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Feasibility Study for Investigation Area F1

Former Mare Island Naval Shipyard
Vallejo, California

September 2015

Prepared for:

Department of the Navy
Base Realignment and Closure
Program Management Office West
Naval Facilities Engineering Command
33000 Nixie Way, Bldg 50
San Diego, California 92147

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Prepared by:

Trevet
9888 Carroll Centre Road, Suite 228
San Diego, California 92126
(858) 578-8859

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Review and Approval

John Willis
Project Manager
Trevet

9/10/2015
Date

Peter M. Stang, P.G.
Principal Geologist
Trevet

REGISTERED GEOLOGIST
PETER M. STANG
NO. 5219
Expires: 7/2016
STATE OF CALIFORNIA

10 September 2015
Date

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§	Section
§§	Sections
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
CHHSL	California Human Health Screening Levels
COC	chemical of concern
COEC	chemical of ecological concern
COPEC	chemical of potential ecological concern
DON	Department of the Navy
DTSC	California Environmental Protection Agency, Department of Toxic Substances Control
EC	engineering controls
ECR	excess carcinogenic risk
EPC	exposure point concentration
ERA	ecological risk assessment
FFSRA	Federal Facility Site Remediation Agreement
FS	feasibility study
GHG	greenhouse gases
GRA	general response action
GSR	Green and Sustainable Remediation
HHRA	human health risk assessment
HI	hazard index
IA	investigation area
ICs	institutional controls
IR	Installation Restoration
LUC	land-use control
LTM	long-term monitoring
Mare Island	former Mare Island Naval Shipyard
MEC	munitions and explosives of concern
mg/kg	milligram per kilogram
mg/L	milligram per liter

MINS	former Mare Island Naval Shipyard
MOA	Memorandum of Agreement
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NO_x	nitrogen oxides
OEHHA	Office of Environmental Health and Hazard Assessment
O&M	operation and maintenance
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PM	particulate matter
RAO	remedial action objective
RD	remedial design
RG	remediation goal
RI	remedial investigation
ROD	Record of Decision
SWRCB	State Water Resources Control Board
SLERA	screening-level ecological risk assessment
SMHM	salt marsh harvest mouse
SO_x	sulfur oxides
TDS	total dissolved solids
TPH	total petroleum hydrocarbons
TPH-dr	total petroleum hydrocarbons – diesel range
TPH-gr	total petroleum hydrocarbons – gas range
TPH-mr	total petroleum hydrocarbons – motor oil range
TRV	toxicity reference value
TSCA	Toxic Substances Control Act
TTZ	target treatment zone
U.S.C.	*United States Code*
U.S. EPA	United States Environmental Protection Agency
UST	underground storage tank
VOC	volatile organic compound
Water Board	San Francisco Bay Regional Water Quality Control Board

Executive Summary

This Feasibility Study (FS) Report presents the evaluation of remedial alternatives conducted by the Department of the Navy (DON or Navy) for Investigation Area (IA) F1, located within the Former Mare Island Naval Shipyard (MINS or Mare Island) in Vallejo, California. This FS Report is being submitted in accordance with the Mare Island Federal Facility Site Remediation Agreement between the Navy, California Department of Toxic Substances Control (DTSC), and the San Francisco Bay Regional Water Quality Control Board (Water Board). The FS Report has been prepared in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Title 42, *United States Code* (U.S.C.) Sections 9601-9675, and associated guidance and regulations.

IA F1 is located along the southeastern shore of Mare Island. For the purposes of the site and conducting the remedial investigation, IA F1 was delineated into seven subareas. Soil, sediment, soil gas, and groundwater were the media evaluated at IA F1 during the remedial investigation (RI) (ChaduxTt 2012a). The RI concluded that groundwater and soil gas throughout the site, and soil for Subareas 1, 2, 3, and 7 were not identified as media of concern for the anticipated land-use scenarios. Media of concern for an unrestricted reuse scenario are surface and subsurface soil, and surface sediment. The media of concern in the anticipated reuse scenarios were limited to surface soil (0 to 2 feet below ground surface [bgs]) in the area south of Building A75 in Subarea 4, the area around Building A17 in Subarea 5 and surface sediment in the northern portion of Subarea 6. Historical operations at a paint shop are the likely sources of metals contamination near Building A75 and Building A17. A possible source of metals contamination in surface sediment in the northern portion of Subarea 6 is from sandblasting operations and disposal of waste sandblast materials at nearby Installation Restoration (IR) Site 4.

This FS focuses primarily on the evaluation of remedial alternatives for Subareas 4, 5, and 6 for both surface soil and surface sediment to be protective in the anticipated reuse scenarios. In addition, potential use of administrative measures were evaluated for chemicals of concerns (COCs) in media that pose a potential risk to receptors that are more sensitive than the anticipated receptors in the reuse scenarios for IA F1. The RI Report for IA F1 (ChaduxTt 2012a) recommended the consideration of land-use controls (LUCs) in the form of institutional controls (ICs). The recommended ICs would prevent sensitive uses, such as residential and agricultural activities, to limit the exposure of sensitive receptors to COCs.

The primary purpose of this FS is to identify and screen remedial alternatives and to provide the Navy with adequate information for the selection of appropriate remedies. Remedial action objectives (RAOs) and numerical preliminary remediation goals (RGs) were developed for the affected media in each area. The Navy follows current United States Environmental Protection

Agency (U.S. EPA) guidance for FS report preparation under CERCLA (U.S. EPA 1988).

Media-specific remedial technologies were initially screened for applicability. Remedial alternatives were selected from the screened technologies developed based on relative effectiveness in achieving the RAOs. The screened remedial alternatives were evaluated against the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) criteria and ranked according to relative performance in achieving the RAOs.

The NCP criteria evaluation considered overall protection of human health and the environment and compliance with applicable or relevant and appropriate requirements (ARARs) as the threshold criteria. The balancing criteria are short-term effectiveness; long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; implementability; and cost. The FS also included a Green and Sustainable Remediation analysis and the results analysis are included in Appendix D. The modifying criteria of state and community acceptance will be evaluated after developing and receiving comments on the Proposed Plan and will be presented in the Record of Decision.

Site Background

Mare Island

MINS is located on the Mare Island Peninsula, within the incorporated boundaries of the City of Vallejo in Solano County, California, and about 25 miles northeast of San Francisco (Figure ES-1). Operations at Mare Island began with shipbuilding in 1854 and expanded to submarines in the early 1920s with the peak of building, repair, overhaul, and maintenance activities occurring during World War II when MINS employed 40,000 workers. Shipyard activity decreased after World War II, and MINS was closed in April 1996 as part of the 1993 Base Realignment and Closure. Munitions were also manufactured and stored at Mare Island with ordnance facilities located within IA F1. Munitions and explosives of concern for IA F1 are being addressed separately under the Navy's Munitions Response Program.

IA F1

IA F1 comprises about 62 acres along the southeastern shore of Mare Island (Figure ES-2). Site features and habitat areas are presented on Figure ES-3. Previous investigations had delineated the IA F1 area into seven subareas to facilitate site characterization.

This FS evaluates active remedial alternatives for three specific areas within IA F1 designated in the RI as requiring further evaluation due to human and/or ecological risks from contaminants of concern: 1) Building A75 in Subarea 4; 2) Building A17 in Subarea 5; and 3) Subarea 6. These three areas were identified based on the anticipated reuse scenarios for IA F1, and are shown on

Figure ES-2 along with the subarea divisions of IA F1. In addition to the active remedies evaluated for these three specific areas, ICs preventing sensitive uses such as residential and agricultural activities are included in the evaluation of remedial alternatives, to restrict reuse activities that are more sensitive than the anticipated reuse scenarios.

Groundwater in IA F1 is characterized by high total dissolved solids content, high salinity, and low potential production. Based on this information, groundwater in IA F1 is not considered a potable water supply as defined by U.S. EPA, nor is it considered to have potential beneficial uses for municipal or domestic supply as defined by State Water Regional Control Board (SWRCB). In May 2010, the Navy received a letter from the Water Board, agreeing that shallow groundwater at IA F1 and neighboring IR Site 4 meet the exception criteria for beneficial use (Water Board 2010). Therefore, the beneficial use of groundwater is an incomplete exposure pathway to receptors. Shallow groundwater at IA F1 is not considered suitable for municipal or domestic water supply.

Summary of IA F1 Remedial Investigation Report

Soil, sediment, soil gas, and groundwater were sampled during previous investigations and analyzed for a comprehensive suite of chemicals including volatile organic compounds, semivolatile organic compounds, polycyclic aromatic hydrocarbons, polychlorinated biphenyls, total petroleum hydrocarbons (TPH), and metals. Groundwater at IA F1 is not considered potable; therefore, beneficial use of groundwater was not evaluated in the risk assessment (ChaduxTt 2012a). The RI evaluated data collected during the RI and other historical data to summarize the nature and extent of chemicals in environmental media. The Final RI Report for IA F1 concluded that certain portions of IA F1 did not require further active remediation based on site conditions and future reuse scenarios, but recommended other areas for further evaluation based on the results of a human health risk assessment (HHRA) and ecological risk assessment. The RI summaries for each subarea are described below and are shown in Table ES-1. The RI conclusions were based on anticipated future reuse, and for that reason, even subareas that are not recommended for further consideration in the RI have been carried forward into this FS for the consideration of ICs as appropriate.

Subarea 1

Cumulative excess carcinogenic risk in humans (ECR) is less than or within the risk management range of 10^{-6} to 10^{-4} (1 in 1,000,000 to 1 in 10,000) for commercial/industrial workers and construction workers. The cumulative ECR for a hypothetical resident is within the risk management range of 10^{-6} to 10^{-4}. The noncancer hazards, measured as hazard indices (HI), for all receptors at Subarea 1 were equal to or less than the threshold of 1. In soil at six areas of Subarea 1 concentrations of TPH exceeded the Tier 2 screening levels developed for IA F1 (Figure ES-A1). Of those six areas, five met the closure criteria for low-risk fuel sites. The RI

recommended further investigation of TPH in soil in the sixth area, TPH Area 2b, to determine the extent of residual contamination (ChaduxTt 2012a).

No chemicals of ecological concern (COECs) in soil were identified in the ecological risk assessment as resulting in unacceptable risk to ecological receptors in Subarea 1. Further consideration of Subarea 1 was not recommended by the RI (ChaduxTt 2012a).

Subarea 2

Cumulative ECRs in Subarea 2 were less than or within the lower end of the risk management range of 10^{-6} to 10^{-4} for a commercial/industrial worker and construction worker. The cumulative ECR for a hypothetical resident was within the risk management range. The estimated HIs for all receptors at Subarea 2 were less than the threshold of 1.

No COECs in soil were identified in the ecological risk assessment as posing unacceptable risk to ecological receptors in Subarea 2. Further consideration of Subarea 2 was not recommended by the RI (ChaduxTt 2012a).

Subarea 3

Exposure to soil, groundwater, and soil gas at Subarea 3 for the commercial/industrial worker, construction worker, and hypothetical resident resulted in estimated incremental cancer risks less than or within the risk management range of 10^{-6} to 10^{-4}. All noncancer hazard estimates at Subarea 3 were less than or equal to the threshold of 1 for noncarcinogens. Exposure to lead in surface soil was estimated to be above the modified DTSC Office of Environmental Health and Hazard Assessment (OEHHA) California Human Health Screening Level (CHHSL) value of 105.6 milligrams per kilogram (mg/kg) for a residential scenario, but below the industrial scenario modified value of 345.6 mg/kg.

No COECs in soil or soil gas were identified in the ecological risk assessment as posing unacceptable risk to ecological receptors in Subarea 3. Further consideration of Subarea 3 was not recommended by the RI.

Subarea 4

Cumulative ECRs in Subarea 4 were less than or within the lower end of the risk management range of 10^{-6} to 10^{-4} for commercial/industrial workers, construction workers and the hypothetical resident. HIs were below the noncancer threshold of 1 for commercial/industrial and construction workers. The HI for a future resident was twice the threshold value of 1; however, the highest target organ segregated HI for residential exposure to surface and subsurface soils were equal to or less than the threshold value of 1.

Lead was detected in surface and subsurface soils above the modified OEHHA residential CHHSL and was detected in only surface soil above the modified OEHHA industrial CHHSL. Since lead in surface soil in the area south of Building A75 results in significant risk to human health for future planned land use, the RI recommended remediation of lead-impacted soil to concentrations below the modified OEHHA industrial CHHSLs in the area south of Building A75 (ChaduxTt 2012a). The Building A75 delineated area is included as a target treatment zone (TTZ) for remedial action due to elevated lead concentrations exceeding the modified OEHHA industrial CHHSL.

The RI identified lead, zinc, and dioxin-like congeners as COECs in the upland habitat. Exposure to dioxin-like congeners resulted in significant risk to birds and mammals at only one location within the upland habitat—location A190-1 in Subarea 4. However, as stated in the RI, the habitat quality around former Building A190 does not encourage foraging in the area. The area consists of non-native grasses, which are regularly mowed to reduce the risk of fire danger to the buildings. This activity reduces the potential exposure to ecological receptors. Therefore, developing remedial alternatives to mitigate exposure to dioxin-like congeners is not necessary (ChaduxTt 2012a). In addition, Subarea 4 is within planned reuse area 10A (Mixed Industrial Reuse). The industrial character of the area will be maintained based on site zoning and is consistent with the City of Vallejo's Re-Use Plan, resulting in an incomplete exposure pathway for ecological receptors. ICs are evaluated for Subarea 4 to prevent the formation of open space or ecological habitat in the industrial portion of the subarea, to assure that the ecological exposure pathway remains incomplete in this area. The specific nature of the ICs necessary to prevent the formation of ecological habitat would be developed in future documents, such as a land-use control remedial design (LUC RD). Therefore, dioxin-like congeners were eliminated as COECs due to an incomplete exposure pathway.

Further evaluation of lead and zinc was recommended in the RI for the area south of Building A75 (Figure ES-5) in Subarea 4 (ChaduxTt 2012a). The area around Building A75 is an industrial area and, as stated earlier, Subarea 4 is planned for industrial reuse. In addition, Building A75 is in close proximity to Building A190 and is similar in that habitat quality does not encourage foraging and results in an incomplete exposure pathway to ecological receptors. As stated above, ICs are evaluated for Subarea 4 to assure habitat is not created during future industrial redevelopment. Therefore, lead and zinc were eliminated as COECs in the area south of Building A75 due to an incomplete exposure pathway. No COECs are identified for soil in Subarea 4.

Subarea 5

Cumulative ECRs in Subarea 5 were less than or within the lower end of the risk management range of 10^{-6} to 10^{-4} for commercial/industrial workers, construction workers and the hypothetical resident. HIs were below the threshold of 1 for the commercial/industrial (ranging

from 0.08 to 0.1), but were greater than 1 for a construction worker (11) from inhalation of manganese particulates. Because manganese was not historically used at the site, but is expected to be naturally occurring in the chert formations that are present at the site, manganese was not carried forward as a COC for the construction worker (ChaduxTt 2012a).

Although, the estimated HI of 2 for the future resident is greater than the noncancer threshold of 1; the highest target organ segregated HIs for residents were less than the threshold of 1. The residential risk estimate is protective of a recreational user who is expected to ingest only half the amount of soil per day as the resident, and be present on site for just 1/12th the amount of time the resident is assumed to be on site (ChaduxTt 2012a).

Building A17 is located within the portion of Subarea 5, which is intended in part to be a regional park (Figure ES-4) and may include both ecological and recreational future receptors. A regional park is an area designated for regular recreational use by the public. Within the A17 delineated area of surface soil, exposure of elevated lead concentrations to future recreational and ecological receptors resulted in risk in the reuse regional park plan scenario. Risk to a potential recreational user was conservatively calculated using modified OEHHA residential CHHSL values for lead. A number of the surface soil samples exceeded residential screening values for lead, primarily adjacent to Building A17. No other COCs or COECs were identified in soil or soil gas in Subarea 5 (ChaduxTt 2012a).

The RI recommended developing remedial alternatives to mitigate the risk to ecological receptors from exposure to lead around Building A17. Although not a recommendation of the RI, this FS also considers potential risks to future recreational receptors due to lead in shallow soil near Building A17. The area recommended for remedial action borders the north, east, and south sides of Building A17 (Figure ES-6). Building A17 is included as a TTZ for remedial action. In addition, ICs are evaluated to limit the formation of open space or ecological habitat in the industrial portion of Subarea 5, and reduce risk to future ecological receptors.

Subarea 6

Subarea 6 comprises about 6.7 acres bounded to the north by IR Site 4, to the east by Mare Island Strait, and to the west by Subareas 1, 2, 4, and 5. The entire area is unpaved and slopes gently towards the Mare Island Strait. There are no remaining buildings in the subarea, although former Buildings A53 and A198 were located close to the shore and on connected docks. From the northernmost point southward to the location of former Building A198, coastal salt marsh wetland comprises the majority of Subarea 6. The ecological habitat throughout the wetlands is described as of moderate quality with regard to function and value; however, some areas are degraded from the physical influence of the tidal waters and overall disturbed nature of the site. To the southeast of the former location of Building A198, Subarea 6 is primarily sandy shoreline with minimal ecological habitat (ChaduxTt 2012a).

IA F1 includes wetlands in Subarea 6. The wetland area is normally above water except during extremely high tides. The RI excluded sloughs associated with Outfalls 33, 34, 35, 102, and 202 because they are part of IA K. Outfall 36 has never been observed in the field, but samples from the suspected location were considered in IA F1. For the FS, the Navy has chosen to be more conservative and include all sediment samples within the footprint of Subarea 6 for developing remedial alternatives to mitigate risk to ecological receptors from exposure to COCs.

The northernmost area of Subarea 6 is adjacent to IR Site 4 where abrasive sandblasting operations formerly occurred. Spent sandblast media were historically discarded along the shoreline at nearby IR Site 4 wetland areas for disposal. Migration of spent sandblast media from the adjacent IR Site 4 into the northern portion of IA F1 Subarea 6 is a potential source for the elevated metals results reported in this northern area. The northern area is also near Building A223, which was formerly used as an ordnance warehouse.

The southern area of Subarea 6 is east of the location of former Building A53. Building A53 was used for ordnance production operations and was demolished in 1985. Building A53 was connected by ramps to former offshore Building A198.

Subarea 6 consists of wetlands and will remain wetlands. These wetlands have been identified for a conservation area. A conservation area is an area designated for protection of its natural resources including ecological receptors. As a result the only complete exposure pathway is to ecological receptors. Although this area will not be available for recreational purposes a hypothetical recreational user has been evaluated as a conservative measure. Exposure to sediment at Subarea 6 for the adult and child recreational user results in an ECR of 1×10^{-5}, within the risk management range of 10^{-6} to 10^{-4}. The HI was estimated as 0.5, less than the threshold of 1. Risk to the hypothetical residential user was not evaluated in the RI for Subarea 6.

The RI identified barium, copper, lead, molybdenum, and zinc as COECs at Subarea 6 (Figure ES-7) (ChaduxTt 2012a). Further evaluation of risk from these COECs was performed and is presented in Appendix B. Based on the results of the evaluation in Appendix B the area north of and including Outfall 33 is the only area designated as a TTZ due to concentrations of barium, copper, lead, molybdenum, and zinc exceeding background levels for metals and posing a potential risk to ecological receptors. Removal of sediment containing elevated metals within the northern area around Outfall 33 would reduce the risk from metals within the entire Subarea 6.

Subarea 7

Cumulative ECRs in Subarea 7 were less than or within the lower end of the risk management range of 10^{-6} to 10^{-4} for commercial/industrial workers, construction workers and the

hypothetical resident. HIs were less than or equal to the threshold of 1 for all receptors. Although specific risks for future adult and child recreational users were not estimated, the risk is considered acceptable since the ECR for a future adult and child residential user are within the risk management range (ChaduxTt 2012a).

No COECs in soil were identified in the ecological risk assessment. Further consideration of Subarea 7 was not recommended by the RI (ChaduxTt 2012a).

TPH Areas 2b, 14, and 15.

TPH Area 2b is located within Subarea 1 at the western edge of the equipment yard, west of Building A220 and south of Building A215 (Figure ES-A1). The most likely sources of TPH at TPH Area 2b were identified as incidental leaks or spills from heavy equipment used during ordnance production and storage (ChaduxTt 2012a). TPH Areas 14 and 15 are located in Subarea 4 (Figure ES-A2). The likely sources of TPH in these two areas are underground storage tanks (USTs) associated with Building A190. The USTs were removed in 1992, and the UST site was later closed as a low-risk fuel site (Tetra Tech 2001).

In response to the RI, the Water Board stated that additional evaluation of petroleum hydrocarbons in soil (TPH Area 2b) and groundwater (TPH Areas 14 and 15 in Subarea 4 as shown on Figure ES-A2) should be performed to further characterize TPH Areas 2b, 14, and 15 (Water Board 2012). The scope of the sampling was described in a letter to the Water Board (Trevet 2013). The Water Board agreed to this approach in a letter dated March 2013 (Water Board 2013) and the additional sampling was conducted in June through July 2013.

Closure as a low-risk fuel site was reevaluated in this FS Report for soil in TPH Area 2b as well as groundwater in TPH Areas 14 and 15. Based on the results of the additional sampling, these areas meet the criteria for closure as a low-risk fuel site. Therefore, no further action is recommended for these areas as discussed in Appendix A. TPH Areas 2b, 14, and 15 are not included in the discussion of active remedial options in this FS.

Remedial Action Objectives and Preliminary RGs

RAOs are goals for protecting human health and the environment. RAOs are established based on the affected media (e.g., soil and sediment), type and concentrations of chemicals in the affected media, existing and future receptors, exposure pathways, and ARARs. RAOs guide the development and assessment of remedial alternatives in this FS.

In this FS Report, specific RAOs are developed for the areas and media of IA F1 requiring evaluation of remedial alternatives. Based on the risk evaluation performed in the RI report for IA F1, subsurface soil, surface soil, and surface sediment were identified as the media of concern at IA F1. No unacceptable risks to human health were identified in groundwater at IA F1 based

on the planned reuse (ChaduxTt 2012a). Within the anticipated future use scenarios, surface soil and surface sediment in three subareas were identified as media requiring active remedial action. Affected media are identified below for both unrestricted and reasonably anticipated future use scenarios.

Unrestricted Reuse Scenario

For the unrestricted reuse scenario, the risk to the hypothetical residential receptor is evaluated as the most sensitive receptor. This scenario does not include the beneficial use of groundwater because it is an incomplete exposure pathway. The beneficial use exception letter received for the site (Water Board 2010) acknowledges shallow groundwater at IA F1 as unsuitable for beneficial use. The following soil/sediment media may pose an unacceptable risk to receptors in the unrestricted reuse scenario at the identified subareas:

Soil – Subarea 3. Elevated lead concentrations in surface soil pose an unacceptable risk to the hypothetical residential receptor in Subarea 3.

Soil – Subareas 4 and 5. Surface and subsurface soil in Subareas 4 and 5 pose an unacceptable risk to the hypothetical residential receptor. Subarea 4 and portions of Subarea 5 that will remain industrial pose an unacceptable risk to ecological receptors if habitat is allowed to develop within these areas.

Subarea 6: The hypothetical resident was not evaluated in the HHRA for Subarea 6; therefore, an unrestricted reuse scenario at Subarea 6 was not evaluated.

Current Use and Anticipated Future Reuse Scenarios (Industrial and Recreational)

The current land use for IA F1 is inactive and vacant land. Maintenance workers from the Navy, the City of Vallejo, and Island Energy visit the site to check electrical substations and towers and to perform basic site maintenance. In addition, Navy subcontractors may conduct removal activities at the site in preparation for closure, transition, and property transfer of IA F1. The Navy is maintaining IA F1 as an industrial area by clearing vegetation periodically for firebreak protection.

The anticipated reuse scenarios for IA F1 are industrial for Subareas 1 through 4 and part of Subarea 5, and recreational for Subareas 6, 7 and the remainder of Subarea 5 (Figure ES-4). Exposure to COCs in groundwater (through vapor intrusion pathways) and subsurface soil do not pose unacceptable risk to the current and anticipated future receptors. The RI and analysis within this FS identified the following areas and media for active remedial action:

Building A75 within Subarea 4. The affected media is surface soil (less than 2 feet bgs).

Building A17 within Subarea 5. The affected media is surface soil (less than 2 feet bgs).

Northern Area of Subarea 6. The affected media is surface sediment (less than 2 feet bgs) located north of and around Outfall 33.

The IA F1 RI and analysis within this FS show that within the planned future use scenarios, no active remedial action is required for upland soil within Subareas 1, 2, 3, and 7 and portions of Subareas 4, 5, and 6 outside of areas of Building A75, Building A17, and Northern Area of Subarea 6, as described above.

The City of Vallejo's Mare Island Specific Plan documents future land-use plans for IA F1, which include mixed industrial, a regional park, and a conservation area as shown on Figure ES-4. The RAOs in this FS take into consideration the current and planned future land use for each remedial area. This FS evaluates active remedial alternatives for three specific areas (Building A17, Building A75, and Northern Area of Subarea 6) within IA F1 designated in the RI as requiring further evaluation due to human and/or ecological risks from contaminants of concern. RAOs for locations of Building A75 and Building A17 are presented together as surface soil RAOs. Subarea 6 RAOs are presented separate from the other locations as sediment-specific RAOs.

Surface Soil RAOs

The following RAOs were developed for surface soil:

- Prevent exposure of future commercial/industrial workers to lead in surface soils containing concentrations that exceed the modified OEHHA industrial worker CHHSL in the Building A75 area.
- Prevent exposure of ecological receptors to lead in surface soils at concentrations that exceed the risk-based ecological goals in the Building A17 area where exposure pathways exist.
- Prevent exposure of future recreational receptors to lead in surface soils in the Building A17 area at concentrations that exceed the modified OEHHA residential CHHSL, which is conservative for the recreational receptor.
- Prevent sensitive reuse exposure to COCs in surface soil in Subareas 3, 4 and 5.
- Prevent exposure of ecological receptors to surface soil in Subareas 4 and industrial reuse portions of Subarea 5.

Surface Sediment RAOs

The following RAO applies to surface sediment in Subarea 6:

- Prevent ecological exposure to barium, lead, copper, and zinc in sediment that exceed the higher of either the Mare Island ambient fill concentration (ambient fill range from other nearby Bay Area Navy facilities for barium) or the calculated risk-based ecological goals in the Northern Area of Subarea 6.
- Prevent residential reuse exposure to COCs in sediment in Subarea 6.

Subsurface Soil RAOs

RAOs were developed for subsurface soil to prevent exposure to unacceptable risks from unrestricted reuse. The following RAO applies to subsurface soil:

- Prevent sensitive reuse exposure to elevated COCs in subsurface soil (0 to 10 feet bgs).

Preliminary RGs

Preliminary RGs are site- and media-specific numerical cleanup goals that are protective of human health and the environment for the RAOs listed above. Preliminary RGs for the three specific locations, as well as additional media of surface and subsurface soil are as follows:

Building A75 (in Subarea 4) Surface Soil Preliminary RGs:

- Preliminary RG for lead of 345.6 mg/kg (modified OEHHA industrial CHHSL).

Building A17 (in Subarea 5) Surface Soil Preliminary RGs:

- Preliminary RG for lead of 105.6 mg/kg (modified OEHHA residential CHHSL). Recreational receptors are expected to be exposed to no more than ½ the residential exposure as stated in the RI. An RG that is protective of the future recreational receptors will also be protective of current commercial/industrial workers and construction workers.
- Preliminary RG for lead of 205 mg/kg, in accordance with the risk-based ecological exposure point concentration (EPC) that does not result in significant risk to ecological receptors.

Subarea 6 Sediment Preliminary RGs

- Preliminary RG for lead of 59 mg/kg, which is consistent with the Mare Island ambient fill concentration. The risk-based concentration of 45.5 mg/kg for lead was the concentration using the low-toxicity reference value (TRV), with HQ=1 for the most sensitive receptor, the salt marsh harvest mouse. Since this is lower than background, the preliminary RG is set at background.

- Preliminary RG for zinc of 230 mg/kg, which is consistent with the Mare Island ambient fill concentration. The risk-based concentration of 200 mg/kg for zinc was the concentration using the low-TRV, with HQ=1 for the most sensitive receptor, the salt marsh harvest mouse. Since this is lower than background, the preliminary RG is set at background.
- Preliminary RG for copper of 120 mg/kg, which is consistent with the Mare Island ambient fill concentration. The concentration at which the HQ=1 for the most sensitive receptor, the endangered salt marsh harvest mouse, using the low TRV, is 49.2 mg/kg, and therefore the RG is set at background.
- Barium is compared to the ambient fill range of 166 to 314.4 mg/kg, based on the ambient fill concentrations of nearby Naval facilities in the Bay Area; only one barium detection exceeded the ambient fill range. This single elevated result is within the area already considered for remediation based on other metals. No numerical preliminary RG for barium is proposed.
- Establish a legal instrument to prevent the residential use of the property unless and until it is suitable for such use.

Surface and Subsurface Soil Preliminary RGs for IA F1:

- Establish a legal instrument to prevent the residential use and other sensitive uses of the property where unrestricted exposure poses an unacceptable risk unless and until it is suitable for such uses.

Target Treatment Zones

The TTZ is the area within which an active remedial alternative for surface soil or surface sediment would be implemented. For the areas evaluated in this FS, the soil and sediment TTZs are developed by comparing the RI and other historical analytical results for the COCs to the preliminary RGs and placing individual sampling locations within the TTZ if the site data at those sampling locations exceed the preliminary RGs. A few sampling locations with exceedances of preliminary RGs are excluded from the TTZs, and these are discussed in the relevant section. Figure ES-2 shows the proposed surface soil and surface sediment TTZs for the areas evaluated in this FS.

Remedial Technologies and Alternatives

This FS identifies and screens potentially applicable remedial technologies to develop an appropriate range of options suitable to address the COCs in soil and sediment, and to accomplish the RAOs for IA F1. An initial screening analysis of technologies and process options is conducted based on the NCP screening criteria of effectiveness, implementability, and

cost. Appropriate technologies and process options based on the initial screening analysis are retained and used in the development of remedial alternatives.

The majority of IA F1 does not pose an unacceptable risk to receptors in the current or future reuse plan. ICs are evaluated to prevent sensitive land-use activities that may result in unacceptable risk to receptors. Active remedial alternatives are also evaluated for three areas identified as having unacceptable risk within the future reuse scenario: Building A17, Building A75, and the Northern Area of Subarea 6. The medium of concern for Building A17 and Building A75 areas is upland surface soil for lead. Buildings A17 and A75 have been grouped together for evaluation. Alternatives for Buildings A17 and A75 are identified by a "U" prefix in the remedial alternative name (i.e., Alternative U2) to denote upland area alternatives. Subarea 6 is composed of wetlands where the medium of concern is surface sediment. Alternatives for Subarea 6 are identified by a "W" prefix in the remedial alternative name (i.e., Alternative W2) to denote wetlands alternatives.

Active remedial alternatives are developed separately for surface soil TTZs and surface sediment TTZs as described above. These alternatives also include sensitive use ICs to limit exposure as applicable. These alternatives are screened based on their overall effectiveness, implementability, and cost. The FS considers a No Action Alternative, two upland remedial alternatives and two wetland remedial alternatives. Remedial alternatives are described below and summarized in Table ES-2.

No Action Alternative

The No Action Alternative is evaluated for baseline purposes in accordance with the NCP.

- Alternative 1: No Action

Upland Remedial Alternatives

Based on the results of the remedial technologies screening, two remedial alternatives were developed for upland soil:

- Alternative U2: Institutional Controls and Asphalt Cap
- Alternative U3: Institutional Controls, Excavation, and Off-Site Disposal

Wetlands Remedial Alternatives

Based on the results of the remedial technologies screening, two remedial alternatives were developed for wetland sediment:

- Alternative W2: Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland
- Alternative W3: Institutional Controls, Excavation, and Off-Site Disposal

Costs for each remedial alternative are presented in Table ES-3. The results of the detailed NCP feasibility criteria analysis are provided in Tables ES-4 and ES-5 for upland and wetland alternatives, respectively. The effectiveness of ICs is evaluated in Table ES-6. A summary of developed remedial alternatives for the areas of concern for IA F1 is presented in Table ES-7. This FS also evaluates each of the developed remedial alternatives comparatively with respect to the same list of NCP criteria.

Executive Summary Tables

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Table ES-1. Refined RI Results and Conclusions

Subarea	Future Land Use	HHRA Results Based on Multi Pathway Total (excluding beneficial use of groundwater[b])				ERA Conclusion	Results and Conclusions Stated in the RI.	Results and Conclusions Refined in the FS
		Future Human Receptor (Soil Depth Interval)	Does Lead Pose a Risk?	Evaluation Using Groundwater Vapor Intrusion Model		Further Evaluation Recommended Based on ERA?		
				Cancer Risk	Hazard Index[a]			
1	Mixed Industrial	Commercial/Industrial Worker (0 to 2 feet bgs)	No	6E-07	0.02	No	Further investigation of TPH Area 2b is recommended. No further evaluation is recommended to address risk to humans or ecological receptors based on anticipated future land use.[b]	Sample results from additional data gap sampling at TPH Area 2b laterally delineate TPH in soil. TPH characterization is complete and closure as a low-risk fuel site is recommended.
		Commercial/Industrial Worker (0 to 10 feet bgs)	No	2E-06	0.08			
		Construction Worker (0 to 10 feet bgs)	No	8E-07	0.9			
		Hypothetical Resident (0 to 2 feet bgs)	No	2E-06	0.2			
		Hypothetical Resident (0 to 10 feet bgs)	No	6E-06	1 (0.7)			
2	Mixed Industrial	Commercial/Industrial Worker (0 to 2 feet bgs)	No	6E-07	0.04	No	No further evaluation is recommended to address risk to humans or ecological receptors based on anticipated future land use.[b]	
		Commercial/Industrial Worker (0 to 10 feet bgs)	No	6E-07	0.04			
		Construction Worker (0 to 10 feet bgs)	No	4E-07	0.6			
		Hypothetical Resident (0 to 2 feet bgs)	No	2E-06	0.5			
		Hypothetical Resident (0 to 10 feet bgs)	No	2E-06	0.5			
3	Mixed Industrial	Commercial/Industrial Worker (0 to 2 feet bgs)	No	7E-06 3E-08[d] (soil gas)	0.1 0.05[d] (soil gas)	No	No further evaluation is recommended to address risk to humans or ecological receptors based on anticipated future land use.[b]	Lead may pose an unacceptable risk to a hypothetical residential receptor. ICs preventing sensitive uses will be evaluated for Subarea 3.
		Commercial/Industrial Worker (0 to 10 feet bgs)	No	1E-05 3E-06[d] (soil gas)	0.1 0.06[d] (soil gas)			
		Construction Worker (0 to 10 feet bgs)	No	7E-07 7E-07[d] (soil gas)	0.7 0.7[d] (soil gas)			
		Hypothetical Resident (0 to 2 feet bgs)	Yes	9E-05 3E-07[d] (soil gas)	1(0.7) 0.7[d] (soil gas)			
		Hypothetical Resident (0 to 10 feet bgs)	No	1E-04 1E-05[d] (soil gas)	1(0.6) 0.7[d] (soil gas)			

Table ES-1. Refined RI Results and Conclusions

Subarea	Future Land Use	HHRA Results Based on Multi Pathway Total (excluding beneficial use of groundwater[b])				ERA Conclusion	Results and Conclusions Stated in the RI.	Results and Conclusions Refined in the FS
		Future Human Receptor (Soil Depth Interval)	Does Lead Pose a Risk?	Evaluation Using Groundwater Vapor Intrusion Model		Further Evaluation Recommended Based on ERA?		
				Cancer Risk	Hazard Index[a]			
4	Mixed Industrial	Commercial/Industrial Worker (0 to 2 feet bgs)	Yes	6E-06	0.2	Yes, lead and zinc identified as COECs in the area south of Building A75.	Lead poses an unacceptable risk to human health in the area to the south of Building A75. Lead and zinc pose unacceptable risk to ecological receptors in the area to the south of Building A75; therefore lead and zinc in this area should be evaluated further in a FS.[b]	The current land use and the planned future land use are industrial in Subarea 4 and a complete exposure pathway to ecological receptors is not anticipated. Therefore, only lead for protection of human health is evaluated as a COC for Building A75. ICs preventing sensitive use will be evaluated for Subarea 4.
		Commercial/Industrial Worker (0 to 10 feet bgs)	No	5E-06	0.2			
		Construction Worker (0 to 10 feet bgs)	No	1E-06	1(0.4)			
		Hypothetical Resident (0 to 2 feet bgs)	Yes	2E-05	2(1)			
		Hypothetical Resident (0 to 10 feet bgs)	Yes	2E-05	2(0.95)			
5	Mixed Industrial/ Regional Park	Commercial/Industrial Worker (0 to 2 feet bgs)	No	2E-06 1E-06[d] (soil gas)	0.09 0.08[d] (soil gas)	Yes, lead identified as a COEC in the area around Building A17.	Lead poses unacceptable risk to ecological receptors in the area around Building A17; therefore, lead in this area should be evaluated further in a FS.[b]	Building A17 is within future reuse plan 12 (regional park) which includes recreational and ecological receptors. Lead poses unacceptable risk to residential receptors (and therefore potentially to recreational receptors) and to ecological receptors in the area around Building A17. Lead is evaluated as a COC and COEC for Building A17. ICs preventing sensitive use will be evaluated for Subarea 5.
		Commercial/Industrial Worker (0 to 10 feet bgs)	No	1E-06 8E-07[d] (soil gas)	0.1 0.1[d] (soil gas)			
		Construction Worker (0 to 10 feet bgs)	No	5E-07 5E-07[d] (soil gas)	12(11)[c] 12(11)[c,d] (soil gas)			
		Hypothetical Resident (0 to 2 feet bgs)	Yes	1E-05 4E-06[d] (soil gas)	1(0.5) 1(0.5)[d] (soil gas)			
		Hypothetical Resident (0 to 10 feet bgs)	Yes	1E-05 4E-06[d] (soil gas)	2(0.9) 2(0.9)[d] (soil gas)			
6	Conservation Area (Wetlands)	Recreational User (0 to 2 feet bgs)	No	1E-05	0.5	Yes, barium, copper, lead, molybdenum and zinc were identified as COECs for Subarea 6.	No unacceptable risks to human health were identified for Subarea 6. COECs pose unacceptable risk to ecological receptors in Subarea 6; therefore, COECs in Subarea 6 should be evaluated further in a FS.[b]	No unacceptable risks to human health were identified for Subarea 6 in the anticipated future land-use scenario. COECs pose unacceptable risk to ecological receptors in Subarea 6; therefore, COECs in Subarea 6 are evaluated further in the FS. ICs preventing sensitive use will be evaluated for Subarea 6.

Table ES-1. Refined RI Results and Conclusions

Subarea	Future Land Use	HHRA Results Based on Multi Pathway Total (excluding beneficial use of groundwater[b])				ERA Conclusion	Results and Conclusions Stated in the RI.	Results and Conclusions Refined in the FS
		Future Human Receptor (Soil Depth Interval)	Does Lead Pose a Risk?	Evaluation Using Groundwater Vapor Intrusion Model		Further Evaluation Recommended Based on ERA?		
				Cancer Risk	Hazard Index[a]			
7	Regional Park	Commercial/Industrial Worker (0 to 2 feet bgs)	No	2E-06	0.1	No	No further evaluation is recommended to address risk to humans or ecological receptors based on anticipated future land use.[b]	
		Commercial/Industrial Worker (0 to 10 feet bgs)	No	2E-06	0.09			
		Construction Worker (0 to 10 feet bgs)	No	1E-06	1(0.99)			
		Hypothetical Resident (0 to 2 feet bgs)	No	5E-06	1(1)			
		Hypothetical Resident (0 to 10 feet bgs)	No	5E-06	1(1)			

Notes: For human health, the soil depth interval shown above for 0 to 2 feet bgs represents the minimal disturbance scenario and the 0 to 10 feet bgs represents the intrusive development scenario. These future scenarios include exposures to soil, groundwater, and soil gas.

a. If the total HI exceeds the threshold of 1, values shown in parentheses represent the highest target organ segregated HI.

b. Groundwater at the site has a Beneficial Use Exception from the Water Board, which precludes groundwater from any beneficial uses (Water Board 2010).

c. Risk driver is manganese. The RI does eliminates manganese as a chemical of concern for the construction worker at Subarea 5 because there is no risk associated with the long-term commercial/industrial worker who is on site for 25 years and because manganese is expected to be naturally occurring at the site.

d. HHRA results for cancer risk and HI were evaluated using soil gas vapor intrusion model. There is no change to risk using the soil gas vapor intrusion model to the construction worker (0 to 10 feet) since vapor intrusion is not a complete pathway for that receptor.

bgs Below ground surface
COC Chemical of concern
COEC Chemical of ecological concern
ERA Ecological Risk Assessment
FS Feasibility study
HHRA Human health risk assessment
HI Hazard index
IA F1 Investigation Area F1
IC Institutional control
RI Remedial investigation
TPH Total petroleum hydrocarbons

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Table ES-2. Summary of Remedial Alternatives

	Alternative	GRA Category	Description	Purpose
	1 – No Action	No Action	No action taken.	Exposure pathways unaffected.
Upland Soil	U2 – Institutional Controls and Asphalt Cap	Containment and ICs	The TTZs would be paved with asphalt, approximately 13,500 square feet. ICs would prevent sensitive uses for soil in areas that do not warrant unrestricted reuse and exposure and provide for maintenance of remedy. Long-term monitoring, maintenance, and reporting would be required.	Removes exposure pathways by physically shielding receptors from exposure to contaminated soil, capped in the TTZ. A beneficial use exception for shallow groundwater was received for the site.
Upland Soil	U3 – Institutional Controls, Excavation, and Off-Site Disposal	Removal and ICs	Soil in the TTZs would be excavated, approximately 1,250 CY. The removed soil would be disposed of off site at a permitted facility and excavations would be backfilled. ICs would prevent sensitive uses for soil in areas that do not warrant unrestricted reuse and exposure and provide for maintenance of remedy. Long-term monitoring, maintenance, and reporting would be required.	Eliminates exposure pathways by removing contaminated soil off site. Prevents sensitive receptor exposure to soil.
Wetland Sediment	W2 – Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland	Relocation and ICs	Alternative W2 employs ICs and the relocation of 3,550 BCY of sediment from the TTZ in Subarea 6 to the uplands portion of IA F1 to meet ARARs and RAOs. The sediment would be characterized prior to relocation to the uplands. Based on this characterization, the sediment relocated to the upland area may be suitable for beneficial reuse, or may be placed in a containment cell and covered to reduce risk. The wetlands would be backfilled to original elevation with imported fill sediment and wetlands habitat restored to target criteria. ICs would prevent sensitive uses in areas that do not warrant unrestricted reuse and exposure and provide for maintenance of remedy. Long-term monitoring, maintenance, and reporting would be required.	Eliminates exposure pathways to ecological receptors by relocating impacted sediment to an upland area devoid of ecological habitat. Prevents sensitive receptor exposure to sediment/soil.
Wetland Sediment	W3 – Institutional Controls, Excavation, and Off-site Disposal	Removal and ICs	Sediment in the TTZ would be excavated, approximately 4,000 CY. The wetlands would be backfilled to original elevation with imported fill sediment and wetlands habitat would be restored to target criteria. The removed sediment would be disposed of off site at a permitted facility. ICs would prevent sensitive uses in areas that do not warrant unrestricted reuse and exposure and provide for maintenance of remedy. Long-term monitoring, maintenance, and reporting would be required.	Eliminates exposure pathways by removing the contaminated sediment off-site. Prevents sensitive receptor exposure to sediment/soil.

Table ES-2. Summary of Remedial Alternatives

ARAR	Applicable or relevant and appropriate requirements
CY	Cubic yards
IA F1	Installation Area F1
ICs	Institutional Controls
RAOs	Remedial action objectives
TTZ	Target treatment zone

Table ES-3. Summary of Estimated Costs

Alternative Description	Remedial Design and Project Management	Capital Cost (Including Off-Site Disposal)	30-Year O&M Cost	Total Cost (Capital Cost Plus 30-Year O&M)	Present Value Cost
Alternative 1: No Action	$0	$0	$0	$0	$0
Upland Alternatives					
Alternative U2: Institutional Controls and Asphalt Capping	$108,000	$ 414,000	$1,080,000	$1,602,000	$1,428,000
Alternative U3: Institutional Controls, Excavation, and Off-Site Disposal	$165,000	$831,000	$900,000	$1,896,000	$1,745,000
Wetland Alternatives					
Alternative W2: Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland	$525,000	$2,021,000	$240,000	$2,787,000	$2,736,000
Alternative W3: Institutional Controls, Excavation, and Off-Site Disposal	$409,000	$2,088,000	$60,000	$2,557,000	$2,533,000

Itemized costs for each alternative are shown in Tables E-1 through E-4.

All costs for land-use ICs preventing sensitive uses are incorporated into Alternatives U2 and U3.

O&M Operation and maintenance

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Table ES-4. Upland Remedial Alternatives Rankings for NCP Criteria

Alternatives	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short-Term Effectiveness	Implementability	Total Cost ($Million)	Overall Rating by Alternative
Alternative 1: No Action	Non-Protective	NA	○	○	●	●	● ($0)	○
Alternative U2: Institutional Controls and Asphalt Capping	Protective	Yes	◑	○	◑	●	◑ ($1.60)	◑
Alternative U3: Institutional Controls, Excavation, and Off-Site Disposal	Protective	Yes	●	○	◔	●	◑ ($1.90)	◕

ARAR applicable or relevant and appropriate requirements
NA not applicable
NCP National Oil and Hazardous Substances Pollution Contingency Plan

Legend:

○ Poor
◔ Marginal
◑ Good
◕ Very Good
● Excellent

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Table ES-5. Wetland Remedial Alternatives Ranking for NCP Criteria

Alternatives	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through Treatment	Short Term Effectiveness	Implementability	Total Cost ($Million)	Overall Rating by Alternative
Alternative 1: No Action	Non-Protective	NA	○	○	●	●	● ($0)	○
Alternative W2: Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland	Protective	Yes	◕	○	◔	◑	◑ ($2.79)	◑
Alternative W3: Institutional Controls, Excavation, and Off-Site Disposal	Protective	Yes	●	○	◔	◕	◑ ($2.56)	◕

ARAR applicable or relevant and appropriate requirements
NA not applicable
NCP National Oil and Hazardous Substances Pollution Contingency Plan

Legend:

○ Poor
◔ Marginal
◑ Good
◕ Very Good
● Excellent

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Table ES-6. Institutional Controls

Subarea	Receptors Considered in HHRA and ERA	Sensitive Uses	Contaminants Driving Site Decisions	Is Unrestricted Reuse Feasible?	Restrictions to Protect Future Receptors	Are ICs Protective of Future Use?
Upland Areas						
Subarea 1 Future Use: Mixed Industrial	**Human Receptors** • Hypothetical Resident, Industrial/Commercial Worker and Construction Worker • Beneficial use exception for shallow groundwater received. **Eco Receptors** • Plants, Invertebrates, Birds, Mammals	**Groundwater Use** • Beneficial use exception for shallow groundwater received. **Land Uses** Examples of Sensitive Land Uses may include: • Residential use • A hospital for humans • A school for persons under 18 years of age • A day care facility for children • Formation of open space or ecological habitat (Subarea 4 and future industrial reuse portions of Subarea 5)	**Soil** – None **Groundwater –** Residual Impacts	**Yes - Soil.** Surface and subsurface soil do not pose an unacceptable risk to sensitive or ecological receptors. **No - GW.** Beneficial use exception for shallow groundwater received.	NFA appropriate for surface and subsurface soil.	**Yes**
Subarea 2 Future Use: Mixed Industrial			**Soil** – None **Groundwater –** Residual Impacts	**Yes - Soil.** Surface and subsurface soil do not pose an unacceptable risk to sensitive or ecological receptors. **No - GW.** Beneficial use exception for shallow groundwater received.	NFA appropriate for surface and subsurface soil.	**Yes**
Subarea 3 Future Use: Mixed Industrial			**Lead** exceeds modified residential CHHSL. Carcinogenic risk to a hypothetical future resident is 1E-4 driven by vinyl chloride in soil and groundwater (nonpotable).	**No.** EPC for lead exceeds the modified residential CHHSL in Subarea 3. Carcinogenic risk to a hypothetical future resident is 1E-4 driven by vinyl chloride in soil and groundwater (nonpotable). Beneficial use exception for shallow groundwater received.	ICs to prevent sensitive land uses at Subarea 3.	**Yes**
Subarea 4 Future Use: Mixed Industrial			**Lead** near Building A75 exceeds modified industrial and residential CHHSL. Carcinogenic risk to a hypothetical future resident is 2E-5 driven by dioxins and benzo(a)pyrene in soil.	**No.** EPC for lead in Subarea 4 exceeds the modified residential CHHSL, and a hotspot near Building A75 exceeds the industrial CHHSL for lead. Carcinogenic risk to a hypothetical future resident is 2E-5 driven by dioxins and benzo(a)pyrene in soil. Beneficial use exception for shallow groundwater received.	ICs to prevent sensitive land uses. Further action needed to meet future land use at Subarea 4.	**Partially.** Outside TTZ, yes. Active remediation evaluated for TTZ.
Subarea 5 Future Use: Mixed Industrial and Regional Park			**Lead** near Building A17 exceeds modified industrial and residential CHHSL. **Lead** near Building A17 poses a potential risk to future ecological receptors.[1]	**No.** EPC for lead for Subarea 5 exceeds the modified residential CHHSL, but not the modified industrial CHHSL. Residential exposure parameters for lead are conservative relative to recreational exposure parameters. Lead near Building A17 poses a potential risk to future ecological receptors. Beneficial use exception for shallow groundwater received.	ICs to prevent sensitive land uses. Further action needed to meet future land uses at Subarea 5.	**Partially.** Outside TTZ, yes. Active remediation evaluated for TTZ.
Subarea 7 Future Use: Mixed Industrial			**Soil** – None **Groundwater –** Residual Impacts	**Yes - Soil.** Surface and subsurface soil do not pose an unacceptable risk to sensitive or ecological receptors. **No - GW**. Beneficial use exception for shallow groundwater received.	NFA appropriate for surface and subsurface soil.	**Yes**

Table ES-6. Institutional Controls

Subarea	Receptors Considered in HHRA and ERA	Sensitive Uses	Contaminants Driving Site Decisions	Is Unrestricted Reuse Feasible?	Restrictions to Protect Future Receptors	Are ICs Protective of Future Use?
Wetland Areas						
Subarea 6 Future Use: Conservation Area	**Human Receptor** • Recreational Receptor • Beneficial use exception for shallow groundwater received **Eco Receptors** • Plants, Invertebrates, Birds, Mammals, Individual SMHM	See above	**Barium, Copper, Lead and Zinc** based on potential risk to ecological receptors.[2]	**No**. Unacceptable risk exists to ecological receptors. Residential reuse incompatible with wetlands. Beneficial use exception for shallow groundwater received	ICs to prevent sensitive land uses. Further action needed based on potential ecological risk at Subarea 6.	**Partially.** Outside TTZ, yes. Active remediation evaluated for TTZ.
Sites with USTs and Other Petroleum Features at IA F1	UST closure letters for IA F1: Water Board. 2004. "Closure Letter and Site Summary for Six Underground Storage Tanks at the Former Mare Island Naval Shipyard, Vallejo, California." December 22. Water Board. 2011a. "No Further Action for UST A-225, Mare Island Naval Shipyard, Vallejo, Solano County, Water Board Case No. 48D9242." January 24. Water Board. 2012. "No Further Action for UST A266S, Former Mare Island Naval Shipyard, Vallejo, Solano County." May 4.					

1. Most sensitive ecological receptor is Western Meadowlark
2. Most sensitive ecological receptor is SMHM

CHHSL – California Human Health Screening Level
EPC – exposure point concentrations
ERA – Ecological Risk Assessment
GW – groundwater
HHRA – Human Health Risk Assessment
ICs – institutional controls
NFA – no further action
RI – Remedial Investigation
SMHM – salt marsh harvest mouse
TTZ – target treatment zone
UST – underground storage tank

Table ES-7. Proposed TTZs Summary

TTZ	Subarea	Media	Contaminant	Targeted Receptor	Preliminary Remedial Goals	Target Treatment Zone	Remedial Alternatives
Upland Areas							
Area A75	Subarea 4	Soil	Lead	Industrial Worker	Preliminary RG for lead of 345.6 mg/kg, in accordance with the risk-based human health EPC. Ecological risk was not considered in development of RGs for Subarea 4 because both the current land use and the planned future land use are industrial in this area and a complete exposure pathway to ecological receptors is not anticipated.	The estimated volume of contaminated soil in the A75 TTZ is 1,000 yd^3 based on a contamination area of 10,800 ft^2 to a depth of 2.5 feet bgs. TTZ areas for A75 are well delineated.	1 – No Action U2 – Institutional Controls and Asphalt Cap U3 – Institutional Controls, Excavation, and Off-Site Disposal
Area A17	Subarea 5	Soil	Lead	Recreational Receptor (child) Western Meadowlark	Preliminary RG for lead of 105.6, based on the modified OEHHA residential CHHSL. Preliminary RG for lead of 205 mg/kg, in accordance with the value at which the HI equals 1 for the most sensitive vertebrate ecological receptor, the Western Meadowlark, using the high TRV. The stricter of the two (human health and ecological) was selected as the screening value. Both human health and ecological risk were considered in development of RGs because the planned future land use in this area is as a Regional Park, and both human and ecological receptors are anticipated.	The estimated volume of contaminated soil in the A17 TTZ is 250 yd^3 based on a contamination area of 2,700 ft^2 to a depth of 2.5 feet bgs. TTZ areas for A17 are well delineated.	1 – No Action U2 – Institutional Controls and Asphalt Cap U3 – Institutional Controls, Excavation, and Off-Site Disposal
Wetlands Area							
Northern Wetlands Area near Outfall 33	Subarea 6	Sediment	Barium Copper Lead Zinc	Salt Marsh Harvest Mouse	Preliminary RG for lead of 59 mg/kg, zinc of 230 mg/kg, and copper of 120 mg/kg, consistent with the Mare Island ambient fill concentrations. The concentration at which the HQ=1, low TRV for the most sensitive receptor, the endangered salt marsh harvest mouse, is lower than the ambient fill concentration, and therefore the ambient fill concentration has been adopted as the Preliminary RG for each of these metals. No ambient value for barium has been established for fill at Mare Island, however all but one of the barium results at Subarea 6 are within the range of ambient fill concentrations (166 to 314.4 mg/kg) established for barium at other naval installations in the Bay Area. No Preliminary RG has been established for barium. The lone elevated barium value falls within the TTZ for Subarea 6.	The total estimated volume of contaminated sediment in Subarea 6 is approximately 4,000 yd^3. The estimated volume of contaminated sediment based on a contaminated area of 38,350 ft^2 and a depth of 2.5 feet bgs.	1 – No Action W2 – Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland W3 – Institutional Controls, Excavation, and Off-Site Disposal

Notes:

CHHSL	California Human Health Screening Level
EPC	exposure point concentration
ft^2	square feet
HI	Hazard Index
HQ	Hazard Quotient
mg/kg	milligrams per kilograms
OEHHA	Office of Environmental Health Hazard Assessment
RG	remedial goal
TRV	toxicity reference value
TTZ	target treatment zone
yd^3	cubic yard

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Executive Summary Figures

Figure ES-1. Location Map

Figure ES-2. Target Treatment Zones Evaluated at IA F1

Figure ES-3. Site Features and Habitat Map

Figure ES-4. Future Land Reuse Zones

Figure ES-5. Subarea 4 Distribution of Lead in Soil and Target Treatment Zone Evaluated

Figure ES-6. Subarea 5 Distribution of Lead in Soil and Target Treatment Zone Evaluated

Figure ES-7. Subarea 6 Distribution of Barium, Copper, Lead, Molybdenum, and Zinc, and Target Treatment Zone Evaluated

Figure ES-A1. TPH Soil Sample Results in Subarea 1

Figure ES-A2. TPH Grab Groundwater Sample Results in Subarea 4

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LEGEND

Boundary of Former Mare Island Naval Shipyard

NOTE:
Environmental Systems Research Institute (ESRI)
USA Spatial Feature Classes

N

3.5 0 3.5 7
Miles

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FIGURE ES-1

LOCATION MAP

TREVET

DATE: SEPTEMBER 2015

CONTRACT NO.: N62473-12-C-4805

Path: N:\GIS_Projects\MareIsland\Figs_IAF1_RAA_9-15\ES-Versions\FigES1_SLM_Mare_9-15.mxd

Date: 9/11/2015

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Approximate Target Treatment Zone

- Lead in Soil - Subarea 4
- Lead in Soil - Subarea 5
- Metals in Sediment - Subarea 6

- Investigation Area F1
- Subarea Boundary
- 2007 - 2008 TCRA Excavation Area
- 2000 Excavation Area

- Removed Structure
- Building/Structure
- Road
- Site Feature

- Wetland
- Mudflat
- Water

Notes:
FS - Feasibility Study
IA - Investigation Area
TCRA - Time-Critical Removal Action
TPH -Total Petroleum Hydrocarbons
TTZ - Target Treatment Zone

GRAPHIC SCALE
0 150 300 600
(IN FEET)
1 INCH = 300 FEET

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FIGURE ES-2

TARGET TREATMENT ZONES EVALUATED AT IA F1

DATE: SEPTEMBER 2015
CONTRACT NO.: N62473-12-C-4805

Date: 9/11/2015 Path: N:\GIS_Projects\MareIsland\Figs_IAF1_RAA_9-15\ES-Versions\FigES2_Remedial_Areas_9-15.mxd

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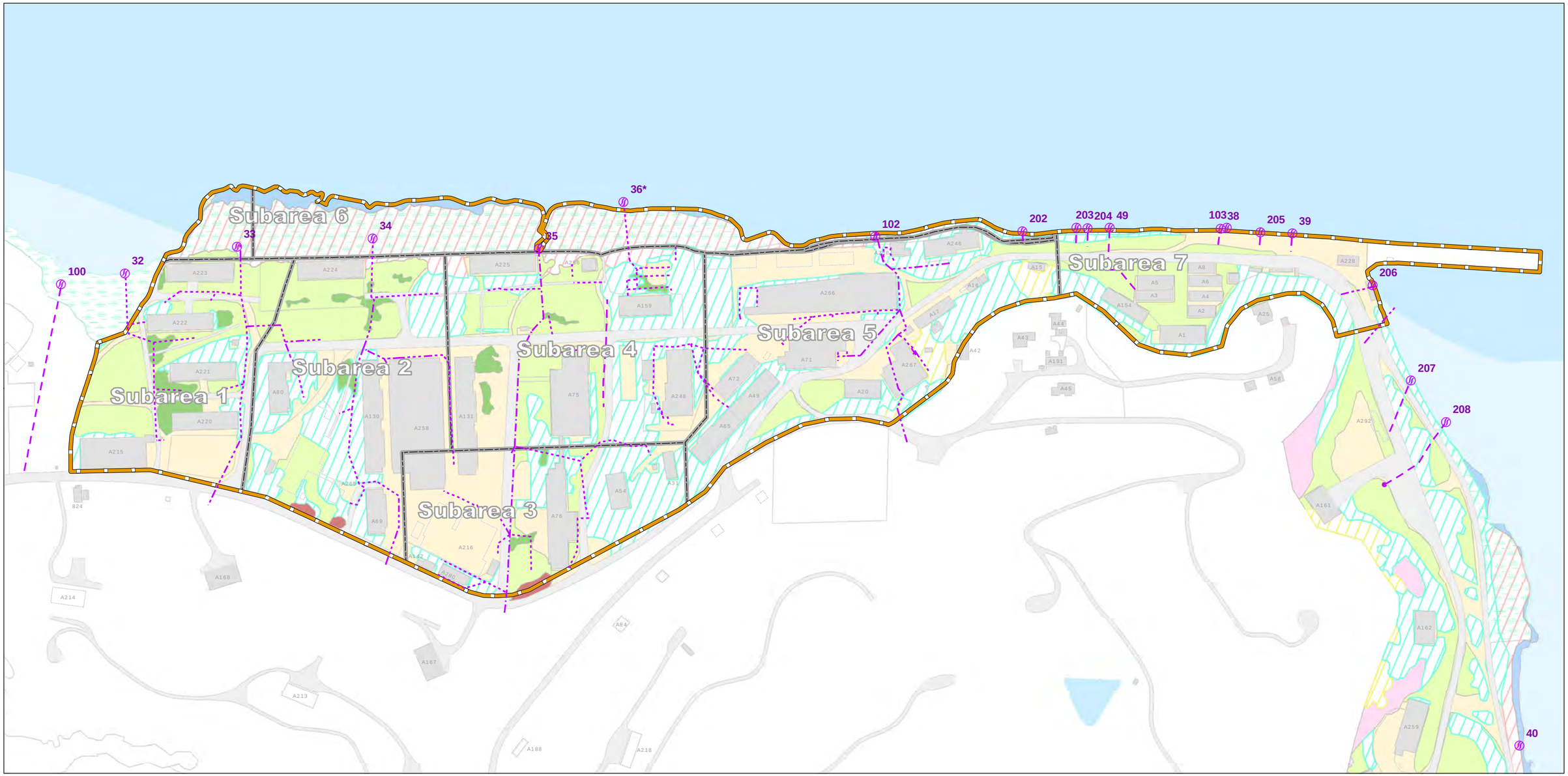

Outfall Number
36
Storm Water Outfall
Storm Drain

Removed Structure
Building/Structure
Road
Site Feature

Wetland
Mudflat
Water

Coastal Salt Marsh Wetland
Grassland Depression
Coastal Live Oak Forest
Coastal Sage Scrub
Investigation Area F1
Subarea Boundary

Eucalyptus
Developed Area
Non-native Grassland

Ruderal Vegetation
Tidal Aquatic / Mudflat
Rip-rap

Notes:
* - Outfall 36 could not be located in the field.
IA - Investigation Area
TCRA - Time-Critical Removal Action

GRAPHIC SCALE
0 150 300 600
(IN FEET)
1 INCH = 300 FEET

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FIGURE ES-3

SITE FEATURES AND HABITAT MAP

TREVET

DATE: SEPTEMBER 2015

CONTRACT NO.: N62473-12-C-4805

Date: 9/11/2015 Path: N:\GIS_Projects\MareIsland\Figs_IAF1_RAA_9-15\ES-Versions\FigES3_Habitats_9-15.mxd

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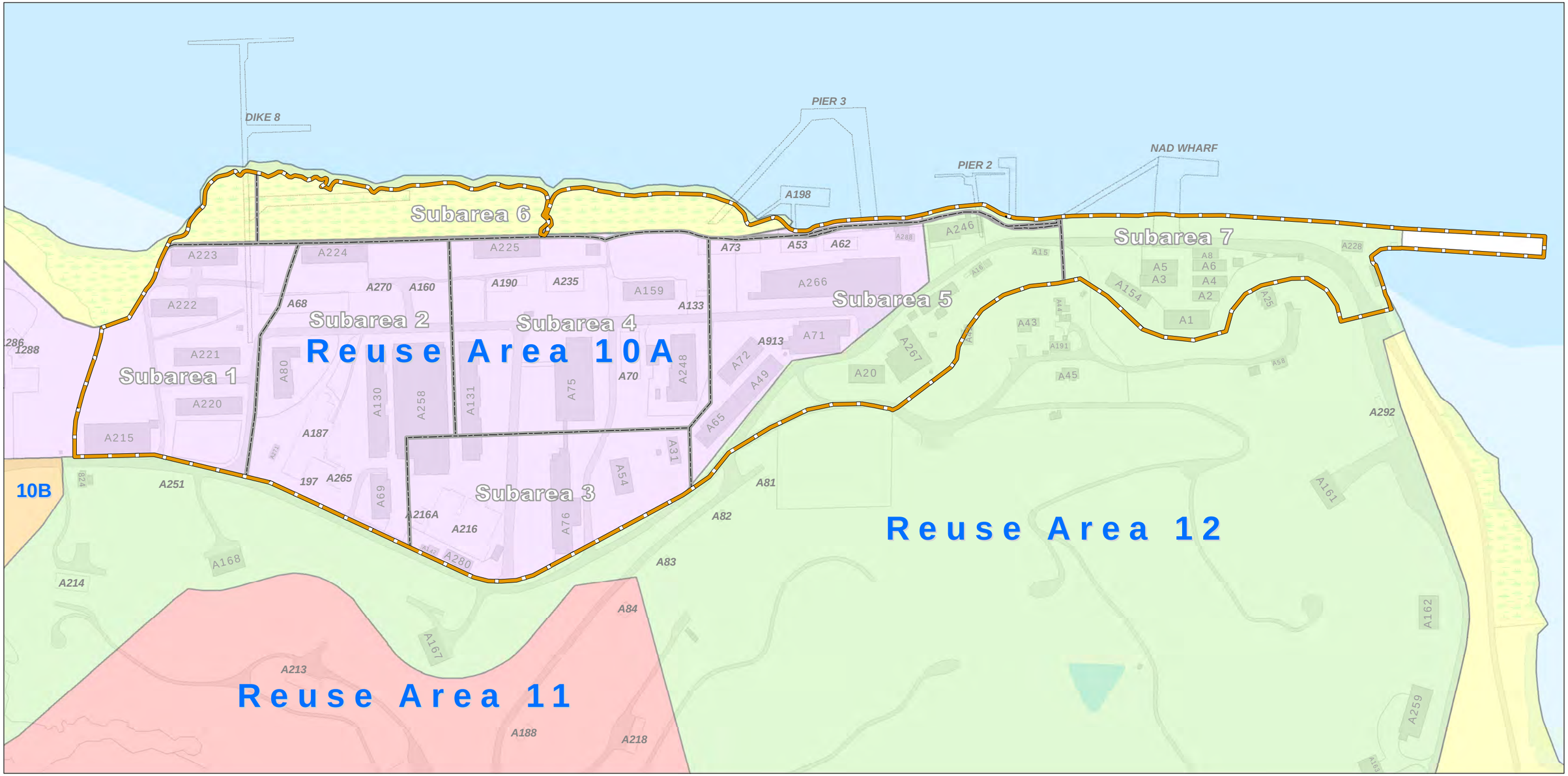

Reuse Areas
- 10A (Mixed Industrial)
- 10B (Army Reserve)
- 11 (Golf Course)
- 12 (Regional Park)
- Open Space Conservation Area

- Subarea Boundary
- Wetland
- Mudflat
- Water
- Removed Structure

- Building/Structure
- Road
- Site Feature

GRAPHIC SCALE
0 150 300 600
(IN FEET)
1 INCH = 300 FEET

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FIGURE ES-4

FUTURE LAND REUSE ZONES

TREVET

DATE: SEPTEMBER 2015

CONTRACT NO.: N62473-12-C-4805

Date: 9/11/2015 Path: N:\GIS_Projects\MareIsland\Figs_IAF1_RAA_9-15\ES-Versions\FigES4_FutureLand_9-15.mxd

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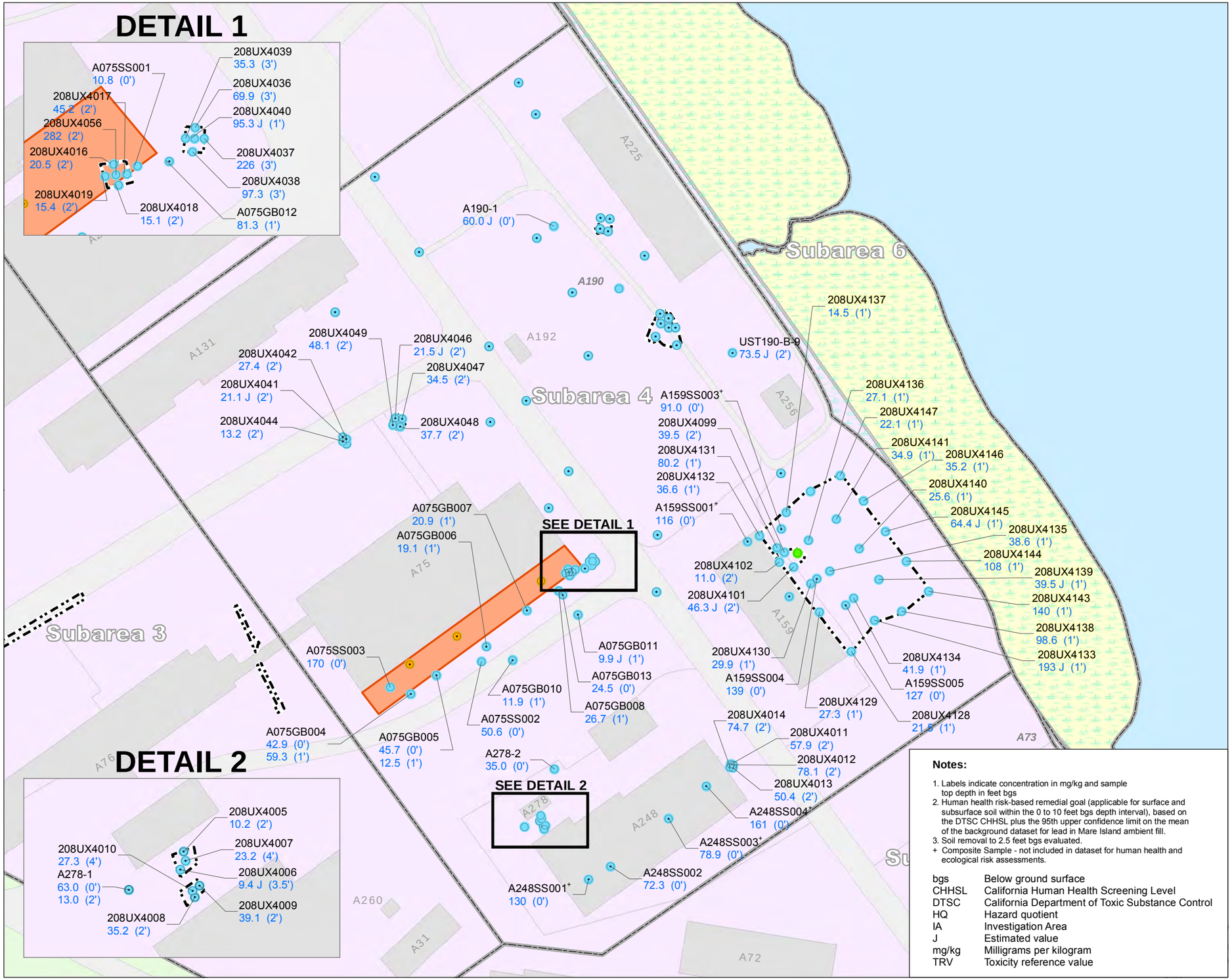

LEGEND

Lead Concentration in Soil Sample[1]

- Not Detected (ND)
- < 345.6[2] mg/kg
- > 345.6[2] mg/kg
- Soil Sample Location
- Soil Boring Location
- Subarea Boundary
- Proposed Target Treatment Zone Evaluated[3]
- 2000 Excavation Area
- Reuse Area-10A (Mixed Industrial)
- Reuse Area-12 (Regional Park)
- Reuse Area-Open Space Conservation Area
- Removed Structure
- Building/Structure
- Wetland
- Road
- Mudflat
- Site Feature
- Water

GRAPHIC SCALE

0 50 100 200

Feet

(IN FEET)
1 INCH = 100 FEET

Notes:

1. Labels indicate concentration in mg/kg and sample top depth in feet bgs
2. Human health risk-based remedial goal (applicable for surface and subsurface soil within the 0 to 10 feet bgs depth interval), based on the DTSC CHHSL plus the 95th upper confidence limit on the mean of the background dataset for lead in Mare Island ambient fill.
3. Soil removal to 2.5 feet bgs evaluated.

\+ Composite Sample - not included in dataset for human health and ecological risk assessments.

bgs	Below ground surface
CHHSL	California Human Health Screening Level
DTSC	California Department of Toxic Substance Control
HQ	Hazard quotient
IA	Investigation Area
J	Estimated value
mg/kg	Milligrams per kilogram
TRV	Toxicity reference value

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FIGURE ES-5

SUBAREA 4 DISTRIBUTION OF LEAD IN SOIL AND TARGET TREATMENT ZONE EVALUATED

TREVET

DATE: SEPTEMBER 2015

CONTRACT NO.: N62473-12-C-4805

Date: 9/11/2015 Path: N:\GIS_Projects\MareIsland\Figs_IAF1_RAA_9-15\ES-Versions\FigES5_Lead_Subarea4_9-15.mxd

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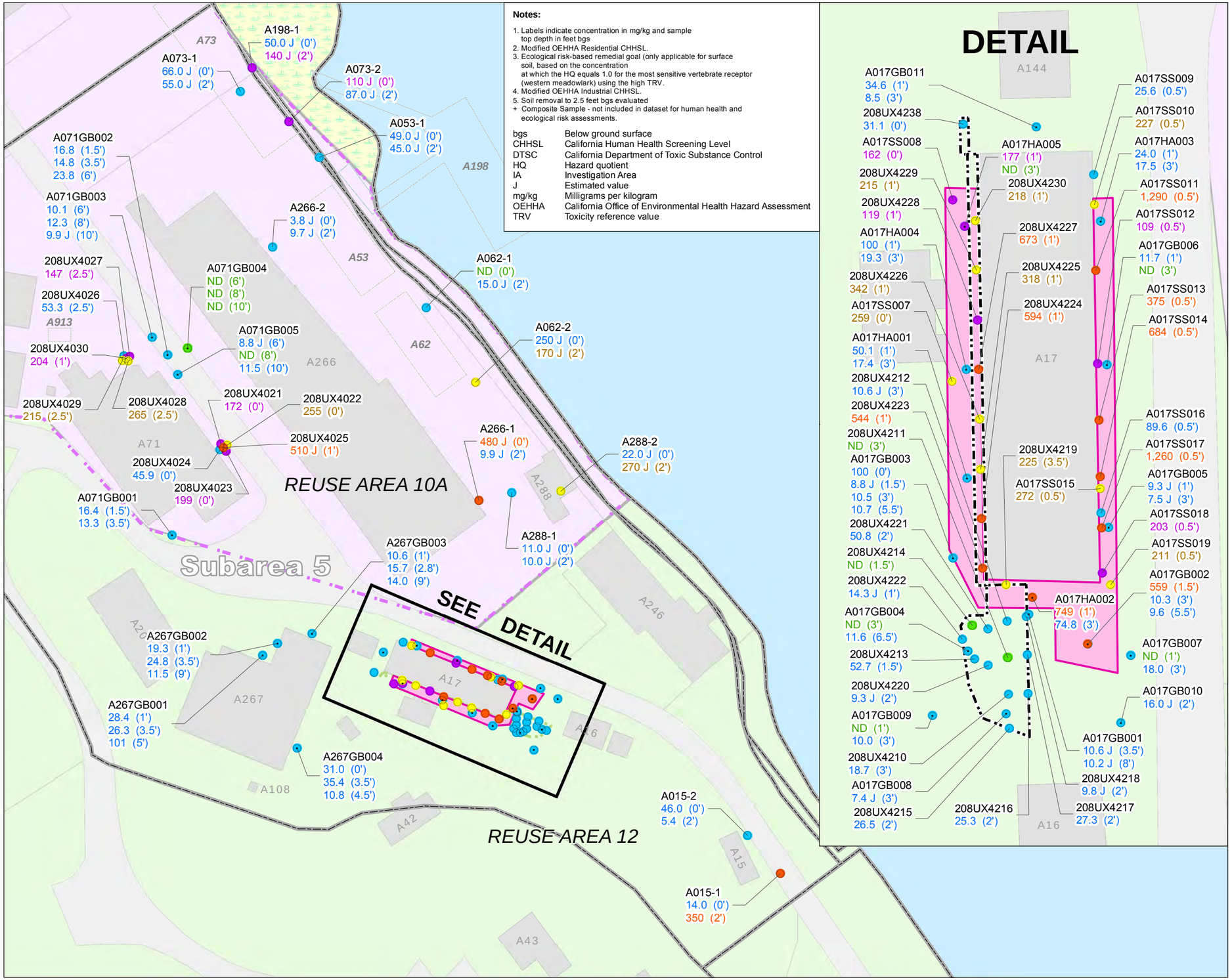

Notes:

1. Labels indicate concentration in mg/kg and sample top depth in feet bgs
2. Modified OEHHA Residential CHHSL.
3. Ecological risk-based remedial goal (only applicable for surface soil, based on the concentration at which the HQ equals 1.0 for the most sensitive vertebrate receptor (western meadowlark) using the high TRV.
4. Modified OEHHA Industrial CHHSL.
5. Soil removal to 2.5 feet bgs evaluated

\+ Composite Sample - not included in dataset for human health and ecological risk assessments.

bgs	Below ground surface
CHHSL	California Human Health Screening Level
DTSC	California Department of Toxic Substance Control
HQ	Hazard quotient
IA	Investigation Area
J	Estimated value
mg/kg	Milligrams per kilogram
OEHHA	California Office of Environmental Health Hazard Assessment
TRV	Toxicity reference value

LEGEND

Lead Concentration in Soil Sample[1]

- Non Detect (ND)
- < 105.6[2] mg/kg
- 105.6[2] - 205[3] mg/kg
- 205[3]- 345.6[4] mg/kg
- > 345.6[4] mg/kg
- Soil Sample Location
- Soil Boring Location
- Subarea Boundary
- Proposed Treatment Target Zone[5]
- 2000 Excavation Area
- Reuse Area-10A (Mixed Industrial)
- Reuse Area-12 (Regional Park)
- Reuse Area-Open Space Conservation Area
- Removed Structure
- Building/Structure
- Road
- Site Feature
- Wetland
- Mudflat
- Water

GRAPHIC SCALE

0 50 100 200

Feet

(IN FEET)
1 INCH = 100 FEET

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FIGURE ES-6

SUBAREA 5 DISTRIBUTION OF LEAD IN SOIL AND TARGET TREATMENT ZONE EVALUATED

TREVET

DATE: SEPTEMBER 2015

CONTRACT NO.: N62473-12-C-4805

Date: 9/11/2015 Path: N:\GIS_Projects\MareIsland\Figs_IAF1_RAA_9-15\ES-Versions\FigES6_Lead_Subarea5_9-15.mxd

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Results for samples 0-2 feet bgs associated with Outfalls 33, 34, 35, 102 and 202. Not evaluated in the IA F1 ERA performed during the RI because considered part of IA K.

