating the Responsible-Charge for the project. The CQA Plan shall be submitted to the Department of Toxics and Substances Control (DTSC) for review and approval.	Comment noted.
2.	---	The Report should be a stand alone document with minimum references to the other documents.	The design basis report (DBR) has been written to be a stand alone document in regards to the technical aspects of the selected remedy itself. References to previously submitted documents have been reduced to the extent possible, and these references are found only in the background sections of the DBR. Some additional background related material has been included in the DBR – specifically, a listing of the applicable or relevant and appropriate requirements (ARAR) for soil and sediment and the cleanup goals for both soil and sediment. Refer to subsequent comments and responses for further information on additional background information added to the DBR.
3.	1	**Section 1.0**. The Report should include cleanup levels for the soils in the summary of the amended Record of Decision (ROD).	Remediation goals for soil have been added as Table 2 to the report, and cleanup goals for sediment have been included as Table 3 to the report.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Ram Ramanujam, Engineering Services Unit)			
4.	3	**Section 2.3, Geology and Surface Soils.** Please include typical cross section profiles of the subsurface materials (with Unified Soil Classification System, USCS) at the site areas (including various aquifers).	A new figure (Figure 3) was added to illustrate cross-sectional profiles of the aquifers at Parcel B. Detailed information, including USCS codes for subsurface materials, is available on the cross sections and borehole logs contained in "Technical Memorandum, Interpretation of Fill Conditions at Installation Restoration Sites 07 and 18" (Tetra Tech 2003).
5.	4	**Section 2.5.1, Soil.** The Report should include cleanup levels for the soils at the Installation Restoration (IR) sites 7 and 18. See Comment No. 4.	Please refer to the response to specific comment 3.
6.	5	**Section 2.5.4, Sediment.** "COCs in sediment along the shoreline ... in this DBR includes a revetment that will cover shoreline sediment to prevent exposure ... ." It is unclear the revetment contains the sediment (with COCs) along the shoreline (length and width of the revetment).	The text has been revised as follows: "The remedial design developed in this DBR includes a revetment that will cover *and prevent access and erosion of* shoreline sediment *along the length and width of the revetment* to prevent exposure and prevent wave action from eroding sediment and transporting it into the bay."
7.	5	**Section 2.6.** The Report should include cleanup goals for the soils at Installation Restoration (IR) sites 7 and 18. See Comment No. 6.	Please refer to the response to specific comment 3.
8.	9	**Section 3.2, Soil Cover.** Basis of Design of the Soil Cover should include at a minimum, the following: • Purpose of the Cover • Engineering design criteria • Applicable or Relevant and Appropriate Requirements (ARARs) for the project • Seismic conditions (such as liquefaction analyses) • Climate conditions with annual rainfall • Foundation conditions • Final cover slope • Cover components • Soil compaction requirements and lift thickness	• Purpose of the cover. Refer to Section 3.0 of the DBR, Basis of Design, for the purpose of the cover (and revetment). Additional details follow in subsequent sections of the report – specifically Section 3.2 and subsections for details on the soil cover. • Engineering design criteria. The engineering design criteria are developed throughout the DBR. Refer to Section 3.2, Protective Soil Cover, for information relating to the soil cover. Refer to Section 3.3, Revetment, for information relating to the revetment. • ARARs for the project. A summary table of the ARARs has been added to the DBR as Table 1. • Seismic conditions (such as liquefaction analyses). Seismic conditions are summarized in Section 3.4 of the DBR, Stability and Seismic Considerations, and the complete stability evaluation including liquefaction analysis is included as Attachment 3.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Ram Ramanujam, Engineering Services Unit)			
8. (Cont'd)	9		• Climate conditions with annual rainfall. A brief summary of the climatic conditions of the site has been added to Section 2.1, Site Description, of the DBR. More specific details of climatic conditions and how they affect the design are included in Section 3.2.4, Surface Drainage, and Section 3.3.2, Wave Dynamics. • Foundation conditions. The suitability of the existing soils as a foundation for the remedy is described in Section 3.2.1 of the DBR, Initial Site Grading. A foundation soil layer is not part of the selected remedy. • Final cover slope. The final cover slope is described in Section 3.2.2 of the DBR, Soil Cover. The final slope will vary depending on location and the existing grade. • Cover components. The cover components and thicknesses are described in Section 3.2 of the DBR, Protective Soil Cover. • Soil compaction requirement and lift thickness. Soil compaction and lift thickness are described in Section 3.2.2 of the DBR, Soil Cover, and in the Earthwork specification 31 00 00.
9.	11	**Section 3.2.3, Demarcation Layer**. "The utility marking tape will be placed in a 10-foot grid on top of the fabric." It is unclear if this requirement is included within the Construction Specification.	The spacing requirements of the utility marking tape are included in the construction drawings and in specification 31 05 22 for Geotextiles.
10.	12	**Section 3.2.4, Surface Drainage**. The Report should include surface drainage calculations satisfying the requirements of CCR Title 22, Section 66264.25(a).	Section 3.2.4 of the DBR, Surface Drainage, summarizes the surface drainage calculations for the site. The actual calculations are included as Appendices C and D to the DBR.
11.	15	**Section 3.3, Revetment**. The report should include a brief summary of the phased revetment construction.	The phased revetment construction anticipated is described in Section 3.3.10 of the DBR. The specific details of the construction will depend on the construction contractor that is selected for the project.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Ram Ramanujam, Engineering Services Unit)			
12.	15	**Section 3.3, Revetment**. "The proposed revetment would be installed along the approximate 950 feet of shoreline where IR Site 7 meets the bay." The Report should include the width of the revetment. Please see Comment No. 9.	The text has been revised as follows: "The proposed revetment would be installed along the approximate 950 feet of shoreline where IR Site 7 meets the bay *and is between 60 and 120 feet wide, depending on location along the shore*."
13.	24	**Section 3.4, Stability and Seismic Considerations**. "Site soils are predominantly sands and gravels and are not susceptible to liquefaction." The Report should include liquefaction analyses based on the MCE for the site and lateral spreading of the side slopes.	A seismic analysis, including liquefaction analysis, was completed by a California-registered geotechnical engineer based on the site-specific conditions and is included as Attachment 3 to the report. More accurate evaluation of impacts during earthquakes would require significant additional subsurface investigation. Considering the limited risks associated with the site and the ease and low associated cost of repairs, further subsurface investigation is not recommended. Following earthquake events of magnitude 6.0 or greater, a full inspection of the site will be conducted as described in the operation and maintenance (O&M) plan. The analysis was based on the maximum probable earthquake (MPE) of magnitude 7.9, which was deemed appropriate for a remedy that does not include impermeable barriers and for a site where there will be land use restrictions that will prevent construction of buildings or rigid permanent structures. This methodology is consistent with other previous work completed for similar projects at Hunters Point Shipyard (HPS).
Additional Comment on the RTC by California Department of Public Health (CDPH)			
Add'1 1	---	Navy's response to DTSC specific comments 13 and 16. The Navy's response is not consistent with the ROD regarding whether buildings will be constructed. The land use restrictions do not preclude "construction of buildings or rigid permanent structures." Please either revise the analysis accordingly, and explain how the Navy proposes to revise the land use restrictions in the ROD.	The amended ROD already includes construction of structures as a restricted activity. Refer to item (a)(2) on page 12-11 of the amended ROD. Evaluation of borehole logs for soil types that would be most subject to liquefaction concluded that few soil intervals below the water table would be subject to liquefaction and that these intervals were not continuous between borings across the site. These intervals are expected to be isolated, especially considering the heterogeneous nature of the fill observed at the site. Furthermore, the geofabric that is part of the demarcation layer will also tend to inhibit upward movement of soils that may liquefy during earthquake shaking. Neither the DBR nor the original response was changed as a result of this comment.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Ram Ramanujam, Engineering Services Unit)			
14.	---	**Figure 3**. The depth of the demarcation layer needs to be identified.	The figure has been revised and the depth of the demarcation layer from surface has been added. The corresponding figure is Figure 4 in the final DBR.
15.	---	**Attachment 2.** Armor rock and gravel layer should be included with the Construction Specifications.	The armor rock and gravel layer are included in specification 35 31 19 Coastal Protection, which includes gradation of the materials to be used in the construction of the revetment.
16.	---	**Attachment 3, Stability Evaluation Report**. • The Report should include site specific shear strength parameters (both total and effective) used for various subsurface materials in the stability analyses. • Page 2: "Using an assumed profile and assumed soil parameters to model weak clays near the toe of the slope, a static slope stability factor of safety (FS) was calculated." Slope stability analyses should be performed on the critical profile of the slope and the site specific shear strength parameters of the subsurface materials. • Seismic slope stability analyses should be based on the maximum credible earthquake (MCE). Please refer CCR Title 22, Section 66264.25(b).	Site-specific shear strength would require collection of soil samples for strength testing. Drilling, sampling, and laboratory testing would be necessary, involving time and monetary resources that were not considered justifiable for a slope evaluation of this type where no structures are proposed. The assumed strength parameters used in the analysis are considered to be a conservative representation of the materials present. The material properties were selected based on review of reference materials and professional experience. Site-specific borehole logs were reviewed, except at offshore locations and below the steeper portions of the existing slope. Collection of site-specific information off shore is not justifiable in an evaluation such as this, where no structures are proposed, where the shoreline slopes are 25 percent or less, and where grades will not be increased. Further, the assumed profile for the transition zone is conservatively drawn, and it is likely to be weaker than the actual conditions. The methodology used for the analysis is consistent with other similar projects at HPS (refer to: Tetra Tech EM Inc. 2004. "Final Parcel E Nonstandard Data Gaps Investigation, Landfill Liquefaction Potential, Hunters Point Shipyard." August 13.). The MPE (magnitude 7.9) has been selected for use in this and other analyses because it is more representative of the probable earthquake exposure. The MCE for the area would have an approximate magnitude of 8.2 and is more appropriate for projects where catastrophic loss of life could occur as a direct result of an earthquake – for instance the collapse of a building. Title 22 CCR Section 66264.25(b) is not an ARAR for this remedial action.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Additional Comments on the RTC by DTSC			
---	---	DTSC's comments were discussed in a teleconference October 14, 2009 with Ms. Lara Urizar of your staff requesting revision of the stability evaluation report (Attachment 3 in the Design Basis Report) in order to present a more detailed static and dynamic slope stability evaluation. DTSC requested additional details as follows.	Refer to the following responses.
1.	---	Various soil layers under consideration (with a figure)	The stability evaluation report was revised to add figures illustrating the soil layers.
2.	---	Geotechnical properties (with a table) of soil layers (such as total shear stress and effective stress parameters) WITH TECHNICAL JUSTIFICATION included.	The stability evaluation report was revised to add a table listing the input parameters for the soil layers. These input parameters were based on the soil present at the site observed from soil borings provided as Appendix 3A to the revised stability evaluation report. The soil property values used in the table and in the analysis were based on professional judgment and the following references, which were also included in the revised document: Bonaparte, R. and Mitchell, J.K. "The Properties of San Francisco Bay Mud at Hamilton Air Force Base, CA" Department of Civil Engineering University of California, Berkeley. April, 1979. Terzaghi, L. and Peck, R. "Soil Mechanics in Engineering Practice." 1967. The Navy forwarded the Bonaparte and Mitchell report to DTSC on December 22.
3.	---	Slope stability analysis (with sub-headings) • Long-term conditions (using effective stress parameters) • Short-term conditions (using total stress parameters) • Seismic analyses—deformation under Seed and Makdisi approach would be compared to current seismic analyses	An analysis of long-term conditions using effective stress parameters was included as Appendix 3B – "Static Stability Analysis Results." An analysis of short-term conditions using total stress parameters was included as Appendix 3C – "Dynamic Stability Analysis Results." Seismic analyses were included as Appendix 3D – "Displacement Predictions Due to Earthquake Shaking Analysis Results by 4 Methods."

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Additional Comments on the RTC by DTSC			
3. (Cont'd)	---		Seismic analysis was conducted using three Newmark analysis methods (simplified rigid block, simplified decoupled, and rigorous rigid block) as well as the Bray and Travasarou (2007) method as recommended by the City of San Francisco. The Bray and Travasarou methodology was developed more recently than the Makdisi and Seed (1978) methodology and was selected for use in this study for that reason. The additional evaluation of dynamic stability did not result in any changes to the remedial design.
4.	---	Sentence referring to liquefaction in Conclusion No. 3 of Attachment 3 (Stability Evaluation Report) will be removed and a description of the technical justification(s) upon which the liquefaction conclusions are based should be included.	The conclusions of the stability evaluation report were revised as requested. This conclusion related to liquefaction is based on review of boring logs located near the top of the existing shoreline embankment. Evaluation of borehole logs for soil types that would be most subject to liquefaction concluded that few soil intervals below the water table would be subject to liquefaction and that these intervals were not continuous between borings across the site. These intervals are expected to be isolated, especially considering the heterogeneous nature of the fill observed at the site. Furthermore, the geofabric that is part of the demarcation layer will also tend to inhibit upward movement of soils that may liquefy during earthquake shaking. Discussion of the review is contained in items 1 and 2 of "Discussion and Results" of the stability evaluation report.
Responses to Comments from DTSC (Vandana Kohli, California Department of Public Health [CDPH])			
SPECIFIC COMMENTS			
1.	---	Please note that any proposed excavations below the demarcation layer in IR 7 and 18 areas requiring institutional controls (ARICs) for radiological materials will require a work plan. The associated documents will need to be reviewed and approved by CDPH and other regulators prior to proposed excavations. Therefore, please incorporate the above information in the document wherever applicable.	Once construction of the remedy is complete, the DBR will not be used on a regular basis by the selected O&M contractor; therefore, this comment will be addressed in the O&M plan. The following text has been added to Section 2.1 of the O&M plan. *"Any repair to the soil cover and revetment must be approved by the FFA signatories (and CDPH within the ARIC for radionuclides) by submitting work plans."*