Location ID	Top Depth (feet bgs)	Bottom Depth (feet bgs)	Analyte	Result	Qualifier	Remedial Goal[1] (mg/kg)
SM033-01	0	0.5	Barium	58.3		NE[4]
SM033-01	0	0.5	Copper	42.9	J	120
SM033-01	0	0.5	Lead	66.9		59
SM033-01	0	0.5	Molybdenum	4.12	J	NE
SM033-01	0	0.5	Zinc	1870	J	230
SM033-01A	0	0.5	Barium	126		NE[4]
SM033-01A	0	0.5	Copper	42.9		120
SM033-01A	0	0.5	Lead	69.3		59
SM033-01A	0	0.5	Molybdenum	1.58		NE
SM033-01A	0	0.5	Zinc	483	J	230
SM033-01A	0.5	1.5	Barium	591		NE[4]
SM033-01A	0.5	1.5	Copper	37.8		120
SM033-01A	0.5	1.5	Lead	60.5		59
SM033-01A	0.5	1.5	Molybdenum	0.971		NE
SM033-01A	0.5	1.5	Zinc	377	J	230
SM034-01	0	0.5	Barium	58.3		NE[4]
SM034-01	0	0.5	Copper	52.6		120
SM034-01	0	0.5	Lead	28.1		59
SM034-01	0	0.5	Molybdenum	1.36	J	NE
SM034-01	0	0.5	Zinc	136	J	230
SM034-01A	0	1	Barium	65.9		NE[4]
SM034-01A	0	1	Copper	76.9		120
SM034-01A	0	1	Lead	40.2		59
SM034-01A	0	1	Molybdenum	1.63		NE
SM034-01A	0	1	Zinc	201	J	230
SM034-01A	1	6	Barium	76.8		NE[4]
SM034-01A	1	6	Copper	71.6		120
SM034-01A	1	6	Lead	53.1		59
SM034-01A	1	6	Molybdenum	1.28		NE
SM034-01A	1	6	Zinc	266	J	230
SM035-01	0	0.5	Barium	90.5		NE[4]
SM035-01	0	0.5	Copper	61.4	J	120
SM035-01	0	0.5	Lead	35.7		59
SM035-01	0	0.5	Molybdenum	0.6	J	NE
SM035-01	0	0.5	Zinc	148	J	230
SM035-01A	0	0.5	Barium	115		NE[4]
SM035-01A	0	0.5	Copper	48.8		120
SM035-01A	0	0.5	Lead	27.8		59
SM035-01A	0	0.5	Molybdenum	0.857	J	NE
SM035-01A	0	0.5	Zinc	113	J	230
SM035-01A	0.5	1.5	Barium	45.3		NE[4]
SM035-01A	0.5	1.5	Copper	30.1		120
SM035-01A	0.5	1.5	Lead	11.2		59
SM035-01A	0.5	1.5	Molybdenum	0.553	J	NE
SM035-01A	0.5	1.5	Zinc	76.4	J	230

Location ID	Top Depth (feet bgs)	Bottom Depth (feet bgs)	Analyte	Result	Qualifier	Remedial Goal[1] (mg/kg)
SM102	0	0	Barium	55.1		NE[4]
SM102	0	0	Copper	17.9		120
SM102	0	0	Lead	25.7	J	59
SM102	0	0	Molybdenum	0.27	J	NE
SM102	0	0	Zinc	50	J	230
SM102-01	0	1	Barium	170		NE[4]
SM102-01	0	1	Copper	87.1		120
SM102-01	0	1	Lead	146		59
SM102-01	0	1	Molybdenum	0.809		NE
SM102-01	0	1	Zinc	256	J	230
SM102-01	1	6	Barium	200		NE[4]
SM102-01	1	6	Copper	52.3		120
SM102-01	1	6	Lead	20.3		59
SM102-01	1	6	Molybdenum	1.39		NE
SM102-01	1	6	Zinc	104	J	230
SM44o	0	0.5	Barium	141	J	NE[4]
SM44o	0	0.5	Copper	47.7	J	120
SM44o	0	0.5	Copper	18.2	J	120
SM44o	0	0.5	Lead	61.8	J	59
SM44o	0	0.5	Lead	39.6	J	59
SM44o	0	0.5	Molybdenum	0.19	J	NE
SM44o	0	0.5	Zinc	1790	J	230
SM44o	0	0.5	Zinc	1850	J	230
SM45o	0	0.5	Barium	80.9	J	NE[4]
SM45o	0	0.5	Copper	67.7	J	120
SM45o	0	0.5	Copper	28.2	J	120
SM45o	0	0.5	Lead	40.5	J	59
SM45o	0	0.5	Lead	28.4	J	59
SM45o	0	0.5	Molybdenum	0.32	UJ	NE
SM45o	0	0.5	Zinc	187	J	230
SM45o	0	0.5	Zinc	105	J	230
SM46o	0	0.5	Barium	94	J	NE[4]
SM46o	0	0.5	Copper	85.8	J	120
SM46o	0	0.5	Lead	149	J	59
SM46o	0	0.5	Molybdenum	0.32	UJ	NE
SM46o	0	0.5	Zinc	210	J	230
SM49o	0	0.5	Barium	33.1	J	NE[4]
SM49o	0	0.5	Copper	17.8	J	120
SM49o	0	0.5	Copper	11.3	J	120
SM49o	0	0.5	Lead	23.4	J	59
SM49o	0	0.5	Lead	12.6	J	59
SM49o	0	0.5	Molybdenum	0.15	UJ	NE
SM49o	0	0.5	Zinc	52.8	J	230
SM49o	0	0.5	Zinc	21.8	J	230

Results for Samples Evaluated in IA-F1 RI

Location ID	Top Depth (feet bgs)	Bottom Depth (feet bgs)	Analyte	Result	Qualifier	Remedial Goal[1] (mg/kg)
A053-2	0	2	Barium	130	J	NE[4]
A053-2	0	2	Copper	44	J	120
A053-2	0	2	Lead	22	J	59
A053-2	0	2	Molybdenum	2.8		NE
A053-2	0	2	Zinc	74	J	230
A053-2	2	4	Barium	94	J	NE[4]
A053-2	2	4	Copper	38	J	NE
A053-2	2	4	Lead	13	J	NE
A053-2	2	4	Molybdenum	1.5		NE
A053-2	2	4	Zinc	130	J	NE
A198-2	0	2	Barium	37	J	NE[4]
A198-2	0	2	Copper	46	J	120
A198-2	0	2	Lead	0.16	UJ	59
A198-2	0	2	Molybdenum	1.1	U	NE
A198-2	0	2	Zinc	57	J	230
A198-2	2	4	Barium	180	J	NE[4]
A198-2	2	4	Copper	59	J	NE
A198-2	2	4	Lead	17	J	NE
A198-2	2	4	Molybdenum	0.35	J	NE
A198-2	2	4	Zinc	88	J	NE
IR04SD003	0	0.5	Barium	55.5		NE[4]
IR04SD003	0	0.5	Copper	367		120
IR04SD003	0	0.5	Lead	95		59
IR04SD003	0	0.5	Molybdenum	3.5	J	NE
IR04SD003	0	0.5	Zinc	326		230
IR04SD003	2.5	3.25	Barium	143		NE[4]
IR04SD003	2.5	3.25	Copper	73.2		NE
IR04SD003	2.5	3.25	Lead	5.6		NE
IR04SD003	2.5	3.25	Molybdenum	1.4	U	NE
IR04SD003	2.5	3.25	Zinc	83.4		NE
IR04SD003	3	4.5	Barium	100		NE[4]
IR04SD003	3	4.5	Copper	26.4		NE
IR04SD003	3	4.5	Lead	2.2	U	NE
IR04SD003	3	4.5	Molybdenum	1.7	U	NE
IR04SD003	3	4.5	Zinc	49.8		NE

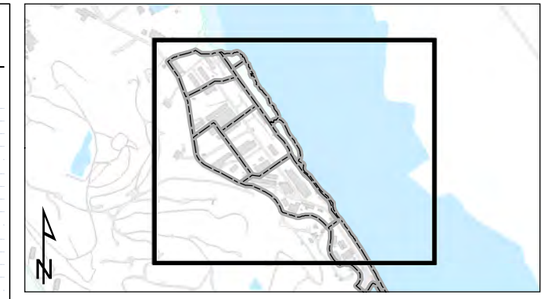
Location ID	Top Depth (feet bgs)	Bottom Depth (feet bgs)	Analyte	Result	Qualifier	Remedial Goal[1] (mg/kg)
IR04SD004	0	1.75	Barium	72.9		NE[4]
IR04SD004	0	1.75	Copper	126		120
IR04SD004	0	1.75	Lead	49.4		59
IR04SD004	0	1.75	Molybdenum	0.3	U	NE
IR04SD004	0	1.75	Zinc	201		230
IR04SD004	3	4.5	Barium	127		NE[4]
IR04SD004	3	4.5	Copper	186		NE
IR04SD004	3	4.5	Lead	92.8		NE
IR04SD004	3	4.5	Molybdenum	1.5	U	NE
IR04SD004	3	4.5	Zinc	288		NE
IR04SD004	4.75	6.25	Barium	70.9		NE[4]
IR04SD004	4.75	6.25	Copper	96.1		NE
IR04SD004	4.75	6.25	Lead	57.5		NE
IR04SD004	4.75	6.25	Molybdenum	0.32	UJ	NE
IR04SD004	4.75	6.25	Zinc	178		NE
SM036	0	0	Barium	65.8		NE[4]
SM036	0	0	Copper	64.6		120
SM036	0	0	Lead	82	J	59
SM036	0	0	Molybdenum	0.57	J	NE
SM036	0	0	Zinc	173	J	230
SM036-02	0	1	Barium	73.9		NE[4]
SM036-02	0	1	Copper	74.4	J	120
SM036-02	0	1	Lead	47.1		59
SM036-02	0	1	Molybdenum	0.92	UJ	NE
SM036-02	0	1	Zinc	163	J	230
SM036-02	1	6	Barium	77.2		NE[4]
SM036-02	1	6	Copper	73.7	J	120
SM036-02	1	6	Lead	33.2		59
SM036-02	1	6	Molybdenum	1.08	UJ	NE

NOTE:
Gray text = samples not in ERA performed during RI.
Black text = sample results included in the ERA

Notes:

bgs - Below Ground Surface
HQ - Hazard Quotient
IA - Investigation Area
J - Estimated Values
mg/kg - Milligrams per kilogram
NE - None Established
SL - Screening level
TCRA - Time-Critical Removal Action
TPH - Total Petroleum Hydrocarbons
TRV - Toxicity Reference Value
U - Not detected, detection limit estimated
UJ - Detection limit estimated

GRAPHIC SCALE
0 150 300 600
(IN FEET)
1 INCH = 300 FEET



LEGEND

- Sample location associated with IA FI which has chemical concentration above preliminary RGs
- Sample location associated with IA FI below preliminary RGs
- Sample location associated with Outfalls 33, 34, 35, 102, or 202
- Soil Boring
- Soil Sample Location
- Subarea Boundary
- Site Feature
- Removed Structure
- Wetland
- Building/Structure
- Mudflat
- Road
- Water
- Approximate Target Treatment Zone

Reuse Areas

- 10A (Mixed Industrial)
- 12 (Regional Park)
- 10B (Army Reserve)
- 11 (Golf Course)
- Open Space Conservation Area

Notes:

Red text = Sample results with 0-2 feet bgs depth interval that exceeds remedial goals

1.Ecological risk-based remedial goals are only applicable to soil between 0 and 2 feet bgs. The ecological risk-based remedial goal is based on the higher of the concentration at which the HQ equals 1 using the low TRV for the salt marsh harvest mouse, or the 95th percentile of the Mare Island ambient fill concentration. In each case the ambient concentration is higher. Remedial goals are not established for molybdenum because all values fall within the range identified for Mare Island Ambient Fill developed for IR Site 17 (ChaduxTt 2012b).
2.Location with data (Samples associated with Outfalls 33, 34, 35, 102, and 202) not included in the IA F1 human or ecological risk assessment datasets.
3.Samples not analyzed for metals. Analysis for TPH only.
4.Remedial goals not established for Barium. Barium background values for Mare Island Fill are not available. All but 1 of the Barium results are within the range of barium background concentrations for fill material at regional Bay Area Naval Installations.
5. Sediment removal to 2.5 feet bgs evaluates.
6. SM036 exceeds the preliminary RG for lead. Based on review of metals data, the exceedance does not appear to indicate widespread metals contamination. See Appendix B for more detail.
RGs – Remediation Goals

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IA F1 FEASIBILITY STUDY REPORT
FORMER MARE ISLAND NAVAL SHIPYARD
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FIGURE ES-7

SUBAREA 6 DISTRIBUTION OF BARIUM, COPPER, LEAD, MOLYBDENUM, AND ZINC, AND TARGET TREATMENT ZONE EVALUATED

TREVET

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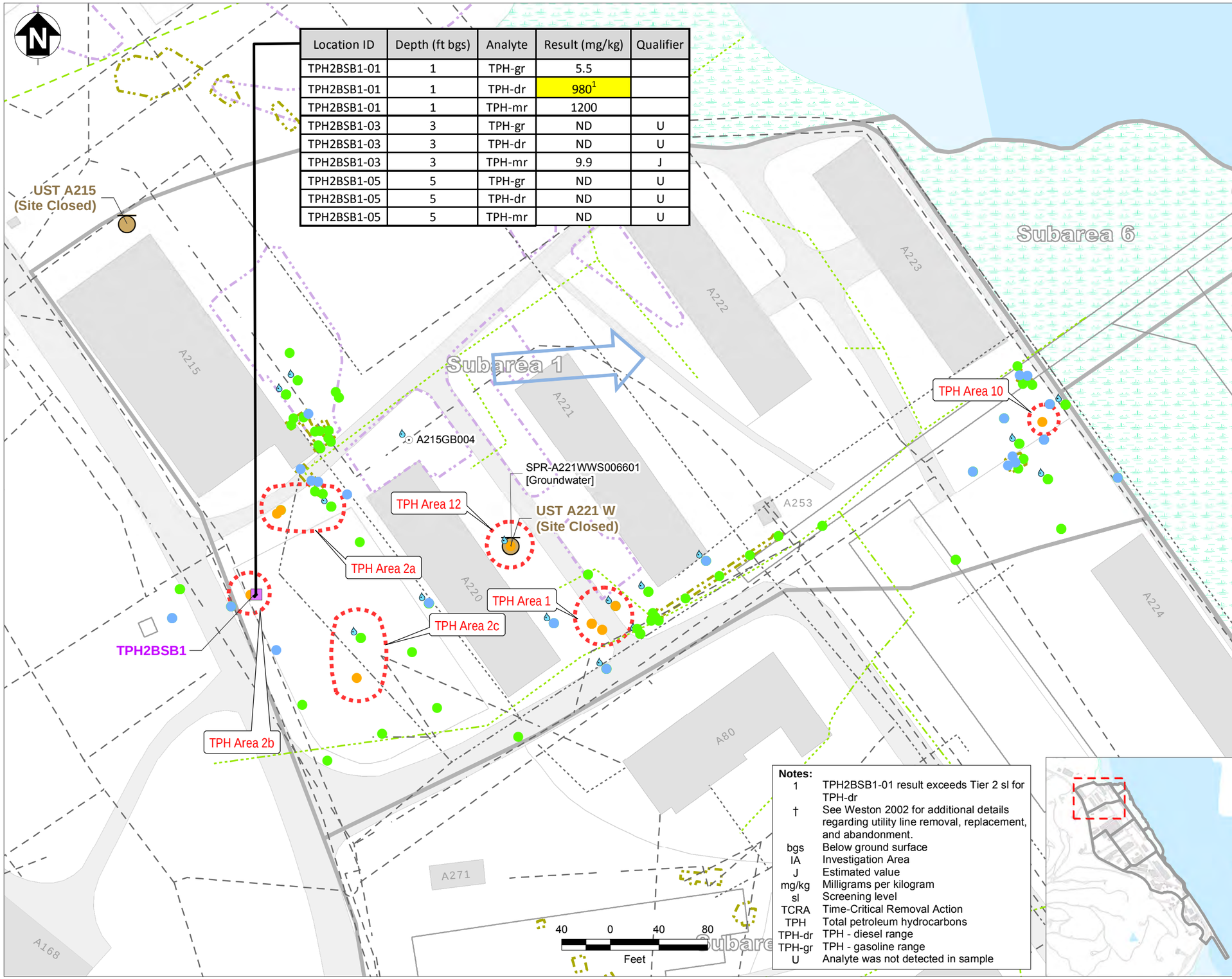
Location ID	Depth (ft bgs)	Analyte	Result (mg/kg)	Qualifier
TPH2BSB1-01	1	TPH-gr	5.5	
TPH2BSB1-01	1	TPH-dr	980[1]	
TPH2BSB1-01	1	TPH-mr	1200	
TPH2BSB1-03	3	TPH-gr	ND	U
TPH2BSB1-03	3	TPH-dr	ND	U
TPH2BSB1-03	3	TPH-mr	9.9	J
TPH2BSB1-05	5	TPH-gr	ND	U
TPH2BSB1-05	5	TPH-dr	ND	U
TPH2BSB1-05	5	TPH-mr	ND	U



Approximate TPH Area boundary, TPH-dr in soil

Approximate TPH Area boundary, other TPH compound in soil

Soil Sample Location

Maximum TPH-dr Concentration

- Not Detected (ND) for TPH-dr
- Below Industrial Comparison Criterion for TPH-dr (<=500 mg/kg)
- Above Industrial Comparison Criterion for TPH-dr (>500 mg/kg)

Groundwater Result(s) Available

- Underground Utility Line
- Replaced Line†
- Line Abandoned in Place†
- Removed Line†

Storm drain lines in green.

Underground Storage Tank Site

Subarea Boundary

Weston 2000 Excavation Area

2007 - 2008 TCRA Excavation Area

Approximate Groundwater Flow Direction (August 2003)

Building/Structure

Road

Site Feature

Wetland

Mudflat

Water

Notes:

1	TPH2BSB1-01 result exceeds Tier 2 sl for TPH-dr
†	See Weston 2002 for additional details regarding utility line removal, replacement, and abandonment.
bgs	Below ground surface
IA	Investigation Area
J	Estimated value
mg/kg	Milligrams per kilogram
sl	Screening level
TCRA	Time-Critical Removal Action
TPH	Total petroleum hydrocarbons
TPH-dr	TPH - diesel range
TPH-gr	TPH - gasoline range
U	Analyte was not detected in sample

Reference:
ChaduxTt. 2012. Final Remedial Investigation Report, Installation Restoration Program Sites Within Investigation Area F1, Former Mare Island Naval Shipyard, Vallejo, California. September 28

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FIGURE ES-A1

TPH-dr SOIL SAMPLE RESULTS IN SUBAREA 1

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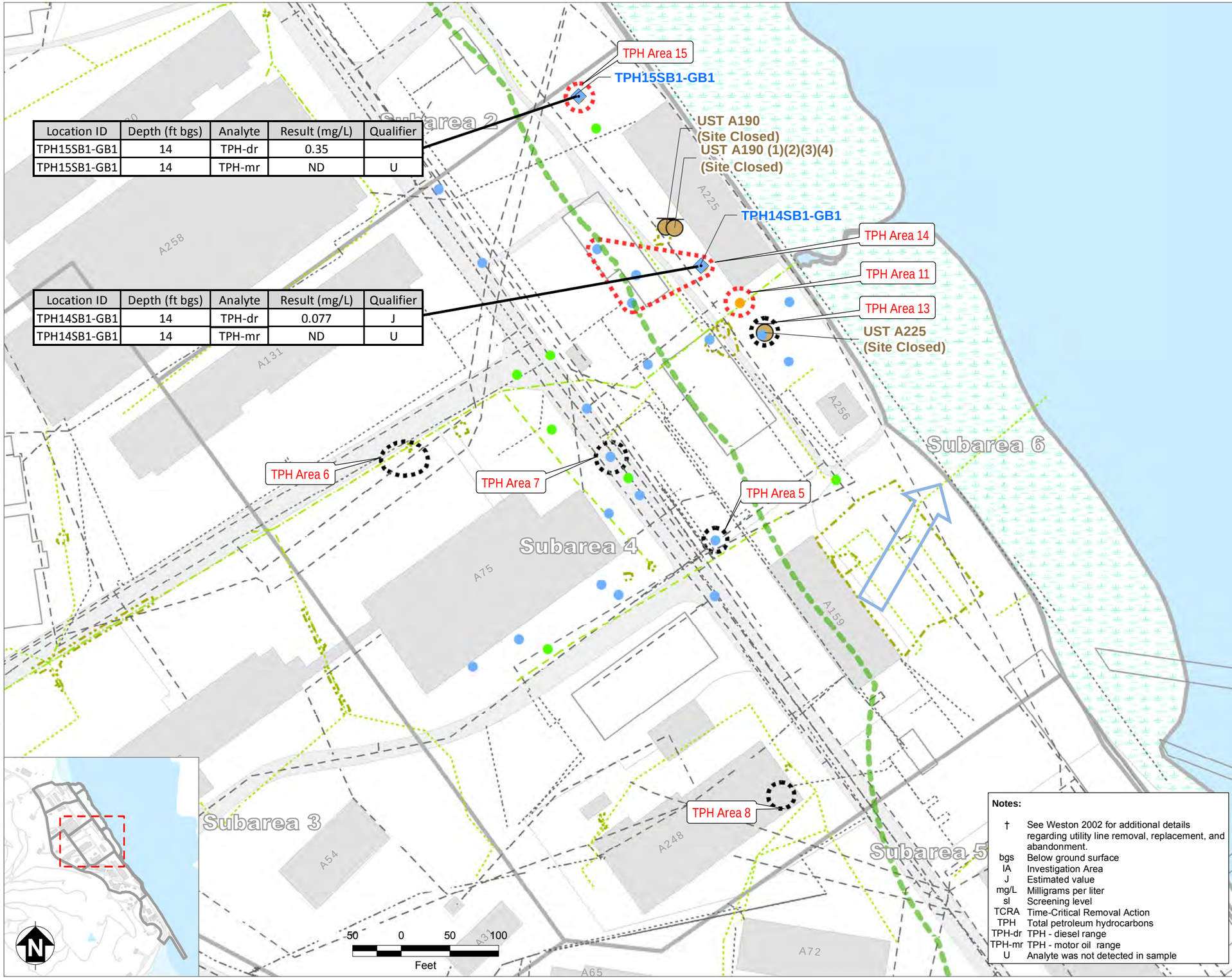

Location ID	Depth (ft bgs)	Analyte	Result (mg/L)	Qualifier
TPH15SB1-GB1	14	TPH-dr	0.35	
TPH15SB1-GB1	14	TPH-mr	ND	U

Location ID	Depth (ft bgs)	Analyte	Result (mg/L)	Qualifier
TPH14SB1-GB1	14	TPH-dr	0.077	J
TPH14SB1-GB1	14	TPH-mr	ND	U

Approximate TPH Area boundary, TPH-dr in soil

Approximate TPH Area boundary, TPH-dr in groundwater

Grab Groundwater Location

TPH-dr Results

- Not Detected (ND) for TPH-dr
- Below Tier 2 sl for TPH-dr for Locations Inland of the Buffer Zone for Aquatic Receptors (<=5 mg/L) or for Locations Within the Buffer Zone (<=0.64 mg/L)
- Above Tier 2 sl for TPH-dr for Locations Inland (>5 mg/L) or Within the Buffer Zone (>0.64 mg/L)

Underground Storage Tank Site

Underground Utility Line

Replaced Line†

Line Abandoned in Place†

Removed Line†

Storm drain lines in green.

Subarea Boundary

Weston 2000 Excavation Area

2007 - 2008 TCRA Excavation Area

300-Foot Buffer Zone for Aquatic Receptors

Approximate Groundwater Flow Direction (August 2003)

Building/Structure

Wetland

Road

Mudflat

Site Feature

Water

Reference:
ChaduxTt. 2012. Final Remedial Investigation Report, Installation Restoration Program Sites Within Investigation Area F1, Former Mare Island Naval Shipyard, Vallejo, California. September 28

Notes:

†	See Weston 2002 for additional details regarding utility line removal, replacement, and abandonment.
bgs	Below ground surface
IA	Investigation Area
J	Estimated value
mg/L	Milligrams per liter
sl	Screening level
TCRA	Time-Critical Removal Action
TPH	Total petroleum hydrocarbons
TPH-dr	TPH - diesel range
TPH-mr	TPH - motor oil range
U	Analyte was not detected in sample

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FIGURE ES-A2

TPH-dr GRAB GROUNDWATER SAMPLE RESULTS IN SUBAREA 4

TREVET

DATE: SEPTEMBER 2015

CONTRACT NO.: N62473-12-C-4805

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Section 1 Introduction

This feasibility study (FS) was prepared for the Base Realignment and Closure Program Management Office West Naval Facilities Engineering Command under Contract Number N62473-12-C-4805. This FS pertains to Investigation Area (IA) F1, located in the southeastern portion of the former Mare Island Naval Shipyard (MINS or Mare Island) in the City of Vallejo, in Solano County, California about 25 miles northeast of San Francisco (Figure 1). This FS develops and evaluates remedial alternatives for soil, sediment, and groundwater to address potential human health and ecological risks identified in the Final Remedial Investigation (RI) Report for IA F1 (ChaduxTt 2012a). This FS also evaluates findings from additional sampling completed to fill data gaps pertaining to total petroleum hydrocarbons (TPH) in site areas designated as TPH Areas 2b, 14, and 15.

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980 and the Superfund Amendments and Reauthorization Act of 1986 established a phased approached for investigation and cleanup of hazardous materials disposal and release sites nationwide. The United States Department of the Navy (DON) created the Installation Restoration (IR) Program in 1983 with the primary objective to clean up past waste disposal or spill areas that endanger public health welfare, or the environment (Navy 2006a). The DON IR Program follows guidance developed by the United States Environmental Protection Agency (U.S. EPA) pursuant to CERCLA to identify, assess, and clean up past hazardous waste sites. IA F1 is currently in the FS phase of the CERCLA process. This FS report was prepared in accordance with the IR Program and U.S. EPA Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (U.S. EPA 1988).

Remedial alternatives evaluated in this FS are assessed individually and comparatively using the National Oil and Hazardous Substance Pollution Contingency Plan (NCP) evaluation criteria, including overall protection of human health and the environment; compliance with applicable or relevant and appropriate requirements (ARARs); short-term effectiveness; long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; implementability; and cost. A detailed Green and Sustainable Remediation (GSR) analysis is also incorporated in the FS. The remaining NCP evaluation criteria, state and community acceptance, will be evaluated further after developing and receiving Agency and public comments on the Proposed Plan.

IA F1 comprises about 62 acres on the eastern shore of MINS and was divided into seven subareas for evaluation in the RI (Figure 2). Subareas 1 through 5 and 7 are considered upland habitat areas while Subarea 6 is considered tidal salt marsh wetlands habitat. Site features and habitat areas are presented on Figure 3. The RI for IA F1 investigated the presence of chemicals of potential concern in soil, soil gas, groundwater, and sediment. The following summarizes the

RI conclusions for each media based on the planned future use. RI results and conclusions for other hypothetical use scenarios are discussed in Section 2.0.

Soil and Sediment

The RI concluded that surface soil at Subareas 4 and 5, and surface sediment at Subarea 6 required additional evaluation in the planned future use scenarios for IA F1. The RI also recommended further evaluation of TPH Area 2b in Subarea 1. In response, additional data gap samples were collected in June 2013. Soil samples were collected at TPH Area 2b in Subarea 1, and sample results vertically delineate TPH concentrations in soil (Appendix A, Figure A1). Based on the results, the Navy recommends no remedial action for closure as a low-risk fuel site as discussed in Appendix A. Surface soil was identified as the medium of concern in the area south of Building A75 in Subarea 4 and the area around Building A17 in Subarea 5. Historical operation as a paint shop is the likely source of metals contamination near Buildings A75 and A17. Surface sediment was identified as the medium of concern in Subarea 6. At Subarea 6, sandblasting operations and disposal of waste sandblast materials at nearby IR Site 4 are the likely sources of metals contamination in the northern portion of Subarea 6, which is recommended for remedial action.

The risk assessments and recommendations in the Final RI Report for IA F1 document that Subareas 1, 2, 3, and 7 and areas outside of the portions of Subareas 4, 5, and 6 described above do not require further evaluation for active remediation in the future use scenario planned for IA F1. California Environmental Protection Agency's Department of Toxic Substances Control (DTSC) accepted the 2012 Final RI Report in its July 5, 2013 letter with provisions that are addressed in this FS Report (DTSC 2013). Planned future uses at IA F1 include mixed use industrial in Subareas 1 through 4 and the northern portion of Subarea 5, a regional park in the southern portion of Subarea 5 and all of Subarea 7, and a conservation wetland area in Subarea 6. These planned future uses are illustrated on Figure 4.

Soil Gas

The Final RI Report evaluated soil gas data for Subareas 3 and 5. Risk from vapor intrusion was also modeled based on groundwater data for Subareas 1 through 5. Because Subarea 6 is the wetland and no structures are anticipated in this subarea, it was not evaluated for vapor intrusion. No volatile chemicals were detected in groundwater within Subarea 7; therefore, Subarea 7 was not evaluated for vapor intrusion (ChaduxTt 2012a). No unacceptable risks to human health or the environment were identified for vapor intrusion based on the planned reuse scenarios for IA F1 (Table 1).

Groundwater

Risk from direct exposure to chemicals of concern (COCs) in groundwater at all subareas in IA F1 was identified as acceptable based on a lack of exposure pathway and the poor characteristics of the groundwater at IA F1 (salinity and low pumping rates). As a result, beneficial use of groundwater was not included in the human health risk assessment (HHRA). Beneficial use exception for shallow groundwater at IA F1 was concurred with by the San Francisco Bay Regional Water Quality Control Board (Water Board), a part of the California Environmental Protection Agency (CalEPA) and was received for the site (Water Board 2010).

The RI also recommended further groundwater evaluation for TPH Areas 14 and 15. TPH Areas 14 and 15 are located in Subarea 4 and have historical grab groundwater results reported in excess of the Tier 2 groundwater screening level for total petroleum hydrocarbon-diesel range (TPH-dr) of 0.64 milligrams per liter (mg/L) established in the IA F1 RI Report for groundwater samples within 300 feet of aquatic receptors. Additional grab groundwater samples in these areas for TPH-dr were collected in June 2013. TPH-dr was reported in both TPH Areas 14 and 15 below the Tier 2 groundwater screening level (Appendix A, Figure A2). Sample results for TPH are discussed further in Appendix A and in Section 2 of this FS.

1.1 Purpose and Scope

The purpose of this FS Report is to identify and evaluate a technically appropriate and defensible range of suitable remedial alternatives to mitigate risk to human and ecological receptors from exposure to COCs at elevated concentrations. To achieve this purpose, the FS follows the following primary steps:

- Develop remedial action objectives (RAOs).
- Identify areas of the site and volumes of impacted media that require remediation to achieve the RAOs.
- Identify and screen remedial technologies and process options within various general response actions (GRAs) (e.g., to contain, remove, dispose of, and/or treat chemicals in environmental media). Identify volumes or areas to which the technology or process would be applied.
- Develop specific remedial alternatives by combining retained technologies and process options.
- Evaluate each remedial alternative independently using the evaluation criteria established by the NCP.
- Comparatively evaluate remedial alternatives against each other using the evaluation criteria established by the NCP.

The process used to evaluate the alternatives is consistent with the U.S. EPA Guidance for Conducting a RI/FS (U.S. EPA 1988). The NCP states that remediation should be accomplished using cost-effective remedial alternatives that effectively lessen threats to and provide adequate protection of public health, welfare, and the environment (U.S. EPA 1990).

As the lead federal agency, the DON is working with DTSC, Water Board, and U.S. EPA Region IX to develop and evaluate the remedial alternatives presented in this report. This FS does not identify or recommend a preferred remedial alternative. However, the FS will be used by the DON, in coordination with the U.S. EPA and the State of California, as the basis for proposing a preferred remedial action for IA F1. The preferred alternative will be documented in a Proposed Plan that will be presented to the public. After public review of the Proposed Plan, the DON will respond to public comments and then select and describe the selected remedy in a Record of Decision (ROD).

1.2 Report Organization

This FS report is organized into the following sections:

- **Section 1, Introduction** provides an overview of the document, including the purpose, scope, and organization of the report.
- **Section 2, Site Description and Remedial Investigation Summary** summarizes the facility and site location and history, current and future land use, the environmental setting, previous investigations, and results of the RI conducted at IA F1. The conceptual site model describing the nature and extent of contamination at IA F1, with an emphasis on the RI human health and ecological risk assessment results is also included. This section also presents the findings from the sampling completed as part of the FS to fill in the data gaps for TPH Areas 2b, 14, and 15. In addition, this section summarizes the evaluation of contaminated sediments in Subarea 6, as recommended by the RI that guides the approach for identifying the proposed remedial action area.
- **Section 3, Remedial Action Objectives** presents the RAOs for IA F1 and identifies the preliminary remediation goals (RGs) based on the site characterization and results of the HHRA and Environmental Risk Assessment (ERA). This section also presents the conceptual remedial footprints and includes a summary of ARARs.
- **Section 4, Identification and Screening of Remedial Technologies** provides a summary of possible remedial technologies and process options within various GRAs applicable to the site. Technologies are screened based on their technical effectiveness, implementability, and cost. Technologies retained are then developed, alone or in combination, into remedial alternatives that would satisfy the RAOs for IA F1 sites.

- **Section 5, Development of Remedial Alternatives** provides a description of the assemblage of potentially suitable alternatives developed to address the project-specific RAOs and achieve preliminary RGs.
- **Section 6, Detailed Analysis of Remedial Alternatives** presents a detailed evaluation of remedial alternatives developed in Section 4 analyzing each alternative using the NCP criteria. Detailed cost estimates for each alternative are also summarized.
- **Section 7, Comparative Analysis of Remedial Alternatives** presents a comparative analysis of remedial alternatives developed in Section 4 against the NCP criteria relative to each other.
- **Section 8, References** lists the documents and supporting material used to prepare this FS Report.

Figures, tables, and the following appendices are presented after Section 7.

- **Appendix A, TPH Data Gap Sampling** summarizes the results of soil sampling for TPH-dr and total petroleum hydrocarbons in the gas range (TPH-gr) at TPH Area 2b, and grab groundwater sampling for TPH-dr at TPH Areas 14 and 15.
- **Appendix B**, **Subarea 6 ERA Analysis** summarizes the process and results of the FS evaluation of the RI ERA findings for Subarea 6.
- **Appendix C, Applicable or Relevant and Appropriate Requirements** provides a detailed discussion of ARARs and "to be considered" criteria identified for the IA F1 FS.
- **Appendix D, Green and Sustainable Remediation Analysis** presents a detailed GSR analysis performed using SiteWise™ for the remedial alternatives identified and evaluated in the IA F1 FS.
- **Appendix E, Remedial Alternatives Cost Summary and Assumptions** provides detailed cost estimates for the remedial alternatives identified and evaluated in the IA F1 FS, and lists assumptions that were made in developing the cost estimates.
- **Appendix F, Responses to Comments from Regulatory Agencies** provides regulatory comments and responses to the Draft version of this report.

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Section 2 Site Description and Remedial Investigation Summary

This section summarizes the MINS facility and IA F1 location and history, current and future land use, the environmental setting, previous investigations, and results of the RI conducted at IA F1, including the nature and extent of contamination and the HHRA and ERA. This section also presents the findings from the sampling completed as part of the FS to fill the data gaps for TPH Areas 2b, 14, and 15, and summarizes the evaluation of contaminated sediments in Subarea 6.

2.1 Facility Location And History

Mare Island is within the incorporated boundaries of the City of Vallejo in Solano County, California, about 25 miles northeast of San Francisco (Figure 1). Mare Island is bordered by Highway 37 to the north, Mare Island Straight (Napa River) to the east, Carquinez Strait to the south, and San Pablo Bay to the west. The main entrance to MINS is a causeway that spans Mare Island Strait, connecting the island to the City of Vallejo at Tennessee Street. A second access point is located at the northern end of Mare Island, where Railroad Avenue and Walnut Avenue connect to Highway 37.

Mare Island was the first Naval station established on the Pacific Coast. The Navy purchased 956 acres that make up Mare Island in 1853 and commenced shipbuilding operations on September 16, 1854. In the early 1920s, the Navy began construction and maintenance of submarines at the shipyard. During World War II, the shipyard reached peak capacity for shipbuilding, repair, overhaul, and maintenance. In this era, more than 40,000 workers were employed and 390 new ships, including landing craft, destroyers, battleships, and submarines, were built. After the war, MINS was one of the primary stations for construction and maintenance of the Navy's Pacific fleet of submarines. Shipyard activity decreased after World War II, and the shipyard was closed on April 1, 1996, after 142 years of operation (ChaduxTt 2012a).

Throughout its history, MINS has supported a diverse range of activities. As needs changed so did the required infrastructure. Shipbuilding and maintenance activities were established along the northeastern shore of the island. Mare Island also supported manufacture and storage of munitions in the south eastern shore. The area of munitions storage and maintenance operations at Mare Island was commonly referred to as the "Concord Annex" in reference to the consolidated installation names "Naval Weapons Station Concord" which included areas of Mare Island as well as the Naval Magazine Port Chicago, located across the Carquinez Strait at Bay Point near the City of Concord.

2.2 Investigation Area F1 Location and History

IA F1 comprises about 62 acres on the southeastern shore of Mare Island. Before the 1900s, the area currently designated as IA F1 was primarily a tidal wetland along the original eastern shoreline of Mare Island. By 1932, most of the area's ground elevation was raised by using imported fill material consisting of dredge spoils or upland fill. A portion of IA F1 is paved, and various buildings, scattered vegetation, and exposed soil cover the remainder of the site. Various sets of railroad tracks run across the site and portions of these tracks have been removed. Utility lines in and around the area include freshwater and stormwater pipelines. During the intrusive investigation conducted by Weston Solutions, Inc., most of the storm drains and catch basins were abandoned or removed (Weston 2002).

Since Naval operations began at MINS, ordnance was manufactured and stored at IA F1. Between 1857 and 1975, the primary purpose of the Mare Island ordnance facility was to store and process ammunition used on Naval ships. Black-powder-loaded munitions were emptied and refilled while ships were overhauled at the shipyard. During the 1890s, facilities were added for loading gun cotton, and by 1916, the loading of Explosive D (ammonium picrate) was in full operation (ChaduxTt 2012a).

The area was upgraded to a Naval Ammunition Depot in 1936. In 1957, these operations merged with the Naval Magazine Port Chicago, located across the Carquinez Strait at Bay Point, near the City of Concord. The consolidated installation was named "Naval Weapons Station Concord." As a result, the area of munitions storage and maintenance operations at Mare Island was commonly referred to as the "Concord Annex" (ChaduxTt 2012a).

In 1973, ordnance production in the Concord Annex ended. Many key production buildings, magazines, and warehouses were subsequently used to store inert materials and ordnance-related supplies. Some buildings were converted for use as office space (e.g., the U.S. Coast Guard station in Building A228). Historical munitions activities at IA F1 created concern for the presence of munitions and explosives of concern (MEC) at Mare Island. MEC at IA F1 is being addressed under the Munitions Response Program, the Navy's program for investigating and remediating munitions (ChaduxTt 2012a).

Polychlorinated biphenyls (PCBs) sampling and abatement activities have been conducted throughout Mare Island under the PCB basewide study to address PCBs regulated by the Toxic Substances Control Act (TSCA). The Navy is currently conducting abatement and preparing closure documentation for PCB sites at IA F1 (ChaduxTt 2012a). The status of PCB sites under TSCA are presented below:

Status of PCB Sites at IA F1

Buildings with NFA under TSCA	Buildings with Evaluation Ongoing under TSCA
A1, A2, A3, A4, A5, A6, A8, A15, A65, A85, A103, A136, A144, A145, A154, A197, A226, A260, A265, A912/824	A17, A71, A142, A192, A215, A253, A266, A271

NFA – No Further Action
TSCA – Toxic Substance Control Act

For the purpose of the RI, IA F1 was divided into seven subareas based on geographic proximity of buildings, distribution and types of potential contaminants at each building, and the practicality of graphic display. Results of the RI are discussed in Section 2.6. This FS addresses remedial alternatives for three locations within IA F1 designated in the RI as requiring further evaluation: the area southeast of Building A75 in Subarea 4; the north, east, and south sides of Building A17 in Subarea 5; and the northern portion of Subarea 6. These three locations are shown on Figure 2 along with the subarea divisions of IA F1. TPH Areas 2b, 14, and 15 are addressed in Appendix A and further evaluation for remedial action for TPH is not recommended.

2.3 Environmental Setting

2.3.1 Physical Setting

Through land reclamation and filling, the original Mare Island was modified into a peninsula. The tombolo, a land bar connecting an island with a larger land area, originally consisted of about 1,000 acres of dry land and 300 acres of wetlands. As a result of land reclamation projects, Mare Island now occupies about 2,800 acres, excluding the intertidal zone (the area that is inundated between low and high tides), and is surrounded by three surface water bodies (Carquinez Strait, Mare Island Strait, and San Pablo Bay). Its dimensions are about 3.5 miles by 1.25 miles. The ground surface generally slopes from west to east. Surface elevations on the western boundary are about 20 feet above mean sea level, with a range from about 14 to 40 feet mean sea level. Surface elevations on the eastern boundary are generally at sea level (ChaduxTt 2012a).

2.3.2 Climate

The climate at Mare Island is moderated by the proximity of San Francisco Bay. It is generally warm and dry in the summer and cool and wet in the winter. The daily average air temperature, as recorded at the Mare Island power plant, was 58°F between 1984 and 1988. Average temperature ranges (minimum to maximum) were from 49 to 95°F in the summer and 38 to 74°F in the winter during the same period. Daily average wind speeds measured over the same time period at the power plant at Mare Island were typically 5 to 10 knots to the south or west.

Maximum velocities of 20 to 30 knots were often recorded, particularly during winter months (ChaduxTt 2012a).

Average annual rainfall at Mare Island based on daily measurements between 1878 and 1994 was 18.07 inches per year. Measurable precipitation typically occurs 50 to 60 days each year. About 95 percent of the total precipitation occurs between October and April (ChaduxTt 2012a).

2.3.3 Geology

Three principal geologic units were identified at Mare Island for areas outside the extent of the original island. From top to bottom stratigraphically, these units include: 1) artificial fill material, 2) unconsolidated natural deposits, and 3) bedrock (ChaduxTt 2012a).

The geology of Mare Island can be characterized as an eroded bedrock surface, exposed in the southern part of the peninsula (including portions of IA F1) and overlain by a blanket of unconsolidated Quaternary sediments and artificial fill material. The eroded bedrock forms a subsurface bedrock ridge, extending northwest along the axis of the Mare Island peninsula and roughly coinciding with Cedar Avenue. The eroded bedrock is estimated to coincide with the original extent of Mare Island in 1869 (ChaduxTt 2012a). The subsections below describe each geologic unit at IA F1.

2.3.3.1 Artificial Fill Material in IA F1

Artificial fill material present throughout IA F1 is heterogeneous, unconsolidated material consisting of clay, silt, sand, and gravel in varying proportions. This fill material overlies either the silty clay unit or bedrock and is characterized by abrupt and unpredictable changes in lithology over short lateral and vertical distances. The thickness of the fill material varies from a minimum of about 0.5 to 1 foot to a maximum of about 11.5 feet. The fill material thins westward toward the hilly area (the bedrock of the original island).

2.3.3.2 Unconsolidated Natural Deposits in IA F1

Unconsolidated natural deposits underlie the fill material and consist primarily of gray to olive-gray silty clay, clay, and clayey silt, but also include localized zones of sandy material. This unit was generally encountered at depths ranging from 2 to 6 feet below ground surface (bgs), but was encountered as shallow as 0.75 feet bgs in the area of Building A75. This unit generally ranges from 40 to 105 feet in thickness throughout the base; however, it thins westward at IA F1 toward the hilly area (the original island). The increasing thickness of this unit to the east reflects the sharp, subsurface drop-off of the bedrock surface toward Mare Island Strait. At some locations, the clay contains varying amounts of organic material, including plant fragments and wood, collectively referred to as “organics.” In addition, a few locations contain brown to dark reddish-brown peat beds made up of 80 to 100 percent organic material that are 0.5 to more than

3.5-feet-thick. Most of the unconsolidated natural deposits encountered in IA F1, which largely represent marshy and subtidal depositional environments, appear to correlate to the Younger Bay Mud in other areas of San Francisco Bay (ChaduxTt 2012a).

2.3.3.3 Bedrock

Bedrock at IA F1 consists of steeply dipping, yellowish-brown to light olive-brown interbedded sandstone, siltstone, mudstone, and claystone. Moderately to highly weathered bedrock was encountered in borings in the western portion of IA F1. The depth to bedrock reported in borings at IA F1 varies from 0 to 3 feet below ground surface (bgs) in the western portion of IA F1 to more than 35 feet bgs in the eastern portion of the site (ChaduxTt 2012a). Bedrock encountered at IA F1 correlates with bedrock outcrops in the hilly area at the southern end of the peninsula. The hilly area is occupied by a golf course, ammunition bunkers, and a residential area along Mesa Avenue. The exposed bedrock at Mare Island is assigned to the undifferentiated Great Valley Sequence and to the Cretaceous Panoche Formation (ChaduxTt 2012a).

2.3.4 Hydrogeology

Three primary water-bearing zones (referred to as shallow, intermediate, and deep) have been identified at Mare Island in deep wells west of the bedrock ridge. At other locations on Mare Island only the shallow water-bearing zones were encountered in shallower borings and wells. Monitoring wells at IA F1 are in the shallow water bearing zone. For this zone, two hydrogeologic units were identified based on the geologic materials present at the site: a primary hydrogeologic unit of artificial fill with underlying sily clay and a second hydrogeologic unit of bedrock and weathered bedrock. Most of the wells in IA F1 were completed in or across the artificial fill or silty clay units (ChaduxTt 2012a).

Depths to groundwater within IA F1 range from about 12 feet bgs at the western, upland side of the site to about 3 feet bgs at the tidal wetland. Groundwater flow patterns at IA F1 were evaluated based on water level information recorded during groundwater sampling events. The primary flow direction in the shallow water-bearing zone at IA F1 is to the northeast toward Mare Island Strait (ChaduxTt 2012a).

2.3.4.1 Groundwater Potability

To assess shallow groundwater potability, groundwater sample results from monitoring wells in IA F1 were reviewed to determine beneficial reuse for comparison against U.S. EPA and State Water Regional Control Board (SWRCB), criteria. Under U.S. EPA guidelines, groundwater with a total dissolved solids (TDS) concentration of less than 10,000 mg/L and a groundwater production rate (or well yield) of at least 150 gallons per day may be considered a potential (or potable) source of drinking water (U.S. EPA 1998). Under Water Board criteria, TDS content

less than 3,000 mg/L and minimum yield of 200 gallons per day are used to classify groundwater as beneficial for municipal or domestic supply.

Groundwater sampling results from 20 monitoring wells were reviewed. While 4 of the 20 wells have the potential to meet the U.S. EPA and SWRCB criteria for yield and TDS, these wells are surrounded by wells that fail to meet either sustainable yield or TDS criteria, or both. The potential for sustained pumping of potable groundwater from the area is reduced by the migration of higher salinity groundwater from the surrounding area and the limited recharge of potable groundwater into the area. Detailed evaluation of the groundwater sampling results can be found in the Final RI Report for IA F1 (ChaduxTt 2012a).

Shallow groundwater in IA F1 is not considered to have significant potential as a potable water supply as defined by U.S. EPA, nor is it considered to have potential beneficial uses for municipal or domestic supply as defined by the SWRCB. In May 2010, the Navy received a letter from the Water Board concurring that shallow groundwater at IA F1 and neighboring IR Site 4 meet the exception criteria for beneficial use; therefore, shallow groundwater at IA F1 is considered not suitable for municipal or domestic water supply (Water Board 2010).

2.3.5 Ecological Setting

The primary habitats found at IA F1 include uplands and tidal wetlands. A survey of existing conditions and special status species at IA F1 was conducted in December 2010 (ChaduxTt 2012a). The sections below describe the current habitat at IA F1.

2.3.5.1 Upland Habitat Flora and Fauna

The upland area of IA F1 is comprised of the following dominant habitats:

- Developed area - 49 percent
- Ruderal vegetation - 26 percent
- Non-native grassland - 21 percent
- Grassland depressions - 2 percent
- Transition area or coastal live oak forest and eucalyptus - 2 percent

Figure 3 presents the extent of each habitat type mapped during the December 2010 survey (ChaduxTt 2012a). A small portion of the site (2 percent) is a transition area between the upland area and the coastal salt marsh wetland (described in the following section). Less than 2 percent of the upland habitat is composed of coastal live oak forest, and less than 1 percent is composed of eucalyptus. The upland area is maintained by the Navy as an industrial area, which is regularly mowed as part of the Navy's ongoing maintenance program for firebreak protection (ChaduxTt 2012a).

No special status plant species are expected to be present in the upland area (ChaduxTt 2012a). Special status bird species including the northern harrier (*Circus cyaneus*), a California species of special concern, and white-tailed kite (*Elanus leucurus*), a California fully protected species, may forage in the upland area (ChaduxTt 2012a).

The developed area consists of historical munitions buildings, offices, associated outbuildings, equipment yards, piers, remnant staging areas, and access roads associated with historical Naval activity; most of the developed area is devoid of significant stands of vegetation. Abandoned buildings may support bats as maternity colony roosting habitat, day-roosting and night-roosting habitat, and as hibernacula. During the existing conditions and special status species survey, an active night roost for bats was observed in the outside stairwell of Building A-266 that most likely supported Mexican free-tailed bats (*Tadarida brasiliensis*); no other signs of bats were found during inspections of building exteriors and ground (ChaduxTt 2012a).

The area of ruderal vegetation surrounds much of the developed area and is characterized by plant species that occur in weedy, disturbed areas that are typically dominated by non-native opportunistic plant species. This area closely resembles open ground associated with non-native grassland habitat created by the Navy's maintenance program. Ruderal vegetation has limited wildlife value because there is little to forage even for small mammals. Areas with remnant and patchy vegetation and mulch may provide habitat for small mammals like California voles (*Microtus californicus*), deer mice (*Peromyscus maniculatus*), and house mice (*Mus musculus*), as well as black-tailed jackrabbits (*Lepus californicus*). Although habitat values will improve slightly between periods of the Navy's maintenance activities, the area will continue to be maintained for industrial use (ChaduxTt 2012a).

Heavily disturbed non-native grassland community occurs throughout much of IA F1, which is dominated by a mix of disturbance-tolerant, opportunistic, non-native grasses and forbs. One third of the area classified as non-native grassland is essentially bare ground, while other areas are covered with short mowed vegetation (height of 3 to 6 inches). The areas of remnant vegetation provide habitat for common small mammals such as California voles, deer mice and house mice, and black-tailed jackrabbits. These small mammals provide the base of a food chain for raptors and mammalian predators. Between periods of maintenance activities, coyotes (*Canis latrans*), raccoons (*Procyon lotor*), and striped skunks (*Mephitis mephitis*) may forage in the non-native grasslands, and ground-dwelling birds such as horned larks (*Eremophila alpestris*) and western meadowlarks (*Sturnella neglecta*) may inhabit the site. Western toads (*Anaxyrus boreas*) and bats may use this habitat to forage for insects at night (ChaduxTt 2012a).

Grassland depressions at IA F1 are typically located between buildings where shallow, degraded depressions and small artificial swales support several inches of herbaceous hydrophytic vegetation. The Navy maintains these areas as part of its ongoing maintenance program

(ChaduxTt 2012a). When these areas are dry, common wildlife species potentially present include deer mice, house mice, and California voles. Larger mammals such as coyotes, raccoons, and striped skunks may forage within these areas, and birds of prey such as harriers and kites may forage overhead. During the time of year when these depressions are inundated with water, Pacific chorus frogs (*Pseudacris regilla*) may occupy the pools and the Yuma myotis bat (*Myotis yumanensis*) may forage on the aquatic macro-invertebrates associated with the seasonal pools (ChaduxTt 2012a).

2.3.5.2 Wetland Habitat Flora and Fauna

The wetland area of IA F1 is characterized by coastal salt marsh wetland. Much of the area is subject to direct tidal influence and wave action. This type of wetland is characterized primarily by pickleweed (*Salicornia pacifica*) and salt grass (*Distichlis spicata*), with some stands of cordgrass (*Spartina* sp.), marsh gumplant (*Grindelia stricta* var. *angustifolia*), bush seepweed (*Suaeda moquinii*), fat hen (*Atriplex triangularis*), California sea lavender (*Limonium sinuatum*) and alkali heath (*Frankenia salina*) interspersed (ChaduxTt 2012a).

The coastal salt marsh wetland is generally composed of moderate quality wetland habitat with regard to functions and values; however, some areas were observed to be degraded from the physical influence of tidal waters and the overall disturbed nature of the site (ChaduxTt 2012a). The literature review accompanying the survey identified the potential presence of one state-listed rare plant species: Mason's lilaeopsis (*Liliaeopsis masonii*) (ChaduxTt 2012a).

The wetland provides potential habitat for the federally endangered salt marsh harvest mouse (SMHM) (*Reithrodontomys raviventris*), a rodent species almost entirely dependent on pickleweed. The existing conditions survey indicated that although neither salt marsh harvest mice nor Suisun shrews (*Sorex ornatus sinuosus*) were observed during the survey, they are presumed to potentially inhabit the IA F1 wetland (ChaduxTt 2012a).

Tidal wetlands at Mare Island are also key habitat for many bird species and are used by shorebirds, waders, waterfowl, and songbirds for migration, foraging, nesting, and roosting. Bird species commonly found in the wetlands at IA F1 include killdeer (*Charadrius vociferous*), great blue heron (*Ardea herodias*), and red-winged blackbird (*Agelaius phoeniceus*). California clapper rails *(Rallus longirostric obsoletus)* and California black rails *(Laterallus jamaicensis coturniculus)* likely occur on Mare Island in low densities, although the somewhat degraded and fragmented condition of the marsh habitat likely prevents regular occurrence of the rails within IA F1 (ChaduxTt 2012a). The northern harrier also forages in wetland and upland habitats. The California vole and gray fox use wetlands in conjunction with upland habitats to fulfill their various habitat requirements (ChaduxTt 2012a).

2.4 Current and Future Anticipated Land Use at IA F1

The current land use for IA F1 is inactive and vacant land. Maintenance workers from the Navy, the City of Vallejo, and Island Energy visit the site to check electrical substations and towers and perform basic site maintenance. In addition, Navy subcontractors may conduct removal activities at the site in preparation for closure, transition, and property transfer of IA F1. The DON is maintaining IA F1 as an industrial area by clearing vegetation periodically. IA F1 is fenced, and access to the site must be arranged through the DON.

The anticipated future land uses are shown on Figure 4 and include mixed industrial for Subareas 1 through 4 and the northern portion of Subarea 5, a regional park for the southern portion of Subarea 5 and the entirety of Subarea 7, and a conservation area for Subarea 6. The following subsections describe what is known about each proposed future reuse as documented in the Mare Island Specific Plan (City of Vallejo 2008).

2.4.1 Mixed Industrial

Subareas 1 through 4 and the northern portion of Subarea 5 are proposed for mixed industrial reuse within Reuse Area 10A. Reuse Area 10A is the South Island Business Park that will be transferred to the City of Vallejo.

2.4.2 Regional Park

The southern portion of Subarea 5 and the entirety of Subarea 7 are proposed for reuse as a regional park and are intended for passive recreational uses. A regional park is an area designated for regular recreational use by the public. The regional park in Reuse Area 12 is intended for passive recreational uses and will be managed as part of the extended open space framework for Mare Island.

2.4.3 Conservation Area

Subarea 6, consisting of tidal wetland, is identified for a conservation area. A conservation area is an area designated for protection of its natural resources including ecological receptors.

2.5 Previous Investigations and Remedial Actions

Previous investigations and remedial actions at IA F1 are described in detail in the Final RI Report (ChaduxTt 2012a).

2.6 Results of Remedial Investigation

This section summarizes results of the RI, including the nature and extent of contamination evaluation, contaminant fate and transport evaluation, HHRA, screening-level ecological risk assessment (SLERA), and Step 3a risk refinement. It also discusses the conclusions and

recommendations based on the RI results. Details regarding the potential sources of contamination, potential release mechanisms, potential contaminants, and potential pathways for migration are included in the Final RI Report.

2.6.1 Remedial Investigation Methodology

During a series of investigations at IA F1 from 1983 to 2009, the Navy collected soil, sediment, groundwater, and soil gas samples to determine whether hazardous substances and petroleum hydrocarbons had been released at IA F1. These investigations resulted in an analytical data set consisting of thousands of samples analyzed for hundreds of chemicals.

Various samples were evaluated for the following analytical groups: metals (including hexavalent chromium), volatile organic compounds (VOCs), semivolatile organic compounds, pesticides, PCBs, petroleum hydrocarbons, organotins, and explosives (ChaduxTt 2012a). Detected concentrations of chemicals were compared with comparison criteria, including regional screening levels for soil and ambient air developed by EPA Region IX (U.S. EPA 2010), preliminary remediation goals modified by the California Environmental Protection Agency, ambient metals concentrations developed for soil and groundwater at Mare Island, and Tier 2 screening levels for TPH developed for IA F1. The comparison criteria were used to evaluate analytical results and narrow the focus of the chemical characterization discussion within the Final RI Report (ChaduxTt 2012a).

Munitions constituents were not detected or only detected at low concentrations according to the RI and will continue to be evaluated in the planned RI under the Munitions Response Program.

2.6.2 Human Health Risk Assessment Methodology

The HHRA for IA F1 was presented in the Final RI Report (ChaduxTt 2012a). Results from the HHRA provide a basis for risk management decisions and identifying areas with significant risk from potential exposure to chemicals in soil, groundwater, and soil gas at IA F1. The HHRA evaluated potential risks to future commercial/industrial workers and future construction workers for the subareas proposed primarily for mixed industrial use (Subareas 1 through 5 and 7) and future recreational users (adult and child) at the tidal wetland that will remain open space as a conservation area (Subarea 6). Though residential use is not a planned use for the site, an evaluation of an unrestricted use scenario (such as residential) was also conducted to determine whether the property could be released by the Navy without restriction. The Navy evaluated effects to a future hypothetical residential receptor in Subareas 1 through 5 and 7, but not in Subarea 6 (wetland). The southern portion of Subarea 5 and the entirety of Subarea 7 are currently planned to be part of a park system in the future, and although a recreational receptor was not evaluated, the residential scenario that was evaluated is conservatively protective of recreational receptors.

If the site remains undeveloped or undergoes minimal disturbance, future site conditions are expected to mirror current site conditions (i.e., the soil will not be excavated and redistributed across the site). Under this future condition (minimal disturbance scenario), a commercial/industrial worker, recreational user, and hypothetical residential receptor were evaluated using the 0 to 2 feet bgs soil data set. If IA F1 is developed in the future (intrusive development scenario), construction workers could be exposed during redevelopment, and commercial/industrial workers and residential users could become potentially exposed after redevelopment. Under a future intrusive developed scenario, a construction worker, commercial/industrial worker, and hypothetical residential receptor were evaluated using the 0 to 10 feet bgs soil data set.

Groundwater data available for Subareas 1 through 5 and 7 were also considered in the HHRA. Groundwater at IA F1 is nonpotable due to high TDS, salinity and slow production rates. As a result, domestic use of groundwater is not considered a complete exposure pathway; therefore, unrestricted use was not evaluated in the risk assessment. Exposure pathways for groundwater were evaluated for a future commercial/industrial worker, construction worker, and hypothetical resident at Subareas 1 through 5 and 7. These include dermal contact with and inhalation of volatile chemicals in groundwater by a construction worker in a trench, and indirect exposure from inhalation of VOCs that volatilize and migrate upwards into enclosures (e.g., indoor air of buildings) by commercial/industrial workers and hypothetical residents. Risks from exposure to soil gas by vapor intrusion were evaluated using a groundwater vapor intrusion model. For Subarea 3 and Subarea 5, soil gas data were available, and this data were used to evaluate vapor intrusion risk. Exposure to groundwater at Subarea 6 is not considered a complete exposure pathway because no current or future groundwater-to-air exposures are expected in the subarea.

The HHRA evaluated risk in three ways–total risk, incremental risk, and ambient risk. For incremental risk, two sets of risk estimates were completed: one set using U.S. EPA toxicity criteria and the other set using State of California DTSC toxicity criteria. Risk estimates were then characterized using cancer risks and noncancer risks calculated as hazard indices (HIs). Cancer risk estimates and HIs were then summed across media and exposure pathways for a combined effect estimate.

The risks were considered acceptable when the HI was less than or equal to 1 for noncancer effects and the excess lifetime cancer risk is below 1 in a million (10^{-6}) for cancer effects. Cancer risks between 10^{-6} (1 in a million) and 10^{-4} (1 in 10,000) were considered as being within the risk management range. Where noncancer HIs exceeded 1 for a receptor, effects were segregated by target organ to determine whether systemic effects would be unacceptable for a specific target organ or system.

Lead: Based on its unique toxicological properties, exposure to lead is evaluated using blood level modeling as a biomarker that accounts for multiple sources of exposure to lead. California Human Health Screening Levels (CHHSLs) represent environmental concentrations of contaminants considered to be below thresholds of concern for risks to human health and are not regulatory cleanup standards (OEHHA 2005; reaffirmed in OEHHA 2007). However, the Navy established modified Office of Environmental Health and Hazard Assessment (OEHHA) CHHSLs for Mare Island such that the soils do not increase the blood lead levels more than 1 microgram per deciliter above background for the residential or industrial receptors (ChaduxTt 2012a). The Mare Island modified OEHHA CHHSL is the sum of the 95 percent upper confidence limit of the arithmetic mean concentration of background lead at Mare Island (25.6 milligrams per kilogram [mg/kg]) and the OEHHA CHHSL for residential and industrial workers. The modified OEHHA residential CHHSL for lead is 105.6 mg/kg, and the modified OEHHA industrial worker CHHSL for lead is 345.6 mg/kg.

2.6.3 RI Results and HHRA Summary

The RI HHRA results for each subarea are summarized in Table 1. The nature and extent of contamination and HHRA results are summarized below for Subareas 1 through 7 with an emphasis on the portions of the subareas that were recommended for evaluation in the Final RI Report. The risk values presented here are based on the incremental risk evaluation and federal toxicity criteria. Detailed results of all the HHRA for all subareas are included in the Final RI Report (ChaduxTt 2012a).

2.6.3.1 Subarea 1

TPH - With the exception of the vertical delineation of TPH-dr at TPH Area 2b, all TPH soil areas in Subarea 1 met the criteria for low-risk fuel sites, and the Water Board concurred with no further action for these soil areas (Water Board 2012). TPH Area 2b was evaluated as part of this FS Report with the results from additional data gap samples for TPH-dr and TPH-gr collected in June-July 2013 as requested by the Water Board in a Water Board Staff Concurrence Letter for Mare Island (Water Board 2012). Based on these additional data, TPH Area 2b meets the criteria for low-risk fuel sites as evaluated in Appendix A of this FS Report. No further remedial action is recommended for TPH Area 2b. TPH Area 2b was not evaluated for remedial action in this FS Report.

HHRA - No chemicals detected in soil or groundwater pose an unacceptable risk to human health in Subarea 1. The HHRA results showed that concentrations of benzo(a)pyrene in soil in Subarea 1 contribute to estimates of cancer risk within the risk management range for commercial/industrial workers exposed to subsurface soil (0 to 10 feet bgs) and residents exposed to surface soil (0 to 2 feet bgs) and subsurface soil (0 to 10 feet bgs). No other risk drivers were identified in soil. The HHRA did not evaluate ingestion of groundwater as a

complete pathway because groundwater is nonpotable at IA F1; therefore, groundwater risk was not evaluated for unrestricted reuse. Exposure to chemicals in groundwater in Subarea 1 from pathways consistent with the future reuse plan did not result in unacceptable risk to human health or the environment (ChaduxTt 2012a).

The cancer risks for all human receptors were within or below the U.S. EPA risk management range (10^{-6} to 10^{-4}) for carcinogens, and the noncancer hazards were equal to or below the threshold of 1 for noncarcinogens. Cancer risk and HI values for Subarea 1 are summarized with their respective risk drivers in Table 1.

2.6.3.2 Subarea 2

TPH - TPH were detected in soil at concentrations above the comparison criteria. The likely source of TPH is leaks or spills from heavy equipment used to manufacture and store ordnance. The regulatory agencies concurred with the Navy's recommendation for no further action for TPH areas (TPH Areas 3 and 4) within Subarea 2 (ChaduxTt 2012a).

HHRA – The results of the HHRA for Subarea 2 did not identify any chemicals as posing a chemical specific cancer risk greater than 10^{-6} or a chemical-specific noncancer hazard greater than 1; thus, no HHRA risk drivers were identified in soil for Subarea 2 based on federal toxicity criteria.

Because site groundwater is not potable and ingestion pathway is incomplete, risks from exposure to chemicals in groundwater from this pathway were not evaluated for unrestricted reuse in the HHRA. The only complete groundwater-related exposure pathway for a future commercial/industrial worker or hypothetical future resident is inhalation of VOCs migrating upward through overlying vadose zone soils into indoor air. In addition, volatile chemicals in groundwater could volatilize into outdoor air within a construction trench. The results of the HHRA indicate that neither subsurface vapor intrusion from groundwater into indoor air, nor inhalation of volatile chemicals in groundwater, poses a potential risk to future receptors at Subarea 2. No risk drivers in groundwater were identified for Subarea 2. Cancer risk and HI values for Subarea 2 are summarized with their respective risk drivers in Table 1.

2.6.3.3 Subarea 3

HHRA – No chemicals in soil in Subarea 3 were detected at concentrations above comparison criteria in more than one sample. Vinyl chloride was detected in a sample collected at 10 feet bgs at location 208UX4261 at a concentration of 51 mg/kg, exceeding the comparison criteria of 1.7 mg/kg. The isolated detection is delineated laterally by soil and groundwater samples, and vertically by groundwater samples. The HHRA did not evaluate ingestion of groundwater as a complete pathway because groundwater is nonpotable at IA F1; therefore, groundwater risk was not evaluated for unrestricted reuse. Based on an intrusive development scenario (0 to 10 feet

bgs), vinyl chloride was identified in the HHRA as a risk driver for the future commercial/industrial worker and the hypothetical future resident using the federal toxicity criteria. Lead was also identified as a risk driver in surface soil for a hypothetical future resident (ChaduxTt 2012a).

The VOCs cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride were the only chemicals consistently detected above comparison criteria in groundwater in Subarea 3. The extents of cis-1,2-DCE and vinyl chloride in groundwater are delineated by downgradient concentrations below comparison criteria.

No VOCs were detected above comparison criteria in the two soil gas samples collected in 2004 in Subarea 3. Cancer risk and HI values for Subarea 3 are summarized with their respective risk drivers in Table 1, using both the vapor intrusion modeling and the soil gas data values.

2.6.3.4 Subarea 4

TPH - TPH was detected at concentrations above comparison criteria in soil at the following locations: 1) near former underground storage tank (UST) A-225 (TPH Area 13), 2) near former pits excavated during the MEC intrusive investigation (TPH Area 6) (Weston 2002), 3) near excavations for former UST A-190, (TPH Areas 5, 7, and 11) and 4) beneath the southeastern corner of Building A248 (TPH Area 8). UST sites A-225 and A248 are closed sites. The regulatory agencies concurred with the Navy's recommendation for no further action at TPH Areas 5, 6, 7, 8, 11, and 13 within Subarea 4 (Water Board 2012).

Additional data were requested by the Water Board to achieve closure as a low-risk fuel site for TPH Areas 14 and 15 (Water Board 2012). Additional grab groundwater sampling for TPH-dr was conducted at TPH Areas 14 and 15 to confirm current concentrations of TPH-dr at these locations. Groundwater sampling results for TPH-dr at both these locations were below Tier 2 screening levels established for IA F1, as discussed in detail in Appendix A. Based on these results, no further action is recommended for groundwater TPH Areas 14 and 15; therefore, these areas are not included for the evaluation of remedies in this FS Report.

HHRA – The estimated cancer risks for each receptor were within or below the U.S. EPA risk management range (10^{-6} to 10^{-4}) for carcinogens. The HHRA showed that concentrations of dioxin-like congeners and benzo(a)pyrene in soil in Subarea 4 contribute to estimates of cancer risk within the risk management range for future commercial/industrial workers and hypothetical future residents exposed to surface and subsurface soils. In addition, naphthalene in subsurface soil was also identified as a risk driver to a hypothetical future resident. The noncancer hazards were below the HI threshold of 1 for the commercial/industrial and construction workers. The noncancer hazards for the hypothetical future resident were greater than the noncancer threshold

of 1; however, the highest target organ segregated HIs for a hypothetical future resident did not exceed the threshold of 1.

Lead is present at levels that may pose a risk to a hypothetical future resident in surface and subsurface soil and to a future commercial/industrial worker in surface soil. For the commercial/industrial worker, the arithmetic mean concentration of lead is the appropriate exposure point concentration for lead evaluated using the U.S. EPA Adult Lead Methodology model (U.S. EPA 2014), rather than using an upper-bound estimate of the mean concentration as is used for estimates of child lead exposure, and for other chemicals. The arithmetic mean for Subarea 4 lead in surface soil is 185 mg/kg (ChaduxTt 2012a). This value is lower than the modified OEHHA industrial CHHSL of 345.6 mg/kg, suggesting that lead does not pose a significant risk to a future commercial/industrial worker. However, lead in Subarea 4 was additionally evaluated for hotspots and a lead hotspot was identified near Building A75. Assessment of the distribution of lead in soil at Subarea 4 indicated that only samples with lead detected that exceeded the modified OEHHA industrial CHHSL were obtained in the area south of Building A75. Lead was identified as a risk driver for a hypothetical future residential exposure to surface and subsurface soil and to a future commercial/industrial worker exposed to surface soil within a certain area at Subarea 4. Lead as a COC near Building A75 is evaluated further in the FS based on the risk in this area posed by lead in an industrial use scenario.

The HHRA did not evaluate ingestion of groundwater as a complete pathway because groundwater is nonpotable at IA F1; therefore, groundwater risk was not evaluated for unrestricted reuse. No chemicals detected in groundwater pose an unacceptable risk to human health in the anticipated future land-use scenarios for Subarea 4 (ChaduxTt 2012a). Cancer risk and HI values for Subarea 4 are summarized with their respective risk drivers in Table 1.

2.6.3.5 Subarea 5

TPH – TPH in the motor-oil range (TPH-mr) were detected at a concentration above the Tier 2 screening level in soil in one soil sample within TPH Area 9 in Subarea 5. The regulatory agencies concurred with the Navy's recommendation for no further action at TPH Area 9 in Subarea 5 (Water Board 2012).

HHRA – Lead near Building A17 is the only COC to move forward for soils due to elevated lead concentrations posing an unacceptable risk to a recreational receptor. Building A17 is located within the portion of Subarea 5 that is intended to be a regional park (Figure 4) and may include both ecological and recreational future receptors. The risk to recreational receptors was not specifically evaluated in the HHRA, but the risk calculated for residential receptors serves as a conservative proxy for recreational risk. An evaluation of the spatial distribution of the elevated lead results within the portion of Subarea 5 planned for recreational reuse indicated that all but one of the soil samples in this area that exceed the modified OEHHA residential CHHSL of

105.6 mg/kg are located in shallow soil adjacent to Building A17. Figure 6 illustrates the distribution of lead in soils at Subarea 5. No other COCs were identified in soil or soil gas in Subarea 5 (ChaduxTt 2012a).

Trichloroethene and tetrachloroethene were identified as risk drivers in groundwater (as indoor air) to a hypothetical future resident. The cancer risks for the future commercial/industrial worker and future hypothetical residents based on vapor intrusion of groundwater into indoor air in Subarea 5 are within the risk management range. No chemicals detected in groundwater pose an unacceptable risk to human health in Subarea 5 (ChaduxTt 2012a). The HHRA did not evaluate ingestion of groundwater as a complete pathway because groundwater is nonpotable at IA F1; therefore, groundwater risk was not evaluated for unrestricted reuse.

The estimated cancer risks for the commercial/industrial worker, construction worker, and hypothetical resident were within or below the EPA risk management range (10^{-6} to 10^{-4}) for carcinogens. The noncancer hazards were below the noncancer threshold of 1 for the commercial/industrial workers. The noncancer hazards for the hypothetical resident were greater than or equal to the noncancer threshold of 1; however, the highest target organ segregated HIs for the residents were both less than the threshold of 1. The noncancer hazards were greater than 1 for a construction worker from inhalation of manganese particulates. However, manganese was not historically used at the site, and manganese is expected to be naturally occurring in the chert formations present at the site. Manganese is found in basalt and chert formations, and chert was only documented at Subarea 5 where one of the higher concentrations of manganese was sampled. Therefore, the RI did not carry manganese forward as a COC for the construction worker receptor for Subarea 5 (ChaduxTt 2012a).

Cancer risk and HI values for Subarea 5 are summarized with their respective risk drivers in Table 1, using both the vapor intrusion modeling and the soil gas data values.

2.6.3.6 Subarea 6

HHRA – No chemicals reported in sediment pose an unacceptable risk to human health in Subarea 6. The HHRA results showed that concentrations of benzo(a)pyrene and dibenz(a,h)anthracene in sediment in Subarea 6 contribute to estimates of cancer risk within the risk management range for recreational visitors exposed to surface sediment. The cancer risk to a future recreational user was within the risk management range (10^{-6} to 10^{-4}), and the noncancer hazard was below the threshold of 1 for noncarcinogens (ChaduxTt 2012a). Recreational receptors were the only receptors evaluated in the HHRA for Subarea 6.

Groundwater was not evaluated in the human health or ecological risk assessments because exposure to groundwater at Subarea 6 is not considered a complete exposure pathway for human

or ecological receptors because no current or future groundwater-to-air exposures are expected in the subarea (ChaduxTt 2012a). Therefore, unrestricted reuse was not evaluated.

Cancer risk and HI values for Subarea 6 are summarized with their respective risk drivers in Table 1.

2.6.3.7 Subarea 7

HHRA – The HHRA results showed that a single detection of benzo(a)pyrene in soil in Subarea 7 contribute to estimates of cancer risk within the lower end of the risk management range for the commercial/industrial worker, construction worker, and hypothetical future resident receptor. The noncancer hazards for these three receptors are equal to or less than the threshold of 1.

One groundwater sample was collected from Subarea 7 and was analyzed for metals, VOCs, semivolatile organic compounds, TPH-gr, and explosives. No chemical results exceeded the comparison criteria. The HHRA did not evaluate ingestion of groundwater as a complete pathway because groundwater is nonpotable at IA F1; therefore, unrestricted reuse was not evaluated. Groundwater in Subarea 7 was not identified as a risk to human health or the environment. Cancer risk and HI values for Subarea 7 are summarized with their respective risk drivers in Table 1.

2.6.4 Screening-Level Ecological Risk Assessment and Step 3a Risk Refinement

The SLERA and Step 3a risk refinement was performed to evaluate whether exposure to chemicals of potential ecological concern (COPEC) resulted in unacceptable risk to upland and wetland plants, invertebrates, herbivorous birds and mammals, omnivorous birds, invertivorous birds and mammals, and carnivorous birds and mammals. Ecological risk was evaluated in the SLERA and Step 3a risk refinement for the upland habitat, which includes Subareas 1 through 5 and 7, and for the wetland habitat, which includes Subarea 6 only (ChaduxTt 2012a).

Representative birds and mammals evaluated in the upland habitat at IA F1 included the western meadowlark, northern harrier, California vole, ornate shrew, and gray fox. Representative birds and mammals evaluated in the wetland habitat at IA F1 included the mallard, killdeer, northern harrier, SMHM, and gray fox. COPEC concentrations in surface soil and surface sediment from 0 to 2 feet bgs for plants, invertebrates, and non-burrowing birds and mammals, and from 0 to 6 feet bgs for burrowing mammals, were compared with ambient metal concentrations and receptor-specific ecological benchmark values.

All COPECs in soil were evaluated for effects on plants and invertebrates. Concentrations of COPECs in soil were compared with U.S. EPA's ecological soil screening levels or Oak Ridge National Laboratory benchmarks for plants and terrestrial invertebrates, and with effects-range

low values for aquatic invertebrates. With the exception of VOCs, all COPECs in surface soil were evaluated using a food chain model for potential effects on birds and mammals. The inhalation pathway for burrowing mammals was modeled for detected VOCs in soil gas. Results of the SLERA and Step 3a risk assessment for the upland and wetland habitats are presented below. The RI ERA results for each subarea are summarized in Table 1.

2.6.4.1 Upland Habitat (Subareas 1 through 5 and 7)

Results of the SLERA for the upland habitat indicated exposure to several chemicals resulted in potentially unacceptable risk to at least one representative vertebrate species. These chemicals included metals (aluminum, antimony, arsenic, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, molybdenum, nickel, selenium, tin, vanadium, and zinc), dioxin-like congeners (based on dioxin toxicity equivalent for dioxin-like PCB congeners), pesticides (total DDTs, total endrins, and carbazole), total PCBs, picric acid, Aroclor-1254, 2,4-DNT, total high molecular weight polynuclear aromatic hydrocarbons (PAHs), and toluene. Exposure to a number of other chemicals were assumed to result in potentially unacceptable risk based on the screening of site concentrations or estimated doses with benchmarks or toxicity reference values (TRVs), or based on the lack of a benchmark or TRV. The site-specific Step 3a risk refinement, conducted in accordance with Navy and U.S. EPA guidance for Step 3a of the baseline ecological risk assessment (Navy 2006b; U.S. EPA 1997), concluded that of the COPECs identified in the preliminary screening evaluation, only lead, zinc, and dioxin-like congeners were identified as chemicals of ecological concern (COECs) for soil.

Ecological risk was not quantitatively evaluated for individual upland subareas; however, an assessment of the spatial distribution of sample results within each subarea was performed for each COEC that exceeded a risk-based concentration within that subarea. That risk-based concentration for each COEC was the concentration at which, using the high TRV, the hazard quotient equaled 1.0 for the most sensitive vertebrate receptor. This evaluation was used to identify areas of the upland habitat that may require additional evaluation.

Dioxin-like congeners were identified as a COEC for the western meadowlark and were retained as a COEC for plants and invertebrates based on the risk decision for birds and mammals. Given the lack of information on the toxicity of dioxin-like congeners to plants and to terrestrial invertebrates, retention of dioxin-like congeners as COECs was evaluated in the RI ERA based on the decisions for higher trophic level organisms. Lead and zinc were identified as COECs for plants and zinc was identified as a COEC for invertebrates. Lead was identified as a COEC for the western meadowlark, the representative receptor for omnivorous birds, and the northern harrier, the representative receptor for carnivorous birds. Lead, zinc, and dioxin-like congeners were identified as COECs for the ornate shrew, the representative receptor for invertivorous upland mammals. No COECs were identified as posing risk to burrowing mammals in the inhalation model (ChaduxTt 2012a).

Conservative fate and transport modeling initially predicted that metals in groundwater beneath IA F1 (aluminum, arsenic, barium, and nickel) may reach the point of exposure at concentrations that exceed comparison criteria (ChaduxTt 2012a). However, incorporation of metal retardation into the model indicated that these COPCs would not present any significant threat to aquatic receptors in the Mare Island Strait for hundreds of years, if at all. Therefore, no further action was recommended for groundwater at IA F1 with respect to ecological receptors (ChaduxTt 2012a).

The SLERA and Step 3a risk refinement, conducted in the RI for the upland areas of IA F1, recommended no further action for soil and groundwater in the anticipated future land-use scenarios at Subareas 1, 2, 3, and 7 (ChaduxTt 2012a). The RI identified portions of Subareas 4 and 5 where unacceptable risk to ecological receptors may exist in the future land reuse scenarios due to the following COECs in soil.

Dioxin-Like Congeners near Building A190 (Subarea 4)

Exposure to dioxin-like congeners results in unacceptable risk to birds and small mammals at one location around former Building A190 in Subarea 4; however, these risks are not widespread. As noted in the RI, the habitat quality around former Building A190 does not encourage foraging in the area and results in an incomplete exposure pathway; therefore, it was not recommended for further evaluation (ChaduxTt 2012a). In addition, Subarea 4 is within planned reuse area 10A (Mixed Industrial Reuse), and any formation of open space or ecological habitat shall not be permitted; therefore, it is expected that the industrial character of the area shall be maintained, resulting in a continued incomplete exposure pathway for ecological receptors. ICs are evaluated for Subarea 4 to assure that habitat is not created prior to or during future industrial redevelopment. Therefore, dioxin-like congeners were eliminated as COECs due to an incomplete exposure pathway.

Lead and Zinc near Building A75 (Subarea 4)

Further evaluation of lead and zinc was recommended in the RI for the area south of Building A75 in Subarea 4 (ChaduxTt 2012a). The area around Building A75 is an industrial area, and, as stated earlier, Subarea 4 is planned for industrial reuse. In addition, Building A75 is in close proximity to Building A190 and is similar in that habitat quality does not encourage foraging and results in an incomplete exposure pathway to ecological receptors. ICs are evaluated for Subarea 4 to assure habitat is not created prior to or during future industrial redevelopment. Therefore, lead and zinc were eliminated as COECs in the area south of Building A75 due to an incomplete exposure pathway. No COECs are identified for soil in Subarea 4.

Lead near Building A17 (Subarea 5)

The spatial assessment of COECs in the upland habitat determined that lead should be further evaluated in the area around Building A17 in Subarea 5 in the portion of the subarea planned for redevelopment as a regional park (ChaduxTt 2012a). ICs are evaluated for the portion of Subarea 5 that is planned for future industrial use to assure that habitat is not created during redevelopment, which could result in risk to future ecological receptors drawn to the area. Lead is identified as a COEC for Subarea 5 near Building A17 and is evaluated in the FS.

2.6.4.2 Wetland Habitat (Subarea 6)

Results of the SLERA for the wetland habitat also indicated several chemicals posed a potential risk to at least one representative vertebrate species. These chemicals included metals (aluminum, antimony, arsenic, barium, cadmium, chromium, copper, lead, manganese, mercury, molybdenum, nickel, selenium, vanadium, and zinc), total high molecular weight PAHs, and toluene. A number of other chemicals posed a potential risk based on the comparison of site concentrations or estimated doses with benchmarks or TRVs, or based on the lack of a benchmark or TRV.

The site-specific Step 3a risk refinement identified COECs as barium, copper, lead, molybdenum, and zinc from the COPECs listed above. Copper was identified as a COEC for plants because of the magnitude of exposure and because concentrations exceeded the Mare Island ambient fill concentrations. Metals values for the wetlands are compared to the ambient Mare Island fill values, which are calculated by the 95th percentile values. Barium, copper, lead, and zinc were identified as COECs for individual salt marsh harvest mice (*Reithrodontomys raviventris*) based on estimated daily doses that exceeded the conservative low TRV. Molybdenum was also identified as a COEC for herbivorous small mammals. Barium and molybdenum were also identified as COECs for benthic macroinvertebrates based on the risk decision for the SMHM. Exposure to total high molecular weight PAHs resulted in unacceptable risk to the SMHM at one location. However, because these PAHs are not widespread at elevated concentrations and the benzo(a)pyrene equivalent concentration is less than that for ambient soils in northern California, the ERA concluded that exposure to total high molecular weight PAHs did not result in unacceptable risk to herbivorous wetland mammals including the SMHM. (ChaduxTt 2012a).

The RI concluded that although barium, copper, lead, molybdenum, and zinc are present at concentrations that may result in unacceptable risk to one or more of the following receptors: plants, benthic macroinvertebrates, SMHM, and other herbivorous mammals, none of these COECs is widespread throughout the wetland habitat. The exposure point concentration used in the ERA for these metals in Subarea 6 was the 95% upper confidence limit (UCL) of the mean

for barium and copper, while the maximum value was used for lead, molybdenum, and zinc (ChaduxTt 2012a).

The estimate of risk is greatly influenced by concentrations of molybdenum and copper at location IR04SD003, located at the northernmost portion of the wetland (Figure 7). The highest concentrations of lead and zinc were also detected at that location. Further evaluation of the magnitude of risk from exposure to barium, copper, lead, molybdenum, and zinc in Subarea 6 was recommended in the RI. Section 2.8 and Appendix B of this FS discuss evaluation of the wetland COECs and propose a remedial action area delineation based on the evaluation findings. These findings support the ERA suggestion of addressing the area of highest metals concentration near location IR04SD003 in the northern area of Subarea 6.

2.6.5 Final IA F1 RI Report Conclusions and Recommendations

The Final RI Report for IA F1 concluded that the extents of soil, sediment, and groundwater contaminants were adequately delineated at each subarea in IA F1 to assess remedial action alternatives in an FS. No groundwater ingestion was evaluated in the HHRA for either current or future receptors based on the lack of potability of shallow saline groundwater at IA F1 and the shallow groundwater use exception (Water Board 2010). Therefore, unrestricted reuse of groundwater is not supported at IA F1. Table 1 presents the RI results and conclusions refined in the FS. Conclusions and recommendations for each of the seven subareas are summarized below:

- **Subarea 1:** No unacceptable risks to human health were identified in soil or groundwater for Subarea 1 based on current and planned reuse and the evaluated exposure pathways. Subarea 1 was evaluated as part of the upland habitat in the ecological risk assessment. Based on the distribution of the COECs in the upland habitat, COECs detected in Subarea 1 do not pose unacceptable risk to ecological receptors. No further evaluation is recommended to address risk to human or ecological receptors for Subarea 1 (ChaduxTt 2012a). TPH Area 2b was reevaluated as part of this FS Report with the additional data gap sampling results for TPH-dr and TPH-gr. Results indicate TPH Area 2b meets the criteria for low-risk fuel sites therefore no further action is recommended as discussed in Appendix A of this FS Report. TPH Area 2b will not be included in the remedial alternative evaluation in this FS Report.
- **Subarea 2:** No unacceptable risks to human health were identified in soil or groundwater for Subarea 2 based on current and planned reuse and the evaluated exposure pathways. Subarea 2 was evaluated as part of the upland habitat in the ecological risk assessment. Based on the distribution of the COECs in the upland habitat, COECs detected in Subarea 2 do not pose unacceptable risk to ecological

receptors. No further evaluation was recommended to address risk to human or ecological receptors for Subarea 2 (ChaduxTt 2012a).

- **Subarea 3:** No unacceptable risks to human health were identified in soil, groundwater, or soil gas for Subarea 3 based on current use and the planned reuse and the evaluated exposure pathways. Subarea 3 was evaluated as part of the upland habitat in the ecological risk assessment. Based on the distribution of the COECs in the upland habitat, COECs detected in Subarea 3 do not pose unacceptable risk to ecological receptors. No ecological risk is posed by concentrations of chemicals in soil gas. No further evaluation was recommended to address risk to human or ecological receptors for Subarea 3 (ChaduxTt 2012a).
- **Subarea 4:** Lead in surface soil poses an unacceptable risk to a future commercial/industrial worker in the area south of Building A75. No other unacceptable risks to human health were identified in soil or groundwater for Subarea 4 based on the planned reuse and the evaluated exposure pathways. Subarea 4 was evaluated as part of the upland habitat in the ecological risk assessment. Based on the distribution of the COECs in the upland habitat, lead and zinc pose unacceptable risk to ecological receptors in the area south of Building A75 (ChaduxTt 2012a); however, there is no pathway for ecological receptors at Building A75, so lead and zinc were dropped from the FS as COECs. However, zinc is co-located with the high lead concentrations, which affect human health. Even though no pathway to ecological receptors has been identified for this area, the active remedial action proposed for the area at Building A75 to address human health concerns related to lead would have the added benefit of lowering the exposure point concentration (EPC) for ecological receptors for zinc as well. TPH Areas 14 and 15 were reevaluated as part of this FS Report with the additional data gap groundwater samples for TPH. TPH results for TPH Areas 14 and 15 are below Tier 2 screening levels therefore no further action is recommended as discussed in Appendix A of this FS Report. TPH Areas 14 and 15 will not be included for remediation in this FS Report.
- **Subarea 5:** No unacceptable risks to human health were identified in soil, groundwater, or soil gas for Subarea 5 based on current use and the evaluated exposure pathways. Under the planned future reuse, a recreator could be at risk due to exposure to lead in soil near Building A17 if no remedial action were taken.. Subarea 5 was evaluated as part of the upland habitat in the ecological risk assessment. The RI evaluated ecological risk quantitatively for all upland subareas as a single unit, and then the distribution of identified COECs was evaluated spatially. Based on the spatial distribution of the COECs in the upland habitat, lead in soil poses unacceptable risk to ecological receptors in the area around Building A17. No

ecological risk is posed by concentrations of chemicals in soil gas or groundwater. Further evaluation was recommended to address risk to ecological receptors within Subarea 5 in the area around Building A17 because this portion of Subarea 5 is planned for reuse as a regional park, the area around Building A17 moves forward to the FS.

- **Subarea 6:** No unacceptable risks to human health were identified in sediment for Subarea 6 based on the planned reuse and the evaluated exposure pathways. Barium, copper, lead, molybdenum, and zinc were identified as COECs based on the Step 3a risk refinement for the wetland habitat. The RI concluded that COECs pose an unacceptable risk to ecological receptors in Subarea 6 and should be evaluated further (ChaduxTt 2012a).
- **Subarea 7:** No unacceptable risks to human health were identified in soil or groundwater for Subarea 7 based on the planned reuse and the evaluated exposure pathways. Subarea 7 was evaluated as part of the upland habitat in the ecological risk assessment. Based on the distribution of the COECs in the upland habitat, COECs detected in Subarea 7 do not pose unacceptable risk to ecological receptors. No further evaluation was recommended to address risk to human or ecological receptors within Subarea 7.

The Final RI Report makes the additional recommendations:

- ICs should be evaluated for all subareas to prevent future reuse from sensitive uses.

2.7 Results of TPH Sampling at TPH Areas 2b, 14, and 15

The Final RI Report for IA F1 concluded that concentrations of TPH-dr in TPH Area 2b in Subarea 1 were not fully delineated; therefore, additional investigation and further evaluation of TPH Area 2b was recommended. Two additional TPH areas (TPH Areas 14 and 15) in Subarea 4 were identified within IA F1 based on groundwater concentrations exceeding the Tier 2 screening levels for protection of aquatic receptors (for groundwater within 300 feet of the Mare Island Strait). In July 2013, Trevet completed additional TPH sampling for TPH Areas 2b, 14 and 15 in IA F1 at MINS. The purpose of the sampling was to evaluate the vertical extent of the elevated TPH reported at TPH Area 2b and to confirm the previously analyzed concentration at the same depth. The locations for additional TPH sampling were based on the findings of the Final RI Report for IA F1, regulatory agency comments, and the Navy's response to agency comments. The results of these samples and the evaluations of extent of contamination can be found in Appendix A of this report.

Soil samples were collected at TPH Area 2b (Appendix A, Figure A1) while groundwater grab samples were collected at TPH Areas 14 and 15 (Appendix A, Figure A2). Soil samples at TPH Area 2b were collected at 1 foot (TPH2BSB1-01), 3 feet (TPH2BSB1-03), 5 feet (TPH2BSB1-

05), and 7 feet (TPH2BSB1-07) bgs. A hold on analysis was placed on the soil sample collected at 7 feet bgs pending the result of TPH2BSB1-05. Three of the four soil samples collected in TPH Area 2b were analyzed for TPH-gr, TPH-dr, and TPH-mr.. Detected concentrations were compared with Tier 2 SL for TPH compounds developed for IA F1.

2.7.1 TPH Area 2b Sampling and Results

TPH-dr, TPH-mr and TPH-gr were detected in sample TPH2BSB1-01. TPH-dr was reported at a concentration of 980 mg/kg at 1-foot bgs, which exceeds the Tier 2 screening level of 500 mg/kg for TPH-dr developed for Mare Island. TPH-mr and TPH-gr were reported at concentrations of 1200 mg/kg for TPH-mr and 5.5 mg/kg for TPH-gr, which are below their respective Tier 2 screening levels for Mare Island (2,500 mg/kg and 500 mg/kg, respectively). TPH2BSB1-03 reported TPH-mr at 9.9J at 3 feet bgs, which is below the Tier 2 screening value of 2,500 mg/kg for TPH-mr. TPH-dr and TPH-mr were not detected at this depth. TPH-gr, TPH-dr and TPH-mr were not detected at 5 feet bgs in sample TPH2BSB1-05. Sample TPH2BSB1-07 was not analyzed because TPH compounds were not detected in sample TPH2BSB1-05. TPH Area 2b is bounded vertically as demonstrated by this data gap sampling. The previous analysis in the RI demonstrated TPH 2b was bounded laterally.

2.7.2 TPH Area 14 and 15 Sampling and Results

Temporary monitoring wells TPH-14 and TPH-15 were installed on June 28, 2013 at IA F1. A grab groundwater sample was collected from each well on July 2, 2013. Sample TPH14SB1-GB1 was collected in TPH Area 14 at the same location as grab groundwater sample UST190-B-11, collected in May of 1992 (Appendix A, Figure A2). Sample TPH15SB1-GB1 was collected in TPH Area 15 at the same location of grab groundwater sample UST190-B-14, also collected in May of 1992 (Figure A2).

TPH-dr was detected in sample TPH14SB1-GB1 (0.077J mg/L) and in sample TPH15SB1-GB1 (0.35 mg/L), at concentrations below the TPH-dr Tier 2 SL (0.64 mg/L) for groundwater within 300 feet of Mare Island Strait.

TPH-mr was not detected in groundwater samples TPH14SB1-GB1 or TPHS15SB1-GB1.

2.7.3 Conclusion

The sample results were compared with low-risk fuel site criteria (Appendix A). Data results show that TPH Area 2b has been adequately characterized and vertically delineated by the additional samples collected in June 2013 and that residual TPH contamination is limited to surface soil. Groundwater impacts are minimal. The area is paved, and surface-soil-to-surface-water and groundwater-to-surface-water migration pathways are incomplete. TPH Area 2b meets all other low-risk fuel site criteria (Appendix A).

TPH-dr in TPH Areas 14 and 15 are below the groundwater Tier 2 SL based on samples TPH14SB1-GB1 and TPH15SB1-GB1 respectively. TPH Areas 14 and 15 meet the criteria for a low-risk fuel site (Appendix A).

The DON recommends no further action for TPH Areas 2b, 14, and 15; these areas are not evaluated for remedial options in this FS Report.

2.8 Analysis of Ecological Risk in Subarea 6

The RI identified the entirety of Subarea 6 as requiring further evaluation of ecological risks from metals detected in the sediments. This section summarizes the findings of the recommended FS evaluation. The detailed FS evaluation of ecological risk in Subarea 6 is included in Appendix B.

Six surface sediment samples, collected from 0 to 2 feet bgs, were evaluated as part of the Subarea 6 wetlands ERA. Seven additional sediment samples from deeper sediments were also collected at these six locations, but were not included in the ERA. These samples were collected to provide additional understanding of the distribution of metals within the sediment in Subarea 6. Additionally, 16 samples were collected from 12 locations as part of the RI for Investigation Area K that is investigating potential contamination from Outfalls 33, 34, 35, 102, and 202. The results from the samples relating to these five outfalls were not included in the IA F1 RI because the outflows flow to offshore water (within the scope of IA K). However, results have been included in this FS to better delineate the areas that may need remedial action. The combined sample results (IA K and IA F1) within Subarea 6 for barium, copper, lead, molybdenum, and zinc are shown on Figure 7.

Critical to the delineation of the nature and extent of contamination in Subarea 6 is an understanding on the possible range of background concentrations of metals, which would naturally occur in sediment and soils. The RI established that the wetland area is a vegetated area with sediments that are likely composed of soils similar to Mare Island ambient fill. Additionally, the ERA stated, “The Navy believes the Mare Island ambient fill values are the most appropriate values against which to screen the wetland sediment because the area is vegetated with wetland plants and inundated only during high tide. The San Francisco ambient values are more appropriate for sediments in the offshore area of Mare Island” (ChaduxTt 2012a). A 2002 study of ambient fill concentrations established the following 95 percentile concentrations for copper, lead, and zinc (Tetra Tech 2002):

- Copper – 120 mg/kg
- Lead – 59 mg/kg
- Zinc – 230 mg/kg

While concentrations for barium and molybdenum were not established by the 2002 study, a study of molybdenum concentrations in Mare Island ambient fill was performed for IR Site 17 (ChaduxTt 2012b). The ambient molybdenum range was determined to be 1.2 to 5.5 mg/kg for Mare Island. Available ambient values established at Naval installations (including Mare Island) for barium and molybdenum are presented below (Tetra Tech 2002).

Naval Installation	Ambient Barium Concentrations (mg/kg)	Ambient Molybdenum Concentrations (mg/kg)
FISCO Fill [a]	166	2.65
Hunter's Point Fill [1]	314.4	2.68
Treasure Island Fill [2]	260	2
Treasure Island Native [2]	270	2.2
Point Mugu [3]	250	19.9
Mare Island Ambient Fill[4]	—	1.2 to 5.5

1 – 95% upper tolerance limit (UTL)
2 – 80% lower confidence limit of 95th percentile
3 – 99th percentile
4 – Mare Island basewide range evaluated for IR 17 – 0 to 10 feet bgs
FISCO – Fleet Industrial Supply Command Oakland

Barium. The ERA identified barium as a COEC, which could result in unacceptable risk to the SMHM. The HI exceeded 1 due to an isolated elevated concentration for barium in the surface sediment (0 to 2 feet bgs) at A053-2 (Figure 7; 130J mg/kg). A053-2 is located south of A198, which was referenced in the RI as being primarily sandy shoreline with minimal ecological habitat. Given the absence of vegetative cover, the area near A053-2 is unlikely to support SMHM making the exposure pathway incomplete.

Mare Island ambient fill values are not available for barium. Barium background values established for fill soil at other Navy facilities in the Bay Area range from 166 mg/kg at Fleet Industrial Supply Command Oakland (FISCO) to 260 mg/kg for Treasure Island fill soil to 314.4 mg/kg for Hunters Point fill soil. The barium value at A053-2 (130J mg/kg) is well below the ambient barium estimates at other California Naval bases listed in the table above. Barium results from IA K that were not included in the ERA were compared to the range of background values seen at these three facilities. The only location to exceed this range is sample location SM033-01A (Figure 7 near the northern end of Subarea 6; 591 mg/kg from 0.5 to 1.5 feet bgs). Additionally location SM102-01 (Figure 7 near the southern portion of Subarea 6) exceeded the lowest of these three background values at two depths, 170 mg/kg from 0 to 1 feet bgs, and 200 mg/kg from 1 to 6 feet bgs. Barium was also found in all 29 samples collected from Subarea 6 at varying concentrations suggesting barium is naturally occurring in this area. Therefore, the area around A053-2 is excluded from further investigation or evaluation.

Sample location SM033-01A is associated with Outfall 33, which indicates that there may be unacceptable risk to the SMHM from barium in the area associated with Outfall 33. The area associated with Outfall 33 is included for further investigation or remediation.

Sample location SM102-01 exceeds the barium background value of 166 mg/kg established for FISCO, but does not exceed the values established for Treasure Island fill soil or for Hunters Point fill soil. In addition, there is minimal to no wetland habitat and vegetative cover associated with SM102-01. The area near SM102-01 is unlikely to support the SMHM, making the exposure pathway in this area incomplete. The FS recommends this area be excluded from further investigation or remediation.

Copper. Copper was detected in all 22 samples collected from Subarea 6. Of the six samples considered in the ERA for IA F1, only two exceed the Mare Island ambient fill concentration of 120 mg/kg, suggesting copper contamination is localized near the northern portion of Subarea 6 (Figure 7). Of the 16 IA K samples associated with the outfalls and considered in this FS evaluation, none exceeded the background value of 120 mg/kg (Appendix B).

Only results from sample locations IR04SD003 and IR04SD004 (located in the northern end of Subarea 6) exceed the ambient level of 120 mg/kg with IR04SD004 (126 mg.kg), and IR04SD003 more than twice the ambient level (367 mg/kg). IR04SD003 was a sediment sample collected during the IR Site 4 investigations. The close proximity of the sample to the northern boundary of Subarea 6 suggests the contamination is associated with the waste sandblasting materials. IR04SD004 is in close proximity to Outfall 33, suggesting either the outfall or sandblasting activities at the adjacent property as the source of contamination. These two locations are recommended for further investigation and remediation as part of this FS.

Lead. Exposure to lead in Subarea 6 results in unacceptable ecological risk to the SMHM. The ambient fill concentration for lead is 59 mg/kg. That value is exceeded at eight sampling locations: 2 of the 16 samples considered in the ERA and 6 of 16 samples associated with the outfalls and IA K. Of these eight samples, only two are located outside the proposed wetlands target treatment zone (TTZ) but still reside within the wetlands: SM46o and SM036.

Sample location SM46o (149J mg/kg) is the single sample location in the wetlands habitat outside of the TTZ that exceeds the ambient value for lead. This sample is located in close proximity to sample locations SM035-01 and SM035-01A (Figure 7). Three samples were collected from these two locations and lead results (35.7 mg/kg, 27.8 mg/kg, and 53.1 mg/kg) were below the ambient value. Lead near SM46o is not recommended for further investigation or remediation.

Sample location SM036 is close in proximity to SM036-02. The surface lead result for SM036-02 (47.1 mg/kg) is below ambient value, suggesting that the elevated value at SM036 (82 mg/kg) does not indicate widespread contamination at this location.

Lead results from sample locations IR04SD003, SM44o, SM033-01, and SM033-01A were all above the Mare Island ambient fill value of 59 mg/kg. The close proximity of these sample locations suggests that the area around and north of Outfall 33 contains elevated lead. Addressing lead at the area north of and surrounding Outfall 33 would lower the lead EPC and result in lead no longer being classified as a COEC for the SMHM.

Molybdenum. Molybdenum was also detected in 16 of the 22 samples collected from Subarea 6. The Mare Island ambient fill range (1.2 to 5.5 mg/kg) is greater than the ERA ecological goal of 0.19 mg/kg based on risk to the SMHM. The highest molybdenum result is from SM033-01 (4.12J mg/kg) and is within Mare Island ambient fill range. Since molybdenum results do not exceed Mare Island ambient fill concentrations, it is recommended that molybdenum be excluded as a COEC in Subarea 6.

Zinc. Zinc was detected in all 22 samples collected from Subarea 6. The ambient fill concentration for zinc is 230 mg/kg. That concentration is only exceeded at one sampling location considered in the ERA (SM034-01A), but is exceeded in 6 of the 16 samples associated with IA K and the outfalls. Sample locations IR04SD003, SM033-01, SM033-01A, SM034-01A, SM44o, and SM102-01 exceed Mare Island ambient fill range concentrations for zinc.

Sample locations IR04SD003, SM033-01, SM033-01A, and SM44o are associated with the area north of and around Outfall 33 and are already included for evaluation as a TTZ based on other metals. The elevated zinc at these four sample locations is consistent with the overall pattern of elevated metals in sediment north of and near Outfall 33.

Outside the TTZ north of and near Outfall 33, the 1 to 6 foot bgs sample from location SM034-01A (Figure 7) is the single sample in the wetlands habitat that exceeds the ambient value for zinc. This sample is located in close proximity to sample locations SM034-01 and SM45o, as well as immediately below a surface sample at SM034-01A. The samples at these two locations, as well as the shallow (0 to 0.5 foot bgs) sample at SM034-01A each report zinc results below the ambient value. Zinc near SM034-01A does not appear to be a widespread concern and the SM034-01A area should not be evaluated for further investigation or remediation.

Addressing zinc at IR04SD003 and near Outfall 33 would lower the zinc EPC and likely eliminate the unacceptable risk; therefore, it is recommended that zinc be excluded as a COEC for the area of Subarea 6 outside of the TTZ.

As discussed for copper and lead, the area north of and around Outfall 33 will be evaluated for remedial action in this FS.

This FS evaluates alternatives for the area adjacent to and north of Outfall 33 as the TTZ due to elevated, copper, lead, and zinc. Based on the evaluation provided in Appendix B, molybdenum is not considered a COEC because all reported values are within the range established for Mare Island ambient fill. It is recommended that additional sampling be performed as part of the remedial design to better characterize the COECs (barium, copper, lead, and zinc) in shallow sediment at the northern end of Subarea 6. Figure 7 illustrates the proposed preliminary remedial action area for Subarea 6.

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Section 3 Remedial Action Objectives

U.S. EPA defines RAOs as medium-specific goals (e.g., soil or groundwater specific) for protecting human health and the environment (U.S. EPA 1988). RAOs serve to focus an FS and provide context for the overall scope of potential cleanup activities at a site; therefore, they guide the development and assessment of suitable remedial alternatives specific to Title 40 *Code of Federal Regulations* (40 CFR) § 300.430(e)(2)(i).

This section presents: 1) the RAOs developed for environmental media at IA F1; 2) numerical cleanup goals (i.e., preliminary RGs) calculated to provide protectiveness to human health and the environment based on the RAOs; 3) the areas requiring remediation at the site (i.e., the "remediation footprint") based on the RAOs and preliminary RGs; and 4) a summary of the ARARs identified for the IA F1 remedy planning process.

3.1 Affected Media and Contaminants of Concern

3.1.1 Affected Media

Affected media are identified below for both unrestricted and reasonably anticipated future use scenarios.

3.1.1.1 Unrestricted Reuse Scenario

For the unrestricted reuse scenario, the risk to the hypothetical residential receptor is evaluated as the most sensitive receptor. This scenario does not include the beneficial use of groundwater because it is an incomplete exposure pathway. The beneficial use exception letter received for the site (Water Board 2010) acknowledges shallow groundwater at IA F1 as unsuitable for beneficial use and is therefore not a complete exposure pathway. The following media may pose an unacceptable risk to receptors in the unrestricted reuse scenario at the identified subareas:

Soil – Subarea 3: Elevated lead concentrations in surface soil pose an unacceptable risk to the hypothetical residential receptor in Subarea 3.

Soil – Subareas 4 and 5: Surface and subsurface soil in Subareas 4 and 5 pose an unacceptable risk to the hypothetical residential receptor. Subarea 4 and portions of Subarea 5 that will remain industrial pose an unacceptable risk to ecological receptors if habitat is allowed to develop within these areas.

Subarea 6: The hypothetical resident was not evaluated in the HHRA for Subarea 6; therefore, an unrestricted reuse scenario at Subarea 6 was not evaluated.

3.1.1.2 Current Use and Anticipated Future Reuse Scenarios (Industrial and Recreational)

The current land use for IA F1 is inactive and vacant land. Maintenance workers from the Navy, the City of Vallejo, and Island Energy visit the site to check electrical substations and towers and to perform basic site maintenance. In addition, Navy subcontractors may conduct removal activities at the site in preparation for closure, transition, and property transfer of IA F1. The Navy is maintaining IA F1 as an industrial area by clearing vegetation periodically for firebreak protection.

The anticipated reuse scenarios for IA F1 are industrial for Subareas 1 through 4 and part of Subarea 5, and recreational for Subareas 6, 7, and the remainder of Subarea 5 (Figure 4). Exposure to COCs in groundwater (through vapor intrusion pathways) and subsurface soil do not pose unacceptable risk to the current and anticipated future receptors. The RI and analysis within this FS identified the following areas that contain affected media posing a potentially unacceptable risk to the anticipated future receptors:

Building A75 within Subarea 4: The affected media for this location is surface soil (less than 2 feet bgs).

Building A17 within Subarea 5: The affected media for this location is surface soil (less than 2 feet bgs).

Northern Area of Subarea 6: The affected media for this location is surface sediment (less than 2 feet bgs) located north of and around Outfall 33.

3.1.2 Contaminants of Concern Selected for Remedial Action

The COCs selected for remedial action were those for which the risk posed by the contaminant exceeded what was considered the acceptable range (ChaduxTt 2012a), based on the anticipated reuse scenarios and receptors for each subarea (Figure 4). For future uses that are not considered likely, such as residential reuse, specific COCs are not identified for remedial action. In these cases, this FS evaluates the use of land-use controls (LUCs) to prevent sensitive uses where they may lead to unacceptable risk.

3.1.2.1 Surface Soil

Surface soil is defined as soil from the ground surface (0 feet bgs) to a depth of 2 feet bgs. For costing purposes, this FS considered the interval from 0 to 2.5 feet bgs for treatment. COCs in surface soil requiring further evaluation or remedial action under the anticipated future use scenarios are:

- Lead near Building A75 in Subarea 4
- Lead near Building A17 in Subarea 5

3.1.2.2 Surface Sediment

IA F1 includes wetland sediment from 0 to 2 feet bgs within Subarea 6, above the high water line, excluding sloughs associated with Outfalls 33, 34, 35, 102, and 202 (outfalls are part of the IA K evaluation). However, sediment samples were collected from these sloughs as part of IA K and the results are included in the evaluation for Subarea 6. Despite the fact that the slough samples from IA K are considered in the evaluation of remedies in Subarea 6, the sloughs are not a part of IA F1. Similar to surface soil, remedial action costs for surface sediment were developed for the interval from 0 to 2.5 feet bgs.

As discussed in the preceding sections, the following chemicals are listed as COECs: barium, copper, lead, and zinc.

3.2 Remedial Action Objectives

RAOs are media-specific and designed to protect human health and the environment. According to U.S. EPA guidance, an RAO should specify: 1) the COC(s); 2) exposure routes and receptors; and 3) an acceptable chemical level or range of levels for each exposure route (i.e., a remedial goal) (U.S. EPA 1988). The preliminary RGs are usually chemical concentration limits that provide a quantitative means of identifying areas for potential remedial action, screening the types of appropriate technologies, and assessing a remedial action's potential for achieving the RAO. Preliminary RGs are also the performance requirements and the main basis for measuring the success of the response actions.

RAOs for locations at Building A75 and Building A17 are presented together as surface soil RAOs in Section 3.2.1. RAOs for Subarea 6 are presented separate from the other locations as surface sediment specific RAOs and are presented in Section 3.2.2.

In future use scenarios that are not considered likely, such as residential reuse, subsurface soil becomes a media of concern. The RAOs developed for subsurface soil are listed in Section 3.2.3. The RAOs developed for media of concern in unlikely use scenarios are less specific than RAOs developed for media of concern in anticipated use scenarios.

3.2.1 Remedial Action Objective for IA F1 Surface Soils

The following RAOs were developed for surface soil:

- Prevent exposure of future commercial/industrial workers to lead in surface soils containing concentrations that exceed the modified OEHHA industrial worker CHHSL in the Building A75 area.
- Prevent exposure of ecological receptors to lead in surface soils containing concentrations that exceed the risk-based ecological goals in the Building A17 area where exposure pathways exist.

- Prevent exposure of future recreational receptors to lead in surface soils in the Building A17 area at concentrations that exceed the modified OEHHA residential CHHSL, which is conservative for the recreational receptor.
- Prevent sensitive reuse exposure to COCs in surface soil in Subareas 3, 4, and 5.
- Prevent exposure of ecological receptors to surface soil in Subareas 4 and industrial reuse portions of Subarea 5.

3.2.2 Remedial Action Objective for IA F1 Surface Sediment

The following RAO applies to surface sediment in Subarea 6:

- Prevent ecological exposure to barium, lead, copper, and zinc in sediment that exceed the higher of either the Mare Island ambient fill concentration (ambient fill range from other nearby Bay Area Navy facilities for barium) or the calculated risk-based ecological goals in the Northern Area of Subarea 6.
- Prevent residential reuse exposure to COCs in sediment in Subarea 6.

3.2.3 Remedial Action Objective for IA F1 Subsurface Soil

An RAO was developed for subsurface soil to prevent exposure to unacceptable subsurface soil risks from unrestricted reuse. The following RAO applies to subsurface soil:

- Prevent sensitive reuse exposure to elevated lead and chemicals in subsurface soil in appropriate areas.

3.3 Preliminary Remedial Goals

Preliminary RGs are site and media specific to achieve RAOs. For IA F1, selection of preliminary RGs were evaluated to applicable screening levels, background concentrations, or ecological risk-based values. Preliminary RGs have not been developed for future use scenarios that are not considered likely, such as residential reuse. In these cases, the FS evaluates the use of LUCs to prevent sensitive uses that may result in unacceptable risk.

Preliminary RGs for the surface soil and sediment are presented below:

Building A75 Surface Soil Preliminary RGs:

- Preliminary RG for lead of 345.6 mg/kg (modified OEHHA industrial CHHSL).

Building A17 Surface Soil Preliminary RGs:

- Preliminary RG for lead of 105.6 mg/kg (modified OEHHA residential CHHSL). Recreational receptors are exposed to no more than ½ the residential exposure as stated in the RI (ChaduxTt 2012a). An RG that is protective of the future recreational receptors will also be protective of current commercial/industrial workers and

construction workers. This preliminary RG for lead is also protective of the most sensitive vertebrate receptor (western meadowlark) since it is lower than the calculated 205 mg/kg for lead based on an HQ of 1 using the high TRV for risk.

Subarea 6 Sediment Preliminary RGs

- Preliminary RG for lead of 59 mg/kg (Mare Island ambient fill concentration). The risk-based concentration was evaluated as 45.5 mg/kg, which results in an HQ of 1 using the low-TRV for the most sensitive receptor, the SMHM. Since this is lower than background, the preliminary RG is set at background.
- Preliminary RG for zinc of 230 mg/kg (Mare Island ambient fill concentration). The risk-based concentration was evaluated as 200 mg/kg, which results in an HQ of 1 using the low-TRV for the most sensitive receptor, the SMHM. Since this is lower than background, the preliminary RG is set at background.
- Preliminary RG for copper of 120 mg/kg (Mare Island ambient fill concentration). The risk-based concentration was evaluated as 49.2 mg/kg, which results in an HQ of 1 using the low-TRV for the most sensitive receptor, the SMHM. Since this is lower than background, the preliminary RG is set at background.
- Barium is compared to the ambient fill range of 166 to 314.4 mg/kg, based on the ambient fill concentrations of nearby Naval facilities in the Bay Area; only one barium detection exceeded the ambient fill range. This single elevated result is within the area already considered for remediation based on other metals. No numerical preliminary RG for barium is proposed.
- Establish a legal instrument to prevent the residential use of the property unless and until it is suitable for such use.

Surface and Subsurface Soil Preliminary RGs for IA F1:

- Establish a legal instrument to prevent the residential use and other sensitive uses of the property where unrestricted exposure poses an unacceptable risk unless and until it is suitable for such uses.

3.4 Remedial Footprints and Volumes of Contaminated Media

The TTZs of the three specific locations proposed for active remedial action are described below. Figure 2 provides an illustration of the proposed TTZs.

Building A75: The Building A75 TTZ is the area to the southeast of the building where lead concentrations exceed the surface soil preliminary RGs. The delineated area proposed for Building A75 is a rectangle roughly 40 feet by 270 feet for a total of 10,800 square feet, which is

effectively delineated in the horizontal direction by existing data. For cost estimating purposes, the FS considered remediation by excavation to a depth of 2.5 feet bgs, which results in an estimated soil volume of 1,000 cubic yards for removal.

Building A17: The delineated area proposed for remedial action at the Building A17 TTZ is roughly "U" shaped bordering the north, east, and south sides of the building. The area to the north is a rectangle approximately 6 feet by 120 feet for an area of 720 square feet. The area to the east is a trapezoid with an area of roughly 880 square feet. The area to the south is a rectangle approximately 10 feet by 110 feet consisting of 1,100 square feet. The total area proposed for remediation at Building A17 is 2,700 square feet, which is effectively delineated in the horizontal direction by existing data. For cost estimating purposes, the FS considered treatment to a depth of 2.5 feet bgs, which results in an estimated soil volume of 250 cubic yards for treatment.

Remedial alternatives are evaluated for both Building A17 and Building A75 surface soil areas collectively. As such, the total surface area to be addressed is the sum of the TTZ areas for Building A75 and Building A17, totaling approximately 13,500 square feet. The total soil volume to be addressed is the sum of the TTZ volumes for Building A75 and Building A17, totaling approximately 1,250 cubic yards, based on a treatment depth to 2.5 feet bgs. The mass of surface soil subject to remedy is estimated using a conversion factor if 1.2 tons per cubic yard for a total mass of approximately 1,500 tons.

Northern Area of Subarea 6: The area for proposed remedial action in Subarea 6 is located to the north of the slough associated with Outfall 33 (Figure 3) as well as the area around the slough associated with Outfall 33 from IA K. The area for remediation is approximately 38,400 square feet based on a polygon area composed of a triangular area roughly 225 feet x 225 feet x 315 feet and a rectangular area of 225 feet x 60 feet. Cost development for remedial alternatives will consider remedial action to a depth of 2.5 feet bgs, which would result in an estimated treatment volume of 3,550 cubic yards with a total mass of 5,000 tons using a conversion factor of 1.4 tons per cubic yard based on wet sediment. As indicated in preceding sections, additional sampling is recommended during the remedial design to support the selected remedy.

3.5 Potential Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA (42 U.S.C. Section [§] 9621[d]), as amended, states that remedial actions at CERCLA sites must attain (or the decision document must justify the waiver of) any federal or more stringent state environmental standards, requirements, criteria, or limitations determined to be legally applicable or relevant and appropriate. An ARARs evaluation is included as Appendix C.

Section 4 Screening of Remedial Technologies and Process Options

4.1 Technology Identification and Screening Approach

The primary objective of the technology identification and screening phase of the FS is to develop an appropriate range of possible technologies and process options suitable to address COCs (or COECs) in each of the environmental media of interest at IA F1. In this section, various technologies and process options are identified, described, and subjected to an initial screening analysis, which focuses on remediation of the particular COCs for each media, as discussed in Section 3.

4.1.1 General Response Actions

GRAs are broad classes of responses or remedial actions intended to meet the RAOs. Similar to RAOs, GRAs are media-specific. GRAs are derived based on engineering judgment and experience with response actions proven successful for the COCs (barium, copper, lead, and zinc) at IA F1.

GRAs may include no action, containment, treatment, ICs, removal, or a combination of these (U.S. EPA 1988). In some cases, response actions may stand alone as complete remedial alternatives, but in many cases, combinations of response actions are necessary to effectively address contamination and meet the RAOs. Because the RAOs were developed based on the current and planned future land use, the GRAs were also developed considering the current and planned future land use of each subarea.

The following GRAs were identified for subsurface soil, surface soil, and surface sediment to meet RAOs that restrict future use.

- **No Action:** No Action alternative is required for CERCLA evaluation.
- **Land-Use Controls:** LUCs include engineering controls (EC) and ICs such as administrative or legal controls. LUCs can minimize or prevent human exposure to contaminants and limit changes to site conditions that alter exposure mechanisms.

The following GRAs were identified for the TTZs in surface soil and surface sediment to meet RAOs protective of planned future land use.

- **Containment:** Containment includes covering or containing contaminated soil to prevent direct exposure of receptors through the dermal contact, inhalation of contaminated particles, and ingestion exposure pathways.
- **Removal**: Removal technologies include excavation and off-site disposal of contaminants in soil or sediment.

- **Treatment:** Treatment processes include in situ and/or ex situ treatment of soil or sediment to reduce the toxicity, mobility, and/or volume of contaminants.

Appropriate technologies and process options are identified and retained for use in the development of remedial alternatives for IA F1 in Section 5. Any vendors and/or products, including the equipment, system components, and other materials identified in this report, are primarily for information purposes only and do not imply recommendation or endorsement.

4.1.2 Screening Criteria

The screening analysis of technologies and process options is based on a subset of the NCP evaluation criteria that includes effectiveness, implementability, and cost. These criteria are summarized below:

Effectiveness

Effectiveness is the ability of a remedial technology to achieve the RAO within a reasonable timeframe. When evaluating effectiveness, three primary factors are considered: 1) the ability to treat the estimated volume or area of contaminated media (in this case, surface soil and surface sediment); 2) the protectiveness of the technology to the environment during implementation; and 3) the reliability of the technology to reduce the toxicity and mobility of chemicals at the site and provide long-term protection.

Implementability

Implementability encompasses both the technical and administrative feasibility of implementing a technology or process option. Technical feasibility includes compatibility with site-specific conditions; the availability of equipment; the ease of any required construction; the labor intensiveness required by the technology; and the availability of vendors that have the capability to design, construct, and maintain the technology. Administrative feasibility includes the ease of obtaining approvals from other offices and agencies and the requirements for, and availability of, specific equipment and technical specialists. It should be noted that CERCLA actions conducted on site are exempt from permits, although CERCLA actions are still undertaken in a manner consistent with the conditions of permits that would otherwise apply.

Cost

Cost plays a limited role in the screening of technologies and process options. The evaluation of cost addresses direct and indirect capital costs and annual operation and maintenance (O&M) costs. The relative cost for each option is categorized as low, moderate, or high. Costs are based on engineering judgment and available information associated with the respective option.

The screening analysis of technologies and process options is discussed in Sections 4.2 through 4.4. Those technologies and process options that are retained are carried forward to Section 5.

4.2 No Action

The NCP requires that the no action option be carried through the detailed analysis of alternatives to serve as a baseline case against which all other actions are compared. Under the no action response, no remedial activities would be conducted and there would be no short-term or long-term monitoring.

4.2.1 Effectiveness

No action may be appropriate if site conditions do not result in unacceptable risk to human health or the environment or if previous remedial actions have eliminated the need for further action. Surface soil and surface sediment would be left as is without implementing any remedy (ICs, containment, removal, treatment, or other mitigating actions). Although certain media and subareas within IA F1 do not present unacceptable risks requiring action, such as surface and subsurface soil within Subareas 1, 2, and 7, Alternative 1 would not achieve RAOs for all media and subareas at IA F1.

4.2.2 Implementability

Because no action would be taken, this response would be easily implementable for surface soil, subsurface soil, and surface sediment.

4.2.3 Cost

No cost is associated with this option because no action is taken.

4.2.4 Screening Result

As required under the NCP, the no action option will be retained for further evaluation as a remedial alternative for comparison only.

4.3 Land-Use Controls

LUCs are restrictive measures placed on the use of land or an area to prevent or limit exposure to hazardous substances left in place at a site, or to ensure effectiveness of a given remedy. LUCs are proposed for portions of subsurface and surface soil and sediment throughout IA F1.

LUCs include ICs and ECs. ICs are legal, administrative, or governmental mechanisms used to implement land use and access restrictions that limit the exposure of future landowner(s) and/or user(s) of the property to hazardous substances present on the property, and to maintain the integrity of the remedial alternative. ECs include constructed access restrictions or barriers, like fencing or signs that would prevent contact with hazardous substances.

LUCs (as ICs, ECs, or both) are required on a property where the selected remedial action results in COCs remaining at the property above levels that allow for unlimited use and unrestricted

exposure. Implementation of LUCs also includes requirements for monitoring and inspections, and reporting to ensure the integrity of the remedy and compliance with any land-use or activity restrictions. LUCs may limit future redevelopment and run with the land in perpetuity or until the hazardous conditions have been removed to allow for unrestricted reuse. ICs were retained for evaluation in the remedial alternatives.

Legal mechanisms include restrictive covenants, negative easements, equitable servitudes, lease restrictions, and deed notices. Administrative mechanisms include notices, adopted local land-use plans and ordinances, construction permitting, or other existing land-use management systems that are intended to ensure compliance with land-use restrictions. ICs are more effective if they are layered or implemented in series. Layering means using several IC mechanisms at the same time to enhance the protectiveness of the remedy. Implementation of ICs in series may be applied to enhance both the short- and long-term effectiveness of the remedy.

4.3.1 LUCs in Property Conveyance

4.3.1.1 Conveyance to a Nonfederal Entity

The Navy will rely on proprietary controls in the form of environmental restrictive covenants as provided in the "Memorandum of Agreement [MOA] between the United States DON and the California Department of Toxic Substances Control" and attached covenant models (Navy and DTSC 2000). More specifically, land-use restrictions will be incorporated into at least one legal instrument and may be offered in a second, separate legal instrument as provided in the Navy/DTSC MOA if the property is transferred to a nonfederal entity:

1. Restrictive covenants included in one or more Quitclaim Deeds from the Navy to the property recipient.
2. Restrictive covenants may be included in one or more "Covenants to Restrict Use of Property" entered into by the Navy and DTSC.

The "Covenants to Restrict Use of Property" would incorporate the land-use restrictions into environmental restrictive covenants that run with the land and that are enforceable by DTSC and the Navy against future transferees. The Quitclaim Deeds would include the identical land-use restrictions in environmental restrictive covenants that run with the land and that would be enforceable by the Navy and DTSC against future transferees.

According to the Department of Defense "Principles and Procedures for Specifying, Monitoring and Enforcement of Land-Use Controls and Other Post-ROD Actions" (DOD 2003), the following issues relating to ICs would need to be addressed in the Record of Decision/Remedial Action Plan and LUC remedial design (RD) for IA F1:

- Description of the risks necessitating the ICs;

- Documentation of risk exposure assumptions and reasonably anticipated land uses;
- General description of the ICs, the logic for their selection, and related deed restrictions and notifications;
- Statement of the IC performance objectives;
- List of the parties responsible for monitoring, reporting and enforcing the ICs;
- Description of the area or property covered by the ICs;
- Expected duration of the ICs; and
- Reference to an RD document for implementation actions, because these details may have to be adjusted periodically based on site conditions and other factors.

4.3.1.2 Conveyance to a Federal Department or Agency

If the Navy transfers the IA F1 to a federal department or agency, the IC objectives set forth above would be incorporated into a MOA or similar document.

4.3.2 LUCs Implementation and Oversight

Monitoring and inspections would be conducted to assure that the ICs are being properly implemented. The Navy and Federal Facility Site Remediation Agreement (FFSRA) signatories and their authorized agents, employees, contractors, and subcontractors would have the right to enter IA F1 to conduct investigations, tests, or surveys; inspect field activities; or construct, operate, and maintain any response or remedial action as required or necessary under the cleanup program. These access agreements would be included in the deed and covenant for property conveyed to a nonfederal entity and in an MOA if the property is conveyed to a federal entity.

The Navy would address IC implementation and maintenance actions, including periodic inspections, in the LUC RD to be developed and submitted to the FFSRA signatories for review and concurrence pursuant to the FFSRA. The LUC RD is a primary document under the FFSRA.

The LUC RD document would include a section to describe required IC implementation and actions, including:

- Requirements for CERCLA 5-year remedy review;
- Frequency and requirements for periodic monitoring or visual inspections and reporting results from monitoring and inspections;
- Notification procedures to the regulators for planned property conveyance, changes, or corrective action required for the remedy;
- Development of language for ICs and parties to receive copies of the deed language once executed;

- Identification of responsibilities for Navy, U.S. EPA, DTSC, Water Board, and other government agencies, and the new property owner for implementation, monitoring, reporting, and enforcing ICs;
- A list of ICs with their expected duration;
- Map(s) identifying where ICs are to be implemented; and
- All requirements for soil associated with the chosen alternative.

The Navy would be responsible for implementing, inspecting, reporting, maintaining, and enforcing the necessary ICs described in the Record of Decision/Remedial Action Plan in accordance with the LUC RD. The Navy might later transfer these procedural responsibilities to another party by contract, property transfer agreement, or other means. Still, the Navy would retain ultimate responsibility for remedy integrity. Should any of the ICs fail, the Navy would ensure that appropriate actions were taken to reestablish protectiveness of the remedy and might initiate legal action to either compel action by a third party or to recover the Navy's costs for mitigating any failing ICs.

4.3.3 Land-Use Control through Institutional Controls

LUCs by ICs were retained for evaluation in the remedial alternatives. The following subsections evaluate ICs as potential technologies for IA F1.

4.3.3.1 Effectiveness

ICs are effective, not through actively treating contaminants, but by preventing human exposure to contaminants through legal restrictions. Similarly, ICs restricting the formation of habitat suitable for ecological receptors may be an effective means of preventing ecological exposure. Land use is restricted for sensitive uses at IA F1 due to unacceptable risks from exposure to COCs in surface soil, subsurface soil, and surface sediment to sensitive human receptors for Subareas 3, 4, 5, and 6. ICs preventing the formation of ecological habitat are evaluated for Subarea 4 and the portion of Subarea 5 that is planned for future industrial development. ICs would be an effective means of limiting human and ecological exposure and of meeting the RAOs for surface sediment, and subsurface and surface soil for the areas outside of the TTZs, where necessary, at IA F1.

4.3.3.2 Implementability

ICs would be easily implemented at IA F1. Effective implementation and enforcement of ICs is often the greatest uncertainty in the application of these tools, but this is a manageable uncertainty.

4.3.3.3 Cost

Implementing and enforcing ICs would be low in cost. However, ICs would require ongoing long-term inspection and verification to ensure the effectiveness of the remedy in preventing exposure to COCs, which results in additional costs versus a permanent remedy such as removal that does not require long-term commitments.

4.3.3.4 Screening Result

ICs are generally effective, implementable, and low in cost. Furthermore, they are often critical in the proper execution of more active remedy elements. Therefore, ICs as land-use and activity restrictions in covenants or MOAs to restrict use of property are retained for further consideration. Developed ICs are to be layered with any ICs associated with protecting the active remedial technologies especially designed for the TTZs.

4.4 Remedial Technologies for TTZs

The remedial technologies presented in this section are applicable only to the TTZs identified in the upland areas (Buildings A17 and A75) for surface soil and wetlands area (Subarea 6) for surface sediment.

4.4.1 Containment

Containment processes are intended to isolate the contaminated soil to prevent direct exposure and contaminant migration. The most appropriate containment alternative for surface soil in the upland areas at IA F1 are surface covers. Cover materials used to prevent direct exposure may include clean soil, synthetic membranes, asphalt, or concrete.

The most appropriate containment alternative for surface sediment at Subarea 6 is relocating the impacted sediments to an on-site containment cell in an upland industrial area, which is already planned for ICs restricting sensitive uses. Sediments planned for relocation will be tested for suitability prior to placement in the cell. While many options exist for the containment covering materials, the most appropriate would be excavated native soil stockpiled from the construction of the containment cell. Erosion control measures would be applied to the containment cell to prevent sediment movement back to the wetlands.

4.4.1.1 Effectiveness

Either a soil or engineered cover of an appropriately designed thickness would be effective to prevent human receptors from exposure through the direct contact and ingestion pathways to chemicals in the underlying soil or sediment. Other cover elements, such as an animal intrusion barrier and a topsoil layer, could be added as necessary and would be effective at preventing cover damage from burrowing animals. For the engineered cap to function effectively, proper

drainage would also need to be provided, through either proper grading or a water collection and conveyance system. Relocating sediment to a containment cell in the upland area effectively eliminates the contact and exposure pathways for ecological receptors. Proper ICs would need to be in place at the site to prevent activities that could lead to a reduction in the effectiveness of the cover over time.

4.4.1.2 Implementability

The technology required to implement soil or engineered covers is readily available and easily implementable for the upland areas at IA F1. Animal intrusion layers are generally constructed as synthetic layers (e.g., plastic) or of other common earth materials (e.g., cobbles), both of which are readily available and easily placed. The technology required to implement a containment cell is readily available, as it involves standard earthmoving equipment.

4.4.1.3 Cost

A soil cover would likely be lower in cost than an engineered cap. The containment alternatives would generally be in the lower range when compared to treatment technologies. Containment requires ongoing long-term maintenance and monitoring to ensure the effectiveness of the remedy in preventing exposure to COCs, which results in additional costs versus a permanent remedy such as removal that does not require ongoing long-term maintenance and monitoring. Containment also requires additional excavation and on-site soil handling relative to removal.

4.4.1.4 Screening Result

A cover to address surface soil areas containing COCs at the site is a relatively cost-effective and moderately implementable way of isolating soil COCs and mitigating risks associated with contact and ingestion pathways at IA F1. This technology is retained as a viable remedial option for upland areas at Buildings A17 and A75.

Sediment consolidation and relocation to a containment cell in the upland area to address surface sediment containing elevated metals at the site is a relatively cost-effective way of eliminating risks associated with contact and ingestion pathways to ecological receptors. Implementation is feasible. This technology is retained as a viable remedial option for wetlands in Subarea 6.

4.4.2 Treatment

Technologies exist that allow the treatment of soils containing COCs in situ by degrading or immobilizing COCs without the need for soil removal. In situ treatment technologies are applied to reduce chemical levels below cleanup criteria, protect receptors from contact with soil containing COCs, and/or minimize the mobility, toxicity, and/or bioavailability of chemicals. Ex situ technologies are used in combination with removal processes that remove the impacted media, treat ex situ and then replace remediated media into the site.

4.4.2.1 Effectiveness

The COC for IA F1 surface soil is lead and the COECs for Subarea 6 are barium, copper, lead, and zinc. Existing technologies for in situ treatments such as solidification/stability, soil vapor extraction, and bioremediation are not commonly used to treat the COCs and COECs effectively. In situ soil mixing with solidification is one technology that could potentially reduce the exposure point concentrations and mobility of the COCs and COECs in IA F1. However, soil mixing would not reduce the overall amount of contaminant present and in the case of Subarea 6, would potentially disrupt ecological habitat.

Phytoremediation is another treatment process that has been used to address metals contamination in soils. While uptake by specifically selected plants, which are then harvested and properly disposed of to remove contamination, has been shown to reduce metals concentrations in soils, the applicability to sediments is less known and the process is time and labor intensive. There is also a high degree of uncertainty in the outcome.

4.4.2.2 Implementability

In situ treatment technologies are often favored for subsurface soils or areas that are difficult to access making treatment easier to implement than removal actions. At IA F1, the surface soil and surface sediment are easy to access, making in situ treatment a less attractive option than other process options such as containment or removal.

4.4.2.3 Cost

The remedial action footprints for surface soil and sediment at IA F1 are shallow and relatively small. As such, treatment is not as cost-effective as other process options such as containment or removal.

4.4.2.4 Screening Result

Due to the limited effectiveness of available treatment technologies, the easily accessible nature of the IA F1 surface soil remedial footprints and the relatively lower cost of other process options in comparison, treatment is eliminated as a viable remedial option for surface soil or surface sediment and is not carried forward.

4.4.3 Removal

Removal technologies would remove surface soil and surface sediment containing COCs and COECs at concentrations that result in unacceptable risk to receptors. By removing impacted media, removal technologies (i.e., excavation) reduce the potential mobility and exposure potential of those chemicals to humans and ecological receptors.

This process option entails removing impacted media using earthmoving equipment. Excavated soil (or sediment) would be transported to permitted off-site treatment and/or disposal facilities. Excavations typically are backfilled with appropriate fill (clean soil in the upland areas and sediment fill for wetlands) available from an off-site source that can be demonstrated as suitable.

4.4.3.1 Effectiveness

Excavation is applicable to the complete range of chemical groups, with no particular target group. However, excavation cannot act as a stand-alone remedial option since excavated soil and sediment typically requires treatment and/or disposal in designated areas or at off-site facilities. Ex situ treatment is not an effective means of reducing total metal concentrations; therefore, contaminated soil and sediment would be transported to an off-site disposal facility. Excavation of soil and sediment containing COCs is commonly supported by a proper post-excavation sampling approach to verify the removal of impacted media.

4.4.3.2 Implementability

Equipment and labor needed to execute an excavation would be readily available, and earthmoving is an easily implemented strategy in both upland and wetlands areas at IA F1.

4.4.3.3 Cost

Excavation is a labor- and equipment-intensive practice, but generally of lower cost than treatment options. Excavation would also eliminate the need for any ongoing long-term maintenance reducing long-term costs of the technology. Overall, costs for excavation would likely be very competitive with other alternatives.

4.4.3.4 Screening Result

Soil excavation for the TTZs in the upland and wetlands areas in IA F1 is retained for further consideration based on its measurable effectiveness, ease of implementation, and competitive cost.

4.4.4 Summary Remedial Technologies for TTZs Screening Outcomes

Four GRAs are retained for further evaluation for surface soil in the upland areas and surface sediment in the wetlands in Subarea 6 at IA F1.

- No Action
- Institutional Controls
- Containment
- Removal

The technologies and process options for treatment were eliminated during the initial screening for soil and sediment at IA F1 because of the limited likelihood of success treating metals, ease of access of remedial footprints, and relatively lower cost of other process options.

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Section 5 Development of Remedial Alternatives

Remedial alternatives to address TTZs at IA F1 are discussed below. Land-use restrictions for IA F1 are incorporated in the discussion of each alternative. These alternatives were developed to address the project-specific RAOs and achieve preliminary RGs by creating assemblages of technologies and process options deemed potentially suitable for the site. The developed remedial alternatives are summarized in Table 2.

5.1 No Action Alternative

A remedial alternative was developed for the No Action Alternative at IA F1. Alternative 1: No Action is described in the following section.

5.1.1 Alternative 1: No Action

With selection and implementation of the No Action Alternative, Alternative 1, no response action would be undertaken and ICs would not be implemented at IA F1. Although certain media and subareas within IA F1 do not present unacceptable risks requiring action, such as surface and subsurface soil within Subareas 1, 2, and 7, Alternative 1 would not achieve RAOs for all media and subareas at IA F1. The No Action Alternative is, nevertheless, retained throughout the evaluation process as required by the NCP to provide a baseline for comparison as required by CERCLA.

The following sections describe the remedial alternatives for specific TTZs.

5.2 Upland Remedial Alternatives

Exposure to lead in upland surface soil at IA F1 results in an unacceptable risk to human health and ecological receptors under the current and/or anticipated future land-use scenario for Subareas 3, 4, and 5. Based on the results of the remedial technologies screening, two remedial alternatives were developed for the upland areas:

- Alternative U2: Institutional Controls and Asphalt Cap
- Alternative U3: Institutional Controls, Excavation, and Off-Site Disposal

The following subsections provide descriptions of these alternatives, including notes on the major design assumptions that were used to estimate costs and action-specific ARARs unique to each alternative. Given the proximity of the remedial action areas as well as the shared COC and limited depth of impact, it is assumed that a single remedy would be selected for upland soils and would be applied to both Building A17 and Building A75 TTZ areas.

5.2.1 Alternative U2: Institutional Controls and Asphalt Cap

Alternative U2 would use ICs and asphalt capping to meet ARARs and RAOs. ICs would prevent sensitive land uses at Subareas 3, 4, and 5. Asphalt capping would address the TTZ areas of Building A17 and Building A75. Additional ICs, specific to the asphalt cap, would be used in conjunction with the sensitive uses ICs. Asphalt cap ICs would only be applicable to the asphalt-capped TTZ areas. ICs restricting sensitive uses at IA F1 are discussed below.

5.2.1.1 Sensitive Use ICs

ICs meet the RAOs and ARARs for sensitive receptors by restricting sensitive uses and exposure pathways at IA F1. The effectiveness of ICs is evaluated in Table 7. The implementation of ICs was discussed in detail in Section 4.3. ICs restricting sensitive reuse of the property would be required to limit exposure to upland soil (surface and subsurface) for Subareas 3, 4, and 5 as evaluated in Table 7 but may be extended sitewide (throughout IA F1) for ease of implementability by the transferee.

It is anticipated that restricted land-use activities for Subareas 3, 4, and 5 would include:

- Residential use
- A hospital for humans
- A school for persons under 18 years of age
- A day care facility for children
- Formation of open space or ecological habitat specifically within Subarea 4 and the industrial reuse portion of Subarea 5.

ICs would be described in the LUC RD document that would also specify roles and responsibilities for implementing, monitoring, and enforcing the ICs. The ICs developed in this alternative are to be enforced in all areas of IA F1 including remediation areas. If site conditions changed in the future and it could be demonstrated to the satisfaction of the Navy and the State that exposure to COCs and COECs in soil or sediment no longer results in unacceptable risk to human health and the environment, the proposed ICs could be removed.

The following section describes asphalt capping for the TTZs at Building A17 and Building A75.

5.2.1.2 Asphalt Cap for TTZ

An asphalt cover is evaluated due to the industrial nature of the redevelopment planned for the Building A75 area because each of the TTZs is immediately adjacent to the existing buildings (A75 and A17). Capping processes are intended to isolate the impacted soil to prevent direct exposure and contaminant migration.

Asphalt capping provides a physical barrier to eliminate the exposure pathways to lead-impacted soil. Asphalt capping would be required for the remediation areas shown on Figures 5 and 6, to prevent the exposure of underlying soil. Standard construction practices for roads would likely be adequate. Examples of asphalt covers could include a minimum 4 inches of asphalt or a minimum 2 inches of asphalt over 6 inches of base material. The need for ongoing maintenance, upgrades, or repairs to the covers would be assessed in the RD and implemented for this alternative, as necessary. The asphalt cap would be inspected annually and reviewed for protectiveness as part of the CERCLA 5-year review.

5.2.1.3 TTZ Specific ICs

Based on the anticipated future land use of the Building A17 and Building A75 areas, the following activities would be prevented within the TTZ areas and would be layered along with the general sensitive-use restrictions:

- Alteration, disturbance, or removal of the asphalt cap cover.

These activities would be restricted with the use of ICs and be implemented at the Building A17 and Building A75 areas along with the other ICs identified for IA F1.

5.2.2 Alternative U3: Institutional Controls, Excavation, and Off-Site Disposal

Alternative U3 consists of soil excavation, off-site disposal at a permitted disposal facility, as well as backfilling the excavations and ICs as discussed in Alternative U2 in Section 5.2.1.1. Soil containing lead at concentrations above remediation goals in the Building A17 and Building A75 would be excavated where feasible to reduce the concentrations of these COCs. Approved backfill will be used. This alternative provides a permanent remedy for chemicals where excavation is feasible. The components of Alternative U3 are described below.

5.2.2.1 Sensitive Use ICs

ICs preventing sensitive uses at IA F1 would be applied as discussed in Alternative U2 in Section 5.2.1.1.

5.2.2.2 Excavation, Disposal, and Backfilling for TTZ

Soil would be excavated in the TTZs within the Building A17 and Building A75 areas. The remedial footprints on Figures 5 and 6 serve as the excavation footprints to a depth of 2.5 feet bgs for the basis of the cost estimate; detailed excavation plans would be developed in the RD. The estimated TTZs for each upland soil area are described in detail in Section 3.4 and summarized below:

- Building A75: Area – 10,800 square feet, Depth – 2.5 feet bgs, Volume – 1,000 cubic yards

- Building A17: Area – 2,700 square feet, Depth – 2.5 feet bgs, Volume – 250 cubic yards
- Total Surface Area: 13,500 square feet
- Total Volume: 1,250 cubic yards
- Total Mass assuming 1.2 tons per cubic yard: 1,500 tons

The open excavations would be backfilled with clean soil, and the excavated soil containing elevated lead would be removed from the site and transported to an appropriate permitted disposal facility for disposal. All other areas with concentrations of lead exceeding remedial goals would be left in place. By removing the soil in the proposed remedial action areas, lead EPCs would be reduced to concentrations that do not pose unacceptable risk to human and/or ecological receptors as appropriate for area reuse. ICs for soil will only be required for areas where unrestricted reuse and exposure is not warranted.

5.3 Wetland Remedial Alternatives

Based on the results of the remedial technologies screening, two remedial alternatives were developed for the wetland area:

- Alternative W2: Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland
- Alternative W3: Institutional Controls, Excavation, and Off-Site Disposal

These alternatives are described in the following sections, including notes on the major design assumptions that were used to estimate costs and action-specific ARARs unique to each alternative.

5.3.1 Alternative W2: Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland

Alternative W2 employs ICs and relocation of sediment from the TTZ in Subarea 6 to the uplands portion of IA F1 to meet ARARs and RAOs. The sediment would be characterized prior to relocation to the uplands. Based on this characterization, the sediment relocated to the upland area may be suitable for beneficial reuse, or may be placed in a containment cell and covered to remove the exposure pathway.

If selected, Alternative W2 would include the ICs restricting sensitive uses as discussed in Alternative U2 and any additional ICs for the capped containment cell if needed. The components for Alternative W2 are discussed below.

5.3.1.1 Sensitive Use ICs

Similar to Subareas 3, 4, and 5, ICs preventing sensitive uses at IA F1 would be applied to Subarea 6 as presented in Alternative U2 as described in Section 5.2.1.1 except for the prevention of habitat development because the promotion of habitat development is an integral element of Subarea 6.

5.3.1.2 Containment Cell ICs

If the sediment relocated to the upland portion of the site is placed within a capped containment cell to reduce risk, then the following activities would be restricted within the footprint of the containment cell to maintain protectiveness of the containment cell cap.

- Alteration, disturbance, or removal of any component of the containment remedy.

5.3.1.3 Excavation, and On-Site Consolidation for Relocation to Upland Area of Site

Surface sediment would be excavated from the TTZ within Subarea 6 including the slough associated with Outfall 33 from IA K and relocated to an upland area of IA F1. The primary receptor driving action in Subarea 6 is the SMHM, and this receptor is not of concern in the upland portions of the site. Figure 7 illustrates the estimated remedial footprint to a depth of 2.5 feet bgs as the basis of the cost estimate.

The Subarea 6 TTZ is coastal salt marsh wetland. The wetland area is normally above water except during extremely high tides, which would allow for standard excavation as opposed to dredging. Detailed excavation plans would be developed in the RD. This estimate assumes sediment would be excavated from the remedial action area around and north of Outfall 33, estimated to cover a total area of roughly 38,350 square feet. The remedial action area would be excavated to a depth of 2.5 feet for an estimated excavation volume of 4,000 cubic yards for Subarea 6.

As stated earlier, the relocation of the sediment to the uplands area will be based on the results of further characterization of the sediment. If characterization indicates that the sediment does not pose a potential threat to human health or the environment to receptors in the upland area, then the sediment will be relocated to an upland area of the site for beneficial reuse. If potential risks to human health or the environment in the upland area are identified during characterization, the material relocated to the upland area may be placed within a containment cell and covered to remove the exposure pathway. The containment cell location would be chosen from one of the subareas slated for future industrial reuse where sensitive use ICs restricting habitat formation will be implemented. Due to the potential for salt marsh harvest mice to utilize upland habitat within 50 feet of salt marsh habitat, the location of the containment cell will be selected at a distance greater than 50 feet from salt marsh habitat. The sediment would be placed in the cell

and covered with an erosion resistant cover. The containment cell would not be suitable for hazardous sediment. If hazardous sediment is found, it would be disposed offsite to an appropriate off-site facility as described in Alternative W3.

Best management practices for stormwater runoff protection will be followed during the handling of the material.

For the purpose of the cost estimate portion of this FS, it is assumed that based on the sediment characterization described above, a containment cell would be needed under Alternative W2, and that the cover for the cell would consist of native soil excavated during the construction of the containment cell. The containment cell location would be selected such that deeper soil excavated during creation of the cell does not itself create unacceptable risk. The surface would be graded to promote drainage to the exterior edges of the cover. The description and location of the containment cell would be recorded as an additional area requiring ICs, as described above in Section 5.3.1.2 and tracked like the other ICs. The containment cell would be maintained and monitored. For cost comparison purposes in this FS, the maintenance and monitoring effort is projected for a 30-year period.

The wetland area is considered a possible minor habitat for the SMHM and a possible nesting area for the California clapper rail. During remedial activities in areas that may contain SMHM habitat (pickleweed) and threatened bird species habitat, a biologist would be present onsite to ensure proper vegetation removal, dig techniques, and area management procedures are implemented to limit the habitat damage outside the excavation area. Silt fencing would be installed between wetlands areas and TTZs to prevent entry of SMHM into the cleared areas prior to excavation. The TTZ area would be cleared of existing vegetation and the upper 2.5 feet of sediment in the TTZ area would be relocated to the uplands portion of the site. Granular fill similar to existing sediment would be backfilled over the excavated TTZ areas in the wetlands and graded to the original elevation. Only approved backfill will be used.

Following excavation of the sediment and backfilling to original elevation, the TTZ area would be revegetated to support SMHM habitat. Site restoration would include the hand transplanting of pickleweed from clean donor areas outside of the TTZ. Monitoring and evaluation of the habitat recovery process may be performed to assure successful revegetation of the disturbed area. The RD would include plans for a performance standard for completion, as well as plans for inspection, maintenance, and problem identification.

5.3.2 Alternative W3: Institutional Controls, Excavation, and Off-Site Disposal

Alternative W3 consists of ICs, sediment excavation, and off-site disposal at a permitted disposal facility, as well as wetland restoration in Subarea 6. Sediment containing metals at concentrations above remediation goals would be excavated where feasible to reduce the

concentrations of these COCs. This alternative provides a permanent remedy for chemicals where excavation is feasible.

5.3.2.1 Sensitive Use ICs

ICs preventing sensitive uses at IA F1 would be applied to Subarea 6. Restrictions to sensitive uses are detailed in Alternative U2 as described in Section 5.2.1.1, except for the prevention of habitat development because the promotion of habitat development is an integral element of Subarea 6.

5.3.2.2 Excavation, Disposal, and Backfilling

Sediment would be excavated in the remedial action area as described in W2.

Excavated sediment would be disposed of offsite at a permitted facility. The excavation backfill material would be clean fill selected to match existing site conditions as best as possible. Only approved backfill will be used. Areas disturbed by excavation would be planted with hand cuttings of pickleweed from nearby areas and be allowed to recover. Monitoring and evaluation of the habitat recovery process may be performed to assure successful revegetation of the disturbed area, as discussed under Alternative W2.

Additional sampling may be included during the remedial design to refine the area of impacted sediment in the TTZ.

5.4 Initial Screening Results of Remedial Alternatives

For sites at which several remedial alternatives are developed, they may be screened to reduce the number of alternatives that will be analyzed in detail. Because the purpose of the screening evaluation is to reduce the number of alternatives that will undergo a more extensive analysis, the alternatives are initially evaluated more generally than during the detailed analysis. During the screening evaluation, alternatives are evaluated with respect to effectiveness, implementability, and cost (U.S. EPA 1988).

No Action Alternative: The No Action Alternative, Alternative 1, would not achieve RAOs for all media and all subareas within IA F1, but is retained as required by CERCLA. No Action does meet the requirements for soil at Subareas 1, 2, and 7.

Upland Alternatives: All of the upland alternatives would be implementable and would achieve the RAOs for IA F1. In comparing the upland alternatives, Alternative U3 would likely be the most implementable because it would not lead to a change in the landscape cover and would allow the greatest flexibility of future redevelopment. Alternative U3 would likely provide the greatest degree of effectiveness because it would remove the majority of the mass of the COCs in upland soil. For this FS, all of the upland remedial alternatives are retained for detailed analysis.

Wetland Alternatives: All of the wetland alternatives would also be implementable and would achieve the RAOs for IA F1. Given the sensitive nature of the wetland habitat of Subarea 6, both Alternatives W2 and W3 would be somewhat challenging to implement. Alternative W3 would be more effective in the long-term because it would remove a majority of the contaminant mass from the site. For this FS, all of the wetland remedial alternatives are retained for detailed analysis.

Section 6 Detailed Analysis of Remedial Action Alternatives

Each remedial alternative developed in Section 4.0 was evaluated against both the threshold and balancing criteria that are based on the statutory requirements of CERCLA § 121, as amended by the Superfund Amendments and Reauthorization Act, the NCP, and U.S. EPA Guidance for Conducting an RI/FS under CERCLA (U.S. EPA 1988). This section summarizes the results of the detailed analysis of the remedial alternatives identified for Site IA F1. Results of the detailed analysis provide sufficient information for adequate comparison of the alternatives, selection of an appropriate remedy for the site, and demonstration of the selected remedy's adherence with the requirements of CERCLA.

6.1 Evaluation Criteria

The detailed analysis of remedial alternatives in this FS was based on the seven threshold and balancing criteria specified by the NCP (Title 40 CFR Part 300) and in U.S. EPA guidance (U.S. EPA 1988).

The NCP specifies nine criteria to be used in the comparative analysis. The first two criteria are threshold criteria that must be satisfied for a remedy to be eligible for selection; the next five are balancing criteria used to evaluate the comparative advantages and disadvantages of the remedies; and the final two are modifying criteria, which are generally considered after public comment is received on the Proposed Plan. The nine criteria are discussed below and grouped by threshold, balancing, and modifying criteria. The GSR evaluation is discussed under short-term effectiveness for each alternative.

Threshold Criteria: The two threshold criteria must be met by each alternative.

- **Overall Protection of Human Health and the Environment:** This criterion describes how each alternative, as a whole, protects human health and the environment and indicates how each chemical source is to be eliminated, reduced, or controlled.
- **Compliance with ARARs:** This criterion evaluates the compliance of each alternative with ARARs or, if an ARAR waiver is required, how the waiver is justified. ARARs consider location-specific, chemical-specific, and action-specific concerns.

Balancing Criteria: The five balancing criteria represent the primary criteria used to evaluate the alternatives.

- **Long-Term Effectiveness and Permanence:** This criterion evaluates the long-term effectiveness of each alternative in protecting human health and the environment after the remedial action is complete. Factors considered for protection of the environment include magnitude of residual risks and adequacy and reliability of release controls.

- **Reduction of Toxicity, Mobility, or Volume through Treatment:** For each alternative, this criterion evaluates the anticipated performance of specific treatment technologies to reduce the toxicity, mobility, or volume of hazardous substances.
- **Short-Term Effectiveness:** This criterion examines the short-term effectiveness of each alternative in protecting human health and the environment during the construction and implementation period of the remedy. The factors considered in evaluating short-term effectiveness include protection of the community during remedial actions, protection of workers during remedial actions, environmental effects that would result from construction or implementation of the alternative, and the time required to complete the remedial action. Also presented within this criteria are the results from the GSR analysis for each alternative analyzed (U2, U3, W2, and W3). The No Action Alternative was not included in the GSR analysis. The sustainability metric evaluated include: greenhouse gas (GHG) emissions, energy use, air emissions of criteria pollutants including nitrogen oxide (NO_x), sulfur oxide (SO_x), and particulate matter (PM10), water consumption, resource consumption, and worker safety broken down into injury and fatality risk. Appendix D provides additional details describing the GSR analysis.
- **Implementability:** This criterion evaluates the technical and administrative feasibility of each alternative and the availability of required resources such as services and materials.
- **Cost:** This criterion evaluates the capital and O&M costs for each alternative. The accuracy of costs developed for an FS typically ranges from minus 30 to plus 50 percent, in accordance with guidance from U.S. EPA (U.S. EPA 2000).

Modifying Criteria. The final two criteria will be evaluated following review of the FS Report and Proposed Plan and receipt of public comments on the Proposed Plan.

- **State Acceptance:** This criterion evaluates technical and administrative issues and concerns the State may have about each of the alternatives. This criterion will be addressed in the ROD after DTSC, Water Board, and U.S. EPA Region IX review and concurrence with this FS Report. The Proposed Plan discusses the preferred remedial alternative and other alternatives that were evaluated.
- **Community Acceptance:** This criterion evaluates the issues and concerns the public may have about each alternative. This criterion will be addressed in the ROD once comments on the FS Report and the Proposed Plan have been received from the community.

6.2 Individual Analysis of No Action Alternative

The No Action Alternative, Alternative 1, is evaluated with the first seven NCP threshold and balancing criteria. The two threshold criteria determine if the alternative meets the RAOs and ARARs. The five balancing criteria rate the effectiveness of the alternative. Each of the five balancing criteria evaluated in this section is weighted equally.

6.2.1 Evaluation of Alternative 1: No Action

Under the No Action Alternative, no response action would occur. An evaluation of the No Action Alternative is required under CERCLA to provide a baseline for comparison with the other alternatives. Unacceptable risk has been identified within portions and specific media of IA F1 in the RI Report; therefore, Alternative 1 does not meet the threshold criteria sitewide; however, it does meet the criteria for soil at Subareas 1, 2, and 7. It will be evaluated along with the action alternatives in this FS for comparison, as required under the NCP. A detailed analysis of Alternative 1 against the first seven NCP criteria is provided below. The five balancing criteria are rated as excellent, very good, marginal or poor.

6.2.1.1 Overall Protection of Human Health and the Environment

Surface and subsurface soil/sediment at Subareas 3, 4, 5, and 6 do not meet the requirements for unrestricted reuse. Alternative 1 proposes no action; therefore, Alternative 1 is not protective of human health and ecological risk throughout, but it is appropriate for soils within Subareas 1, 2, and 7.

Concentrations of lead in surface soil at Subarea 5 exceed the RGs for ecological and recreational receptors in the area around Building A17 (Figure 6) based on exposure pathways. This area is within Reuse Area 12, planned for future use as a Regional Park, and Alternative 1 would not reduce this risk; therefore, this alternative is not considered protective of recreational and ecological risk in the TTZ at Building A17 within Subarea 5.

Concentrations of lead near Building A75 (Figure 5) have been identified as posing unacceptable risk to humans. Alternative 1 would not reduce this risk, therefore this alternative is not considered protective of human health in the TTZ at Building A75 within Subarea 4.

The northern portion of Subarea 6 (sediment) has been identified as having concentrations of barium, lead, copper, and zinc (Figure 7) in excess of RGs for ecological receptors, notably the SMHM. Alternative 1 would not reduce this risk; therefore, this alternative is not considered protective of ecological receptors in this area.

6.2.1.2 Compliance with ARARs

There is no need to identify ARARs for the No Action Alternative because ARARs apply to removal or remedial action conducted entirely on site. CERCLA § 121 (42 U.S.C. § 9621) cleanup standards for selection of a remedy, including the requirement to meet ARARs, are not triggered by the No Action Alternative (U.S. EPA 1991). Therefore, a discussion of compliance with ARARs is not appropriate for this alternative.

6.2.1.3 Long-Term Effectiveness and Permanence

No controls would be implemented to prevent potential human and ecological exposure to soil. Therefore, the long-term effectiveness of this alternative in meeting the RAOs would be poor for soils and sediment at Subareas 3, 4, 5, and 6 and good for soils at Subareas 1, 2, and 7. The rating for long-term permanence is poor.

6.2.1.4 Reduction in Toxicity, Mobility, or Volume through Treatment

Alternative 1 would not reduce the toxicity, mobility, or volume of COCs and COECs in TTZs identified for surface soil at Building A17 and Building A75 or sediment in the northern portion of Subarea 6 because no action would be taken. Because Alternative 1 meets the first threshold criteria of overall protection of human health and the environment for soils at Subareas 1, 2, and 7, no action is needed, and evaluation to reduce the toxicity, mobility, or volume is not appropriate for this media in these subareas. Alternative 1 does not meet the first threshold criteria for soils and sediment at Subareas 3, 4, 5, and 6 ; therefore it rates poor for these subareas and media. Because of this, the rating for Alternative 1 for reduction of toxicity, mobility, and volume through treatment is poor.

6.2.1.5 Short-Term Effectiveness

The factors considered as part of the short-term effectiveness criterion are assessed below for Alternative 1, where no response action would occur.

- The on-site community would not be exposed to additional risks from surface soil; the risks would remain as presented in the Final RI Report (ChaduxTt 2012a). The off-site community would be protected in the short-term because surface soils posing unacceptable risk would not be disturbed.
- No workers would be exposed to health risks during implementation of Alternative 1.
- No adverse environmental effects would result from construction and implementation of Alternative 1.
- No time would be required to complete Alternative 1.

Alternative 1 would be effective in the short-term for all subareas, because there would be no exposure to workers or the surrounding community since no response action would be taken. The short-term effectiveness rating for Alternative 1 is excellent.

6.2.1.6 Implementability

No equipment, labor, or resources would be required to implement Alternative 1. No operations would be conducted and no administrative efforts would be required. As such, the No Action Alternative would be readily implementable and the rating for implementability is excellent for all subareas.

6.2.1.7 Cost

No capital or O&M costs are associated with Alternative 1; therefore, the rating for Alternative 1 for cost is excellent for all subareas.

6.2.1.8 Overall Rating

Alternative 1 does not meet the threshold criteria for soils or sediment at Subareas 3, 4, 5, and 6. The overall rating for Alternative 1 is poor. The rating for short-term effectiveness, implementability, and cost is excellent, and the rating is poor for long-term effectiveness and permanence, and reduction of toxicity, mobility, or volume through treatment.

6.3 Individual Analysis of Upland Alternatives

In this section, each of the retained upland alternatives, U2 (Institutional Controls and Asphalt Cap) and U3 (Institutional Controls, Excavation, and Off-Site Disposal), is compared with seven of the nine NCP criteria (threshold and balancing criteria).

Alternatives U2 and U3 would use ICs to prevent sensitive uses at IA F1. Table 7 presents the ICs for IA F1. The ICs for IA F1 focus on managing:

- Risk to sensitive users by restricting sensitive uses at IA F1

The evaluation of upland remedial alternatives for upland TTZs, using the seven NCP criteria, focuses on addressing:

- Risk to potential future commercial/industrial workers at Subarea 4 posed by lead in soil in the area south of Building A75
- Risk to recreational and ecological receptors at Subarea 5 posed by lead in soil in the area around Building A17.

Table 3 presents the cost summary for each alternative, and Table 4 provides a summary of each alternative's rating under the seven evaluation criteria. The ranking categories used in Table 4 and in the discussion of the alternatives are: 1) protective or not protective, and meets ARARs or

does not meet ARARs, for the two threshold criteria; and 2) excellent, very good, good, marginal, and poor for the five balancing criteria.

6.3.1 Evaluation of Alternative U2: Institutional Controls and Asphalt Cap

Alternative U2 would use ICs to prevent sensitive uses at IA F1 and asphalt capping to prevent exposure to the TTZs in Building A17 and Building A75 areas that pose a potential risk in the anticipated future reuse scenarios at IA F1. Additional ICs to protect the asphalt cap would be included and layered with the sensitive use ICs to prevent intrusive activities on the asphalt cap. A detailed analysis of Alternative U2 against the first seven of the nine NCP criteria is provided below.

6.3.1.1 Overall Protection of Human Health and the Environment

Outside the TTZs identified in this FS, the sensitive-use ICs in Alternative U2 would protect human health by preventing unintended uses of the property, thereby controlling potential future exposure. This alternative would limit risks to sensitive users from soil. ICs would meet the RAOs for the protection of human health and ecological receptors for the areas outside of the TTZs.

Asphalt capping within the TTZs would prevent windblown dust exposure to human and ecological receptors. This alternative would effectively achieve the RAO for protection of human health and ecological receptors in the TTZs and is rated as protective for overall protection of human health and the environment.

6.3.1.2 Compliance with ARARs

Alternative U2: Institutional Controls and Asphalt Cap complies with ARARs identified in Appendix C. Alternative U2 would meet all identified ARARs.

6.3.1.3 Long-Term Effectiveness and Permanence

ICs that restrict sensitive land-use activities would effectively control risk to humans under future-use scenarios at IA F1. Long-term enforcement of the ICs would be required to maintain the effectiveness of the land-use restrictions, access restrictions, and covenants. The specific ICs will be detailed in the ROD and LUC RD. Under Alternative U2, risks associated with exposure to COCs and COECs in surface soil would be reduced by covering the soils with asphalt. As a result, the exposure pathways are eliminated. The adequacy and reliability of the alternative also depend on monitoring and maintenance of the covers. The rating for Alternative U2 for long-term effectiveness and permanence is good.

6.3.1.4 Reduction in Toxicity, Mobility, or Volume through Treatment

Alternative U2 includes asphalt cover over contaminated soil and ICs to improve the permanence of the alternative. This alternative does not include any treatment of contaminated soil at Subareas 4 and 5. Therefore, this alternative would not result in the reduction of COCs and COECs in soil or reduce the overall toxicity or mobility of contamination through treatment. This alternative would not meet the statutory preference for treatment options. The rating for Alternative U2 for the reduction of toxicity, mobility, and volume through treatment is poor.

6.3.1.5 Short-Term Effectiveness

Alternative U2 is ranked as good for effectiveness in the short-term for protection of human health and ecological receptors. The four factors and the GSR results considered as part of the short-term effectiveness criteria are assessed below for Alternative U2.

- Risks to the community may occur due to increased construction traffic. Only tested asphalt would be imported to construct the covers, and trucks would cover their loads and adhere to a traffic plan to reduce community noise and traffic concerns.
- Risk to workers who are constructing covers over known contaminated soil may occur. However, workers would adhere to a chemical- and activity-specific accident prevention and health and safety plan, which would include the assignment of appropriate personal protective equipment and implementation of protective exposure measures.
- Construction efforts for asphalt capping would affect a small area at IA F1. Effects on the local environment would be reduced through implementation of best management work practices.
- The estimated time required to implement Alternative U2 would be approximately 17 months. This period is based on 12 months or less for the preparation and approval of the LUC RD document, 1 month for mobilization and site preparation, 3 weeks for constructing the two asphalt caps, plus 3 months for project closeout.
- GSR: Energy and GHG emissions are spread between residual handling, equipment use, personnel transportation, and equipment transportation with equipment transportation outweighing the other categories. However, residual handling alone drives most of the SOx and PM10 impacts during the remedial action phase. For the long-term monitoring (LTM), the on-site visits for ICs result in emissions from transportation, and personnel transportation during LTM contributes to the accident risk.

6.3.1.6 Implementability

This alternative would be feasible and easily implemented (high implementability) because grading and installing asphalt is conventional and a commonplace process. The rating for Alternative U2 for implementability is excellent.

6.3.1.7 Cost

The estimated 30-year total present value cost for Alternative U2 is $1,428,000 (Table 3) and is detailed in Appendix E. The detailed cost analysis for Alternative U2 includes an estimate of RD and project management, capital, and O&M costs. RD and project management includes preparation of the RD and management activities ($108,000). Capital costs include implementing the ICs and installing the asphalt cap ($414,000). Annual O&M costs for cap inspections and asphalt repair and annual review of ICs are discounted to present value and are included as maintenance costs ($909,000). Costs for Alternative U2 considers the ICs for IA F1 (including Subarea 6) which includes 30 years of monitoring and enforcement of ICs, and 5-year reviews discounted to present value. The rating for Alternative U2 for cost is good.

6.3.1.8 Overall Rating

Asphalt capping would provide a physical barrier to eliminate the exposure pathways to surface soil. Investigation area and remediation area ICs would prevent future human and/or ecological exposure to COCs in surface soil at IA F1. ICs would prevent sensitive uses at IA F1. In summary, for implementability the rating is excellent, good for long-term effectiveness and permanence, cost, and short-term effectiveness, and poor for reduction of toxicity, mobility, or volume through treatment. The overall rating for Alternative U2 is good.

6.3.2 Evaluation of Alternative U3: Institutional Controls, Excavation, and Off-Site Disposal

Alternative U3 includes ICs at IA F1 and excavation and off-site disposal of surface soil at Subareas 4 and 5 that may pose an unacceptable risk to potential future commercial/industrial workers or ecological receptors as appropriate.

Surface soils with concentrations of lead above RGs that may pose a risk would be excavated and transported to a licensed off-site disposal facility. The excavated areas would be backfilled with clean tested soil. This alternative provides a permanent remedy for contaminants where excavation is feasible. ICs would be used to restrict sensitive uses of the property in appropriate areas. A detailed analysis of Alternative U3 against the first seven of the nine NCP criteria is provided below.

6.3.2.1 Overall Protection of Human Health and the Environment

ICs would protect human health and the environment by preventing unintended uses of the property, thereby controlling potential future exposure. This alternative would limit risk to sensitive users from soil. ICs would meet the RAOs for the protection of human health and ecological receptors for the areas outside of the TTZs.

This alternative would permanently reduce the risk, in the upland areas within the TTZ, by excavating and disposing of soil containing lead that poses an unacceptable risk in areas near Building A17 and Building A75 to an off-site facility. Alternative U3 would meet the RAOs for human health and the environment.

6.3.2.2 Compliance with ARARs

See Appendix C for a complete discussion of ARARs. Alternative U3 would meet all identified ARARs.

6.3.2.3 Long-Term Effectiveness and Permanence

Alternative U3 includes excavations at TTZ areas near Building A17 and Building A75. These excavations would be highly effective in the long-term because they effectively and permanently remove shallow impacted soil that poses an unacceptable risk to human and ecological receptors. Long-term enforcement of ICs would be required to maintain the effectiveness of the land-use restrictions, access restrictions, and covenants. LUCs would affect the future use of IA F1 because they would prevent sensitive land-use activities at the site. The specific ICs will be detailed in the ROD and LUC RD. The rating for Alternative U3 for long-term effectiveness and permanence is excellent.

6.3.2.4 Reduction in Toxicity, Mobility, or Volume through Treatment

Alternative U3 includes removal and disposal of the contaminated surface soil. This alternative would not reduce the overall toxicity, volume or mobility of contaminants from IA F1 through treatment. However, if the disposal facility places the contaminated soil in a lined cell then the mobility of contaminants would be reduced through containment. This alternative would not meet the statutory preference for reduction in toxicity, mobility, or volume through treatment. The rating for Alternative U3 for the reduction of toxicity, mobility, or volume through treatment is poor.

6.3.2.5 Short-Term Effectiveness

Alternative U3 is rated as marginal for effectiveness in the short-term protection of human health and wildlife. The four factors and the GSR results considered under the short-term effectiveness criteria are assessed below.

- Risks to the community would occur due to increased construction traffic. The community would be protected during excavation and transportation by implementing containment controls, such as dust suppression during excavation and covers over the trucks transporting soil and excavation backfill. A traffic control plan would be prepared to address additional traffic during removal of the contaminated soil. The traffic control plan and temporary traffic controls would be implemented as necessary to prevent accidents, minimize congestion, and protect the community.
- Risk to workers that are excavating known contaminated soil may occur. However, workers would be protected during soil excavation by implementing containment controls, such as dust suppression during excavation, stockpiling, and loading; and by following health and safety protocols, including use of personal protective equipment and proper decontamination procedures.
- Construction efforts for soil excavation would affect a small area at IA F1. The topsoil and vegetation would be removed, resulting in short-term loss of habitat at Building A17. Building A75 is maintained as industrial so this would not apply as a short-term loss of habitat in that area. Best management practices for construction would minimize the effects on the local environment to the most practical extent possible.
- The estimated time required to implement Alternative U3 would be approximately 19 months. This period is based on 12 months or less for RD document preparation and approval, 2 months for mobilization and site preparation, 1 month for removal of 1,250 cubic yards of surface soil and complete backfill, plus 4 months for project closeout.
- GSR: Residual handling drives the impact for all emissions and energy use. Equipment use and transportation drive accident risk. LTM for U3 has less impact than Alternative U2 because there would be shorter on-site visits and fewer institutional controls to review.

6.3.2.6 Implementability

This alternative is technically and administratively feasible because excavation and disposal are considered conventional and commonplace processes. Vendors that specialize in excavation and transportation of contaminated soil are readily available and several permitted treatment and disposal facilities exist in California. In addition, ICs would be easy to implement administratively. The overall rating for Alternative U3 for implementability is excellent.

6.3.2.7 Cost

The estimated 30-year total present value cost for Alternative U3 is $1,745,000 (Table 3) and is detailed in Appendix E. The detailed cost analysis for Alternative U3 includes an estimate of RD and project management ($165,000); and capital, and O&M costs. Capital costs include completing excavation, disposal and backfilling ($831,000). Annual O&M costs for annual review of ICs are discounted to present value and are included as maintenance costs ($756,000). Costs for Alternative U3 considers the land-use ICs for IA F1 (including Subarea 6) which includes 30 years of monitoring and enforcement of ICs, and 5-year reviews discounted to present value. The rating for Alternative U3 for cost is good.

6.3.2.8 Overall Rating

Removal and off-site disposal of surface soil with concentrations that may pose a risk would prevent long-term exposure. In summary, the rating is excellent for long-term effectiveness, permanence, and implementability; good for cost; marginal for short-term effectiveness, and poor for reduction of toxicity, mobility, or volume through treatment. The overall rating for Alternative U3 is very good.

6.4 Individual Analysis of Wetland Alternatives

In this section, each of the retained alternatives (Alternatives W2 and W3) is compared with seven of the nine NCP criteria (threshold and balancing criteria).

The evaluation of wetland remedial alternatives using the seven criteria focuses on addressing risk to ecological receptors, principally the SMHM, in Subarea 6 posed by barium, copper, lead, and zinc concentrations in sediment found in the northern portion of Subarea 6, including the area around the slough associated with Outfall 33.