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Additional Comment on the RTC by CDPH			
Add'l 2	---	Navy's Response to Specific Comment 1 (and Navy's Response to Specific Comment 2 on the Operation and Maintenance Plan). The Navy's statement that repairs "should" be approved is not responsive to CDPH's original comment that the documents "will need to be reviewed and approved" as the word "should" does not impose a requirement. Please replace "should" with "must."	The DBR and the O&M plan and the related responses were revised as requested.
Responses to Comments from DTSC (Vandana Kohli, California Department of Public Health [CDPH])			
2.	---	Please explain how the Navy will ensure that 2 foot of soil cover is placed above the demarcation layer and one foot below it (for areas requiring institutional controls) given the topography of IR 7. Clarify if the Navy plans to confirm the thickness of the cover by comparing the fill area contours before and after the placement of the soil cover.	It should be noted that the requirements for the cover components are that the demarcation layer will be *not less* than 1 foot from the existing ground surface and the soil cover placed above the demarcation layer shall be *not less* than 2 feet. There will likely be portions of the cover where there will be more than 2 feet of clean fill above the demarcation layer. The demarcation layer will be placed during construction after a minimum of 1 foot of clean fill has been placed and compacted in 6-inch lifts and confirmed using survey data. The final cover elevation and thickness will be confirmed with survey data and comparison between the existing conditions before construction. Additional fill will be added to areas that do not meet the minimum requirements – either thickness under the demarcation layer or total thickness of the cover. A similar method for verification would be used for the areas outside the ARIC for radionuclides. The exact methodology used for verification will be selected by the construction contractor and included in quality control documents related to construction.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Vandana Kohli, California Department of Public Health [CDPH])			
3.	10	**Section 3.2.2.** Please provide verification from a horticulturist that the intended vegetation is not deep rooted and will not breach the demarcation layer.	A horticulturalist proposed the grass seeding for the project and confirmed that, given the compaction and species, the root depth of the grasses would not pose an issue for the demarcation layer. Other species or weeds that could invade the site would have the potential for deeper root depth. Specifically, any species that would outgrow the height of the predominant grasses could have a deeper than 2-foot root potential. Control of the vegetation is an O&M issue, and the following has been added to the text of the O&M plan: *"Species not included in the seed mix must be controlled to the greatest extent possible. Any species that grows to a height greater than the predominant grass species could have the potential for root depths of greater than 2 feet, which could breach the demarcation layer. Vegetation, especially tree species that grow to a height greater than the predominant grasses must be removed from the site."* The following task has been added to the inspection-related lists included in Appendix A to the report: *"Remove vegetative species that grow to heights greater than the predominant grasses."* *"The roots of any species outgrowing the predominant grasses could breach the demarcation layer and must be promptly removed."*
Additional Comment on the RTC by CDPH			
Add'l 3	---	Navy's Response to Specific Comment 3. The Navy states that "Species not included in the seed mix should be controlled…" and that "The roots of any species outgrowing the predominant grasses…should be promptly removed" are not responsive to CDPH's original comment asking for verification that the roots will not breach the demarcation layer. Please replace "should" with "must."	The DBR and the related response were revised as requested.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Vandana Kohli, California Department of Public Health [CDPH])			
4.	---	**Ref: Navy's Response to General Comment 3.** CDPH-EMB could not find plans and provisions for continual air monitoring in the Remedial Design Work Plan. If it is provided in the document please reference its location or incorporate it in the document.	The DBR is not intended to be used as a task-by-task specific work plan for the construction contractor, but rather as a description of what is required. The construction contractor will be responsible for the preparation and approval of specific remedial action work plans describing how site activities will be conducted. Plans for air monitoring and dust control will be prepared in conjunction with the other work plans necessary to implement the remedial action. These plans will be submitted by the construction contractor prior to the start of construction. The regulatory agencies, including CDPH, will have the opportunity to review and approve these plans. Air monitoring activities are described generally in the Health, Safety, and Emergency response specification 01 35 29.13.
5.	---	**Ref: Navy's Response to General Comment 4.** CDPH-EMB could not find provisions for area dosimeters for measuring ambient direct exposure levels along with the requirement that the results will be provided to CDPH. If it is provided in the document please reference its location or incorporate it in the document.	The following is included in the DBR in Section 1.13.1 of specification 01 35 29.13 Health, Safety, and Emergency Response: *"Use dosimeters to evaluate occupational exposure to radioactive isotopes and ionizing radiation fields in coordination with current standards and procedures at the facility."* The following has been added to the text of the specification: *"Provide results to the California Department of Public Health."* This requirement applies only during remedial action construction activities.
Additional Comment on the RTC by CDPH			
Add'l 4	---	Ref: Navy's Response to General Comment 5. It appears from the Navy's response that ambient direct exposure level measurements will be provided to CDPH during the remedial design phase. Please state if ongoing direct level measurements will also be made available by the transferee post transfer of the site as a part of the operation and maintenance of the cap. Please see Navy's responses to comments from CDPH on the draft Proposed Plan for Parcel B, HPS, San Francisco, California, March 25, 2008. According to the Navy's response to CDPH comment 4.4 provisions for air monitoring will be included in the RD/RA work plan and RMP [risk management plan].	Results from dosimeter measurements made during the remedial action phase will be made available to CDPH. The Navy is not recommending ongoing direct level measurements during regular operation and maintenance activities of the soil cover. The DBR was revised as indicated in the original response. The DBR was not changed as a result of the additional comment.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Vandana Kohli, California Department of Public Health [CDPH])			
6.	---	**Ref: Navy's Response to Specific Comment 11.** CDPH-EMB requests that the Navy revise the Final Remedial Design report to include their response to Specific Comment 11 in the text (provided by the Navy on May 29, 2009 Response to Comments).	Section 2.7 was revised as follows. "Plans for the open space area include recreational features such as sports fields, playgrounds, and gardens. *Land uses other than open space will be allowed in other areas of IR Sites 7 and 18 outside the ARIC for radionuclides.* Any modifications to the soil cover..."
7.	---	**Ref: Navy's Response to Specific Comment 13.** Currently, Figure 3 provides the design overview for the IR 7 and 18 areas requiring institutional controls (ARICs) for radiological materials and the areas not requiring ARICs. Based on the information provided in the figure, the potential exists for misunderstanding that 3 feet of clean soil fill will be placed above the demarcation layer for portions of IR 7 and IR 18 requiring ICs for radiological materials. Therefore, please make changes in the figure text and wherever else it is applicable to indicate that for areas requiring ICs for radiological materials, 1 foot of clean soil will be placed below the demarcation layer and 2 feet above it.	The following note was added to the figure. "*Refer to Figure 6 and Drawing C11 for details of the cover components. The cover in the potentially radiologically impacted area will include, from the top down, 2 feet of clean imported fill, a demarcation layer, and 1 foot of clean imported fill.*"
8.	---	**Ref: Navy's Response to Specific Comment 22.** CDPH-EMB could not locate Section 3.29 in the document. Therefore, please change this response to specify the correct section.	The response should have referenced Section 3.3.10, not Section 3.2.9. The text listed in the cited response is included in the last paragraph of Section 3.3.10.

TABLE 3: RESPONSES TO COMMENTS FROM THE SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the response to the comment received from the San Francisco Bay Regional Water Quality Control Board (Water Board) on the "Draft Final Design Basis Report, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comment addressed below was received from the Water Board on July 20, 2009.

No.	Page	Comment	Response
Response to Comment from Water Board			
GENERAL COMMENT			
1.	---	I have no further comments on the Draft Final Remedial Design Package for IR 7 and 18 and concur with comments submitted by DTSC on July 16, 2009.	Comment noted.

TABLE 4: RESPONSES TO COMMENTS FROM CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the responses to comments received from the City and County of San Francisco Health Department (CCSF) on the "Draft Final Design Basis Report, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comments addressed below were received from CCSF on July 15, 2009. The Navy forwarded draft responses to CCSF on September 11, 2009 for an over-the-shoulder review. CCSF provided additional comments on October 14, 2009. Responses to these additional comments are included following the appropriate comment throughout this table. Throughout this table, *italicized* text represents additions to the document and ~~strikeout~~ text indicates locations of deletions. Also throughout this table, references to page, section, table, and figure numbers pertain to the new document unless indicated otherwise.

No.	Page	Comment	Response
Responses to Comments from the City and County of San Francisco Health Department (CCSF)			
GENERAL COMMENTS			
1.	---	The City has requested that the Navy transfer IRs 7 and 18 property to SFRA after they have received concurrence from the Regulatory Agencies that the property is suitable for the intended use under a Finding of Suitability to Transfer (FOST). As written, this Remedial Design Package (RDP) (and any future close-out reports) may not contain enough information that will allow the Navy and Regulators to sign off that this property is suitable for the intended use. The restrictions for the ARIC for radionuclides, as written, will allow open space and recreation uses; however, the restrictions will not allow installation of water (which includes irrigation) or sewer lines without additional approvals. We think it is reasonable to expect that a useable park in this location at HPS would include water and sewer lines for a bathroom and some irrigation lines. The Navy needs to reference additional documents in the appropriate sections of this RDP to explain how these installations can be accomplished. The amended ROD stated that a Parcel B Risk Management Plan (RMP) for the areas outside of the ARIC for radionuclides and a specific RMP for the area within the ARIC for radionuclides "may be prepared" and "may set forth certain requirements or protocols that, if followed, will allow certain activities that are otherwise restricted to be performed without additional approval by the FFA signatories..." The City has already issued a draft Parcel B RMP and we look forward to working with the Navy to finalize that document. We will be happy to work with the Navy to draft the RMP for the ARIC for radionuclides. The Navy needs to reference both RMPs in the appropriate sections of this RDP.	The Parcel B RMP does not apply to IR Sites 7 and 18 and does not address radionuclides. As provided in the amended ROD, the City and County of San Francisco may prepare an RMP for IR Sites 7 and 18 for approval by the federal facility agreement (FFA) signatories and CDPH (for the ARIC for radionuclides). The report was not changed as a result of this comment because the status of any future RMP for IR Sites 7 and 18 is uncertain.

TABLE 4: RESPONSES TO COMMENTS FROM CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

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Additional Comment on the RTC by CCSF			
Add'l 1	---	The City has requested that the Navy transfer IRs 7 and 18 property to SFRA after they have received concurrence from the Regulatory Agencies that the property is suitable for the intended use under a Finding of Suitability to Transfer (FOST). As written, this Remedial Design Package (RDP) (and any future close-out reports) may not contain enough information that will allow the Navy and Regulators to sign off that this property is suitable for the intended use. The restrictions for the ARIC for radionuclides, as written, will allow open space and recreation uses; however, the restrictions will not allow installation of water (which includes irrigation) or sewer lines without additional approvals. We think it is reasonable to expect that a useable park in this location at HPS would include water and sewer lines for a bathroom and some irrigation lines. The Navy needs to reference additional documents in Section 1 of this RDP to explain how these installations can be accomplished. The amended ROD stated that a Parcel B Risk Management Plan (RMP) for the areas outside of the ARIC for radionuclides and a specific RMP for the area within the ARIC for radionuclides "may be prepared" and "may set forth certain requirements or protocols that, if followed, will allow certain activities that are otherwise restricted to be performed without additional approval by the FFA signatories…". The City has already issued a draft Parcel B RMP for the areas not covered by the radionuclide ARIC and we look forward to working with the Navy to finalize that document. The City anticipates working with the Navy to draft the RMP for the ARIC for radionuclides. We request that the Navy reference both RMPs at the end of Section 1 following the sentence "*Other related documents include future transfer documents, such as a Covenant to Restrict Use of Property and a Quitclaim Deed.*" please add: "Additionally, the Parcel B Risk Management Plan (RMP) for areas not covered by the radionuclide Area Requiring Institutional Controls (ARIC) will set forth certain requirements or protocols that, if followed, will allow certain activities that are otherwise restricted to be performed without additional approval by the FFA signatories. A separate RMP for the portions of IR Sites 7 and 18 covered by the radionuclide ARIC will also set forth certain requirements or protocols that, if followed, will allow certain activities that are otherwise restricted to be performed without additional approval by the FFA signatories and the California Department of Public Health (CDPH)."	The text of the DBR was expanded as requested, with additions to the suggested language shown in italics. "Additionally, *if it is prepared*, the Parcel B RMP for areas not covered by the radionuclide ARIC will set forth certain requirements or protocols that, if followed, will allow certain activities that are otherwise restricted to be performed without additional approval by the FFA signatories. A separate RMP for the portions of IR Sites 7 and 18 covered by the radionuclide ARIC, *if prepared*, will also set forth certain requirements or protocols that, if followed, will allow certain activities that are otherwise restricted to be performed without additional approval by the FFA signatories and CDPH."

TABLE 4: RESPONSES TO COMMENTS FROM CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

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2.	---	Various figures in the RDP show current fencing, temporary construction fencing and permanent post-construction fencing. Some of the current fencing shown is on adjacent non-Navy property and some of what is noted has been removed. Please coordinate with all adjacent property owners for all fencing needs. In particular, please coordinate on permanent post-construction fencing to verify whether it is required in all places as drawn.	The Navy will coordinate with all adjacent property owners before installing fencing.
New General Comment by CCSF received on October 14, 2009			
---	---	We request that the Navy construct the shoreline revetment at IR7 in such a way that a concrete boat ramp for input of small water craft can be added later.	The current revetment design will allow for a future boat ramp. Concrete (or other materials) could be placed over the rip rap of the revetment to create a ramp to the water's edge that could be used for hand-launching small water craft. However, the revetment is not designed to accommodate vehicle traffic and would not be usable for a future vehicle-launch boat ramp. The shallow water depth offshore from IR Site 7 would preclude launching boats beyond small craft such as kayaks and canoes except during high tidal stages. The report was not changed as a result of this comment.
SPECIFIC COMMENTS			
1.	---	Please include a schedule of major site construction activities and durations.	The schedule for site construction and the anticipated duration will be established by the construction contractor in the remedial action work plan.
2.	7	**Section 3.1 Site Preparation – Site Security Fencing.** Suggest including sentence indicating coordinates will be provided to contractor setting up temporary fencing to be consistent with DWG. No. 2.	The following has been included in the final report. *"Coordinates for the location of temporary security fencing have been included with the design construction drawings."*

TABLE 4: RESPONSES TO COMMENTS FROM CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

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3.	8	**Section 3.1 Site Preparation – Extension of Existing Monitoring Wells.** Suggest including sentence indicating contractor will replace wells damaged during grading activities.	The following has been included in the final report. *"Where existing groundwater monitoring wells or methane monitoring probes obstruct construction activities, the wells may be decommissioned in accordance with California regulations and replaced with newly constructed wells or probes. Wells that are designated for long-term monitoring in accordance with the remedial action monitoring plan will be replaced; however, wells that are not designated for long-term monitoring and that obstruct construction may be decommissioned. Any wells damaged during construction and that are designated for long-term monitoring will be properly decommissioned and replaced. New replacement wells will be constructed of like materials, will maintain the original screening intervals, and will be located as near to the original position as is feasible "*
4.	---	**Section 3.2.4, Figure 7.** Figure 7 shows the drainage swale cutting across a portion of the 3-foot cover area. Provide a focused cross section detail or put more detail into DWG. No. C9, Cross section B-B'. Include detail for drainage swale to verify that there will be enough structure to prevent erosion, i.e. show placement of reinforced turf mat for erosion prevention.	An additional cross section detail has been included with the construction drawings and the location of the reinforced turf mat has been included.
5.	16	**Section 3.3.1 Water Level Ranges**, states that a contingency of 3 feet has been used, but the Table 4 Response to Comments on previous City comment #3 states that the Navy is not committed to using 3 feet of sea level rise at locations other than the design crest elevation. The Navy should use the 3-foot increase in its calculations.	A 3-foot increase in the sea level has been considered in all design calculations, including the determination of the crest elevation for the revetment at IR Site 7. However, the Navy is not committed to using a 3-foot sea level rise for other projects at HPS or other bases.
Additional Comment on the RTC by CCSF			
Add'l 2	---	We acknowledge that a 3-foot increase in the sea level has been considered in all design calculations, including the determination of the crest elevation for the revetment at IR Site 7.	Comment noted.

TABLE 4: RESPONSES TO COMMENTS FROM CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

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6.	19	**Section 3.3.3, Selection of Suitable Armor Material, last sentence of last paragraph.** Suggest revising "...by definition is two layers of the median stone thick." to "is typically comprised of two layers of the selected armor stone" or please clarify.	The following change has been made to the text of the final report. *"This design and calculations found in the appendices related to the revetment were completed using a randomly placed natural riprap, which ~~by definition is two layers of the median stone thick~~ is typically composed of two layers of the selected median size armor stone."*
7.	22	**Section 3.3.7 Toe Protection, paragraph three.** The explanation of edge conditions where the revetment meets Parcel F is confusing, please clarify.	The text of the final report has been revised as follows. *"Some portions of the revetment, primarily in the central portion of the shoreline, will not reach the site boundary with Parcel F at the 1V:4H slope without excessive excavation based on the distance off shore of the property boundary. The toe will be extended in these areas at a less steep slope, similar to the existing off-shore conditions, until the site boundary is reached. This extension will reduce the amount of excavation necessary."*
8.	22	**Section 3.3.8 Filters and Underlayers.** Suggest including description of how revetment stone ties into or meets edge conditions laterally at adjacent sites.	The following explanation has been included in Section 3.3.10 of the final report. *"The lateral extents of the revetment along the existing shoreline, or where the revetment meets the adjacent sites, will be below the existing grade for the toe and the lower portions of the revetment. Sediment will fill in above the revetment over time to meet the existing grade. The crest portion of the revetment at the lateral extents will be above the existing adjacent site grade and will slope on site to meet the existing grade of the adjacent site while maintaining the 3-foot thickness. Eventually, the northeastern revetment extent will be tied into the revetment anticipated for the remainder of Parcel B."*

TABLE 4: RESPONSES TO COMMENTS FROM CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

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Additional Comment on the RTC by CCSF			
Add'l 3	---	Suggest the following edits to the response. *"The lateral extents of the revetment along the existing shoreline, or where the revetment meets the adjacent sites, will be below the existing grade for the toe and the lower portions of the revetment. Sediment will fill in above the revetment over time to meet the existing grade. The crest portion of the revetment at the lateral extents will be above the existing* ***adjacent site*** *grade and will slope on site to meet the existing grade* ***of the adjacent site*** *while maintaining the 3-foot thickness. Eventually, the northeastern revetment extent will be tied into the revetment anticipated for the remainder of Parcel B."*	The DBR and the response were revised as suggested.
Responses to Comments from CCSF			
9.	23	**Section 3.3.10 Other Design Considerations-Revetment.** Suggest adding text describing the extent of the perimeter fence ties into the new riprap at the parcel boundaries. Clarify on DWG. No. C3 and/or C5, where fence will stop, explain or include coordinate cross section A-A'.	Further clarification and coordinates have been included with the construction drawings and the following has been included in Section 3.3.10 of the final report. *"A permanent site security fence will be constructed as described in Section 3.2.6 of this DBR to prevent unauthorized access to the site from non-Navy property. The fence will extend along the northeastern property boundary to meet the mean sea level elevation, as is the current condition, and will be installed into the revetment armoring material as necessary."*
10a.	24	**Section 3.4 Stability and Seismic Considerations.** MPE stands for "Maximum Probable Earthquake" (not Probabilistic); please correct the definition.	The text has been revised as suggested.
10b.	24	As noted on the flysheet for Attachment 3, the analysis was performed by three different methods. However, the second bullet in this section mentions the result (estimated displacement of less than 10 centimeters) of only one of the methods. Please discuss briefly all three methods and their results and explain why one method's result (< 10 cm) was chosen over the others (> 40 cm).	Refer to the response to city specific comment 20 for a more detailed response concerning the methods used in the analysis. Given the limitations of data available for the study, a significant variation in the displacement results exists, which is not unusual for this type of analysis. Ten centimeters (cm) was referenced in text as the estimated displacement because the majority of calculated displacement estimates were less than 10 cm (refer to part 5 of the Discussion and Results section of Attachment 3). The text has been revised to discuss the range of results in Section 3.4 of the report.