Exposure to groundwater at Subarea 6 is not considered a complete human health exposure pathway because no current or future groundwater-to-air exposures are expected in Subarea 6. Alternatives W2 and W3 would also employ ICs (Table 7) similar to the ICs proposed for the upland area to restrict sensitive uses at IA F1 to:

- Manage risk to sensitive users by restricting sensitive land uses at IA F1, and

The ICs for the wetlands alternatives would not include the prevention of habitat development because the promotion of habitat development is an integral element of Subarea 6,

Table 3 presents the cost summary for each alternative, and Table 5 provides a summary of each surface sediment alternative's rating under the seven evaluation criteria. The ranking categories used in Table 5 and in the discussion of the alternatives are: 1) protective or not protective, and

meets ARARs or does not meet ARARs, for the two threshold criteria; and 2) excellent, very good, good, marginal and poor for the five balancing criteria.

6.4.1 Evaluation of Alternative W2: Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland

Alternative W2 involves the excavation of sediment in the TTZ that poses an unacceptable risk to ecological receptors in the wetlands; the relocation of this sediment to the upland area of the site where these receptors do not exist; and the implementation of ICs. A detailed analysis of Alternative W2 against the first seven of the nine NCP criteria is provided below.

6.4.1.1 Overall Protection of Human Health and the Environment

Sediment in Subarea 6 does not pose unacceptable risk to human receptors in the anticipated future use scenario, recreational use. Other use scenarios were not evaluated in the HHRA for this subarea, therefore ICs would be implemented to prevent risk to sensitive users. Alternative W2 is considered protective of human health.

Metals in surface sediment at Subarea 6 were identified in the ERA as posing potentially unacceptable risk for the SMHM in Subarea 6. The additional analysis performed in the FS (Appendix B) of metals in sediment in Subarea 6, which was recommended by the Final RI Report, resulted in the FS recommending the area north of Outfall 33 as the remedial footprint. This alternative would be effective in achieving the RAO for the protection of ecological receptors and is rated as protective for overall protection of human health and the environment.

6.4.1.2 Compliance with ARARs

The action-specific ARARs for Alternative W2 are discussed in detail in Appendix C. Alternative W2 would meet all identified ARARs.

6.4.1.3 Long-Term Effectiveness and Permanence

Under Alternative W2, risk to the SMHM associated with exposure COECs in sediment would be reduced by relocating the sediment to the uplands area of the site where the SMHM is not located. The TTZ area would be restored to the original elevation with imported clean fill appropriate for use in wetlands. Site restoration includes the planting of pickleweed from donor areas outside of the TTZ. Once replanted, Alternative W2 would eliminate both the sediment ingestion and plant ingestion pathways of exposure in the TTZ. According to the ERA, the plant ingestion pathway leads to a higher daily dose than the sediment ingestion pathway (ChaduxTt 2012a).

If the relocated sediment is placed in an upland area containment cell to reduce risk, then long-term enforcement of ICs, specific to the created containment cell in the upland area, would be required to limit disturbance of the cap so it would remain protective of the environment. These

TTZ specific ICs would be in addition to the sensitive use ICs described in Alternative U2, except for the prevention of habitat development because the promotion of habitat development is an integral element of Subarea 6 that would improve long-term effectiveness of the alternative.

Alternative W2 for Subarea 6 is considered protective in the long-term. Relocating impacted sediment that poses an unacceptable risk to the SMHM to the upland areas of IA F1 eliminates all pathways for that receptor.

The rating for Alternative W2 for long-term effectiveness and permanence is very good.

6.4.1.4 Reduction in Toxicity, Mobility, or Volume through Treatment

Alternative W2 does not include treatment of contaminated sediment in Subarea 6. Therefore, this alternative would not result in the destruction of COECs, reduce the overall mobility of metals in sediment, or reduce the overall toxicity or volume of contamination through treatment. This alternative would not meet the statutory preference for treatment options. The rating for Alternative W2 for the reduction of toxicity, mobility, and volume through treatment is poor.

6.4.1.5 Short-Term Effectiveness

Alternative W2 is rated as marginal for effectiveness of short-term protection of human and ecological receptors. The four factors and the GSR results considered as part of the short-term effectiveness criteria are assessed below for Alternative W2.

- Risks to the community would occur due to increased construction traffic during the active construction of the remedy. Clean fill would be imported to bring the wetlands excavation area back to grade prior to wetlands reconstruction, as well as to construct the containment cell cover, if needed. Trucks would cover their loads and adhere to a traffic plan that reduces noise and traffic concerns of the community. Ecological receptors may be exposed to minimal risks from surface sediment during construction. After which, wildlife would be protected. During construction, salt marsh harvest mice will have reduced habitat due to loss of area during the construction. They will be closely monitored to ensure the silt fence remains an effective barrier so they do not enter the work area.
- Risk to workers that are excavating contaminated sediment may occur. However, workers would adhere to chemical- and activity-specific accident prevention and health and safety plans, which would include the assignment of appropriate protective equipment and implementation of other protective exposure measures.
- Construction efforts for sediment excavation and relocation would affect approximately 2 percent of the 62 acres of IA F1. Effects on the local environment would be reduced through implementation of best management work practices.

- The estimated time required to implement Alternative W2 would be approximately 17 months. This period is based on 14 months or less for pre-design sampling, and RD document preparation and approval, 1 month for mobilization and site preparation, 1 week for sediment relocation, plus 2 months for project closeout.
- GSR: Equipment use is the dominating driver for accident risk, energy use, PM10, GHG, NOx, and SOx emissions during the remedial action phase (Appendix D, Figure D4). For LTM, the on-site visits result in emissions and accident risk from personnel transportation.

6.4.1.6 Implementability

The TTZ is easily accessible and above the water line, except during extremely high tides, allowing for remediation execution using mostly conventional equipment. Sediment would be excavated and relocated to the upland areas of IA F1. Relocating sediment would require an accessible area in the upland area. This alternative would be technically feasible and would include additional requirements during implementation due to the wetland habitat and the sensitivity to the SMHM habitat.

The ICs are administratively easy to implement. Procedures for implementing LUCs are already in place, and delays or difficulties in coordinating with other regulatory agencies are not likely.

The rating for Alternative W2 for implementability is good because the elements for Alternative W2 are technically feasible using conventional equipment. Alternative W2 did not rate higher than good due to the efforts required to minimize the impact to the wetland habitat during construction and to reestablish the habitat following excavation. The additional handling of excavated sediment to relocate the sediment to an area in the upland portions of IA F1 differentiates the good rating from very good.

6.4.1.7 Cost

The estimated 30-year total present value cost for Alternative W2 is $2,736,000 (Table 3) and is detailed in Appendix E. The detailed cost analysis for Alternative W2 includes an estimate of RD and project management, capital, and O&M costs. RD and project management includes preparation of the RD and management activities ($525,000). Capital costs include additional sampling, construction of the containment cell, importing sediment and earth movement activities ($2,021,000). Annual O&M costs include wetlands monitoring for 5 years after wetlands establishment and inspection of the upland containment cell for 30 years discounted to present value ($211,000). Annual O&M costs for 30 years of monitoring and enforcement of ICs and 5-year reviews are included in Alternatives U2 and U3. The rating for Alternative W2 for cost is good.

6.4.1.8 Overall Rating

In summary, for long-term effectiveness and permanence the rating is very good, good for implementability and cost, marginal for short-term effectiveness, and poor for reduction of toxicity, mobility, or volume through treatment. The overall rating for Alternative W2 is good.

6.4.2 Evaluation of Alternative W3: Institutional Controls, Excavation, and Off-Site Disposal

Similar to Alternative U3, Alternative W3 includes ICs and excavation and off-site disposal of sediment from Subarea 6 that poses an unacceptable risk to the SMHM. Surface sediment with concentrations of barium, copper, lead, and zinc above the remedial goals that may pose a risk would be excavated and transported to a licensed off-site disposal facility. The excavated areas would be backfilled with clean fill appropriate for wetlands. This alternative provides a permanent remedy for chemicals where excavation is feasible. A detailed analysis of Alternative W3 against the first seven of the nine NCP criteria is provided below.

6.4.2.1 Overall Protection of Human Health and the Environment

Sediment in Subarea 6 does not pose unacceptable risk to human receptors in the current or future land-use scenarios and, therefore, Alternative W3 is considered protective of human health. Similar to the upland Alternative U2, ICs would be used to prevent sensitive uses at IA F1, except for the prevention of habitat development because the promotion of habitat development is an integral element of Subarea 6, and would improve long-term effectiveness of the alternative.

Metals in surface sediment were evaluated as discussed in Section 6.4.1.1. Excavation would remove a majority of the mass of contaminants and reduce the EPC to acceptable levels. This alternative would effectively achieve the RAO for protection of ecological receptors and is rated as protective for human health and the environment.

6.4.2.2 Compliance with ARARs

The action-specific ARARs for Alternative W3 are detailed in Appendix C. Alternative W3 would meet all identified ARARs.

6.4.2.3 Long-Term Effectiveness and Permanence

Under Alternative W3, risk to the SMHM associated with exposure COECs in sediment would be reduced by removing a majority of the mass of contaminants. The excavation would eliminate the sediment ingestion and plant ingestion pathways of exposure and would not require future disturbances. Long-term enforcement of ICs would be required to maintain the effectiveness of the land-use restrictions, access restrictions, and covenants.

The rating for Alternative W3 for long-term effectiveness and permanence is excellent.

6.4.2.4 Reduction in Toxicity, Mobility, or Volume through Treatment

Similar to Alternative U3, Alternative W3 includes removal and disposal of the contaminated sediment to an offsite facility. This alternative would not meet the statutory preference for treatment options. The rating for Alternative W3 for the reduction of toxicity, mobility, or volume through treatment is poor.

6.4.2.5 Short-Term Effectiveness

Alternative W3 is rated as marginal for effectiveness in the short-term protection of human health and ecological receptors. The four factors and GSR results considered under the short-term effectiveness criteria are assessed below.

- Risks to the community may occur due to increased construction traffic. The community would be protected during excavation and transportation by implementing containment controls. A traffic control plan would be prepared to address additional traffic during removal of the contaminated sediment. The traffic control plan and temporary traffic controls would be implemented as necessary to prevent accidents, minimize congestion, and protect local residents. Ecological receptors may be exposed to minimal risks from surface sediment during construction. After which, wildlife would be protected. During construction, salt marsh harvest mice will have reduced habitat due to loss of area during the construction. They will be closely monitored to ensure the silt fence remains an effective barrier so they do not enter the work area. Risk to workers that are excavating contaminated sediment may occur. However, workers would be protected during sediment excavation by implementing containment controls, such as dust suppression during excavation, stockpiling, and loading; and by following health and safety protocols, including appropriate personal protective equipment and proper decontamination procedures.
- Construction efforts for sediment excavation and relocation would affect approximately 2 percent of the 62 acres of IA F1. Effects on the local environment would be reduced through implementation of best management work practices.
- The estimated time required to implement Alternative W3 would be approximately 18 months. This period is based on 14 months or less for pre-design sampling, net environmental benefit analysis, and RD document preparation and approval, 1 month for mobilization and site preparation, 3 weeks for removal of 3,000 cubic yards of surface sediment and complete backfill, plus 2 months for project closeout.

- GSR: For Alternative W3, similar to Alternative U3, residual handling drives the impact for all emissions and energy use. Equipment use, residual handling and transportation drive accident risk. LTM for Alternative W3 has less impact than Alternative W2 since there would be shorter on-site visits and fewer institutional controls to review.

6.4.2.6 Implementability

The area is relatively accessible and above the mudflats habitat, which would allow for excavation using conventional equipment. This alternative would be technically feasible but somewhat challenging to implement because of the wetland habitat. The excavation would be backfilled and replanted to resemble the original wetland habitat.

ICs would be easy to implement. The rating for Alternative W3 for implementability is considered very good and not excellent because of the concerns regarding the temporary impact to the wetland habitat during construction. It is rated higher than good since additional sediment handling and relocation is not part of this remedial alternative.

6.4.2.7 Cost

The estimated 30-year total present value cost for Alternative W3 is $2,533,000 (Table 3) and is detailed in Appendix E. The detailed cost analysis for Alternative W3 includes an estimate of RD and project management ($409,000); and capital, and O&M costs. RD and project management includes preparation of the RD and management activities. Capital costs include pre-design sampling, and completing excavation, disposal and backfilling ($2,088,000). Annual O&M costs would include wetlands monitoring for 5 years after wetlands establishment discounted to present value ($58,000). Annual O&M costs for 30 years of monitoring and enforcement of ICs and 5-year reviews are included in Alternatives U2 and U3. The rating for Alternative W3 for cost is good.

6.4.2.8 Overall Rating

Removal and off-site disposal of sediment would eliminate exposure pathways to contaminated sediment within Subarea 6. In summary, the rating for long-term effectiveness and permanence is excellent, very good for implementability, good for cost, marginal for short-term effectiveness, and poor for reduction of toxicity, mobility, or volume through treatment. The overall rating for Alternative W3 is very good.

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Section 7 Comparative Analysis of Remedial Alternatives

This section presents a comparative analysis of the remedial alternatives with respect to the NCP criteria. The purpose of this comparative analysis is to identify the relative advantages and disadvantages of each alternative to provide a sound basis for remedy selection consistent with the NCP. The NCP states, "The national goal of the remedy selection process is to select remedies that are protective of human health and the environment, that maintain protection over time, and that minimize untreated waste." (U.S. EPA 1990).

This section compares the habitat-specific (upland and wetlands) remedial alternatives that meet the threshold criteria, overall protection of human health and the environment and compliance with ARARs.

A GSR analysis was carried out using SiteWise™ to evaluate the relative impact of each alternative with respect to specific environmental metrics. The results of the analysis are incorporated into the comparative analysis section of the FS under the short-term effectiveness criteria as that criterion most directly incorporates impacts to the environment. The full GSR evaluation results are included in Appendix D.

Alternative 1 is not protective of human health or the environment and does not meet the threshold criteria evaluations performed in Section 5 for all Subareas and media; however, it is protective for soils at Subareas 1, 2, and 7.

There are two viable remedial alternatives for the upland areas and two for the wetland area. These alternatives are screened against five balancing criteria: long-term effectiveness and permanence; reduction of toxicity, mobility or volume through treatment; short-term effectiveness; implementability; and cost.

Alternatives that meet the threshold criteria by controlling, or reducing risk to humans and the environment and meeting ARARs are compared to each other by habitat area using the balancing criteria to assess the relative performance of the alternatives with respect to those criteria. The discussion of each evaluation criterion generally proceeds from the alternative that best satisfies the criterion to the one that least satisfies the criterion.

The preferred alternative for protecting human and ecological health will be selected in the Proposed Plan and documented in the ROD after comments are received from the community and the regulatory agencies.

7.1 Comparative Analysis of Upland Alternatives

7.1.1 Long-Term Effectiveness and Permanence

Alternative U3, Institutional Controls, Excavation, and Off-Site Disposal, is an effective and permanent alternative in the long-term. Surface soil, that may pose an unacceptable risk to humans under the potential future commercial/industrial use scenario combined with the current unacceptable risk to ecological receptors, would be excavated and removed from the site. TTZ-specific ICs would not require any additional maintenance and monitoring to ensure effectiveness; however, ICs would be required to prevent sensitive uses within portions of IA F1.

Alternative U2, Institutional Controls and Asphalt Capping, would not be as effective as Alternative U3 because it would only reduce the risks associated with exposure to COCs and COECs in surface soil by cutting off the exposure pathway. Similar to Alternative U3, ICs are required to be implemented for Alternative U2. Additional TTZ ICs would be required that restrict certain activities that would disturb the asphalt cap.

In summary, Alternative U3 is the most effective and permanent in the long-term followed by Alternative U2.

7.1.2 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives U2 and U3 would not reduce the toxicity, mobility, or volume of contaminated surface soil through treatment. As a result, neither of the remedial alternatives satisfies the statutory preference for treatment and both Alternatives U2 and U3 rate equally.

7.1.3 Short-Term Effectiveness

Alternative U2 would have minimal effect on the community and remedial workers because it does not include excavation, hauling, and disposal of soil that contains contamination. Alternative U3 would expose workers, the environment, and the community to contaminated soil during excavation and stockpiling. In addition, Alternative U3 would require transport of the contaminated soil through the community to the disposal facility and require transport of clean backfill through the community from an offsite source. Best management practices and health and safety protocols would be used during implementation of Alternative U3 to minimize exposure of the community, workers, and the environment to contaminated soil. Alternative U2 would also require transport of materials for the asphalt cap and equipment through the community to the site. Both Alternatives U2 and U3 would have negative short-term effects on the environment because of site disturbance during construction.

The SiteWise™ GSR analysis incorporated resource inputs assumed for each of the alternatives. The results of the evaluation concluded that Alternatives U3 and U2 would result in similar

impacts for GHG emissions, energy usage, and PM10 emissions. Alternative U3 would have a greater environmental impact for three of the eight sustainability metrics, including water use, NO_x emissions, and SO_x emissions. Alternative U2 would have greater accident injury risk and accident fatality risk impacts due to increased equipment use as analyzed in the GSR. Table 6 provides the summary values of the sustainability metrics for IA F1 remedial alternatives. The full summary tables, including comparative analysis from the SiteWise™ analysis, are provided in Appendix D.

The high level of sustainability impacts for Alternative U3 is primarily associated with the disposal of contaminated soils, which involves transportation off site that embodies substantial energy and emissions. Employing strategies such as sorting and stock piling during excavation and planning for disposal of soil at a nearby landfill would reduce the anticipated sustainability impacts of Alternative U3.

Alternative U2 rates higher than Alternative U3 in short-term effectiveness since Alternative U2 is rated as good and Alternative U3 is rated as marginal due to the greater environmental impacts of excavation.

7.1.4 Implementability

Alternatives U2 and U3 are both easy to implement as installing covers and excavating soil are standard technologies and the remedial footprints are located in easily accessible areas within IA F1. Both the alternatives also consist of ICs that are easy to implement administratively. However, long-term monitoring and maintenance would be more extensive for Alternative U2. The implementation of Alternative U3 includes excavating an estimated 1,300 cubic yards of soil, and trucking soil and backfill materials on city and county roads, which may increase the difficulty of implementing this alternative as compared to Alternative U2. However, Alternative U2 would also involve transport of asphalt paving materials. Alternatives U2 and U3 rate equally in implementability.

7.1.5 Cost

The present value costs over 30 years for Alternatives U2 and U3 are listed in Table 3 and are detailed in Appendix E. In terms of both total cost and total present value, Alternative U2 is estimated to be less expensive than Alternative U3.

7.1.6 Comparative Analysis of Upland Remedial Alternatives Summary

This FS evaluates three remedial alternatives for upland areas to reduce potential risk to humans and ecological receptors:

- Alternative 1: No Action
- Alternative U2: Institutional Controls and Asphalt Cap

- Alternative U3: Institutional Controls, Excavation, and Off-Site Disposal

These three alternatives were evaluated against seven of the nine NCP criteria in Section 5.0, and the comparison is shown in Table 4. Alternative 1 meets the threshold criteria of overall protection of human health and the environment for soil at Subareas 1, 2, and 7. Only Alternatives U2 and U3 meet the threshold criteria of overall protection of human health and the environment throughout all subareas and media at IA F1. Additionally, compliance with ARARs does not apply for Alternative 1 where no action would occur while Alternatives U2 and U3 comply with ARARs.

Based on the comparative analysis for Alternatives U2 and U3, Alternative U3 offers advantages over Alternative U2 because it is the most effective in the long-term and is easy to implement. Additionally, Alternative U3 offers better long-term protectiveness because it eliminates risk to humans from lead under the potential future commercial/industrial worker scenario and ecological receptors such as the western meadowlark and the ornate shrew and long-term monitoring and maintenance to maintain the effectiveness of the alternative. Alternative U2 is more cost effective. Alternative U2 is rated as good for short-term effectiveness and U3 is rated as marginal. The overall rating using the NCP criteria for Alternatives 1 is poor, Alternative U2 is good, and for Alternative U3 is very good.

7.2 Comparative Analysis of Wetland Alternatives

7.2.1 Long-Term Effectiveness and Permanence

Alternative W3 is an effective and permanent alternative in the long-term because surface sediment that may pose an unacceptable risk to ecological receptors would be removed and disposed of offsite.

Alternative W2 would be as effective as Alternative W3 because it would reduce the risks associated with exposure to COECs in surface sediment by cutting off the exposure pathway. However, the long-term effectiveness of Alternative W3 is more certain than Alternative W2 since Alternative W2 will rely on monitoring and maintenance to ensure the integrity of the containment cell. The excavation and off-site disposal associated with Alternative W3 provides a permanent solution whereas consolidating and relocating sediment to an upland containment cell would require maintaining the containment cell and cover in the future. Alternative W3 is the most effective and permanent in the long-term followed by Alternative W2.

7.2.2 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternatives W2 or W3 would not reduce the toxicity, mobility, or volume of contaminated surface soil through treatment. As a result, neither of the remedial alternatives satisfies the

statutory preference for treatment and both Alternatives W2 and W3 rate equally for this criterion.

7.2.3 Short-Term Effectiveness

Alternatives W2 and W3 would expose workers, the environment, and the community to contaminated sediment during excavation and stockpiling activities.

While both Alternatives W2 and W3 would require transport of clean material through the community from an off-site source, Alternative W3 would also require the contaminated soil be transported through the community to the disposal facility. Alternative W2 would require contaminated soil to be consolidated and relocated onsite to a created upland containment cell, which would increase the exposure to contaminated sediment for workers and the community during sediment handling. Best management practices and health and safety protocols would be used during implementation of Alternatives W2 and W3 to minimize exposure of the community, workers, and the environment to contaminated sediment. Both Alternatives W2 and W3 would have negative short-term effects on the environment during construction.

The SiteWise™ GSR analysis incorporated resource inputs assumed for each of the alternatives. The results of the evaluation concluded that Alternative W3 would have greater environmental impacts with greater GHG, NOx, Sox and PM10 emissions, and total energy use compared to Alternative W2 while Alternative W2 would have greater water usage. The accident injury risk and accident fatality risk outcomes are greater for Alternative W2. Table 6 provides the summary values of the sustainability metrics for IA F1 remedial alternatives. The full summary tables, including comparative analysis from the SiteWise™ analysis, are provided in Appendix D.

Refining the remedial footprint during the pre-design sampling survey, importing fill from a nearby source and planning for disposal of soil at a nearby landfill (for Alternative W3) would reduce the anticipated sustainability impacts of the alternatives.

Alternatives W2 and W3 are rated equally in short-term effectiveness.

7.2.4 Implementability

Alternative W3 is easier to implement than Alternative W2 since sediment excavation and off-site disposal are more commonplace than constructing an on-site confinement cell. The remedial footprint for Subarea 6 is easily accessible which would ease the excavation activities for both alternatives. The area is sensitive wetland habitat, and, if conducted, pre-design sampling to refine the footprint would be performed in as minimally disruptive a manner as possible. Both Alternatives W2 and W3 call for ICs. However, the ICs for Alternative W2 would be more

extensive and require more long-term monitoring and maintenance than Alternative W3. Alternative W3 is rated higher than Alternative W2 for implementability.

7.2.5 Cost

The present value costs over 30 years for Alternatives W2 and W3 are listed in Table 3 and are detailed in Appendix E. In terms of both total cost and total present value, Alternative W2 is estimated to be less expensive than Alternative W3.

7.2.6 Comparative Analysis of Wetland Remedial Alternatives Summary

This FS evaluates three remedial alternatives for sediment in Subarea 6 in the remedial footprint area north of Outfall 33:

- Alternative 1: No Action
- Alternative W2: Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland
- Alternative W3: Institutional Controls, Excavation, and Off-Site Disposal

These three alternatives were evaluated against seven of the nine NCP criteria in Section 5.0 (Table 5). Only Alternatives W2 and W3 meet the threshold criteria of overall protection of human health and the environment. Alternative 1 does not meet the threshold criteria of overall protection of the environment due to unacceptable potential risk posed to the SMHM. Based on comparative analysis, Alternative W3 offers advantages over Alternative W2 because it is more effective in the long-term and it is easier to implement. Additionally, Alternative W3 offers better long-term protectiveness because it eliminates risk to ecological receptors and does not rely on long-term monitoring and maintenance to maintain the effectiveness of the alternative. Alternatives W2 and W3 both rated as good for short-term effectiveness. Based on the assumptions detailed in this FS, the overall rating using the NCP criteria for Alternative 1 is poor, Alternative W2 is good, and Alternative W3 is very good. All evaluated remedial alternatives for IA F1 are summarized in Table 8.

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Figures

Figure 1. Location Map

Figure 2. Target Treatment Zones Evaluated at IA F1

Figure 3. Site Features and Habitat Map

Figure 4. Future Land Reuse Zones

Figure 5. Subarea 4 Distribution of Lead in Soil and Target Treatment Zone Evaluated

Figure 6. Subarea 5 Distribution of Lead in Soil and Target Treatment Zone Evaluated

Figure 7. Subarea 6 Distribution of Barium, Copper, Lead, Molybdenum, and Zinc, and Target Treatment Zone Evaluated

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LEGEND

Boundary of Former Mare Island Naval Shipyard

NOTE:
Environmental Systems Research Institute (ESRI)
USA Spatial Feature Classes

N

3.5 0 3.5 7
Miles

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IA F1 FEASIBILITY STUDY REPORT
FORMER MARE ISLAND NAVAL SHIPYARD
VALLEJO, CALIFORNIA

FIGURE 1

LOCATION MAP

TREVET

DATE: SEPTEMBER 2015

CONTRACT NO.: N62473-12-C-4805

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Date: 9/3/2015

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Approximate Target Treatment Zone

- Lead in Soil - Subarea 4
- Lead in Soil - Subarea 5
- Metals in Sediment - Subarea 6

- Investigation Area F1
- Subarea Boundary
- 2007 - 2008 TCRA Excavation Area
- 2000 Excavation Area

- Removed Structure
- Building/Structure
- Road
- Site Feature

- Wetland
- Mudflat
- Water

Notes:
FS - Feasibility Study
IA - Investigation Area
TCRA - Time-Critical Removal Action
TPH -Total Petroleum Hydrocarbons
TTZ - Target Treatment Zone

GRAPHIC SCALE
0 150 300 600
(IN FEET)
1 INCH = 300 FEET

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VALLEJO, CALIFORNIA

FIGURE 2

TARGET TREATMENT ZONES EVALUATED AT IA F1

TREVET

DATE: SEPTEMBER 2015
CONTRACT NO.: N62473-12-C-4805

Date: 9/3/2015 Path: N:\GIS_Projects\MareIsland\Figs_IAF1_RAA_9-15\Fig2_Remedial_Areas_9-15.mxd

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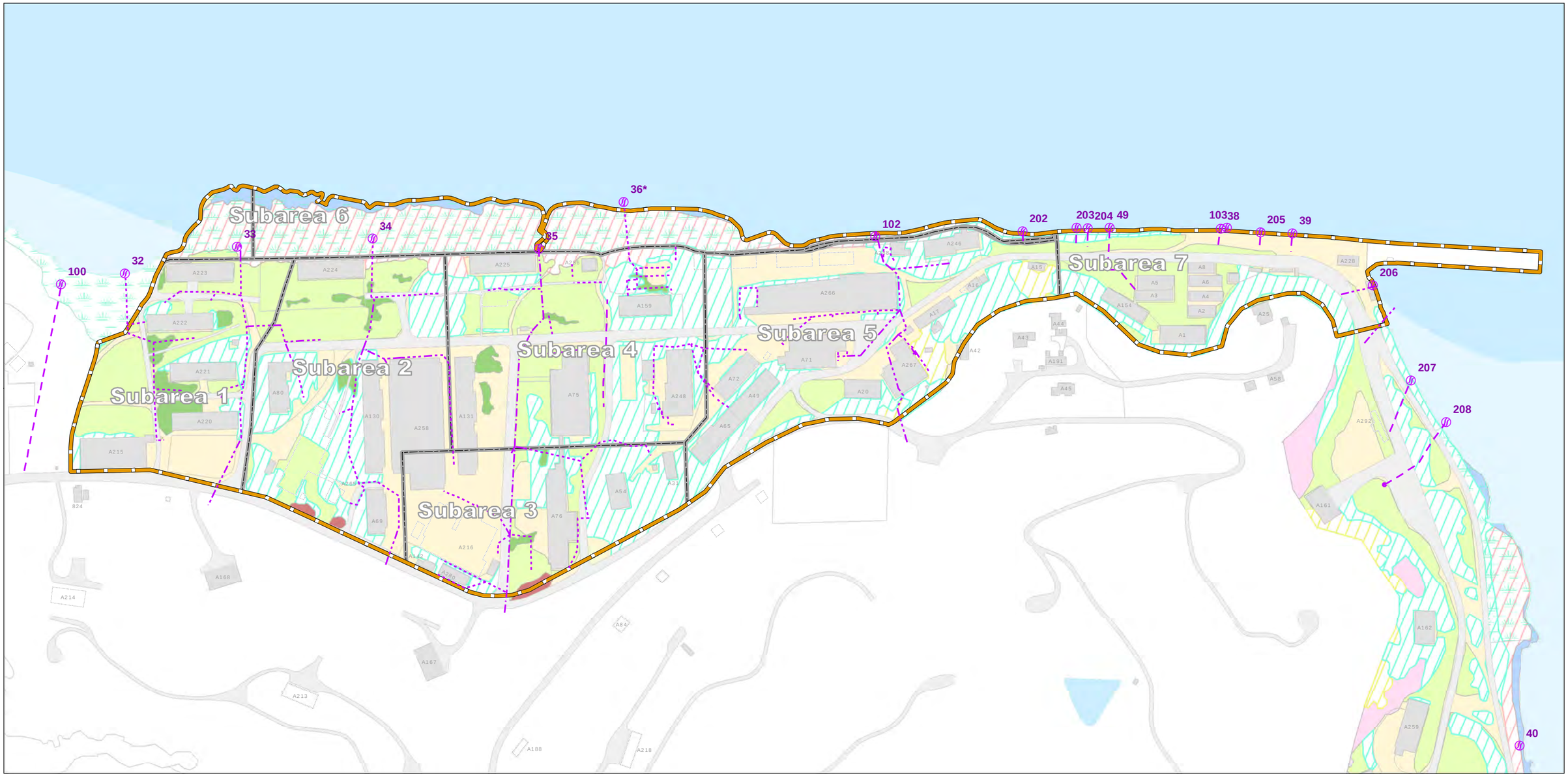

Outfall Number
36
Storm Water Outfall
Storm Drain

Removed Structure
Building/Structure
Road
Site Feature

Wetland
Mudflat
Water

Coastal Salt Marsh Wetland
Grassland Depression
Coastal Live Oak Forest
Coastal Sage Scrub
Investigation Area F1
Subarea Boundary

Eucalyptus
Developed Area
Non-native Grassland

Ruderal Vegetation
Tidal Aquatic / Mudflat
Rip-rap

GRAPHIC SCALE
0 150 300 600
(IN FEET)
1 INCH = 300 FEET

Notes:
* - Outfall 36 could not be located in the field.
IA - Investigation Area
TCRA - Time-Critical Removal Action

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FIGURE 3

SITE FEATURES AND HABITAT MAP

TREVET

DATE: SEPTEMBER 2015

CONTRACT NO.: N62473-12-C-4805

Path: N:\GIS_Projects\MareIsland\Figs_IAF1_RAA_9-15\Fig3_Habitats_9-15.mxd

Date: 9/3/2015

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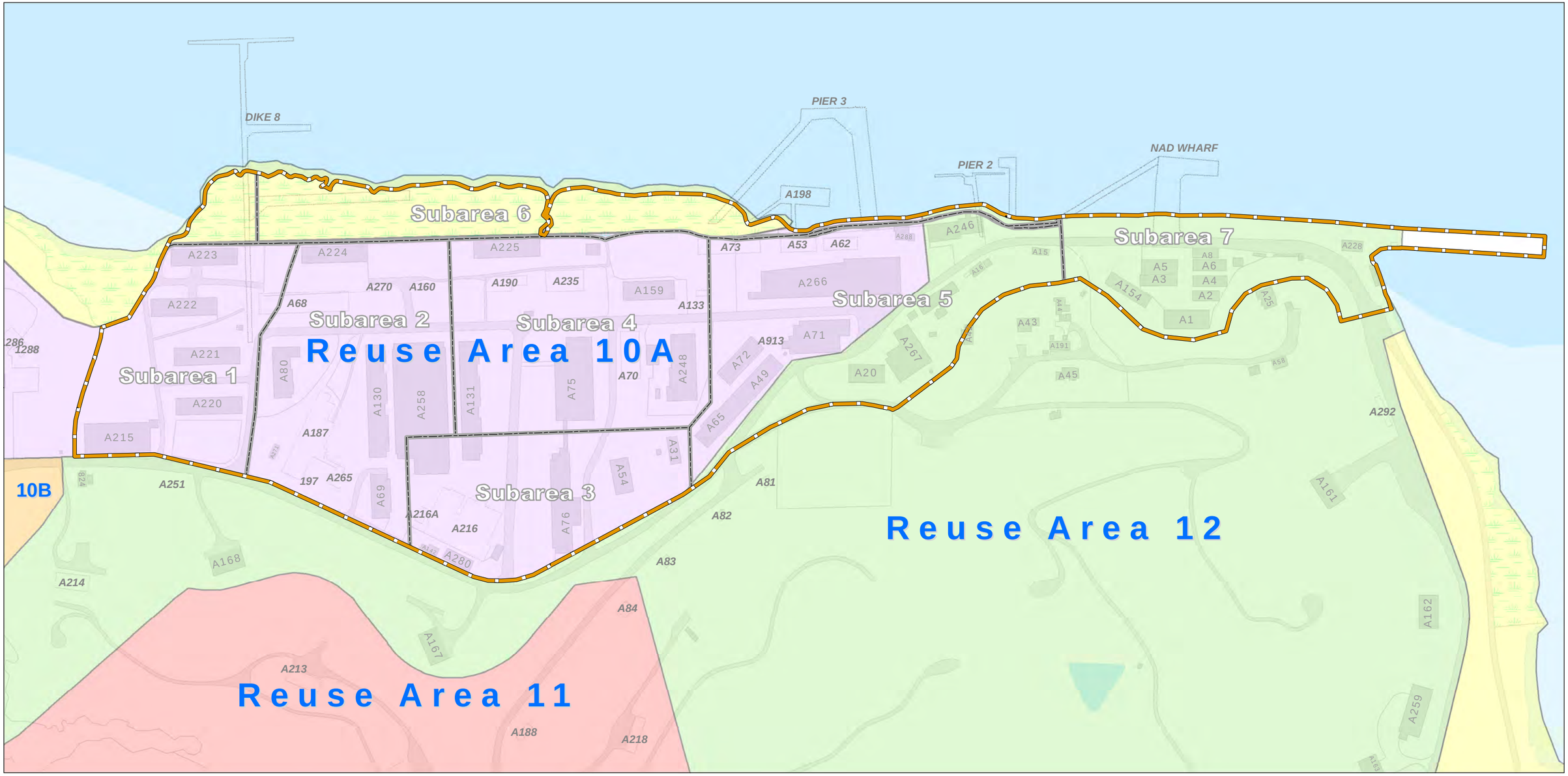

Reuse Areas
- 10A (Mixed Industrial)
- 10B (Army Reserve)
- 11 (Golf Course)
- 12 (Regional Park)
- Open Space Conservation Area

- Subarea Boundary
- Wetland
- Mudflat
- Water
- Removed Structure

- Building/Structure
- Road
- Site Feature

GRAPHIC SCALE
0 150 300 600
(IN FEET)
1 INCH = 300 FEET

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FIGURE 4

FUTURE LAND REUSE ZONES

TREVET

DATE: SEPTEMBER 2015

CONTRACT NO.: N62473-12-C-4805

Date: 9/3/2015 Path: N:\GIS_Projects\MareIsland\Figs_IAF1_RAA_9-15\Fig4_FutureLand_9-15.mxd

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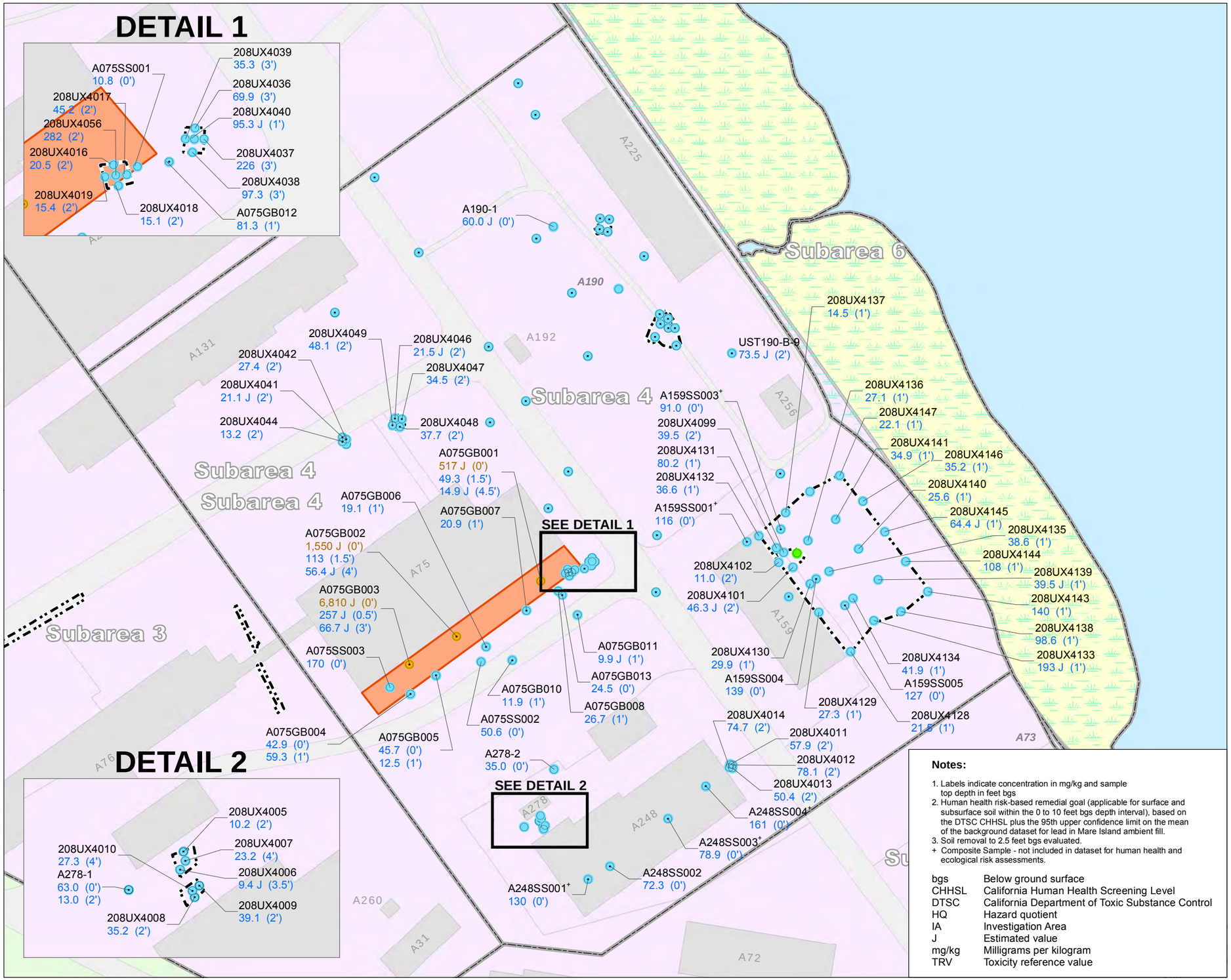

LEGEND

Lead Concentration in Soil Sample[1]

- Not Detected (ND)
- < 345.6[2] mg/kg
- > 345.6[2] mg/kg
- Soil Sample Location
- Soil Boring Location
- Subarea Boundary
- Proposed Target Treatment Zone Evaluated[3]
- 2000 Excavation Area
- Reuse Area-10A (Mixed Industrial)
- Reuse Area-12 (Regional Park)
- Reuse Area-Open Space Conservation Area
- Removed Structure
- Building/Structure
- Road
- Site Feature
- Wetland
- Mudflat
- Water

GRAPHIC SCALE

0 50 100 200

Feet

(IN FEET)
1 INCH = 100 FEET

Notes:

1. Labels indicate concentration in mg/kg and sample top depth in feet bgs
2. Human health risk-based remedial goal (applicable for surface and subsurface soil within the 0 to 10 feet bgs depth interval), based on the DTSC CHHSL plus the 95th upper confidence limit on the mean of the background dataset for lead in Mare Island ambient fill.
3. Soil removal to 2.5 feet bgs evaluated.

\+ Composite Sample - not included in dataset for human health and ecological risk assessments.

bgs	Below ground surface
CHHSL	California Human Health Screening Level
DTSC	California Department of Toxic Substance Control
HQ	Hazard quotient
IA	Investigation Area
J	Estimated value
mg/kg	Milligrams per kilogram
TRV	Toxicity reference value

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FIGURE 5

SUBAREA 4 DISTRIBUTION OF LEAD IN SOIL AND TARGET TREATMENT ZONE EVALUATED

TREVET

DATE: SEPTEMBER 2015

CONTRACT NO.: N62473-12-C-4805

Date: 9/3/2015 Path: N:\GIS_Projects\MareIsland\Figs_IAF1_RAA_9-15\Fig5_Lead_Subarea4_9-15.mxd

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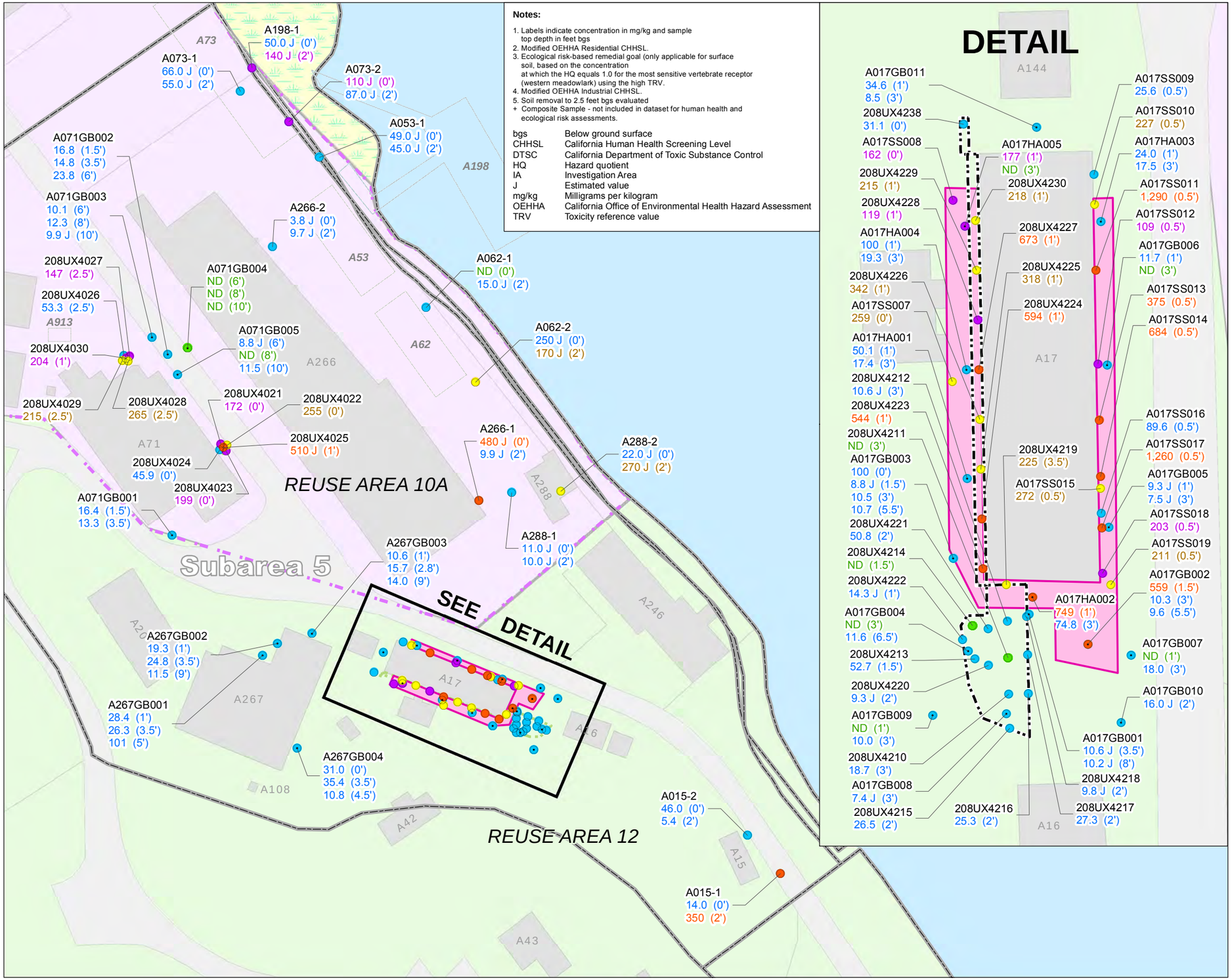
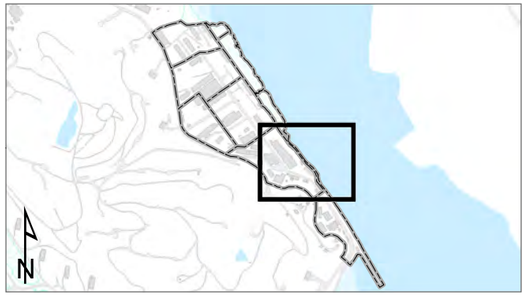
Notes:

1. Labels indicate concentration in mg/kg and sample top depth in feet bgs
2. Modified OEHHA Residential CHHSL.
3. Ecological risk-based remedial goal (only applicable for surface soil, based on the concentration at which the HQ equals 1.0 for the most sensitive vertebrate receptor (western meadowlark) using the high TRV.
4. Modified OEHHA Industrial CHHSL.
5. Soil removal to 2.5 feet bgs evaluated

\+ Composite Sample - not included in dataset for human health and ecological risk assessments.

bgs	Below ground surface
CHHSL	California Human Health Screening Level
DTSC	California Department of Toxic Substance Control
HQ	Hazard quotient
IA	Investigation Area
J	Estimated value
mg/kg	Milligrams per kilogram
OEHHA	California Office of Environmental Health Hazard Assessment
TRV	Toxicity reference value





LEGEND

Lead Concentration in Soil Sample[1]

- Non Detect (ND)
- < 105.6[2] mg/kg
- 105.6[2] - 205[3] mg/kg
- 205[3]- 345.6[4] mg/kg
- > 345.6[4] mg/kg
- Soil Sample Location
- Soil Boring Location
- Subarea Boundary
- Proposed Treatment Target Zone[5]
- 2000 Excavation Area
- Reuse Area-10A (Mixed Industrial)
- Reuse Area-12 (Regional Park)
- Reuse Area-Open Space Conservation Area
- Removed Structure
- Building/Structure
- Road
- Site Feature
- Wetland
- Mudflat
- Water

GRAPHIC SCALE

0 50 100 200

Feet

(IN FEET)
1 INCH = 100 FEET

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FIGURE 6

SUBAREA 5 DISTRIBUTION OF LEAD IN SOIL AND TARGET TREATMENT ZONE EVALUATED

TREVET

DATE: SEPTEMBER 2015

CONTRACT NO.: N62473-12-C-4805

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Date: 9/3/2015

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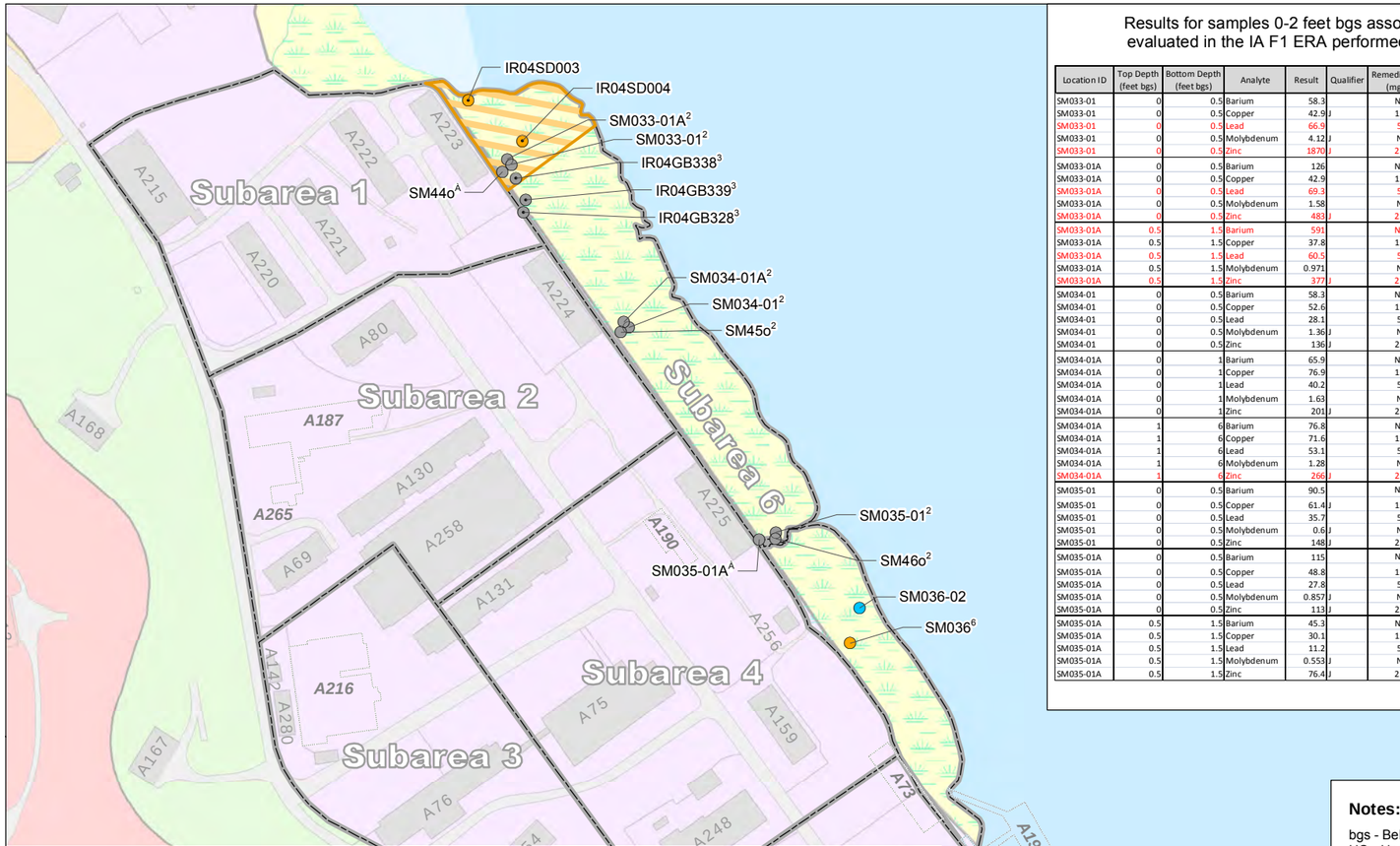
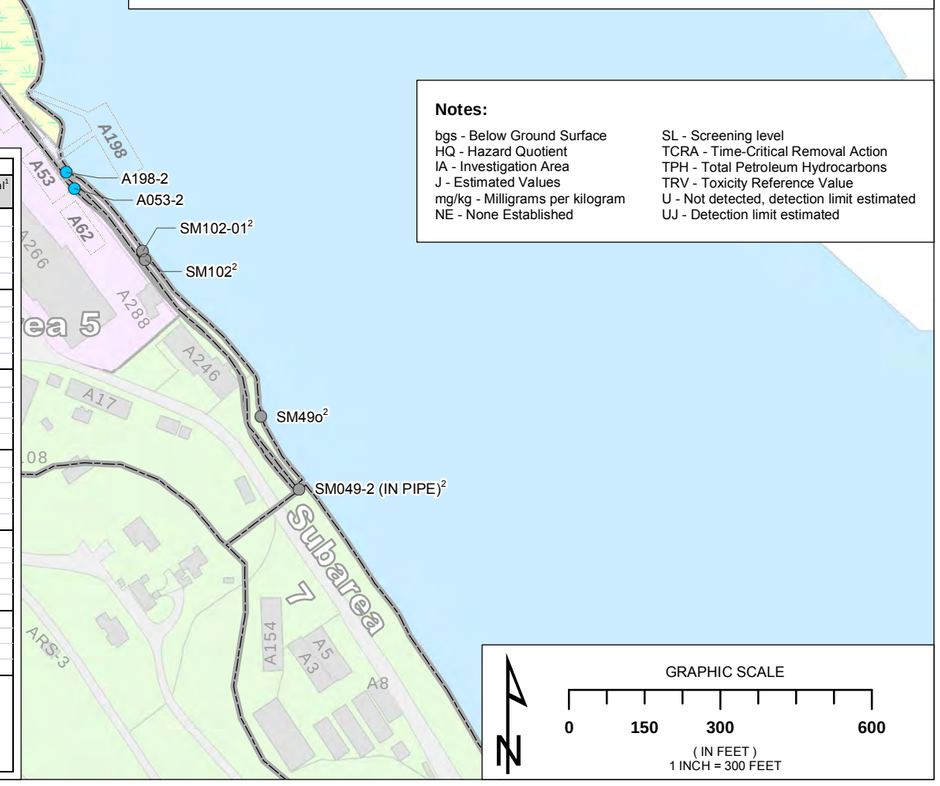


Results for samples 0-2 feet bgs associated with Outfalls 33, 34, 35, 102 and 202. Not evaluated in the IA F1 ERA performed during the RI because considered part of IA K.

Location ID	Top Depth (feet bgs)	Bottom Depth (feet bgs)	Analyte	Result	Qualifier	Remedial Goal[1] (mg/kg)
SM033-01	0	0.5	Barium	58.3		NE[4]
SM033-01	0	0.5	Copper	42.9	J	120
SM033-01	0	0.5	Lead	66.9		59
SM033-01	0	0.5	Molybdenum	4.12	J	NE
SM033-01	0	0.5	Zinc	1870	J	230
SM033-01A	0	0.5	Barium	126		NE[4]
SM033-01A	0	0.5	Copper	42.9		120
SM033-01A	0	0.5	Lead	69.3		59
SM033-01A	0	0.5	Molybdenum	1.58		NE
SM033-01A	0	0.5	Zinc	483	J	230
SM033-01A	0.5	1.5	Barium	591		NE[4]
SM033-01A	0.5	1.5	Copper	37.8		120
SM033-01A	0.5	1.5	Lead	60.5		59
SM033-01A	0.5	1.5	Molybdenum	0.971		NE
SM033-01A	0.5	1.5	Zinc	377	J	230
SM034-01	0	0.5	Barium	58.3		NE[4]
SM034-01	0	0.5	Copper	52.6		120
SM034-01	0	0.5	Lead	28.1		59
SM034-01	0	0.5	Molybdenum	1.36	J	NE
SM034-01	0	0.5	Zinc	136	J	230
SM034-01A	0	1	Barium	65.9		NE[4]
SM034-01A	0	1	Copper	76.9		120
SM034-01A	0	1	Lead	40.2		59
SM034-01A	0	1	Molybdenum	1.63		NE
SM034-01A	0	1	Zinc	201	J	230
SM034-01A	1	6	Barium	76.8		NE[4]
SM034-01A	1	6	Copper	71.6		120
SM034-01A	1	6	Lead	53.1		59
SM034-01A	1	6	Molybdenum	1.28		NE
SM034-01A	1	6	Zinc	266	J	230
SM035-01	0	0.5	Barium	90.5		NE[4]
SM035-01	0	0.5	Copper	61.4	J	120
SM035-01	0	0.5	Lead	35.7		59
SM035-01	0	0.5	Molybdenum	0.6	J	NE
SM035-01	0	0.5	Zinc	148	J	230
SM035-01A	0	0.5	Barium	115		NE[4]
SM035-01A	0	0.5	Copper	48.8		120
SM035-01A	0	0.5	Lead	27.8		59
SM035-01A	0	0.5	Molybdenum	0.857	J	NE
SM035-01A	0	0.5	Zinc	113	J	230
SM035-01A	0.5	1.5	Barium	45.3		NE[4]
SM035-01A	0.5	1.5	Copper	30.1		120
SM035-01A	0.5	1.5	Lead	11.2		59
SM035-01A	0.5	1.5	Molybdenum	0.553	J	NE
SM035-01A	0.5	1.5	Zinc	76.4	J	230

Location ID	Top Depth (feet bgs)	Bottom Depth (feet bgs)	Analyte	Result	Qualifier	Remedial Goal[1] (mg/kg)
SM102	0	0	Barium	55.1		NE[4]
SM102	0	0	Copper	17.9		120
SM102	0	0	Lead	25.7	J	59
SM102	0	0	Molybdenum	0.27	J	NE
SM102	0	0	Zinc	50	J	230
SM102-01	0	1	Barium	170		NE[4]
SM102-01	0	1	Copper	87.1		120
SM102-01	0	1	Lead	146		59
SM102-01	0	1	Molybdenum	0.809		NE
SM102-01	0	1	Zinc	256	J	230
SM102-01	1	6	Barium	200		NE[4]
SM102-01	1	6	Copper	52.3		120
SM102-01	1	6	Lead	20.3		59
SM102-01	1	6	Molybdenum	1.39		NE
SM102-01	1	6	Zinc	104	J	230
SM44o	0	0.5	Barium	141	J	NE[4]
SM44o	0	0.5	Copper	47.7	J	120
SM44o	0	0.5	Copper	18.2	J	120
SM44o	0	0.5	Lead	61.8	J	59
SM44o	0	0.5	Lead	39.6	J	59
SM44o	0	0.5	Molybdenum	0.19	J	NE
SM44o	0	0.5	Zinc	1790	J	230
SM44o	0	0.5	Zinc	1850	J	230
SM45o	0	0.5	Barium	80.9	J	NE[4]
SM45o	0	0.5	Copper	67.7	J	120
SM45o	0	0.5	Copper	28.2	J	120
SM45o	0	0.5	Lead	40.5	J	59
SM45o	0	0.5	Lead	28.4	J	59
SM45o	0	0.5	Molybdenum	0.32	UJ	NE
SM45o	0	0.5	Zinc	187	J	230
SM45o	0	0.5	Zinc	105	J	230
SM46o	0	0.5	Barium	94	J	NE[4]
SM46o	0	0.5	Copper	85.8	J	120
SM46o	0	0.5	Lead	149	J	59
SM46o	0	0.5	Molybdenum	0.32	UJ	NE
SM46o	0	0.5	Zinc	210	J	230
SM49o	0	0.5	Barium	33.1	J	NE[4]
SM49o	0	0.5	Copper	17.8	J	120
SM49o	0	0.5	Copper	11.3	J	120
SM49o	0	0.5	Lead	23.4	J	59
SM49o	0	0.5	Lead	12.6	J	59
SM49o	0	0.5	Molybdenum	0.15	UJ	NE
SM49o	0	0.5	Zinc	52.8	J	230
SM49o	0	0.5	Zinc	21.8	J	230



Results for Samples Evaluated in IA-F1 RI

Location ID	Top Depth (feet bgs)	Bottom Depth (feet bgs)	Analyte	Result	Qualifier	Remedial Goal[1] (mg/kg)
A053-2	0	2	Barium	130	J	NE[4]
A053-2	0	2	Copper	44	J	120
A053-2	0	2	Lead	22	J	59
A053-2	0	2	Molybdenum	2.8		NE
A053-2	0	2	Zinc	74	J	230
A053-2	2	4	Barium	94	J	NE[4]
A053-2	2	4	Copper	38	J	NE
A053-2	2	4	Lead	13	J	NE
A053-2	2	4	Molybdenum	1.5		NE
A053-2	2	4	Zinc	130	J	NE
A198-2	0	2	Barium	37	J	NE[4]
A198-2	0	2	Copper	46	J	120
A198-2	0	2	Lead	0.16	UJ	59
A198-2	0	2	Molybdenum	1.1	U	NE
A198-2	0	2	Zinc	57	J	230
A198-2	2	4	Barium	180	J	NE[4]
A198-2	2	4	Copper	59	J	NE
A198-2	2	4	Lead	17	J	NE
A198-2	2	4	Molybdenum	0.35	J	NE
A198-2	2	4	Zinc	88	J	NE
IR04SD003	0	0.5	Barium	55.5		NE[4]
IR04SD003	0	0.5	Copper	367		120
IR04SD003	0	0.5	Lead	95		59
IR04SD003	0	0.5	Molybdenum	3.5	J	NE
IR04SD003	0	0.5	Zinc	326		230
IR04SD003	2.5	3.25	Barium	143		NE[4]
IR04SD003	2.5	3.25	Copper	73.2		NE
IR04SD003	2.5	3.25	Lead	5.6		NE
IR04SD003	2.5	3.25	Molybdenum	1.4	U	NE
IR04SD003	2.5	3.25	Zinc	83.4		NE
IR04SD003	3	4.5	Barium	100		NE[4]
IR04SD003	3	4.5	Copper	26.4		NE
IR04SD003	3	4.5	Lead	2.2	U	NE
IR04SD003	3	4.5	Molybdenum	1.7	U	NE
IR04SD003	3	4.5	Zinc	49.8		NE

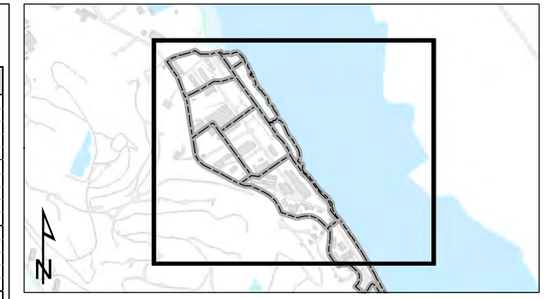
Location ID	Top Depth (feet bgs)	Bottom Depth (feet bgs)	Analyte	Result	Qualifier	Remedial Goal[1] (mg/kg)
IR04SD004	0	1.75	Barium	72.9		NE[4]
IR04SD004	0	1.75	Copper	126		120
IR04SD004	0	1.75	Lead	49.4		59
IR04SD004	0	1.75	Molybdenum	0.3	U	NE
IR04SD004	0	1.75	Zinc	201		230
IR04SD004	3	4.5	Barium	127		NE[4]
IR04SD004	3	4.5	Copper	186		NE
IR04SD004	3	4.5	Lead	92.8		NE
IR04SD004	3	4.5	Molybdenum	1.5	U	NE
IR04SD004	3	4.5	Zinc	288		NE
IR04SD004	4.75	6.25	Barium	70.9		NE[4]
IR04SD004	4.75	6.25	Copper	96.1		NE
IR04SD004	4.75	6.25	Lead	57.5		NE
IR04SD004	4.75	6.25	Molybdenum	0.32	UJ	NE
IR04SD004	4.75	6.25	Zinc	178		NE
SM036	0	0	Barium	65.8		NE[4]
SM036	0	0	Copper	64.6		120
SM036	0	0	Lead	82	J	59
SM036	0	0	Molybdenum	0.57	J	NE
SM036	0	0	Zinc	173	J	230
SM036-02	0	1	Barium	73.9		NE[4]
SM036-02	0	1	Copper	74.4	J	120
SM036-02	0	1	Lead	47.1		59
SM036-02	0	1	Molybdenum	0.92	UJ	NE
SM036-02	0	1	Zinc	163	J	230
SM036-02	1	6	Barium	77.2		NE[4]
SM036-02	1	6	Copper	73.7	J	120
SM036-02	1	6	Lead	33.2		59
SM036-02	1	6	Molybdenum	1.08	UJ	NE

NOTE:
Gray text = samples not in ERA performed during RI.
Black text = sample results included in the ERA

Notes:

bgs - Below Ground Surface
HQ - Hazard Quotient
IA - Investigation Area
J - Estimated Values
mg/kg - Milligrams per kilogram
NE - None Established
SL - Screening level
TCRA - Time-Critical Removal Action
TPH - Total Petroleum Hydrocarbons
TRV - Toxicity Reference Value
U - Not detected, detection limit estimated
UJ - Detection limit estimated

GRAPHIC SCALE
0 150 300 600
(IN FEET)
1 INCH = 300 FEET



LEGEND

- Sample location associated with IA FI which has chemical concentration above preliminary RGs
- Sample location associated with IA FI below preliminary RGs
- Sample location associated with Outfalls 33, 34, 35, 102, or 202
- Soil Boring
- Soil Sample Location
- Subarea Boundary
- Site Feature
- Removed Structure
- Wetland
- Building/Structure
- Mudflat
- Road
- Water
- Approximate Target Treatment Zone

Reuse Areas

- 10A (Mixed Industrial)
- 12 (Regional Park)
- 10B (Army Reserve)
- 11 (Golf Course)
- Open Space Conservation Area

Notes:

Red text = Sample results with 0-2 feet bgs depth interval that exceeds remedial goals

1.Ecological risk-based remedial goals are only applicable to soil between 0 and 2 feet bgs. The ecological risk-based remedial goal is based on the higher of the concentration at which the HQ equals 1 using the low TRV for the salt marsh harvest mouse, or the 95th percentile of the Mare Island ambient fill concentration. In each case the ambient concentration is higher. Remedial goals are not established for molybdenum because all values fall within the range identified for Mare Island Ambient Fill developed for IR Site 17 (ChaduxTt 2012b).
2.Location with data (Samples associated with Outfalls 33, 34, 35, 102, and 202) not included in the IA F1 human or ecological risk assessment datasets.
3.Samples not analyzed for metals. Analysis for TPH only.
4.Remedial goals not established for Barium. Barium background values for Mare Island Fill are not available. All but 1 of the Barium results are within the range of barium background concentrations for fill material at regional Bay Area Naval Installations.
5. Sediment removal to 2.5 feet bgs evaluates.
6. SM036 exceeds the preliminary RG for lead. Based on review of metals data, the exceedance does not appear to indicate widespread metals contamination. See Appendix B for more detail.
RGs ï Remediation Goals

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

IA F1 FEASIBILITY STUDY REPORT
FORMER MARE ISLAND NAVAL SHIPYARD
VALLEJO, CALIFORNIA

FIGURE 7

SUBAREA 6 DISTRIBUTION OF BARIUM, COPPER, LEAD, MOLYBDENUM, AND ZINC, AND TARGET TREATMENT ZONE EVALUATED

TREVET

DATE: SEPTEMBER 2015

CONTRACT NO.: N62473-12-C-4805

Path: N:\GIS_Projects\MareIsland\Figs_IAF1_RAA_9-15\Fig7_Subarea6_9-15.mxd

Date: 9/3/2015

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Tables

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Table 1. Refined RI Results and Conclusions

Subarea	Future Land Use	HHRA Results Based on Multi Pathway Total (excluding beneficial use of groundwater)				ERA Conclusion	Results and Conclusions Stated in the RI.	Results and Conclusions Refined in the FS
		Future Human Receptor (Soil Depth Interval)	Does Lead Pose a Risk?	Evaluation Using Groundwater Vapor Intrusion Model		Further Evaluation Recommended Based on ERA?		
				Cancer Risk	Hazard Index[a]			
1	Mixed Industrial	Commercial/Industrial Worker (0 to 2 feet bgs)	No	6E-07	0.02	No	Further investigation of TPH Area 2b is recommended. No further evaluation is recommended to address risk to humans or ecological receptors based on anticipated future land use.[b]	Sample results from additional data gap sampling at TPH Area 2b laterally delineate TPH in soil. TPH characterization is complete and closure as a low-risk fuel site is recommended.
		Commercial/Industrial Worker (0 to 10 feet bgs)	No	2E-06	0.08			
		Construction Worker (0 to 10 feet bgs)	No	8E-07	0.9			
		Hypothetical Resident (0 to 2 feet bgs)	No	2E-06	0.2			
		Hypothetical Resident (0 to 10 feet bgs)	No	6E-06	1 (0.7)			
2	Mixed Industrial	Commercial/Industrial Worker (0 to 2 feet bgs)	No	6E-07	0.04	No	No further evaluation is recommended to address risk to humans or ecological receptors based on anticipated future land use.[b]	
		Commercial/Industrial Worker (0 to 10 feet bgs)	No	6E-07	0.04			
		Construction Worker (0 to 10 feet bgs)	No	4E-07	0.6			
		Hypothetical Resident (0 to 2 feet bgs)	No	2E-06	0.5			
		Hypothetical Resident (0 to 10 feet bgs)	No	2E-06	0.5			
3	Mixed Industrial	Commercial/Industrial Worker (0 to 2 feet bgs)	No	7E-06 3E-08[d] (soil gas)	0.1 0.05[d] (soil gas)	No	No further evaluation is recommended to address risk to humans or ecological receptors based on anticipated future land use.[b]	Lead may pose an unacceptable risk to a hypothetical residential receptor. ICs preventing sensitive uses will be evaluated for Subarea 3.
		Commercial/Industrial Worker (0 to 10 feet bgs)	No	1E-05 3E-06[d] (soil gas)	0.1 0.06[d] (soil gas)			
		Construction Worker (0 to 10 feet bgs)	No	7E-07 7E-07[d] (soil gas)	0.7 0.7[d] (soil gas)			
		Hypothetical Resident (0 to 2 feet bgs)	Yes	9E-05 3E-07[d] (soil gas)	1(0.7) 0.7[d] (soil gas)			
		Hypothetical Resident (0 to 10 feet bgs)	No	1E-04 1E-05[d] (soil gas)	1(0.6) 0.7[d] (soil gas)			

Table 1. Refined RI Results and Conclusions

Subarea	Future Land Use	HHRA Results Based on Multi Pathway Total (excluding beneficial use of groundwater)				ERA Conclusion	Results and Conclusions Stated in the RI.	Results and Conclusions Refined in the FS
		Future Human Receptor (Soil Depth Interval)	Does Lead Pose a Risk?	Evaluation Using Groundwater Vapor Intrusion Model		Further Evaluation Recommended Based on ERA?		
				Cancer Risk	Hazard Index[a]			
4	Mixed Industrial	Commercial/Industrial Worker (0 to 2 feet bgs)	Yes	6E-06	0.2	Yes, lead and zinc identified as COECs in the area south of Building A75.	Lead poses an unacceptable risk to human health in the area to the south of Building A75. Lead and zinc pose unacceptable risk to ecological receptors in the area to the south of Building A75; therefore lead and zinc in this area should be evaluated further in a FS.[b]	The current land use and the planned future land use are industrial in Subarea 4 and a complete exposure pathway to ecological receptors is not anticipated. Therefore, only lead for protection of human health is evaluated as a COC for Building A75. ICs preventing sensitive uses will be evaluated for Subarea 4.
		Commercial/Industrial Worker (0 to 10 feet bgs)	No	5E-06	0.2			
		Construction Worker (0 to 10 feet bgs)	No	1E-06	1(0.4)			
		Hypothetical Resident (0 to 2 feet bgs)	Yes	2E-05	2(1)			
		Hypothetical Resident (0 to 10 feet bgs)	Yes	2E-05	2(<1)			
5	Mixed Industrial/ Regional Park	Commercial/Industrial Worker (0 to 2 feet bgs)	No	2E-06 1E-06[d] (soil gas)	0.09 0.08[d] (soil gas)	Yes, lead identified as a COEC in the area around Building A17.	Lead poses unacceptable risk to ecological receptors in the area around Building A17; therefore, lead in this area should be evaluated further in a FS.[b]	Building A17 is within future reuse plan 12 (regional park) which includes recreational and ecological receptors. Lead poses unacceptable risk to residential receptors (and therefore potentially to recreational receptors) and to ecological receptors in the area around Building A17. Lead is evaluated as a COC and COEC for Building A17. ICs restricting sensitive uses will be evaluated for Subarea 5.
		Commercial/Industrial Worker (0 to 10 feet bgs)	No	1E-06 8E-07[d] (soil gas)	0.1 0.1[d] (soil gas)			
		Construction Worker (0 to 10 feet bgs)	No	5E-07 5E-07[d] (soil gas)	12(11)c 12(11)[c,d] (soil gas)			
		Hypothetical Resident (0 to 2 feet bgs)	Yes	1E-05 4E-06[d] (soil gas)	1(0.5) 1(0.5)[d] (soil gas)			
		Hypothetical Resident (0 to 10 feet bgs)	Yes	1E-05 4E-06[d] (soil gas)	2(0.9) 2(0.9)[d] (soil gas)			
6	Conservatio n Area (Wetlands)	Recreational User (0 to 2 feet bgs)	No	1E-05	0.5	Yes, barium, copper, lead, molybdenum and zinc were identified as COECs for Subarea 6.	No unacceptable risks to human health were identified for Subarea 6. COECs pose unacceptable risk to ecological receptors in Subarea 6; therefore, COECs in Subarea 6 should be evaluated further in a FS.[b]	No unacceptable risks to human health were identified for Subarea 6 in the anticipated future land use scenario. COECs pose unacceptable risk to ecological receptors in Subarea 6; therefore, COECs in Subarea 6 are evaluated further in the FS. ICs preventing sensitive uses will be evaluated for Subarea 6.

Table 1. Refined RI Results and Conclusions

Subarea	Future Land Use	HHRA Results Based on Multi Pathway Total (excluding beneficial use of groundwater)				ERA Conclusion	Results and Conclusions Stated in the RI.	Results and Conclusions Refined in the FS
		Future Human Receptor (Soil Depth Interval)	Does Lead Pose a Risk?	Evaluation Using Groundwater Vapor Intrusion Model		Further Evaluation Recommended Based on ERA?		
				Cancer Risk	Hazard Index[a]			
7	Regional Park	Commercial/Industrial Worker (0 to 2 feet bgs)	No	2E-06	0.1	No	No further evaluation is recommended to address risk to humans or ecological receptors based on anticipated future land use.[b]	
		Commercial/Industrial Worker (0 to 10 feet bgs)	No	2E-06	0.09			
		Construction Worker (0 to 10 feet bgs)	No	1E-06	1(0.99)			
		Hypothetical Resident (0 to 2 feet bgs)	No	5E-06	1(1)			
		Hypothetical Resident (0 to 10 feet bgs)	No	5E-06	1(1)			

Notes: For human health, the soil depth interval shown above for 0 to 2 feet bgs represents the minimal disturbance scenario and the 0 to 10 feet bgs represents the intrusive development scenario. These future scenarios include exposures to soil, groundwater, and soil gas.

a. If the total HI exceeds the threshold of 1, values shown in parentheses represent the highest target organ segregated HI.

b. Groundwater at the site has a Beneficial Use Exception from the Water Board, which precludes groundwater from any beneficial uses (Water Board 2010).

c. Risk driver is manganese. The RI does eliminates manganese as a chemical of concern for the construction worker at Subarea 5 because there is no risk associated with the long-term commercial/industrial worker who is on site for 25 years and because manganese is expected to be naturally occurring at the site.

d. HHRA results for cancer risk and HI were evaluated using soil gas vapor intrusion model. There is no change to risk using the soil gas vapor intrusion model to the construction worker (0 to 10 feet) since vapor intrusion is not a complete pathway for that receptor.

bgs Below ground surface
COC Chemical of concern
COEC Chemical of ecological concern
ERA Ecological Risk Assessment
FS Feasibility study
HHRA Human health risk assessment
HI Hazard index
IA F1 Investigation Area F1
IC Institutional control
RI Remedial investigation
TPH Total petroleum hydrocarbons

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Table 2. Summary of Remedial Alternatives

	Alternative	GRA Category	Description	Purpose
	1 – No Action	No Action	No action taken.	Exposure pathways unaffected.
Upland Soil	U2 – Institutional Controls and Asphalt Cap	Containment and ICs	The TTZs would be paved with asphalt, approximately 13,500 square feet. ICs would prevent sensitive uses for soil in areas that do not warrant unrestricted reuse and exposure and provide for maintenance of remedy. Long-term monitoring, maintenance, and reporting would be required.	Removes exposure pathways by physically shielding receptors from exposure to contaminated soil, capped in the TTZ. A beneficial use exception for shallow groundwater was received for the site.
Upland Soil	U3 – Institutional Controls, Excavation, and Off-Site Disposal	Removal and ICs	Soil in the TTZs would be excavated, approximately 1,250 CY. The removed soil would be disposed of off site at a permitted facility and excavations would be backfilled. ICs would prevent sensitive uses for soil and groundwater in areas that do not warrant unrestricted reuse and exposure and provide for maintenance of remedy. Long-term monitoring, maintenance, and reporting would be required.	Eliminates exposure pathways by removing contaminated soil off site. Prevents sensitive receptor exposure to soil.
Wetland Sediment	W2 – Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland	Relocation and ICs	Alternative W2 employs ICs and the relocation of 3,550 BCY of sediment from the TTZ in Subarea 6 to the uplands portion of IA F1 to meet ARARs and RAOs. The sediment would be characterized prior to relocation to the uplands. Based on this characterization, the sediment relocated to the upland area may be suitable for beneficial reuse, or may be placed in a containment cell and covered to reduce risk. The wetlands would be backfilled to original elevation with imported fill sediment and wetlands habitat restored to target criteria. ICs would prevent sensitive uses for soil in areas that do not warrant unrestricted reuse and exposure and provide for maintenance of remedy. Long-term monitoring, maintenance, and reporting would be required.	Eliminates exposure pathways to ecological receptors by relocating impacted sediment to an upland area devoid of ecological habitat. Prevents sensitive receptor exposure to soil.
Wetland Sediment	W3 – Institutional Controls, Excavation, and Off-site Disposal	Removal and ICs	Sediment in the TTZ would be excavated, approximately 4,000 CY. The wetlands would be backfilled to original elevation with imported fill sediment and wetlands habitat would be restored to target criteria. The removed sediment would be disposed of off site at a permitted facility. ICs would prevent sensitive uses for soil in areas that do not warrant unrestricted reuse and exposure and provide for maintenance of remedy. Long-term monitoring, maintenance, and reporting would be required.	Eliminates exposure pathways by removing the contaminated sediment off-site. Prevents sensitive receptor exposure to soil.

ARAR Applicable or relevant and appropriate requirements

Table 2. Summary of Remedial Alternatives

ARAR	Applicable or relevant and appropriate requirements
CY	Cubic yards
IA F1	Installation Area F1
ICs	Institutional Controls
RAOs	Remedial action objectives
TTZ	Target treatment zone

Table 3. Summary of Estimated Costs

Alternative Description	Remedial Design and Project Management	Capital Cost (Including Off-Site Disposal)	30-Year O&M Cost	Total Cost (Capital Cost Plus 30-Year O&M)	Present Value Cost
Alternative 1: No Action	$0	$0	$0	$0	$0
Upland Alternatives					
Alternative U2: Institutional Controls and Asphalt Capping	$108,000	$414,000	$1,080,000	$1,602,000	$1,428,000
Alternative U3: Institutional Controls, Excavation, and Off-Site Disposal	$165,000	$831,000	$900,000	$1,896,000	$1,745,000
Wetland Alternatives					
Alternative W2: Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland	$525,000	$2,021,000	$240,000	$2,787,000	$2,736,000
Alternative W3: Institutional Controls, Excavation, and Off-Site Disposal	$409,000	$2,088,000	$60,000	$2,557,000	$2,533,000

Itemized costs for each alternative are shown in Tables E-1 through E-4.

All costs for land-use ICs preventing sensitive uses are incorporated into Alternatives U2 and U3.

O&M Operation and maintenance

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Table 4. Upland Remedial Alternatives Rankings for NCP Criteria

Alternatives	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through treatment	Short-Term Effectiveness	Implementability	Total Cost ($Million)	Overall Rating by Alternative
Alternative 1: No Action	Non-Protective	NA	○	○	●	●	● ($0)	○
Alternative U2: Institutional Controls and Asphalt Capping	Protective	Yes	◑	○	◑	●	◑ ($1.60)	◑
Alternative U3: Institutional Controls, Excavation, and Off-Site Disposal	Protective	Yes	●	○	◔	●	◑ ($1.90)	◕

ARAR applicable or relevant and appropriate requirements
NA not applicable
NCP National Oil and Hazardous Substances Pollution Contingency Plan

Legend:

○ Poor
◔ Marginal
◑ Good
◕ Very Good
● Excellent

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Table 5. Wetland Remedial Alternatives Ranking for NCP Criteria

Alternatives	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-Term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume through treatment	Short Term Effectiveness	Implementability	Total Cost ($Million)	Overall Rating by Alternative
Alternative 1: No Action	Non-Protective	NA	○	○	●	●	● ($0)	○
Alternative W2: Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland	Protective	Yes	◕	○	◔	◑	◑ ($2.79)	◑
Alternative W3: Institutional Controls, Excavation, and Off-Site Disposal	Protective	Yes	●	○	◔	◕	◑ ($2.56)	◕

ARAR applicable or relevant and appropriate requirements
NA not applicable
NCP National Oil and Hazardous Substances Pollution Contingency Plan

Legend:

○ Poor
◔ Marginal
◑ Good
◕ Very Good
● Excellent

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Table 6. GSR Final Summary

Remedial Alternative	GHG Emissions	Total Energy Used	Water Consumption	NO_x emissions	SO_x Emissions	PM_{10} Emissions	Accident Risk Fatality	Accident Risk Injury
	metric ton	MMBtu	gallons	metric ton	metric ton	metric ton		
U2	59.73	7.53E+02	3.50E+03	2.29E-02	1.08E-03	5.92E-03	2.58E-03	3.45E-01
U3	49.77	7.92E+02	4.00E+04	1.20E-01	5.93E-02	2.75E-01	1.03E-03	1.82E-01
W2	67.05	8.63E+02	1.00E+05	5.29E-02	1.67E-02	7.71E-03	2.73E-03	4.87E-01
W3	111.81	1.95E+03	1.00E+04	3.74E-01	1.91E-01	9.30E-01	1.08E-03	1.87E-01

GHG – greenhouse gas

GSR – Green and Sustainable Remediation

MMBtu – million British thermal units

NO_x – nitrogen oxides

PM_{10} – particulate matter 10 microns in diameter or smaller

SO_x – sulfur oxides

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Table 7. Institutional Controls

Subarea	Receptors Considered in HHRA and ERA	Sensitive Uses	Contaminants Driving Site Decisions	Is Unrestricted Reuse Feasible?	Restrictions to Protect Future Receptors	Are ICs Protective of Future Use?
Upland Areas						
Subarea 1 Future Use: Mixed Industrial	**Human Receptors** • Hypothetical Resident, Industrial/Commercial Worker and Construction Worker • Beneficial use exception for shallow groundwater received. **Eco Receptors** • Plants, Invertebrates, Birds, Mammals	**Groundwater Use** • Beneficial use exception for shallow groundwater received. **Land Uses** Examples of Sensitive Land Uses may include: • Residential use • A hospital for humans • A school for persons under 18 years of age • A day care facility for children • Formation of open space or ecological habitat (Subarea 4 and future industrial reuse portions of Subarea 5)	**Soil** – None **Groundwater –** Residual Impacts	**Yes - Soil.** Surface and subsurface soil do not pose an unacceptable risk to sensitive or ecological receptors. **No - GW.** Beneficial use exception for shallow groundwater received.	NFA appropriate for surface and subsurface soil.	**Yes**
Subarea 2 Future Use: Mixed Industrial			**Soil** – None **Groundwater –** Residual Impacts	**Yes - Soil.** Surface and subsurface soil do not pose an unacceptable risk to sensitive or ecological receptors. **No - GW.** Beneficial use exception for shallow groundwater received.	NFA appropriate for surface and subsurface soil.	**Yes**
Subarea 3 Future Use: Mixed Industrial			**Lead** exceeds modified residential CHHSL. Carcinogenic risk to a hypothetical future resident is 1E-4 driven by vinyl chloride in soil and groundwater (nonpotable).	**No.** EPC for lead exceeds the modified residential CHHSL in Subarea 3. Carcinogenic risk to a hypothetical future resident is 1E-4 driven by vinyl chloride in soil and groundwater (nonpotable). Beneficial use exception for shallow groundwater received.	ICs to prevent sensitive land uses at Subarea 3.	**Yes**
Subarea 4 Future Use: Mixed Industrial			**Lead** near Building A75 exceeds modified industrial and residential CHHSL. Carcinogenic risk to a hypothetical future resident is 2E-5 driven by dioxins and benzo(a)pyrene in soil.	**No.** EPC for lead in Subarea 4 exceeds the modified residential CHHSL, and a hotspot near Building A75 exceeds the industrial CHHSL for lead. Carcinogenic risk to a hypothetical future resident is 2E-5 driven by dioxins and benzo(a)pyrene in soil. Beneficial use exception for shallow groundwater received.	ICs to prevent sensitive land uses. Further action needed to meet future land use at Subarea 4.	**Partially.** Outside TTZ, yes. Active remediation evaluated for TTZ.
Subarea 5 Future Use: Mixed Industrial and Regional Park			**Lead** near Building A17 exceeds modified industrial and residential CHHSL. **Lead** near Building A17 poses a potential risk to future ecological receptors.[1]	**No.** EPC for lead for Subarea 5 exceeds the modified residential CHHSL, but not the modified industrial CHHSL. Residential exposure parameters for lead are conservative relative to recreational exposure parameters. Lead near Building A17 poses a potential risk to future ecological receptors. Beneficial use exception for shallow groundwater received.	ICs to prevent sensitive land uses. Further action needed to meet future land uses at Subarea 5.	**Partially.** Outside TTZ, yes. Active remediation evaluated for TTZ.
Subarea 7 Future Use: Mixed Industrial			**Soil** – None **Groundwater –** Residual Impacts	**Yes - Soil.** Surface and subsurface soil do not pose an unacceptable risk to sensitive or ecological receptors. **No - GW**. Beneficial use exception for shallow groundwater received.	NFA appropriate for surface and subsurface soil.	**Yes**

Table 7. Institutional Controls

Subarea	Receptors Considered in HHRA and ERA	Sensitive Uses	Contaminants Driving Site Decisions	Is Unrestricted Reuse Feasible?	Restrictions to Protect Future Receptors	Are ICs Protective of Future Use?
Wetland Areas						
Subarea 6 Future Use: Conservation Area	**Human Receptor** • Recreational Receptor • Beneficial use exception for shallow groundwater received **Eco Receptors** • Plants, Invertebrates, Birds, Mammals, Individual SMHM	See above	**Barium, Copper, Lead and Zinc** based on potential risk to ecological receptors.[2]	**No**. Unacceptable risk exists to ecological receptors. Residential reuse incompatible with wetlands. Beneficial use exception for shallow groundwater received	ICs to prevent sensitive land uses. Further action needed based on potential ecological risk at Subarea 6.	**Partially.** Outside TTZ, yes. Active remediation evaluated for TTZ.
Sites with USTs and Other Petroleum Features at IA F1	UST closure letters for IA F1: Water Board. 2004. "Closure Letter and Site Summary for Six Underground Storage Tanks at the Former Mare Island Naval Shipyard, Vallejo, California." December 22. Water Board. 2011a. "No Further Action for UST A-225, Mare Island Naval Shipyard, Vallejo, Solano County, Water Board Case No. 48D9242." January 24. Water Board. 2012. "No Further Action for UST A266S, Former Mare Island Naval Shipyard, Vallejo, Solano County." May 4.					

1. Most sensitive ecological receptor is Western Meadowlark
2. Most sensitive ecological receptor is SMHM

CHHSL – California Human Health Screening Level
EPC – exposure point concentrations
ERA – Ecological Risk Assessment
GW – groundwater
HHRA – Human Health Risk Assessment
ICs – institutional controls
NFA – no further action
RI – Remedial Investigation
SMHM – salt marsh harvest mouse
TTZ – target treatment zone
UST – underground storage tank

Table 8. Proposed TTZs Summary

TTZ	Subarea	Media	Contaminant	Targeted Receptor	Preliminary Remedial Goals (RGs)	Target Treatment Zone (TTZ)	Remedial Alternatives
Upland Areas							
Area A75	Subarea 4	Soil	Lead	Industrial Worker	Preliminary RG for lead of 345.6 mg/kg, in accordance with the risk-based human health EPC. Ecological risk was not considered in development of RGs for Subarea 4 because both the current land use and the planned future land use are industrial in this area and a complete exposure pathway to ecological receptors is not anticipated.	The estimated volume of contaminated soil in the A75 TTZ is 1,000 yd^3 based on a contamination area of 10,800 ft^2 to a depth of 2.5 feet bgs. TTZ areas for A75 are well delineated.	1 – No Action U2 – Institutional Controls and Asphalt Cap U3 – Institutional Controls, Excavation, and Off-Site Disposal
Area A17	Subarea 5	Soil	Lead	Recreational Receptor (child) Western Meadowlark	Preliminary RG for lead of 105.6, based on the modified OEHHA residential CHHSL. Preliminary RG for lead of 205 mg/kg, in accordance with the value at which the HI equals 1 for the most sensitive vertebrate ecological receptor, the Western Meadowlark, using the high TRV. The stricter of the two (human health and ecological) was selected as the screening value. Both human health and ecological risk were considered in development of RGs because the planned future land use in this area is as a Regional Park, and both human and ecological receptors are anticipated.	The estimated volume of contaminated soil in the A17 TTZ is 250 yd^3 based on a contamination area of 2,700 ft^2 to a depth of 2.5 feet bgs. TTZ areas for A17 are well delineated.	1 – No Action U2 – Institutional Controls and Asphalt Cap U3 – Institutional Controls, Excavation, and Off-Site Disposal
Wetlands Area							
Northern Wetlands Area near Outfall 33	Subarea 6	Sediment	Barium Copper Lead Zinc	Salt Marsh Harvest Mouse	Preliminary RG for lead of 59 mg/kg, zinc of 230 mg/kg, and copper of 120 mg/kg, consistent with the Mare Island ambient fill concentration. The concentration at which the HQ=1, low TRV for the most sensitive receptor, the endangered salt marsh harvest mouse, is lower than the ambient fill concentration, and therefore the ambient fill concentration has been adopted as the Preliminary RG for each of these metals.. No ambient value for barium has been established for fill at Mare Island, however all but one of the barium results at Subarea 6 are within the range of ambient fill concentrations (166 to 314.4 mg/kg) established for barium at other naval installations in the Bay Area. No Preliminary RG has been established for barium. The lone elevated barium value falls within the TTZ for Subarea 6.	The total estimated volume of contaminated sediment in Subarea 6 is approximately 4,000 yd^3. The estimated volume of contaminated sediment based on a contaminated area of 38,350 ft^2 and a depth of 2.5 feet bgs.	1 – No Action W2 – Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland W3 – Institutional Controls, Excavation, and Off-Site Disposal

Notes:

CHHSL	California Human Health Screening Level
EPC	exposure point concentration
ft^2	square feet
HI	Hazard Index
HQ	Hazard Quotient
mg/kg	milligrams per kilograms
OEHHA	Office of Environmental Health Hazard Assessment
RG	remedial goal
TRV	toxicity reference value
TTZ	target treatment zone
yd^3	cubic yard

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Appendix A:

TPH Data Gap Sampling

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Attachments:

A1. TPH15SB1 Borelog
A2. TPH14SB1 Borelog
A3. TPH2BSB1 Borelog

Figures:

A1: TPH Soil Sample Results in Subarea 1
A2: TPH Grab Groundwater Sample Results in Subarea 4

Tables:

1: Soil Sampling Results
2: Grab Groundwater Results

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Section 1 Introduction

In July 2013, Trevet Environmental (Trevet) completed the additional total petroleum hydrocarbons (TPH) sampling for three TPH areas in Investigation Area (IA) F1 at the Former Mare Island Naval Shipyard (MINS). The locations for additional TPH sampling were based on the findings of the Final Remedial Investigation (RI) Report for IA F1 and subsequent regulatory agency comments. The planned sampling event was described in a letter included as Appendix H of the Final Data Gaps Investigation Work Plan for IR Site 4, MINS (Trevet 2013).

The Draft of the Final RI for IA F1 at Mare Island Naval Shipyard stated that some areas of detected TPH in IA F1 were not completely delineated but were adequately characterized. The California Regional Water Quality Control Board, San Francisco Bay Region Water Board (Water Board) requested that the Navy clarify this statement, and in response the Navy prepared a technical memorandum regarding the extent of TPH contamination exceeding Tier 2 screening levels (SLs) at IA F1, which were presented in the Final RI Report as Appendix O.

Based on this memorandum as well as further technical discussion between the Navy and the regulatory agencies, the Navy and the Water Board were able to reach agreement on November 2012 that no further action (NFA) was suitable for all but three of the IA F1 TPH areas (Water Board 2012). For these three areas, the Water Board has requested additional sampling to assess current conditions at locations where elevated concentrations were previously reported. This request was presented in a letter from the Water Board to the Navy, dated November 2, 2012 (Water Board 2012). The Navy agreed and the scope of the planned sampling was described in a letter included as Appendix H of the Final Data Gaps Investigation Work Plan for IR Site 4, MINS (Trevet 2013). The Water Board concurred with this approach in a letter dated March 2013 (Water Board 2013) and the additional sampling at these three locations was completed in June-July 2013 by Trevet.

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Section 2 Sample Locations

Three locations were selected for additional sampling: TPH Areas 2b, 14, and 15, in accordance with the planned sampling approach. Soil samples were collected at TPH Area 2b while groundwater grab samples were collected at TPH Areas 14 and 15. Sampling procedures are discussed further below.

2.1 TPH Area 2b

The soil sampling in TPH Area 2b consisted of one soil boring advanced at or adjacent to the location of previous boring IR04GB222 in Subarea 1 (Figure 1). The previous sample at this location had reported TPH as diesel (TPH-dr) at an estimated concentration of 8,800 milligrams per kilogram (mg/kg) and TPH as gasoline (TPH-gr) at 1,950 mg/kg from a single sample collected at a depth of 1 foot below ground surface (bgs). These concentrations exceed the Tier 2 SLs for soil developed during the RI (i.e., 500 mg/kg for both TPH-dr and for TPH-gr) (ChaduxTt 2012). The intention of the additional samples was to evaluate the vertical extent of the elevated TPH reported at this location and to evaluate the current concentration at the depth previously sampled. Soil samples were therefore collected at depths of approximately 1 foot, 3 feet, and 5 feet in accordance with the sampling plan, and at the discretion of the field geologist an additional sample was collected at 7 feet bgs (Trevet 2013). A hold on analysis was placed on the soil sample collected at 7 feet bgs pending the result of the 5 feet bgs soil sample.

2.2 TPH Areas 14 and 15

One temporary monitoring well was installed and sampled in both TPH Areas 14 and 15 within Subarea 4. The temporary monitoring well in TPH Area 14 was installed at or adjacent to the location of grab groundwater sample UST190-B-11, collected in May of 1992. The temporary monitoring well in TPH Area 15 was installed at or adjacent to the location of grab groundwater sample UST190-B-14, also collected in May of 1992 (Figure 2).

The groundwater sample UST190-B-11, previously collected in TPH Area 14, reported TPH-dr at a concentration of 3 milligrams per liter (mg/L), which is greater than the Tier 2 SL of 0.64 mg/L established for locations within the 300-foot buffer zone for aquatic receptors in the bay. The groundwater sample UST190-B-14, previously collected in TPH Area 15, reported TPH-dr at a concentration of 2 mg/L, which is also greater than the Tier 2 SL of 0.64 mg/L (ChaduxTt 2012). The intention of the additional samples at TPH Areas 14 and 15 was to evaluate the current concentrations of TPH-dr at these locations (Trevet 2013).

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Section 3 Fieldwork

There were three phases of fieldwork associated with the sampling event: pre-investigation, sampling and surveying. These three phases are discussed in the following subsections:

3.1 Pre-investigation Activities

The planned pre-investigation activities were completed before drilling and included: marking-out sample locations; conducting underground utility clearance; and notification of appropriate personnel. This work was coordinated with the Resident Officer in Charge of Construction (ROICC) and the Caretaker Site Office (CSO) and at least two weeks advance notification was provided before fieldwork.

The three boring locations were marked-out with a surveyor using a global positioning system (GPS) device. The proposed locations were marked with marking paint and a labeled stake driven into the ground. Prior to the start of drilling, the boring locations for soil and temporary monitoring well installations were marked out and geophysically screened for underground utilities and anomalies. A geophysical survey of the area was conducted (using Ground Penetrating Radar) to identify potential unknown buried utilities, pipes, and/or other subsurface obstructions. No hazards or obstructions were found at the proposed locations. Underground utility clearance was completed prior to intrusive fieldwork. Underground Service Alert of Northern California and Nevada was notified to obtain utility clearance. In addition a 5-foot radius around each of the proposed boring locations was cleared by a subcontracted, private utility-locating company, NORCAL Geophysical Consultants. No utilities were identified within 3 feet of the proposed sampling or drilling locations.

The three sampled locations were surveyed by a California Professional Land Surveyor. All elevations were determined and reported to the nearest 0.01 foot relative to the North American Vertical Datum 1988. The horizontal positions were reported to the nearest 0.1 foot defined relative to the State Plane Coordinate System, North American Datum 1983.

3.2 Collecting Samples

3.2.1 Soil Sampling in TPH Area 2B

Soil samples from TPH Area 2B were collected using a combination of a hand auger and direct push drill rig. Samples from 1 foot bgs and 3 feet bgs were collected using a hand auger. Hand auger refusal was encountered at 3.5 feet bgs. To reach further depths, a direct push drill rig was used to collect samples from 5 feet bgs and 7 feet bgs. During soil sampling, soil was described in general accordance with the Unified Soil Classification System and the soil boring was logged lithologically. The borelog for TPH2BSB1 is attached to this appendix as attachment A1.

Soil samples were collected using a hand auger or hand trowel and transferred to glass jars and Encores® for submittal to the analytical laboratory. A total of three Encore® samplers and one four ounce glass jar were collected for each sample depth for TPH-gr and TPH-dr analysis by EPA 8015M. A total of four samples were collected at TPH Area 2B. Samples were collected at depths of 1, 3, 5 and 7 feet bgs. Analysis for the 7 feet bgs sample was put on hold pending the results of the 5 feet bgs soil sample.

3.2.2 Grab Groundwater Sampling in TPH Areas 14 and 15

The temporary groundwater monitoring wells in TPH Areas 14 and 15 were advanced using a direct-push drill rig. A temporary well consisting of a schedule 40 polyvinyl chloride (PVC) casing was installed in the hole made by the direct-push rig. The depth of the well was based on the depth to first-encountered groundwater as seen in the field. The following sections further detail the construction of the temporary wells in each of the areas. Boring TPH14SB1 was advanced to a total depth of 15 feet bgs in TPH Area 14 and a temporary monitoring well installed with a screen interval from 4 to 14 feet bgs. Likewise boring TPH15SB1 was advanced to a total depth of 15 feet bgs in TPH Area 15 and a temporary monitoring well installed with a screen interval from 4 to 14 feet bgs.

3.2.2.1 TPH Area 14

A temporary groundwater monitoring well was installed to a total depth of 15 feet bgs in TPH Area 14 with a 0.010-inch slotted PVC screen interval from 4 to 14 feet bgs. A California-certified professional geologist oversaw the drilling activities and installation of the temporary well. The soil was also described and logged by a professional geologist in accordance with the Unified Soil Classification System. The temporary well was completed on June 28, 2013. The borelog for TPH14SB1 is attached to this appendix as attachment A2.

The installed temporary well did not initially produce sufficient groundwater for groundwater sample collection. The well was purged dry using a peristaltic pump and allowed to recharge. The field team revisited the well on July 2, 2013. A sample was collected using a peristaltic pump and the well was able to produce enough groundwater to fill two 1-liter ambers for TPH-dr and TPH-mr analysis. Water quality parameters were collected prior to sampling; however, the intention was to collect a grab sample, and the purging of the well consisted of the removal of a limited amount of water to reduce sample turbidity. Due to the limited scope of the sampling and the use of disposable sampling equipment, quality control samples such as rinsate samples or field duplicate samples were not collected; however, temperature blanks accompanied samples to the lab to assure temperature control during sample handling and transport.

Following sampling, the temporary well was destroyed by grouting in accordance with California Department of Water Resources Bulletin 74-90.

3.2.2.2 TPH Area 15

After completion of TPH Area 14, a temporary groundwater monitoring well was installed to a total depth of 15 feet bgs in TPH Area 15 with a 0.010-inch slotted PVC screen interval from 4 to 14 feet bgs. A California-certified professional geologist oversaw the drilling activities and installation of the temporary well. The soil was also described and logged by a professional geologist in accordance with the Unified Soil Classification System. The temporary well was completed on June 28, 2013. The borelog for TPH15SB1 is attached to this appendix as attachment A3.

Similar to the temporary well in TPH Area 14, the installed temporary well initially did not produce sufficient groundwater for low flow sampling. The well was purged dry using a peristaltic pump and allowed to recharge. The field team revisited the well on July 2, 2013 and the well was able to produce over one liter of groundwater. A sample was collected using a peristaltic pump and enough groundwater was obtained to fill one 1-liter amber, and to partially fill a second, for TPH-dr and TPH-mr analysis. Water quality parameters were collected prior to sampling; however, the intention was to collect a grab sample, and the purging of the well consisted of the removal of a limited amount of water to reduce sample turbidity. Due to the limited scope of the sampling and the use of disposable sampling equipment, quality control samples such as rinsate samples or field duplicate samples were not collected; however, temperature blanks accompanied samples to the lab to assure temperature control during sample handling and transport.

Following sampling, the temporary well was destroyed by grouting in accordance with California Department of Water Resources Bulletin 74-90.

3.3 Investigation-Derived Waste

All development and purge water, and soil cuttings were containerized into DOT-approved, 55-gallon drums and consolidated for disposal with the waste generated during the concurrent Data Gaps Investigation at the adjacent IR Site 4, and will be reported in the Revised RI for that site.

All waste manifests and profiles, along with analytical data and land disposal restrictions, will be routed through the Navy CSO Representative for signature. All wastes will be transported via a licensed transporter.

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Section 4 Results

This section presents the analytical result of the groundwater grab samples collected from TPH Area 14 and 15 on July 2, 2013 and the soil samples collected from TPH Area 2b in June 2013. The soil and groundwater grab samples were collected in order to delineate the detected TPH areas characterized in the Final RI for IA F1. Data results are compared to the same Tier 2 site specific screening levels for IA F1 used in the Final RI Report.

4.1 Results for Soil Sampling at TPH Area 2b

Four samples were collected at TPH Area 2b at depths of 1 foot, 3 feet, 5 feet and 7 feet bgs. Lab analysis was performed on samples from 1 foot (TPH2BSB1-01), 3 feet (TPH2BSB1-03) and 5 feet (TPH2BSB1-05) bgs. Results of the 5 feet bgs soil sample were non-detect for TPH-d; therefore analysis was not performed for the sample collected at 7 feet bgs. Results for TPH in soil were compared to the Tier 2 SL for each TPH compound as shown in Table 1 below.

Table 1. Soil Sampling Results

Analyte	Units	TPH2BSB1-01 1 foot bgs	TPH2BSB1-03 3 ft bgs	TPH2BSB1-05 5 ft bgs	TPH2BSB1-07 7 ft bgs	Soil Tier 2 SL for Mare Island
TPH-dr	mg/kg	980[1]	9.9J	ND (<2.8)	NA[2]	500
TPH-mr	mg/kg	1200	ND (<3.0)	ND (<2.8)	NA[2]	2,500
TPH-gr	mg/kg	5.5	ND (<0.27)	ND (<0.25)	NA[2]	500

Note:
1. Highlighted value exceeds Tier 2 SL for Mare Island
2. TPH2BSB1-07 not analyzed due to non-detect results at TPH2BSB1-05

bgs – below ground surface
ft – feet
ND – non-detect (detection limit value shown for information only)
NA – not analyzed

4.2 Groundwater Sampling at TPH Areas 14 and 15

Two temporary monitoring wells were installed on June 28, 2013 at IA F1: TPH-14 and TPH-15. A grab groundwater sample was collect from both wells on July 2, 2013; TPH14SB1-GB1 was collected at TPH Area 14 and TPH15SB1-GB1 was collected at TPH Area 15 in Subarea 4. The samples were analyzed for TPH-dr. The temporary monitoring well in TPH Area 14 was installed at the location of grab groundwater sample UST190-B-11, collected in May of 1992 in Subarea 4. The temporary monitoring well in TPH Area 15 was installed at the location of grab groundwater sample UST190-B-14, also collected in May of 1992. The resultant detections for TPH are discussed in the following subsection. The intention of the additional samples at Areas 14 and 15 is to evaluate the current concentrations of TPH-dr at their respective locations. Results for TPH in groundwater were compared to the Tier 2 SL for each TPH compound shown in Table 4-2.

4.2.1 Results for TPH Areas 14 and 15

Groundwater grab samples TPH14SB1-GB1 and TPH15SB1-GB1 were both analyzed for TPH-dr and TPH-mr. TPH-dr was detected in TPH14SB1-GB1 and in TPH15SB1-GB1 at concentrations below the Tier 2 SL for groundwater within 300 feet of Mare Island Strait for TPH-dr as shown in Table 2 below. TPH-mr was not detected in TPH14SB1-GB1 or TPHS15SB1-GB1.

Table 2. Grab Groundwater Results

Analyte	Units	TPH14SB1-GB1	TPH15SB1-GB1	Tier 2 SL for shallow groundwater within 300 feet of Mare Island Strait
TPH-dr	mg/L	0.077J	0.35	0.64
TPH-mr	mg/L	ND	ND	0.64

Note:
ND – non-detect
NA – not applicable

Section 5 Evaluation of Extent of Contamination

The evaluations performed in the *Final Technical Memorandum: Evaluation of Extent of Contamination where Total Petroleum Hydrocarbon Sample Results Exceed Tier 2 Screening Levels at IA F1,MINS* (TPH Tech Memo) in Appendix O of the Final RI are updated in this section for TPH Areas 2B, 14 and 15. Revisions to the characterization criteria were made to incorporate the data results from the additional data gap sampling conducted in June-July 2013. The additional data gap samples adequately characterized TPH Areas 2b, 14 and 15 and satisfy the Regional Water Board's request for additional TPH samples stated in the Water Board Staff Concurrence Letter (Water Board 2012).

The technical memorandum evaluated TPH Areas for closure as low-risk fuel sites using the following criteria and protocol detailed in Appendix O of the Final RI (ChaduxTt 2012):

1) **Criterion 1, Source Removal or Control:** The leak has been stopped and ongoing sources, including free product, have been removed or remediated.

   Protocol 1: The potential source of TPH contamination was identified and evaluated to determine if the source is still in place. Items considered include: (1) historical and current uses, (2) proximity to excavations conducted in 2000 (excavations in the vicinity of the TPH Areas are labeled as MX0008 through MX0036 in Figure A1 and A2), (3) proximity to formally closed UST sites, and (4) proximity to storm drain lines that could act as migration conduits. Criterion 1 was evaluated in the TPH Tech Memo (Chadux Tt 2012).

2) **Criterion 2, Characterization:** The site has been adequately characterized.

   Protocol 2: Sample results in the vicinity of each TPH Area were reviewed, and sample results (nondetect [ND] or values below the Tier 2 SL) were identified to delineate the extent of contamination laterally and vertically. Physical barriers, such as changes in topography, were also identified to support lateral delineation of contamination. The results from additional TPH data gap sampling are incorporated in this evaluation.

3) **Criterion 3, Groundwater Impact:** Little or no groundwater impact exists and no contaminants are found at levels above established maximum contaminant levels (MCLs) or other applicable water quality objectives.

   Protocol 3: Groundwater (grab and well) sample results were compared with the established Tier 2 SLs. Groundwater sample results downgradient and cross-gradient of each TPH Area were assessed for any impact.

4) **Criterion 4, Surface Water or Sensitive Receptors Impact:** No water wells, deeper drinking water aquifers, surface water, or other sensitive receptors are likely to be impacted.

   Protocol 4: Surface water exposure pathways were assessed to determine if an existing utility corridor in the area could act as a pathway to Mare Island Strait. Where the contamination is detected at or near the ground surface, the current ground surface cover conditions (pavement, asphalt, hardpacked soil) are also discussed to evaluate the possibility of migration of contamination via surface water flow to the strait. Because shallow groundwater at the site has been granted an exception as a source of drinking water by the Water Board and no drinking water wells or deeper drinking water aquifers are present in IA F1, this criterion does not apply, and thus drinking water wells or drinking water aquifers are not discussed in this evaluation (ChaduxTt 2012).

5) **Criterion 5, Surrogate Chemical Human Health Risk:** The site presents no significant risk to human health.

   Protocol 5: The human health risk assessment (HHRA) results for each subarea at IA F1 were reviewed to determine if potential risk from exposure to TPH surrogate chemicals are unacceptable in the Final RI. Of the TPH surrogate chemicals, only two polynuclear aromatic hydrocarbon (PAHs) (benzo[a]pyrene and naphthalene) were identified as risk drivers (cancer risk greater than 10^{-6} or a noncancer hazard greater than 1) in any subarea at IA F1. No PAHs and benzene, toluene, ethylbenzene, toluene (BTEX) chemicals were identified as risk drivers for any of the subareas, and thus BTEX is not discussed further in this evaluation (ChaduxTt 2012).

   In addition to the subarea-wide HHRA evaluation, within each TPH Area, TPH samples that exceeded Tier 2 SLs were reviewed to determine if PAH data were available (or BTEX data if PAH data were not available), and if so, whether the concentrations of PAHs at these locations contributed to the human health risk for the applicable subarea (ChaduxTt 2012).

6) **Criterion 6, Surrogate Chemical Ecological Health Risk:** The site presents no significant risk to the environment.

   Protocol 6: Ecological risk assessment (ERA) results for the upland habitat (subareas 1 through 5 and 7) at IA F1 were reviewed to determine if potential risk from exposure to TPH surrogate chemicals (PAHs or BTEX) was unacceptable. The ERA evaluated ecological risk as a single area for subareas 1 through 5 and 7 at IA F1, and all TPH Areas are located within the area evaluated. No PAHs were identified as risk drivers. Based on comments from the regulatory agencies on the draft final RI report, in the final

RI report ecological risk from volatile organic compounds (VOCs), including BTEX, is evaluated using soil gas, rather than soil, data. The results of the soil gas evaluation indicate toluene is present in one of four soil gas samples at a concentration posing unacceptable risk for burrowing receptors. However, the sample was not collected within or near, and is not related to the historical release at any of the TPH Areas (the closest soil gas sample is 220 feet west of TPH Area 9 in Subarea 5). Therefore, surrogate chemicals do not contribute to ecological risk at any TPH Area (ChaduxTt 2012).

TPH Areas that meet all six of the above criteria, meet the closure criteria for low-risk fuel sites. TPH Areas 2b, 14, and 15 met all of the above criteria in the TPH Tech Memo (ChaduxTt 2012) except for characterization (Water Board 2012). Descriptions of the satisfied criteria can be found in greater detail in Appendix O of the Final RI. The following sections update the characterization criteria with the sample results from the recent TPH data gap sampling event for TPH Areas 2b, 14 and 15 taken into consideration.

5.1 TPH Area 2B

Issue: Residual TPH-gr and TPH-dr are above Tier 2 SL in boring IR04GB222 from 1 to 1.5 feet bgs. Additional sampling confirms TPH-dr above Tier 2 SL in only the 1 foot bgs sample (TPH2BSB1-01) as discussed in Section 4.1.

1. **Source Removal or Control:** This criterion has been satisfied as detailed in Appendix O of the Final RI (ChaduxTt 2012a).

2. **Characterization:** TPH Area 2b was deemed inadequately characterized in the “Review of Final Remedial Investigation Report” Water Board Tech Memo (Water Board 2012). Additional TPH data gap sampling was conducted to provide data for characterization and the results are incorporated below in the evaluation of the characterization criteria.

    a. Figure A1 - TPH-gr and TPH-dr: IR04GB222 is delineated vertically by samples at 3 feet (TPH2BSB1-03) and 5 feet (TPH2BSB1-05) bgs as discussed in Section 4.1; lateral delineation to below Tier 2 SLs 80 feet to the east (IR04GB224), 80 feet to the southeast, (IR04GB321), and 40 feet to the south (IR04GB210) (down- and crossgradient). Not delineated laterally to west and north by samples but these areas are hydrogeologically upgradient of IR04GB222 and are unlikely to be impacted (ChaduxTt 2012a). No observed impact to downgradient groundwater suggests there is little vertical migration in soil, as shown by the rapid decrease in TPH concentration with depth (ChaduxTt 2012a).

3. **Groundwater Impact:** This criterion has been satisfied as detailed in Appendix O of the Final RI (ChaduxTt 2012a).

4. **Surface Water or Sensitive Receptor Impact:** This criterion has been satisfied as detailed in Appendix O of the Final RI (ChaduxTt 2012a).

5. **Surrogate Chemical Human Health Risk:** This criterion has been satisfied as detailed in Appendix O of the Final RI (ChaduxTt 2012a).

6. **Surrogate Chemical Ecological Health Risk:** This criterion has been satisfied as detailed in Appendix O of the Final RI (ChaduxTt 2012a).

Summary of Closure Criteria: TPH Area 2b met all closure criteria in the TPH Tech Memo (ChaduxTt 2012a) except for characterization. Additional characterization was requested by the Water Board (Water Board 2012). Characterization at TPH Area 2b was investigated further with additional data gap samples and it was confirmed that residual TPH contamination above Tier 2 SL at this location is limited to surface soil. Residual TPH contamination in TPH Area 2b is now vertically delineated with TPH reported below Tier 2 SL from samples at 3 feet and 5 feet bgs. TPH Area 2b now meets the criteria for closure of a low risk fuel site.

Recommendation: Navy recommends NFA for TPH Area 2b based on the completion of vertical delineation of TPH in soil, the only remaining closure criteria that was previously unsatisfied.

5.2 TPH Area 14

Issue: TPH Area 14 was investigated further due to a grab groundwater sample collected in 1992 from boring UST190-B-11 exceeding Tier 2 SL. An investigation was performed in July 2013 and sample results from boring TPH14SB1, located adjacent to UST190-B-11, reported TPH-dr below groundwater Tier 2 SL for protection of aquatic receptors. This sample is used to characterize TPH Area 14.

Concentrations of TPH-dr in groundwater at nearby borings UST190-B-15 and UST190-B-20 were slightly above the Tier 2 SLs for aquatic receptors. Although they are not within the 300 foot buffer zone, UST190-B-15 and UST190-B-20 are included in the evaluation of TPH Area 14 because they are located just inland of the boundary of the buffer zone (ChaduxTt 2012).

1) **Source Removal or Control:** This criterion has been satisfied as detailed in Appendix O of the Final RI (ChaduxTt 2012a).

2) **Characterization:** Characterization for TPH Area 14 was insufficient in the TPH Tech Memo (Water Board 2012). Additional groundwater sampling for TPH was performed and the results are incorporated below for the characterization criterion.

    a. Figure A2 – TPH-dr: The results for soil samples collected at UST190- B-11, UST190-B-15, and UST190-B-20 are below Tier 2 SLs or ND, and laterally

delineated on all sides; these locations were sampled to 9.5 and 10 feet bgs. Previous grab groundwater samples from UST190-B-15 and UST190-B-20, which are located just inland of the buffer zone, were less than the Tier 2 SL for areas inland of the buffer zone, but exceeded the Tier 2 SL for areas within the buffer zone. Groundwater samples from nearby well A190W01 are a better indicator of actual groundwater concentrations in the area —samples collected between 1995 and 2003 contained TPH-dr concentrations below the Tier 2 SL for protection of aquatic receptors. The recent grab groundwater sample at TPH15SB1 is below the Tier 2 SL for protection of aquatic receptors.

3) **Groundwater Impact:** This criterion has been satisfied as detailed in Appendix O of the Final RI (ChaduxTt 2012a).

4) **Surface Water or Sensitive Receptor Impact:** This criterion has been satisfied as detailed in Appendix O of the Final RI (ChaduxTt 2012a).

5) **Surrogate Chemical Human Health Risk:** This criterion has been satisfied as detailed in Appendix O of the Final RI (ChaduxTt 2012a).

6) **Surrogate Chemical Ecological Health Risk:** This criterion has been satisfied as detailed in Appendix O of the Final RI (ChaduxTt 2012a).

Summary of Closure Criteria: TPH Area 14 met all low risk fuel site closure criteria except for characterization in the TPH Tech Memo (Water Board 2012). Results from recent data gap grab groundwater sampling at TPH14SB1 are below the Tier 2 SL for TPH-dr and TPH-mr. TPH Area 14 meets the characterization criteria for closure.

Recommendation: The Navy recommends NFA for TPH at TPH Area 14 based on current groundwater concentrations below the Tier 2 SL.

5.3 TPH Area 15

Issue: A grab groundwater sample collected in 1992 from boring UST190-B-14 exceeded Tier 2 SL. A more recent grab groundwater sample (TPH15SB-GB1) was collected adjacent to UST190-B-140 in July 2013. Results of TPH15SB-GB1 indicate residual TPH-dr (Figure 2) is below the groundwater Tier 2 SL for protection of aquatic receptors. TPH15SB-GB1 is used to characterize TPH Area 15.

1) **Source Removal or Control:** This criterion has been satisfied as detailed in Appendix O of the Final RI (ChaduxTt 2012a).

2) **Characterization:** TPH Area 15 did not meet the characterization criterion in the TPH Tech Memo (Water Board 2012). Additional TPH data gap sampling was conducted to

collect more recent grab groundwater samples and the results are incorporated in the characterization evaluation below.

a. Figure A2 – TPH-dr: Soil sample results at location UST190- B-14 are less than Tier 2 SL, and samples extend to 8 feet bgs. Grab groundwater sample results for TPH15SB-GB1 are below the Tier 2 SL and the results from nearby and crossgradient sample location USTA190-B-13 is ND, indicating that concentration of TPH-dr was localized to the area immediately around UST190-B-14. Although there is no downgradient sample location from UST190-B-14, groundwater impact appears minimal, as the current concentration of TPH at this location has attenuated to below the Tier 2 SL.

3) **Groundwater Impact:** This criterion has been satisfied as detailed in Appendix O of the Final RI (ChaduxTt 2012a).

4) **Surface Water or Sensitive Receptor Impact:** This criterion has been satisfied as detailed in Appendix O of the Final RI (ChaduxTt 2012a).

5) **Surrogate Chemical Human Health Risk:** This criterion has been satisfied as detailed in Appendix O of the Final RI (ChaduxTt 2012a).

6) **Surrogate Chemical Ecological Health Risk:** This criterion has been satisfied as detailed in Appendix O of the Final RI (ChaduxTt 2012a).

Summary of Closure Criteria: TPH Area 15 met all criteria for closure as a low risk fuel site except for characterization (Water Board 2012). Additional sampling was conducted and results for grab groundwater sample at TPH15SB1 are below the Tier 2 SL for TPH-dr and TPH-mr. TPH Area 15 meets all low risk fuel site criteria.

Recommendation: The Navy recommends NFA for TPH at TPH Area 15 based on current groundwater concentrations below the Tier 2 SL.

Section 6 Summary of Results, Recommendations, and Regulatory Agency Concurrence

The results of the evaluations demonstrate that TPH Areas 2b, 14 and 15 meet the closure criteria for low-risk fuel sites; therefore, the Navy recommends NFA for these 3 TPH Areas at IA F1. The results of the evaluations indicate: (1) industrial operations that may have contributed to TPH releases at each TPH Area ceased prior to 1996 and sources of TPH contamination have been removed; (2) each TPH Area has been adequately characterized and residual TPH contamination is limited primarily to soil; (3) little or no groundwater impact exists (4) surface soil to surface water and groundwater to surface water migration pathways are not significant; (5) no additional human health risks or (6) ecological risks have been identified for surrogate chemicals associated with the residual TPH contamination.

TPH Areas 1, 2a, 2c, and 3 through 13 at IA F1 were evaluated in the Final RI. Based on previous discussions between the Navy and regulatory agencies, the regulatory agencies concurred with the Navy's recommendations for NFA at TPH Areas 1, 2a, 2c, and 3 through 13 as discussed in Appendix O of the Final RI. Based on the completed vertical delineation of TPH in soil at TPH Area 2b and the attenuation of groundwater TPH concentrations at TPH areas 14 and 15 to below Tier 2 SLs, the Navy now recommends NFA for these three remaining TPH areas.

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Section 7 Reference

ChaduxTt 2012. Final Remedial Investigation Report, Installation Restoration Program Sites Within Investigation Area F1, Former Mare Island Naval Shipyard, Vallejo, California.

Water Board 2012. "Review of Final Remedial Investigation Report, Installation Restoration Program Sites within Investigation Area F1, Former Mare Island Naval Shipyard, Vallejo, Solano County." November.

Water Board. 2013. *Conditional Concurrence on Planned Additional Sampling for Total Petroleum Hydrocarbons at Investigation Area F1, Former Mare Island Naval Shipyard, Vallejo, Solano County.* March.

Trevet 2013. Final Data Gap Investigation Work Plan Installation Restoration Site 4, Former Mare Island Naval Shipyard, Appendix H, Vallejo, California. April.

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Attachment - Borelogs

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Borehole Log/Well Completion Log

Project Name: IR Site 4	Project Number: A082-004	**Borehole Number:**	**TPH2BSB1**
Borehole Location: IA F1	*Northing:* 1,792,510.20	*Easting:* 6,487,700.56	Sheet *1* of *1*
Drilling Agency: Gregg Drilling	Driller: German Garcia		
Drilling Equipment: Marl M2.5 DP	Date Started: 6/27/13	Total Depth (feet): 7.0	
Drilling Method: DIRECT PUSH	Number of Soil Samples: 4	Date Finished: 6/28/13	
Drilling Fluid: None	Borehole Diameter (in): 3	Depth to Water (feet): *Drilling: N/A*	*Static: N/A*
Completion Information: Backfilled with bentonite grout. Note: Groundwater was not encountered in this boring.		Elevation (feet MSL) :	
		Logged By: P. Hamner, PG	Checked By: P. Sones, PG

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: PID/FID (ppm) Sample	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Remarks
0											
1	TPH2B SB1-01				16:27	PID = 12.7			SC	Clayey SAND with gravel, very dark greenish gray (5GY 3/1), moist, fine grained, poorly graded, slightly plastic, with coarse angular gravel, diesel odor	
2											
3	TPH2B SB1-03				16:50	PID = 4.4				Clayey SAND, very dark greenish gray (5G 3/1), moist, fine grained, poorly graded, slightly plastic, no odor	
4									SP	hand auger refusal at 3.5' on rock	
5	TPH2B SB1-05				10:43	PID = 0.3				SAND, very dark greenish gray (10Y 3/1), wet, fine grained, poorly graded, trace gravel	
6											
7	TPH2B SB1-07				10:50	PID = 0.1				SAND, brown (10YR 5/3), moist, fine grained, poorly graded, dense	

Borehole Log/Well Completion Log

Project Name: IR Site 4	Project Number: A082-004	**Borehole Number:**	**TPH14SB1**
Borehole Location: IA F1	*Northing:* 1,791,968.62	*Easting:* 6,488,771.67	Sheet *1* of *1*
Drilling Agency: Gregg Drilling	Driller: German Garcia		
Drilling Equipment: Marl M2.5 DP	Date Started: 6/28/13	Total Depth (feet): 15.0	
Drilling Method: DIRECT PUSH	Number of Soil Samples: 0	Date Finished: 6/28/13	
Drilling Fluid: None	Borehole Diameter (in): 3	Depth to Water (feet): *Drilling:* 10.5	*Static: 6.40*
Completion Information: Installed temporary well. Backfilled with bentonite grout after removing screen and casing.		Elevation (feet MSL) :	
		Logged By: P. Hamner, PG	Checked By: P. Sones, PG

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: PID/FID (ppm) Sample	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Details	Remarks
0–1									GW	GRAVEL with sand, brown (10YR 5/3), dry, fine to medium grained sand, coarse gravel, well graded		
1–2									SW	SAND, very pale brown (10YR 2/4), dry, fine to medium grained, well graded, trace fine gravel		
2–3												
3–4						PID = 0						Prepack slotted screen from 4-14'
4–5										poor sample recovery		
5–6						PID = 0						
6–7										same as above, greenish gray (10Y 5/1), no gravel		
7–8												
8–9						PID = 0				poor sample recovery		
9–10												
10–11						PID = 2			CL	CLAY, very dark greenish gray (10Y 3/1), saturated, plastic, soft, black mottling		
11–12												
12–13						PID = 0.3						
13–14												
14–15												

Borehole Log/Well Completion Log

Project Name: IR Site 4	Project Number: A082-004	**Borehole Number:**	**TPH15SB1**
Borehole Location: IA F1	*Northing:* 1,792,142.93	*Easting:* 6,488,645.97	Sheet *1* of *1*
Drilling Agency: Gregg Drilling	Driller: German Garcia		
Drilling Equipment: Marl M2.5 DP	Date Started: 6/28/13	Total Depth (feet): 15.0	
Drilling Method: DIRECT PUSH	Number of Soil Samples: 0	Date Finished: 6/28/13	
Drilling Fluid: None	Borehole Diameter (in): 3	Depth to Water (feet): *Drilling:* 6.0	*Static:*
Completion Information: Installed temporary well. Backfilled with bentonite grout after removing screen and casing.		Elevation (feet MSL) :	
		Logged By: P. Hamner, PG	Checked By: P. Sones, PG

Depth (feet)	Samples: Number	Type	Blow Count	Percent Recovery	Time	Field Analyses: PID/FID (ppm) Sample	Additional Tests	Log: Graphic	USCS or Rock Type	Lithologic Description	Well Details	Remarks
0–1						PID = 0			SP	SAND with gravel, dark grayish brown (10YR 4/2), dry, fine grained, poorly graded, coarse angular gravel, trace silt		
1–5						PID = 0			CL	CLAY, dark greenish gray (5GY 4/1), wet, plastic, soft, trace gravel, black mottling		Prepack slotted screen from 4-14'
5–6						PID = 0.1			SP	SAND, grayish brown (10YR 5/2), wet, fine grained, poorly graded, trace fine gravel, trace silt		
6–8						PID = 0.1			SC	Clayey SAND, very dark greenish gray (5GY 3/1), saturated, fine grained, poorly graded, slightly plastic		
8–10						PID = 0.1			CL	CLAY with sand, very dark greenish gray (10Y 3/1), saturated, plastic, stiff, trace roots		
10–11						PID = 0			SC	Clayey SAND, dark greenish gray (10Y 4/1), saturated, fine grained, poorly graded, slightly plastic		
11–15						PID = 0.3			CL	CLAY, very dark gray (N 3/1), saturated, plastic, very soft, trace roots, organic odor		
15						PID = 3.2			OH	PEAT with clay, very dark brown (10YR 2/2), saturated, slightly plastic, very soft, hydrocarbon odor		

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Attachment - Figures

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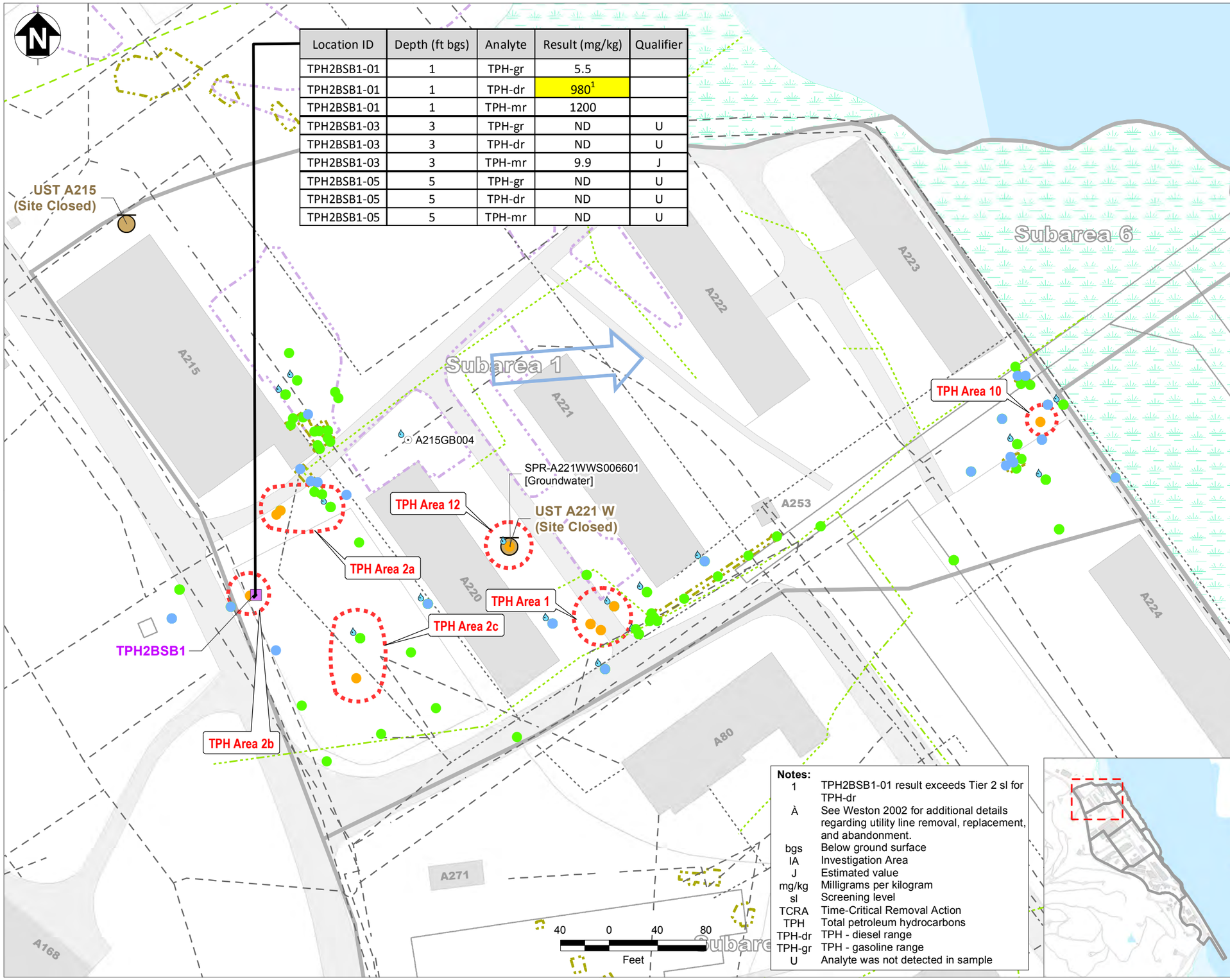
Location ID	Depth (ft bgs)	Analyte	Result (mg/kg)	Qualifier
TPH2BSB1-01	1	TPH-gr	5.5	
TPH2BSB1-01	1	TPH-dr	980[1]	
TPH2BSB1-01	1	TPH-mr	1200	
TPH2BSB1-03	3	TPH-gr	ND	U
TPH2BSB1-03	3	TPH-dr	ND	U
TPH2BSB1-03	3	TPH-mr	9.9	J
TPH2BSB1-05	5	TPH-gr	ND	U
TPH2BSB1-05	5	TPH-dr	ND	U
TPH2BSB1-05	5	TPH-mr	ND	U



Approximate TPH Area boundary, TPH-dr in soil

Approximate TPH Area boundary, other TPH compound in soil

Soil Sample Location

Maximum TPH-dr Concentration

- Not Detected (ND) for TPH-dr
- Below Industrial Comparison Criterion for TPH-dr (<=500 mg/kg)
- Above Industrial Comparison Criterion for TPH-dr (>500 mg/kg)

Groundwater Result(s) Available

Underground Utility Line

Replaced Line[À]

Line Abandoned in Place[À]

Removed Line[À]

Storm drain lines in green.

Underground Storage Tank Site

Subarea Boundary

Weston 2000 Excavation Area

2007 - 2008 TCRA Excavation Area

Approximate Groundwater Flow Direction (August 2003)

Building/Structure

Road

Site Feature

Wetland

Mudflat

Water

Notes:

1	TPH2BSB1-01 result exceeds Tier 2 sl for TPH-dr
À	See Weston 2002 for additional details regarding utility line removal, replacement, and abandonment.
bgs	Below ground surface
IA	Investigation Area
J	Estimated value
mg/kg	Milligrams per kilogram
sl	Screening level
TCRA	Time-Critical Removal Action
TPH	Total petroleum hydrocarbons
TPH-dr	TPH - diesel range
TPH-gr	TPH - gasoline range
U	Analyte was not detected in sample

Reference:
ChaduxTt. 2012. Final Remedial Investigation Report, Installation Restoration Program Sites Within Investigation Area F1, Former Mare Island Naval Shipyard, Vallejo, California. September 28

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NAVAL FACILITIES ENGINEERING COMMAND
SAN DIEGO, CALIFORNIA

MARE ISLAND NAVAL SHIPYARD
VALLEJO, CALIFORNIA

FIGURE A1

TPH-dr SOIL SAMPLE RESULTS IN SUBAREA 1

TREVET

DATE: SEPTEMBER 2015

CONTRACT NO.: N62473-12-C-4805

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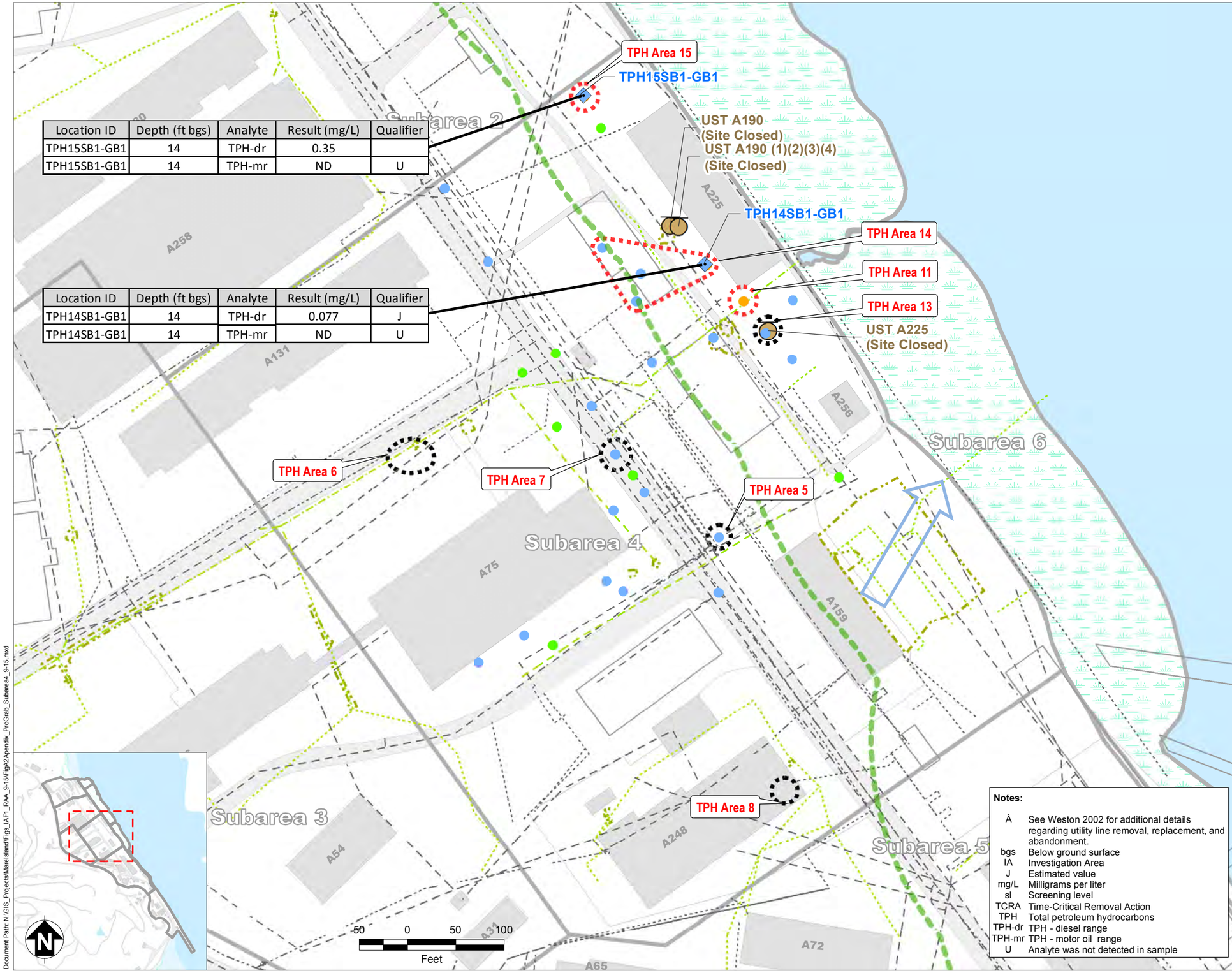

Location ID	Depth (ft bgs)	Analyte	Result (mg/L)	Qualifier
TPH15SB1-GB1	14	TPH-dr	0.35	
TPH15SB1-GB1	14	TPH-mr	ND	U

Location ID	Depth (ft bgs)	Analyte	Result (mg/L)	Qualifier
TPH14SB1-GB1	14	TPH-dr	0.077	J
TPH14SB1-GB1	14	TPH-mr	ND	U

Approximate TPH Area boundary, TPH-dr in soil

Approximate TPH Area boundary, TPH-dr in groundwater

Grab Groundwater Location

TPH-dr Results

- Not Detected (ND) for TPH-dr
- Below Tier 2 sl for TPH-dr for Locations Inland of the Buffer Zone for Aquatic Receptors (<=5 mg/L) or for Locations Within the Buffer Zone (<=0.64 mg/L)
- Above Tier 2 sl for TPH-dr for Locations Inland (>5 mg/L) or Within the Buffer Zone (>0.64 mg/L)

Underground Storage Tank Site

Underground Utility Line

Replaced Line[À]

Line Abandoned in Place[À]

Removed Line[À]

Storm drain lines in green.

Subarea Boundary

Weston 2000 Excavation Area

2007 - 2008 TCRA Excavation Area

300-Foot Buffer Zone for Aquatic Receptors

Approximate Groundwater Flow Direction (August 2003)

Building/Structure

Road

Site Feature

Wetland

Mudflat

Water

Reference:
ChaduxTt. 2012. Final Remedial Investigation Report, Installation Restoration Program Sites Within Investigation Area F1, Former Mare Island Naval Shipyard, Vallejo, California. September 28

Notes:

À	See Weston 2002 for additional details regarding utility line removal, replacement, and abandonment.
bgs	Below ground surface
IA	Investigation Area
J	Estimated value
mg/L	Milligrams per liter
sl	Screening level
TCRA	Time-Critical Removal Action
TPH	Total petroleum hydrocarbons
TPH-dr	TPH - diesel range
TPH-mr	TPH - motor oil range
U	Analyte was not detected in sample

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NAVAL FACILITIES ENGINEERING COMMAND
SAN DIEGO, CALIFORNIA

MARE ISLAND NAVAL SHIPYARD
VALLEJO, CALIFORNIA

FIGURE A2

TPH-dr GRAB GROUNDWATER SAMPLE RESULTS IN SUBAREA 4

TREVET

DATE: SEPTEMBER 2015

CONTRACT NO.: N62473-12-C-4805

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Appendix B: ERA Analysis

Subarea 6 Ecological Risk Assessment Detailed Analysis

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1. Introduction

This appendix presents the detailed analysis for the Subarea 6 metals recommended for further analysis in the conclusions of the Mare Island Investigation Area (IA) F1 Remedial Investigation (RI). The appendix initially provides general information and then individually addresses each metal recommended for further investigation in the FS including barium, copper, lead, molybdenum and zinc. This appendix shows figures for specific portions of Subarea 6. The overall site figure for this subarea showing both sample locations and analytical results for barium, copper, lead, molybdenum, and zinc is shown on Figure 7 of the FS to which this appendix is attached.

2. Ambient/Background Concentrations

Ambient Mare Island fill concentrations were developed in 2002 by Tetra Tech in the Final Compilation of Technical Memoranda on Ambient Analyses of Metals in Soils and Groundwater (Tetra Tech 2002). The ERA for IA F1 is attached as Appendix J in the final RI for IA F1 and states on page J-52 that, "The wetland area is a vegetated area with sediments that are likely composed of soils similar to Mare Island ambient fill, as it consists of dredge spoils." The ERA also states on page J-52 that while there is uncertainty as to the wetland habitat background concentration, "The Navy believes the Mare Island ambient fill values are the most appropriate values against which to screen the wetland sediment because the area is vegetated with wetland plants and inundated only during high tide. The San Francisco ambient values are more appropriate for sediments in the offshore area of Mare Island" (ChaduxTt 2012a).

Mare Island ambient fill concentrations were developed for copper, lead, and zinc in the 2002 tech memo by Tetra Tech (Tetra Tech 2002). San Francisco estuary sediment ambient concentrations were developed in the staff report "Ambient Concentrations of Toxic Chemicals in Sediments" by the California Regional Water Quality Control Board (RWQCB) in 1998 (RWQCB 1998). Both Mare Island ambient fill concentrations and San Francisco estuary sediment ambient values are presented in the table below for comparison. Note, the San Francisco ambient values are lower than the ambient fill for all three metals for which values are established.

Metal	95th Percentile Mare Island Ambient Concentration in Fill Soil[1]	85th Percentile SF Estuary Sediment Ambient Concentrations[2]
Copper	120 mg/kg	68.1 mg/kg
Lead	59 mg/kg	43.2 mg/kg
Zinc	230 mg/kg	158 mg/kg

Source:
1. Tetra Tech 2002
2. RWQCB 1998

There are no established values for barium or molybdenum from either of these two sources. While the 2002 Tetra Tech report did not establish ambient fill concentrations for molybdenum or barium, the report did include a table providing maximum ambient metals for other Naval installations including barium and molybdenum. A study of molybdenum concentrations in Mare Island ambient fill was performed for IR Site 17 (ChaduxTt 2012). The ambient molybdenum range was determined to be 1.2 to 5.5 mg/kg for Mare Island. Available ambient values established at Naval installations (including Mare Island) for barium and molybdenum are presented below (Tetra Tech 2002).

Naval Installation	Barium (mg/kg)	Molybdenum (mg/kg)
FISCO Fill[a]	166	2.65
Hunter's Point Fill[a]	314.4	2.68
Treasure Island Fill[b]	260	2
Treasure Island Native[b]	270	2.2
Point Mugu[c]	250	19.9
Mare Island Ambient Fill[d]	NE	1.2 to 5.5

Notes:
a - 95% upper tolerance limit (UTL)
b - 80% lower confidence limit (LCL) of 95th percentile
c - 99th percentile
d - IR Site 17 range
NE – not established
FISCO – U.S. Navy's Fleet and Industrial Supply Center, Oakland

In addition to the 2002 Tetra Tech report that is specific to Mare Island and the 2012 ChaduxTt Technical Memorandum for IR Site 17, a 2005 study evaluated at inorganic chemicals in groundwater and soil to determine background concentrations at California Air Force bases (Hunter, Davis, and Roach, 2005). The study yielded the following 95% upper confidence limit (UCL) estimates at Air Force facilities within California:

Barium – 320.0 mg/kg from 8340 samples from 12 bases

Molybdenum – 20.0 mg/kg from 6967 samples from 12 bases.

Ambient/Background Findings:

Ambient fill is appropriate for background comparison. Barium lacks established Mare Island specific background concentrations, but values from nearby Naval installations and Air Force bases in the Bay Area provide a reference point.

3. Wetland Habitat and Salt Marsh Harvest Mouse

3.1 Existing Conditions and Special-Status Species

According to the Existing Conditions and Special-Status Species Report for Mare Island Production Manufacturing Area and South Shore (ChaduxTt 2012a), Subarea 6 is considered a Coastal Salt Marsh Wetland. Pickleweed is predominant in this area. Additionally, it is noted, "The coastal salt marsh wetland within the Project Area is generally comprised of moderate quality wetland habitat with regard to functions and values; however, some areas appear to be rather degraded as a result of the physical influence of tidal waters and the overall disturbed nature of the project site." This is important in considering the net environmental impacts of active remediation. The quality is only moderate and the area is disturbed already, but also is influenced by tidal waters. The report also notes, "The majority of this habitat type [coastal salt marsh wetland] is subject to the direct influence of tidal water and wave action."

The salt marsh harvest mouse is an endangered species according to both the federal and state listings. According to the Existing Conditions and Special-Status Species Report, "The highest core populations are found in salt marshes along San Pablo Bay, including Mare Island (CNDDB 2010)." Notably, the mice are dependent on pickleweed, which is abundant in Subarea 6. They also use upland grassy areas especially when the pickleweed is affected by high tides. Grassy areas are present upland of Subarea 6. The salt marsh harvest mouse does not burrow and would not use existing burrows. Historically, large numbers of mice have been collected during different trapping efforts at Mare Island that included Subarea 6.

Wetland habitat and Salt Marsh Harvest Mouse Findings:

Subarea 6 habitat value is moderate, it is already disturbed, and will continue to be disturbed by tidal waters. Vegetation encourages/supports a salt marsh harvest mouse population, and the salt marsh harvest mouse is confirmed to be present in Subarea 6.

4. IA F1 Subarea 6 Sampling Results

There are 6 outfalls within the footprint of Subarea 6 (33, 34, 35, 36, 102, and 202). Samples relating to Outfalls 33, 34, 35, 102, and 202 were not included in the IA F1 RI, but have been included in this FS. These samples were initially excluded from IA F1 because the outfalls flow to offshore water and were therefore considered related to IA K.

The IA F1 RI (ChaduxTt 2012a) evaluated the sediment results from the following locations and depths (in feet bgs) for Subarea 6

- A053-02: 2 depths (0-2 ft bgs, 2-4 ft bgs)
- A198-02: 2 depths (0-2 ft bgs, 2-4 ft bgs)
- IR04SD003: 3 depths (0-0.5 ft bgs, 2.5-3.25 ft bgs, 3-4.5 ft bgs)
- IR04SD004: 3 depths (0-1.75 ft bgs, 3-4.5 ft bgs, 4.75-6.25 ft bgs)

- SM036: 1 depth (0)
- SM036-2: 2 depths (0-1 ft bgs, 1-6 ft bgs)

The following IA K sediment results were not included in the IA F1 RI but are incorporated into Subarea 6 in this FS.

- SM033-01: 1 depth (0-0.5 ft bgs)
- SM033-01A: 2 depths (0-0.5 ft bgs, 0.5-1.5 ft bgs)
- SM034-01: 1 depths (0-0.5 ft bgs)
- SM034-01A: 2 depths (0-1, 1-6 ft bgs)
- SM035-01: 1 depth (0-0.5 ft bgs)
- SM035-01A: 2 depths (0-0.5 ft bgs, 0.5-1.5 ft bgs)
- SM102: 1 depth (0)
- SM102-01: 2 depths (0-1 ft bgs, 1-6 ft bgs)
- SM44o: 1 depth (0-0.5 ft bgs)
- SM45o: 1 depth (0-0.5 ft bgs)
- SM46o: 1 depth (0-0.5 ft bgs)
- SM49o: 1 depth (0-0.5 ft bgs)

Summary results for metals are shown in Table B1 below. This summary includes all sample locations associated with Outfalls 33, 34, 35, 102, and 202 at all depths, not just surface sediment. The ERA only considered the surface sediments.

Table B1: Summary of results from Subarea 6 sediment sampling

Metal	Detection Frequency	Maximum Detected Conc. (mg/kg)	Average Detected Conc. (mg/kg)	Location of Maximum	Depth of Maximum (ft)
Barium	29/29	591	111.3	SM033-01A	0.5-1.5
Copper	29/29	367	68.2	IR04SD003	0-0.5
Lead	29/29	95	45.9	IR04SD003	0-0.5
Molybdenum	18/29	4.12J	1.3	SM033-01	0-0.5
Zinc	29/29	1870	260.3	SM033-01	0-0.5

There are 16 samples from 12 additional sampling locations from IA K are evaluated in this FS Report. See Figure B2 (Figure 4-78 from the IA K RI) illustrating the locations of samples near Outfall 33.

Samples SM036 and SM036-02 were collected from an area of the wetlands where Outfall 36 was thought to discharge. However, there was no evidence of the outfall identified in the field.

Tables B2-B6 provide the raw data for each metal. The top half of the table are the six locations considered in IA F1 with the six surface sediment samples evaluated in the ERA highlighted in yellow. Both the IA F1 samples and the IA K samples not included in the IA F1 ERA were screened for the contaminants of ecological concern (COECs) identified in the IA F1 RI. The bottom half of the tables provide the IA K sampling results for the sample locations incorporated into Subarea 6. Results which exceed the ambient fill values (when applicable) are bolded (both for IA F1 and IA K samples). Results which are qualified with a "U" in the six surface sediment samples were not included in the ERA and are noted with a red highlight in the tables.

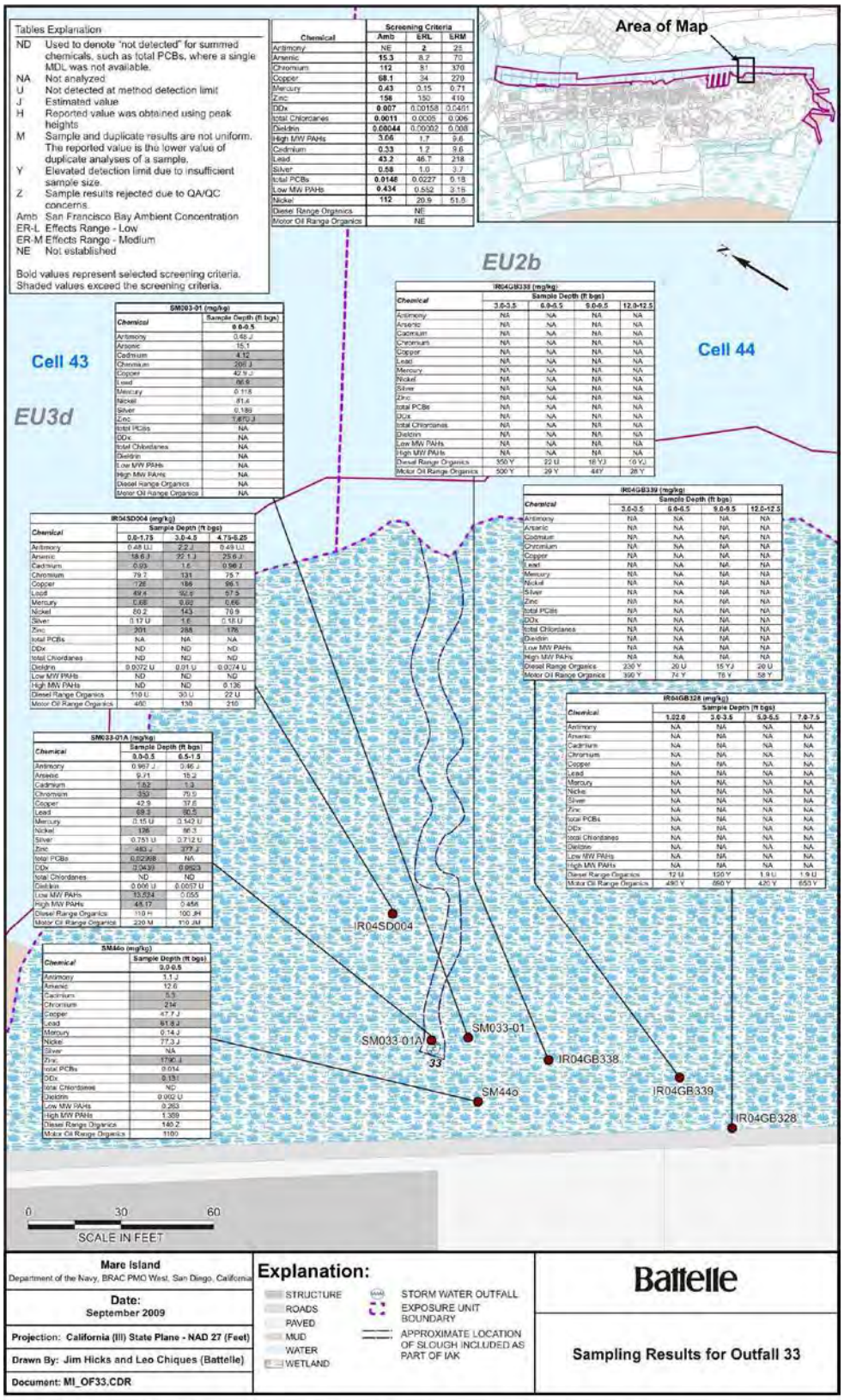

Figure 4-87. Map Summarizing Analytical Results for Sediment Samples Collected Adjacent to Outfall 33

Figure B2: IA K Sampling locations near Outfall 33

Table B2: Full list of barium sampling results from all Subarea 6 locations. Results for locations and sample depths considered within the IA F1 ERA are above the bolded line and highlighted in yellow. No ambient value has been established for Mare Island fill soil for background, however the single reported concentration exceeding the range of ambient barium values established at other Bay Area Navy installations is shown in bold font.

	Barium	No Mare Island Ambient Value, other Bay Area Navy Installations report a Range of Ambient Values From 166 mg/kg to 314.1 mg/kg	No San Francisco Bay Sediment Value	Qualifiers
Included in IA F1 RI	Sample Location	Depth (ft)	Result (mg/kg)	
	A053-2	0-2	130	J
		2-4	94	J
	A198-2	0-2	37	J
		2-4	180	J
	IR04SD003	0-0.5	55.5	
		2.5-3.25	143	
		3-4.5	100	
	IR04SD004	0-1.75	72.9	
		3-4.5	127	
		4.75-6.25	70.9	
	SM036	0	65.8	
	SM036-2	0-1	73.9	
		1-6	77.2	
Not included in IA F1 ERA because considered IA K	SM033-01	0-0.5	58.3	
	SM033-01A	0-0.5	126	
		0.5-1.5	**591**	
	SM034-01	0-0.5	58.3	
	SM034-01A	0-1	65.9	
		1-6	76.8	
	SM035-01	0-0.5	90.5	
	SM035-01A	0-0.5	115	
		0.5-1.5	45.3	
	SM102	0	55.1	
	SM102-01	0-1	170	
		1-6	200	
	SM44o	0-0.5	141	J
	SM45o	0-0.5	80.9	J
	SM46o	0-0.5	94	J
	SM49o	0-0.5	33.1	J

Table B3: Full list of copper sampling results from all Subarea 6 locations. Results for locations and sample depths considered within the IA F1 ERA are above the bolded line and highlighted in yellow. Sample results exceeding the Mare Island ambient value for fill soil are shown in bold font.

	Copper	Mare Island Ambient Value = 120 mg/kg	San Francisco Bay Sediment Value = 68.1 mg/kg	Qualifiers
Included in IA F1 RI	Sample Location	Depth (ft)	Result (mg/kg)	
	A053-2	0-2	44	J
		2-4	38	J
	A198-2	0-2	46	J
		2-4	59	J
	IR04SD003	0-0.5	367	
		2.5-3.25	73.2	
		3-4.5	26.4	
	IR04SD004	0-1.75	126	
		3-4.5	186	
		4.75-6.25	96.1	
	SM036	0	64.6	
	SM036-2	0-1	74.4	
	SM036-2	1-6	73.7	
Not included in IA F1 ERA because considered IA K	SM033-01	0-0.5	42.9	J
	SM033-01A	0-0.5	42.9	
		0.5-1.5	37.8	
	SM034-01	0-0.5	52.6	J
	SM034-01A	0-1	76.9	
		1-6	71.6	
	SM035-01	0-0.5	61.4	
	SM035-01A	0-0.5	48.8	
		0.5-1.5	30.1	
	SM102	0	17.9	
	SM102-01	0-1	87.1	
		1-6	52.3	
	SM44o	0-0.5	47.7	J
	SM44o	0-0.5	18.2	J
	SM45o	0-0.5	67.7	J
	SM45o	0-0.5	28.2	J
	SM46o	0-0.5	85.8	J
	SM49o	0-0.5	17.8	J
	SM49o	0-0.5	11.3	J

Table B4: Full list of lead sampling results from all Subarea 6 locations. Results for locations and sample depths considered within the IA F1 ERA are above the bolded line and highlighted in yellow. Results highlighted in red from IA F1 were not included in the ERA because of a U qualifier. Sample results exceeding the Mare Island ambient value for fill soil are shown in bold font.

	Lead	Mare Island Ambient Value = 59 (mg/kg)	San Francisco Bay Sediment Value = 43.2 (mg/kg)	Qualifiers
Included in IA F1 RI	Sample Location	Depth (ft)	Result (mg/kg)	
	A053-2	0-2	22	J
		2-4	13	J
	A198-2	0-2	0.16	UJ
		2-4	17	J
	IR04SD003	0-0.5	95	
		2.5-3.25	5.6	
		3-4.5	2.2	
	IR04SD004	0-1.75	49.4	
		3-4.5	92.8	
		4.75-6.25	57.5	
	SM036	0	82	
	SM036-2	0-1	47.1	
	SM036-2	1-6	33.2	
Not included in IA F1 ERA because considered IA K	SM033-01	0-0.5	66.9	
	SM033-01A	0-0.5	69.3	
		0.5-1.5	60.5	
	SM034-01	0-0.5	28.1	
	SM034-01A	0-1	40.2	
		1-6	53.1	
	SM035-01	0-0.5	35.7	
	SM035-01A	0-0.5	27.8	
		0.5-1.5	11.2	
	SM102	0	25.7	
	SM102-01	0-1	146	
		1-6	20.3	
	SM44o	0-0.5	61.8	J
	SM45o	0-0.5	40.5	J
	SM46o	0-0.5	149	J
	SM49o	0-0.5	23.4	J

Table B5: Full list of molybdenum sampling results from all Subarea 6 locations. Results for locations and sample depths considered within the IA F1 ERA are above the bolded line and highlighted in yellow. Results highlighted in red from IA F1 were not included in the ERA because of a U qualifier. None of the sediment samples exceeded the range of Mare Island ambient values for fill soil.

	Molybdenum	Range of Mare Island Ambient Values = 1.2-5.5 (mg/kg)	No San Francisco Bay Sediment Value	Qualifiers
	Sample Location	Depth (ft)	Result (mg/kg)	
Included in IA F1 RI	A053-2	0-2	2.8	
		2-4	1.5	
	A198-2	0-2	1.1	U
		2-4	0.35	J
	IR04SD003	0-0.5	3.5	J
		2.5-3.25	1.4	U
		3-4.5	1.7	U
	IR04SD004	0-1.75	0.3	U
		3-4.5	1.5	U
		4.75-6.25	0.32	UJ
	SM036	0	0.57	J
	SM036-2	0-1	0.92	UJ
	SM036-2	1-6	1.08	UJ
Not included in IA F1 ERA because considered IA K	SM033-01	0-0.5	4.12	J
	SM033-01A	0-0.5	1.58	
		0.5-1.5	0.971	
	SM034-01	0-0.5	1.36	
	SM034-01A	0-1	1.63	
		1-6	1.28	
	SM035-01	0-0.5	0.6	J
	SM035-01A	0-0.5	0.857	J
		0.5-1.5	0.533	J
	SM102	0	0.27	
	SM102-01	0-1	0.809	
		1-6	1.39	
	SM44o	0-0.5	0.19	
	SM45o	0-0.5	0.32	UJ
	SM46o	0-0.5	0.32	UJ
	SM49o	0-0.5	0.15	UJ

Table B6: Full list of zinc sampling results from all Subarea 6 locations. Results for locations and sample depths considered within the IA F1 ERA are above the bolded line and highlighted in yellow. Sample results exceeding the Mare Island ambient value for fill soil are shown in bold.

	Zinc	Mare Island Ambient Value = 230 (mg/kg)	San Francisco Bay Sediment Value = 158 (mg/kg)	Qualifiers
Included in IA F1 RI	Sample Location	Depth (ft)	Result (mg/kg)	
	A053-2	0-2	74	J
		2-4	130	J
	A198-2	0-2	57	J
		2-4	88	J
	IR04SD003	0-0.5	326	J
		2.5-3.25	83.4	
		3-4.5	49.8	
	IR04SD004	0-1.75	201	
		3-4.5	288	
		4.75-6.25	178	
	SM036	0	173	J
	SM036-2	0-1	163	J
	SM036-2	1-6	143	J
Not included in IA F1 ERA because considered IA K	SM033-01	0-0.5	1870	J
	SM033-01A	0-0.5	483	J
		0.5-1.5	377	J
	SM034-01	0-0.5	136	J
	SM034-01A	0-1	201	J
		1-6	266	J
	SM035-01	0-0.5	148	J
	SM035-01A	0-0.5	113	J
		0.5-1.5	76.4	J
	SM102	0	50	J
	SM102-01	0-1	256	J
		1-6	104	J
	SM44o	0-0.5	1850	J
	SM45o	0-0.5	187	J
	SM46o	0-0.5	210	J
	SM49o	0-0.5	52.8	J

The locations of sediment samples collected and analyzed from Subarea 6 were selected to focus on areas of potential contamination from known or suspected release points (e.g., outfalls). A

full grid sampling of the area was not conducted as there was no likely source of contamination between the outfalls.

5. ERA Receptors

The ERA looked at ecological risks to four classes of ecological receptors:

- Plants
- Benthic Macroinvertebrates
- Birds
- Mammals

Not all 5 metals are COECs for all four classes of receptors. In fact, the primary concern is the risk to the salt marsh harvest mouse. Table B7 below indicates which metals are a concern for which type of receptor and the ERA justification. There were no COECs for birds in the wetland habitat.

Table B7: Metals with classification and justification of COECs for the four classes of ecological receptors (ChaduxTt 2012a). Note that the ERA did not include the 16 samples within the footprint of Subarea 6 that were associated with the outfalls and IA K.

	Plants		Benthic MacroInv.		Salt marsh Harvest Mouse		Other herbivorous mammals	
Metal	COEC	Reason	COEC	Reason	COEC	Reason	COEC	Reason
Barium			Yes	Not enough toxicology info. Based on mammal risk findings.	Yes	Including value at A053-2 put HQ > 1. Excluding A053 value, HQ < 1.		
Copper	Yes	HQ = 4.6, EPC 342 mg/kg			Yes	HQ >1 for low TRV		
Lead					Yes	HQ >1 for low TRV EPC 95.		
Molybdenum			Yes	Not enough toxicology info. Based on mammal risk findings.	Yes	Daily dose > high and low TRV. EPC 3.5 mg/kg	Yes	Daily dose > high and low TRV
Zinc					Yes	Refined dose > low TRV		

EPC – Exposure Point Concentration; The EPC was estimated using the 95 UCL concentration or the maximum concentration whichever was lower.

HQ – Hazard Quotient

TRV – Toxicity Reference Value

6. Metals Specific Analysis

6.1 Barium

Results from ERA indicated that barium only posed an unacceptable ecological risk to the salt marsh harvest mouse when sample A053-2 (130J mg/kg) was included. Benthic macroinvertebrate risk parallels the mammal risk findings.

A053-2 is located south of A198 which was referenced in the RI as being primarily sandy shoreline with minimal ecological habitat (ChaduxTt 2012a). Aerial images of area show it as void of the vegetation that supports the salt marsh harvest mouse. Figure B3 shows the location of A053-2 alongside an aerial photo of the location showing little vegetation exists.

Figure B3: Location of A053-2 and existing vegetation conditions

Given the absence of vegetative cover, the area near A053-2 is unlikely to support salt marsh harvest mouse, making the exposure pathway in this area incomplete and supporting the exclusion of this area from further consideration. Additionally, the value of 130J mg/kg at A053-2 is well within the ambient barium estimates at other California Naval and Air Force bases, as discussed below.

Mare Island ambient fill values are not available for barium. Barium background values established for fill soil at other Navy facilities in the Bay Area range from 166 mg/kg at Fleet Industrial Supply Command Oakland (FISCO) to 260 mg/kg for Treasure Island fill soil to 314.4 mg/kg for Hunters Point fill soil.

Barium results from IA K that were not included in the ERA were compared to the range of background values seen at these three facilities. The only location to exceed this range is sample location SM033-01A (591 mg/kg from 0.5-1.5 feet bgs). Additionally location SM102-01 exceeded the lowest of these three background values at two depths, 170 mg/kg from 0-1 feet bgs, and 200 mg/kg from 1-6 feet bgs.

Sample location SM033-01A is associated with Outfall 33, which indicates that there may be unacceptable risk to the salt marsh harvest mouse from barium in the area associated with Outfall 33. However this is the only exceedance (591 mg/kg from 0.5-1.5 feet bgs) in this area, including the shallowest sample at this same location which reported a barium concentration of 126 mg/kg, well within the range of background values established for fill soil at other Navy facilities in the Bay Area. This distribution suggests that if the elevated barium result does indicate contamination, it is not widespread.

Sample location SM102-01 does exceed the barium background value of 166 mg/kg established for FISCO, but does not exceed the values established for Treasure Island fill soil or for Hunters Point fill soil. In addition there is minimal to no wetland habitat and vegetative cover associated with SM102-01. The area near SM102-01 is unlikely to support salt marsh harvest mouse, making the exposure pathway in this area incomplete. Therefore, this area is not recommended for further investigation.

6.1.1 Barium Findings and Recommendation

The area around SM102-01 would not support a salt water harvest mouse population. The single surface sample that exceeds the range of background values is located around Outfall 33 where risk may exist, but is bounded above and laterally by samples that do not exceed the range of background values. This is consistent with the other elevated metals seen in the Outfall 33 area. With this exception the values of barium reported in Subarea 6 are consistent with background values seen in statewide evaluations and other Bay Area Naval facilities.

It is recommended that barium should be included as a COEC for the area near Outfall 33 based on the single elevated detection in this area, although it does not appear to pose a widespread risk. The area around Outfall 33 is recommended as a target treatment areas for elevated concentrations of other metals presenting an unacceptable risk to the salt marsh harvest mouse, and any actions taken based on these other COECs will reduce what risk may be created in this area by barium. Because the single reported elevated barium concentration is within the planned target treatment zone, it is recommended that barium be excluded as a COEC for the area of Subarea 6 outside of the target treatment zone.

6.2 Copper

Copper is considered a COEC for plants and the salt marsh harvest mouse. Copper was detected in six of the six samples considered in the ERA, and in 16 of 16 samples previously brought in from IA K. The concentrations are shown in Table B8. Sample results exceeding the Mare Island ambient value for fill soil are shown in bold.

Table B8: Copper surface sediment sample results

Sample Location	Copper Result (mg/kg)	Depth (ft)
Copper Surface Sediment Results Considered in the ERA		
A053-2	44	0-2
A198-2	76	0-2
IR04SD003	367	0-0.5
IR04SD004	126	0-1.75
SM036	64.6	0
SM036-2	74.4	0-1
Copper Surface Sediment Results from IA K within IA F1		
SM033-01	42.9J	0-0.5
SM033-01A	42.9	0-0.5
SM033-01A	37.8	0.5-1.5
SM034-01	52.6J	0-0.5
SM034-01A	76.9	0-1
SM034-01A	71.6	1-6
SM035-01	61.4	0-0.5
SM035-01A	48.8	0-0.5
SM035-01A	30.1	0.5-1.5
SM102	17.9	0
SM102-01	87.1	0-1
SM102-01	52.3	1-6
SM44o	47.7J	0-0.5
SM45o	67.7J	0-0.5
SM46o	85.8J	0-0.5
SM49o	17.8J	0-0.5

Only IR04SD003 and IR04SD004 exceed the ambient level of 120 mg/kg with IR04SD004 just over the level, and IR04SD003 more than double the ambient level.

Using these six samples the ERA calculates with an EPC of 342 mg/kg. This value would not seem to accurately reflect the exposure risk from copper given the small number of samples and non-normal distribution of the data. The 16 IA K samples shown were not included in the ERA, however none of these samples exceeded the background value of 120 mg/kg.