TABLE 4: RESPONSES TO COMMENTS FROM CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

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Add'l 4	---	Please see our comment on the RTC for Comment 20 below.	Please refer to the response below.
Responses to Comments from CCSF			
10c.	24	If a higher displacement is more appropriate (e.g., > 40 cm), please revise/reword the third through sixth bullet items as needed.	Although predicted average displacements were calculated to values as high as 43.9 cm (17.3 inches), the maximum predicted displacement calculation is not the prediction of most likely displacement. The highest calculated average predicted displacement is only the high point of the range of predicted possibilities. In response to additional comments, the Navy has included additional analyses. Although some of the resulting displacement predictions are even higher than the previously computed maximum (formerly 38 cm, now 43.9 cm), most results are within the lower range of possibilities. It is the Navy's opinion that the higher magnitude displacements are unlikely. Please see the response to comment 20 below for additional information and clarification. Damages would not be anticipated because no structures will be permitted on the site (without approval of site-specific work plans). Given the shallow slopes of the cover and revetment, any minor damage could be easily repaired, even with displacements at the higher end of the range. No revisions were necessary for bullets three through six.
11a.	C1	Where is boundary line between IR 18 and IR07?	The boundary line between IR Sites 7 and 18 is not relevant to the actual construction of the cover, and the text has been removed from the drawing.
11b.	C1	New well head box internal diameter should match existing well head box internal diameter at a minimum.	Note 5 on drawing C1 was modified to include the following text. *"Construct new well head boxes; match existing well head boxes' internal diameter at a minimum."*
11c.	C1	Define screened back and black (MLLW) dashed contour lines along shoreline in legend.	The mean sea level and the mean lower low water contour lines have been added to the legend of the drawing.

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11d.	C1	Utility pole to be removed includes associated overhead line? Existing groundwater monitoring wells schedule covers part of overhead line associated with this pole.	The overhead line associated with the utility pole does not extend beyond the pole in question. The associated overhead length of line extending from the street to the utility pole will need to be removed. A note has been added to the drawing to make this information more explicit. The existing groundwater monitoring well schedule has been moved to drawing C4 along with all control points to provide more space on the drawings.
11e.	C1	Include note to protect existing utility features unless designated for removal.	All utility features within the site boundary could require future work that may involve excavation or disruption of the cover layer and as such will be removed. The following note has been added to the drawing as note 9. *"Remove all existing utility features from within site boundary. Protect existing utility feature outside the site boundary as necessary."*
11f.	C1	Include in note 3 to clear and grub existing vegetation.	The following has been included with note 3. *"Clear and grub existing vegetation"*
11g.	C1	Designate utility features (such as street lights) to be protected in place in legend.	Utility features designated for protection in place have been added to the legend of the drawing.
11h.	C1	Designate water features to be removed in legend.	Water features to be removed have been designated in the legend of the drawing.

TABLE 4: RESPONSES TO COMMENTS FROM CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

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12a.	C2	Boundary grading details A, B and D – Please clarify how storm water will flow onto adjacent sites to the Northwest and Southeast during storm events without excessive surface water ponding.	Given the proposed grading and the construction of the drainage swale along the southwest of the site, there will not be significant flow onto the property from off site. Refer to Appendix C for these calculations and information on how the grading affects the flow patterns and drainage catchments over the site. Overall water will flow from the site to existing off-site drainage features without reducing the integrity of the cover. A large drainage ditch runs along the northwest boundary that receives the majority of the current flow from the site. Based on the future flow patterns (refer to Appendix C of the DBR), this existing drainage will receive significantly less stormwater flow than currently from the site. Based on the topography of the area, there is little possibility for ponding to occur. Additionally, there is no evidence that ponding occurs now. Currently, the flow toward the east is directed to the existing drainage channel, which has been included in the revised drawings. This drainage feature currently receives stormwater originating from the surrounding area. The contractor will be responsible for maintaining the grade to prevent ponding. The following note has been added to the revised drawing C2 for the southeastern portion of the property. *"Grade area off site as necessary to prevent surface water ponding."*
12b.	C2	Should note 4 read "Grade bottom of cover portion of site…." ?	Note 4 has been revised and includes the following addition. *"Finished surface grade as shown constitutes bottom of cover."*
Additional Comments on the RTC by CCSF			
Add'l 5a	---	Boundary grading details A, B and D – Suggest showing drainage swale in sections A and B on sheet C8.	This drainage swale is located off site and the Navy does not have land survey information from that area to include the swale on drawing C2. This off-site swale will receive less runoff after the cover is constructed that it currently does. The report was not changed as a result of this comment.

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Add'l 5b	---	The previous comment refers to the first sentence of Note 4. Suggest revising first sentence of Note 4 from "Grade cover portion of site…" to "Grade sub-surface of site…"	The report has been revised as suggested.
Responses to Comments from CCSF			
12c.	C2	Legend: Shouldn't the following read – "Proposed Revetment Subgrade Contour"? Also, please clarify that control coordinates shown are for the revetment subgrade.	The legend has been revised as suggested.
12d.	C2	Note 5 – Refer to plan that details the specifications on screening for radionuclides.	The screening for radionuclides is being addressed outside of this design and construction and is, therefore, not included in the specifications for this design. Refer to the following documents for details. Tetra Tech EC, Inc. (TtEC). 2008. "Final Base-wide Radiological Work Plan Revision 2, Hunters Point Shipyard, San Francisco, California." May. TtEC. 2009. "Final Task-Specific Plan for the IR-18 Scoping Survey, Revision 1, Hunters Point Shipyard, San Francisco, California." July.
12e.	C2	Indicate that temporary fencing will extend around entire site to the shoreline.	The temporary fence along the northwestern property boundary will extend to the shoreline and has been included in the drawing as requested. The existing fence for the remainder of the site will be assessed at the time of construction for adequacy of use during construction and as permanent fencing following construction.
13a.	C3	Correct the reference in detail K. Which drawing should it refer to?	Detail K should refer to drawing C11. This text has been revised.
13b.	C3	Remove note 3 call out from revetment toe.	The callout has been removed from the toe of the revetment.
13c.	C3	Include a detail 3 sheet 11 call out for non-radiologically impacted area.	An addition detail (detail 4) has been included with the revised drawings, as requested.
Additional Comment on the RTC by CCSF			
Add'l 6	---	"Include a Detail 3 Sheet 11 call out for non-radiologically impacted area." Intention of the comment was to suggest inserting a Detail 3 Sheet 11 call out within the non-radiologically impacted area on C3 as shown for the radiologically impacted area.	The drawing has been revised as suggested.

TABLE 4: RESPONSES TO COMMENTS FROM CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

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13d.	C3	Include a note 4 call out near northeastern perimeter of cover near shoreline.	The additional callout has been included along the northeastern perimeter of the site, as requested.
13e.	C3	Top of Riprap Elevation in Revetment Control Point Table for Point D-1 – is currently 12 feet, shouldn't this be 15 feet?	This elevation has been corrected in the table of control points; the revised table of control points has been moved to drawing C4.
13f.	C3	Is it the intent to place the composite turf material on the adjacent property, Parcel A?	A small portion of the erosion control material will extend outside the site boundary. The total area that will extend off the site will be approximately 100 square yards, and it will not affect any off-site activities.
13g.	C3	Include coordinates for contractor to place composite turf.	The control points for the turf have been included in the revised drawings.
14a.	C4	Shouldn't drawing title and tables title be "Final Cover Control Points" instead of "Shoreline Revetment Control Points"?	The table heading has been revised.
14b.	C4	Refer to DWG. No. C3.	References to the appropriate sheets for the control points have been included in the revised drawings.
15a.	C5	Section A-A'; Point A-1 existing grade elevation (1.7 feet) shown in table does not match section (1.6 feet).	This section has been revised accordingly.
16a.	C8	See DWG. No. C2 comment 11a concerning storm water flow. Should details A, B, C and D be referenced on DWG. No. C3 Final Grading Plan instead of DWG. No. C2 Subgrade Plan since they show final cover sections over sub-grade?	These details relate to both the initial grading of the site as well as the final cover and are therefore pertinent to both drawings C2 and C3. They have been called out of drawing C2 because they would first become necessary during the initial grading for construction of the project.
17a.	C9	Cover Cross Section A-A' should refer to edge condition details A and C on DWG. No. C8.	This reference has been included in the revised drawings.
18a.	C10	Detail 1 – include "min." with protective cover diameter dimension.	This term has been included with the cover dimensions of all well- and probe-related details.
19a.	C11	Detail K – include the 14' dimension for drainage swale from drawing.	This dimension has been included in the revised drawings.

TABLE 4: RESPONSES TO COMMENTS FROM CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

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20.	---	**Attachment 3.** Please provide a brief narrative describing the calculations, including the input parameters (MPE, Factors of Safety, etc.), the values of those parameters, the software used, and so forth. Please also discuss the results of each of the three methods. We note that the Ambraseys and Menu equation gives a calculated value for displacement of 5.9 cm. However, a subsequent method gives a mean value of 13.1 cm, a median value of 7.1 cm, and a standard deviation of 12.9 cm; the median value is close to the earlier calculated value of 5.9, but the mean value is twice as large. Then, if one takes a closer look at the particular earthquakes listed (Imperial Valley 1979, Morgan Hill 1984, Kobe 1995, etc.) it can be seen that the calculated displacements based on those records are as high as 39.4 cm (Turkey 1999). Given the similarities between the geology at the site of the Turkey earthquake and the Bay Area, it may be appropriate to focus on that result. Thus, it is possible that the most appropriate value of estimated displacement at IR-7/18 is three times higher than the "less than 10 cm" value discussed in the text (see comment above). Please provide a comprehensive discussion of the results of these analyses in this Attachment and a rationale for selecting the displacement value applied to this site.	The italicized text in the response below has been added to Section 3.4 of the report as a narrative summary of the analysis completed. *The calculations were performed using the U.S. Department of the Interior, U. S. Geological Survey (USGS), "Java Programs for Using Newmark's Method and Simplified Decoupled Analysis to Model Slope Performance during Earthquakes (Jibson and Jibson 2003)."* *Each of the three calculation methods is a variation of Newmark's method of analysis. The methods used are (1) Simplified Rigid Block Analysis, (2) Simplified Decoupled Analysis, and (3) Rigorous Rigid Block Analysis. All three methods were used to generate results for comparison with each other.* The Java program and help files associated with USGS Open File Report 03-005 can be found at the following link: http://earthquake.usgs.gov/resources/software/slope_perf.php The Java program help files contain a thorough description of the Newmark method and describe its use in the various methods of analysis. *The input parameters selected for these Newmark analyses are site specific. The method uses actual earthquake records from other locations, but these records are mathematically altered to scale for postulated duration and acceleration that mimic the estimated peak ground acceleration and magnitude of the maximum credible earthquake at Parcel B in San Francisco. The maximum probable earthquake (MPE) used in each of the analyses is a very large 7.9 magnitude event located on the San Andreas Fault at a distance of 12 kilometers (7.5 miles) from the site. A peak ground surface acceleration of 0.5g was used based on site-specific evaluations at HPS.*

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20. (Cont'd)	---		The Newmark method of analysis does not calculate a factor of safety. In brief, the method seeks to predict realistic displacements that might occur during earthquake shaking. Simplified dynamic slope stability models (known as pseudo-static analysis), which were once commonly used, evaluate slopes under uniform acceleration of unlimited duration. Under pseudo-static analysis, permanent displacement would be considered to equal a factor of safety failure (FS < 1.0). Pseudo-static analysis does not attempt to predict slope movements, even though failure might result in only an infinitesimal displacement. Since earthquakes are of limited duration and involve oscillating accelerations, the Newmark methodology was developed as a refinement. Please refer to Open File Report 03-005 for a more complete description of the Newmark method. The first method used was a simplified rigid block analysis and the result was 5.9 cm of displacement. The second method was a simplified decoupled analysis and the result was 32.5 cm of displacement. The third method was a rigorous rigid block analysis and the results ranged from 0.3 to 43.9 cm. The third method of analysis uses selected earthquake records and is discussed in more detail in the following paragraphs. **Method 3 – Rigorous Rigid Block Analysis** Earthquakes are unique events and the earthquake records are also unique because each earthquake record is recorded at a real location. As a result, two earthquake records of the same earthquake are not the same. For example, please refer to the calculation results presented on page 5 of 7 in Attachment 3. There are 12 records of the Kobe, Japan, earthquake of 1995 collected from six stations (each station produced a north/south record and an east/west record). For the Newmark analysis that Tetra Tech performed, each record was scaled to a peak ground acceleration of 0.5g.

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20. (Cont'd)	---		All earthquake records that were selected for analysis are generated from strike-slip faults and were from sites classified as "soft." These sites were selected because the San Andreas Fault is also a strike-slip fault and site conditions at Parcel B are considered soft based on the presence of Bay Mud soils. The records which resulted from the screening include 22 records from the database of 2,160 records. The differences in each analysis result from the differences in the site-specific scaled earthquake records. For example, consider the north/south 1999 record for Kocaeli, Turkey, and the east/west record from the same site. In that example, the average displacement predicted is 6.0 cm for the north/south analysis and 37.5 cm for the east/west analysis. In the 22 analyses performed, five average displacement predictions were between values of 29.7 cm (11.7 inches) and 43.9 cm (17.3 inches). The remaining 17 analyses all predicted average displacements of less than 13.9 cm or 5.5 inches. A help screen from the program states the following: "The accompanying programs make conducting large numbers of analyses almost trivial, and so the best approach for judging the likely performance of a slope is to select a large number of earthquake records, perhaps 50-200, that have a reasonable range of properties of interest and to then interpret the range of output displacements. Experience indicates that the results tend to be log-normally distributed, with a few records yielding very high displacements forming the right-hand tail of the distribution. Thus, mean displacements are virtually always greater than median displacements, and standard deviations are fairly high."

TABLE 4: RESPONSES TO COMMENTS FROM CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Additional Comment on the RTC by CCSF			
Add'l 7	---	The displacements calculated from Method 3- Rigorous rigid block analysis have a large range (0.3 to 55.8 centimeters). This large range may be attributable to the range in magnitudes and corresponding duration of the suite of time histories used in the evaluation. It should be noted that the duration of shaking increases with an increase in the earthquake magnitude. In general, the larger calculated displacements correspond to time histories where there is significant number of cycles of acceleration values above the yield acceleration of 0.2g. In the analyses, 22 time histories were used. The moment magnitude of these time histories ranged from 5.8 to 7.4. Of the 22 records, 20 were from magnitudes 6.9 or less. The governing earthquake scenario for this site is a magnitude 7.9 occurring on the San Andreas fault. Although the consultant has selected time histories from soft sites and scaled the peak ground acceleration of the 22 time histories to the estimated peak ground acceleration of 0.5g for the design earthquake, the time histories are from smaller earthquakes that may not appropriately represent the duration and cycles of significant shaking that are associated with a large magnitude 7.9 earthquake where duration of significant shaking could be over 40 seconds and up to a few minutes on soft soil. We recommend that records from the Manjil, Denali, Landers and Chi-Chi earthquakes be used to check the displacements using method 3. The recordings from these earthquakes may not match the soil properties or fault mechanism, but are from larger earthquakes that may represent the duration and cycles of significant shaking more appropriately. Furthermore, we suggest that the consultants estimate the movements with the simplified procedure developed by Jonathan D. Bray and Thaleia Travasarou (*Journal of Geotechnical and Geoenvironmental Engineering, ASCE, V. 133(4), pp. 381-392, April 2007, copy attached).* This procedure includes the yield acceleration, magnitude of the earthquake and period of the sliding mass as well as the spectral acceleration at the degraded period and can be used to estimate the median displacement as well as other probabilities of exceedance.	The stability analysis was revised as suggested. The analysis was expanded to include time history data from the Landers earthquake. The analysis was not revised to include the Manjil or Denali earthquakes because time history data were not available. These earthquakes will be included in future stability analyses for other portions of HPS. The analysis was not revised to include the Chi-Chi earthquake because that earthquake occurred on a reverse thrust fault and the analysis included only strike-slip faults. The range of potential displacements was revised. The maximum displacement increased from 37.7 to 43.9 cm. An analysis using the method of Bray and Travasarou was added. The change in the potential range of displacements caused by an earthquake did not result in any changes to the design of the soil cover or revetment.

TABLE 5: RESPONSES TO COMMENTS FROM THE PUBLIC ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains responses to comments received from the public on the "Draft Final Design Basis Report, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comments addressed below were received as preprinted postcards from various members of the public during September and October 2009 and as a memorandum on October 19, 2009.