Based on the results of all available sampling data, copper appears to be found throughout Subarea 6, but only at levels above ambient concentrations at IR04SD003 and IR04SD004. IR04SD003 is also near Outfall 33, within the slough area that will likely be treated.

6.2.1 Copper Findings and Recommendations:

<u>Designate the area north of and around Outfall 33 as the target treatment area for F1 wetland sediment to address elevated copper near IR04SD003. Addressing copper at IR04SD003 would</u>

lower the copper EPC and eliminate the source of unacceptable risk; therefore, it is recommended that copper be excluded as a COEC for the area of Subarea 6 outside of the target treatment zone.

6.3 Lead

Lead poses an unacceptable ecological risk to the salt marsh harvest mouse. The ambient fill concentration for lead is 59 mg/kg and that is exceeded at eight sampling locations, two of the six samples considered in the ERA and six of sixteen samples associated with the outfalls and IA K. Lead results from these samples are provided in Table B9 below. Sample results exceeding the Mare Island ambient value for fill soil are shown in bold. The result from A198-2 was not considered in the ERA because of the "U" qualifier.

Table B9: Lead surface sediment sample results considered in the ERA

Sample Location	Lead Result (mg/kg)	Depth (ft)
Lead Surface Sediment Results Considered in the ERA		
A053-2	22	0-2
A198-2	Not included due to "U" qualifier	0-2
IR04SD003	95	0-0.5
IR04SD004	49.4	0-1.75
SM036	82	0
SM036-2	47.1	0-1
SM036-2	33.2	1-6
Lead Surface Sediment Results from IA K within IA F1		
SM033-01	**66.9**	0-0.5
SM033-01A	**69.3**	0-0.5
SM033-01A	**60.5**	0.5-1.5
SM034-01	28.1	0-0.5
SM034-01A	40.2	0-1
SM034-01A	53.1	1-6
SM035-01	35.7	0-0.5
SM035-01A	27.8	0-0.5
SM035-01A	11.2	0.5-1.5
SM102	25.7	0
SM102-01	**146**	0-1
SM102-01	20.3	1-6
SM44o	**61.8J**	0-0.5
SM45o	40.5J	0-0.5
SM46o	**149J**	0-0.5
SM49o	23.4J	0-0.5

Lead exceeds the ambient fill at two locations evaluated in the IA F1 ERA, IR04SD003 and SM036. From IA K sample locations within IA F1, lead exceeds the ambient fill at locations: SM033-01, SM033-01A, SM102-01, SM44o, and SM46o.

Using five samples, the ERA estimated an EPC of 95 mg/kg. The highest value sample was again from IR04SD003.

The lead result was above ambient for sample location SM036 that is close to another sample (SM036-02) in which the lead was well below ambient suggesting the elevated value at SM036 does not indicate widespread contamination at this location.

The IA K samples not included in the ERA that exceed the ambient value of 59 mg/kg are SM033-01, SM033-01A, SM102-01, SM44o, and SM46o.

Outside the TTZ north of and near Outfall 33, sample location SM46o is the single sample location in the wetlands habitat that exceeds the ambient value for lead. This sample is located in close in proximity to sample locations SM035-01 and SM035-01A. Three samples were collected from these two locations and lead results were well below the ambient value. Lead near SM46o does not appear to be a widespread concern and the SM46o area should not be evaluated for remediation.

SM102-01 is located outside the wetlands habitat. Lead results from sample SM102 collected adjacent to SM102-01 are well below ambient values for lead. This suggests that the elevated lead in SM102-01 is not a widespread concern and the lack of wetland habitat suggests incomplete pathways for ecological receptors. SM102-01 is not recommended for further evaluation due to incomplete pathways.

Lead results from sample locations SM44o, SM033-01, and SM033-01A were all above the Mare Island ambient fill value of 59 mg/kg. The close proximity to sample location IR04SD004 and elevated lead location IR04SD003 suggests that the area associated with and north of Outfall 33 contain elevated lead results; therefore, these areas are included in the target treatment zone for further evaluation.

6.3.1 Lead Findings and Recommendation:

<u>The area north of and around Outfall 33 is recommended as a target treatment zone for barium and copper (see above sections), and the lead results support that delineation as well. Lead results also support the addition of the area associated with Outfall 33 as an additional target treatment zone. Addressing lead at IR04SD003 and the areas north of and surrounding Outfall 33 would also lower the overall site lead EPC and likely eliminate the source of unacceptable risk; therefore, it is recommended that lead be excluded as a COEC for the area of Subarea 6 outside of the target treatment zone.</u>

6.4 Molybdenum

Molybdenum was identified in the ERA as posing an unacceptable ecological risk to the salt marsh harvest mouse, and other mammals. Molybdenum is the only metal identified as posing risk to mammals other than the salt marsh harvest mouse because the HQ is greater than one for both the high and low TRV. When the HQ is greater than one for just the low TRV only the salt marsh harvest mouse is indentified because it is an endangered species. Molybdenum was also considered a COEC for benthic macroinvertebrates only because risk benthic macroinvertebrate risk mirrors the mammal risk findings.

It is important to note that only 3 samples were used in the ERA for molybdenum as three results had "U" qualifiers. Table B10 provides the molybdenum results fincluding samples not included in the ERA.

Table B10: Molybdenum surface sediment sample results considered in the ERA

Sample Location	Lead Result (mg/kg)	Depth (ft)
Molybdenum Surface Sediment Results Considered in the ERA		
A053-2	2.8	0-2
A198-2	Not included "U" qualifier	0-2
IR04SD003	3.5	0-0.5
IR04SD004	Not included "U" qualifier	0-1.75
SM036	0.57	0
SM036-2	Not included "U" qualifier	0-1
Molybdenum Surface Sediment Results from IA K within IA F1		
SM033-01	4.12J	0-0.5
SM033-01A	1.58	0-0.5
SM033-01A	0.971	0.5-1.5
SM034-01	1.36	0-0.5
SM034-01A	1.63	0-1
SM034-01A	1.28	1-6
SM035-01	0.6J	0-0.5
SM035-01A	0.857J	0-0.5
SM035-01A	0.533J	0.5-1.5
SM102	0.27	0
SM102-01	0.809	0-1
SM102-01	1.39	1-6
SM44o	0.19	0-0.5
SM45o	"U" qualifier	0-0.5
SM46o	"U" qualifier	0-0.5
SM49o	"U" qualifier	0-0.5

Because there were only 3 molybdenum values used in the ERA, ranging from 0.57-3.5 mg/kg, 3.5 mg/kg was used as the EPC. This value would not seem to accurately reflect the exposure risk from molybdenum given the small number of samples and when molybdenum values from other IA K sampling locations are considered. Also, the high TRV used in the HQ calculation was taken directly from a dosage from laboratory control study and it may be overly conservative to translate those findings directly as the TRV.

While molybdenum does not have a San Francisco Bay sediments value, a Mare Island Ambient Fill range of 1.2 to 5.5 mg/kg was established as part of a molybdenum study for IR Site 17 in 2012 (ChaduxTt 2012a). This study was not incorporated into the ERA performed as part of the IA F1 RI. All of the IA F1 and IA K samples reported molybdenum concentrations within or below the Mare Island Ambient Fill range. Additionally, all three of the molybdenum values used in the ERA are within the background levels for molybdenum found at California Air Force bases and comparable to the background values established other Naval installation in the Bay Area.

6.4.1 Molybdenum Findings and Recommendation:

<u>Molybdenum should be excluded as a COEC because all of the detected molybdenum concentrations are within the range of molybdenum values established for Mare Island Ambient Fill in 2012.</u>

6.5 Zinc

Zinc poses a potentially unacceptable ecological risk to only the salt marsh harvest mouse. The ambient fill concentration for zinc is 230 mg/kg. That level is only exceeded at one sampling location considered in the ERA, but is exceeded in six of the 16 samples excluded from the ERA because of association with IA K and the outfalls. Zinc results for shallow sediment are shown below. Sample results exceeding the Mare Island ambient value for fill soil are shown in bold.

Table B11: Zinc surface sediment sample results considered in the ERA

Sample Location	Zinc Result (mg/kg)	Depth (ft)
Zinc Surface Sediment Results Considered in the ERA		
A053-2	74	0-2
A198-2	57	0-2
IR04SD003	326	0-0.5
IR04SD004	201	0-1.75
SM036	173	0
SM036-2	163	0-1
Zinc Surface Sediment Results from IA K within IA F1		
SM033-01	1870J	0-0.5
SM033-01A	483J	0-0.5
SM033-01A	377J	0.5-1.5
SM034-01	136J	0-0.5
SM034-01A	201J	0-1
SM034-01A	266J	1-6
SM035-01	148J	0-0.5
SM035-01A	113J	0-0.5
SM035-01A	76.4J	0.5-1.5
SM102	50J	0
SM102-01	256J	0-1
SM102-01	104J	1-6
SM44o	1850J	0-0.5
SM45o	187J	0-0.5
SM46o	210J	0-0.5
SM49o	52.8J	0-0.5

Sample locations IR04SD003, SM033-01, SM033-01A, SM033-01A, SM44o, and SM102-01 exceed ambient concentrations for zinc. Locations IR04SD003, SM033-01, SM033-01A, and SM44o are associated with the area north of and around Outfall 33 and are already included for evaluation as a target treatment zone based on other metals. The elevated zinc at these three sample locations is consistent with the overall pattern of elevated metals in sediment north of and near Outfall 33.

Outside the TTZ north of and near Outfall 33, the 1-6 foot sample from location SM034-01A is the single sample in the wetlands habitat that exceeds the ambient value for zinc. This sample is located in close in proximity to sample locations SM034-01 and SM45o, as well as immediately below a surface sample at SM034-01A. The samples at these two locations, as well as the shallow (0-0.5 foot) sample at SM034-01A each report zinc results below the ambient value. zinc near SM034-01A does not appear to be a widespread concern and the SM034-01A area should not be evaluated for remediation.

Zinc at SM102-01 is just above ambient concentrations and there is minimum wetland habitat at this location. The zinc result from sample SM102 collected adjacent to SM102-01 is well below ambient. This suggests that the elevated zinc near SM102-01 is not a widespread concern and the lack of wetland habitat indicates an incomplete pathway for the ecological receptor, the salt marsh harvest mouse. SM102-01 is not recommended for further evaluation due to incomplete pathways.

6.5.1 Zinc Findings and Recommendations:

Designate the area associated with and north of Outfall 33 as the target treatment area for F1 wetland sediment to address elevated zinc near IR04SD003 and the area around Outfall 33. Addressing zinc at IR04SD003 and Outfall 33 would lower the zinc EPC and likely eliminate the source of unacceptable risk; therefore, it is recommended that lead be excluded as a COEC for the area of Subarea 6 outside of the target treatment zone. This is consistent with the recommendations and findings for barium, copper and lead.

7. Conclusion

Recommend remedial evaluation for the area adjacent to and north of Outfall 33 as the target treatment zone due to elevated barium, copper, lead and zinc. Recommend dropping molybdenum as a COEC because all reported values are within the range established for Mare Island ambient fill. It is recommended additional sampling be performed as part of the remedial design to better characterize the COECs (barium, copper, lead, and zinc) in shallow sediment at the northern end of Subarea 6.

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Appendix C: ARARs

Applicable or Relevant and Appropriate Requirements

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Attachments

ATTACHMENT C-1 - ARARS Request Letter and Response

ATTACHMENT C-2 - California Department of Fish and Wildlife Correspondence Letters

Acronyms and Abbreviations

ARAR	Applicable or relevant and appropriate requirement
AST	Aboveground storage tank
BAAQMD	Bay Area Air Quality Management District
Cal. Code Regs.	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
ch.	Chapter
DF&W	Department of Fish and Wildlife
div.	Division
EP	Extraction procedure
EPA	U.S. Environmental Protection Agency
ERA	Ecological risk assessment
FS	Feasibility study
HHRA	Human health risk assessment
HSWA	Hazardous and Solid Waste Amendments of 1984
IA F1	Investigation Area F1
LDR	Land disposal restriction
mg/L	Milligrams per liter
Navy	Department of the Navy
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
RCRA	Resource Conservation and Recovery Act
SWRCB	State Water Resources Control Board
TBC	To be considered
TCLP	Toxicity characteristic leaching procedure
Tetra Tech	Tetra Tech EM Inc.
tit.	Title
TTLC	Total threshold limit concentrations

U.S.C.	United States Code
Water Board	San Francisco Bay Regional Water Quality Control Board
WQO	Water quality objective
VOC	Volatile organic compound

Section 1 Introduction

This appendix identifies and evaluates potential federal and state of California applicable or relevant and appropriate requirements (ARAR) from the universe of regulations, requirements, and guidance and sets forth the Department of the Navy (Navy) determinations regarding those potential ARARs for each remedial action alternative retained for detailed analysis in the feasibility study (FS) for Investigation Area (IA) F1 of the former Mare Island Naval Shipyard (Mare Island) in Vallejo, California.

This evaluation includes an initial determination of whether the potential ARARs actually qualify as ARARs and a comparison for stringency between the federal and state regulations to identify the controlling ARARs. The identification of ARARs is an iterative process. The final determination of ARARs (no longer "potential" ARARs) will be made by the Navy in the record of decision (ROD) after public review as part of the response action selection process.

1.1 Summary of CERCLA and NCP Requirements

Section 121(d) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 *United States Code* [U.S.C.] Section [§] 9621[d]), as amended, states that remedial actions at CERCLA sites must attain (or the decision document must justify the waiver of) any federal or more stringent state environmental standards, requirements, criteria, or limitations determined to be legally applicable or relevant and appropriate.

Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address the situation at a CERCLA site. The requirement is applicable if the jurisdictional prerequisites of the standard show a direct correspondence when objectively compared to the conditions at the site. An applicable federal requirement is an ARAR. An applicable state requirement is an ARAR only if it is more stringent than federal ARARs.

If the requirement is not legally applicable, then the requirement is evaluated to determine whether it is relevant and appropriate. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not applicable, address problems or situations similar to the circumstances of the proposed response action and are well suited to the conditions of the site (U.S. Environmental Protection Agency [EPA] 1988a). A requirement must be determined to be both relevant <u>and</u> appropriate to be considered an ARAR.

The criteria for determining relevance and appropriateness are listed in 40 CFR § 300.400(g)(2) and include the following:

- The purpose of the requirement and the purpose of the CERCLA action
- The medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site
- The substances regulated by the requirement and the substances found at the CERCLA site
- Any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site
- The type of place regulated and the type of place affected by the release or CERCLA action
- The type and size of structure or facility regulated and the type and size of structure or facility affected by the release or contemplated by the CERCLA action
- Any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resources at the CERCLA site.

According to CERCLA ARARs guidance (EPA 1988a), a requirement may be "applicable" or "relevant and appropriate," but not both. ARARs must be identified on a site-specific basis and the identification involves a two-part analysis. First, a determination is made about whether a given requirement is applicable. If it is not applicable, a determination is made about whether it is nevertheless both relevant and appropriate. It is important to explain that some regulations may be applicable or, if not applicable, relevant and appropriate. When the analysis determines that a requirement is both relevant and appropriate, such a requirement must be complied with to the same degree as though it were applicable (EPA 1988a).

Tables C-1 through C-6 included in this appendix present each potential ARAR with a determination of ARAR status (that is, applicable or relevant and appropriate). For the determination of relevance and appropriateness, the pertinent criteria were examined to determine whether the requirements addressed problems or situations sufficiently similar to the circumstances of the release or response action contemplated and whether the requirement was well suited to the site. A negative determination of relevance and appropriateness indicates that the requirement did not meet the pertinent criteria. Negative determinations are documented in the tables of this appendix and are discussed in the text only for specific cases.

To qualify as a state ARAR under CERCLA and the NCP, the following descriptions must apply:

- A state law or regulation
- An environmental or facility siting law or regulation
- Promulgated (of general applicability and legally enforceable)
- Substantive (not procedural or administrative)
- More stringent than the federal requirement
- Identified in a timely manner
- Consistently applied.

To constitute an ARAR, a requirement must be substantive; therefore, only the substantive provisions of requirements identified as ARARs in this analysis are considered to be ARARs. Permits are considered to be procedural or administrative requirements. Provisions of generally relevant federal and state statutes and regulations that were determined to be procedural or nonenvironmental, including permit requirements, are not considered to be ARARs. CERCLA 121(e)(1), Title 42 U.S.C. § 9621(e)(1), states that "no Federal, State, or local permit shall be required for the portion of any removal or remedial action conducted entirely on-site, where such remedial action is selected and carried out in compliance with this section." The term "*on-site*" is defined for purposes of this ARARs discussion as "the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the response action" (Title 40 CFR § 300.5).

Nonpromulgated advisories or guidance issued by federal or state governments are not legally binding and do not have the status of ARARs. Such requirements may, however, be useful, and are "to be considered" (TBC). TBC (Title 40 CFR § 300.400[g][3]) requirements complement ARARs but do not override them. They are useful for guiding decisions regarding cleanup levels or methodologies when regulatory standards are not available.

Pursuant to EPA guidance (EPA 1988a), ARARs are generally divided into three categories: chemical-specific, location-specific, and action-specific requirements. This classification was developed to aid in the identification of ARARs; some ARARs do not fall precisely into one group or another. ARARs are identified on a site basis for remedial actions where CERCLA authority is the basis for cleanup.

Potential federal ARARs that have been identified for the IA F1 EE/CA are discussed in Section C1.2.2 Pursuant to the definition of the term "on-site" in Title 40 CFR § 300.5, the area that is part of this action includes the areal extent of contamination and all suitable areas in very close proximity to the contamination necessary for implementation of the remedial action at IA F1.

Identification of potential state ARARs was initiated through Navy requests to DTSC and is discussed in more detail in Section C1.2.3.

1.2 Methodology Description

The process of identifying and evaluating potential federal and state ARARs is described in this subsection.

1.2.1 General

As the lead federal agency, the Navy has primary responsibility for identification of potential ARARs for IA F1. In preparing this ARARs analysis, the Navy undertook the following measures, consistent with CERCLA and the NCP:

- Identified federal ARARs for each remedial action alternative addressed in the FS, taking into account site-specific information for IA F1
- Reviewed potential state ARARs to determine whether they satisfy CERCLA and NCP criteria that must be met to constitute state ARARs
- Evaluated and compared federal ARARs and their state counterparts to determine whether state ARARs are more stringent than the federal ARARs or are in addition to the federally required actions
- Reached a conclusion as to which federal and state ARARs are the most stringent or "controlling" ARARs for each alternative.

As outlined in Section 3.2 of the FS report, the remedial action objectives for IA F1 soil are:

- Prevent exposure of future commercial/industrial workers to lead in surface soils containing concentrations that exceed the modified OEHHA industrial worker CHHSL in the A75 area.
- Prevent exposure of ecological receptors to lead in surface soils containing concentrations that exceed the risk-based ecological goals in the A17 area.
- Prevent exposure of future recreational receptors to lead in surface soils containing concentrations that exceed the modified OEHHA residential CHHSL, which is overly conservative for the recreational receptor in the A17 area.
- Prevent sensitive reuse exposure to lead and chemicals in surface and subsurface soil.

The remedial action alternatives retained for detailed analysis for soil in the uplands area are:

- Alternative 1: No Action
- Alternative U2: Institutional Controls and Asphalt Cap
- Alternative U3: Institutional Controls, Excavation, and Off-Site Disposal

The remedial action objectives for IA F1 surface sediment in Subarea 6 is:

- Prevent ecological exposure to barium, lead, copper, and zinc in sediment that exceed the higher of either the Mare Island ambient fill concentration (ambient fill range from other nearby Bay Area Navy facilities for barium) or the calculated risk-based ecological goals.

The remedial action alternatives retained for detailed analysis for shallow sediment in Subarea 6 wetland are:

- Alternative 1: No Action
- Alternative W2: Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland
- Alternative W3: Institutional Controls, Excavation, and Off-Site Disposal

1.2.2 Identifying and Evaluating Federal Applicable or Relevant and Appropriate Requirements

The Navy is responsible for identifying federal ARARs as the lead federal agency under CERCLA and the NCP. The final determination of federal ARARs will be made when the Navy issues the Record of Decision. The federal government implements a number of federal environmental statutes that are the source of potential federal ARARs, either in the form of the statutes or the regulations promulgated there under. Examples include the Resource Conservation and Recovery Act (RCRA), the Clean Water Act (CWA), the Safe Drinking Water Act (SDWA), the Toxic Substances Control Act (TSCA), and their implementing regulations, to name a few. See NCP preamble at Title 55 *Federal Register* 8764 to 8765 [1990] for a more complete listing.

The Navy reviewed the proposed remedial action alternatives against all potential federal ARARs, including, but not limited to, those set forth at Title 55 *Federal Register* 8764 to 8765 (1990) to determine whether they were applicable or relevant and appropriate using CERCLA and NCP criteria and procedures for ARARs identification by lead federal agencies.

1.2.3 Identifying and Evaluating State Applicable or Relevant and Appropriate Requirements

The process of identifying and evaluating potential state ARARs by the state and the Navy is described in this subsection.

EPA guidance recommends that the lead federal agency consult with the state when identifying state ARARs for remedial actions (EPA 1988b). In essence, CERCLA and NCP requirements at Title 40 CFR § 300.515 for remedial actions provide that the lead federal agency request that the state identify chemical- and location-specific state ARARs upon completion of site characterization. The requirements also provide that the lead federal agency request

identification of all categories of state ARARs (chemical-, location- and action-specific) upon completion of identification of remedial alternatives for detailed analysis. The state must respond within 30 days of receipt of the lead federal agency requests. The remainder of this section details the Navy's efforts to date to identify and evaluate state ARARs.

The Navy generally followed the procedures set forth in Title 40 CFR § 300.515 and the Mare Island Federal Facility Site Remediation Agreement in seeking state assistance in identifying state ARARs. The Navy initially requested an identification of State of California ARARs for IA F1 in a letter to the State of California, DTSC, dated January 6, 1999, and repeated the request in a letter to the State of California, DTSC, dated April 14, 2010. The Navy received a list of state ARARs from DTSC in a letter dated May 17, 2010. The list included ARARs provided by DTSC, the Department of Fish and Game (DF&G) and the San Francisco Bay Regional Water Quality Control Board (RWCB). The ARARs request and state response letters are included as Attachment C-1.

1.3 Other General Issues

General issues identified during the evaluation of ARARs for IA F1 are discussed in the following sections.

1.3.1 General Approach to Requirements of the Federal Resource Conservation and Recovery Act

RCRA is a federal statute passed in 1976 to meet four goals: the protection of human health and the environment, the reduction of waste, the conservation of energy and natural resources, and the elimination of the generation of hazardous waste as expeditiously as possible. The Hazardous and Solid Waste Amendments of 1984 (HSWA) significantly expanded the scope of RCRA by adding new corrective action requirements, land disposal restrictions (LDRs), and technical requirements. RCRA, as amended, contains several provisions that are potential ARARs for CERCLA sites.

Substantive RCRA requirements are applicable to response actions on CERCLA sites if the waste is a RCRA hazardous waste and if either of the following descriptions applies:

- The waste was initially treated, stored, or disposed of after the effective date of the particular RCRA requirement, or
- The activity at the CERCLA site constitutes treatment, storage, or disposal, as defined by RCRA (EPA 1988a).

The preamble to the NCP indicates that state regulations that are components of a federally authorized or delegated state program are generally considered federal requirements and potential federal ARARs for the purposes of ARARs analysis (Title 55 *Federal Register* 8666, 8742 [1990]). The State of California received approval for its base RCRA hazardous waste

management program on July 23, 1992 (Title 57 *Federal Register* 32726 [1992]). The State of California "Environmental Health Standards for the Management of Hazardous Waste," set forth in Title 22 *California Code of Regulations* (Cal. Code Regs.), Division (div.) 4.5, were approved by EPA as a component of the federally authorized State of California RCRA program. On September 26, 2001, California received final authorization of its revised State Hazardous Waste Management Program by EPA (Title 63 *Federal Register* 49118 [2001]).

The regulations at Cal. Code Regs. Title (tit.) 22, div. 4.5, are a source of potential federal ARARs for CERCLA response actions. The exception is when a state regulation is "broader in scope" than the corresponding federal RCRA regulations. In that case, these regulations are not considered part of the federally authorized program or potential federal ARARs. Instead, they are purely state law requirements and potential state ARARs.

The EPA July 23, 1992, notice approving the state of California RCRA program (Title 57 *Federal Register* 32726 [1992]) specifically indicated that the state regulations addressed certain non-RCRA, state-regulated hazardous wastes that fell outside the scope of federal RCRA requirements. Cal. Code Regs. tit. 22, div. 4.5 requirements would be potential state ARARs for these non-RCRA, state-regulated wastes.

A key threshold question for the ARARs analysis is whether the contaminants at IA F1 constitute federal hazardous waste as defined under RCRA and the state's authorized program or qualify as non-RCRA, state-regulated hazardous waste. A discussion of waste characterization is included in Section 1.4.

1.4 Waste Characterization

Selection of ARARs involves the characterization of wastes as described below.

1.4.1 RCRA Hazardous Waste Determination

Federal RCRA hazardous waste determination is necessary to determine whether a waste is subject to RCRA requirements at Cal. Code Regs. tit. 22, div. 4.5 and other state requirements at Cal. Code Regs. tit. 23, div. 3, Chapter (ch.) 15. The first step in the RCRA hazardous waste characterization process is to evaluate contaminated media at the site and determine whether the contaminant constitutes a "listed" RCRA waste. The preamble to the NCP states that "it is often necessary to know the origin of the waste to determine whether it is a listed waste and that, if such documentation is lacking, the lead agency may assume it is not a listed waste" (55 Fed. Reg. 8666, 8758 [1990]).

This approach is confirmed in EPA guidance for CERCLA compliance with other laws (EPA 1988a) as follows.

To determine whether a waste is a listed waste under RCRA, it is often necessary to know the source. However, at many Superfund sites, no information exists on the source of wastes. The lead agency should use available site information, manifests, storage records, and vouchers in an effort to ascertain the nature of these contaminants. When this documentation is not available, the lead agency may assume that the wastes are not listed RCRA hazardous wastes, unless further analysis or information becomes available that allows the lead agency to determine that the wastes are listed RCRA hazardous wastes.

RCRA hazardous wastes that have been assigned EPA hazardous waste numbers (or codes) are listed in Cal. Code Regs. tit. 22, § 66261.30–66261.33. The lists include hazardous waste codes beginning with the letters "F," "K," "P," and "U."

Knowledge of the exact source of a waste is required for source-specific listed wastes (K waste codes). Some knowledge of the nature or source of the waste is required even for listed wastes from nonspecific sources, such as spent solvents (F waste codes) or commercial chemical products (P and U waste codes). These listed RCRA hazardous wastes are restricted to commercially pure chemicals used in particular processes such as degreasing.

P and U wastes cover only unused and unmixed commercial chemical products, particularly spilled or off-specification products (EPA 1991a). Not every waste containing a P or U chemical is a hazardous waste. To determine whether a CERCLA investigation-derived waste contains a P or U waste, there must be direct evidence of product use. In particular, all the following criteria must be met. The chemicals must be:

- Discarded (as described in 40 CFR § 261.2[a][2]),
- Either off-specification commercial products or a commercially sold grade,
- Not used (soil contaminated with spilled unused wastes is a P or U waste), and
- The sole active ingredient in a formulation.

The Navy does not believe that there is any RCRA-listed waste at IA F1.

The second step in the RCRA hazardous waste characterization process is to evaluate potential hazardous characteristics of the waste. The evaluation of characteristic waste is described in EPA guidance as follows (EPA 1988a).

Under certain circumstances, although no historical information exists about the waste, it may be possible to identify the waste as RCRA characteristic waste. This is important in the event that (1) remedial alternatives under consideration at the site involve on-site treatment, storage, or disposal, in which case RCRA may be triggered as discussed in this section; or (2) a remedial alternative involves off-site shipment. Since the generator (in this case, the agency or responsible party conducting the Superfund action) is responsible for determining whether the

wastes exhibit any of these characteristics (defined in 40 CFR § 261.21–261.24), testing may be required. The lead agency must use best professional judgment to determine, on a site-specific basis, if testing for hazardous characteristics is necessary.

In determining whether to test for the toxicity characteristic using the extraction procedure (EP) toxicity test, it may be possible to assume that certain low concentrations of waste are not toxic. For example, if the total waste concentration in soil is 20 times or less the EP toxicity concentration, the waste cannot be characteristic hazardous waste. In such a case, RCRA requirements would not be applicable. In other instances, where it appears that the substances may be characteristic hazardous waste (ignitable, corrosive, reactive, or EP toxic), testing should be performed.

Hazardous waste characteristics, as defined in 40 CFR § 261.21–261.24, are commonly referred to as ignitability, corrosivity, reactivity, and toxicity. California environmental health standards for the management of hazardous waste set forth in Cal. Code Regs. tit. 22, div. 4.5 were approved by EPA as a component of the federally authorized California RCRA program. Therefore, the characterization of RCRA waste is based on the state requirements.

The characteristics of ignitability, corrosivity, reactivity, and toxicity are defined in Cal. Code Regs. tit. 22, § 66261.21–66261.24. According to Cal. Code Regs. tit. 22, § 66261.24(a)(1)(A), "A waste that exhibits the characteristic of toxicity pursuant to subsection (a)(1) of this section has the EPA Hazardous Waste Number specified in Table I of this section which corresponds to the toxic contaminant causing it to be hazardous." Table I assigns hazardous waste codes beginning with the letter "D" to wastes that exhibit the characteristic of toxicity; D waste codes are limited to "characteristic" hazardous wastes.

According to Cal. Code Regs. tit. 22, § 66261.10, waste characteristics can be measured by an available standardized test method or be reasonably classified by generators of waste based on their knowledge of the waste, provided that the waste has already been reliably tested or there is documentation of chemicals used. Any contamination at IA F1 is not expected to be ignitable, corrosive, or reactive, as defined in Cal. Code Regs. tit. 22, § 66261.21–66261.23. This determination was based on knowledge of the nature and concentrations of contaminants.

The requirements at Cal. Code Regs. tit. 22, § 66261.24 list the toxic contaminant concentrations that determine the characteristic of toxicity. The concentration limits are in milligrams per liter (mg/L). These units are directly comparable to total concentrations in waste groundwater and surface water. For waste soils, these concentrations apply to the extract or leachate produced by the toxicity characteristic leaching procedure (TCLP).

A waste is considered hazardous if the contaminants in the wastewater or in the soil TCLP extract equal or exceed the TCLP limits. TCLP testing is required only if total contaminant

concentrations in soil equal or exceed 20 times the TCLP limits because TCLP uses a 20-to-1 dilution for the extract (EPA 1988a).

1.4.2 California-Regulated Non-Resource Conservation and Recovery Act Hazardous Waste

A waste determined not to be an RCRA hazardous waste may still be considered a state-regulated, non-RCRA hazardous waste. The state is broader in scope in its RCRA program in determining hazardous waste. Cal. Code Regs. tit. 22, § 66261.24(a)(2) lists the total threshold limit concentrations (TTLC) and the soluble threshold limit concentrations (STLC) for non-RCRA hazardous waste. The state applies its own leaching procedure, the waste extraction test (WET), which uses a different acid reagent and a different dilution factor (10-fold). Other state requirements may be broader in scope than federal ARARs for identifying non-RCRA wastes regulated by the state. These requirements may be potential ARARs for wastes not covered under federal ARARs. (See additional subsections of Cal. Code Regs. tit. 22, § 66261.24.) A waste is considered hazardous if its total concentrations exceed the TTLCs or if the extract concentrations exceed the STLCs. A WET is required when the total concentrations exceed the STLC but are less than the TTLCs (Cal. Code Regs. tit. 22, Chapter 11, Appendix II[b]).

As stated in Section C1.3.1, the RCRA regulations, including the definition of non-RCRA, state-regulated hazardous waste, are not applicable to the release at IA F1 because the release occurred before the effective date of RCRA. They may be applicable to or relevant and appropriate for excavated soil; therefore, they are discussed in Section C2.0.

1.4.3 Other California Waste Classifications

For waste discharged after July 18, 1997, solid waste classifications at Cal. Code Regs. tit. 27, §§ 20210, 20220, and 20230 are used to determine the applicability of waste management requirements. These are summarized below.

A "designated waste" under Cal. Code Regs. tit. 27, § 20210 is defined at *California Water Code* § 13173. Under *California Water Code* § 13173, designated waste is "hazardous waste that has been granted a variance from hazardous waste management requirements or nonhazardous waste that consists of or contains pollutants that, under ambient environmental conditions at a waste management unit, could be released in concentrations exceeding applicable water quality objectives or that could reasonably be expected to affect beneficial uses of the waters of the state."

A nonhazardous solid waste under Cal. Code Regs. tit. 27, § 20220 is "all putrescible and nonputrescible solid, semisolid, and liquid wastes, including garbage, trash, refuse, paper, rubbish, ashes, industrial wastes, demolition and construction wastes, abandoned vehicles and parts thereof, discarded home and industrial appliances, manure, vegetable or animal solid and

semisolid wastes, and other discarded waste (whether of solid or semisolid consistency), provided that such wastes do not contain wastes that must be managed as hazardous wastes or wastes that contain soluble pollutants in concentrations that exceed applicable water quality objectives or could cause degradation of waters of the state."

Under Cal. Code Regs. tit. 27, § 20230, inert waste is that subset of solid waste that does not contain hazardous waste or soluble pollutants at concentrations in excess of applicable water quality objectives and does not contain significant quantities of decomposable waste.

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Section 2 Chemical-Specific Applicable or Relevant and Appropriate Requirements

Chemical-specific ARARs are generally health- or risk-based numerical values or methodologies applied to site-specific conditions that result in the establishment of a cleanup level. Many potential ARARs associated with particular response alternatives (such as closure or discharge) can be characterized as action-specific but include numerical values or methodologies to establish them so they fit in both categories (chemical- and action-specific). To simplify the comparison of numerical values, most action-specific requirements that include numerical values are included in this chemical-specific section and, if repeated in the action-specific section, the discussion refers back to this section.

This section presents the ARARs determination conclusions that address numerical values for soil and a summary of the potential ARARs followed by a more detailed discussion of the ARARs for soil.

2.1 Summary of Chemical-Specific Applicable or Relevant and Appropriate Requirements Conclusions by Medium

Groundwater, soil, and sediment are the environmental media potentially affected by the IA F1 response actions. The conclusions for ARARs pertaining to these media are presented in the following sections. Table C-1 summarizes the requirements determined to be potential federal chemical-specific ARARs, and Table C-2 summarizes the potential state chemical-specific ARARs.

2.1.1 Groundwater ARARs Conclusions

The domestic use of groundwater was not considered a complete exposure pathway in the HHRA because only shallow groundwater has been impacted by site releases and the shallow groundwater is not a potential source of drinking water under federal EPA groundwater classification guidelines (EPA 1986) or state drinking water criteria under State Water Resources Control Board (SWRCB) Resolution 88-63. Therefore, drinking water standards, such as maximum contaminant levels (MCL), are not applicable or relevant or appropriate requirements. In a letter dated 18 May 2010, the California Regional Water Quality Control Board, San Francisco Region concurred with the Navy's assessment that the shallow groundwater at IA F1 meets the requirements for exception to California's sources of drinking water policy and is thus not suitable for municipal or domestic water supply (RWQCB, 2010). This determination is based on high TDS and low yield. Therefore, the shallow groundwater at IA F1 is not a potential drinking water source.

The Navy accepts the substantive provisions of the following as potential state ARARs:

- Chapter 2 of the Comprehensive Water Quality Control Plan for the San Francisco Bay Region (Basin Plan) which identifies beneficial uses of groundwater at IA F1
- SWRCB Resolution 88-63 which identifies exceptions to potential sources of drinking water and is incorporated into the Basin Plan.

2.1.2 Surface Water ARARs Conclusions

Surface water is not a medium of concern for this FS. Therefore no surface water ARARs were identified.

2.1.3 Soil ARARs Conclusions

The Navy is evaluating remedial alternatives that would generate waste that is expected to contain the soil COC: lead. Potential chemical-specific ARARs are associated with this waste generation. These potential ARARs require characterization of the waste for proper off-site disposal. The substantive provisions of the following requirements are potential federal and state chemical-specific ARARs:

- RCRA hazardous waste definitions at Cal. Code Regs. tit. 22, §§ 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100
- Non-RCRA, state-regulated hazardous waste definitions at Cal. Code Regs. tit. 22, §§ 66261.22(a)(3) and (a)(4), 66261.24(a)(2) through (a)(8), 66261.101, 66261.3(a)(2)(C) and (a)(2)(F)
- Designated, nonhazardous and inert solid waste definitions at Cal. Code Regs. tit., 27 §§ 20210, 20220 and 20230

2.1.4 Air ARARs Conclusions

Air is not a medium of concern for this FS.

2.1.5 Sediment ARARs Conclusions

The Navy is evaluating remedial alternatives that would generate waste that is expected to contain the sediment COCs: copper, lead and zinc. Potential chemical-specific ARARs are associated with this waste generation. These potential ARARs require characterization of the waste for proper off-site disposal. The substantive provisions of the following requirements are potential federal and state chemical-specific ARARs:

- RCRA hazardous waste definitions at Cal. Code Regs. tit. 22, §§ 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100
- Non-RCRA, state-regulated hazardous waste definitions at Cal. Code Regs. tit. 22, §§ 66261.22(a)(3) and (a)(4), 66261.24(a)(2) through (a)(8), 66261.101, 66261.3(a)(2)(C) and (a)(2)(F)

- Designated, nonhazardous and inert solid waste definitions at Cal. Code Regs. tit., 27 §§ 20210, 20220 and 20230

2.2 Detailed Discussion of Applicable or Relevant and Appropriate Requirements

2.2.1 Groundwater ARARs

Historical use of groundwater at Mare Island has been limited by poor water quality and wells that seasonally ran dry. Currently, groundwater at Mare Island is not used for domestic or municipal purposes. No water supply wells are within 1,000 feet of the site and drinking water is provided by the City of Vallejo from off-island sources.

2.2.1.1 Federal

Under the SDWA and RCRA, a significant issue in identifying ARARs for groundwater is whether the groundwater at the site can be classified as a source of drinking water. The EPA groundwater policy is set forth in the preamble to the NCP (55 Fed. Reg. 8666, 8752-8756 [1990]). This policy uses the protocols in the EPA Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy (EPA 1986). Under this policy, groundwater is classified in one of three categories (Class I, II, or III), on the basis of ecological importance, its ability to be replaced, and vulnerability. Class I groundwater is irreplaceable groundwater currently used by a substantial population or groundwater that supports a vital habitat. Class II consists of groundwater currently used or that might be used as a source of drinking water in the future. Class III groundwater is groundwater that cannot be used for drinking water because of its poor quality (for example, high salinity or widespread, naturally occurring contamination) or insufficient quantity. The EPA guidelines define Class III groundwater as groundwater with TDS concentrations over 10,000 mg/L and a yield of less than 150 gallons per day (EPA 1986). Class III groundwater can also be classified based on economic or technical treatability tests as well as quality or quantity.

Shallow groundwater at IA F1 is Class III groundwater and not suitable for use as a source of drinking water because most of the wells cannot likely sustain a yield of 150 gpd. In addition, naturally occurring TDS concentrations over 10,000 mg/L were found in wells. Because shallow groundwater is not a potential source of drinking water under the federal criteria, drinking water standards under the SDWA are not potential ARARs.

2.2.1.2 State

The state identified several state laws and regulations for groundwater in its response to the Navy's ARAR requests. The Navy accepts the substantive provisions of SWRCB Resolution 88-63 and Basin Plan Chapter 2 potential state ARARs:

SWRCB Res. 88-63, Adoption of Policy Entitled "Sources of Drinking Water."

SWRCB Res. 88-63 establishes criteria to help RWQCBs identify potential sources of drinking water (SWRCB 1988). According to this resolution, all groundwater in California is considered suitable or potentially suitable for domestic or municipal freshwater supply except in cases where any one of the following water quality and production criteria is met:

- TDS exceed 3,000 mg/L (or electrical conductivity is greater than 5,000 micromhos per centimeter) and the RWQCB does not reasonably expect the groundwater to supply a public drinking water system.
- Groundwater is contaminated, either by natural processes or by human activity unrelated to a specific pollution incident, and cannot reasonably be treated for domestic use either by best management practices (BMP) or best economically available treatment practices.
- The groundwater does not provide sufficient water to supply a single well capable of producing an average sustained yield of 200 gallons per day.
- Comprehensive Water Quality Control Plan for the San Francisco Bay Region (Basin Plan)

The Navy accepts the substantive provisions in Chapter 2 of the Basin Plan, except the municipal and domestic supply (MUN) beneficial use designation, as potential ARARs for implementing remedial action to address contamination in the shallow aquifer. The Basin Plan for the San Francisco region was prepared and implemented by the Water Board to protect and enhance the quality of the waters in the San Francisco region. The Basin Plan establishes location-specific beneficial uses and water quality objectives (WQO) for the surface water and groundwater of the region, and is the basis of the Water Boards regulatory programs. The WQOs are intended to protect the beneficial uses of the waters of the region and to prevent nuisance.

Beneficial use and reuse of water are key aspects of the Basin Plan for the San Francisco region. IA F1 is located in the Napa-Sonoma Valley groundwater basin and the Napa-Sonoma Lowlands subbasin. The Basin Plan identifies the following beneficial uses for Napa-Sonoma Lowlands subbasin:

- Municipal and Domestic supply
- Industrial process supply
- Industrial service supply
- Agricultural supply

As previously discussed, the shallow groundwater underlying IA F1 meets the requirements for exception to California's sources of drinking water policy and is thus not suitable for municipal or domestic water supply (RWQCB, 2010). Therefore potential ARARs associated with the use

of shallow groundwater as a drinking water source were not identified as chemical-specific ARARs for IA F1.

2.2.2 Soil

2.2.2.1 Federal

Federal requirements evaluated as potential ARARs for soil are discussed the subsections below.

Resource Conservation and Recovery Act

The federal RCRA requirements at 40 CFR Part 261 do not apply in California because the state RCRA program is authorized. The authorized state RCRA requirements are therefore considered potential federal ARARs. The applicability of RCRA requirements depends on whether the waste is a RCRA hazardous waste; whether the waste was initially treated, stored, or disposed of after the effective date of the particular RCRA requirement; and whether the activity at the site constitutes treatment, storage, or disposal as defined by RCRA. However, RCRA requirements may be relevant and appropriate even if they are not applicable. Examples include activities that are similar to the definition of RCRA treatment, storage, or disposal for waste that is similar to RCRA hazardous waste.

The determination of whether a waste is an RCRA hazardous waste can be made by comparing the site waste to the definition of RCRA hazardous waste. The RCRA requirements at Cal. Code Regs. tit. 22, §§ 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100, are potential ARARs because they define RCRA hazardous waste. These requirements are potential ARARs for soil and for any investigation-derived waste. A waste can meet the definition of hazardous waste if it has the toxicity characteristic of hazardous waste. This determination is made by using the TCLP. The maximum concentrations allowable for the TCLP listed in § 66261.24(a)(1)(B) are potential federal ARARs for determining whether hazardous waste is present at the site. If the site waste has concentrations exceeding these values, it is determined to be a characteristic RCRA hazardous waste. As described in Section C1.4.1, the determination of whether a waste is RCRA hazardous is also based on the characteristics of ignitability, corrosivity, and reactivity.

Alternatives evaluated will result in the generation of waste for off-site disposal. If the Navy determines that this waste is RCRA hazardous waste, the Navy will comply with all applicable requirements for proper off-site disposal, such as packaging, manifesting, and land disposal restrictions. The Navy has not identified any of these requirements as potential ARARs because none of the alternatives evaluates permanent on-site disposal of RCRA hazardous waste.

As long as the excavated material remains inside the area of contamination, it is not considered newly generated waste and will not be subject to RCRA generator, treatment, or other waste

management requirements. If excavated material is moved outside the area of contamination, the substantive RCRA requirements associated with managing hazardous waste (including RCRA land disposal restrictions) will be applicable.

The substantive provisions of Cal. Code Regs. tit. 22, §§ 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100, are potential applicable federal ARARs for soil and sediment at the site.

2.2.2.2 State

State requirements evaluated as potential ARARs for soil are discussed in the subsections below.

Resource Conservation and Recovery Act

State RCRA requirements included within the EPC-authorized RCRA program for California are considered potential federal ARARs and are discussed above. The exception is when a state a regulation is broader in scope than the corresponding federal regulations. In that case, such regulations are not considered part of the federally authorized program or potential federal ARARs. Instead, they are purely state law requirements and potential state ARARs.

State requirements such as the non-RCRA, state-regulated hazardous waste requirements may be potential state ARARs because they are not within the scope of the federal ARARs (57 Fed. Reg. 60848). The Cal. Code Regs. tit. 22, div. 4.5 requirements that are part of the state-approved RCRA program would be potential state ARARs for non-RCRA, state-regulated hazardous wastes.

The non-RCRA, state-regulated waste definition requirements at Cal. Code Regs. tit. 22, § 66261.24(a)(2) are potential state ARARs for determining whether other RCRA requirements are potential state ARARs. This section lists the TTLCs and STLCs. The site waste may be compared to these thresholds to determine whether it meets the characteristics for a non-RCRA, state-regulated hazardous waste. Section 66261.24(a)(2) lists the TTLCs and STLCs. The Navy will determine whether any waste it generates meets the characteristics for a non-RCRA, state-regulated hazardous waste prior to off-site disposal.

The substantive provisions of Cal. Code Regs. tit. 22,§§ 66261.22(a)(3) and (a)(4), 66261.24(a)(2) through (a)(8), 66261.101, 66261.3(a)(2)(C) and (a)(2)(F) are potential applicable state chemical-specific ARARs for soil and sediment at the site.

Cal. Code Regs, tit.27, div. 2, subdiv. 1

Former Cal. Code Regs. tit. 23, div. 3, ch. 15 requirements that were repealed went into effect under Cal. Code Regs. tit. 27 on 18 July 1997. The following Cal. Code Regs. tit. 27 sections define waste characteristics for discharge of waste to land. These requirements may be

applicable for soil or sediment that will be discharged after the effective date of the requirements. They are not potentially applicable to discharges before that date but may be relevant and appropriate.

Cal. Code Regs. tit. 27, § 20230(a) defines inert waste as waste "that does not contain hazardous waste or soluble pollutants at concentrations in excess of applicable water quality objectives, and does not contain significant quantities of decomposable waste." Cal. Code Regs. tit. 27, § 20230(b) states, "inert wastes do not need to be discharged at classified waste management units." Cal. Code Regs. tit. 27, § 20230(a) and (b) may be potential state ARARs for soil or sediment that meets the definition of inert waste.

Cal. Code Regs. tit. 27, §§ 20210 and 20220 are state definitions for designated waste and nonhazardous waste, respectively. These may be potential ARARs for soil or sediment that meets the definitions. These soil classifications determine state classification and siting requirements for discharging waste to land.

The substantive provisions of Cal. Code Regs. tit. 27, §§ 20210, defining a designated waste, 20220, defining a nonhazardous solid waste, and 20230, defining inert waste, are potential ARARs for characterizing waste for proper off-site disposal.

2.2.3 Sediment

The same chemical-specific ARARs for soil are chemical-specific ARARs for sediment.

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Section 3 Location-Specific Applicable or Relevant and Appropriate Requirements

Potential location-specific ARARs are identified and discussed in this section. The discussions are presented based on various attributes of the site location, such as whether it is within a floodplain.

3.1 Location-Specific Applicable or Relevant and Appropriate Requirement Conclusions by Resource Category

Wetlands protection, floodplain management, biological resources, and coastal resources are the resource categories potentially relating to location-specific ARARs potentially affected IA F1. The conclusions for ARARs pertaining to these resources are presented in Section C3.1.1 through C3.1.4 followed by more detailed discussions in Section C3.2. Table C-3 summarizes the requirements determined to be potential federal location-specific ARARs. Table C-4 summarizes the requirements identified as potential state location-specific ARARs.

3.1.1 Biological Resources Conclusions

Migratory birds may be present at IA F1and therefore the substantive provisions at 16 U.S.C. § 703 of the Migratory Bird Treaty Act are potential federal ARARs.

Several listed species are potentially present in Subarea 6 therefore:

- Substantive provisions of the Endangered Species Act at 16 U.S.C. §§ 1531–1543 are potential federal ARARs because the following species may be present at IA F1: salt marsh harvest mouse and California clapper rail are listed as endangered.
- Substantive provisions at Cal. Fish and Game Code §2080 and 2081 are potentially relevant and appropriate because the following species may be present at IA F1: the salt marsh harvest mouse and California clapper rail are listed as endangered species under the California Endangered Species Act.
- Substantive provisions at Cal. Fish and Game Code §1908 are potentially relevant and appropriate because the following species may be present at IA F1: Mason's lilaeopsis is listed as a rare plant.
- Substantive provisions at Cal. Fish and Game Code §4700 are potentially relevant and appropriate because the salt marsh harvest mouse is listed as a fully protected mammal and may be present at IA F1.
- Because the California clapper rail and the white tailed kite are California fully protected birds that may be present at the site, California Fish & Game Code § 3511 is a potential state ARAR.

3.1.2 Wetlands Protection and Floodplains Management Conclusions

The subarea 6 wetlands are a part of IA F1. Therefore, Exec. Order No. 11990 is TBC guidance for protecting the wetlands.

Because one of the remedial action alternatives includes building a confined disposal unit within the floodplain, the Executive Order 11988 is TBC guidance for managing the floodplain.

3.1.3 Coastal Zone Conclusions

The active remedial alternatives evaluated in the FS for wetlands would take place in the coastal zone. The Coastal Zone Management Act (CZMA) (16 U.S.C. §§ 1451–1464) has been identified as potentially relevant and appropriate federal ARAR. The McAteer-Petris Act (California Government Code §§ 66600 through 66661 as authorizing legislation for the San Francisco Bay Plan) has been identified as a relevant and appropriate state ARAR and the San Francisco Bay Plan at Cal. Code Regs. tit. 14, §§ 10110 through 11990 has been identified as a TBC. The remedial action alternatives will comply with the substantive provisions of these requirements which include limitations on filling the Bay, promoting public access, regulating development, and the minimization of harmful effects on the Bay.

3.1.4 Geological Resource Conclusions

Under Cal. Code Regs. tit. 22, § 66264.18(a), any new hazardous waste facility may not be located within 61 meters (200 feet) of a fault that has had displacement in Holocene time. Determined to be relevant and appropriate, the staging of waste will not occur within 200 feet of a fault.

3.2 Detailed Discussion

This section discusses the federal and state ARARs by location-specific resources.

3.2.1 Biological Resources

3.2.1.1 Federal ARARs

Migratory Bird Treaty Act of 1972

The Migratory Bird Treaty Act (MBTA) (16 U.S.C. §§ 703–712) protects migratory bird species. The substantive provisions at 16 U.S.C. § 703 prohibit at any time, using any means or manner, the pursuit, hunting, capturing, and killing or the attempt to take, capture, or kill any migratory bird. The MBTA also prohibits the possession, sale, export, and import of any migratory bird or any part of a migratory bird, as well as nests and eggs. A list of migratory birds for which this requirement applies is found at 50 C.F.R. § 10.13. It is the Navy's position that this act is not legally applicable to Navy actions; however, in July 2006, the Department of Defense (DoD) signed a Memorandum of Understanding (MOU) with the United States Fish and Wildlife

Service agreeing that the MBTA will continue to be evaluated as a potentially relevant and appropriate requirement for Navy CERCLA response actions.

Because migratory birds are present at IA F1, the substantive provisions at 16 U.S.C. § 703 are potentially relevant and appropriate for this FS.

Endangered Species Act of 1973

The Endangered Species Act (ESA) of 1973 (16 U.S.C. §§ 1531–1543) provides a means for conserving various species of fish, wildlife, and plants that are threatened with extinction. The ESA defines endangered and threatened species and provides for the designation of critical habitats. Critical habitat is a specific geographical area that is deemed essential for the conservation of a listed species, as designated by the Secretary of Interior or Secretary of Commerce under the ESA. Under Section 7(a) of the ESA (16 U.S.C., ch. 35, § 1536[a][2]), Federal agencies shall carry out conservation programs for threatened and endangered species. Federal agencies may not fund, authorize, or carry out any action that is likely to jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. Also, it is unlawful under Section 9 of the ESA for any person, including federal agencies, to "take" any listed fish or wildlife species (16 U.S.C. § 1538[a][1][B]) or remove, maliciously damage, or destroy any listed plant species (16 U.S.C. § 1538[a][2][B]). "Take" is defined broadly and includes, but is not limited to, harassing, harming, or killing (16 U.S.C. § 1532[19]). Incidental take may be authorized for the limited circumstances outlined in 16 USC 1536(b)(4) and only when not associated with a finding of jeopardy or adverse modification. The Endangered Species Committee may grant an exemption for agency action when there are no reasonable and prudent alternatives to agency action and reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are not sufficient to avoid a finding of jeopardy or adverse modification (16 U.S.C. § 1536[h]). The substantive requirements at 16 U.S.C. §§ 1531–1543 are potentially ARARs for CERCLA sites that have listed species or designated critical habitats. The administrative requirements of ESA, including the Section 7 consultation process and the associated production of Biological Assessment (BA) and Biological Opinion (BO) documents and the Section 10 permit requirements, are not ARARs. See *CERCLA Compliance with Other Laws Manual, part II*, page 4-12, USEPA, 1989 (providing guidance that ESA consultation is not a requirement for CERCLA actions conducted entirely on-site). See generally *Preamble to NCP Final Rule*, 55 Fed. Reg. 8756, 8757 (1990) (explaining distinction between substantive and administrative requirements). Compliance with the substantive requirements of ESA requires the Navy to determine whether listed species and designated critical habitat are present at the CERCLA site and to identify reasonable and prudent mitigation measures to avoid "take" of listed species and allow the response action to be undertaken without jeopardizing the continued existence of a listed species or resulting in the destruction or adverse modification of designated critical habitat.

If the Navy determines that endangered species or critical habitat are not present or will clearly not be affected by the proposed response actions (without having to implement mitigation measures), then no further action is required.

The wetland area is normally above water except during extremely high tides, and is considered to be a possible minor habitat for endangered species. The Salt-marsh harvest mouse and California clapper rail are potentially present at IA F1 and are listed as endangered under the ESA, Therefore the substantive provisions at 16 U.S.C. §§ 1531–1543 are potential ARARs and the Navy would identify reasonable and prudent measures to avoid takings, jeopardy, or adverse modification of habitat.

3.2.1.2 State ARARs

The following sections of the Cal. Fish & Game Code and Cal. Code Regs. tit. 14 div. 1 have been identified by the state as potential ARARs.

- Cal. Fish and Game Code §§1908, 2080, 3005, 3503, 3503.5, 3511, 4700, and 5650(a), (b) and (f)
- Cal. Code Regs. tit. 14, §460

The Navy's position is that the United States Congress did not specifically waive sovereign immunity in the Endangered Species Act (ESA) for the subject matter of the Department of Fish and Wildlife statutes or regulations. Therefore, authority does not exist to authorize applicability of the Cal. Fish & Game Code or its implementing regulations. However, the Navy has determined that requirements that protect state listed endangered, threatened, or fully protected species or state listed rare plants may be potentially relevant and appropriate if those species use the site.

Some of the Department of Fish and Wildlife requirements may allow incidental take as defined by Federal regulation through a permitting process. Section 121(e) of CERCLA exempts on-site CERCLA response actions from permit requirements, but the Navy will comply with the substantive requirements of the regulations by coordinating with biological resource trustees to determine appropriate measures to avoid incidental take as defined by Federal regulation, implementing those take avoidance measures during field work, and providing appropriate mitigation for any incidental take that cannot be avoided.The Department of Fish and Wildlife continues to take the position that the waiver of sovereignty for the requirements under the Federal Endangered Species Act is not relevant to this CERCLA remedial action, as documented in their comments on this document (Appendix F). The Navy and CDFW counsel are initiating discussions to resolve this issue related to ARARs. The resolution will be included in the ROD.

Cal. Fish & Game Code §§1908, 2080, 3511, and 4700

Cal. Fish & Game Code §§1908, 2080, 3511, and 4700 are not applicable because the United States of America has not waived sovereign immunity in the federal Endangered Species Act for these State of California requirements. However as noted above, these requirements were evaluated to determine if they may be relevant and appropriate at IA F1.

Endangered or Rare Native Plants

Cal. Fish & Game Code § 1908 states, "No person shall import into this state, or take, possess, or sell within this state, except as incident to the possession or sale of the real property on which the plant is growing, any native plant, or any part or product thereof, that the commission determines to be an endangered native plant or rare native plant." Cal. Fish & Game Code § 1901 defines "native plant" as a plant growing in a wild uncultivated state that is normally found native to the plant life of this state. A species, subspecies, or variety is endangered when its prospects of survival and reproduction are in immediate jeopardy from one or more causes. A species, subspecies, or variety is rare when, although not presently threatened with extinction, it is in such small numbers throughout its range that it may become endangered if its present environment worsens.

There is the potential for the rare species Mason's lilaeopsis to occur at IA F1. The substantive provisions of Cal. Fish & Game Code §1908 meet the pertinent NCP criteria under 40 C.F.R. § 300.400(g)(2)(vii) and are "relevant and appropriate" because rare and endangered species may be present at the site and protection of these vulnerable resources allow them to be "used" in the sense that they continue to provide their unique value to the State of California.

The Navy accepts Fish & Game Code Section 1908 as a state ARAR subject to the following conditions. The State of California, through CDFW- OSPR, concurs that this statute addresses prohibited conduct but does not provide for or prescribe affirmative measures to avoid a "taking." Notwithstanding the absence of specific affirmative measures in the statute, the Navy will implement reasonable measures to ensure adequate protection of ecological receptors including rare plants during response action construction following issuance of a CERCLA decision document pursuant to the Navy's obligations under CERCLA to select removal or remedial actions that are protective of human health and the environment (see Section 121(b)(1) of CERCLA). The Navy will coordinate with the State, through CDFW- OSPR, prior to implementation of such reasonable measures. The Navy understands that the State reserves the right to conduct periodic site visits during removal or remedial activities to confirm implementation of avoidance measures.

California Endangered Species Act

The California Endangered Species Act is set forth in the Cal. Fish & Game Code §§2050–2116. The substantive provisions in Cal. Fish & Game Code § 2080 prohibit the "take" of California endangered or threatened species. "Take" is defined in Cal. Fish & Game Code § 86 as "hunt, pursue, catch, capture, or kill, or attempt to hunt, pursue, catch, capture, or kill."

The wetland area is normally above water except during extremely high tides, and is considered to be a possible minor habitat for the salt marsh harvest mouse. The Salt-marsh harvest mouse has been observed at Subarea 6 at IA F1 and the California clapper rail may be present at IA F1. Both are protected as a listed endangered species by Cal. Fish & Game Code § 2080 The substantive provisions of Cal. Fish & Game Code § 2080 meet the pertinent NCP criteria under 40 C.F.R. § 300.400(g)(2)(vii) and are "relevant and appropriate" because the Salt-marsh harvest mouse and California clapper rail may be present at the site and protection of these vulnerable resources allow them to be "used" in the sense that they continue to provide their unique value to the State of California.

The Navy accepts Fish & Game Code Section 2080 as a state ARAR subject to the following conditions. The State of California, through CDFW- OSPR, concurs that this statute addresses prohibited conduct but does not provide for or prescribe affirmative measures to avoid a "taking." Notwithstanding the absence of specific affirmative measures in the statute, the Navy will implement reasonable measures to ensure adequate protection of ecological receptors during response action construction following issuance of a CERCLA decision document pursuant to the Navy's obligations under CERCLA to select removal or remedial actions that are protective of human health and the environment (see Section 121(b)(1) of CERCLA). The Navy will coordinate with the State, through CDFW- OSPR, prior to implementation of such reasonable measures. The Navy understands that the State reserves the right to conduct periodic site visits during removal or remedial activities to confirm implementation of avoidance measures.

Cal. Fish & Game Code §2081(b): This section states that the department may authorize, by permit, the take of endangered species, threatened species, and candidate species if the take is incidental to an otherwise lawful activity and the impacts are minimized and fully mitigated. Pursuant to CERCLA Section 121 (e) (42 USC Section 9621 [e]), on-site response actions are exempt from permit requirements. The substantive provisions of this requirement are potentially relevant and appropriate

Fully Protected Species

Cal. Fish & Game Code §3511

This section states that fully protected birds or parts thereof may not be taken or possessed at any time. The list of fully protected birds includes the white tailed kite and the California clapper rail.

The white tailed kite and California clapper rail are fully protected birds that are potentially present at IA F1. These species are protected under Cal. Fish & Game Code § 3511. The substantive provisions of Cal. Fish & Game Code §3511 meet the pertinent NCP criteria under 40 C.F.R. § 300.400(g)(2)(vii) and are "relevant and appropriate" because the California clapper rail and the White tailed kite are potentially present at the site and protection of these vulnerable resources allow them to be "used" in the sense that they continue to provide their unique value to the State of California.

The Navy accepts Fish & Game Code Section 3511 as a state ARAR subject to the following conditions. The State of California, through CDFW- OSPR, concurs that this statute addresses prohibited conduct but does not provide for or prescribe affirmative measures to avoid a "taking." Notwithstanding the absence of specific affirmative measures in the statute, the Navy will implement reasonable measures to ensure adequate protection of ecological receptors during response action construction following issuance of a CERCLA decision document pursuant to the Navy's obligations under CERCLA to select removal or remedial actions that are protective of human health and the environment (see Section 121(b)(1) of CERCLA). The Navy will coordinate with the State, through CDFW- OSPR, prior to implementation of such reasonable measures. The Navy understands that the State reserves the right to conduct periodic site visits during removal or remedial activities to confirm implementation of avoidance measures.

Cal. Fish & Game Code § 4700

Cal. Fish & Game Code § 4700 states that fully protected mammals or parts thereof may not be taken or possessed at any time. Fully protected mammals include the salt-marsh harvest mouse (*Reithrodontomys raviventris*).The salt marsh harvest mouse may be present at Subarea 6 at IA F1. The wetland area is normally above water except during extremely high tides, and is considered to be a possible minor habitat for the salt marsh harvest mouse. This species is protected under Cal. Fish & Game Code §4700. The substantive provisions of Cal. Fish & Game Code §4700 meet the pertinent NCP criteria under 40 C.F.R. § 300.400(g)(2)(vii) and are "relevant and appropriate" because the Salt-marsh harvest mouse is present at the site and protection of this vulnerable resource allows it to be "used" in the sense that it continues to provide its unique value to the State of California.

The Navy accepts Fish & Game Code Section 4700 as a state ARAR subject to the following conditions. The State of California, through CDFW- OSPR, concurs that this statute addresses prohibited conduct but does not provide for or prescribe affirmative measures to avoid a "taking." Notwithstanding the absence of specific affirmative measures in the statute, the Navy will implement reasonable measures to ensure adequate protection of ecological receptors during response action construction following issuance of a CERCLA decision document pursuant to the Navy's obligations under CERCLA to select removal or remedial actions that are protective of human health and the environment (see Section 121(b)(1) of CERCLA). The Navy will coordinate with the State, through CDFW- OSPR, prior to implementation of such reasonable measures. The Navy understands that the State reserves the right to conduct periodic site visits during removal or remedial activities to confirm implementation of avoidance measures.

Cal. Fish & Game Code §§ 3503.5

This section prohibits the take, possession, or destruction of any birds in the orders of Falconiformes or Strigiformes (birds-of-prey) or to take, possess or destroy the nests or eggs of such birds.

The State has withdrawn its previous identification of this requirement as a state ARAR in light of Navy's identification of the substantive provisions of the Migratory Bird Treaty Act (MBTA) as a 'relevant and appropriate' federal ARAR for this action.

Cal. Fish & Game Code § 3005

This section states , "It is unlawful to take birds or mammals with any net, pound, cage, trap, set line or wire, or poisonous substance, or to possess birds or mammals so taken, whether taken within or without this state."

The Navy has determined that Cal. Fish & Game Code § 3005(a) is not a state ARAR. It is not applicable because the federal government has not issued a waiver of sovereignty for these state requirements under the Endangered Species Act (ESA) or any other related federal statute. The Navy evaluated the requirements of Cal. Fish & Game Code § 3005(a) to determine whether it might be relevant and appropriate and determined that it did not meet all the requirements under 40 CFR § 300.400(g)(2). The State of California, through CDFW-OSPR, asserts that Cal. Fish & Game Code §3005(a) should be considered relevant and appropriate. Whereas, the Navy and the State have not agreed upon whether Cal. Fish & Game Code §3005(a) is an ARAR, this FS report documents each party's position on the statute but does not attempt to resolve the issue. However, the Navy and the State have previously agreed on harm-avoidance measures for activities on MINS, and the Navy believes a similar agreement can be reached for the F1 remedial alternatives. Additionally, the State has determined that the proposed ecological cleanup levels would substantively comply with the State requirement and provide an acceptable

level of protectiveness. These harm-avoidance measures and cleanup levels will be documented in the future Remedial Action Work Plan.

Cal. Fish & Game Code § 3503

It is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto.

The Navy has determined that Cal. Fish & Game Code § 3503 is not a state ARAR and it is not applicable or relevant and appropriate because the Navy determined that there is no waiver of sovereignty for these requirements under the federal Endangered Species Act (ESA). The State of California, through CDFW-OSPR, asserts that Section 3503 is a state ARAR because it is relevant and appropriate. Whereas, the Navy and the State have not agreed upon whether Cal. Fish & Game Code § 3503 is an ARAR, this FS Report documents each party's position on the statute but does not attempt to resolve the issue. Nonetheless, the Navy agrees that it will undertake measures in order to generally avoid harm to nests and eggs when there is potential that they may be impacted by response action construction. The Navy and the State have previously agreed on harm-avoidance measures for activities on this site, and the Navy believes a similar agreement can be reached for the F1 remedial alternatives. These harm-avoidance measures would be documented in the future Remedial Action Work Plan.

Cal. Code Regs. Tit. 14, § 460

Fisher, marten, river otter, desert kit fox, and red fox may not be taken at any time.

The Navy has determined that Cal. Code Regs. tit. 14 §460 is not a state ARAR and it is not applicable or relevant and appropriate because the Navy determined that there is no waiver of sovereignty for these requirements under the federal Endangered Species Act (ESA). The State of California, through CDFW-OSPR, asserts that Cal. Code Regs. tit. 14 §460 is a state ARAR because it is relevant and appropriate. Whereas, the Navy and the State have not agreed upon whether Cal. Code Regs. tit. 14 §460 is an ARAR, this FS Report documents each party's position on the statute but does not attempt to resolve the issue. Nonetheless, the Navy agrees that it will undertake measures in order to generally avoid harm to fisher, marten, river otter, desert kit fox, and red fox when there is potential that they may be impacted by response action construction. The Navy and the State have previously agreed on harm-avoidance measures for activities on this site, and the Navy believes a similar agreement can be reached for the F1 remedial alternatives. These harm-avoidance measures would be documented in the future Remedial Action Work Plan.

For a more detailed explanation of the positions set forth above, see letters in Attachment C-2.

Cal. Fish & Game Code § 5650(a) and (b)

Cal. Fish & Game Code § 5650(a) and (b) prohibits depositing or placing, where it can pass into waters of the state, any petroleum products, factory refuse, sawdust, shavings, slabs or edgings, and any substance deleterious to fish, plant life, or bird life. Section 5650(b) of the Cal. Fish & Game Code states that this section does not apply to a discharge or a release that is expressly authorized pursuant to, and in compliance with, the terms and conditions of a waste discharge requirement pursuant to Cal. Water Code § 13263 or a waiver issued pursuant to Cal. Water Code § 13269, subdiv. (a), issued by the SWRCB or RWQCB after a public hearing, or that is expressly authorized pursuant to, and in compliance with, the terms and conditions of a federal permit for which the SWRCB or RWQCB has, after a public hearing, issued a water quality certification pursuant to Cal. Water Code § 13160. This remedial action will be placing materials where they could potentially pass into waters of the state. Therefore, the substantive provisions at Cal. Fish & Game Code § 5650(a) and (b) are potentially relevant and appropriate state requirements. The remedial action will be conducted in a manner to prevent passage of pollutants to waters of the state.

3.2.2 Wetlands and Floodplain Resources

3.2.2.1 Federal ARARs

Federal requirements evaluated as potential ARARs for wetlands protection and floodplains management are discussed in the subsections below.

Protection of Wetlands, Exec. Order No. 11990

Exec. Order No. 11990 requires that federal agencies minimize the destruction, loss, or degradation of wetlands; preserve and enhance the natural and beneficial value of wetlands; and avoid support of new construction in wetlands if a practicable alternative exists. The subarea 6 wetlands are a part of IA F1. Therefore, the Exec. Order No. 11990 has been identified as a TBC.

Floodplain Management, Exec. Order No. 11988

Executive Order 11988 requires federal agencies to evaluate the potential effects of action they may take in a floodplain; avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain; and, implement acceptable floodproofing and other flood protection measures for the construction of new structures or facilities in a floodplain. The alternatives for IA F1 will be partly conducted within a floodplain. Therefore, Executive Order 11988 is a potential TBC requirement.

3.2.2.2 State ARARs

There were no potential state ARARs for Wetlands or Floodplains identified.

3.2.3 Coastal Zone Resources

3.2.3.1 Federal ARARs

Federal requirements evaluated as potential ARARs for the coastal zone are discussed in the subsections below

Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) (16 U.S.C. §§ 1451–1464) specifically excludes federal lands from the coastal zone (16 U.S.C. § 1453[1]). Therefore, the CZMA is not potentially applicable to IA F1. The CZMA will be evaluated as a potentially relevant and appropriate requirement. Section 1456(c)(1)(A) requires each federal agency activity within or outside the coastal zone that affects any land or water use or natural resource to conduct its activities in a manner that is consistent to the maximum extent practicable with enforceable policies of approved state management policies. A state coastal zone management program is developed under state law guided by the CZMA and its accompanying implementing regulations in 15 C.F.R. pt. 930. A state program sets forth objectives, policies, and standards to guide public and private uses of lands and water in the coastal zone. See the discussion of the State programs applicable at Mare Island below.

3.2.3.2 State ARARs

The California Coastal Act of 1976 is codified at Public Resources Code (Cal. Pub. Res. Code) §§ 30000–30900 and Cal. Code Regs. tit. 14, §§ 13001–13666.4. These sections regulate activities associated with development to control direct significant impacts on coastal waters and to protect state and national interests in California coastal resources. However, §30103 specifically excludes the areas under the jurisdiction of the San Francisco Bay Conservation and Development Commission (BCDC), established pursuant to the McAteer-Petris Act at Cal. Gov. Code, tit. 7.2 commencing with §66600. Under Cal. Gov. Code, tit. 7.2, §66610(b), the jurisdiction of the BCDC is a shoreline band 100 feet inland of and parallel to the shoreline.

Therefore, the Navy has identified the substantive provisions of the following requirements as State location-specific relevant and appropriate ARAR and TBC for activities in the wetlands:

- McAteer-Petris Act (California Government Code §§ 66600 through 66661 as authorizing legislation for the San Francisco Bay Plan) and
- TBC - San Francisco Bay Plan at Cal. Code Regs. tit. 14, §§ 10110 through 11990 regulating activities that affect the San Francisco Bay

McAteer-Petris Act and the San Francisco Bay Plan

The Coastal Zone Management Act was evaluated and certain substantive provisions were determined to be relevant and appropriate federal requirements because the remedial action

contemplates activity within the coastal zone. Coastal Zone Management Act at 16 USC § 1456(c)(1)(A) and CFR § 930 requires each federal agency activity within or outside the coastal zone that affects any land or water use or natural resource to conduct its activities in a manner that is consistent to the maximum extent practicable with enforceable policies of approved state management policies. The State of California's approved coastal management program includes the McAteer-Petris Act, the authorizing legislation for the San Francisco Bay Plan, developed by the Bay Conservation and Development Commission. Substantive provisions of this statute and plan are state ARARs. The remedial actions selected will be completed in a manner consistent with the substantive provisions of the San Francisco Bay Plan which include limitations on filling the Bay, promoting public access, regulating development, and the minimization of harmful effects on the Bay.

3.2.4 Geological Resources

3.2.4.1 Federal ARARs

The state location-specific RCRA requirements for geologic characteristics are part of the federally approved program and are evaluated as potential federal ARARs.

Resource Conservation and Recovery Act (42 U.S.C. §§ 6901–6991[i])

Under Cal. Code Regs. tit. 22, § 66264.18(a), any new hazardous waste facility may not be located within 61 meters (200 feet) of a fault that has had displacement in Holocene time. These requirements are applicable to new RCRA hazardous waste facilities. The Navy does not anticipate that the excavated soil would be RCRA hazardous waste, so the requirements are likely not applicable. The Navy has determined that the requirements would be relevant and appropriate because the excavated soil would be similar to a RCRA hazardous waste. As a result, the temporary staging pile constructed as a component of Alternatives evaluated would not be constructed within 61 meters (200 feet) of a fault that has had displacement in Holocene time.

3.2.4.2 State ARARs

There were no potential geological state ARARs identified.

Section 4 Action-Specific Applicable or Relevant and Appropriate Requirements

The FS report evaluated remedial action alternatives for the remediation of lead in upland areas and copper, lead and zinc in the wetlands of IA F1. This ARAR analysis is based on the following alternatives:

- Alternative 1: No Action
- Alternative U2 : Institutional Controls and Asphalt Cap
- Alternative U3: Institutional Controls, Excavation, and Off-Site Disposal
- Alternative W2: Institutional Controls, Excavation, and On-site Sediment Relocation to Upland
- Alternative W3: Institutional Controls, Excavation, and Off-Site Disposal

Table C-5 summarizes and evaluates federal potential action-specific ARARs for the site. Potential state action-specific ARARs are summarized in Table C-6. The ARARs determined to be pertinent to each alternative being evaluated for the site are discussed in this section. A discussion of how the alternative complies with each identified ARAR is also provided.

4.1 Alternative 1: No Action

There is no need to identify ARARs for the no-action alternative because ARARs apply to "any removal or remedial action conducted entirely on-site," and "no action" is not a removal or remedial action (CERCLA § 121[e], Title 42 U.S.C. § 9621[e]). CERCLA § 121 (Title 42 U.S.C. § 9621) cleanup standards for selection of a Superfund remedy, including the requirement to meet ARARs, are not triggered by the no-action alternative (EPA 1991). A discussion of compliance with action-specific ARARs is not, therefore, appropriate for this alternative.

4.2 Alternative U2: Institutional Controls and Asphalt Cap

Alternative U2 for soil uses institutional controls and asphalt capping to meet RAOs. The remediation area institutional controls would require preparation and approval of plans and specifications for all construction activities in the remediation areas that may pose unacceptable exposure to construction workers. Plans and specifications would be required to evaluate and help reduce exposure risks posed by the soil COCs for all human receptors. The remedial design document will identify specific implementation actions to ensure compliance with the institutional controls and to specify roles and responsibilities for implementing, monitoring, and enforcing the institutional controls.

Asphalt capping would prevent windblown dust and human and ecological receptor exposure. Asphalt capping is an engineering control and provides a physical barrier to eliminate the

exposure pathways associated with soil at IA F1. Asphalt capping would prevent the exposure of underlying soil. The asphalt caps would be maintained at least every 10 years.

Land use controls in the form of institutional controls, including proprietary controls, restrictive covenants, restricted land uses, restricted activities, and prohibited activities, are described in detail in Section 4.3 of the FS. Institutional controls such as proprietary controls, restrictive covenants, and restricted land uses would be implemented for all of the subareas of IA F1 to prohibit unintended uses of the property. Institutional controls associated with remedial action such as institutional controls for the asphalt cap for U2 would be implemented in the remediation areas only along with the land use ICs. LUCs would prohibit residential development, and limit future use to commercial/industrial use. The institutional controls would be more fully described in an LUC RD document.

The federal and state action-specific ARARs for Alternative U2 are discussed in the following sections.

4.2.1 Federal

The Navy has identified the following the substantive provisions of the following requirements as potential action-specific ARARs for construction the asphalt cap. These requirements will be further evaluated to determine whether they are necessary to meet the RAOs.

- Cal. Code Regs, tit. 22, § 66264.309(a) – requires a map showing the exact location of the cover with respect to permanently surveyed benchmarks.
- Cal. Code Regs, tit. 22, § 66264.310(a)(5) – requires that a final cover accommodate lateral and vertical shear forces generated by the maximum credible earthquake.
- Cal. Code Regs, tit. 22, § 66264.310(a)(7) – allows an engineered alternative to replace prescriptive cover standards at Cal. Code Regs, tit. 22, § 66264.228(e).
- Cal. Code Regs, tit. 22, § 66264.310(b)(1) – requires maintenance of final cover, making repairs as necessary.
- Cal. Code Regs, tit. 22, § 66264.310(b)(4) – requires cover design that prevents run-on and runoff from eroding or otherwise damaging the final cover.
- Cal. Code Regs, tit. 22, § 66264.310(b)(5) – requires maintenance of surveyed benchmarks.
- Cal. Code Regs, tit. 22, § 66264.228(e) through (r) – prescriptive cap requirements unless not necessary to protect human health, the environment or water quality.
- Cal. Code Regs, tit. 22, § 66264.228(e)(13) – requires permanent disposal areas be graded with allowance for settling and subsidence so that the slope of the land surface prevents ponding of water.
- Cal. Code Regs, tit. 22, § 66264.25(a) – all cover systems and drainage control systems shall be designed to function without failure when subjected to capacity,

hydrostatic and hydrodynamic loads resulting from a 24-hour probable maximum precipitation storm.

- Cal. Code Regs, tit. 22, § 66264.25(b)(2) – all covers shall be designed, constructed and maintained to withstand the maximum credible earthquake without the level of public health and environmental protection afforded by the original design being decreased.

There are no federal ARARs for institutional controls.

4.2.2 State

No state ARARs were identified for the asphalt cap that were more stringent than federal ARARs.

The state identified Cal. Code Regs. tit. 22, §67391.1, Cal. Health and Safety Code §25202.5, 25221, 25223, 25224 and 25355.5(a)(1)(C) and Cal. Civil Code §1471 as potential ARARs for institutional controls.

State statutes that have been accepted by the Navy as ARARs for implementing institutional controls and entering into an Environmental Restriction Covenant and Agreement with DTSC include substantive provisions of the Cal. Civ. Code § 1471 and Cal. Health & Safety Code §§ 25202.5, 25221, 25223, 25224, and 25355.5(a)(1)(C). DTSC promulgated a regulation on 19 April 2003 regarding "Requirements for Land Use Covenants" at Cal. Code Regs. tit. 22, § 67391.1. The substantive provisions of this regulation have been determined to be "relevant and appropriate" state ARARs by the Navy.

The substantive provisions of Cal. Civ. Code § 1471 are the following general narrative standard: ". . . to do or refrain from doing some act on his or her own land . . . where . . . : (c) Each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence on the land of hazardous materials, as defined in Section 25260 of the Health and Safety Code." This narrative standard would be implemented through incorporation of restrictive environmental covenants in the deed at the time of transfer. These covenants would be recorded with the environmental restriction covenant and agreement and run with the land.

The substantive provisions of Cal. Health & Safety Code § 25202.5 are the general narrative standard to restrict "present and future uses of all or part of the land on which the . . . facility . . . is located . . . ." These substantive provisions will be implemented by incorporation of restrictive environmental covenants in the Environmental Restriction Covenant and Agreement at the time of transfer for purposes of protecting present and future public health and safety.

Cal. Health & Safety Code §§ 25221 and 25355.5(a)(1)(C) provide the authority for the state to enter into voluntary agreements to establish land-use covenants with the owner of property. The

substantive requirements of the following Cal. Health & Safety Code § 25221 provisions are "relevant and appropriate": (1) the general narrative standard: "restricting specified uses of the property. . ." and (2) ". . . the agreement is irrevocable, and shall be recorded by the owner, . . . as a hazardous waste easement, covenant, restriction or servitude, or any combination of those servitudes, as appropriate, upon the present and future uses of the site." The substantive requirements of the following Cal. Health & Safety Code § 25355.5(a)(1)(C) provisions are "relevant and appropriate": ". . .execution and recording of a written instrument that imposes an easement, covenant, restriction, or servitude, or combination thereof, as appropriate, upon the present and future uses of the land." The Navy will comply with the substantive requirements of Cal. Health & Safety Code §§ 25221 and 25355.5(a)(1)(C) by incorporating the CERCLA use restrictions into the Navy's deed of conveyance in the form of restrictive covenants under the authority of Cal. Civ. Code § 1471 and into the environmental restriction covenant and agreement. The substantive provisions of Cal. Health & Safety Code §§ 25221 and 25355.5(a)(1)(C) may be interpreted in a manner that is consistent with the substantive provisions of Cal. Civ. Code § 1471. The covenants shall be recorded with the deed and run with the land.

Cal. Health & Safety Code § 25223 sets forth "relevant and appropriate" substantive criteria for granting variances from prohibited uses based upon specified environmental and health criteria. Cal. Health & Safety Code § 25224 sets forth the following "relevant and appropriate" substantive criteria for the removal of a land-use restriction on the grounds that ". . . the waste no longer creates a significant existing or potential hazard to present or future public health or safety."

In addition to being implemented through the Environmental Restriction Covenant and Agreement between the Navy and DTSC, the appropriate and relevant portions of Cal. Health & Safety Code §§ 25202.5, 25221, 25223, 25224, and 25355.5(a)(1)(C) and Cal. Civ. Code § 1471 shall also be implemented through the deed between the Navy and the transferee.

4.3 Alternative W2: Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland

Alternative W2 employs ICs and relocation of sediment from the TTZ in Subarea 6 to the uplands portion of IA F1 to meet RAOs. The sediment would be characterized prior to relocation to the uplands. Based on this characterization, the sediment relocated to the upland area may be suitable for beneficial reuse, or may be placed in a containment cell and covered to reduce risk. The institutional controls for this alternative are the same as Alternative U2 except for the prohibition of habitat since that is an integral element of Subarea 6. If characterization indicates that the sediment does not pose a potential threat to human health or the environment in the upland area, then the sediment will be relocated to an upland area of the site for beneficial

reuse. If potential risks to human health or the environment in the upland area are identified during characterization, the material relocated to the upland area may be placed within a containment cell and covered to reduce these risks. The containment cell location would be chosen from one of the subareas slated for future industrial reuse. The sediment would be placed in the cell and covered with an erosion resistant cover. The containment cell would not be suitable for hazardous sediment. If hazardous sediment is found, the hazardous sediment would be disposed off-site to an appropriate offsite facility as described in Alternative W3.

4.3.1 Federal

The backfilling of the wetlands could be defined as discharge of fill material under the CWA requirements at § 404 of the CWA. Substantive provisions for evaluating fill material proposed for discharge to waters of the United States are considered to be potentially applicable for the backfilling element of this alternative. Prior to filling, samples of potential backfill material ("clean" sediments) will be collected and tested for discharge to waters of the United States. Evaluations will be made in accordance with CWA § 404(b)(1) guidelines, which are codified as potentially applicable ARAR criteria at 40 C.F.R. pt. 230.

The Navy is planning to relocate the excavated material to the upland containment cell in an industrial use area of the site. The sediment will be characterized before relocation to ensure that it is protective of human health, the environment and groundwater quality at the relocation area.

The backfill material for the wetland will be characterized to ensure compliance with the substantive guidelines at 40 C.F.R. pt. 230 and the USACE permit regulations at 33 C.F.R. pts. 320–330. For fill material to comply with the guidelines, it must meet the following substantive provisions:

- 40 C.F.R. § 230.10(a) – requires that the discharge represent the least damaging, practicable alternative;
- 40 C.F.R. § 230.10(c) – requires that discharge of dredged material not result in significant degradation of the aquatic ecosystem; and
- 40 C.F.R. § 230.10(d) – requires that all practicable means be utilized to minimize adverse environmental impacts.