No.	Page	Comment	Response
Responses to comments posted on a postcard mailed from the public (28 postcards received as of November 4, 2009)			
SPECIFIC COMMENTS			
1.	---	Buck's Beach is a community asset and a rare living beach on the northern side of the Hunters Point Shipyard. Kayakers regularly visit this small sandy beach and neighbors hope it will become part of a park planned nearby.	Trespassing on Navy property is illegal and discouraged due to the potential for exposure to chemicals at the site, including along the shoreline. The Navy will not establish the reuse of this area. Please discuss redevelopment options for the area with the San Francisco Redevelopment Agency.
2.	---	Nevertheless, the Navy plans to cover Buck's Beach with rip rap – boulders and rock – as part of its cleanup of the Shipyard. This plan is bad for habitat and the environment, and would destroy Buck's Beach as we know it.	Sediment along the shoreline contains chemicals including pesticides, polychlorinated biphenyls (PCB), and metals at levels that pose an unacceptable risk to human health and aquatic life in San Francisco Bay. These risk estimates are based on risk assessment protocols required by EPA and state regulatory agencies. The Navy evaluated several options for addressing the risk to human health and the environment including a sheet pile wall, a living shoreline and breakwater, and a revetment. These alternatives were evaluated using criteria established by EPA for Superfund sites including protection of human health and the environment, compliance with laws, long- and short-term effectiveness, implementability, and cost. The Navy presented the evaluation of alternatives and its proposed plan for remediation in a document (called the Proposed Plan) which was mailed to 2,700 members of the local community in June 2008. The Navy also presented its plan for cleanup to the public at a meeting on July 8, 2008 and accepted comments from the public for a 30-day period. After considering public comments, the Navy selected the revetment (a geofabric to prevent sediment migration protected by rip rap) as the remedy for the shoreline and presented its decision to EPA and the state regulatory agencies in a record of decision (ROD). The other proposed alternatives evaluated would not prevent exposure to sediment and would not prevent the migration of contaminants from the shoreline to the bay. EPA and the State signed the ROD in January 2009 in agreement with the Navy's plan. Public comments on the proposed plan and Navy's responses are published in the ROD (ChaduxTt 2009a).

TABLE 5: RESPONSES TO COMMENTS FROM THE PUBLIC ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to comments posted on a postcard mailed from the public (28 postcards received as of November 4, 2009)			
2. (Cont'd)	---		While the revetment will change the existing habitat, in the future, sediment from offshore may wash up on the revetment and reestablish a sandy area along the shoreline.
3.	---	The Navy estimates a five-foot surf at Buck's Beach. The fact is that Buck's Beach has no surf, even at high tide during the strongest storms.	The revetment design for the shoreline considered a 3-foot (not 5-foot) significant wave height based on 100-year return period winds. The Navy uses conservative but realistic assumptions in its designs as a good engineering practice as well as to satisfy requests from the regulatory agencies to prepare designs that will remain protective even during unusually severe conditions. The 3-foot design wave correlates with other shoreline studies done at or near HPS (Woods Hole Group 2001; Moffatt and Nichol 2009).
4.	---	Facts are better than estimates. The Navy can test their estimates at low cost and without delaying the transfer of Shipyard Parcel B by: • Installing sheet piling, the least expensive cleanup remedy • Transferring Buck's Beach into Parcel F (the water's edge) • Observing the true size of the surf • Choosing a new remedy based on facts, not estimates	Superfund law has an established procedure for evaluating remedial alternatives, presenting them to the public for comment, and selecting a remedy in a ROD (as described above in the response to comment 2). This procedure includes changes to remedies as is contemplated in the comment. The Navy must follow Superfund law and meet the law's requirements. Installing a sheet pile wall and transferring the shoreline to Parcel F would only delay addressing the ongoing risks to human health and aquatic life. Short-term (even several years) monitoring of surf conditions will not affect the estimated design wave, which is based on 100-year return period winds, and would not affect the need to protect people and aquatic life from exposure to the shoreline sediment. As discussed in the response to comment 2, a revetment is the most protective, implementable, and cost-effective remedy for the shoreline at Parcel B.
Responses to Comments on the Memorandum "The Case for Bucks Beach"			
1.	---	The current remediation plan for the waterfront area known as IR-07 is to cover it entirely with rip rap. The rationale for this decision is described in the document titled "Shoreline Protection Technical Memorandum, Installation Restoration Site 7, Parcel B." The analysis in this document contains several errors. Additional study is necessary to correct this analysis. (Specific comments listed as footnote 1 in the comment memo are included in this RTC as comments 5 through 8.)	Please refer to the following responses to the specific comments. The analyses presented in the Shoreline Protection Technical Memorandum are based on accepted principles of coastal engineering (U.S. Army Corps of Engineers 1985, 1995, 2006). The Navy believes the analysis incorporates sound engineering practice. The Final Parcel B Technical Memorandum in Support of a Record of Decision Amendment (ChaduxTt 2007) also contains information supporting the rationale for selection of a revetment for protection of the shoreline at IR Site 7.

TABLE 5: RESPONSES TO COMMENTS FROM THE PUBLIC ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments on the Memorandum "The Case for Bucks Beach"			
2.	---	However, the community members who support the preservation of the sandy beach known as Buck's Beach have no desire to hold up the work on Parcel B nor in any way slow down the transfer of the parcel to the city. To achieve the twin goals of preserving the beach and maintain the current schedule for clean-up and transfer we propose the following.	Please see the following responses.
2a.	---	A. Recognize that the shoreline for this area IR-07 is not homogeneous but is in fact very irregular and that the area defined by the grid lines A', B', and C' is in fact a small cove with a naturally sandy beach. And that this area, known as Buck's Beach, should be treated differently from the remainder of the shoreline. Footnote 2: The remainder of the shoreline is mostly rip rap already and is not of particular interest to the community. Further this area (Buck's Beach) is planned to be a "naturalized shoreline" in Lennar's plan for this area, and as such rip rap is not compatible with their proposed uses.	The area described as Buck's Beach is only present adjacent to cross section A-A'. The sandy beach area does not extend to cross sections B-B' or C'C'. None of IR Site 7 is a natural shoreline. The entire shoreline of IR Site 7 was created by the Navy filling the bay with engineered fill. Sediment along the entire shoreline at IR Site 7 contains chemicals including pesticides, PCBs, and metals at levels that pose an unacceptable risk to human health and aquatic life in San Francisco Bay. The Navy will not establish the reuse of this area. Please discuss redevelopment options for the area with the San Francisco Redevelopment Agency. Construction of the revetment will not preclude use of the shoreline; in fact, the revetment was specifically designed to accommodate foot traffic.
2b.	---	B. Install the sheet pile barrier option (4.3 of tech memo) in front of Buck's Beach. The revetment option (4.1) may be used for the remainder of the IR-07 shoreline.	Installing a sheet pile wall and transferring the shoreline to Parcel F would only delay addressing the ongoing risks to human health and aquatic life. Short-term (even several years) monitoring of surf conditions will not affect the estimated design wave, which is based on 100-year return period winds, and would not affect the need to protect people and aquatic life from exposure to the shoreline sediment.
2c.	---	C. Transfer the waterside of the sheetpiles to Parcel F for further study and consideration.	Please see the response to the previous comment.

TABLE 5: RESPONSES TO COMMENTS FROM THE PUBLIC ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments on the Memorandum "The Case for Bucks Beach"			
3.	---	This plan has the following advantages over the present (all revetment) plan: I. First and foremost, it preserves the sandy beach. II. Second, it allows the work to proceed with no impact to the present schedule. III. Third, it actually will cost the Navy less to implement than the present plan (see pages 21 and 22 of the tech memo, Section 4.3.2.1). IV. It allows additional studies done under the Parcel F process to correct the errors in the present analysis.	(i) Whether erosion or sedimentation will be encouraged by installation of a sheet pile wall cannot be predicted without further study. Installing a sheet pile wall could change current patterns that would lead to erosion of the sandy beach area. (ii) Superfund law has an established procedure for evaluating remedial alternatives, presenting them to the public for comment, and selecting a remedy in a ROD (as described above in the response to comment 2 on the post card). This procedure includes changes to remedies as is contemplated in the comment. The Navy must follow Superfund law and meet the law's requirements. Consequently, the project schedule would be delayed to accommodate this change process. At least 18 months would be required to amend the ROD, based on the recently completed amendment for Parcel B. (iii) The Navy disagrees. The overall cost of a sheet pile wall plus the additional cost to remediate the shoreline (at some future time in conjunction with Parcel F) would exceed the cost of the revetment. In addition, significant additional costs will be required to further amend the ROD. (iv) Please see the response to comment 1.
4.	---	We believe this is a win-win solution as it avoids a long, protracted battle that will only delay the project that we all want to see built. It will allow the regulators to be totally comfortable with the level of protection finally achieved. And, it will save the Navy and the taxpayer some money.	The public comment period to provide feedback on the proposed amended remedy for Parcel B closed on July 28, 2008. The revetment remedy was selected by the Navy in the amended ROD and approved by the regulatory agencies in January 2009. The Navy must install the remedy to meet its requirements under Superfund law.

TABLE 5: RESPONSES TO COMMENTS FROM THE PUBLIC ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments on the Memorandum "The Case for Bucks Beach"			
5.	---	The primary reason for rejecting the living shoreline option is the analysis of projected wave action against the shore. The projected wave action would require a constructed breakwater to protect the shore from the monster waves projected. This breakwater would be difficult to construct and make this option cost prohibitive. Without the breakwater, the living shoreline option would be among the least expensive and most easily constructed options. Wave action is governed by three factors. The first being wind speed and direction. The second is by what is called "fetch" or the distance of open water that the wind blows across to develop a wave. And the third is the shape or topography of the shore itself. This analysis is flawed in its consideration of each of those elements.	Please refer to the following responses for specific information.
6.	---	(a) There exists abundant historical data for the lands near this site as regards to historical patterns of wind direction and speed. (The Port of San Francisco did a major wind analysis in conjunction with their Backlands Planning Project. The data collection points were close to Buck's Beach.) These records indicate that the predominant wind patterns are from the west and during storm activities from the west/southwest due to the cyclonic nature of storms. Further, as this area is protected by the hill of Hunters Point, the wind speeds are reduced from the levels experienced by other parts of the city. This analysis did not consider any of this local data in drawing their assumptions as to wind speed and direction. They are asserting that the maximum storm wind will be coming from the east/northeast. The only time we get any wind from that quadrant is during late summer when we may experience "Chinook" or easterly winds down slope from the Sierra. While such winds do create extreme fire hazards, for example, the Oakland fire, they are not sufficient to induce 5-foot waves at Buck's Beach. The analysis for wind speed and direction must be based on actual historical data and not hypothesis.	Wind speeds were based on data collected since 1948 from land-based meteorological stations at the San Francisco airport which is located approximately 8 miles south of Hunters Point. The airport receives unobstructed winds from the north and northeast which is similar to the wind exposure and wave generating winds applicable to Sites 7 and 18. Only winds coming from directions over the bay were considered in the design wave analysis. The larger wind velocities directed from the southwest were not used for wave analysis because existing land blocks the wind from that direction. The long data record available from the San Francisco airport allows for a more accurate projection of future wind velocities than short-term measurements made in other locations.

TABLE 5: RESPONSES TO COMMENTS FROM THE PUBLIC ON THE DRAFT FINAL DESIGN BASIS REPORT, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments on the Memorandum "The Case for Bucks Beach"			
7.	---	(b) The fetch used in their analysis is wind blowing from the north/northeast across the entire bay from Emeryville to the beach. This is the wrong direction (see [a] above) but also does not consider the protection received from Herron's Head point and from the promontory along IR-07 at the submarine pens. These geologic features protect the beach from any waves generated by that long fetch and in fact the correct fetch for wave calculation of this beach is the distance from Herron's Head point to Buck's Beach and a distance of less than a mile. Their analysis uses a hypothetical line drawn on a map and not the true indented shape of the actual landform for its calculation and is grossly in error.	Only unobstructed wave directions were considered in the design wave analysis. Herron's Head Point and the breakwater adjacent to the submarine dry docks do not shield the IR Site 7 shoreline from waves originating from the northeast.
8.	---	This analysis makes no attempt to consider the shape of the land under the surf, yet every surfer knows that this is the single most important factor in determining the size and shape of waves. It is the underwater topography that explains how monster 80-foot waves can be created at Maverick's and only one-twentieth that size a few feet further down the shore in Half Moon Bay. This despite the fact that both are subject to the same wind direction and intensity and the same fetch (essentially all the way across the Pacific Ocean). This failure to understand the underwater dynamics leads to the internal contradiction in the document where in one section (page 14, section 4.1.2.2) they have the concern that the waves will deposit material onto the shore (accrete) and in another section (several places including page 11, section 3.0) they are concerned about the waves removing material (erosion).	The Navy uses conservative but realistic assumptions in its designs as a good engineering practice as well as to satisfy requests from the regulatory agencies to prepare designs that will remain protective even during unusually severe conditions. The 3-foot design wave correlates with other shoreline studies done at or near HPS (Woods Hole Group 2001; Moffatt and Nichol 2009).

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TABLE 1: RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT FINAL REMEDIAL ACTION MONITORING PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the response to the comment received from the U.S. Environmental Protection Agency (EPA) on the "Draft Final Remedial Action Monitoring Plan, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comment addressed below was received from EPA on July 20, 2009.

No.	Page	Comment	Response
Response to Comment from EPA (Mark Ripperda)			
GENERAL COMMENT			
1.	---	EPA has no comments on the Draft Final Remedial Design for IR 07/18.	Comment noted.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL REMEDIAL ACTION MONITORING PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the responses to comments received from the Department of Toxic Substances Control (DTSC) on the "Draft Final Remedial Action Monitoring Plan, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comments addressed below were received from DTSC on July 16, 2009. The Navy forwarded draft responses to DTSC on September 11, 2009 for an over-the-shoulder review. DTSC provided additional comments on October 19, 2009. Responses to these additional comments are included following the appropriate comment throughout this table. Throughout this table, *italicized* text represents additions to the document and ~~strikeout~~ text indicates locations of deletions. Also throughout this table, references to page, section, table, and figure numbers pertain to the new document unless indicated otherwise.

No.	Page	Comment	Response
Responses to Comments from DTSC (Ryan Miya)			
GENERAL COMMENTS			
1.	---	Response to general comment 1. The Navy states that additional monitoring wells are not necessary due to the stable subsurface conditions observed since 2001 and the expectation that the groundwater flow regime will not change significantly after cover installation. However, DTSC does not concur that only two wells are adequate to provide sufficient information about groundwater along the approximately 950 feet of shoreline that exists downgradient of IR site 7. Additional groundwater monitoring wells for chemical and radiological concentrations is warranted along the shoreline.	Subsurface conditions at Installation Restoration (IR) Sites 7 and 18 have been stable since the end of remedial action excavations in 2001 (except for the methane source removal in 2008), and groundwater would have reached equilibrium conditions within months after excavation and backfilling ceased. Groundwater has been monitored at IR Sites 7 and 18 since 1999 and no significant plumes of chemicals have been detected. (Somewhat elevated concentrations of nickel in groundwater sampled from several wells were originally thought to represent a plume, but these concentrations were later shown to be derived from corrosion of the stainless steel casing in those wells and do not represent aquifer conditions.) The trigger level analysis conducted for all chemicals (metals and organic chemicals) presented in the Technical Memorandum in Support of a Record of Decision (ROD) Amendment (TMSRA) (ChaduxTt 2007) provided a highly conservative evaluation of potential effects of groundwater on aquatic life in San Francisco Bay. Trigger levels selected to evaluate potential effects correspond to the lowest available benchmarks for protection of the environment, or to Hunters Point groundwater ambient levels. Furthermore, no attenuation of chemical concentrations is assumed for wells near the shoreline even though attenuation occurs by the following processes:

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL REMEDIAL ACTION MONITORING PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Ryan Miya)			
1. (Cont'd)	---		1. As chemicals migrate through soil and groundwater, they are subjected to physical, chemical, and biological processes that tend to reduce their concentrations. These processes include sorption of chemicals to soil particles, volatilization, hydrodynamic dispersion and molecular diffusion, and chemical and biological transformation (biodegradation). 2. Additional reduction in chemical concentrations takes place in the tidal mixing zone near the shoreline. 3. Concentrations of chemicals that enter the bay with discharging groundwater will be further reduced by dilution of groundwater with the bay water at the interface of the groundwater and the bay. None of the six metals (chromium VI, copper, lead, mercury, nickel, and selenium) proposed for monitoring at IR Sites 7 and 18 exceeds its trigger level based on the most recent groundwater data (collected in March 2009). Likewise, none of these metals shows any trends that would suggest concentrations might exceed trigger levels in the future. Each of these six metals is further discussed below, including the distribution of each metal in groundwater throughout IR Sites 7 and 18 based on samples collected for the past 12 quarters through March 2009. In this discussion, the trigger level for a well near the shoreline (that is, using an attenuation factor of 1) is used for comparison and is listed following each metal in micrograms per liter (µg/L). However, actual trigger levels are specific to each individual well and depend on the distance from the shoreline. **Chromium VI (50 µg/L).** No groundwater samples collected from wells at IR Sites 7 and 18 have exceeded the trigger level for chromium VI for the past 12 quarters. Chromium VI was included in the analytical suite based on detections in other parts of Parcel B as a conservative measure.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL REMEDIAL ACTION MONITORING PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Ryan Miya)			
1. (Cont'd)	---		**Copper (28.04 µg/L).** Concentrations exceeding the trigger level for copper were observed in one sample from each of three wells during the past 12 quarters. A concentration of 32.2 µg/L was measured at well IR07MW20A1 on 8/23/06. The eight subsequent samples did not exceed the trigger level, including six non-detections. A concentration of 41.7 µg/L was measured at well IR07MW19A on 8/22/06. The two subsequent samples did not exceed the trigger level: 25 µg/L on 11/15/06 and not detected on 3/1/07. A concentration of 504 µg/L was measured at well IR07MWS-2 on 2/22/07. The seven subsequent samples did not exceed the trigger level, including five non-detections. Of the eight detected concentrations for copper at well IR07MWS-2 in the past 12 quarters, the single detection of 504 µg/L was unusually high. The other detections ranged from 1.4 to 12.4 µg/L, suggesting that the high concentration was an anomaly not representative of aquifer conditions. **Lead (14.44 µg/L).** Concentrations exceeding the trigger level for lead were observed in one sample from each of two wells during the past 12 quarters. A concentration of 15.4 µg/L was measured at well IR07MW20A1 on 7/17/08. Lead was not detected in the subsequent sample collected on 3/13/09. Concentrations of lead in the ten samples collected before July 2008 did not exceed the trigger level, including eight non-detections. A concentration of 17.5 µg/L was measured at well IR07MW26A on 10/11/07. The four subsequent samples did not exceed the trigger level, including three non-detections. **Mercury (0.6 µg/L).** No groundwater samples collected from wells at IR Sites 7 and 18 have exceeded the trigger level for mercury for the past 12 quarters. Mercury was included in the analytical suite based on detections in other parts of Parcel B as a conservative measure. **Nickel (96.48 µg/L).** No groundwater samples collected from wells at IR Sites 7 and 18 have exceeded the trigger level for nickel for the past 12 quarters. Nickel was included in the analytical suite based on past detections as a conservative measure

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL REMEDIAL ACTION MONITORING PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Ryan Miya)			
1. (Cont'd)	---		**Selenium (14.5 µg/L).** Concentrations exceeding the trigger level for selenium were observed in a total of nine samples collected from seven wells during the past 12 quarters. Concentrations exceeding the trigger level ranged from 21.3 to 52 µg/L. The samples that exceeded the trigger level were collected during two sampling events—12/05 (five samples) and 7/08 (four samples). In all cases, at least one subsequent sample (and often several samples) indicated a concentration below the trigger level. The list below describes the details of these nine samples; concentrations are in µg/L. **Well / Concentration / Date / Subsequent Samples** IR07MW19A / 26.2 / 12/15/05 / 5, all ND IR07MW20A1 / 42.9 / 7/17/08 / 3.5 µg/L on 3/13/09 IR07MW20A1 / 27.1 / 12/15/05 / 6, all ND, until 7/08 IR07MW24A / 52 / 7/17/08 / ND on 3/12/09; 7 previous ND IR07MW25A / 24.5 / 7/17/08 / ND on 3/12/09; 7 previous ND IR07MW26A / 46.9 / 7/17/08 / ND on 3/12/09 IR07MW26A / 21.3 / 12/15/05 / 8, all ND, until 7/08 IR07MWS-2 / 25.8 / 12/19/05 / 10, including 6 ND IR07MWS-4 / 22.6 / 12/19/05 / 11, including 9 ND ND – Not detected Detections for selenium were isolated and infrequent within the past 12 quarters of monitoring. No samples collected during the most recent sampling event (March 2009) exceeded the trigger level. No samples indicated any trend that would suggest concentrations might exceed trigger levels in the future.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL REMEDIAL ACTION MONITORING PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Ryan Miya)			
1. (Cont'd)	---		The soil cover at IR Sites 7 and 18 is not designed to limit infiltration and, therefore, is not expected to cause any changes to the groundwater flow regime in the area. Changes that may occur post-redevelopment cannot be predicted in advance. Additional monitoring locations to address potential post-redevelopment changes in groundwater flow cannot be identified until the nature of any changes and their significance to potential chemical migration have been assessed. Continued measurement of groundwater elevations and construction of potentiometric surface elevation maps are the preferred method to identify changes in the pattern of groundwater flow. Additional monitoring locations can be identified as part of the dynamic monitoring process and new wells added at that time if changes in the flow pattern are identified in the future and it is concluded that the two guard wells currently proposed are not located appropriately or that additional wells are needed to ensure the protectiveness of the remedy. Evaluation of the current condition of groundwater at IR Site 7 does not indicate a risk to aquatic life in the bay. Nevertheless, the remedial action monitoring plan (RAMP) proposes monitoring in the unlikely event that groundwater conditions change post remediation. The Navy believes that wells IR07MW24A and IR07MW26A provide sufficient information about groundwater near the shoreline and that additional wells are not necessary at this time. The report was not changed as a result of this comment.
2.	---	Response to DTSC Geological Services Unit comment 9 and DTSC Engineering Services Unit comment 30. Typical cross section profiles of the site including various aquifers should be included in the Final RAMP.	A new figure (Figure 3) was added to illustrate cross-sectional profiles of the aquifers at Parcel B.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL REMEDIAL ACTION MONITORING PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Ryan Miya)			
3.	---	Response to DTSC Geological Services Unit comment 12a. Please briefly explain how the groundwater and soil gas reporting requirements are consistent with the DTSC guidance documents referenced.	The reporting requirements listed in Section 4.0 are consistent with DTSC guidance for groundwater (DTSC 1995, 2008) and soil gas (DTSC 2003, 2005a, 2005b). In general, the proposed reports will provide tables and maps summarizing the data collected and will discuss trends observed in the data. The reports will identify deviations from the approved sampling plan (that is, the RAMP) as well as damage to the monitoring systems, will provide recommendations for corrective actions, and will suggest adjustments to improve the effectiveness of the monitoring program. Section 4.0 was expanded to include additional information in the lists of report items to be consistent with DTSC guidance. DTSC will have the opportunity to review the proposed reports and could suggest further modifications in conjunction with its review.
4.	---	Section 3.3 – Methane Monitoring. DTSC recommends that the Navy conduct quarterly monitoring of the five compliance gas wells (instead of semi-annual) for the duration of two years after which time, depending on the results of the monitoring obtained, evaluation and modification of the monitoring frequency can be conducted with approval of the Federal Facility Agreement (FFA) signatories.	The five soil gas monitoring probes at IR Site 7 were installed only to confirm the effectiveness of the methane source removal and are not appropriately termed "compliance gas wells." Landfill gas monitoring requirements are not applicable or relevant and appropriate requirements (ARAR) in the amended ROD because IR Site 7 is not a municipal solid waste landfill. The removal action found that debris was confined to a layer that extended from about 2 to 8 feet below ground surface (bgs) and was above the water table, which was at about 18 feet bgs at the excavation site. Removed debris included primarily wood, brick, concrete, wire, and other materials consistent with construction or demolition debris and did not contain garbage or other wastes similar to municipal waste. Material below 8 feet bgs was predominantly clean, engineered fill without debris or staining. Methane was not detected in any probe in samples collected in December 2008. Conditions at the site do not justify more frequent monitoring and no ARAR requires more frequent monitoring. The Navy agrees that, depending on the results of monitoring, evaluation and modification of the monitoring frequency can be conducted with the approval of the FFA signatories. The report was not changed as a result of this comment.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL REMEDIAL ACTION MONITORING PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Ram Ramanujam, Engineering Services Unit)			
SPECIFIC COMMENTS			
17.	2	**Section 2.0**. Please include a few typical cross section profiles of the site including various aquifers.	A new figure (Figure 3) was added to illustrate cross-sectional profiles of the aquifers at Parcel B.
18.	2	**Section 2.0**. Please include established trigger levels for various compounds of the groundwater for protection of the beneficial use of the bay.	Table 5 provides trigger levels for the chemicals of concern at IR Sites 7 and 18. The report was not changed as a result of this comment.
19.	4	**Section 3.1**. Please include a baseline groundwater elevation contour map.	Figure 4 shows the potentiometric surface elevation of the A-aquifer in May 2009. The report was not changed as a result of this comment.
20.	5	**Section 3.2.2**. "This RAMP also includes sampling at two guard wells ... during redevelopment." The report should identify those two guard wells on a map.	Figure 5 shows the locations of the two monitoring wells selected for collection of groundwater samples. The report was not changed as a result of this comment.
21.	---	The RAMP should include a table with monitoring schedule.	Tables 2 and 3 provide the monitoring schedule for groundwater. The report was not changed as a result of this comment.
22.	---	Please include a table for the methane monitoring probes.	Table 6 lists the probes for methane monitoring. The report was not changed as a result of this comment.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL REMEDIAL ACTION MONITORING PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Vandana Kohli, California Department of Public Health [CDPH])			
SPECIFIC COMMENTS			
1.	---	**Ref: Navy's response to General Comment 1.** Please provide justification in the final document why two wells would be adequate for monitoring migration of radionuclides to the groundwater. The justification as presented is not clear in large part because data from long term monitoring of radionuclides is unavailable.	The Navy has collected groundwater samples for analysis of radionuclides from wells IR07MW24A, IR07MW25A, IR07MW26A, IR07MW27A, IR07MW93A, and IR07MWS-4 as part of supplemental data collection for the basewide groundwater monitoring program. Samples were collected in July 2008 and again in March 2009. Results from the July 2008 and March 2009 samples are presented in semiannual reports (CE2-Kleinfelder 2009a, 2009b). None of the samples collected in July 2008 or March 2009 contained concentrations of radionuclides that exceeded the remediation goals for radionuclides established in the amended ROD (ChaduxTt 2009). No detections of radionuclides were observed in any samples collected in March 2009. All detections observed in samples collected in July 2008 were less than 1 picocurie per liter (pCi/L). The following list provides a summary of maximum detected concentrations in samples collected in July 2008; all concentrations are in pCi/L. **Radionuclide** — **Maximum Concentration** — **Remediation Goal** Cesium-137 — 0.496 — 119 Plutonium-239 — 0.035 — 15 Radium-226 — Not detected — 5.0 Strontium-90 — 0.815 — 8.0 The Navy believes that the two selected wells are sufficient to monitor for potential radionuclides in groundwater at IR Sites 7 and 18. Please also see the response to DTSC (Miya) general comment 1. The report was not changed as a result of this comment.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL REMEDIAL ACTION MONITORING PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Additional Comment on the RTC by CDPH			
Add'l 1	---	Ref: Navy's response to General Comment 1. Please provide semiannual reports (CE2-Kleinfelder 2009a, 2009b) for CDPH perusal. CDPH is still not convinced that two wells will be adequate in monitoring migration of radionuclides to the bay. Location of the groundwater monitoring wells with respect to the groundwater flow direction from radiological contamination to the bay is an important factor in determination of whether radionuclides in the groundwater will be detected by the monitoring system. For that reason, please provide Navy's rationale for location and number of the groundwater monitoring wells for sufficient characterization of the nature, extent, and potential rate of migration of radionuclides especially from fill areas with nonhomogeneous distribution of radiological materials.	The Navy will forward the most recent semiannual report (dated July 2009). Reports are also available online at www.ce2corporation.com/hp_portal Groundwater flow is toward the bay. Wells IR07MW24A and IR07MW26A are centrally positioned to intercept flow. Wells located more northwest or southeast of them would primarily monitor groundwater from off site moving on to IR Sites 7 and 18. Samples were collected for radionuclides in July 2008 and March 2009. No detections were observed in the samples collected in March 2009. All detections observed in the samples collected in July 2008 were less than remediation goals. Refer to the above response for details on the concentrations. Continued measurement of groundwater elevations and construction of potentiometric surface elevation maps are the preferred method to identify changes in the pattern of groundwater flow. Additional monitoring locations can be identified as part of the dynamic monitoring process and new wells added at that time if changes in the flow pattern are identified in the future and it is concluded that the two wells currently proposed are not located appropriately or that additional wells are needed to ensure the protectiveness of the remedy.
Responses to Comments from DTSC (Vandana Kohli, California Department of Public Health [CDPH])			
2.	---	Based on the Navy's response to CDPH's comments related to the trigger levels for radionuclides, it appears that no trigger levels are associated with any of the radionuclides. Therefore, please explain and incorporate the actions which would be taken in case the concentrations of the radionuclides in the ground water exceed the associated remedial goals.	Considering the concentrations of radionuclides observed in groundwater (see previous response), it appears unlikely that future concentrations of radionuclides in groundwater would exceed remediation goals. However, Section 3.2.3 was revised to more clearly describe the activities the Navy will undertake if a comparison benchmark (including trigger levels for metals or remediation goals for radionuclides) is exceeded. These activities are contained in the bulleted list in this section.. The Navy believes it is unlikely that future concentrations of radionuclides in groundwater will exceed remediation goals.
Additional Comment on the RTC by CDPH			
Add'l 2	---	Ref: Specific Comment 2. Please remove "highly" from the Navy's response. "Considering the concentrations of radionuclides observed in groundwater, it appears highly unlikely that future concentrations of radionuclides in groundwater would exceed remediation goals."	The response was revised as requested.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL REMEDIAL ACTION MONITORING PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Vandana Kohli, California Department of Public Health [CDPH])			
3.	---	Based on the Navy's response it appears there are no restriction requirements for infiltration of surface water through the demarcation layer. However, this is contrary to what CDPH-EMB was made to believe in the past. Therefore, please explain why it is not necessary to have this as a characteristic for the currently proposed demarcation layer.	Both the draft and draft final remedial designs indicated that the demarcation layer would be permeable to water. Future leaching of radionuclides into groundwater is not considered likely because the fill has been in place at IR Sites 7 and 18 and has been subject to leaching for more than 40 years, and the lack of detections of radionuclides observed in groundwater in samples collected in 2008 and 2009 indicates that leaching has not been occurring historically. Results from on-going monitoring of groundwater also will be available to identify future concentrations of radionuclides in groundwater. Also refer to the response to CDPH specific comment 1. The report was not changed as a result of this comment.
4.	---	**Ref: Navy's response to Specific Comment 1**. Please revise the RTC paragraph by incorporating the Navy's technical justification for the following statement, "the breach of the soil cover will not effect the migration of radionuclides in groundwater."	The soil cover is not designed to limit infiltration of water because leaching of radionuclides to groundwater is not a concern (refer to the response to the previous comment). Because infiltration and leaching are not of concern, enhanced infiltration (such as might occur through a breach in the cover) is similarly not of concern. The report was not changed as a result of this comment.
5.	---	**Ref: Navy's response to Specific Comment 2**. If the results from July 2008 samples collected for monitoring radionuclides in groundwater have been presented in a separate report, then please reference the report and if the results have not been presented, then please provide these under a separate cover for CDPH review.	Results from the July 2008 and March 2009 samples are presented in semiannual reports (CE2-Kleinfelder 2009a, 2009b). The report was not changed as a result of this comment.
6.	---	**Ref: Navy's response to Specific Comment 3**. As per the Navy's response, "The Navy has collected groundwater samples for analysis of radionuclides from wells IR07MW24A, IR07MW25A, IR07MW26A, IR07MW27A, IR07MW93A, and IR07MWS-4...." Based on the information provided in the current document, only two wells have been selected for monitoring radionuclides in groundwater. Therefore, please confirm if the Navy has collected groundwater samples from six wells as stated above.	The Navy has collected groundwater samples for analysis of radionuclides from wells IR07MW24A, IR07MW25A, IR07MW26A, IR07MW27A, IR07MW93A, and IR07MWS-4 as part of supplemental data collection for the basewide groundwater monitoring program. Samples were collected in July 2008 and again in March 2009. Results from the July 2008 and March 2009 samples are presented in semiannual reports (CE2-Kleinfelder 2009a, 2009b). The report was not changed as a result of this comment.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL REMEDIAL ACTION MONITORING PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Vandana Kohli, California Department of Public Health [CDPH])			
7.	---	**Ref: Navy's response to Specific Comment 4**. According to the Navy's response, the trigger levels were not evaluated for the radionuclides and remedial goals for radionuclides will be used for comparison purposes. Please explain the Navy's plan of action in case the radionuclide concentrations exceed the remedial goals.	Please refer to the response to CDPH specific comment 2.
8.	---	**Ref: Navy's response to Specific Comment 9**. Please note that CDPH's comment was in reference to radionuclides. Therefore, please confirm that the Navy's response relates to radionuclides, and if it does not, please revise the response accordingly.	The Navy's response relates to radionuclides. The report was not changed as a result of this comment.
9.	---	**Ref: Navy's response to Comment 11**. Page 6, Section 4.0. Please provide the actions that will be taken in case the remediation goals for radionuclides in groundwater are exceeded.	Section 3.2.3 was revised to more clearly describe the activities the Navy will undertake if a comparison benchmark (such as a trigger level for metals or a remediation goal for radionuclides), is exceeded. The text was revised to clarify that the activities apply to trigger levels for metals as well as to remediation goals for radionuclides.

TABLE 3: RESPONSES TO COMMENTS FROM THE SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD ON THE DRAFT FINAL REMEDIAL ACTION MONITORING PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the response to the comment received from the San Francisco Bay Regional Water Quality Control Board (Water Board) on the "Draft Final Remedial Action Monitoring Plan, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comment addressed below was received from the Water Board on July 20, 2009.

No.	Page	Comment	Response
Response to Comment from Water Board			
GENERAL COMMENT			
1.	---	I have no further comments on the Draft Final Remedial Design Package for IR 7 and 18 and concur with comments submitted by DTSC on July 16, 2009.	Comment noted.

TABLE 4: RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL REMEDIAL ACTION MONITORING PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the response to the comment received from the City and County of San Francisco Health Department on the "Draft Final Remedial Action Monitoring Plan, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comment addressed below was received from the San Francisco Health Department on July 15, 2009.

No.	Page	Comment	Response
Response to Comment from City and County of San Francisco			
SPECIFIC COMMENT			
1.	---	**Section 5 Changes to This RAMP.** Please include the methane monitoring strategy in the referenced Triad approach. Please also state the three "future actions" sentences included in the Navy's response to the City's comment number 3 on the Draft Remedial Action Monitoring Plan, i.e. "Future actions will depend on the results of the monitoring and will be planned in consultation with....".	Section 5.0 was revised to include methane monitoring in the discussion of future changes. Section 3.3 was expanded to include the three cited sentences related to future actions concerning methane.

REFERENCES

CE2-Kleinfelder. 2009a. "Semi-annual Groundwater Monitoring Report, April—September 2008, Hunters Point Shipyard, San Francisco, California." February.

CE2-Kleinfelder. 2009b. "Semi-annual Groundwater Monitoring Report, October 2008—March 2009, Hunters Point Shipyard, San Francisco, California." July.

ChaduxTt. 2007. "Final Parcel B Technical Memorandum in Support of a Record of Decision Amendment, Hunters Point Shipyard, San Francisco, California." December 12.

ChaduxTt. 2009. "Final Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California." January 26.

Department of Toxic Substances Control (DTSC). 1995. "Reporting Hydrogeologic Characterization Data at Hazardous Substance Release Sites." July.

DTSC. 2003. "Advisory—Active Soil Gas Investigations." January 28.

DTSC. 2005a. "Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air." February 7.

DTSC. 2005b. "Advisory on Methane Assessment and Common Remedies at Schools Sites." June 16.

DTSC. 2008. "Representative Sampling of Groundwater for Hazardous Substances. February.

TABLE 1: RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT FINAL LAND USE CONTROL REMEDIAL DESIGN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the response to the comment received from the U.S. Environmental Protection Agency (EPA) on the "Draft Final Land Use Control Remedial Design, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comment addressed below was received from EPA on July 20, 2009.

No.	Page	Comment	Response
Response to Comment from EPA (Mark Ripperda)			
GENERAL COMMENT			
1.	---	EPA has no comments on the Draft Final Remedial Design for IR 07/18.	Comment noted.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL LAND USE CONTROL REMEDIAL DESIGN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the responses to comments received from the Department of Toxic Substances Control (DTSC) on the "Draft Final Land Use Control Remedial Design, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comments addressed below were received from DTSC on July 16, 2009. The Navy forwarded draft responses to DTSC on September 11, 2009 for an over-the-shoulder review. DTSC provided additional comments on October 19, 2009. Responses to these additional comments are included following the appropriate comment throughout this table. Throughout this table, *italicized* text represents additions to the document and ~~strikeout~~ text indicates locations of deletions. Also throughout this table, references to page, section, table, and figure numbers pertain to the new document unless indicated otherwise.

No.	Page	Comment	Response
Responses to Comments from DTSC (Ryan Miya)			
GENERAL COMMENTS			
1.	---	Response to comment 4. Please reference the specific location within the Amended Parcel B Record of Decision (ROD) where the Land Use Controls Checklist items 1 through 9 are presented in an Attachment C footnote as well as in the response to comments.	The table in Attachment C was revised to include a footnote to indicate that items 1 through 9 of the land use controls (LUC) checklist (EPA 2006) are provided in the amended record of decision (ROD).
Responses to Comments from DTSC (Vandana Kohli, California Department of Public Health [CDPH])			
SPECIFIC COMMENTS			
1.	---	**Ref: Navy's response to Comment 6.** The O&M Plan does not show the text that will appear on the signs. Please revise the response to comment and describe the text.	The text provided in the operation and maintenance (O&M) plan that will appear on the signs is shown on drawing C12 in the O&M plan. The text is "CAUTION. NO GROUND DISTURBANCE ALLOWED WITHOUT APPROVAL. CONTACT (619) 532-0913." Furthermore, the text will also appear in Spanish, in accordance with DTSC (Miya) specific comment 4 on the O&M plan.
Additional Comment on the RTC by CDPH			
Add'l 1	---	Ref: Navy's response to Comment 6. Please revise the sign to "CAUTION RADIOACTIVE MATERIAL PRESENT IN SOIL. NO GROUND DISTURBANCE ALLOWED WITHOUT WRITTEN APPROVAL. FOR ADDITIONAL INFORMATION CONTACT (619) 532-0913."	The text of the sign was revised to "CAUTION. POTENTIAL BURIED HAZARDOUS MATERIALS. NO GROUND DISTURBANCE ALLOWED WITHOUT APPROVAL. CONTACT (619) 532-0913." The presence of radioactive material is only a possibility, not a certainty that would be implied by the comment.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL LAND USE CONTROL REMEDIAL DESIGN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Vandana Kohli, California Department of Public Health [CDPH])			
2.	---	**Ref: Navy's response to Comment 7.** The text continues to state that the "work plan ... [and] completion report ... must be submitted to and approved in writing by the FFA signatories and CDPH in accordance with the procedures and timeframes that are set forth in Section 6.0 of this LUC RD." However, Section 6.0 consists primarily of timelines, and merely states that "various documents... maybe subject to review and approval..." Please either describe the approval process for the proposed work plan, state where the approval process already appears, or indicate when the approval process will be developed.	Section 6.0 was revised as follows. "As described above, various documents may be prepared by the Navy or the transferee during the implementation of ICs. These documents *will* ~~may~~ be subject to review and approval by the Navy and FFA signatories (and CDPH for the documents that may affect the ARIC for radionuclides)."
3.	---	**Ref: Navy's response to Comment 13.** The CDPH continues to assert that "reestablishing protectiveness" is an ambiguous statement if the remedy proved not to be protective, but CDPH defers to the City and EPA on the Navy's obligations to ensure the protectiveness of the remedy.	Comment noted.
4.	---	**Ref: Navy's response to Comments 17 and 18.** The Navy states in response to the CDPH's comment that entities should be notified more quickly than within 10 days if actions occur that interfere with IC effectiveness, that "the notification period of 10 working days is consistent with EPA guidance on LUCs (EPA 2006)..." However, CDPH notes that if the document the Navy refers to is the EPA's October 2006 document entitled "Sample Federal Facility Land Use Controls ROD Checklist with Suggested Language," that document contains the following suggested language: "The [federal agency] will notify EPA and [the state] as soon a practicable but no longer than ten days after discovery of any activity that is inconsistent with the IC objectives or use restrictions, or any other action that may interfere with the effectiveness of the ICs. The [federal agency] will notify EPA and [the state] regarding how the [federal agency] has addressed or will address the breach within 10 days of sending EPA and [the state] notification of the breach." CDPH requests that the text be revised to include the EPA's suggested language.	Item 8 in Section 5.1 already contains the suggested language. The report was not changed as a result of this comment.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL LAND USE CONTROL REMEDIAL DESIGN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Additional Comment on the RTC by CDPH			
Add'l 2	---	Ref: Navy's response to Comments 17 and 18. The Navy's language conflicts with the EPA language because the EPA says 10 days while the Navy says 10 working days. Please delete the word "working" so that the language comports with the EPA's suggested language.	EPA has already accepted the current language. Neither the LUC RD nor the original response was changed as a result of this comment.
Responses to Comments from DTSC (Vandana Kohli, California Department of Public Health [CDPH])			
5.	---	**Ref: Navy's response to Comment 19**. The Navy states that the text "identifies that prior approval of plans is needed before activities that may disrupt the effectiveness of ICs." However, CDPH believes that the text states only that the Navy "shall seek prior concurrence," but does not say that the Navy shall obtain concurrence. The CDPH requests that the text be revised accordingly. In addition, CDPH again asks for an explanation as to what kinds of actions that sentence is designed to address. The ROD and this document elsewhere have identified activities that are prohibited and permitted, and those for which approval is required. This sixth sentence appears to be inconsistent with the ROD by adopting a different process for permitting certain activities to occur.	Item 10 in Section 5.1 was revised as follows. "The Navy shall not modify or terminate ICs, implementation actions, or modify land use without *prior* approval by the FFA signatories and CDPH. The Navy or transferee shall *obtain* ~~seek~~ prior concurrence before any anticipated action by the Navy or transferee that may disrupt the effectiveness of the ICs or any action that may alter or negate the need for ICs." The text addresses any changes to ICs. However, the process for making changes to the ICs would still need to meet the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Item 10 in Section 5.1 addresses this need as follows. "The Navy and FFA signatories shall determine whether a ROD amendment or explanation of significant differences, or some other procedure consistent with the NCP, is required to support the modification of the IC." The Navy does not believe that the processes described in the LUC RD are inconsistent with the amended ROD (ChaduxTt 2009).

TABLE 3: RESPONSES TO COMMENTS FROM THE SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD ON THE DRAFT FINAL LAND USE CONTROL REMEDIAL DESIGN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the response to the comment received from the San Francisco Bay Regional Water Quality Control Board (Water Board) on the "Draft Final Land Use Control Remedial Design, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comment addressed below was received from the Water Board on July 20, 2009.

No.	Page	Comment	Response
Response to Comment from Water Board			
GENERAL COMMENT			
1.	---	I have no further comments on the Draft Final Remedial Design Package for IR 7 and 18 and concur with comments submitted by DTSC on July 16, 2009.	Comment noted.

TABLE 4: RESPONSES TO COMMENTS FROM CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL LAND USE CONTROL REMEDIAL DESIGN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the responses to comments received from the City and County of San Francisco Health Department (CCSF) on the "Draft Final Land Use Control Remedial Design, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comments addressed below were received from CCSF on July 15, 2009. The Navy forwarded draft responses to CCSF on September 11, 2009 for an over-the-shoulder review. CCSF provided additional comments on October 14, 2009. Responses to these additional comments are included following the appropriate comment throughout this table. Throughout this table, *italicized* text represents additions to the document and ~~strikeout~~ text indicates locations of deletions. Also throughout this table, references to page, section, table, and figure numbers pertain to the new document unless indicated otherwise.

No.	Page	Comment	Response
Responses to Comments from City and County of San Francisco (CCSF)			
SPECIFIC COMMENTS			
1.	3	**Section 4.1 IC Performance Objectives.** As stated above in our general comments, please add references in this section to the Parcel B RMP and the ARIC for radionuclides RMP and a description of how those RMPs will "allow certain activities that are otherwise restricted to be performed without additional approval by the FFA signatories" and CDPH (for the ARIC for radionuclides only).	The Parcel B risk management plan (RMP) does not apply to IR Sites 7 and 18 and does not address radionuclides. As provided in the amended ROD, the City and County of San Francisco (CCSF) may prepare an RMP for IR Sites 7 and 18 for approval by the federal facility agreement (FFA) signatories and CDPH (for the area requiring institutional controls [ARIC] for radionuclides). The report was not changed as a result of this comment because the status of any future RMP for IR Sites 7 and 18 is uncertain.
Additional Comment on the RTC by CCSF			
Add'l 1	---	As stated above in regards to the RTC on our DBR Comment 1, please add references in this section to the Parcel B RMP and the ARIC for radionuclides RMP and a description of how those RMPs will "allow certain activities that are otherwise restricted to be performed without additional approval by the FFA signatories" and CDPH (for the ARIC for radionuclides only). Please add the following item to the list of IC performance objectives:	The text of the report was expanded as requested, with additions to the suggested language shown in italics. "5. The Parcel B Risk Management Plan (RMP) for areas not covered by the ARIC for radionuclides, *if it is prepared*, will set forth certain requirements or protocols that, if followed, will allow certain activities that are otherwise restricted to be performed without additional approval by the FFA signatories. A separate RMP for the portions of IR Sites 7 and 18 covered by the radionuclide ARIC, *if prepared*, will also set forth certain requirements or protocols that, if followed, will allow certain activities that are otherwise restricted to be performed without additional approval by the FFA signatories and the California Department of Public Health (CDPH).

TABLE 4: RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL LAND USE CONTROL REMEDIAL DESIGN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Additional Comment on the RTC by CCSF			
Add'l 1 (Cont'd)	---	"5. The Parcel B Risk Management Plan (RMP) for areas not covered by the radionuclide Area Requiring Institutional Controls (ARIC) will set forth certain requirements or protocols that, if followed, will allow certain activities that are otherwise restricted to be performed without additional approval by the FFA signatories. A separate RMP for the portions of IR Sites 7 and 18 covered by the radionuclide ARIC will also set forth certain requirements or protocols that, if followed, will allow certain activities that are otherwise restricted to be performed without additional approval by the FFA signatories and the California Department of Public Health (CDPH)."	
Responses to Comments from CCSF			
2.	3	**Section 4.1 IC Performance Objectives, Item 3a.** "Land disturbing activity" is a restricted activity unless prior written approval is obtained. As worded, this restriction does not exclude "clean" soil that may be brought onto the site and placed above the "soil cover" or "soil cap/containment systems" on IRs 7 and 18. Taken literally, it means that anytime anyone wants to move a shovelful of soil from a high spot to fill in a low spot or move some soil while repairing a bikepath in the radionuclides area, even if it was constructed well above the soil cap or cover, all the FFA signatories and CDPH will have to sign off? We envisioned and addressed this concern by incorporating the concept of the Parcel B RMP and a IR7/18 RMP into the Parcel B Amended ROD. We suggest that the document clarify that land disturbing activity that disturbs the native soil, soil cover or imported fill placed above the finished cap or cover will be addressed in the Parcel B RMP or IRs 7 and 18 RMP, as appropriate. Any other references to this land disturbing activity restriction throughout this document should also make a reference to the RMPs.	Land disturbing activities will require prior approval based on a work plan. Note, however, that land disturbing activities were not intended to include placement of additional clean, imported fill on top of the soil cover that the Navy will construct at IR Sites 7 and 18. Section 4.1 was expanded to include this clarification. Also refer to the response to the previous comment.

TABLE 4: RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL LAND USE CONTROL REMEDIAL DESIGN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from CCSF			
3.	4	**Section 4.1 IC Performance Objectives, Item 3e.** Sentence beginning, "Alternatively, the ARIC for VOC vapors may be modified by the FFA signatories and CDPH." We note that this is an example of a reference to CDPH without clarifying that its role is limited to the "area with radionuclides." There are many other such instances in this document. We suggest adding a sentence at the beginning of this document, Section 1.0, Purpose, third paragraph, after the sentence that discusses CDPH's regulatory authority: "All references in this document to CDPH, including, but not limited to, requirements for approvals and reviews by CDPH, are intended to refer to and apply only in the ARIC for radionuclides.	Section 1.0 was expanded as follows. *"All references in this document to CDPH including, but not limited to, requirements for approvals and reviews by CDPH, are intended to refer to and apply only within the area requiring institutional controls for radionuclides."*
4.	6	**Section 5.1 Navy Responsibilities, Introductory paragraph, second sentence,** states that the "Navy will later transfer these procedural responsibilities to the San Francisco Redevelopment Agency via an early transfer cooperative agreement (ETCA) or other agreement." The Redevelopment Agency has not agreed yet to take responsibilities for the procedural obligations that are enumerated in this section and Section 5.2. While the City does not disagree that the actions enumerated are appropriate for someone to carry out to maintain the ICs, who will be responsible for exactly which activities and under what circumstances is the subject of negotiations at this time. This section reflects the Navy's intent, but does not reflect an agreement between the Navy and Agency or necessarily accurately reflect the responsibilities that will be imbedded in a deed document versus those that will be contained in a separate contract, such an ETCA. Further, the Agency has not agreed whether provisions related to IRs 7 and 18 will be included in the ETCA for Parcel B that is now under discussion or will be contained in a separate agreement, given that it is the City's and Agency's clearly stated intent to have the IRs 7 and 18 property transfer via a FOST. Therefore, we recommend that this section be clarified along these lines: "It is the Navy's intent to later transfer these procedural responsibilities to the San Francisco Redevelopment Agency. Agreement on which of these responsibilities will transfer and the mechanism that will be used for such a transfer of responsibility will be the subject of future negotiations between the parties. This section and Section 5.2 sets out the Navy's intent on how responsibilities will be allocated."	The Navy acknowledges CCSF's concerns, and modified Section 5.1 to include the following. "It is the Navy's intent to later transfer these procedural responsibilities to the San Francisco Redevelopment Agency. Agreement on the details of the transfer responsibilities will be subject of future negotiations."