Substantive provisions of the following requirements regarding discharge of fill material were identified as potential federal ARARs for backfilling the wetland:

- 33 C.F.R. § 320.4 (general policies for evaluating permit applications);
- 40 C.F.R. §§ 230.10 (restrictions on discharge) and 230.11 (factual determinations);
- 40 C.F.R. §§ 230.20–230.25 (potential impacts on physical and chemical characteristics of the aquatic ecosystem such as substrate, suspended particulate/turbidity, water, current patterns and water circulation, normal water fluctuations, and salinity gradients);

- 40 C.F.R. §§ 230.31 and 230.32 (potential impacts on biological characteristics of the aquatic ecosystem such as fish, crustaceans, mollusks, and other aquatic organisms in the food web; and other wildlife); and
- 40 C.F.R. § 230.53 (potential effects on human-use characteristics, such as aesthetics).

Provisions of 40 C.F.R. §§ 230.60 and 230.61 give the basis for certain factual determinations with regard to dredged material discharge activities. Provisions of 40 C.F.R. § 230.60 describe a general evaluation of the material and establishes a framework to determine, based on existing information on the proposed dredging and discharge sites, whether the material at issue requires further testing. If the conditions at 40 C.F.R. § 230.60 cannot be met or are not applicable, the testing requirements of § 230.61 must be applied. The Upland Testing Manual details the testing procedures outlined in 40 C.F.R. §§ 230.60 and 230.61. Conclusions reached utilizing this manual will be used to make factual determinations of the potential effects of a proposed discharge of fill material on the physical, chemical, and biological components of the aquatic environment. Such factual determinations are used to make findings of compliance or noncompliance with relevant parts of 40 C.F.R. § 230.10(b) (including compliance with established water quality standards) and 40 C.F.R. § 230.10(c) (determinations of potential contaminant-related impacts to aquatic resources). All specifications of discharge sites must also comply with 40 C.F.R. §§ 230.10(a) and 230.10(d). Site monitoring and/or management activities developed following the use of this manual may be said to contribute to satisfying the aforementioned requirements of 40 C.F.R. § 230.10(d).

Chemical analysis results for the fill material found to be suitable for fill will also be compared to site-specific risk-based values used in the ecological assessment. Only fill material that passes both comparisons without identified potential risk of adverse effects on the wetland will be considered “clean” and viable as fill material.

The Navy has identified the substantive provisions of the following requirements as potential federal action-specific ARARs for handling and characterization of removed sediment:

- RCRA hazardous waste identification requirements at 22 CCR § 66262.10(a) and (11)
- The requirement to analyze generated waste to determine if it is hazardous at 22 CCR § 66264.13(a) and (b)
- Temporary staging pile requirements at 40 CFR §264.554(d)(1)(i-ii) and (d)(2), (e), (f), (h), (i), (j), and (k)
- Minimize the need for further maintenance controls and minimize or eliminate, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated rainfall or runoff, or waste decomposition products to groundwater or surface water or to the atmosphere at Cal. Code Regs. tit. 22, § 66264.111(a) and (b)

- Closure requirements for the temporary staging pile at 22 CCR § 66264.258(a)

Since this alternative includes a cover to prevent the erosion if the sediment is not acceptable for beneficial use, the following landfill cover requirements were determined to be potentially relevant and appropriate.

- Cal. Code Regs, tit. 22, § 66264.310(b)(1) – requires maintenance of final cover, making repairs as necessary.
- Cal. Code Regs, tit. 22, § 66264.310(b)(4) – requires cover design that prevents run-on and runoff from eroding or otherwise damaging the final cover.

Other landfill cover requirements were not determined to be potentially relevant and appropriate since the sediment will be protective of human health, the environment and groundwater at the relocation site.

The Navy has identified the following potential federal action-specific ARARs for air emissions from excavating sediment:

- Bay Area Air Quality Management District (BAAQMD) Regulation 8-40-304, requiring active storage units of contaminated soil to be kept visibly moist by water spray, treated with a vapor suppressant, or covered with continuous heavy-duty plastic sheeting or other cover to minimize emissions of organic compounds to the atmosphere
- BAAQMD Regulation 6-302, prohibiting emissions with opacities equal to or greater than 20 percent for a period aggregating more than 3 minutes in any hour of emission.

This remedial alternative may involve disturbance of 1 or more acres of land. Therefore, the substantive provisions of the requirements for storm water plans, BMPs, and effluent limitations reflecting the best practical technology currently available set forth in 40 C.F.R. §122.44(k)(2) and (4), and CWA Section 301(b) (33 U.S.C. ch. 26, § 1311) are potential federal ARARs.

4.3.2 State

Other landfill cover requirements were not determined to be potentially relevant and appropriate since the sediment will be protective of human health, the environment and groundwater at the relocation site. The relocated sediment will not be hazardous as defined by the chemical-specific ARARs and will meet the definition of inert defined at Cal. Code Regs. tit. 27, § 20230(a).

The state identified their general NPDES permit State Water Resources Control Board No. 2009-0009-DWQ if one or more acres of land is disturbed. Pursuant to CERCLA Section 121(e) (42 USC § 9621 [e]), on-site response actions are exempt from permit requirements, including an NPDES Permit. The State of California's General Construction Storm Water Permit (SWRCB Order No. 2009-0009-DWQ as amended by 2010-0014-DWQ) is such a permit. Although not an ARAR in itself, Navy will implement the substantive provisions of this permit to comply with

federal Clean Water Act ARARs and water quality State ARARs for discharge to surface water, if one or more acres of land is disturbed during the remedial action. The federal and state ARARs require BMPs and a storm water plan to meet the substantive numeric effluent limit and action level requirements. The Navy will implement the BMPs and prepare a CERCLA storm water plan which will include monitoring, sampling and analysis, and numeric action level and effluent limit requirements as specified under California's General Construction Storm Water Permit.

4.4 Alternative U3 and W3: Institutional Controls, Excavation, and Off-Site Disposal

Alternatives U3 and W3 consists of soil and sediment excavation, respectively, and off-site disposal at a permitted disposal facility, as well as backfilling the excavations and the institutional controls discussed in Alternative U2. Soil containing lead in the upland areas and copper, lead and zinc in the wetlands area at concentration above remediation goals would be excavated where feasible to reduce the concentrations of these COCs. Backfill soil would be analyzed and confirmed to be below remediation goals.

Soil and sediment would be excavated in the remedial action areas within each subarea of IA F1. Figure 2 of the FS shows the excavations that are the basis of the cost estimate; detailed excavation plans would be developed in the RD. The institutional controls ARARs are identified under Alternative U2 and are the same for this alternative. Additional federal and state action-specific ARARs for Alternatives U3 and W3 are discussed in the following sections.

4.4.1 Federal

The Navy has identified the substantive provisions of the following requirements as potential federal action-specific ARARs for excavation, off-site disposal and backfilling:

- RCRA hazardous waste identification requirements at 22 CCR § 66262.10(a) and (11)
- The requirement to analyze generated waste to determine if it is hazardous at 22 CCR § 66264.13(a) and (b)
- Temporary staging pile requirements at 40 CFR §264.554(d)(1)(i-ii) and (d)(2), (e), (f), (h), (i), (j), and (k)
- Minimize the need for further maintenance controls and minimize or eliminate, post-closure escape of hazardous waste, hazardous constituents, leachate, contaminated rainfall or runoff, or waste decomposition products to groundwater or surface water or to the atmosphere at Cal. Code Regs. tit. 22, § 66264.111(a) and (b)
- Closure requirements for the temporary staging pile at 22 CCR § 66264.258(a)

Alternatives U3 and W3 include backfilling. The same ARARs identified for Alternative W2 for discharge of dredging and fill material are also ARARs for Alternatives U3 and W3 backfilling.

The Navy has also identified the following potential federal action-specific ARARs for air emissions from excavating soil and sediment:

- Bay Area Air Quality Management District (BAAQMD) Regulation 8-40-304, requiring active storage units of contaminated soil to be kept visibly moist by water spray, treated with a vapor suppressant, or covered with continuous heavy-duty plastic sheeting or other cover to minimize emissions of organic compounds to the atmosphere
- BAAQMD Regulation 6-302, prohibiting emissions with opacities equal to or greater than 20 percent for a period aggregating more than 3 minutes in any hour of emission.

This remedial alternative may involve disturbance of 1 or more acres of land. Therefore, the substantive provisions of the requirements for storm water plans, BMPs, and effluent limitations reflecting the best practical technology currently available set forth in 40 C.F.R. §122.44(k)(2) and (4), and CWA Section 301(b) (33 U.S.C. ch. 26, § 1311) are potential federal ARARs.

4.4.2 State

The institutional controls ARARs are the same as those identified for Alternative U2.

The state identified their general NPDES permit State Water Resources Control Board No. 2009-0009-DWQ if one or more acres of land is disturbed. Pursuant to CERCLA Section 121(e) (42 USC § 9621 [e]), on-site response actions are exempt from permit requirements, including an NPDES Permit. The State of California's General Construction Storm Water Permit (SWRCB Order No. 2009-0009-DWQ as amended by 2010-0014-DWQ) is such a permit. Although not an ARAR in itself, Navy will implement the substantive provisions of this permit to comply with federal Clean Water Act ARARs and water quality State ARARs for discharge to surface water, if one or more acres of land is disturbed during the remedial action. The federal and state ARARs require BMPs and a storm water plan to meet the substantive numeric effluent limit and action level requirements. The Navy will implement the BMPs and prepare a CERCLA storm water plan which will include monitoring, sampling and analysis, and numeric action level and effluent limit requirements as specified under California’s General Construction Storm Water Permit.

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Section 5 References

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Tables

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Table C-1. Potential Federal Chemical-Specific[a] Applicable or Relevant and Appropriate Requirements Feasibility Study for IA F1, Mare Island, Vallejo, California

Requirement	Prerequisite	Citation [b]	Preliminary ARAR Determination	Comments
Soil				
Resource Conservation and Recovery Act (42 U.S.C., ch. 82, §§ 6901 through 6991[i]) [c]				
This requirement defines RCRA hazardous waste. Solid wastes are characterized as toxic based on the TCLP results if the wastes exceed the TCLP maximum concentrations.	Waste	Cal. Code Regs. tit. 22, §§ 66261.21, 66261.22(a)(1), 66261.23, 66261.24(a)(1), and 66261.100	Applicable	Applicable for determining whether excavated waste is hazardous.

Notes:

a	Many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables
b	Only the substantive provisions of the requirements cited in this table are potential ARARs
c	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 are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs
§	Section
ARAR	Applicable or relevant and appropriate requirement
Cal. Code Regs.	California Code of Regulations
RCRA	Resource Conservation and Recovery Act
TCLP	Toxicity characteristic leaching procedure
TSD	Treatment, storage, or disposal
U.S.C.	United States Code

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Table C-2. Potential State Chemical-Specific Applicable or Relevant and Appropriate Requirements Feasibility Study for IA F1, Mare Island, Vallejo, California

Requirement	Prerequisite	Citation [a]	Preliminary ARAR Determination	Comments
Soil				
Cal/EPA Department of Toxic Substances Control [c]				
Definition of "non-RCRA hazardous waste."	Waste	Cal. Code Regs. tit. 22, § 66261.22(a)(3) and (4), § 66261.24(a)(2)–(a)(8), § 66261.101, § 66261.3(a)(2)(C) or § 66261.3(a)(2)(F)	Applicable	Applicable for determining whether a waste is a non-RCRA hazardous waste.
State and Regional Water Quality Control Boards [c]				
Definitions of designated waste, nonhazardous waste, and inert waste.	Waste	Cal. Code Regs, tit. 27, §§ 20210, 20220, 20230	Applicable	These are applicable to any operation that generates waste. The Navy will determine whether any waste generated from the response actions meets the definition of designated waste, nonhazardous solid waste, or inert waste at the time the waste is sent off site for disposal. If the waste meets the definition of designated or nonhazardous solid waste, the Navy will dispose of it appropriately in Class I or Class II landfills.
Describes the water basins in San Francisco Basin, establishes beneficial uses of groundwater and surface water, establishes WQOs, including narrative and numerical standards, establishes implementation plans to meet WQOs and protect beneficial uses, and incorporates statewide water quality control plans and policies.		Water Quality Control Plan for the San Francisco Basin (Basin Plan) (Cal. Water Code § 13240) Chapters 2 Beneficial Uses (except for MUN)	Applicable	The Navy accepts the substantive provisions of Chapter 2 (beneficial uses) as potential state ARARs for shallow groundwater at IA F1, except the MUN designation. The shallow groundwater underlying IA F1 is not currently used as a drinking water source and meets the criteria for exception to the state's drinking water policy. As a result, the use of the groundwater at IA F1 as a source of drinking water was not considered a complete exposure pathway for hypothetical future residents.
Establishes the policy that high-quality waters of the state "shall be maintained to the maximum extent		Statement of Policy With Respect to Maintaining High Quality	Not an ARAR	Not an ARAR for setting sediment or soil cleanup levels.

Table C-2. Potential State Chemical-Specific Applicable or Relevant and Appropriate Requirements Feasibility Study for IA F1, Mare Island, Vallejo, California

Requirement	Prerequisite	Citation [a]	Preliminary ARAR Determination	Comments
possible" consistent with the "maximum benefit to the people of the State." It provides that whenever the existing quality of water is better than that required by applicable water quality policies, such existing high-quality water will be maintained until it has been demonstrated to the state that any change will be consistent with maximum benefit to the people of the state, will not unreasonably affect present and anticipated beneficial use of such water, and will not result in water quality less than that prescribed in the policies. It also states that any activity that produces or may produce a waste or increased volume or concentration of waste and that discharges or proposes to discharge to existing high-quality waters will be required to meet waste-discharge requirements that will result in the best practicable treatment or control of the discharge.		of Waters in California, SWRCB Res. 68-16		
Describes requirements for RWQCB oversight of investigation and cleanup and abatement activities resulting from discharges of hazardous substances. RWQCB may decide on cleanup and abatement goals and objectives for the protection of water quality and beneficial uses of water within each region. Establishes		Policies and procedures for investigation and cleanup and abatement of discharges under Cal. Water Code § 13304, SWRCB Res. 92-49	Not an ARAR	Not an ARAR for setting sediment or soil cleanup levels.

Table C-2. Potential State Chemical-Specific Applicable or Relevant and Appropriate Requirements Feasibility Study for IA F1, Mare Island, Vallejo, California

Requirement	Prerequisite	Citation [a]	Preliminary ARAR Determination	Comments
criteria for "containment zones" where cleanup to established water-quality goals is not economically or technically practicable.				
Incorporated into all regional board basin plans. Designates all groundwater and surface waters of the state as drinking water except where the TDS is greater than 3,000 ppm, the well yield is less than 200 gpd from a single well, the water is a geothermal resource or in a water conveyance facility, or the water cannot reasonably be treated for domestic use using either best management practices or best economically achievable treatment practices.		SWRCB Res. 88-63 (Sources of Drinking Water Policy)	Applicable	The TDS and yield criteria from this requirement were used in the analysis to justify the shallow groundwater's exception from the state's drinking water policy. Neither the Mare Island Strait nor the shallow groundwater underlying IA F1 are potential sources of drinking water.

Notes:

a	Many potential action-specific ARARs contain chemical-specific limitations and are addressed in the action-specific ARAR tables
b	Only the substantive provisions of the requirements cited in this table are potential ARARs
c	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 are addressed in the table below each general heading; only pertinent substantive requirements of the specific citations are considered potential ARARs
§	Section
ARAR	Applicable or relevant and appropriate requirement
Cal. Code Regs.	California Code of Regulations
Cal/EPA	California Environmental Protection Agency
RCRA	Resource Conservation and Recovery Act
Res.	Resolution
tit.	Title

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Table C-3: Potential Federal Location-Specific Applicable or Relevant and Appropriate Requirements Feasibility Study IA F1, Mare Island, Vallejo, California

Location	Requirement	Prerequisite	Citation [a]	Preliminary ARAR Determination	Comments
Endangered Species Act of 1973 (16 U.S.C. §§ 1531–1543) [b]					
Habitat upon which endangered species or threatened species depend	Federal agencies may not jeopardize the continued existence of any listed species or cause the destruction or adverse modification of critical habitat. The Endangered Species Committee may grant an exemption for agency action if reasonable mitigation and enhancement measures such as propagation, transplantation, and habitat acquisition and improvement are implemented.	Determination of effect upon endangered or threatened species or its habitat. Critical habitat upon which endangered species or threatened species depend.	16 U.S.C. § 1536(a), (h)(1)(B); 16 U.S.C. § 1538(a)(1)(B)and (G); and 16 U.S.C. § 1538(a)(2)(B) and (E)	Relevant and appropriate.	The substantive provisions of these requirements are potential ARARs because of endangered or threatened species potentially present in Subarea 6. However, none of the alternatives evaluated are expected to impact these species.
Migratory Bird Treaty Act of 1972 (16 U.S.C. §§ 703–712) [b]					
Migratory bird area	Protects almost all species of native migratory birds in the U.S. from unregulated "take," which can include poisoning at hazardous waste sites.	Presence of migratory birds	16 U.S.C. § 703	Applicable	The substantive provisions of these requirements are potential ARARs because migratory birds are present at IA F1.
Exec. Order No. 11988, Floodplain Management					
Evaluate potential effects of actions in a floodplain to avoid, to the extent possible, adverse effects	Action that will occur in a floodplain (i.e., lowlands) and relatively flat areas adjoining inland and coastal waters and other flood-prone areas.	Exec. Order No. 11988		TBC	Although Executive Orders are not potentially ARARs, these requirements present a substantive provision that will serve as TBC guidance to avoid adverse affects to the floodplain.

Table C-3: Potential Federal Location-Specific Applicable or Relevant and Appropriate Requirements Feasibility Study IA F1, Mare Island, Vallejo, California

Location	Requirement	Prerequisite	Citation [a]	Preliminary ARAR Determination	Comments
associated with direct and indirect development of a floodplain.					
Exec. Order No. 11990, Protection of Wetlands[b]					
Wetland	Avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and avoid support of new construction in wetlands if practicable alternatives exist.	Wetland meeting definition of Section 7(c) of the Exec. Order No. 11990.	Exec. Order No. 11990	TBC	Although Executive Orders are not potentially ARARs, these requirements present a substantive provision that will serve as TBC guidance to avoid adverse affects to wetlands.
Coastal Zone Management Act (16 U.S.C. §§ 1451–1464)[b]					
Within coastal zone	Conduct activities in a manner consistent with approved state management programs.	Activities affecting the coastal zone including lands thereunder and adjacent shore land.	16 U.S.C. § 1456(c) 15 C.F.R. § 930	Relevant and appropriate	Not potentially applicable to federal government. However, since the site is within the Coastal Zone, the provisions requiring compliance with State management programs is relevant and appropriate.
Resource Conservation and Recovery Act (42 U.S.C. §§ 6901–6991[i])[b]					
Within 61 meters (200 feet) of a fault displaced in Holocene time	New treatment, storage, or disposal of hazardous waste prohibited.	RCRA hazardous waste; treatment, storage, or disposal of hazardous waste.	Cal. Code Regs. tit. 22, § 66264.18(a)	Relevant and appropriate	Excavation and temporary storage of soil is evaluated. The substantive provisions of this requirement are not potentially applicable to the temporary staging pile because the excavated soil will not likely be RCRA hazardous waste. The substantive provisions are potentially relevant and

Table C-3: Potential Federal Location-Specific Applicable or Relevant and Appropriate Requirements Feasibility Study IA F1, Mare Island, Vallejo, California

Location	Requirement	Prerequisite	Citation [a]	Preliminary ARAR Determination	Comments
					appropriate because the temporary staging pile will hold soil likely contaminated at regulated levels. Therefore, the temporary staging pile will not be located within 61 meters of a fault displaced in Holocene time.

Notes:

a	Only the substantive provisions of the requirements cited in this table are potential ARARs
b	Statutes and policies, as well as 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 statues or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirement of the specific citations are considered potential ARARs
§	Section
ARAR	Applicable or relevant and appropriate requirement
Cal. Code Regs.	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
FS	Feasibility Study
RCRA	Resource Conservation and Recovery Act
U.S.C.	United States Code

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Table C-4: Potential State Location-Specific Applicable or Relevant and Appropriate Requirements Feasibility Study IA F1, Mare Island, Vallejo, California

Location	Requirement	Prerequisite	Citation [a]	Preliminary ARAR Determination	Comments
California Fish and Game Code [b]					
Fully protected birds	Fully protected birds or parts thereof may not be taken or possessed at any time.	A fully protected species must be potentially affected	Cal. Fish & Game Code § 3511	Relevant and Appropriate	The substantive provisions of this requirement are potentially relevant and appropriate because the white tailed kite and California clapper rail are fully protected birds that may be present at the site.
Waters of the state	Prohibits the passage of enumerated substances or materials into waters of the state deleterious to fish, plant life, or birds.	Discharge not authorized under Cal. Water Code § 13263 or a waiver issued pursuant to subdivision (a) of § 13269 of the Water Code.	Cal. Fish & Game Code § 5650(a), (b), and (c)	Relevant and appropriate	Cal. Fish & Game Code § 5650 is not applicable because the United States of America has not waived sovereign immunity for this State of California requirement. However, the Navy has agreed to comply with substantive provisions as potential relevant and appropriate ARARs.
Area with birds or mammals	It is unlawful to take birds or mammals with any net, pound, cage, trap, set line or wire, or poisonous substance, or to possess birds or mammals so taken, whether taken within or without this state.		Cal. Fish & Game Code §3005		The Navy has determined that Cal. Fish & Game Code § 3005(a) is not a state ARAR because it is not applicable or relevant and appropriate. The State of California, through CDFW-OSPR, asserts that Cal. Fish & Game Code §3005(a) is a state ARAR because it is relevant and appropriate. Whereas, the Navy and the State have not agreed upon whether Cal. Fish & Game Code §3005(a) is an ARAR, this FS report documents each party's position on the statute but does not attempt to resolve the issue. However, the State has determined that the proposed ecological cleanup levels would substantively comply with

Table C-4: Potential State Location-Specific Applicable or Relevant and Appropriate Requirements Feasibility Study IA F1, Mare Island, Vallejo, California

Location	Requirement	Prerequisite	Citation [a]	Preliminary ARAR Determination	Comments
					the requirement and provide an acceptable level of protectiveness, and the State does not intend to dispute the FS.
Area used by fully protected mammals	Fully protected mammals may not be taken at any time.	A fully protected species must be potentially affected.	Cal. Fish & Game Code § 4700	Relevant and appropriate	The substantive provisions of this requirement are potentially relevant and appropriate because the salt-marsh harvest mouse is a fully protected mammal that may be present at the site.
Area with bird nest or eggs	It is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto.	Bird nests or eggs on-site.	Cal. Fish & Game Code § 3503		The Navy has determined that Cal. Fish & Game Code § 3503 is not a state ARAR because it is not applicable or relevant and appropriate. The State of California, through CDFW-OSPR, asserts that Section 3503 is a state ARAR because it is relevant and appropriate. Whereas, the Navy and the State have not agreed upon whether Cal. Fish & Game Code § 3503 is an ARAR, this FS Report documents each party's position on the statute but does not attempt to resolve the issue. Nonetheless, the Navy agrees that it will undertake measures in order to generally avoid harm to nests and eggs when there is potential that they may be impacted by response action construction. The State will not dispute the selected remedy for failure to identify Cal. Fish & Game Code §

Table C-4: Potential State Location-Specific Applicable or Relevant and Appropriate Requirements Feasibility Study IA F1, Mare Island, Vallejo, California

Location	Requirement	Prerequisite	Citation [a]	Preliminary ARAR Determination	Comments
					3503 as an ARAR because the State has determined that the mutually agreed measures to generally avoid harm will result in substantive compliance with the state requirement.
Area with Falconiformes or Strigiformes	It is unlawful to take, possess, or destroy any birds in the orders Falconiformes or Strigiformes (birds-of-prey) or to take, possess, or destroy the nest or eggs of any such bird.	Falconiformes or Strigiformes birds on-site.	Cal. Fish & Game Code § 3503.5	Not an ARAR	The State withdraws its previous identification of this requirement as a potential state ARAR in light of Navy's identification of the substantive provisions of the Migratory Bird Treaty Act (MBTA) as a 'relevant and appropriate' federal ARAR for this action.
Area with fisher, marten, river otter, desert kit fox, and red fox	Fisher, marten, river otter, desert kit fox, and red fox may not be taken at any time.	A fisher, marten, river otter, desert kit fox, or red fox must be potentially harmed.	Cal. Code Regs. tit. 14, § 460		The Navy has determined that Cal. Code Regs. tit. 14 §460 is not a state ARAR because it is not applicable or relevant and appropriate. The State of California, through CDFW-OSPR, asserts that Cal. Code Regs. tit. 14 §460 is a state ARAR because it is relevant and appropriate. Whereas, the Navy and the State have not agreed upon whether Cal. Code Regs. tit. 14 §460 is an ARAR, this FS Report documents each party's position on the statute but does not attempt to resolve the issue. Nonetheless, the Navy agrees that it will undertake measures in order to generally avoid harm to fisher, marten, river otter, desert kit fox, and red fox when there is potential that they may

Table C-4: Potential State Location-Specific Applicable or Relevant and Appropriate Requirements Feasibility Study IA F1, Mare Island, Vallejo, California

Location	Requirement	Prerequisite	Citation [a]	Preliminary ARAR Determination	Comments
					be impacted by response action construction. The State will not dispute the selected remedy for failure to identify Cal. Code Regs. tit. 14 §460 as an ARAR because the State has determined that the mutually agreed upon measures to generally avoid harm will result in substantive compliance with the state requirement.
Area used by endangered or threatened species	No person shall take any endangered or threatened species.	Threatened or endangered species are present.	Cal. Fish & Game Code §2080	Relevant and Appropriate	The substantive provisions of this requirement are potentially relevant and appropriate because the salt-marsh harvest mouse and California clapper rail are state endangered species that may be present at the site.
Area used by endangered, threatened species	The department may authorize, by permit, the take of endangered species, threatened species, and candidate species if the take is incidental to an otherwise lawful activity and the impacts are minimized and fully mitigated.	Potential for incidental take of endangered, threatened, or candidate species.	Cal. Fish & Game Code §2081(b)	Relevant and appropriate	Pursuant to CERCLA § 121 (e) (42 USC Section 9621 [e]), on-site response actions are exempt from permit requirements. The substantive provisions of this requirement are potentially relevant and appropriate.
Area with rare or endangered native plants	No person shall take, possess, or sell within this state, except as incident to the possession or sale of the real property on	Endangered or rare native plant species must be present at site.	Cal. Fish & Game Code §1908	Relevant and appropriate	The substantive provisions of this requirement are potentially relevant and appropriate because the Mason's lilaeopsis may be present at IA F1.

Table C-4: Potential State Location-Specific Applicable or Relevant and Appropriate Requirements Feasibility Study IA F1, Mare Island, Vallejo, California

Location	Requirement	Prerequisite	Citation [a]	Preliminary ARAR Determination	Comments
	which the plant is growing, any native plant, or any part or product thereof, which the commission determines to be an endangered native plant or rare native plant.				
McAteer-Petris Act (California Government Code §§66600 through 66661)[a]					
Within the San Francisco Bay coastal zone	Reduce fill and disposal of dredged material in San Francisco Bay, maintain marshes and mudflats to the fullest extent possible to conserve wildlife, abate pollution, and protect the beneficial uses of the bay.	Activities affecting San Francisco Bay and 100 feet of the shoreline.	San Francisco Bay Plan at Cal. Code Regs. tit. 14, §§ 10110 through 11990	Relevant and appropriate	The remedial action selected would be consistent with the substantive provisions of the San Francisco Bay Plan.

Notes:

a Only the substantive provisions of the requirements cited in this table are potential ARARs

b 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 statues or policies as potential ARARs; specific potential ARARs are addressed in the table below each general heading; only substantive requirement of the specific citations are considered potential ARARs.

§ Section

ARAR Applicable or relevant and appropriate requirement

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Table C-5: Potential Federal Action-Specific Applicable or Relevant and Appropriate Requirements Feasibility Study, IA F1, Mare Island, Vallejo, California

Alternative 1: No Action; U2 – Institutional Controls and Asphalt Cap; W2 – Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland; U3 and W3 - Institutional Controls, Excavation, and Off-Site Disposal

Action	Requirement	Prerequisite	Citation	A	RA	TBC	Comments
Resource Conservation and Recovery Act (Title 42 U.S.C., Chapter 82, Sections 6901 to 6991[i]) [a]							
Construct a 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 regulated unit	Cal. Code Regs. tit. 22, § 66264.310(a)(5)		U2		The Navy has determined that this regulation is a potential ARAR for constructing a cap for the soil. This regulation is not applicable because the cap will not be constructed as one for a landfill waste management unit. Instead, the regulation is relevant and appropriate because the cap will be constructed solely to prevent exposure through contact with and ingestion of contaminants in the soil.
Construct a cover	Allows an engineered alternative to replace prescriptive cover standards at Cal. Code Regs. tit. 22, § 66264.228(e) through (r).	RCRA regulated unit	Cal. Code Regs. tit. 22, § 66264.310(a)(7)		U2		The Navy has determined that this regulation is a potential ARAR for constructing a cap for the soil. This regulation is not applicable because the cap will not be constructed as one for a landfill waste management unit. Instead, the regulation is relevant and appropriate because the cap will be constructed solely to prevent exposure through contact with and ingestion of contaminants in the soil.
Construct a 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 postclosure period.	RCRA regulated unit	Cal. Code Regs. tit. 22, § 66264.310(b)(1)		U2, W2		The Navy has determined that this regulation is a potential ARAR for constructing a cap for the soil. This regulation is not applicable because the cap will not be constructed as one for a landfill waste management unit. Instead, the regulation is relevant and appropriate because the cap will be constructed solely to prevent exposure through contact with and ingestion of contaminants in the soil. Relevant and appropriate for the cover over upland sediment relocation cover.
Construct a cover	Prevent run-on and runoff from eroding or otherwise damaging the final cover throughout the postclosure period.	RCRA regulated unit	Cal. Code Regs. tit. 22, § 66264.310(b)(4)		U2, W2		The Navy has determined that this regulation is a potential ARAR for constructing a cap for the soil. This regulation is not applicable because the cap will not be constructed as one for a landfill waste management unit. Instead, the regulation is relevant and appropriate because the cap will be constructed solely to prevent exposure through contact with and ingestion of contaminants in the soil. Relevant and appropriate for the cover over upland sediment relocation cover.
Construct a cover	Prescriptive landfill cover design standards.	RCRA regulated unit	Cal. Code Regs. tit. 22, § 66264.228(e) through (r)		U2		The Navy has determined that this regulation is a potential ARAR for constructing a cap for the soil. Only the substantive provisions that are necessary to protect public health, water quality or other environmental quality. This regulation is not applicable because the cap will not be constructed as one for a landfill waste management unit. Instead, the regulation is relevant and appropriate because the cap will be constructed solely to prevent exposure through contact with and ingestion of contaminants in the soil.

Table C-5: Potential Federal Action-Specific Applicable or Relevant and Appropriate Requirements Feasibility Study, IA F1, Mare Island, Vallejo, California

Alternative 1: No Action; U2 – Institutional Controls and Asphalt Cap; W2 – Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland; U3 and W3 - Institutional Controls, Excavation, and Off-Site Disposal

Action	Requirement	Prerequisite	Citation	A	RA	TBC	Comments
Construct a cover	Requires permanent disposal areas be graded with allowance for settling and subsidence so that the slope of the land surface prevents ponding of water.	RCRA regulated unit	Cal. Code Regs. tit. 22, § 66264.228(e)(13)		U2		The Navy has determined that this regulation is a potential ARAR for constructing a cap for the soil. This regulation is not applicable because the cap will not be constructed as one for a landfill waste management unit. Instead, the regulation is relevant and appropriate because the cap will be constructed solely to prevent exposure through contact with and ingestion of contaminants in the soil.
Construct a cover	All facilities and all cover systems and drainage control systems shall be designed to function without failure when subjected to capacity, hydrostatic, and hydrodynamic loads resulting from a 24-hour probable maximum precipitation storm.	RCRA regulated unit	Cal. Code Regs. tit. 22, § 66264.25(a)		U2		The Navy has determined that this regulation is a potential ARAR for constructing a cap for the soil. This regulation is not applicable because the cap will not be constructed as one for a landfill waste management unit. Instead, the regulation is relevant and appropriate because the cap will be constructed solely to prevent exposure through contact with and ingestion of contaminants in the soil.
Post-Closure Care	Postclosure care, after completion of closure of the unit and continuing for 30 years after that date, shall consist of at least the following: (A) monitoring in accordance with the requirements of articles 6, 11, 12, 13, and 14 of this chapter; and (B) maintenance and monitoring of waste containment systems in accordance with the requirements of articles 6, 11, 12, 13, and 14 of this chapter. Any time during the postclosure period, (A) shorten the postclosure care period, or (B) extend the postclosure care period, based on whether the postclosure period is sufficient to protect human health and the environment.	RCRA regulated unit	Cal. Code Regs. tit. 22, § 66264.117(b)(1) and (2)		U2		Substantive provisions are potentially relevant and appropriate for the asphalt cover until the site is protective of human health and the environment.
Resource Conservation and Recovery Act (Title 42 U.S.C., Chapter 82, Sections 6901 to 6991[i])[a]							
On-site waste generation	Person who generates waste shall determine whether that waste is a hazardous waste.	Generator of waste	Cal. Code Regs, tit. 22, §§ 66262.10(a), 66262.11	W2, U3, W3			These regulations are potentially applicable to the excavation of soil and the generation of waste. The Navy will determine whether the soil is RCRA hazardous waste when it is generated.
Excavate soil or generate waste	Requirements for analyzing waste for determining whether waste is hazardous.	Generator of waste	Cal. Code Regs. tit. 22, §§ 66264.13(a) and (b)	W2, U3, W3			These regulations are potentially applicable to the excavation of soil and the generation of waste. The Navy will determine whether the soil is RCRA hazardous waste when it is generated.
Waste piles	Allows generators to accumulate solid remediation waste in an EPC-designated pile for storage only, up to 2 years, during remedial operations without triggering LDRs.	Hazardous remediation waste temporarily stored in piles	40 CFR §§ 264.554(d)(1)(i-ii) and (d)(2), (e), (f), (h), (i), (j), and (k)		W2, U3, W3		The Navy will temporarily stockpile soil in staging piles for off-site disposal. The Navy does not anticipate that all soil would be RCRA hazardous waste; however, the Navy has determined that these requirements are relevant and appropriate for all stockpiled soil.
Close temporary soil staging pile	Minimize the need for further maintenance controls and minimize or eliminate, to the extent necessary to protect human health and the environment, postclosure escape of hazardous waste, hazardous constituents, leachate, contaminated rainfall or runoff, or waste decomposition	RCRA hazardous waste management facility	Cal. Code Regs. tit. 22, § 66264.111(a) and (b)		W2, U3, W3		These requirements are potential ARARs for closing the temporary soil stockpile.

Table C-5: Potential Federal Action-Specific Applicable or Relevant and Appropriate Requirements Feasibility Study, IA F1, Mare Island, Vallejo, California

Alternative 1: No Action; U2 – Institutional Controls and Asphalt Cap; W2 – Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland; U3 and W3 - Institutional Controls, Excavation, and Off-Site Disposal

Action	Requirement	Prerequisite	Citation	A	RA	TBC	Comments
	products to groundwater or surface water or to the atmosphere.						
Close temporary soil staging pile	At closure, owner shall remove or decontaminate all waste residues, contaminated containment system components, contaminated subsoils, and structures and equipment contaminated with waste and leachate, and manage them as hazardous waste. If waste is left on site, postclosure care shall be performed in accordance with the closure and postclosure care requirements that apply to landfills.	RCRA hazardous waste pile.	Cal. Code Regs. tit. 22, § 66264.258(a)		W2, U3, W3		These requirements are potential ARARs for closing the temporary soil stockpile.
Clean Air Act (Title 42 U.S.C. Sections 7401 to 7671) [a]							
Air emissions	For active storage units, contaminated soil shall be kept visibly moist by water spray, treated with a vapor suppressant, or covered with continuous heavy duty plastic sheeting or other covering to minimize emissions of organic compounds to the atmosphere. Covering shall be in good condition, joined at the seams, and securely anchored to minimize headspace where vapors may accumulate. The surface area not covered by plastic sheeting or other covering shall not exceed 6,000 square feet.	Storage of materials containing organic compounds in units	BAAQMD § 8-40-304	W2, U3, W3			The substantive provisions of this requirement are potential ARARs for excavation and handling of soil and sediment.
Air emsissions	A person shall not emit from any source for a period or periods aggregating more than 3 minutes in any hour a visible emission which is as dark as or darker than No. 1 on the Ringelmann Chart or of such opacity as to obscure an observer's view to an equivalent or greater degree.	Source emitting particulates to air.	BAAQMD Regulation 6-301	W2, U3, W3			The substantive provisions of this requirement are potential ARARs for excavation dust emissions.
Air emissions	Prohibits emissions equal to or greater than 20 percent opacity.	Emission from a source	BAAQMD Regulation 6-302	W2, U3, W3			The substantive provisions of this requirement are potential ARARs for excavation and handling soil and sediment.
Discharge of Dredged and Fill Material	Guidelines for specification of disposal sites for dredged material. The discharge must represent the least damaging, practicable alternative. The discharge of dredged material must not result in significant degradation of the aquatic ecosystem. All practicable means must be utilized to minimize adverse environmental impacts.	Discharge of dredged material to waters of the United States.	40 C.F.R. § 230.10(a), (c), and (d)	W2, W3			Substantive provisions will be used to comply with the testing requirements for the discharge of dredged and fill material.
Discharge of Dredged and Fill Material	Where the proposed discharge and dredging sites are adjacent and are comprised of similar materials and subject to the same sources of contaminants, disposal may be conducted without further testing because discharge is not likely to result in degradation of the discharge site, as long as the potential spread of contaminants to less contaminated areas can be prevented.	Discharge of dredged material to waters of the United States.	40 C.F.R. § 230.60(c)	W2, W3			Substantive provisions will be used to comply with the testing requirements for the discharge of fill material.

Table C-5: Potential Federal Action-Specific Applicable or Relevant and Appropriate Requirements Feasibility Study, IA F1, Mare Island, Vallejo, California

Alternative 1: No Action; U2 – Institutional Controls and Asphalt Cap; W2 – Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland; U3 and W3 - Institutional Controls, Excavation, and Off-Site Disposal

Action	Requirement	Prerequisite	Citation	A	RA	TBC	Comments
Discharge of dredged material to waters of the United States.	The discharge of dredged material may be conducted without further testing if constraints are available to reduce contamination to acceptable levels within the discharge site and to prevent contaminants from being transported beyond the proposed discharge site boundaries.	Discharge of dredged material to waters of the United States.	40 C.F.R. § 230.60(d)	W2, W3			Substantive provisions will be used to comply with the testing requirements for the discharge of fill material.
Discharge of dredged material to waters of the United States.	Evaluation and testing requirements for discharges of dredged material to waters of the United States.	Discharge of dredged material to waters of the United States.	40 C.F.R. § 230.61	W2, W3			Substantive provisions will be used to comply with the testing requirements for the discharge of fill material.
Discharge of dredged material to waters of the United States.	U.S. Army Corps of Engineers requirements for permitting discharges of dredged material to waters of the United States.	Discharge of dredged material to waters of the United States.	33 C.F.R. §§ 320–330	W2, W3			Substantive provisions will be used to comply with the testing requirements for the discharge of fill material.
Discharge to surface waters, including storm water	Owners and operators of construction activities must be in compliance with discharge standards, including substantive provisions of the general requirements for storm water plans and BMPs.	Construction activity that may result in discharges to surface water.	CWA Section 402 (33 U.S.C. ch. 26, § 1342) and 40 C.F.R. § 122.44(k)(2) and (4)	W2, U3, W3			Substantive provisions may be applicable for land disturbance of 1 or more acres.
Discharge to surface waters, including storm water	All direct dischargers meet technology-based requirements including the best control technology and the best available technology economically achievable.	Construction activity that may result in discharges to surface water.	CWA Section 301(b) (33 U.S.C. ch. 26, § 1311)	W2, U3, W3			Substantive provisions may be applicable for land disturbance of 1 or more acres.

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
ARAR	Applicable or relevant and appropriate requirements
BAAQMD	Bay Area Air Quality Management District
Cal. Code Regs.	*California Code of Regulations*
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	*Code of Federal Regulations*
EPA	U.S. Environmental Protection Agency
RCRA	Resource Conservation and Recovery Act
tit.	Title
U.S.C.	*United States Code*

Table C-6: Potential State Action-Specific Applicable or Relevant and Appropriate Requirements Feasibility Study IA F1, Mare Island, Vallejo, California

Alternative 1: No Action, U2 – Institutional Controls and Asphalt Cap , W2 – Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland, U3 and W3 - Institutional Controls, Excavation, and Off-Site Disposal							
Action	**Requirement**	**Prerequisite**	**Citation**	**A**	**RA**	**TBC**	**Comments**
Department of Toxic Substances Control[a]							
California Civil Code*							
Land-use controls	Provides conditions under which land-use restrictions will apply to successive owners of land.	Transfer property from the Navy to a nonfederal agency.	Cal. Civ. Code § 1471		U2, W2, U3, W3		Generally, Cal. Civ. Code § 1471 allows an owner of land to make a covenant to restrict the use of land for the benefit of a covenantee. The covenant runs with the land to bind successive owners, and the restrictions must be reasonably necessary to protect present or future human health or safety or the environment as a result of the presence on the land of hazardous materials, as defined in Cal. Health & Safety Code § 25260. Substantive provisions are the following general narrative standard: "to do or refrain from doing some act on his or her own land where each such act relates to the use of land and each such act is reasonably necessary to protect present or future human health or safety or the environment as a result of the presence of hazardous materials, as defined in Section 25260 of the California Health and Safety Code." This narrative standard would be implemented through incorporation of restrictive covenants in the deed and Environmental Restriction and Covenant Agreement at the time of transfer. See Section C4.2.1 for DTSC and U.S. EPA positions.
California Health and Safety Code*							
Land-use controls	Allows DTSC to enter into an agreement with the owner of a hazardous waste facility to restrict present and future land uses.	Transfer property from the Navy to a nonfederal agency.	Cal. Health & Safety Code § 25202.5		U2, W2, U3, W3		The substantive provisions of Cal. Health & Safety Code § 25202.5 are the general narrative standards to restrict "present and future uses of all or part of the land on which the . . . facility . . . is located . . ." See Section C4.2.1 for DTSC and U.S. EPA positions.
Land-use controls	Provides a streamlined process to be used to enter into an agreement to restrict specific use of property in order to implement the substantive use restrictions of Cal. Health & Safety Code § 25232(b)(1)(A)–(E).	Transfer property from the Navy to a nonfederal agency.	Cal. Health & Safety Code §§ 25221 and 25355.5(a)(1)(C)		U2, W2, U3, W3		Generally, Cal. Health & Safety Code §§ 25221 and 25355.5(a)(1)(C) provide the authority for the DTSC to enter into voluntary agreements with land owners to restrict the use of property. The agreements run with the land restricting present and future uses of the land. The substantive requirements of the following Cal. Health & Safety Code § 25221 provisions are "relevant and appropriate": (1) the general narrative standard: "restricting specified uses of the property…" and (2) "…the agreement is irrevocable, and shall be recorded by the owner, …as a hazardous waste easement, covenant, restriction or servitude, or any combination thereof, as appropriate, upon the present and future uses of the land." The substantive requirements of the following Cal. Health & Safety Code § 25355.5(a)(1)(C) provisions are "relevant and appropriate": "…execution and recording of a written instrument that imposes an easement, covenant, restriction, or servitude, or combination thereof , as appropriate, upon the present and future uses of the land."

Table C-6: Potential State Action-Specific Applicable or Relevant and Appropriate Requirements Feasibility Study IA F1, Mare Island, Vallejo, California

Alternative 1: No Action, U2 – Institutional Controls and Asphalt Cap , W2 – Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland, U3 and W3 - Institutional Controls, Excavation, and Off-Site Disposal							
Action	**Requirement**	**Prerequisite**	**Citation**	**A**	**RA**	**TBC**	**Comments**
Land use controls	Provides processes and criteria for obtaining written variances from a land-use restriction and for removal of the land use restrictions.	Transfer property from the Navy to a nonfederal agency.	Cal. Health & Safety Code §§ 25223 and 25224		U2, W2, U3, W3		Cal. Health & Safety Code § 25223(c) sets forth "relevant and appropriate" substantive criteria for granting variances based upon specified environmental and health criteria. Cal. Health & Safety Code § 25224 sets forth the following "relevant and appropriate" substantive criteria for the removal of a land-use restriction on the grounds that "…the waste no longer creates a significant existing or potential hazard to present or future public health or safety."
Construction and land disturbance	Most non-storm water discharges are prohibited. Requires BMPs, developing and implementing a stormwater pollution prevention plan, and monitoring of stormwater discharges. Contains numeric effluent limits and action levels.	Construction site that disturbs one or more acres of land.	SWRCB Order No. 2009-0009-DWQ, as amended by 2010-0014-DWQ (General Construction Activity Storm Water Permit)				Not an ARAR. Pursuant to CERCLA Section 121 (e) (42 USC Section 9621 [e]), on-site response actions are exempt from permit requirements, including an NPDES Permit. The State of California's General Construction Storm Water Permit (SWRCB Order No. 2009-0009-DWQ) is such a permit. Although not an ARAR in itself, Navy will implement the substantive provisions of this permit to comply with federal CWA ARARs and State water quality ARARs for discharge to surface water, if an acre or more of land is disturbed. The federal and State ARARs require BMPs and a storm water plan. The Navy will implement the BMPs and prepare a CERCLA Storm Water Plan which will include monitoring, sampling and analysis, and numeric effluent action levels and effluent limits as required under the State general storm water permit.

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
ARAR	Applicable or relevant and appropriate requirement
Cal. Code Regs.	*California Code of Regulations*
tit.	Title

ATTACHMENT C-1
ARARS Request Letter and Response

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DEPARTMENT OF THE NAVY
BASE REALIGNMENT AND CLOSURE
PROGRAM MANAGEMENT OFFICE WEST
1455 FRAZEE RD, SUITE 900
SAN DIEGO, CA 92108-4310

Ser BPMOW.JL\0450
APR 1 4 2010

CERTIFIED MAIL, RETURN RECEIPT REQUESTED

Ms. Janet Naito
California Environmental Protection Agency
Department of Toxic Substances Control (DTSC)
700 Heinz Avenue, Suite 200
Berkeley, CA 94710-2737

Dear Ms. Naito:

Subj: IDENTIFICATION OF STATE "APPLICABLE" OR "RELEVANT AND APPROPRIATE" REQUIREMENTS (ARARS) FOR THE REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (RI/FS) AT INVESTIGATION AREA F1, FORMER MARE ISLAND NAVAL SHIPYARD

Pursuant to our previous discussions and Navy policy, we are hereby requesting that the Department of Toxic Substances Control (DTSC) as the lead agency for the State of California, identify potential State ARARS for Investigation Area (IA) F1, former Mare Island Naval Shipyard (MINS). The Navy previously issued a ARARs request letter for IA F1 to the DTSC on January 6, 1999, however, a response was not received. ARARs identified by the State will be considered and evaluated during the preparation of the Remedial Investigation and Feasibility Study (RI/FS) for the site.

In the *Draft Final Remedial Investigation Report Installation Restoration Program Sites, Investigation Area F1, Former Mare Island Naval Shipyard, Vallejo, California* (ChaduxTt 2010), we transmitted to you site characterization data for IA F1. The site characterization data should allow you to begin to identify, with some specificity, State chemical-specific and location -specific ARARs.

The following information is being provided to aid the State in their identification of potential action-specific State ARARs. The following alternatives are proposed for IA F1.

No Remedial Action. This alternative provides a baseline against which other remedial action alternatives can be compared. Its evaluation is required by the NCP. Under this alternative, no remedial measures or institutional controls (ICs) would be implemented.

Institutional Controls – Deed Restrictions. Under this alternative, ICs in the form of deed restrictions would prohibit certain activities at IA F1.

Containment – In Situ Capping. Under this alternative, impacted soil would be left in place and capped. ICs would be necessary to protect the cap from potentially damaging activities.

Removal of Soil to an Off-site Landfill: Under this alternative, impacted soil would be excavated and transported to an off-site landfill.

The State of California may also identify any other criteria, advisories, guidance, and proposed standards that the State requests be considered (TBCs) for the above-identified IA F1, which has entered the RI/FS phase.

Timely identification of potential State ARARs is required under Section 121(d)(2)(A) of CERCLA and under the National Contingency Plan (NCP), 40 CFR §§300.400(g) and 300.515(d) & (h). Experience to date around the country has shown that a failure to identify ARARs with sufficient precision, early in the RI/FS process, can cause severe disruptions in timely implementation of remedial action. To ensure timely and complete ARARs identification, for IA F1, please include the following information:

1. A specific citation to the statutory or regulatory provision(s) for the potential State ARAR and the date of enactment or promulgation.

2. A brief description of why the potential State ARAR is applicable or relevant and appropriate to the particular site.

3. A description of how the potential State ARAR would apply to potential remedial action, including: specific numeric discharge, effluent, or emission limitations; hazardous substance/constituent action or cleanup levels; etc., if the State intends to take the position that the potential State ARAR includes such limitations, levels, etc.

4. If the State believes its proposed ARAR is more stringent than the corresponding Federal ARAR, please provide the rationale and technical justification for this position.

5. If the State determines that there is not enough information to fully respond to our request, please identify any additional information that would be required to support identification of State ARARs.

Consistent with 40 CFR §300.515(h)(2), we are requesting that you send a response via first class mail addressed to me and postmarked within 30 calendar days of receipt of this request. Please direct any technical questions that you may have concerning this request to me (619) 532-0967 and any legal questions to Mr. Edward Balsamo, Counsel, NAVFAC SW (619) 532-0910.

Sincerely,

MICHAEL S. BLOOM
BRAC Environmental Coordinator
By direction of the Director

Department of Toxic Substances Control

Linda S. Adams
Secretary for
Environmental Protection

Maziar Movassaghi
Acting Director
700 Heinz Avenue
Berkeley, California 94710-2721

Arnold Schwarzenegger
Governor

May 17, 2010

Anthony Megliola
Department of the Navy
BRAC Program Management Office West
1455 Frazee Road, Suite 900
San Diego, California 92108

Dear Mr. Megliola:

Thank you for the opportunity to provide Applicable or Relevant and Appropriate Requirements (ARARs) for the Remedial Investigation and Feasibility Study for Investigation Area F1 located along the southeastern shore of Mare Island along the Mare Island Strait. The ARARs listed in the enclosed table incorporate ARARs provided to DTSC by the California Department of Fish and Game and the San Francisco Bay Regional Water Quality Control Board. Thank you in advance for your consideration of the identified ARARs. If you have any questions, please contact me at (510) 540-3833 or jnaito@dtsc.ca.gov.

Sincerely,

Janet Naito
Senior Hazardous Substance Scientist

Enclosure

cc: See next page

cc: Ms. Elizabeth Wells (via electronic mail to: ewells@waterboards.ca.gov)
Regional Water Quality Control Board
San Francisco Bay Region
1515 Clay Street, Suite 1400
Oakland, California 94612

Ms. Carolyn d'Almeida (via electronic mail to: dAlmeida.Carolyn@epamail.epa.gov)
U. S. Environmental Protection Agency
413 Poppyfield Drive
American Canyon, California 94503

Ms. Dayna Yocum (via electronic mail to: dayna.yocum@ttemi.com)
Tetra Tech EM Inc.
135 Main Street, Suite 1800
San Francisco, California 94105

Tami Nakahara (via electronic mail to: tnakahar@ospr.dfg.ca.gov)
California Department of Fish and Game
Office of Spill Prevention and Response (OSPR)
1700 K Street, Suite 250
Sacramento, California 95811

No.	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered	Comments
1	Porter-Cologne Water Quality Control Act (California Water Code sections 13000, 13304, 13240, 13241, 13242, 13243) Water Quality Control Plan (Basin Plan) for San Francisco Bay Basin, RWQCB, SFB.	Chapter 2 - Beneficial Uses	Chapter 2 describes beneficial uses of surface and ground waters	Applicable	Applicable to define beneficial uses of surface water where treated effluent may be discharged or at locations where impacted ground water may be impacting surface water.
		Chapter 3 - Water Quality Objectives	Chapter 3 establishes water quality objectives, including narrative and numerical standards that protect the beneficial uses and water quality objectives of surface and ground waters in the region. Narrative objectives describe the water quality to attain via pollution control and form the basis for the numerical values. Numerical objectives are designed to limit the adverse effects of pollutants.	Applicable	Applicable where effluent is discharged to surface water or where groundwater discharges to surface water. Any activity, including, but not limited to the discharge of contaminated soils or water or in-situ treatment or containment of contaminated soils or waters, must not result in actual water quality exceeding water quality objectives.
		Chapter 4 - Implementation Plans	Chapter 4 describes implementation plans and other control measures designed to ensure compliance with statewide plans and policies and provide comprehensive water quality planning. Includes groundwater and surface water protection and management. Describes program goals, how water quality objectives are applied, and strategies for managing polluted sites.	Applicable	States that groundwater cleanup levels are established based upon the most sensitive beneficial use identified and that groundwater cleanup levels will be to background unless groundwater cleanup levels can be established based upon acceptable health risks. Requires groundwater monitoring to verify that groundwater is not polluted by chemicals remaining in soil.

No.	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered	Comments
2	Porter-Cologne Water Quality Control Act (California Water Code sections 13000 et seq.)	13307.1(c)	If the State Board or Regional Board finds that the property is not suitable for unrestricted use and that a land use restriction is necessary for the protection of public health, safety, or the environment, then the State Board and the Regional Boards may not issue a closure letter, or make a determination that no future action is required with respect to a site that is subject to a cleanup or abatement order pursuant to Section 13304 and that is not an underground storage tank site, unless a land use restriction is recorded or required to be recorded pursuant to Section 1471 of the Civil Code.	Applicable	The section of the Water Code is applicable to soil remedial actions.
		13243	The Regional Board may specify certain conditions or areas where the discharge of waste, or certain types of waste, will not be permitted.	Applicable	Applies to soil remedial action.

No.	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered	Comments
3	Porter-Cologne Water Quality Control Act (California Water Code sections 13000, 13140, 13263, 13304)	State Water Resources Control Board Resolution No. 68-16 Statement of Policy with Respect to Maintaining High Quality Waters in California ("Anti-Degradation Policy")	Requires that high quality surface and groundwater be maintained ot the maximum extent possible. Establishes policy that whenever the existing water quality is better than the quality established in policies as of the date on which such policies become effective, such existing high quality will be maintained until it has been demonstrated that any change will be consistent with the maximum benefit to the people of the State, won't unreasonably affect present and anticipated beneficial use of such water, and will not result in water quality less than prescribed in the policies. Discharges or proposed discharges to existing high quality waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge necessary to assure that a pollution or nuisance will not occur and the highest water quality consistent with the maximum benefit to the people of the State will be maintained.	Applicable	Applies to discharges of waste to waters, including discharges to soil that may affect surface or ground water. Applicable to sites where discharges of contaminants to the soil or soil action have potential to cause active discharges to surface waters and groundwater. In-situ cleanup levels for contaminanted soils must be set so that groundwater will not be degraded, unless degradation is consistent wiht the maximum benefit to the people of the state. If degradation is allowed, the discharge must meet best practical treatment or control standards, and result in the highest water quality possible consistent with the maximum benfit to the people of the state. In no case may water quality objectives be exceeded. In-situ cleanup levels for contaminated groundwaters must be set at background level, unless allowing contained degradation is consistent with the maximum benefit of the people of the State.

No.	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered	Comments
4	Porter-Cologne Water Quality Control Act (California Water Code sections 13000, 13140, 13240, 13260, 13263, 13267, 13300, 13304, 13307)	State Water Resources Control Board Resolution No. 92-49 ("Policies and Procedures for Investigation and Cleanup and Abatement of Discharges Under Water Code 13304")	Establishes requirements for investigation and cleanup and abatement of discharges. Among other requirements, dischargers must cleanup and abate the effects of discharges in a manner that promotes the attainment of either background water quality, or the best quality that is reasonable if background water quality cannot be restored. Requires the application of Title 23, CCR, section 2550.4 requirements to cleanups.	Applicable	Applies to all cleanups of wastes to soil that threatens or may affect the quality of ground or surface water. Applies to groundwater remedial actions. Applies to all cleanups where the quality of groundwater or surface water is threatened.
5	Porter-Cologne Water Quality Control Act (California Water Code sections 13000, 13140, 13240)	State Water Resources Control Board Resolution 88-63 ("Sources of Drinking Water Policy") (as contained in the Water Board's Water Quality Control Plan)	Specifies that, with certain exemptions, all ground and surface waters must have the beneficial use of municipal or domestic supply. SWRCB Resolution 88-63 applies to all sites that may be affected by discharges of waste to groundwater or surface water. The resolution specifies that, with certain exemptions, all groundwater and surface waters have beneficial uses of municipal or domestic supply. These exceptions include, among others, if: (1) the TDS exceeeds 3,000 mg/L, or (2) the water source does not provide sufficient water to supply a single well capable of producing an average sustained yield of 200 gallons per day.	Applicable	Applies in determining beneficial uses for waters that may be affected by discharges of waste. Applies to soil actions that will result in a discharge to groundwater or surface water.

No.	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered	Comments
6	Porter-Cologne Water Quality Control Act (California Water Code sections 13240, 13241, 13242, 13243)	RWQCB, SFB Basin Plan, "Discharge of Treated Groundwater;" RWQCB Resolution No. 88-160.	Urges the dischargers of extracted groundwater from groundwater cleanup projects to reclaim their effluents to the extent technologically and economically feasible, and if not technologically and economically feasible, urges discharge to POTWs. Where neither reclamation nor POTW discharge is technically or economically feasible, discharge in accordance whit NPDES requirements will be authorized by the Board.	Relevant and Appropriate	Applicable to all groundwater sites where groundwater extraction occurs. Board NPDES permitting requirements identified by the resolution are procedural and not ARARs.
7	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13267, 13304)	Title 27, California Code of Regulations (CCR), Division 2, Subdivision 1 (Section 20080 et seq.), Title 23, CCR, Division 3, Chapter 15 (Section 2510 et seq.)	Establishes waste and siting classification systems and minimum waste management standards for discharges of waste to land for treatment, storage, and disposal. Engineered alternatives that are consistent with Title 27/Title 23 performance goals may be considered. Establishes corrective action requirements for responding to discharges to land, including spills and leaks and other unauthorized discharges.	Applicable	Applies to all discharges of waste to land for treatment, storage, or disposal that may affect water quality. The application of some of the specific sections of Title 27/Title 23 to different situations is discussed below. Provisions of Title 23 apply to hazardous waste and provisions of Title 27 apply to designated and non-hazardous waste.
8	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13269)	Title 23, CCR, Section 2520, 2521	Requires that hazardous waste be discharged to Class I waste management units that meet certain design and monitoring standards.	Applicable	Applies to discharges to hazardous waste to land for treatment, storage or disposal.
9	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13269)	Title 27, CCR, Section, 20200(c), 20210	Requires that designated waste be discharged to Class I or Class II waste management units.	Applicable	Applies to discharges of designated waste (nonhazardous waste that could cause degradation of surface or ground waters) to land for treatment, storage, or disposal.

No.	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered	Comments
10	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13269)	Title 27, CCR, Section 20230	Requires that inert waste does not need to be discharged at classified units	Applicable	Applies to discharges of inert waste to land for treatment, storage, or disposal.
11	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13269)	Title 27, CCR, Section 20200(c), 20220	Requires that non-hazardous solid waste be discharged to a classified waste management unit.	Applicable	Applies to discharges of non-hazardous solid waste to land for treatment, storage or disposal.
12	Porter-Cologne Water Quality Control Act (California Water Code sections 13260, 13263, 13370.5, 13372, 13373, 13374, 13375, 13376, 13377, 13383).	40 CFR Parts 122, 123, 124, National Pollution Discharge Elimination System, implemented by California Storm Water Permit for Industrial Activities, State Water Resources Control Board Order #97-03-DWQ.	Regulates pollutants in discharge of storm water associated with hazardous waste treatment, storage, and disposal facilities, wastewater treatment plants, landfills, land application sites, and open dumps. Requirements to ensure storm water discharges do not contribute to a violation of surface water quality standards.	Applicable	Applies to storm water discharges from industrial areas. Includes measures to minimize and/or eliminate pollutants in storm water discharges and monitoring to demonstrate compliance.

No.	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered	Comments
13	Porter-Cologne Water Quality Control Act (California Water Code sections 13260, 13263, 13370.5, 13372, 13373, 13374, 13375, 13376, 13377, 13383).	40 CFR Parts 122, 123, 124, National Pollution Discharge Elimination System, implemented by State Water Resources Control Board Order No. 99-08 DWQ prior to 7/1/2010 and No. 2009-009-DWQ as of 7/1/2010 (Waste Discharge Requirements for Discharges of Storm Water Runoff Associated with Construction Activity).	Requires control of storm water runoff discharges at construction sites that are greater than 1 acre in size. Regulates pollutants in discharge of storm water associated with construction activity (clearing, grading, or excavation) involving the disturbance of one acre or more. Requirements to ensure storm water discharges do not contribute to a violation of surface water quality standards.	Applicable	Applies to construction areas of 1 acre in size. Includes measures to minimize and/or eliminate pollutants in storm water discharges and monitoring to demonstrate compliance.
14	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13267, 13304)	Title 27, CCR, Section 20800(g), Title 23, CCR, Section 2510(g)	Requires monitoring. If water quality is threatened, corrective action consistent with Title 27, Title 23 is required.	Applicable	Applies to areas of land where discharges had ceased as of November 27, 1984 (the effective date of the revised Title 27/Title 23 regulations).
15	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13267, 13304)	Title 27, CCR, Section 20090(d) Title 23 CCR, Section 2511(d)	Actions taken by public agencies to cleanup unauthorized releases are exempt from Title 27/Title 23 except that wastes removed from immediate place of release and discharged to land must be managed in accordance with classification (Title 27 CCR, Section 20200/Title 23 CCR, Section 2520) and siting requirements of Title 27 or Title 23 and wastes contained or left in place must comply with Title 27 or Title 23 to the extent feasible.	Applicable	Applies to remediation and monitoring of sites.

No.	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered	Comments
16	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13267, 13304)	Title 27, CCR, Section 20080(d), Title 23, CCR, Section 2510(d)	Requires closure of existing waste management units according to Title 27/Title 23.	Applicable	Applies to "existing" waste management units (i.e., areas where waste was discharged to land on or before November 27, 1984, but that were not closed, abandoned, or inactive prior to that date).
17	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13269)	Title 27, CCR, Section 21400, Title 23, CCR, section 2582.	Requires surface impoundments to be closed by removing and treating all free liquid and either removing all remaining contamination or closing the surface impoundment as a landfill.	Applicable	if water quality is threatened, this section is relevant and appropriate for natural topographic depressions, excavations, and diked areas where wastes containing free liquids were discharged.
18	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13267, 13269)	Title 27, CCR, sections 20385-20435, Title 23, CCR, section 2550	Applicable where groundwater monitoring is required under 2510 or 2511 of Chapter 15 (and equivalent for Title 27), applies to authorized waste management units as well as unauthorized discharges of waste to land and to closed, abandoned or inactive units	Applicable	Applies to all areas in which waste has been discharged to land to determine the threat to water quality.
19	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13267, 13269)	Title 27, CCR, Section 20385, Title 23, CCR, Section 2550.1	Requires detection monitoring. Once a significant release has occurred, evaluation, or corrective action monitoring is required.	Applicable	Applies to all areas in which waste has been discharged to land to determine the threat to water quality.
20	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13267, 13269)	Title 27, CCR, Section 20390, Title 23, CCR, Section 2550.2	Requires establishment of a water quality protection standard consisting of a list of constituents of concern, concentration limits, compliance monitoring points and all monitoring points. This section further specifies the time period that the standard shall apply.	Applicable	Applies to all areas in which waste has been discharged to land where groundwater is threatened.

No.	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered	Comments
21	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13267, 13269)	Title 27, CCR, Section 20395, Title 23, CCR, Section 2550.3	Requires development of a list of constituents of concern, which include all waste constituents that are reasonably expected to be present in the soil from discharges to land, and could adversely affect water quality.	Applicable	Applies to all areas in which waste has been discharged to land where groundwater is threatened.
22	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13267, 13269)	Title 27, CCR, Section 20400, Title 23, CCR, Section 2550.4	Concentration limits must be established for groundwater, surface water, and the unsaturated zone. Must be based on background, equal to background, or for corrective actions, may be greater than background, not to exceed the lower of the applicable water quality objective or the concentration technologically or economically achievable. Specific factors must be considered in setting cleanup standards above background levels.	Applicable	If water quality is threatened, this section applies in setting soil cleanup levels for all cleanups of discharges of waste to land. Applies in setting groundwater cleanup levels for all discharges of waste to land.
23	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13267, 13269)	Title 27, CCR, Section 20405, Title 23, CCR, section 2550.5	Requires identification of the point of compliance, hydraulically down gradient from the area where waste was discharged to land.	Applicable	Applies to all areas in which waste has been discharged to land where groundwater is threatened.
24	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13267, 13269)	Title 27, CCR, section 20410, Title 23, CCR, Section 2550.6	Requires monitoring for compliance with remedial action objectives for three years from the date of achieving cleanup levels.	Applicable or Relevant and Appropriate	Applicable for groundwater remedial actions. Relevant and Appropriate for all soil cleanup activities.
25	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13267, 13269)	Title 27, CCR section 20415, Title 23, CCR, section 2550.7	Requires general soil, surface water, and groundwater monitoring.	Relevant and Appropriate	Applies to all areas in which waste has been discharged to land.

No.	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered	Comments
26	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13267, 13269)	Title 27, CCR, section 20420, Title 23, CCR, section 2550.8	Requires detection monitoring to determine if a release has occurred.	Applicable	Applies to all areas where waste has been discharged to land and groundwater is threatened.
27	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13267, 13269)	Title 27, CCR, section 20425, Title 23, CCR, Section 2550.9	Requires an assessment of the nature and extent of the release, including a determination of the spatial distribution and concentration of each constituent.	Applicable	Applies to sites at which monitoring results show statistically significant evidence of a release.
28	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13267, 13269)	Title 27, CCR, Section 20430, Title 23, CCR, section 2550.10	Requires implementation of corrective action measures that ensure that cleanup levels (i.e., water quality protection standards established under section 2550.2) are achieved throughout the zone affected by the release by removing the waste constituents or treating them in place. Source control may be required. Also requires monitoring to determine the effectiveness of the corrective actions.	Applicable or Relevant and Appropriate	Applicable for groundwater remedial actions. If water quality is threatened, this section applies to soil cleanup activities.
29	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13267, 13269)	Title 27, CCR, section 20950; 22207(a); 22212(a); and 22222. Title 23, CCR, section 2550.0(b); 2580; 2580(f).	General closure requirements, including continued maintenance of waste containment, drainage controls, and groundwater monitoring throughout the closure and post-closure maintenance periods.	Applicable	Applies to partial or final closure of waste management units.

No.	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered	Comments
30	Porter-Cologne Water Quality Control Act (California Water Code sections 13140-13147, 13172, 13260, 13263, 13267, 13269, 13304)	Title 27, CCR, section 21090	Requires a final cover for landfills constructed in accordance with specific prescriptive standards, to be maintained as long as wastes pose a threat to water quality.	Relevant and Appropriate	If waste quality is threatened, this section is relevant and appropriate for waste contained or left in place at the end of remedial actions that could affect water quality. Includes closure of landfills and other areas where wastes have been discharged to land.
31	Porter-Cologne Water Quality Control Act (California Water Code section 13000 et seq.)	California Water Code section 13304.1(a)	Requires that a groundwater cleanup system that is required to obtain a discharge permit from the regional board and that discharges treated groundwater to surface water or groundwater, shall treat the groundwater to standards approved by the regional board, taking into account the beneficial uses of the receiving water, the location of the discharge, and the method by which the discharge takes place.	Relevant and Appropriate	Applies to groundwater remedial actions
		California Water Code section 13243	The RWQCB may specify certain conditions or areas where the discharge of waste, or certain types of waste, will not be permitted.	Applicable	Applies to groundwater remedial actions
32	California Safe Drinking Water Act (California Health and Safety Code section 4010 et seq.	Title 22, CCR, section 64400 et seq.	Requirements for public water systems. Includes Maximum Contaminant Levels (MCLs) and Secondary Maximum Contaminant Levels (SMCLs).	Relevant and Appropriate	The act is legally applicable for an aquifer and associated distribution and pre-treatment systems currently defined as a "public water system." If it is only a potential "public water system," then the act is relevant and appropriate.

No.	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered	Comments
33	Staff report of the RWQCB, Central Valley Region	"A Compilation of Water Quality Goals"	Provides guidance on selecting numerical values to implement narrative water quality objectives contained in the Basin Plan.	To Be Considered	Performance Standard. To be considered in selecting appropriate numerical values to implement the Basin Plan for setting cleanup levels and discharge limits. The numerical values contained in the staff report may be ARARs, or Performance Standards, depending on the source of the values.
34	California Toxics Rule	40 CFR 131.38	Contains criteria for priority toxic pollutants in the State of California for inland surface waters and enclosed bays and estuaries, except in those waters subject to objectives in the Regional Board's 1995 Basin Plan.	Relevant and Appropriate	Applies to groundwater remedial actions.
35	Technical Document prepared by San Francisco Regional Water Quality Control Board Staff	"Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater," (Interim Final November 2007; revised May 2008)	Provides guidance on selecting numerical values to implement narrative water quality objectives contained in the Basin Plan.	To Be Considered; Relevant and Appropriate	This performance standard is to be considered in selecting numerical values to implement the Basin Plan for setting cleanup levels and discharge limits. The numerical values contained in the staff report may be ARARs or Performance Standards, depending on the source of the values.
36	Porter-Cologne Water Quality Control Act (California Water Code)	section 13304.2	Requires the assessment of potential human health or ecological risks caused or created by the discharge using human health and environmental screening levels or a site-specific assessment of risks. Risk assessments consider all media pathways including, but not limited to, drinking water, food, ambient and indoor air, and soil.	Applicable	

California Department of Fish and Game ARARs and TBCs

No.	Source	Standard, Requirement, Criterion, or Limitation	Description
1	Fish and Game Code section 5650(a), (b) & (f)	Action must be taken if toxic materials are placed where they can enter waters of the State. There can be no release that would have a deleterious effect on species or habitat.	This code section prohibits depositing or placing where it can pass into waters of the state any petroleum products (Section 5650(a)(1)), factory refuse (section 5650(a)(4)), sawdust, shavings, slabs or edgings (section 5650(a)(3)), and any substance deleterious to fish, plant life or bird life (section 5650(a)(6)). These are substantive, promulgated environmental protection requirements. These requirements impose strict criminal liability on violators. (*People v. Chevron Chemical Company (1983) 143 Cal. App. 3d 50*). This imposition of strict criminal liability imposes a standard that is more stringent than federal law. The extent to which each section 5650 is relevant and appropriate depends on the site characterization of IA F1 and potential for contaminants to enter state waters.
2	Fish and Game Code section 3005 (Stats. 1957, c. 456, p. 1353 section 3005)	Action must be taken to prohibit the taking of birds and mammals, including taking by poison.	This code section prohibits the taking of birds and mammals, including taking by poison. "Take" is defined by Fish and Game Code section 86 to include killing. "Poison" is not defined in the code. Although there is no state authority on this point, federal law recognizes that poison, such as Strychnine, may effect incidental taking. (*Defenders of Wildlife v. Administrator, Environmental Protection Agency (1989) 882. F. 2d. 1295).* This code section imposes a substantive, promulgated environmental protection requirement and is relevant and appropriate to the remedial actions at IA F1.
3	Fish and Game Code section 1908 (Added by Stats. 1977, c. 1181, p. 3869, section 8).	Action must be taken to conserve native plants, there can be no releases and/or actions that would have a deleterious effect on species or habitat.	Section 1908 imposes a substantive requirement by forbidding any "person" to take rare or endangered native plants. California Code of Regulations Title 14 section 670.2 provides a listing of the plants of California that have been declared to be Endangered, Threatened or Rare. Fish and Game Code section 67 provides the definition of "person" as any natural person or any partnership, corporation, limited liability company, trust, or other type of association. Whether the federal government or contractors acting on behalf of the federal government would fall within that definition is a potential issue. To the extent that there are rare or endangered plants on site, such as Mason's lilaeopsis (*Lilaeopsis masonii*) and chaparral ragwort (*Senecio aphanactis*), section 1908 would be an ARAR.
4	Fish and Game Code section 2080 (Added by Stats. 1984, c. 1240, section 2).	Action must be taken to conserve endangered species, there can be no releases and/or actions that would have a deleterious effect on species or habitat.	This section prohibits the take, possession, purchase or sell within the state, any species (including rare native plant species), or any product thereof, that the commission determines to be an endangered or threatened species, or the attempt of any of these acts. This section is relevant and appropriate to the extent that there are endangered or threatened species in the area, such as the salt marsh harvest mouse, California Clapper Rail, California Black Rail, longfin smelt, and delta smelt, which have the potential of being affected if actions are not taken to avoid take of the species. This section prohibits releases and/or actions that would have a deleterious effect on species or their habitat. This section and applicable Title 14 regulations should be considered as ARARs.

No.	Source	Standard, Requirement, Criterion, or Limitation	Description
5	Fish and Game Code section 3511 (Added by Stats. 1970, c. 1036, p. 1848 section 4)	Action must be taken to prevent the taking of fully protected birds.	This section provides that it is unlawful to take or possess any of the following fully protected birds: a) American Peregrine Falcon; b) Brown Pelican; c) California Black Rail; d) California Clapper Rail; e) California Condor; f) California Least Tern; g) Golden Eagle; h) Greater Sandhill Crane; i) Light-footed Clapper Rail; j) Southern Bald Eagle; k) Trumpeter Swan; l) White-tailed Kite; and m) Yuma Clapper Rail. This should be considered relevant and appropriate to the extent that such fully protected birds, including the American Peregrine Falcon, Brown Pelican, California Black Rail, California Clapper Rail, Golden Eagle, and White-tailed Kite, and/or their habitat are detected on or near the site.
6	Fish and Game Code section 4700 (added by Stats. 1970, c. 1036, p. 1848 section 6).	Actions must be taken to assure that no fully protected mammals are taken or possessed at any time.	This section prohibits the take or possession of any of the fully protected mammals or their parts. The following are fully protected mammals: a) Morro Bay kangaroo rat; b) Bighorn sheep except Nelson bighorn sheep; c) Northern elephant seal; d) Guadalupe fur seal; e) Ring-tailed cat; f) Pacific right whale; and g) Salt-marsh harvest mouse; h) Southern sea otter; and i) Wolverine. This section is relevant and appropriate to the extent that salt marsh harvest mouse and their habitat are located on or near the site.
7	Fish and Game Code section 3503.	Action must be taken to avoid the take or destruction of the nest or eggs of any bird.	This section prohibits the take, possession, or needless destruction of the nest or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto. This section is relevant and appropriate to the extent that birds and their habitat are located on or near the site.
8	Fish and Game Code section 3503.5 (Added by Stats. 1985, c. 1334, section 6).	Action must be taken to prevent the take, possession, or destruction of any birds-of-prey or their eggs.	This section prohibits the take, possession, or destruction of any birds in the orders of Falconiformes or Strigiformes (birds-of-prey) or to take, possess, or destroy the nest or eggs of any such bird except as otherwise provided by this code or any regulation adopted pursuant thereto. This section will be relevant and appropriate to the extent that species, such as Osprey, Northern Harrier, Red-tailed Hawk, and Western Burrowing Owl, or their eggs are located on or near the site.
9	Title 14 CCR section 460 (effective 07/01/59)	Action must be taken to avoid take	Regulation makes it unlawful to take Fisher, marten, river otter, desert kit fox, and red fox. This section is relevant and appropriate to the extent that red fox and their habitat are located on or near the site.

DTSC ARARs and TBCs

No.	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered
1	22 CCR § 66261.21, 66261.22(a)(1-2), 66261.23, 66261.24(a)(1) and 66261.100	Hazardous Waste Determination Requirements	Criteria for determining whether waste exhibits hazardous waste characteristics.	Applicable for wastes generated.
2	22 CCR §§ 66261.3(a), 66261.22(a)(3) and (a)(4), 66261.24(a)(2)-(a)(8) and 66261.101,	Waste Classification Requirements for non-RCRA hazardous waste	Criteria for determining whether excavated media exhibits non-RCRA hazardous waste characteristics (i.e., California-only waste).	Applicable for wastes generated.
3	27 CCR §2023(a) and (b)	Inert Waste Classification	Criteria for determining whether excavated media exhibits inert waste characteristics and presents disposal restrictions.	Applicable for wastes generated.
4	22 CCR §§ 66267.10	Definition of Waste	Defines a used or fired military munition a waste, and, therefore, potentially subject to corrective action authorities under sections 25200.10 and 25187 of the Health and Safety Code if the munition lands off-range and is not promptly rendered safe and/or retrieved.	Relevant and Appropriate
5	27 CCR §§ 20210, 20220, and 20230	Waste Classification Requirements	Criteria for determining whether excavated media is designated, nonhazardous solid, or inert waste.	Applicable
6	22 CCR § 66268.7(a)	Land Disposal Restrictions	Criteria for determining whether waste is subject to land disposal restrictions. Identifies requirements for testing, tracking, and recordkeeping of hazardous wastes subject to land disposal restrictions.	Applicable
7	22 CCR, Chapter 12 and Chapters 15 and 18	Hazardous Waste Generator Requirements	On-site hazardous waste accumulation requirements are applicable if hazardous waste is generated and accumulated onsite before transport. Applicable for offsite disposal of generated waste disposed of to landfills.	Applicable
8	22 CCR § 66262.10(a) and 66262.11	Hazardous Waste Determination Requirement	Requires person who generates waste to determine if that waste is a hazardous waste. Applicable for any operation where hazardous waste is generated. Applicable for removal and off-site disposal of any generated waste.	Applicable
9	22 CCR § 66264.13(a) and (b)	Onsite Waste Generation	Specifies requirements for analyzing waste to determine whether waste is hazardous.	Applicable
10	22 CCR § 66262.34	Hazardous Waste Accumulation	Allows onsite hazardous waste accumulation for up to 90 days, as long as the waste is stored in containers in accordance with §66262.171-178 or in tanks, on drip pads, inside buildings, is labeled and dated, etc. Applicable for removal and offsite disposal of any generated waste.	Applicable

No.	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered
11	22 CCR § 66268.40 and 66268.42	Placement of Waste in Land Disposal Units	Movement of excavated materials to a new location and placement in or on land will trigger land disposal requirements for the excavated waste or closure requirements for the unit in which the waste is being placed. Applicable if wastes are determined to be RCRA wastes and disposed of off-site.	Applicable
12	HSC §§ 25187, 25200, 25200.10 and 25316	Corrective Action Management Unit (CAMU)	Specifies performance standards for CAMUs. May be applicable if the remedy involves consolidation or capping.	Applicable
13	22 CCR § 66264.552(c) and (e)	Corrective Action Management Unit (CAMU)	An area at a RCRA facility maybe designated a CAMU. May be applicable if the remedy involves consolidation or capping.	Applicable
14	HSC, Chapter 6.5, Article 2, section 25123.3	Remediation Waste Staging and On-Site Storage	Defines requirements for onsite storage of non-RCRA hazardous waste soil prior to onsite treatment or offsite transportation and is applicable if non-RCRA hazardous waste soil is accumulated and stored onsite.	Applicable
15	22 CCR §67391.1	Covenants to Restrict Use of Property - Environmental Restrictions	Defines requirements for establishing land use covenants imposing limitations on land use when hazardous materials, hazardous waste or constituents, or hazardous substances will remain at the property at levels which are not suitable for unrestricted use of the land.	Applicable
16	HSC §25202.5	Covenants to Restrict Use of Property - Environmental Restrictions	Allows DTSC to enter into an agreement with the owners of a hazardous waste facility to restrict present and future land uses.	Applicable
17	HSC §25221.1 and 25355.5(a)(1)(C)	Covenants to Restrict Use of Property - Environmental Restrictions	Allows DTSC to enter into voluntary agreements with land owners to restrict the use of property. The agreements run with the land restricting present and future uses of the land.	Applicable
18	HSC §25233(c) and 25234	Covenants to Restrict Use of Property - Environmental Restrictions	Provides the process and criteria for obtaining written variances from land use restrictions and for termination of land use restrictions.	Applicable
19	Cal. Civil Code §1471	Covenants to Restrict Use of Property - Environmental Restrictions	Allows DTSC to enter into voluntary agreements with land owners to restrict the use of property. The agreements run with the land restricting present and future uses of the land.	Applicable
20	HSC § 25355.2	Financial Assurance Requirements	If operation and maintenance activities are required as part of the selected remedy, financial assurance must be provided throughout the time necessary to complete all required operation and maintenance activities. This is applicable if the property is sold or transferred in the future to a non-governmental entity.	Relevant and Appropriate
21	HSC § 25358.9	Exclusion from Hazardous Waste permitting requirements	Excludes onsite work from certain permitting requirements if the work is being conducted pursuant to a removal action workplan or remedial action plan and the cleanup complies with all applicable laws, rules, regulations, standards and requirements.	Relevant and Appropriate

No.	Source	Standard, Requirement, Criterion, or Limitation	Description	ARARs, or To Be Considered
22	8 CCR §5192	Health and Safety for Onsite Workers	Workers involved in hazardous substance operations associated with cleanup of sites must perform these operations in accordance with the health and safety requirements of Cal/OSHA.	Applicable
23	BAAQMD Regulation 8-40	Soil Stockpiling regulations	Requirements for soil stockpiling. Applicable if soil is accumulated and stored onsite.	Applicable
24	BAAQMD Regulation 8, Organic Compounds	VOC emissions	Rule 40-300 contains standards for VOC emissions from soil remediation operations.	Applicable
25	BAAQMD Regulation 6, Particulate Matter	Particulate emissions	Limits the quantity of particulate matter in the atmosphere by controlling emission rates, concentration, visible emissions and opacity.	Applicable
26	BAAQMD, CEQA Guidelines	Dust control	Describes potential feasible control measures for dust mitigation.	To Be Considered
27	14 CCR Div. 7, Ch. 3, Article 7.8, Section 17760	Solid waste disposal sites	Solid waste disposal sites not subject to requirements for Municipal Solid Waste Landfills in Section 17258 (contains requirements for cover, slope, and revegetation.	Applicable
28	Public Resources Code Sections 30000-30900; 14 CCR, Parts 13001-13666.4	California Coastal Act of 1976	Regulates activities associated with development to control direct significant impacts on coastal waters and to protect state and national interests in California coastal resources.	Applicable
29	Government Code, Title 7.2.	The McAteer-Petris Act	Regulates activities to fill, to extract materials, and to make substantial changes in use of land, water or existing structures in the Bay	Applicable to activities within 100-foot shoreline band.
30	SF Bay Conservation and Development Commission	Living with a Rising Bay: Vulnerability and Adaptation in San Francisco Bay and on its Shoreline, dated 4/7/2009	Provides information and proposed revisions to the San Francisco Bay Plan to address climate change issues.	To Be Considered

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ATTACHMENT C-2
California Department of Fish and Wildlife Correspondence Letters

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DEPARTMENT OF THE NAVY
OFFICE OF THE GENERAL COUNSEL
COUNSEL FOR
NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
1220 PACIFIC HIGHWAY ROOM 250
SAN DIEGO, CA 92132-55189

5800
Ser 5724/09C.RC/MW
June 16, 2009

Ms. Wendy Johnson, Staff Counsel II
Office of Spill Prevention and Response
California Department of Fish and Game
1700 K Street, Suite 250
Sacramento, CA 95811

Re: California Department of Fish and Game Laws and Regulations

Dear Ms. Johnson:

Over the past several months, the California Department of Toxic Substances Control (DTSC) and Department of Fish and Game (CDF&G) have provided the United States Department of Navy (DoN) with lists of State of California "takings" statutes and regulations that have been identified by CDF&G as potential State "applicable or relevant and appropriate requirements" (ARARs) for DoN cleanups pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP)(40 CFR Part 300). The lists have included, *inter alia*, California Fish and Game Code Sections 1908, 2080, 3003.1, 3005(a), 3503, 3503.5, 3511, 3513, 3800(a), 4002, 4150, 4700, 4750, 4800, 5050, 5515, and 8500, and Cal. Code Regs. title 14 Sections 40, 460, 465, and 472.