TABLE 4: RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL LAND USE CONTROL REMEDIAL DESIGN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from CCSF			
5.	6	**Section 5.1 Navy Responsibilities, Item 3, Site Inspections.** This section should set out what the Navy will do, namely it will conduct annual site inspections, etc. This section is about Navy responsibilities, not future owner or subsequent transferee responsibilities, which are dealt with in 5.2. I would add at the beginning: "The Navy will undertake annual site inspections to ensure that all IC objectives and land use restrictions are complied with as long as it owns the property." Then proceed with the text that is there.	The text was revised as suggested.
6.	9	**Section 5.2 Property Owner Responsibilities, First paragraph.** The first sentence lists both an ETCA "and/or" quitclaim deed as mechanisms that may be used to enforce these requirements on subsequent property owners, but as pointed out previously, the Agency has not yet resolved with the Navy the scope of obligations that it would take on related to this property. Again, while the City does not disagree that these actions are appropriate to be carried out in the future, how these responsibilities will be allocated is the subject of ongoing negotiations and the precise scope and nature of those obligations is still under negotiation.	The Navy acknowledges CCSF's concerns, but does not believe is it appropriate or necessary to include this language in the LUC RD. The report was not changed as a result of this comment.
Additional Comment on the RTC by CCSF			
Add'l 2	---	The first sentence lists both an ETCA "and/or" quitclaim deed as mechanisms that may be used to enforce these requirements on subsequent property owners, but as pointed out previously, the Agency has not yet resolved with the Navy the scope of obligations that it would take on related to this property. Again, while the City does not disagree that these actions are appropriate to be carried out in the future, how these responsibilities will be allocated is the subject of ongoing negotiations and the precise scope and nature of those obligations is still under negotiation. Please delete reference to an ETCA by revising the first sentence as follows: *"The Navy will include appropriate provisions in the ~~ETCA and/or~~ Quitclaim Deed or other enforceable documents pertaining to the conveyance...."*	The text was revised as follows. "The Navy will include appropriate provisions in the ETCA—*if there is an early transfer*—and/or Quitclaim Deed or other enforceable documents pertaining to the conveyance..."

TABLE 4: RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL LAND USE CONTROL REMEDIAL DESIGN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from CCSF			
7.	---	**Attachment B-1, Checklist item 3.** Since the Navy intends to permanently prohibit the use of groundwater at Parcel B through ICs, footnote "a" does not seem applicable ("These restricted activities may be conducted provided that the requirements in the LUC RD are followed"). Please remove footnote "a" from item 3.	The text was revised as suggested.

REFERENCES

ChaduxTt. 2009. "Final Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California." January 26.

U.S. Environmental Protection Agency. 2006. "Sample Federal Facility Land Use Control ROD Checklist with Suggested Language." Available on-line at http://www.epa.gov/fedfac/documents/icchecklist.pdf

TABLE 1: RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT FINAL OPERATION AND MAINTENANCE PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the response to the comment received from the U.S. Environmental Protection Agency (EPA) on the "Draft Final Operation and Maintenance Plan, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comment addressed below was received from EPA on July 20, 2009.

No.	Page	Comment	Response
Response to Comment from EPA (Mark Ripperda)			
GENERAL COMMENT			
1.	---	EPA has no comments on the Draft Final Remedial Design for IR 07/18.	Comment noted.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL OPERATION AND MAINTENANCE PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the responses to comments received from the Department of Toxic Substances Control (DTSC) on the "Draft Final Operation and Maintenance Plan, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comments addressed below were received from DTSC on July 16, 2009. The Navy forwarded draft responses to DTSC on September 11, 2009 for an over-the-shoulder review. DTSC provided additional comments on October 19, 2009. Responses to these additional comments are included following the appropriate comment throughout this table. Throughout this table, *italicized* text represents additions to the document and ~~strikeout~~ text indicates locations of deletions. Also throughout this table, references to page, section, table, and figure numbers pertain to the new document unless indicated otherwise.

No.	Page	Comment	Response
Responses to Comments from DTSC (Ryan Miya)			
SPECIFIC COMMENTS			
1.	3	**Section 1.4 – Regulatory Framework.** The text provided in this section should be expanded to at least list and describe the regulatory oversight agencies and their roles within the framework of the required operation and maintenance components at IR Sites 7 and 18. This comment has been repeated because the response provided previously was inadequate.	The following has been included in Section 1.4 of the report. "The effectiveness of operation and maintenance activities will be overseen by the FFA signatories (and CDPH for the ARIC for radionuclides). *FFA signatories include the Navy, EPA, DTSC, and the Water Board. CDPH regulates activities related to remediation of radionuclides and, therefore, is also involved in oversight of actions at the portion of IR Sites 7 and 18 that is radiologically impacted. EPA is the lead oversight agency for the federal government. DTSC is the lead oversight agency for the State of California.*"
2.	3	**Section 2.0 – Inspection, Maintenance, and Repair.** Please revise the text to specify that modifications to the inspection materials and/or the appendices of the operation and maintenance (O&M) plan must be submitted for regulatory agency (FFA signatories) review and approval prior to placement / replacement in the O&M plan	The following was added to the fourth paragraph for Section 2.0. *"Any additions or modifications to the O&M plan, including the appendices and attachments, must be approved by the FFA signatories (and CDPH for the ARIC for radionuclides)."*
3.	---	**Response to comment 3b.** The response provided indicates that a table summarizing qualifications of supervisory personnel has been added to the text. Section 2.0, O&M Personnel subsection also states that "The following table summarizes general qualifications . . ." However, it is unclear where this table exists in the text. Please clarify and reference in the text if it is Table 2.	This sentence was an error, and Table 2 should have been referenced. The following change in the text has been made. "~~The following table~~ *Table 2 of this O&M plan* summarizes general qualifications that should be followed for the supervisory personnel responsible for oversight of the O&M-related work at the site."

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL OPERATION AND MAINTENANCE PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

Responses to Comments from DTSC (Ryan Miya)			
4.	---	**Response to comment 4a.** The construction specification for signs should be revised to include example sign text in English and Spanish.	Sign text has been revised to include both English and Spanish in the specifications and design drawings.
5.	---	**Response to comment 4b.** Section 2.1.1 text should reference that the proposed sign locations are presented in Figure 6.	The following text has been included in Section 2.1.1. *"The sign locations are included in both Figure 6 and on the design drawings."*
6.	---	**Response to comment 5.** Section 2.1.2.2 text should be revised to state that the annual inspection report should also describe and document any maintenance of groundwater monitoring wells and methane monitoring probes that had been conducted over the past year.	Section 3.0, Reporting, has been modified as follows. "The annual inspection report will include, at a minimum, the results of the inspections *and a summary of all repair and maintenance activities conducted.*"
7.	---	**Tables A-1 and A-2.** Thank you for providing the monitoring well information in response to our January 26, 2009 comments. Please be aware that after the cap installation is completed, including the groundwater and methane well extensions, these tables will need to be updated and replaced accordingly.	Comment noted.
Responses to Comments from DTSC (Ram Ramanujam, Engineering Services Unit)			
SPECIFIC COMMENTS			
23.	8	**Section 2.1.4.1.** Inspection of soil cover should satisfy the requirements of CCR Title 22, Section 66264.228.	The selected remedy for the site has not been constructed as a landfill waste management unit and, therefore, California Code of Regulations (CCR) Title 22, Section 66264 does not apply. Please refer to Table 1 of the report for the applicable or relevant and appropriate requirements (ARAR) identified in the amended record of decision (ROD) for further details.
24.	9 and 10	**Sections 2.1.4.3 and 2.1.5.3.** Repairs of soil cover and revetment should be reviewed and approved by the agencies.	The following has been added to Section 2.1 of the report. *"Any repair to the soil cover and revetment, must be approved by the FFA signatories (and CDPH within the ARIC for radionuclides) by submitting work plans. "*

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL OPERATION AND MAINTENANCE PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

Responses to Comments from DTSC (Ram Ramanujam, Engineering Services Unit)			
25.	11	**Section 3.0.** An annual inspection report should be certified by a California Registered Professional Engineer (Ref: CCR Title 22, Section 66264. 228(k)).	This stipulation is already included in Section 3.0 of the report. No changes to the report resulted from the comment.
28.	---	**Table 1**. ARARs should include appropriate section of Title 22.	Table 1 includes regulations from Title 22 that were identified as ARARs in the amended ROD. The report was not changed as a result of this comment.
Responses to Comments from DTSC (Vandana Kohli, California Department of Public Health [CDPH])			
SPECIFIC COMMENTS			
1.	---	Currently, Figure 3 provides the design overview for the IR 7 and 18 areas requiring institutional controls (ARICs) for radiological materials and the areas not requiring ARICs. Based on the information provided in the figure, the potential exists for misunderstanding that 3 feet of clean soil fill will be placed above the demarcation layer for portions of IR 7 and IR 18 requiring ICs for radiological materials. Therefore, please make changes in the figure text and wherever else it is applicable to indicate that for areas requiring ICs for radiological materials, 1 foot of clean soil will be placed below the demarcation layer and 2 feet above it.	The following note was added to the figure. *"Refer to Drawing C11 for details of the cover components. The cover in the potentially radiologically impacted area will include, from the top down, 2 feet of clean imported fill, a demarcation layer, and 1 foot of clean imported fill."*
2.	---	Please note that any proposed excavations below the demarcation layer in IR 7 and 18 areas requiring institutional controls (ARICs) for radiological materials will require a work plan. The associated documents will need to be reviewed and approved by CDPH and other regulators prior to proposed excavations. Therefore, please incorporate the above information in the document wherever applicable.	Please refer to the response to DTSC (Ramanujam) specific comment 24.
Additional Comment on the RTC by CDPH			
Add'l 1	---	Navy's Response to Specific Comment 2 on the Operation and Maintenance Plan. The Navy's statement that repairs "should" be approved is not responsive to CDPH's original comment that the documents "will need to be reviewed and approved" as the word "should" does not impose a requirement. Please replace "should" with "must."	The O&M plan and the related response were revised as requested.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL OPERATION AND MAINTENANCE PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

Responses to Comments from DTSC (Vandana Kohli, California Department of Public Health [CDPH])			
3.	5	**Ref: Navy's response to Specific Comment 5, Section 2.1.1.** The O&M Plan does not show the text that will appear on the signs. Please revise the response to comment and describe the text.	The text of the sign has been included in Section 2.1.1 of the report.
Additional Comment on the RTC by CDPH			
Add'l 3	---	Ref: Navy's response to Specific Comment 5, Page 3, Section 2.1.1. The O&M plan does not provide the text that will be used on the sign. (Please refer to CDPH's comment 1 on the Land Use Control.)	The text of the sign has been included in Section 2.1.1 of the report.
Responses to Comments from DTSC (Vandana Kohli, California Department of Public Health [CDPH])			
4.	---	**Appendix A-2, Section 2.1, second paragraph.** Please provide a technical justification as to why the site would be inspected only after a seismic activity of 6.0 or greater that is within a 40 mile radius from IR 7 and 18. Please confirm with a seismologist for verification of the proposed magnitude of the seismic activity, distance from the site and how promptly after the seismic activity the site would need to be inspected.	This magnitude earthquake was selected by a California-registered geotechnical engineer based on the stability evaluation conducted for the design (refer to Attachment 3 of the design basis report). A design earthquake of magnitude 7.9 was used for the assessment of the soil cover and revetment, and significant damages to the soil cover and revetment would not be anticipated to result. This magnitude of 6.0 has been selected as it is considerably more conservative (about 100 times less energy) than the magnitude earthquake that would have the potential for causing damage. Surface displacement is unlikely to occur during a magnitude 6.0 earthquake. Refer to Table 3 of the report for the inspection and corrective action response times. Inspection of the site would occur as soon as possible following the earthquake; an evaluation of problem areas (for example, slope failure or surface cracking) by a geotechnical consultant would occur within 48 hours.
5.	---	**Appendix A-2.** Please explain and incorporate in the document the Navy's plan of action in case of liquefaction of the site as a consequence of a seismic activity.	Emergency response activities are included in Table 3 of the report. Although response actions resulting specifically from liquefaction are not included, response actions resulting from earthquakes and releases of potentially contaminated soils are discussed.
Additional Comment on the RTC by CDPH			
Add'l 2	---	Response to Specific Comment 5. Please provide response activities in case of liquefaction or please explain why the Navy thinks that it is not necessary to have response activities in case of liquefaction of the sites.	The heading on Table 3 was revised to "Earthquake, *including liquefaction*" to indicate that the response activities also address potential liquefaction.

TABLE 3: RESPONSES TO COMMENTS FROM THE SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD ON THE DRAFT FINAL OPERATION AND MAINTENANCE PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the response to the comment received from the San Francisco Bay Regional Water Quality Control Board (Water Board) on the "Draft Final Operation and Maintenance Plan, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comment addressed below was received from the Water Board on July 20, 2009.

No.	Page	Comment	Response
Response to Comment from Water Board			
GENERAL COMMENT			
1.	---	I have no further comments on the Draft Final Remedial Design Package for IR 7 and 18 and concur with comments submitted by DTSC on July 16, 2009.	Comment noted.

TABLE 4: RESPONSES TO COMMENTS FROM CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL OPERATION AND MAINTENANCE PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the responses to comments received from the City and County of San Francisco Health Department on the "Draft Final Operation and Maintenance Plan, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comments addressed below were received from the San Francisco Health Department on July 15, 2009. Throughout this table, *italicized* text represents additions to the document and ~~strikeout~~ text indicates locations of deletions. Also throughout this table, references to page, section, table, and figure numbers pertain to the new document unless indicated otherwise.

No.	Page	Comment	Response
Responses to Comments from City and County of San Francisco (CCSF)			
SPECIFIC COMMENTS			
1.	4	**Section 2.0 Inspection, Maintenance, and Repair, first paragraph.** Attachment 3 of the O&M Plan should be updated with as-built information upon completion of the RD. If different material types or manufacturers are used other than what is specified, the revised specification sections should be included that reflect this.	The following text has been added to Section 2.0 the report. *"Attachment 3 of this O&M plan should be updated with as-built information from construction when it becomes available. Materials selected in the actual construction of the revetment and the soil cover may differ slightly from the design, and the specifications of the O&M plan should be revised to reflect these changes, or if any changes are made during the O&M period."*
2.	---	Please include a sample maintenance form/checklist showing sign, fence, soil cover and revetment inspection parameters.	A preliminary inspection checklist has been included in Appendix A.
3.	6	**Section 2.1.3 Groundwater Monitoring Wells and Methane Monitoring Probes, last sentence.** What qualifies as a "significant detection." Please clarify.	The following text has been added to Section 2.1.3 of the report. "The O&M contractor should maintain communication with the property owner concerning any ~~significant~~ detections of COCs in groundwater or soil gas monitoring *that exceed the remediation goals established in the amended ROD for Parcel B* and adjust site activities accordingly."
4.	7	**Section 2.1.3.2 Maintenance and Repair of Groundwater Monitoring Wells and Methane Monitoring Probes.** Please include a sample maintenance form/checklist for well and probe inspection.	Please refer to the response to specific comment 2.
5.	---	**Appendix A.** Inspection Summary and Frequency Table includes inspection items for area within ARIC for radionuclides and area outside ARIC for radionuclides – how will different ARIC areas be designated so inspection personal can differentiate?	Although inspection activities do not vary between the two areas, the drainage swale (see Figure 6 and drawing C3 of the design drawings), combined with the site maps and drawings provided in this O&M plan, would allow for sufficient differentiation between the two areas for inspections.

TABLE 4: RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL OPERATION AND MAINTENANCE PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from CCSF			
6.	---	Inspection and Repair Procedures – Include a phone and contact list under list of materials to bring during inspection.	A telephone and contact list has been added to the referenced portion of the report.
7.	---	**Table 1, Applicable or Relevant and Appropriate Requirements for Soil Cover and Revetment.** This table seems extraneous to an O&M Manual. Please consider deleting this table.	This table was included based on comments from DTSC on the draft O&M plan. Future activities relating to O&M at the site would need to comply with the ARARs. The report was not changed as a result of this comment.
8.	A-3	**Inspection and Repair Procedures**. The suggested items to be brought to the field are given in a bullet item list near the top of the page; the fourth bullet item is "Appropriate documentation materials including any inspection checklists". We request that this O&M Manual be expanded to include all appropriate documentation materials and inspection checklists, at least an initial set of these materials and checklists, appropriate for use by field personnel. Also, if any portion of the cover and revetment wall includes an item or component that comes with a manufacturer's warranty, those items or components should be identified as such in this O&M Manual and in the inspection checklist(s). If those components exhibit defects in materials or workmanship, the repairs might be performed under the manufacturer's or installer's warranty. Furthermore, the warranty for certain items may be voided if repairs are performed by an individual or entity that has not been certified or trained by the manufacturer. All information of this nature should be included in the O&M Manual, with follow-up procedures spelled out (e.g., contact information for manufacturer, installer).	A preliminary inspection checklist has been included with Appendix A of the report. After the remedy has been constructed, manufacturer's cut sheets will be included with the O&M plan as Attachment 1. Manufacturers have not been selected and therefore the attachment is currently a list of the anticipated cut sheets. Cut sheets generally include, at a minimum, inspection needs for the materials, warranty information, and manufacturer contact information.
9.	---	**Appendix A.** Inspection Summary and Frequency Table includes inspection items for area within ARIC for radionuclides and area outside ARIC for radionuclides – how will different ARIC areas be designated so inspection personal can differentiate?	Please see the response to specific comment 5.
10.	---	Inspection and Repair Procedures – Include a phone and contact list under list of materials to bring during inspection.	Please see the response to specific comment 6.

TABLE 4: RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL OPERATION AND MAINTENANCE PLAN, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

REFERENCES

ChaduxTt. 2009. "Final Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California." January 26.

U.S. Environmental Protection Agency. 2006. "Sample Federal Facility Land Use Control ROD Checklist with Suggested Language." Available on-line at http://www.epa.gov/fedfac/documents/icchecklist.pdf

TABLE 1: RESPONSES TO COMMENTS FROM THE U.S. ENVIRONMENTAL PROTECTION AGENCY ON THE DRAFT FINAL PRECONSTRUCTION COST OPINION, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the response to the comment received from the U.S. Environmental Protection Agency (EPA) on the "Draft Final Preconstruction Cost Opinion, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comment addressed below was received from EPA on July 20, 2009.

No.	Page	Comment	Response
Response to Comment from EPA (Mark Ripperda)			
GENERAL COMMENT			
1.	---	EPA has no comments on the Draft Final Remedial Design for IR 07/18.	Comment noted.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL PRECONSTRUCTION COST OPINION, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the responses to comments received from the Department of Toxic Substances Control (DTSC) on the "Draft Final Preconstruction Cost Opinion, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comments addressed below were received from DTSC on July 16 and July 27, 2009. The Navy forwarded draft responses to DTSC on September 11, 2009 for an over-the-shoulder review. DTSC provided additional comments on October 19, 2009. Responses to these additional comments are included following the appropriate comment throughout this table. Throughout this table, *italicized* text represents additions to the document and ~~strikeout~~ text indicates locations of deletions. Also throughout this table, references to page, section, table, and figure numbers pertain to the new document unless indicated otherwise.

No.	Page	Comment	Response
Responses to Comments from DTSC (Ryan Miya)			
SPECIFIC COMMENTS			
1a.	5	**Section 2.1 - Cost Opinion Assumptions, bullet 3.** The text states that specialized equipment will be necessary for compaction of the filled portions of the shoreline. Please specify some examples of the specialized equipment and verify that the cost estimates for their use have been incorporated into Table 2.	By "specialized" it was intended to convey that equipment specific to the task of compaction would be necessary and that natural compaction through placement of the riprap alone or compaction by means of vehicle traffic would not be adequate. This text has been revised to be more consistent with the anticipated methods. "It has been assumed that compaction of the filled portions of the shoreline ~~using specialized equipment~~ *will be necessary and that* using *standard compaction* equipment will be ~~necessary~~ *sufficient*." Only minimal areas of filling and compaction are necessary below the elevation of the mean higher high water, and compaction equipment similar to what will be used for construction of the cover should be sufficient.
1b.	5	**Section 2.1 - Cost Opinion Assumptions, last bullet.** The text states that dust control watering trucks have been assumed to be necessary for 25 percent of the day to suppress dust. Please modify the text and budgetary line item(s) as needed to conduct dust suppression activities during all periods of the day when construction activities associated with implementation of the cap remedy will be occurring. The same comment applies to the sixth bullet in the construction subsection on page 7 regarding dust control watering.	The text was changed as follows. "Dust control watering trucks have been assumed to be necessary ~~for 25% of~~ *throughout* the day to suppress dust along traffic areas and construction areas." And: "Dust control watering is assumed to be necessary ~~for 2 hours per day~~ *throughout* the day in the work areas." The use of 25 percent and 2 hours per day were intended to reflect some cost savings that could be assumed by using equipment operators for multiple tasks and using water trucks for both dewatering and compaction. It was not intended to reflect the actual amount of time when the activities would occur. The costs have been adjusted accordingly.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL PRECONSTRUCTION COST OPINION, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Ryan Miya)			
2a.	---	**Table 2 - Construction Budgetary Cost Opinion.** It is unclear if implementation of the radionuclide screening has been included (either as a table line item or embedded within a particular line item). Please clarify.	The radionuclide screening facilities have not been included in the cost estimate, but operation labor for facilities has been included. The screening process is not a part of this design. The line item for assembly and disassembly of the facilities had been included to indicate that a cost could be associated with the project if necessary. It has been removed from the revised costs estimate. Please refer to the following documents for specific information on the screening activities. Tetra Tech EC, Inc. (TtEC). 2008. "Final Base-wide Radiological Work Plan Revision 2, Hunters Point Shipyard, San Francisco, California." May. TtEC. 2009. "Final Task-Specific Plan for the IR-18 Scoping Survey, Revision 1, Hunters Point Shipyard, San Francisco, California." July. While screening costs have not been included in this RD, they will be included in the scope of work for the remedial action and the Navy will conduct radiological screening during remedial action activities. Remedial action costs related to screening, sampling, and reporting on radiologically affected materials are expected to range from $650,000 to $750,000.
Additional comment on the RTC by California Department of Public Health (CDPH)			
Add'l 1	---	Response to DTSC Specific Comment 2a. The Navy states that the radionuclide screening facilities have not been included in the cost estimate but the operation labor for facilities has been included. The Navy also states that "screening costs" have not been included in this remedial design but will be included in the remedial action phase. Please explain why the screening costs were not in the remedial design phase though will be included in the remedial action phase.	Construction contractors bidding on the remedial design were not required to provide radiological screening facilities. Instead, the Navy's basewide radiological contractor will provide this function. Neither the cost opinion nor the original response was changed as a result of this comment.
2b.	---	**Table 2 - Construction Budgetary Cost Opinion.** The units presented have not been defined or clarified in the table footnotes. Examples include "mo", "mi", "ls", and "sy".	The units have been defined in the footnotes.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL PRECONSTRUCTION COST OPINION, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Responses to Comments from DTSC (Vandana Kohli, California Department of Public Health [CDPH])			
SPECIFIC COMMENTS			
1.	---	Please note that draft version of this document was not provided for CDPH review.	Comment noted.
2.	2	**Section 1.3.** Based on the information provided in the text, the potential exists for misunderstanding that 3 feet of clean soil fill will be placed above the demarcation layer for portions of IR 7 and IR 18 requiring ICs for radiological materials. Therefore, please make changes in the text and wherever else it is applicable in the document text to indicate that for areas requiring ICs for radiological materials, 1 foot of clean soil will be placed below the demarcation layer and 2 feet above it.	The following revision has been made to the text. "The final cover for the potentially radiologically impacted area at IR Sites 7 and 18 will consist of a minimum 3-foot cover layer of clean imported soil. *A demarcation layer will be positioned within the cover; a minimum of 1 foot of clean soil will be placed below the demarcation layer and a minimum of 2 feet of clean soil will be placed above it.* ~~and a demarcation layer over the area and within the cover layer, 1 foot above the existing ground surface."~~
3.	4	**Section Site Security.** CDPH-EMB does not agree that 12 signs are adequate in warning trespassers with regards to the health and safety hazards associated with the site. Therefore, please consider posting additional signs warning trespassers regarding access to the site.	The spacing of the signs was reduced from 200 to 100 feet. The number of signs is now 24.
4.	4	**Section Shoreline Preparation.** Please ensure that the temporary shoreline access route does not penetrate deeper than one foot below the scanned surface of IR Sites 7 and 18.	The temporary shoreline access route is a contingency used for estimating and may ultimately not be used. The remedial action contractor will be aware of the limitations of the screening depth and any disturbed materials will be screened during the construction process. Radiological screening details will be summarized in the remedial action construction work plan, which will be submitted for regulatory review and approval.
5.	4	**Section Shoreline Preparation.** Please add a sentence stating that all material excavated from either the shoreline or the fill area will be screened for radiologically impacted material.	The following has been added to both the revetment and the soil cover portions of the text. *"All excavated material will be screened for radiological contamination."*
6.	6	**Section Waste Hauling and Disposal.** Please provide justification for the statement, "It is assumed that 10 percent of the soil and sediment excavated along the shoreline will be determined during screening to be radiologically impacted."	This estimate is being used for costing and is a rough estimate. It is recognized that this estimate could vary considerably with the actual conditions. The estimate is based on previous excavation work completed at Hunters Point Shipyard.

TABLE 2: RESPONSES TO COMMENTS FROM THE DEPARTMENT OF TOXIC SUBSTANCES CONTROL ON THE DRAFT FINAL PRECONSTRUCTION COST OPINION, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Additional comment on the RTC by California Department of Public Health (CDPH)			
Add'l 2	---	Response to Specific Comment 6. According to the Navy's response, the estimate is based on previous excavation work at Hunters Point Shipyard. Please explain the previous excavation work the Navy has referred.	The Navy has conducted excavations at HPS as removal and remedial actions since 1996 (most notably the remedial actions summarized in the Parcel B construction summary report) and has removed hundreds of thousands of cubic yards of soil from HPS. General professional judgment from this previous work was applied to the cost opinion. Neither the cost opinion nor the original response was changed as a result of this comment.

TABLE 3: RESPONSES TO COMMENTS FROM THE SAN FRANCISCO BAY REGIONAL WATER QUALITY CONTROL BOARD ON THE DRAFT FINAL PRECONSTRUCTION COST OPINION, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the response to the comment received from the San Francisco Bay Regional Water Quality Control Board (Water Board) on the "Draft Final Preconstruction Cost Opinion, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comment addressed below was received from the Water Board on July 20, 2009.

No.	Page	Comment	Response
Response to Comment from Water Board			
GENERAL COMMENT			
1.	---	I have no further comments on the Draft Final Remedial Design Package for IR 7 and 18 and concur with comments submitted by DTSC on July 16, 2009.	Comment noted.

TABLE 4: RESPONSES TO COMMENTS FROM CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL PRECONSTRUCTION COST OPINION, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009

The table below contains the responses to comments received from the City and County of San Francisco Health Department (CCSF) on the "Draft Final Preconstruction Cost Opinion, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California," dated May 29, 2009. The comments addressed below were received from CCSF on July 15, 2009. The Navy forwarded draft responses to CCSF on September 11, 2009 for an over-the-shoulder review. CCSF provided additional comments on October 14, 2009. Responses to these additional comments are included following the appropriate comment throughout this table. Throughout this table, *italicized* text represents additions to the document and ~~strikeout~~ text indicates locations of deletions. Also throughout this table, references to page, section, table, and figure numbers pertain to the new document unless indicated otherwise.

No.	Page	Comment	Response
Responses to Comments from City and County of San Francisco (CCSF)			
SPECIFIC COMMENTS			
1.	3	**Section 2.1 Cost Opinion Assumptions.** What are the overhead and profit (O&P) percentage markups assumed for contractor labor and materials?	The labor overhead multiplier used was 1.719. The professional labor multiplier was 1.8. The profit on material and equipment was 10 percent. These values are assumed based on similar projects and are used for estimations. Actual costs may differ.
2.	---	**Table 2: Construction Budgetary Cost Opinion.** No line item for Radionuclide Surface Screening as described in the Design Basis Report. Please clarify.	Please refer to comment 2a from DTSC (Ryan Miya).
3.	---	**Table 2: Construction Budgetary Cost Opinion; Site Wide Costs, Mobilization/Demobilization.** Assembly and Disassembly has no cost associated with it – please clarify.	Please refer to comment 2a from DTSC (Ryan Miya).
4.	---	**Table 2: Construction Budgetary Cost Opinion, Revetment Costs/Materials.** Crushed Stone Filter unit is shown as "CY", the unit is shown in Table 1 as "Tons" – please clarify. Please confirm Total Unit Cost for Crushed Stone Filter.	Costs associated with the filter stone has been calculated as a cost per ton of material. On Table 1 there are two line items for the stone for both the cubic yards of material and the tonnage.

TABLE 4: RESPONSES TO COMMENTS FROM THE CITY AND COUNTY OF SAN FRANCISCO ON THE DRAFT FINAL PRECONSTRUCTION COST OPINION, INSTALLATION RESTORATION SITES 7 AND 18, PARCEL B, HUNTERS POINT SHIPYARD, SAN FRANCISCO, CALIFORNIA, MAY 29, 2009 (CONTINUED)

No.	Page	Comment	Response
Additional comment on the RTC by CCSF			
Add'l 1	---	**Comment 4, Table 2: Construction Budgetary Cost Opinion, Revetment Costs/Materials.** Please revise the Table 2 unit for the 2,250 quantity of crushed stone filter material to match Table 1.	The cost opinion was revised as requested.
5a.	---	**Table 2: Construction Budgetary Cost Opinion, Revetment Costs/Construction.** Riprap Dumped unit is shown as "CY", the unit is shown in Table 1 as "Tons" – please clarify. Please confirm Total Unit Cost for riprap dumped?	The tables have been revised to show the cost per ton for the riprap material on both tables.
5b.	---	**Table 2: Construction Budgetary Cost Opinion, Revetment Costs/Construction.** Dust control only required for 3 months during 6 months of construction – please clarify.	The line items are specific to both construction of the revetment and construction of the soil cover. For cost estimating, 3 months was assumed for each portion, and a line item is included for each portion as a separate task.
5c.	---	**Table 2: Construction Budgetary Cost Opinion, Revetment Costs/Construction.** Please differentiate between Bank CYs and Loose CYs within the Units column.	The units have been revised to include both bank and loose cubic yards.
6a.	---	**Table 2: Construction Budgetary Cost Opinion; Waste Hauling and Disposal.** Haul Rad Impacted Soil line item units are "ea" - please clarify.	The "ea" refers to a cost associated for each item.
Additional comment on the RTC by CCSF			
Add'l 2	---	**Comment 6a, Table 2: Construction Budgetary Cost Opinion; Waste Hauling and Disposal.** Please clarify what the quantity "23" represents.	This quantity represents an approximate number of trips to haul contaminated material off site for disposal. The units in Table 2 were revised from "ea" to "ea load."
6b.	---	**Table 2: Construction Budgetary Cost Opinion; Waste Hauling and Disposal.** Please clarify "Dry Decontamination."	Dry decontamination refers to the practices of using vibration of the vehicle to shake off soil and debris. The costs associated with the item are the cost per station.

REFERENCES

ChaduxTt. 2009. "Final Amended Parcel B Record of Decision, Hunters Point Shipyard, San Francisco, California." January 26.

U.S. Environmental Protection Agency. 2006. "Sample Federal Facility Land Use Control ROD Checklist with Suggested Language." Available on-line at: http://www.epa.gov/fedfac/documents/icchecklist.pdf

PUBLIC SUMMARY

Public Summary: **Final Remedial Design Package, Installation Restoration Sites 7 and 18, Parcel B, Hunters Point Shipyard, San Francisco, California, January 8, 2010**

The Department of the Navy has prepared this draft final remedial design package for Installation Restoration (IR) Sites 7 and 18 to address remaining contamination in a portion of Parcel B at Hunters Point Shipyard in San Francisco, California. The remedial design describes the detailed actions selected by the amended record of decision for Parcel B to protect the public health, welfare, and the environment from actual or potential releases of contaminants from the site. The remedial action for Parcel B addresses metals, polycyclic aromatic hydrocarbons, pesticides, and radionuclides in soil and shoreline sediment, methane in soil gas (vapor), and several metals and radionuclides in groundwater.

The primary risk to human health and the environment from these chemicals is through direct contact with the soil or sediment. The remedial design developed in this report includes a soil cover to prevent exposure and a revetment that will prevent contact with shoreline sediment and prevent wave action from eroding sediment and transporting it into the bay. The remedial design for IR Sites 7 and 18 also includes monitoring for metals and radionuclides in groundwater and methane in soil gas. The remedial design includes land use restrictions to limit exposure of future landowners or users of the property to hazardous substances and to maintain the integrity of the remedy. The remedial design package includes five components: (1) design basis report, (2) remedial action monitoring plan, (3) land use controls remedial design, (4) operation and maintenance plan, and (5) engineer's opinion of probable cost. Together, these components describe the detailed process that the Navy will follow to build and maintain the remedy for IR Sites 7 and 18.

Information Repositories: A complete copy of the "Final Remedial Design Package, Installation Restoration Sites 7 and 18, Parcel B" dated January 8, 2010, is available to community members at:

San Francisco Main Library
100 Larkin Street
Government Information Center, 5th Floor
San Francisco, CA 94102
Phone: (415) 557-4500

Anna E. Waden Bayview Library
5075 Third Street
San Francisco, CA 94124
Phone: (415) 355-5757

The report is also available to community members on request to the Navy. For more information about environmental investigation and cleanup at Hunters Point Shipyard, contact Lara Urizar, remedial project manager for the Navy, at:

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