These lists have been provided to DoN for both BRAC and active installations. DoN has subsequently proposed to reject several of these requirements as potential ARARs and this has, in turn, generated additional CDF&G commentary. The purpose of this letter is to set forth DoN's general response to these lists and comments and offer a proposed resolution.

As an initial matter, DoN believes that it is valid to question whether any of the "takings"-based requirements identified by the State qualify as State ARARs under federal law for reasons set forth below. Nonetheless, DoN is willing to exercise its discretion to accept the State laws and regulations that protect federal and/or state endangered, threatened, rare, or fully protected species as State ARARs (California Fish and Game Code Sections 1908, 2080, 3511, 4700, 5050, and 5515). DoN is willing to do so because it supports the State's policies of providing special protections to specified fish, wildlife, and plant species because of their special ecological, educational, historical, recreational, esthetic, economic, and scientific value to the people of this state. See Fish

and Game Code Sections 2051 and 2052. This is consistent with and supports DoN's requirements for adequately addressing ecological risk and protection of the environment. However, DoN does not believe that this policy is served by other State "takings" laws and regulations that apply to species that have not been identified by the State as warranting the special protections afforded by the State laws and regulations protecting federal and/or state endangered, threatened, rare, or fully protected species.[1]

The following discussion addresses the question of whether or not the "takings" laws and regulations identified by CDF&G may qualify as State ARARs. CERCLA provides that a federal or State law or regulation must be an environmental or facility siting law or regulation in order to qualify as an ARAR. DoN must also evaluate whether a particular federal or state law or regulations is "applicable" or "relevant and appropriate" in order to determine whether or not it constitutes an ARAR (See Section 121(d) of CERCLA). In addition, a State requirement must be more stringent than its federal counterpart(s) in order to be accepted as a State ARAR.

Environmental or Facility Siting Requirement.

DoN has reviewed the laws and regulations identified by CDF&G and has concluded that California Fish and Game Code Sections 1908, 2080, 3511, 4700, 5050, and 5515 are environmental laws and regulations addressing environmental protection and satisfy this threshold CERCLA ARAR requirement. DoN has also concluded that the California Fish and Game Code Sections 3003.1, 3005(a), 3503, 3503.5, 3513, 3800(a), 4002, 4150, 4750, 4800, and 8500, and Cal. Code Regs. title 14 Sections 40, 460, 465, and 472 regulate hunting, fishing, trapping, commercial trade, and wildlife management activities (e.g., use of pest and predator control poisons) and are not environmental requirements. DoN further reviews below whether or not these requirements would otherwise qualify as State ARARs if they were deemed to be environmental requirements.

Applicable:

DoN has addressed the potential applicability of all of the statutory provisions and regulations cited above and determined that there has been no waiver of sovereign immunity for those requirements under the federal Endangered Species Act, and that they are, therefore, not "applicable" ARARs. The text of several of our recent proposed ARAR determinations was not clear on this point so DoN will clarify its determinations to make it clear that DoN is referring to the lack of waiver in the federal Endangered Species Act rather than CERCLA.

In making this assertion, DoN does not mean to suggest that there is *no* waiver of sovereign immunity within CERCLA, or that, accordingly, the Navy would never under

[1] DoN notes that the Court in DFG v. Anderson-Cottonwood Irrigation District, 8 Cal.App.4th 1554, 11 Cal.Rptr.2d 222 (1992) analyzed "take" under the Fish and Game Code specifically with respect to a state-listed endangered species, and, accordingly, believes the holding must be considered dicta with respect to Code sections concerning non-listed species.

any circumstances have to comply with certain State requirements. For example, DoN acknowledges that the United States is potentially liable under CERCLA to the same extent as non-governmental entities, as discussed in Shell Oil Company, 294 F.3d 1045 (Ninth Cir. 2002). Furthermore, DoN of course acknowledges the need to comply with ARARs per Section 121(d) of CERCLA. We trust this clarification will satisfy any concerns CDF&G has expressed in its comments with respect to the question of sovereign immunity generally.

Relevant and Appropriate:

DoN has evaluated each specific requirement identified by CDF&G pursuant to the eight factors for determining whether or not a requirement is "relevant and appropriate" that are set forth in 40 CFR Section 300.400(g)(2) of the NCP.[2] DoN has determined that several of the statutory provisions and regulations identified by CDF&G are not potentially "relevant and appropriate", because they do not address problems or situations sufficiently similar to the circumstances of the release or response action alternatives and are not well-suited to the site based upon the pertinent provisions of Subsections 300.400(g)(2)(i) and (iv) of the NCP. These requirements are California Fish and Game Code Sections 3003.1, 3005(a), 3503, 3503.5, 3513, 3800(a), 4002, 4150, 4750, 4800, and 8500, and Cal. Code Regs. title 14 Sections 40, 460, 465, and 472.

DoN has also determined that other provisions identified by CDF&G do constitute potential State ARARs based upon the criteria set forth in Subsection 300.400(g)(2)(viii) of the NCP if they satisfy other CERCLA and NCP requirements for identification of State ARARs. These requirements are California Fish and Game Code Sections 1908, 2080, 3511, 4700, 5050, and 5515.[3]

The requirements of Fish and Game Code Sections 3003.1, 3005(a), 3503, 3503.5, 3513, 3800(a), 4002, 4150, 4750, 4800, and 8500, and Cal. Code Regs. title 14 Sections 40, 460, 465, and 472 are not "relevant and appropriate" based upon Section 300.430(g)(2)(i) and (iv) of the NCP for the following reasons. CERCLA response actions are intended to respond to releases of hazardous substances in order to protect human health and the environment including environmental receptors such as the species addressed in the statutory provisions and regulations cited by CDF&G.

In contrast, the purpose of the State statutory provisions and regulations cited above are to regulate and set forth conditions for the "taking" of the species addressed by those requirements in the course of traditional hunting, fishing, trapping, commercial trade, and wildlife management activities (e.g., use of pest and predator control poisons).

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[2] Note that there is no requirement in Subsection 300.400(g)(2) of the NCP that the Navy make specific findings for each of the eight factors listed in Subsection 300.400(g)(2)(i) through (viii) for each potential State ARAR). The factors are to be examined "where pertinent," with pertinence "depending, in part, on whether a requirement addresses a chemical, location, or action."

[3] The Navy notes that these laws and regulations would not constitute ARARs if the species addressed by the requirements are not present at a site.

Moreover, that purpose is achieved through the regulation of intentional conduct directed at the species as opposed to incidental "take" (or possession, etc.) of species in the course of lawful activity.[4] The focus on intentional conduct is not well-suited to the circumstances at CERCLA sites, where any potential injury to the species addressed by these requirements (assuming *arguendo* the potential for such harm) would occur only unintentionally. Furthermore, since the provisions and regulations cited above regulate the "taking" of particular species, it follows that their purpose is not protection of those species *per se*; rather, the requirements (for example, Sections 3503, 3503.5, and 4150) protect given species only until the conditions under which "take" is lawful have been met. Conversely, for species listed as federal and/or state endangered, threatened, rare, or fully protected, the mandate to protect is more comprehensive.

To summarize, the purposes of these State requirements and the actions that they regulate do not include responding to releases of hazardous substances. Therefore, they are not "relevant and appropriate" based upon the pertinent provisions of Subsections 300.400(g)(2)(i) and (iv) of the NCP. DoN's ecological risk assessment process takes into account representative environmental receptors for the site and final remediation/cleanup goals will ensure that they are adequately protected from exposure to CERCLA hazardous substances that present unacceptable risk.

The provisions of California Fish and Game Code Sections 1908, 2080, 3511, 4700, 5050, and 5515 regulating federal and/or state endangered, threatened, rare, or fully protected species are potentially "relevant and appropriate" ARARs that are well-suited to the site based upon the pertinent provisions of Subsection 300.400(g)(2)(viii) of the NCP. DoN has considered the use or potential use of affected resources pursuant to Subsection 300.400(g)(2)(viii) and believes that these protected biological resources are significant resources in contrast to species that are not federal and/or state endangered, rare, or fully protected species. The protection of state endangered, threatened, rare, or fully protected species helps ensure that vulnerable species are protected, thus promoting crucial biodiversity, and that they can be "used" in the sense that they continue to provide their unique value to the people of the state of California. Species that are not state endangered, threatened, rare, or fully protected are not used in this manner.

As the California Legislature has stated at Section 2051(c) of the Fish and Game Code, "(threatened or endangered) species of fish, wildlife, and plants are of ecological, educational, historical, recreational, esthetic, economic, and scientific value to the people of this state, and the conservation, protection, and enhancement of these species and their habitat is of statewide concern." Section 2052 of the Fish and Game Code goes on to state that "it is the policy of the state to conserve, protect, restore, and enhance any endangered species or any threatened species and its habitat and that it is the intent of the Legislature, consistent with conserving the species, to acquire lands for habitat for these species."

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[4] Note that Section 86 states that "take" means not only "hunt, pursue, catch, capture, or kill," but also an "attempt" to perform such actions, with "attempt" having meaning only in the context of intentional action.

DoN agrees with these policy statements and believes that it is appropriate for purposes of ARARs analysis to view rare and fully protected species as possessing comparable significance. Accordingly, as stated above, DoN stresses its belief that the relevance and appropriateness of California Fish and Game Code Sections 1908, 2080, 3511, 4700, 5050, and 5515 is tied to the unique and significant status of the species in question. By that same token, the species regulated by Fish and Game Code Sections 3003.1, 3005(a), 3503, 3503.5, 3513, 3800(a), 4002, 4150, 4750, 4800, and 8500, and Cal. Code Regs. title 14 Sections 40, 460, 465, and 472 are not significant resources in the way that federal and/or state endangered, threatened, rare, or fully protected species are. Certain species have been designated by the State as being of greater significance and concern, and, by extension, those species which the State of California has not seen fit to provide with special protection are not of comparable significance or concern. Therefore, DoN believes it is appropriate to distinguish between protected species and non-protected species for purposes of ARARs determinations.

Stringency:

The CDF&G has asserted that the statutes and regulations it has identified as potential State ARARs are more stringent than federal ARARs. However, CDF&G has not made a meaningful demonstration comparing these State requirements to federal ARARs and documenting that the State requirements are more stringent. This problem is compounded by the very general nature of the language in the State requirements identified by CDF&G and the lack of explanation as to how they would be interpreted and applied to DoN cleanups if they were ARARs. The State has the burden of proving greater stringency under Section 300.400(g)(4) of the NCP. While DoN is willing to accept certain proposed State ARARs as a matter of policy, we believe that the State has not met that burden for any of the identified requirements.

Inconsistent Application:

A determination that a State requirement is either "applicable" or "relevant and appropriate" does not end the analysis of potential ARAR requirements required by CERCLA and the NCP. A requirement must also have been consistently applied throughout the State. DoN recently began to receive from DTSC and CDF&G lists of whole new categories of State laws and regulations that had not been identified in the past by the State as potential ARARs. These lists have been submitted on an intermittent and irregular basis. Most of these laws and regulations were enacted and promulgated many years ago but were not identified as potential ARARs over the long history of DoN's cleanup program from the late 1980s until the "new" lists began to be submitted less than two years ago. Many of them are "takings" laws and regulations regulating the hunting and collecting of various types of plants and animals and do not apply on their face to remediation or construction. To DoN's knowledge, they are not applied by the state to non-federal construction activity.

These inconsistencies are potentially significant enough to support an ARAR waiver pursuant to Section 121(d)(4)(E) of CERCLA if the requirements were determined to be

State ARARs. However, at this time, DoN is not pursuing such a waiver in order to engage in a dialogue with DTSC and CDF&G in an effort to seek a consensus regarding federal and/or state endangered, threatened, rare, or fully protected species (see above).

We hope that this letter clarifies DoN's position. Please contact us if you have any questions or if you would like to meet in the near future to discuss the path forward. Rex's phone number is (619)-532-0988 and Mike's phone number is (619)-532-2312.

Sincerely,

Rex Callaway

Rex Callaway

Michael R. Waters

Mike Waters

Copy to:

Robert Elliott, DTSC Counsel
Isabella Alasti, DTSC Counsel
Robert Kirkbright, Environmental Business Line Coordinator, NAVFAC Southwest
Laura Duchnak, Director, BRAC PMO West
Vasio Giamulias, Counsel, NAVFAC Southwest
Walter Sandza, Environmental Restoration Product Line Coordinator, NAVFAC Southwest
Lawrence Lansdale, Environmental Program Manager, BRAC PMO

California Natural Resources Agency
DEPARTMENT OF FISH AND GAME
Office of Spill Prevention and Response
1700 K. Street, Ste 250
Sacramento, California 95811
Telephone: (916) 445-9338
www.dfg.ca.gov

ARNOLD SCHWARZENEGGER, Governor
John McCamman, Acting Director

December 3, 2009

Rex Callaway and Michael R. Waters
Department of the Navy
Office of the General Counsel
Counsel for Naval Facilities Engineering Command Southwest
1220 Pacific Highway Room 250
San Diego, CA 92132-55189

Dear Mr. Callaway and Mr. Waters,

RE: California Department of Fish and Game Laws and Regulations

I am writing in response to your June 16, 2009 correspondence concerning California Department of Fish and Game, Office of Spill Prevention and Response (DFG-OSPR) laws and regulations proposed as Applicable or Relevant and Appropriate Requirements (ARARs) and to confirm agreements reached during a series of five teleconference calls on July 8, 16, and 23; September 24; and October 30, 2009. I appreciate your efforts in drafting the June 16, 2009 correspondence and believe that we have been able to reach a reasonable resolution on the issues related to DFG-OSPR ARARs submitted for consideration at Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) remedial actions occurring at Department of Navy (DON) federal facilities.

Background

DFG-OSPR is under contract with the Department of Toxic Substances Control (DTSC) to provide regulatory oversight activities and services to implement its responsibilities during the environmental restoration and reuse of military bases in California. DFG-OSPR is a California designated state natural resource trustee pursuant to CERCLA. Congress has provided a limited waiver of sovereign immunity within CERLCA which allows the State to propose substantive state standards which are either applicable or relevant and appropriate to remedial actions occurring at federal facilities. DFG-OSPR has been submitting ARARs to DON for its consideration in implementing remedial actions pursuant to CERCLA and the above referenced agreement with the DTSC.

DON and DFG-OSPR have not agreed on certain potential state ARARs that DFG-OSPR has identified for DON's consideration. DON sent a letter to DFG-OSPR on June 16, 2009, which prompted a series of discussions between DON counsel (Mike Waters and Rex Callaway) and DFG-OSPR counsel (Wendy Johnson). We have worked to resolve the disagreements and have reached the following agreements with respect to the ARARs that DFG-OSPR will submit to DON in the future pursuant to CERCLA section 121(d)(2)(A). Where no agreement as to ARARs could be reached, the DON and DFG-OSPR have prepared mutually agreed upon "agree-to-disagree" language to be incorporated into DON's responses to DFG-OSPR in CERCLA documents when there is

technical agreement on cleanup levels or measures to avoid harm or take of species and habitats during remedial or removal activities.

Applicable or Relevant and Appropriate Requirements

The DFG-OSPR appreciates the DON's willingness to agree that certain specific provisions of the California Endangered Species Act (CESA) and Fully Protected Species statutes are relevant and appropriate for consideration for DON cleanups pursuant to CERCLA. These sections are California Fish and Game Code sections 1908, 2080, 3511, 4700, 5050, and 5515. We are willing to recognize that these statutes are not specific with respect to affirmative measures the DON must take to avoid "take." DFG-OSPR will provide DON with reasonable recommendations to avoid "take" pursuant to the above referenced statutes. We appreciate the DON's thoughtful consideration of the recommendations in light of the expertise and specialized knowledge of our staff.

Accordingly, with respect to each of the six Code sections identified above, the DFG-OSPR agrees to the following language to be included in DON CERCLA Records of Decisions (RODs) and removal Action Memoranda:

"The DON accepts Fish and Game Code Section (x) as a state ARAR subject to the following conditions. DFG-OSPR concurs that this statute addresses prohibited conduct but does not provide for or prescribe affirmative measures to avoid a "taking." Notwithstanding the absence of specific affirmative measures in the statute, the DON will implement reasonable measures to ensure adequate protection of ecological receptors during removal or remedial actions pursuant to the DON's obligations under CERCLA to select removal or remedial actions that are protective of human health and the environment (see Section 121(b)(1) of CERCLA). The DON will coordinate with DFG-OSPR prior to implementation of such reasonable measures. The DON understands that DFG-OSPR reserves the right to conduct periodic site visits during removal or remedial activities to confirm implementation of avoidance measures."

The DON has outlined various factors in determining whether a statute should be an ARAR. Factors for consideration are whether the state statute is an environmental or facility siting law, applicable, relevant and appropriate, more stringent than applicable federal laws, and consistently applied.

Environmental or Facility Siting Law

There does not appear to be any guidance on the types of statutes which are Environmental or Facility Siting Laws for purposes of determining whether they might be relevant and appropriate for consideration as an ARAR. Whether a statute is an environmental law appears to be rather vague and subject to some interpretation. DFG-OSPR has asserted various state statutes pertaining to resource protection as ARARs because we believe that they are location specific environmental laws due to wildlife resources, which occur or are likely to occur at a site.

Applicable

It appears that for a statute to be an ARAR, it may fall within one of two categories; it may be "applicable" or "relevant and appropriate." It is my understanding that to meet the applicability requirement; it must "specifically address a hazardous substance, pollutant,

contaminant, remedial action location or other circumstance found at a CERCLA site" per the National Oil and Hazardous Substances Pollution Contingency Plan (NCP).[1] DFG-OSPR agrees that the "take" statutes identified by DFG-OSPR do not appear to be "applicable" as defined in the NCP.

Relevant and Appropriate

DFG-OSPR identifies resource protection laws which may be relevant and appropriate to a particular site in light of the habitat, species which occur at the site, contaminants of concern and the remedial action contemplated. We try to reference our request that the Fish and Game Code (F&GC) and California Code of Regulations (CCR) sections be included because we believe that they are relevant and appropriate, but there may have been occasions in the past where memo's have requested their consideration as applicable or relevant and appropriate.

The remaining F&GC sections at issue will be addressed individually for consideration of relevance and appropriateness.

1. F&GC section 3003.1: This section prohibits the use of body gripping traps in catching mammals, dogs or cats. Trapping is typically authorized pursuant to a DFG Wildlife Services Memorandum of Understanding (MOU) and since the DON is presumably hiring professionals operating pursuant to the provisions of the MOU, this section should not be an issue if trapping is necessary in order to implement a CERCLA cleanup. The DFG-OSPR agrees to remove this provision from the proposed ARARs table.

2. F&GC section 3005: This section prohibits the taking of birds and mammals by poison. "Take" is defined by F&GC section 86 to include killing. "Poison" is not defined in the code. Although there is no state authority on this point, federal law recognizes that poison, such as Strychnine, may affect incidental taking. *(Defenders of Wildlife v. Administrator, Environmental Protection Agency (1989) 882 F. 2d 1295).* The DFG-OSPR includes this section to ensure that "take" by poison or contaminants present at cleanup sites does not occur. "Take" can occur during removal or remedial activities if contaminants are placed in a manner where fish and/or wildlife are exposed and avoiding "take" is a consideration for cleanup goals.

Whenever possible, DFG-OSPR recommends cleanup goals approximate contaminant levels that have been reported to have no observed adverse effects on birds and mammals. However, a number of site-specific considerations must be taken into account (e.g., habitat quality, sensitivities of species to contaminants, environmental fate of contaminants, remediation feasibility etc), such that DFG-OSPR's recommended cleanup goal may fall between a no observed and the lowest observed effects level that has been reported to have a statistically significant adverse effect on biota. The DFG-OSPR appreciates the DON's concern with respect to consistency in determining these levels and will work with DON to resolve any consistency issues as they arise. However, since each site has a unique set of circumstances in light of the species at risk, the habitat type

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[1] 40 CFR Part 300.5

and contaminants present, cleanup goals must be selected on a site-specific basis following the nine balancing criteria specified in the NCP. Ultimately, the DON and state remedial project managers select site cleanup goals that are deemed protective of human health and the environment.

Additionally, it appears that generally the requirements of CERCLA and the NCP provide a level of protectiveness that would not result in "take" for purposes of F&GC section 3005. However, there have been occasions where DFG-OSPR believes that a lowest observed adverse effects level could, depending upon interpretation, be considered a "take" for purposes of this statute, and that the DON should consider including this statute as an ARAR on a site-specific basis.

Notwithstanding the above, DFG-OSPR is willing to support the following "agree-to-disagree" language in ARAR determinations when the DON and DFG-OSPR have agreed upon ecological cleanup levels:

"The DON has determined that F&GC section 3005(a) is not a state ARAR because it is not applicable or relevant and appropriate. DFG-OSPR asserts that F&GC section 3005(a) is a state ARAR because it is relevant and appropriate. Whereas, the DON and DFG-OSPR have not agreed upon whether F&GC section 3005(a) is an ARAR, this Record of Decision (ROD) or Action Memorandum (AM) documents each party's position on the statute but does not attempt to resolve the issue. However, the DFG-OSPR has determined that the ecological cleanup levels would substantively comply with the requirement and provide an acceptable level of protectiveness, DFG-OSPR does not intend to dispute the ROD or AM. In the event that the remedial action does not meet the "protectiveness" component of F&GC section 3005, DFG-OSPR reserves the right to apply and assert F&GC section 3005 in any future decision to revise the cleanup levels or any dispute regarding the cleanup."

3. F&GC section 3503: This section prohibits the take, possession, or needless destruction of the nest or eggs of any bird, except as otherwise provided. The DON believes that this section is not an ARAR because the DON would not "take" or "needlessly destroy" the nest or eggs of any bird. The DON believes that "take" requires intent and the DON would not intend to "take" and, therefore, would not be in violation of the provision. The DFG-OSPR disagrees with the DON's interpretation of the definition of "take" and while the DON may not intend to effectuate a "take" of a bird's nest or eggs, remedial or construction activities associated with the cleanup may result in "take" for purposes of the F&GC definition.

Notwithstanding such disagreement in interpretation, DFG-OSPR is willing to support the following "agree-to-disagree" language in ARAR determinations when the DON and DFG-OSPR have agreed upon measures to avoid impacts or take of special-status species and habitats:

"The DON has determined that F&GC section 3503 is not a state ARAR because it is not applicable or relevant and appropriate. DFG-OSPR asserts that section 3503 is a state ARAR because it is relevant and appropriate. Whereas, the DON and DFG-OSPR have not agreed upon whether F&GC section 3503 is an ARAR, this ROD or AM documents each party's position on the statute but does not attempt to resolve the issue. Nonetheless, the DON agrees that it will undertake measures in order to avoid harm or

take of nests and eggs when there is potential that they may be impacted by remedial actions: (fill in specific agreed-to "take avoidance" measures). DFG-OSPR will not dispute the selected remedy for failure to identify F&GC section 3503 as an ARAR because the DFG-OSPR has determined that the mutually agreed upon measures to avoid impacts or take of protected species and/or habitats will result in substantive compliance with the state requirement."

If the DON and DFG-OSPR cannot agree upon measures to avoid impacts to protected species and/or habitats, we acknowledge that the DON is reserving its rights to reject this requirement as an ARAR, and DFG-OSPR reserves its rights to apply and assert F&GC section 3503 in any future decision or any dispute regarding the take-avoidance measures.

4. F&GC section 3503.5 and 3513. These sections prohibit the take, possession or destruction of any birds in the orders of Falconiformes, Strigiformes or Migratory Birds and includes the nest or eggs of any such bird. These statutes do not appear to be more stringent than the Federal Migratory Bird Treaty Act (MBTA). If the MBTA is an ARAR, then DFG-OSPR will remove this statute from the proposed ARARs table, however if the MBTA is not an ARAR, and migratory birds or birds of prey are likely to occur at the site then the DFG-OSPR will recommend this provision as an ARAR to ensure some protection for migratory birds or birds of prey.

5. F&GC section 3800(a). This section prohibits the take of nongame birds, except in accordance with regulations of the commission. The Title 14 CCR section 475 appears to allow take of certain nongame birds and does not appear relevant to contemplated BRAC CERCLA remedial actions. DFG-OSPR will remove this statute from the proposed ARARs table.

6. F&GC section 4002. This statute outlines approvable methods of take for fur-bearing mammals and does not appear to be relevant to contemplated CERCLA remedial actions. DFG-OSPR will remove this statute from the proposed ARARs table.

7. F&GC section 4150: This statute provides that nongame mammals may not be taken or possessed except as provided within the code or regulations. The Title 14 CCR section 475 appears to allow take of certain nongame mammals and does not appear relevant to BRAC CERCLA contemplated remedial actions. DFG-OSPR will remove this statute from the proposed ARARs table.

8. F&GC section 4750: This section outlines methods of take for bears and does not appear to be relevant to contemplated CERCLA remedial actions. DFG-OSPR will remove this statute from the proposed ARARs table.

9. F&GC section 4800: This section provides that it is unlawful to take, injure, possess, transport or sell any mountain lion. DFG-OSPR will continue to provide this provision as a proposed ARAR in the very rare occasion that a mountain lion is likely to occur at a site where remedial action is proposed. DFG-OSPR is willing to support the following "agree-to-disagree" language in ARAR determinations when the DON and DFG-OSPR have agreed upon measures to avoid harm to mountain lions:

"The DON has determined that F&GC section 4800 is not a state ARAR because it is not applicable or relevant and appropriate. DFG-OSPR asserts that F&GC section 4800 is a

state ARAR because it is relevant and appropriate. Whereas, the DON and DFG-OSPR have not agreed upon whether F&GC section 4800, this ROD or AM documents each party's position on the statute but does not attempt to resolve the issue.

Nonetheless, the DON agrees that it will undertake the following measures in order to generally avoid harm to mountain lions when there is potential that they may be impacted by remedial activities: (fill in specific agreed-to "take avoidance" measures). DFG-OSPR will not dispute the selected remedy for failure to identify F&GC section 4800 as an ARAR because DFG-OSPR has determined that the mutually agreed upon measures to generally avoid harm will result in substantive compliance with the state requirement."

If the DON and DFG-OSPR cannot agree upon measures to generally avoid harm to mountain lions, we acknowledge that the DON is reserving its rights to reject this requirement as an ARAR, and DFG-OSPR reserves its rights to apply and assert F&GC section 4800 in any future decision or any dispute regarding the take-avoidance.

10. F&GC section 8500. This provision prohibits take of tidal invertebrates for commercial purposes and does not appear to be relevant to contemplated CERCLA remedial actions. DFG-OSPR will remove this statute from the proposed ARARs table.

11. Title 14 CCR section 40: This regulation makes it unlawful to capture, collect, intentionally kill or injure, any native reptile or amphibian unless under special permit from the DFG-OSPR. To the extent that DON will not intentionally kill or injure native reptiles or amphibians, this provision does not appear to be relevant and will be removed from the ARARs table.

12. Title 14 CCR section 460: This regulation makes it unlawful to take fisher, marten, river otter, desert kit fox, and red fox. The fisher is a candidate species under status review for listing pursuant to CESA. The DON asserts that Title 14 CCR section 460 is not a state ARAR. DFG-OSPR asserts that Title 14 CCR section 460 is a state ARAR. DFG-OSPR is willing to support the following "agree-to-disagree" language in ARAR determinations when the DON and DFG-OSPR have agreed upon measures to avoid harm to fisher, marten, river otter, desert kit fox, and red fox:

"The DON has determined that Title 14 CCR section 460 is not a state ARAR because it is not applicable or relevant and appropriate. DFG-OSPR asserts that CCR section 460 is a state ARAR because it is relevant and appropriate. Whereas, the DON and DFG-OSPR have not agreed upon whether Title 14 CCR section 460 is an ARAR, this ROD or AM documents each party's position on the statute but does not attempt to resolve the issue.

Nonetheless, the DON agrees that it will undertake the following measures in order to generally avoid harm to fisher, marten, river otter, desert kit fox, and red fox when there is potential that they may be impacted by response action construction: (fill in specific agreed-to "take avoidance" measures). DFG-OSPR will not dispute the selected remedy for failure to identify Title 14 CCR section 460 as an ARAR because DFG-OSPR has determined that the mutually agreed upon measures to generally avoid harm will result in substantive compliance with the state requirement."

If the DON and DFG-OSPR cannot agree upon measures to generally avoid harm, we acknowledge that the DON is reserving its rights to reject this requirement as an ARAR,

and the DFG-OSPR reserves its rights to apply and assert this statutes in any future decision or any dispute regarding the take-avoidance.

13. Title 14 CCR section 472: This regulation provides a list and the manner in which nongame birds and nongame mammals may be taken. Since it authorizes take of certain nongame bird and nongame mammals and appears to provide the method of take, it does not appear relevant to the activities contemplated by a CERCLA remedial action. DFG-OSPR will remove this statute from the proposed ARARs table.

Stringency

DFG-OSPR may not be aware of some potential federal ARARs at the time that DFG-OSPR submits its proposed ARARs list to articulate a comparison of the statutes. DFG-OSPR recognizes that the DON does compare the stringency of federal ARARs to potential state ARARs identified by the DFG-OSPR during preparation of the Feasibility Studies and EE/CA reports and the DFG-OSPR has an opportunity to comment on the DON's proposed findings and further demonstrate that its requirements are more stringent. DFG-OSPR believes that stringency is generally an issue when a species, which occur at the site, is a Fully Protected Species and listed per the Federal Endangered Species Act (FESA). The FESA will allow incidental take, while the Fully Protected Species statutes (F&GC sections 3511, 4700, 5050, and 5515) do not authorize the DFG-OSPR to permit take. DFG-OSPR believes that the Fully Protected Species statutes are more stringent than FESA because "take" is prohibited unless for scientific, educational or recovery efforts. Otherwise, we have maintained that if there are no federal statutes that are protective of state protected species, then the state's resource protection law is more stringent based on the theory that the statute providing greater resource protection is more stringent

Inconsistent Application

DFG-OSPR tries to tailor the list of state statutes that apply at CERCLA remedial actions in light of the location of the site, species that occur, habitat, the action contemplated, and the contaminants of concern. DFG-OSPR does not submit the same ARARs for every site because of the unique characteristics of each site. DFG-OSPR has been referencing the same statutes since 2001 for potential inclusion in the proposed ARARs table. We do not believe that statutes are applied inconsistently, except to the extent that we attempt to tailor the proposed ARARs list to each site as deemed appropriate per the best professional judgment of our biologists and toxicologists based on the specific characteristics of the site and action contemplated. Additionally, CERCLA appears to require comparisons of site specificities in assessing the relevance and appropriateness of state ARARs which we consider when proposing our ARARs.[2]

Conclusions

We have agreed to substantially revise our list of proposed ARARs and appreciate the DON's willingness to accept the six state statutes specified above as "relevant and

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[2] 40 CFR Part 300.400(g)(2)(i-viii)

appropriate" requirements. While we have reached many resolutions in our discussions, there is still some disagreement with respect to Fish and Game code sections 3005, 3503, 4800 and Title 14 CCR section 460. We will continue to propose those provisions as state ARARs on a site-specific basis with the understanding that DON may not accept them as ARARs. Accordingly, we generally support incorporation of the "agree-to-disagree" language set forth above into Navy RODs and AMs when the Navy and DFG-OSPR have reached technical agreement on cleanup levels and "take avoidance" measures relating to the subject matter of these laws and regulations. If the Navy and DFG-OSPR cannot reach agreement upon the cleanup levels and measures to generally avoid harm during remedial or removal activities relating to the subject matter of these laws and regulations, we acknowledge that the Navy is reserving its rights to reject the requirement as an ARAR, and the DFG-OSPR reserves its rights to apply and assert state resource protection laws in any future decision or any dispute regarding the take-avoidance measures.

Although we were able to reach these resolutions, state ARARs and cleanup goals are site specific and variable depending on contaminants of concern, habitat type, the remedial or construction activity contemplated and species which may inhabit the area. We will continue to carefully evaluate appropriate resource protection laws that we submit as ARARs at DON sites and take all of our discussions and agreements into account to hopefully minimize or avoid any issues related to our ARARs in the future.

I hope that this letter attempts to clarify DFG-OSPR's response to the June 16, 2009 DON correspondence and clearly articulates agreements and concessions reached in our numerous conference calls on the issues. Please contact me if you have any questions or would like to discuss the issues further at (916) 324-5660 or at wendyjohnson@ospr.dfg.ca.gov.

Sincerely,

Wendy Johnson

Wendy Johnson
Staff Counsel III, Spec.
Office of Spill Prevention and Response

cc: Michael Anderson
Office of Spill Prevention and Response

Robert Elliot
Department of Toxic Substance Control

Isabella Masti
Department of Toxic Substance Control

DEPARTMENT OF THE NAVY
OFFICE OF THE GENERAL COUNSEL
COUNSEL FOR
NAVAL FACILITIES ENGINEERING COMMAND SOUTHWEST
1220 PACIFIC HIGHWAY ROOM 250
SAN DIEGO, CA 92132-5189

5800
Ser 5753/09C.RC/MW
April 29, 2010

Ms. Wendy Johnson, Staff Counsel II
Office of Spill Prevention and Response
California Department of Fish and Game
1700 K Street, Suite 250
Sacramento, CA 95811

Re: California Department of Fish and Game Laws and Regulations

Dear Ms. Johnson:

We are writing in response to the December 3, 2009 letter from California Department of Fish and Game, Office of Spill Prevention and Response (DFG-OSPR) to the Department of the Navy (DON) concerning various state laws and regulations that have been proposed as Applicable or Relevant and Appropriate Requirements (ARARs) for DoN cleanups conducted pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP)(40 CFR Part 300). In sending this letter, we seek to confirm agreements reached with respect to a number of such proposed ARARs during a series of teleconference calls (on July 8, 16, and 23; September 24; and October 30, 2009); and also, pursuant to our teleconference call of January 12, 2010, to set forth the Navy's final position regarding "agree to disagree" language concerning four other proposed state ARARs, with respect to which final agreement has not been reached; for inclusion in appropriate CERCLA documents when the State and the DON are able to agree upon ecological cleanup levels.

As discussed on January 12th, the DON's overall perspective is as follows:

First, with respect to the four proposed ARARs for which the State and the DON have not reached final agreement (Fish and Game Code (F&GC) Sections 3005, 3503, and 4800, and Title 14 California Code of Regulations (14 CCR) Section 460), we are hopeful the "agree to disagree" language set forth herein will be acceptable to the State.

However, if the DON's language is not acceptable as presented herein, then we believe the State and the DON should not continue to attempt to reach resolution with respect to the four proposed ARARs in question, and instead both parties should deal with the potential ARARs status of these four state statutes and regulations on a case-by-case basis, with the DON reserving its right to accept or reject such statutes and regulations as ARARs, and with the State reserving its right to decide whether or not to invoke dispute resolution or take other actions that DFG-OSPR believes may be available to it.

Finally, notwithstanding whether the DON's proposed language concerning the four state statutes and regulations referenced above is acceptable to the State, the DON believes that it would be desirable for the DON and the State to abide by the agreements previously reached with respect to the other proposed state ARARs discussed during the course of negotiations on this matter, and specifically as set forth in the DON's letter of June 16, 2009 (with respect to F&GC Sections 1908, 2080, 3511, 4700, 5050, and 5515) (with one revision to the language concerning these sections, per discussion below) and DFG-OSPR's letter of December 3, 2009 (with respect to F&GC Sections 3003.1, 3503.5, 3513, 3800(a), 4002, 4150, 4750, and 8500, and 14 CCR Sections 40 and 472). Accordingly, DON intends to include language such as the following in Records of Decision, Action Memoranda, Feasibility Study reports, and Engineering Evaluation/Cost Analysis reports that have not yet been completed, and that are still in the process of resolving the ARAR status of F&GC Sections 3003.1, 3800(a), 4002, 4150, 4750, and 8500, and 14 CCR Sections 40 and 472: "The State has re-evaluated and withdrawn its previous identification of this requirement as a state ARAR." With respect to discussion of the ARAR status of F&GC Sections 3503.5 and 3513 in such documents, if the Migratory Bird Treaty Act has been identified as an ARAR, DON intends to include the following language: "The State withdraws its previous identification of this requirement in light of DON's identification of the substantive provisions of the Migratory Bird Treaty Act as a 'relevant and appropriate' federal ARAR for this action."

We will also discuss below certain aspects of DFG-OSPR's December 3, 2009 letter with which the DON disagrees, but with respect to which we generally seek only to note our disagreement, and not to request changes in DFG-OSPR's stated position.

Proposed Language for Four As-Yet-Unresolved Proposed State ARARs:

We reference the parties' previous correspondence for discussion of the background underlying this matter and in-depth explanation of the parties' relative positions on particular points.

With respect to the four proposed state ARARs discussed in this section of the letter, our understanding is that the parties agree that the language set forth below would only apply if the DON and the State, through DFG-OSPR, are able to reach agreement as to cleanup levels (with respect to F&GC Section 3005) or as to measures to be taken to avoid harm to pertinent species (with respect to the three other proposed state ARARs in question). With respect to any of these four proposed ARARs for which the DON and the State, through DFG-OSPR, cannot reach agreement as to cleanup levels and/or harm-avoidance measures for a particular site, the DON would reserve its right to reject the law or regulation in question as an ARAR, and the State would reserve its right to decide whether or not to invoke dispute resolution or take other actions that the State believes may be available to it, subject to the provisions of any signed Federal Facility Agreements and Federal Facility Site Remediation Agreements that pertain to the site(s) in question. The Navy has revised this language to clarify that the State is addressing these requirements through DFG-OSPR.

1. F&GC Section 3005

As discussed above, the DON is willing to accept the following "agree-to-disagree" language in ARAR determinations for CERCLA sites where, notwithstanding disagreement as to the ARARs status of F&GC 3005, the Navy and DFG-OSPR have agreed upon ecological cleanup levels:

"The DON has determined that F&GC Section 3005(a) is not a state ARAR because it is not applicable or relevant and appropriate. The State of California, through DFG-OSPR, asserts that F&GC 3005(a) is a state ARAR because it is relevant and appropriate. Whereas, the DON and the State have not agreed upon whether F&GC Section 3005(a) is an ARAR, this (Record of Decision (ROD), Action Memorandum (AM), Feasibility Study (FS) report, or Engineering Evaluation/Cost Analysis (EE/CA) report) documents each party's position on the statute but does not attempt to resolve the issue. However, the State has determined that the (proposed or final, as appropriate) ecological cleanup levels would substantively comply with the requirement and provide an acceptable level of protectiveness, and the State does not intend to dispute the (ROD, AM, FS report, or EE/CA report)."

2. F&GC Section 3503

As discussed above, the DON is willing to accept the following "agree-to-disagree" language in ARAR determinations for CERCLA sites where, notwithstanding disagreement as to the ARARs status of F&GC 3503, the DON and DFG-OSPR have agreed upon measures to avoid harm to nests and eggs:

"The DON has determined that F&GC Section 3503 is not a state ARAR because it is not applicable or relevant and appropriate. The State of California, through DFG-OSPR, asserts that Section 3503 is a state ARAR because it is relevant and appropriate. Whereas, the DON and the State have not agreed upon whether Section 3503 is an ARAR, this (Record of Decision (ROD), Action Memorandum (AM), Feasibility Study (FS) report, or Engineering Evaluation/Cost Analysis (EE/CA) report) documents each party's position on the statute but does not attempt to resolve the issue. Nonetheless, the DON agrees that it will undertake the following measures in order to generally avoid harm to nests and eggs when there is potential that they may be impacted by response action construction: (fill in specific agreed-upon measures). The State will not dispute the selected remedy for failure to identify F&GC 3503 as an ARAR because the State has determined that the mutually agreed measures to generally avoid harm will result in substantive compliance with the state requirement."

3. F&GC Section 4800

As discussed above, the DON is willing to accept the following "agree-to-disagree" language in ARAR determinations when the DON and DFG-OSPR have agreed upon measures to avoid harm to mountain lions:

"The DON has determined that Fish and Game Code section 4800 is not a state ARAR because it is not applicable or relevant and appropriate. The State of California, through DFG-OSPR, asserts that F&GC Section 4800 is a state ARAR because it is relevant and appropriate. Whereas, the DON and DFG-OSPR have not agreed upon whether F&GC Section 4800 is an ARAR, this (Record of Decision (ROD), Action Memorandum (AM), Feasibility Study (FS) report, or Engineering Evaluation/Cost Analysis (EE/CA) report) documents each party's position on the statute but does not attempt to resolve the issue. Nonetheless, the DON agrees that it will undertake the following measures in order to generally avoid harm to mountain lions when there is potential that they may be impacted by response action construction: (fill in specific agreed-upon measures). The State will not dispute the selected remedy for failure to identify F&GC Section 4800 as an ARAR because the State has determined that the mutually agreed upon measures to generally avoid harm will result in substantive compliance with the state requirement."

4. 14 CCR 460

As discussed above, the DON is willing to accept the following "agree-to-disagree" language in ARAR determinations when the DON and DFG-OSPR have agreed upon measures to avoid harm to fisher, marten, river otter, desert kit fox, and red fox:

"The DON has determined that Title 14 CCR section 460 is not a state ARAR because it is not applicable or relevant and appropriate. The State of California, through DFG-OSPR, asserts that CCR section 460 is a state ARAR because it is relevant and appropriate. Whereas, the DON and the State have not agreed upon whether Title 14 CCR section 460 is an ARAR, this (Record of Decision (ROD), Action Memorandum (AM), Feasibility Study (FS) report, or Engineering Evaluation/Cost Analysis (EE/CA) report) documents each party's position on the statute but does not attempt to resolve the issue. Nonetheless, the DON agrees that it will undertake the following measures in order to generally avoid harm to fisher, marten, river otter, desert kit fox, and red fox when there is potential that they may be impacted by response action construction: (fill in specific agreed-upon measures). The State will not dispute the selected remedy for failure to identify Title 14 CCR Section 460 as an ARAR because the State has determined that the mutually agreed upon measures to generally avoid harm will result in substantive compliance with the state requirement."

F&GC Sections 1908, 2080, 3511, 4700, 5050, and 5515:

As stated above, the DON proposes to abide by the agreements previously reached with respect to the other proposed state ARARs discussed during the course of negotiations—to accept F&GC Sections 1908, 2080, 3511, 4700, 5050, and 5515 as potential state ARARs—as discussed in the DON's letter of June 16, 2009. However, in order to do so, the DON would need to have the language concerning these F&GC sections intended for inclusion in DON CERCLA Records of Decision and (removal) Action Memoranda (under 'Applicable or Relevant and Appropriate Requirements' in the December 3, 2009 letter) revised to incorporate the construction-related language that DFG-OSPR and the DON had been using in these negotiations prior to DFG-OSPR's letter of December 3,

2009. This is a critical point for DON. DON cannot agree in advance that these laws are relevant to activities other than construction occurring after issuance of a CERCLA decision document for a site (to include construction-related aspects of sampling and Operation & Maintenance). DON is willing to consider the potential relevance of these laws to other aspects of the CERCLA process on a case-by-case basis; however, for purposes of finalizing an agreed-upon way forward with language to be utilized consistently from site to site, DON can only agree to language along the lines of what the parties had been utilizing in discussions prior to December 3, 2009. Consistent with the language set forth in DoN's November 3, 2009 comments upon DFG-OSPR's October 29, 2009 draft letter, the DON is willing to accept language concerning F&GC Sections 1908, 2080, 3511, 4700, 5050, and 5515 as follows:

"The DON accepts Fish and Game Code Section (x) as a state ARAR subject to the following conditions. The State of California, through DFG-OSPR, concurs that this statute addresses prohibited conduct but does not provide for or prescribe affirmative measures to avoid a "taking." Notwithstanding the absence of specific affirmative measures in the statute, the DON will implement reasonable measures to ensure adequate protection of ecological receptors during response action construction following issuance of a CERCLA decision document pursuant to the DON's obligations under CERCLA to select removal or remedial actions that are protective of human health and the environment (see Section 121(b)(1) of CERCLA). The DON will coordinate with the State, through DFG-OSPR, prior to implementation of such reasonable measures. The DON understands that the State reserves the right to conduct periodic site visits during removal or remedial activities to confirm implementation of avoidance measures."

Additional Comments:

As discussed above, the following comments are meant to memorialize instances where the DON may disagree with something stated in DFG-OSPR's December 3, 2009 letter, but where, unless otherwise stated, the DON (1) acknowledges that the State is of course free to state its position as it sees fit, and thus (2) is simply noting such disagreement for the record.

1. At the end of the second paragraph under 'Background,' there is a reference to avoiding "harm or take of species and habitats during...." The DON notes that, given its different interpretation of what is required to constitute "take" under the F&GC, it cannot concede that it is taking measures to avoid "take" per se. Our preference would be to see this phrased along the lines of "to avoid harm (to include harm that the State would view as take of species and habitat) during...." However, we note that, in preparing this letter, the DON has edited out such reference to "take" where necessary to avoid stating or implying that the DON agrees as a formal matter that it would be implementing measures specifically to avoid "take" (i.e., in the introductory language immediately preceding the "agree to disagree" language for F&GC Section 3503).

2. In the paragraph discussing F&GC Section 3800(a), DFG-OSPR's letter states that these sections "do not appear relevant to contemplated BRAC CERCLA remedial

actions." Comparable language appears in the paragraph discussing F&GC Section 4150. The DON believes the parties' negotiations have sought to encompass Navy CERCLA cleanups on both BRAC and active installations, and that ideally the language of DFG-OSPR's letter would reflect this (e.g., by stating that the two F&GC sections "do not appear relevant to CERCLA actions contemplated by the DON").

We hope that this letter clarifies DoN's position. Please contact us if you have any questions. Rex's phone number is (619)-532-0988 and Mike's phone number is (619)-532-2312.

Sincerely,

Rex Callaway

REX CALLAWAY
Associate Counsel

Michael R. Waters

MICHAEL R. WATERS
Associate Counsel

Copy to:

Robert Kirkbright
Environmental Business Line Coordinator, NAVFAC SW

Laura Duchnak
Director, BRAC PMO West

Vasio Gianulias
Counsel, NAVFAC Southwest

Walter Sandza
Environmental Restoration Product Line Coordinator, NAVFAC SW

Lawrence Lansdale
Environmental Program Manager, BRAC PMO West

Michael M. Montgomery
Federal Facilities Site Cleanup Branch Chief, United States Environmental Protection Agency, Region 9

Robert Carr
Office of Legal Counsel, United States Environmental Protection Agency, Region 9

Daniel T. Ward, P.E.
Statewide DoD Cleanup Manager, Department of Toxic Substances Control

Robert Elliott
Office of Legal Counsel, Department of Toxic Substances Control

Isabella Alasti
Senior Staff Counsel, Department of Toxic Substances Control

Todd Thompson, P.E.
Program Manager, DoD/Site Cleanup Program, Division of Water Quality, State Water Resources Control Board

Frances L. McChesney
Senior Staff Counsel, State Water Resources Control Board

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Appendix D: GSR Analysis

Green and Sustainable Remediation Analysis

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1. Introduction

The Green and Sustainable Remediation (GSR) analysis summarized in this appendix supports the Feasibility Study (FS) Report for Investigation Area (IA) F1 at the former Mare Island Naval Shipyard in Vallejo, California. Specifically, this GSR analysis looks at the remedial alternatives identified and described in detail in the FS Report in the context of their likely environmental footprint to provide decision-makers with additional information in evaluating the alternatives.

Sustainable practices are those that consider economic and natural resources, ecology, human health and safety, and quality of life. The GSR entails implementing remediation projects in a manner that not only meets the traditional requirements of remediation (i.e., protection of human health and the environment and compliance with applicable or relevant and appropriate requirements), but also considers sustainable practices with a minimal environmental "footprint."

To reduce the environmental footprint of a remediation effort, thereby improving the sustainability of the remedy, a baseline GSR analysis was completed using the SiteWise™ program. The SiteWise™ program supports optimizing environmental restoration projects by evaluating sustainability metrics for remedial alternatives. The results of the GSR are used in the following two general ways:

(1) to allow the environmental footprint to be considered, for example under the short-term effectiveness FS evaluation criterion, when selecting the preferred remedial approach; and/or

(2) to identify the particular elements of the selected remedy that result in the greatest impact, thus allowing impact mitigation methods to be focused on these high footprint elements.

Unless otherwise stated, the default SiteWise™ assumptions for basis of calculations were used in this GSR analysis. The GSR analysis evaluated the action alternatives developed in the FS for surface soil and surface sediment. The No Action Alternative was not included in the GSR analysis. Institutional controls (ICs) were incorporated in the alternatives below in the GSR analysis.

1.1.1.1 Surface Soil

- Alternative U2: Institutional Controls and Asphalt Capping
- Alternative U3: Institutional Controls, Excavation, and Off-Site Disposal

1.1.1.2 Surface Sediment

- Alternative W2: Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland
- Alternative W3: Institutional Controls, Excavation, and Off-Site Disposal

2. Sustainability Metrics and Assessment Process

SiteWiseTM is a stand-alone tool that assesses the remedy footprint of a remedial alternative/technology in terms of a consistent set of metrics, including: 1) greenhouse gas (GHG) emissions; 2) energy use; 3) air emissions of criteria pollutants including nitrogen oxide (NOx), sulfur oxide (SOx), and particulate matter (PM); 4) water consumption; 5) resource consumption; and 6) worker safety, broken down into injury and fatality risk.

The assessment is carried out using a building block approach where every remedial alternative is first broken down into modules that mimic the remedial phases in most remedial actions, including remedial investigation (RI), remedial action construction (RAC), remedial action operations (RA-O), and long-term monitoring (LTM). Once broken down into various modules, the footprint of each module is individually calculated. The different footprints are then combined to estimate the overall footprint of the remedial alternative.

Details regarding the calculations of the metrics and data sources for assumptions within the basis of calculations can be found in the Naval Facilities Engineering Command SiteWise™ Version 2 User Guide (NAVFAC 2011).

2.1 Site and Alternative Specific Assumptions and Inputs

SiteWise™ requires information input for activities pertaining to material production, transportation of personnel and equipment/materials, equipment use entailing electrical equipment, drilling equipment, earthwork equipment, pumps, and other equipment used for mixing, agricultural, and paving activities, and residual handling for each unique alternative within the possible remedial phases.

For the IA F1 GSR analysis only the RAC and LTM phase are considered. For upland alternatives, U2 and U3, remedial action is considered for the upland target treatment zones (TTZs): A75 and A17 along with LTM using ICs. For wetland alternatives, W2 and W3, remedial action is considered for the TTZ in the northern portion of Subarea 6 along with LTM using ICs. The Western Electricity Coordinating Council / California (CAMX) was selected as the electricity region for all alternatives. Costs in the GSR analysis are taken from the FS cost estimates. The GSR RAC cost estimate includes the capital costs and contingency. The GSR LTM cost estimate is the 30-Year O&M net present value including contingency. The alternative specific inputs to the analysis are provided below:

2.1.1 Alternative U2: Institutional Controls and Asphalt Cap

2.1.1.1 RAC Input Sheet

Transportation

Personnel transportation during construction assuming 3 weeks of on-site work:

- 6 people x 15 days x 50 miles round trip per day

Equipment transportation during construction assuming single mobilization for one paver and one roller:

- Assume each piece of equipment weighs 20 tons and total distance traveled is 200 miles

Equipment Use

Capping equipment one paver and one roller:

- Area of 13,500 square feet over 15 work days

Operator Labor

- Assume 3 construction laborers, 2 operating engineers and 1 technical advisor each for 3 weeks of on-site work at 40 hours per week

Residual Handling

Residue Disposal/Recycling

- Assume construction waste of 8 tons to be transported 60 miles in one trip to non-hazardous landfill

Resource Consumption

- Assume a total of 3,500 gallons of water used during construction activities

2.1.1.2 LTM Input Sheet

Assume 30 years of LTM with annual review requiring 3-day site visit and 5-year reviews requiring 5-day site visit.

Transportation

Personnel transportation for on-site LTM:

- 2 people x 3 days x 50 miles round trip x 24 reviews – Annual Reviews
- 2 people x 5 days x 50 miles round trip x 6 reviews – 5-Year Reviews

Operator Labor

- Assume 1 technical advisor and 1 other on-site for 3 days for each annual review and 1 technical advisor and 1 other on-site for 5 days for each 5-year review:
  - 1 technical advisor x 3 days x 8 hours per day x 24 reviews – Annual Reviews
  - 1 other x 3 days x 8 hours per day x 24 reviews – Annual Reviews
  - 1 technical advisor x 5 days x 8 hours per day x 6 reviews –5-Year Reviews
  - 1 other x 5 days x 8 hours per day x 6 reviews – 5-Year Reviews

2.1.2 Alternative U3: Institutional Controls, Excavation, and Off-Site Disposal

2.1.2.1 RAC Input Sheet

Transportation

Personnel transportation during construction assuming 3 weeks of on-site work:

- 6 people x 15 days x 50 miles round trip per day

Equipment transportation during construction assuming single mobilization for one excavator:

- Assume excavator weighs 30 tons and total distance traveled is 200 miles
- Loader/backhoe assume equipment weighs 20 tons and total distance traveled is 200 miles

Equipment Use

Earthwork equipment one excavator:

- Volume of 1,250 bulk cubic yards

Earthwork equipment one loader/backhoe for backfill:

- Volume of 1,500 loose cubic yards

Operator Labor

- Assume 3 construction laborers, 2 operating engineers and 1 technical advisor each for 3 weeks of on-site work at 40 hours per week

Laboratory Analysis

- Assume $5,000 in analytical costs

Residual Handling

Residue Disposal/Recycling

- Assume 1.2 tons per cubic yard of soil excavated for a total of 1,500 tons to be disposed of in landfill
- Assume 40 tons transported per trip at 60 miles per tri
- 1,500 tons of non-hazardous waste to landfill

Resource Consumption

- Assume a total of 40,000 gallons of water used during construction activities

2.1.2.2 LTM Input Sheet

Assume 30 years of LTM with annual review requiring 1-day site visit and 5-year reviews requiring 2-day site visit.

Transportation

Personnel transportation for on-site LTM:

- 2 people x 1 day x 50 miles round trip x 24 reviews – Annual Reviews
- 2 people x 2 days x 50 miles round trip x 6 reviews – 5-Year Reviews

Operator Labor

- Assume 1 technical advisor and 1 other on-site for 1 day for each annual review and 1 technical advisor and 1 other for on-site 2 days for each 5-year review:
  - 1 technical advisor x 1 day x 8 hours per day x 24 reviews – Annual Reviews

- 1 other x 1 day x 8 hours per day x 24 reviews – Annual Reviews
- 1 technical advisor x 2 days x 8 hours per day x 6 reviews –5-Year Reviews
- 1 other x 2 days x 8 hours per day x 6 reviews – 5-Year Reviews

2.1.3 Alternative W2: Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland

2.1.3.1 RAC Input Sheet

Transportation

Personnel transportation during pre-design sampling and excavation activities, assuming 1 week of on-site work for pre-design sampling, 3 weeks of on-site work for excavation and 1 week of on-site work for upland sediment relocation and if needed soil cover:

- 2 people x 5 days x 50 miles round trip per day – Pre-design sampling
- 6 people x 15 days x 50 miles round trip per day – Excavation and site preparation
- 6 people x 5 days x 50 miles round trip per day –Sediment relocation to Upland

Equipment transportation during construction assuming single mobilization for one loader/backhoe:

- Excavator assume equipment weighs 30 tons and total distance traveled is 200 miles
- Loader/backhoe assume equipment weighs 20 tons and total distance traveled is 200 miles

Equipment Use

Earthwork equipment one excavator:

- Volume of 3,600 bulk cubic yards excavated from wetlands

Earthwork equipment one loader/backhoe:

- Relocate sediment volume of 3,600 bulk cubic yards to Upland
- Import volume of 4,000 loose cubic yards for backfill to original wetlands elevation

Operator Labor

- Assume 2 technical scientists for 1 week of on-site pre-design sampling activities
- Assume 4 construction laborers, 1 operating engineer and 1 technical advisor each for 4 weeks of on-site work at 40 hours per week

Laboratory Analysis

- Assume $10,000 in analytical costs

Residual Handling

Residue Disposal/Recycling

- Assume construction waste of 4 tons to be transported 60 miles in one trip to non-hazardous landfill

Resource Consumption

- Assume a total of 100,000 gallons of water used during construction activities

2.1.3.2 LTM Input Sheet

Assume 30 years of LTM with annual review requiring 3-day site visit and 5-year reviews requiring 5-day site visit.

Transportation

Personnel transportation for on-site LTM:

- 2 people x 3 days x 50 miles round trip x 24 reviews. – Annual Reviews
- 2 people x 5 days x 50 miles round trip x 6 reviews. – 5-Year Reviews

Equipment Use

Operator Labor

- Assume 1 technical advisor and 1 other on-site for 3 days for each annual review, and 1 technical advisor and 1 other on-site for 5 days for each 5-year review:
  - 1 technical advisor x 3 days x 8 hrs per day x 24 years – Annual Reviews
  - 1 other x 3 days x 8 hrs per day x 24 years – Annual Reviews
  - 1 technical advisor x 5 days x 8 hrs per day x 6 years –5-Year Reviews
  - 1 other x 5 days x 8 hrs per day x 5 years – 6-Year Reviews

2.1.4 Alternative W3: Institutional Controls, Excavation, and Off-Site Disposal

2.1.4.1 RAC Input Sheet

Transportation

Personnel transportation during pre-design sampling and construction, assuming 1 week of on-site work for pre-design sampling and 3 weeks of on-site work for construction:

- 2 people x 5 days x 50 miles round trip per day – Pre-design sampling
- 6 people x 15 days x 50 miles round trip per day – Construction

Equipment transportation during construction assuming single mobilization for one excavator:

- Excavator weighs 30 tons and total distance traveled is 200 miles
- Loader/backhoe assume equipment weighs 20 tons and total distance traveled is 200 miles

Equipment Use

Earthwork equipment one excavator

- Volume of 3,600 bulk cubic yards

Earthwork equipment one loader/backhoe for backfill

- Volume of 4,000 loose cubic yards

Operator Labor

- Assume 2 technical scientists for 1 week of on-site pre-design sampling activities at 40 hours per week.
- Assume 4 construction laborers, 1 operating engineers and 1 technical advisor each for 3 weeks of on-site work at 40 hours per week.

Laboratory Analysis

- Assume $10,000 in analytical costs

Residual Handling

Residue Disposal/Recycling

- Assume 1.4 tons per cubic yard of soil excavated for a total of 5,100 tons to be disposed of in landfill
- Assume 40 tons transported per trip at 60 miles per trip

Resource Consumption

- Assume a total of 10,000 gallons of water used during construction activities

2.1.4.2 LTM Input Sheet

Assume 30 years of LTM with annual review requiring 1-day site visit and 5-year reviews requiring 2-day site visit.

Transportation

Personnel transportation for on-site LTM:

- 2 people x 1 day x 50 miles round trip x 24 reviews – Annual Reviews
- 2 people x 2 days x 50 miles round trip x 6 reviews – 5-Year Reviews

Equipment Use

Operator Labor

- Assume 1 technical advisor and 1 other on-site for 1 day for each annual review and 1 technical advisor and 1 other for on-site 2 days for each 5-year review:
  - 1 technical advisor x 1 day x 8 hours per day x 24 reviews – Annual Reviews
  - 1 other x 1 day x 8 hours per day x 24 reviews – Annual Reviews
  - 1 technical advisor x 2 days x 8 hours per day x 6 reviews –5-Year Reviews
  - 1 other x 2 days x 8 hours per day x 6 reviews – 5-Year Reviews

3. Results

Figure D1 provides the comparative analysis of the GSR evaluation results for all four alternatives. Figures D2-D5 provides the breakdown for impact contributions from various

activities within each phase (RAC and LTM). The breakdowns help to determine the impact drivers for each alternative. Comparing media, upland remediation will have a lesser overall impact than the surface sediment remediation. The results for the upland alternatives and wetland alternatives are discussed separately.

3.1 Upland Alternatives

Alternative U2 calls for institutional controls and asphalt capping. During the RAC phase, energy and GHG emissions are spread between residual handling, equipment use, personnel transportation, and equipment transportation with equipment transportation outweighing the other categories (Figure D2). However, residual handling alone drives most of the SOx and PM10 impacts during RAC. For LTM, the on-site visits for ICs result in emissions from transportation and personnel transportation during LTM contributes to the accident risk.

Alternative U3 calls for institutional controls, excavation, and off-site disposal. For U3, residual handling drives the impact for all emissions and energy use (Figure D3). Equipment use and transportation drive accident risk. LTM for U3 has less impact than U2 because there would be shorter on-site visits and fewer institutional controls to review; however, ICs are still required for U3 as detailed in the FS.

Comparing upland alternatives U2 and U3 in the RAC phase, GHG emissions, energy usage, and PM10 emissions are similar for U2 and U3. Compared to U2, U3 would result in greater water usage, NO_x emissions, and SO_x emissions than U2 due to soil handling and transport to landfill facility. U2 would result in greater accident risk injury and fatality due to asphalt capping activities. Impacts for LTM are similar for U2 and U3 due to personnel transportation. Figure D1 presents the relative impacts for all alternatives for each of the categories discussed above.

Based on the findings for U2 and U3, the best potential methods to mitigate the environmental footprint of any of the soil remedial alternatives may include:

- Additional characterization to minimize the volume of soil that is excavated and shipped off-site, while still being protective of human health
- Investigation into the possibility of rail shipments
- The use of greener fuels, such as biodiesel, for excavation equipment and trucks
- Use of After-treatment Technologies for Emission Reduction, such as: Diesel Oxidation Catalyst, Diesel Particulate Filter, Selective Catalytic Reduction, and/or Diesel Multistage Filter for excavation equipment and trucks.
- Implementation of an idle control plan and other operating strategies to improve efficiency of site activities

The above options, as well as other impact mitigation techniques, can be considered during the design and implementation of the selected remedy.

3.2 Wetland Alternatives

Alternative W2 calls for ICs, excavation, and relocation activities for sediment in the TTZ in Subarea 6 and ICs for Subarea 6. Surface sediment in the TTZ in Subarea 6 would be excavated, stored in stockpiles (for characterization) and relocated in the on-site upland area located at IA F1. ICs would be maintained during the LTM phase. Equipment use is the dominating driver for accident risk, energy use, PM10, GHG, NOx, and SOx emissions during the RAC phase (Figure D4). For LTM, the on-site visits result in emissions and accident risk from personnel transportation.

Alternative W3 calls for ICs, excavation, and off-site disposal. For W3, similar to U3, residual handling drives the impact for all emissions and energy use (Figure D5). Equipment use, residual handling and transportation drive accident risk. LTM for W3 has less impact than W2 since there would be shorter on-site visits and fewer institutional controls to review.

Comparing wetland alternatives in the RAC phase, W3 impacts are greater than W2 impacts for GHG emissions, total energy used, NOx and GHG emissions. Accident risk impacts are greater for W2 compared to W3. Relocation for W2 may require additional ICs, the LTM impacts of W2 are greater than W3 assuming a containment cell would be needed in the upland area.

Based on the findings for W2 and W3, the best potential methods to mitigate the environmental footprint of any of the wetland remedial alternatives are the same as those methods recommended for the upland alternatives.

3.3 Summary and Conclusions

Figure D1 presents a summary and comparison of impacts of the sustainability metrics evaluated for each of the IA F1 remedial alternatives considered in the FS. Figures D2-D5 provide a breakdown of impact contributions by metric and phase.

For the upland area, both U2 and U3 would result in similar environmental footprint with U3 resulting in slightly greater NO_x and SO_x emissions and water use than U2. Accident risk is greater for U2 than U3. Much of the impact for U3 is embodied in the handling of the residual waste, and while the RAC phase for excavation has more impacts than capping, capping in U2 has more impacts during the LTM phase than excavation due to cap maintenance activities.

W2 would result in a lower environmental footprint than W3, and a greater water usage and accident risk than W3. Much of the impact for W2 is due to sediment handling and relocation. For W3 much of the impact is due to transportation and offsite disposal of excavated sediment during the RAC phase.W3 would have lower impact during the LTM phase because the sediment in the TTZ would be removed offsite.

4. References

NAVFAC. 2011. “SiteWise™ Version 2 User Guide” UG-2092-ENV, Prepared by Battelle Memorial Institute. June.

Figures

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Figure D1: Summary Comparison of GSR Metrics for Mare Island IA F1 Remediation Alternatives

Remedial Alternatives	GHG Emissions	Total energy Used	Water	NO_x emissions	SO_x Emissions	PM_{10} Emissions	Accident	Accident
	metric ton	MMBTU	gallons	metric ton	metric ton	metric ton	Risk Fatality	Risk Injury
U2	59.73	7.53E+02	3.50E+03	2.29E-02	1.08E-03	5.92E-03	2.58E-03	3.45E-01
U3	49.77	7.92E+02	4.00E+04	1.20E-01	5.93E-02	2.75E-01	1.03E-03	1.82E-01
W2	67.05	8.63E+02	1.00E+05	5.29E-02	1.67E-02	7.71E-03	2.73E-03	4.87E-01
W3	111.81	1.95E+03	1.00E+04	3.74E-01	1.91E-01	9.30E-01	1.08E-03	1.87E-01

Additional Sustainability Metrics

Remedial Alternatives	Non-Hazardous Waste Landfill Space	Hazardous Waste Landfill Space	Topsoil Consumption	Costing	Lost Hours - Injury	Final Cost with Footprint Reduction
	tons	tons	cubic yards	$		$
U2	8.00	0.00E+00	0.00E+00	1.49E+06	2.76E+00	1.49E+06
U3	1500.00	0.00E+00	0.00E+00	1.73E+06	1.46E+00	1.73E+06
W2	4.00	0.00E+00	0.00E+00	2.26E+06	3.89E+00	2.26E+06
W3	5100.00	0.00E+00	0.00E+00	2.15E+06	1.50E+00	2.15E+06

Relative Impact

Remedial Alternatives	GHG Emissions	Energy Usage	Water Usage	NOx emissions	SOx Emissions	PM10 Emissions	*Accident Risk Fatality	*Accident Risk Injury	Community Impacts	Resources Lost
U2	Medium	Medium	Low	Low	Low	Low	High	High	user select	user select
U3	Medium	Medium	Medium	Medium	Medium	Low	Medium	Medium	user select	user select
W2	Medium	Medium	High	Low	Low	Low	High	High	user select	user select
W3	High	High	Low	High	High	High	Medium	Medium	user select	user select

Relative Impact (User Override)

Remedial Alternatives	GHG Emissions	Energy Usage	Water Usage	NOx emissions	SOx Emissions	PM10 Emissions	*Accident Risk Fatality	*Accident Risk Injury	Community Impacts	Resources Lost
U2	Medium	Medium	Low	Low	Low	Low	High	High	user select	user select
U3	Medium	Medium	Medium	Medium	Medium	Low	Medium	Medium	user select	user select
W2	Medium	Medium	High	Low	Low	Low	High	High	user select	user select
W3	High	High	Low	High	High	High	Medium	Medium	user select	user select

*Accident Risk is an estimate of how many accidents may occur. This risk is not the same as Cancer Risk, which is the probablity (for a single person) of getting cancer. Accident risk is not comparable to Cancer Risk due to inherent

Figure D1: Continued

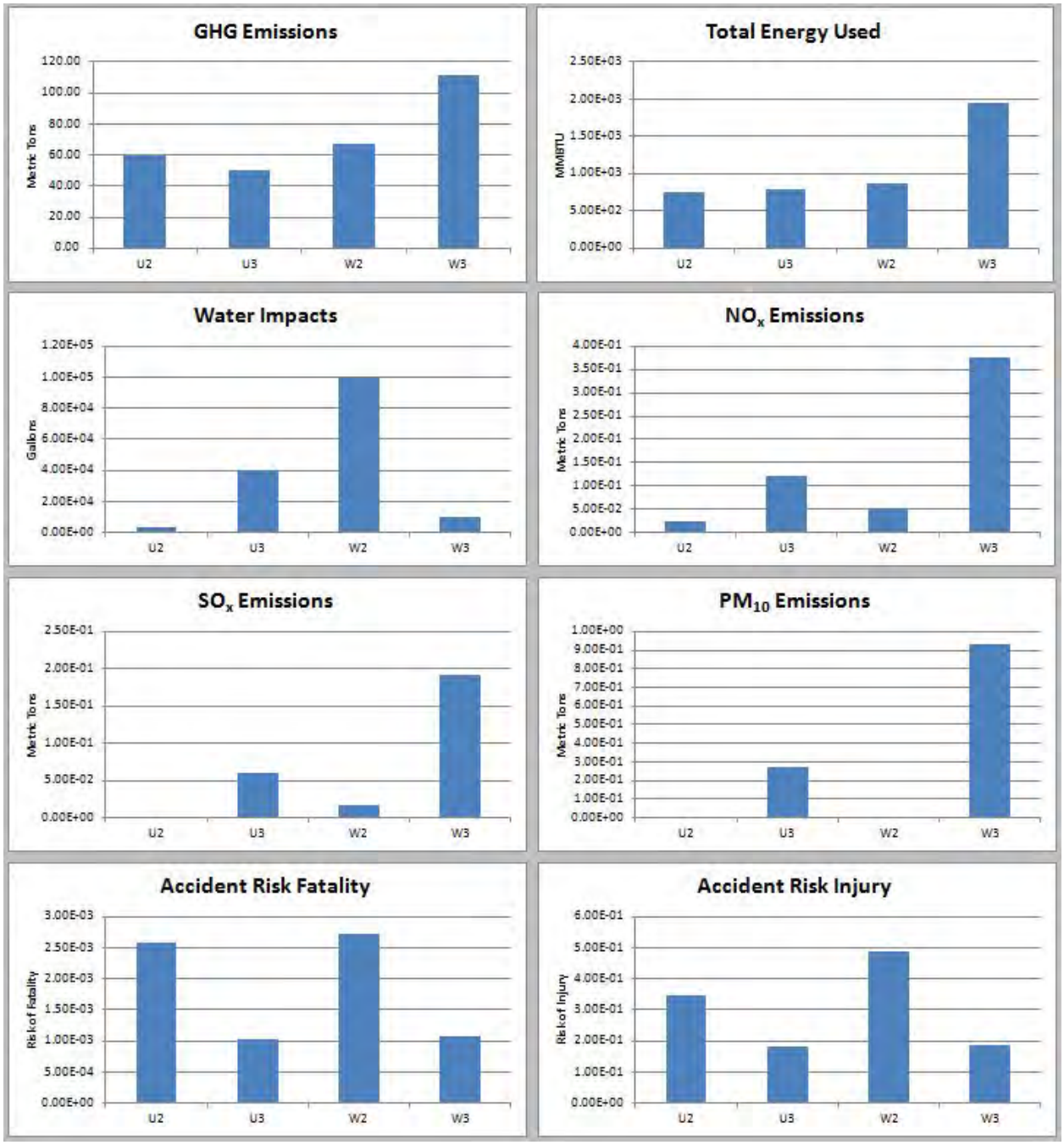

Figure D1: Continued

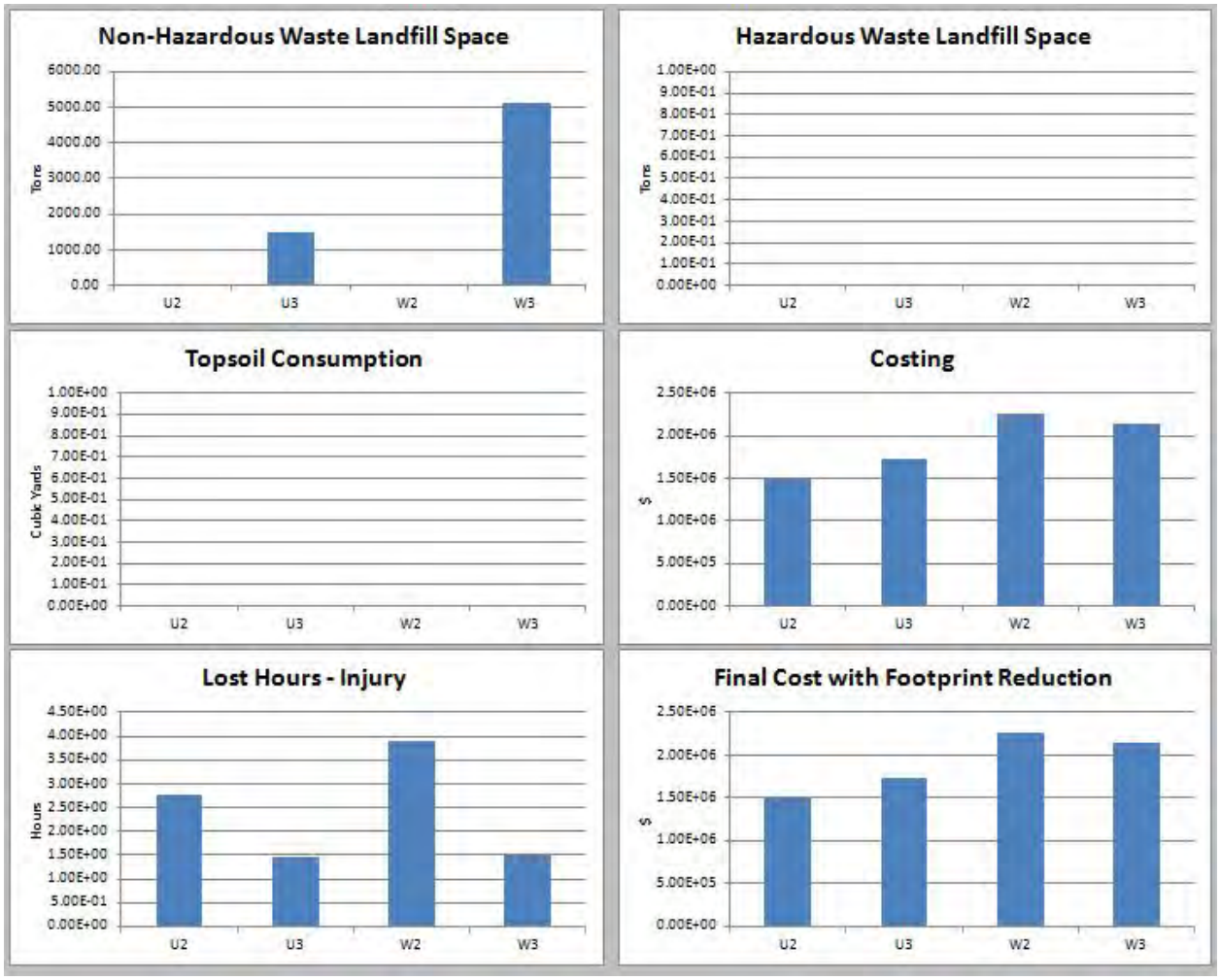

Figure D2: Impact Contributions Breakdown for Mare Island IA F1 Soil Alternative U2: Institutional Controls and Asphalt Capping

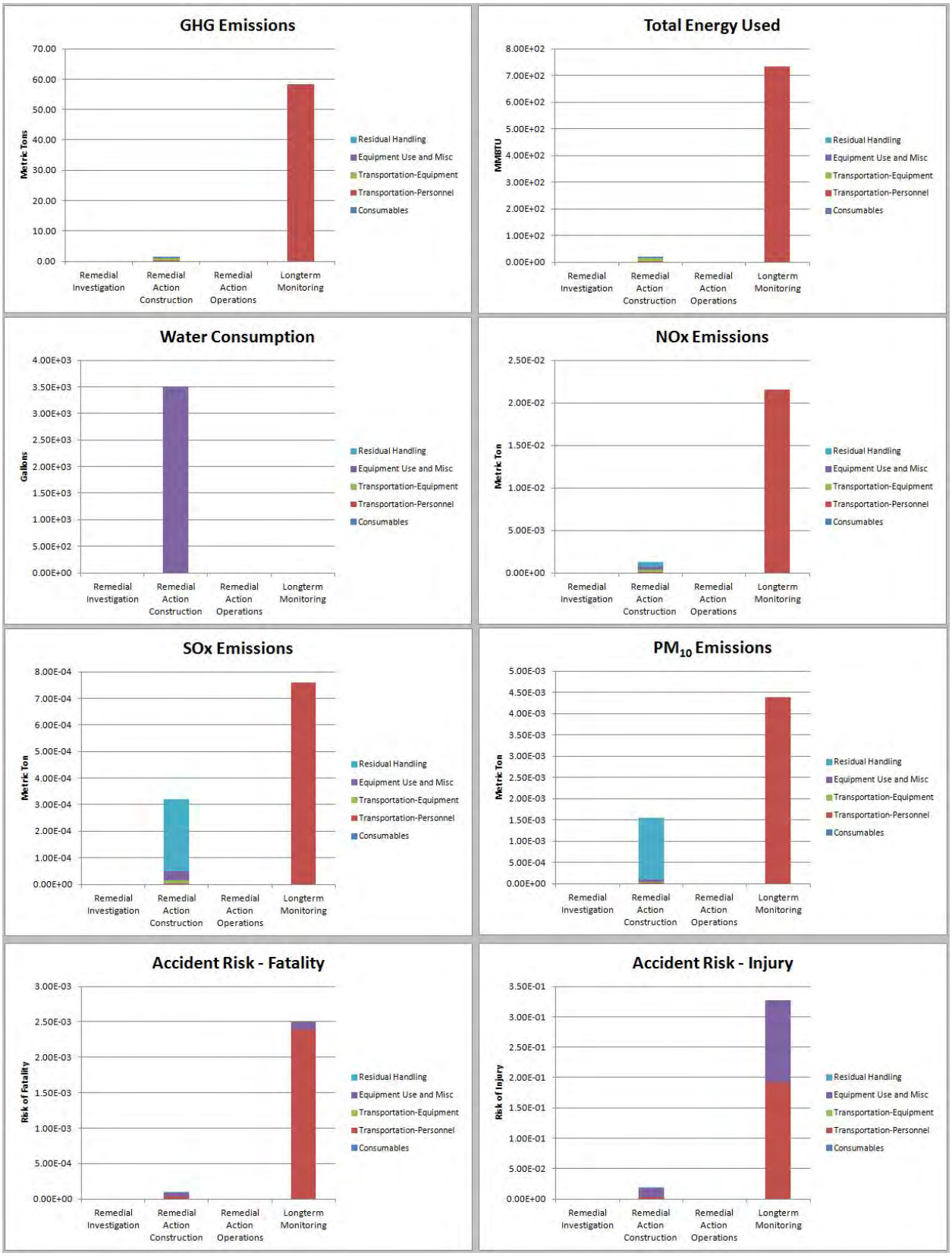

Figure D3: Impact Contributions Breakdown for Mare Island IA F1 Soil Alternative U3: Institutional Controls, Excavation, and Off-site Disposal

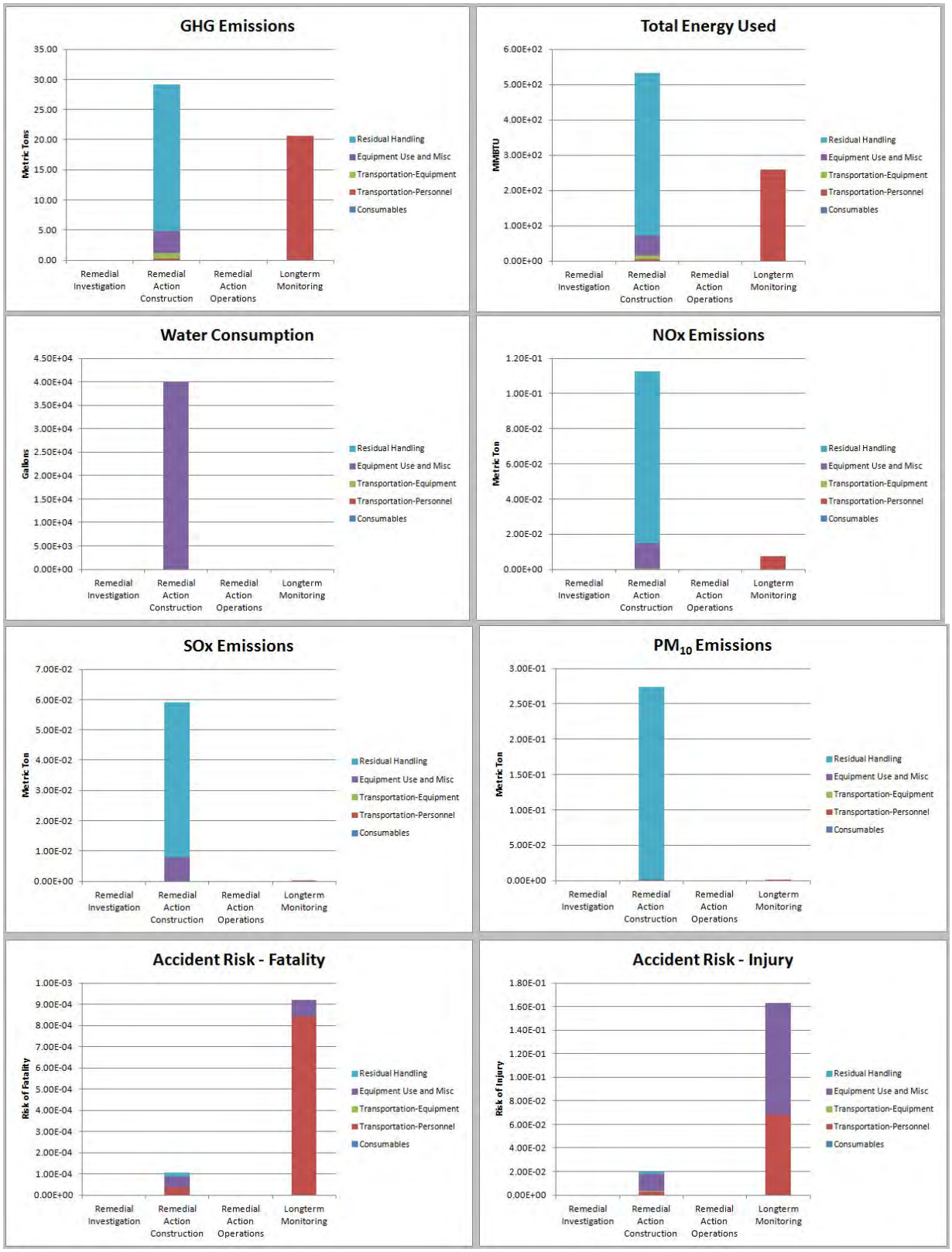

Figure D4: Impact Contributions Breakdown for Mare Island IA F1 Sediment Alternative W2: Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland

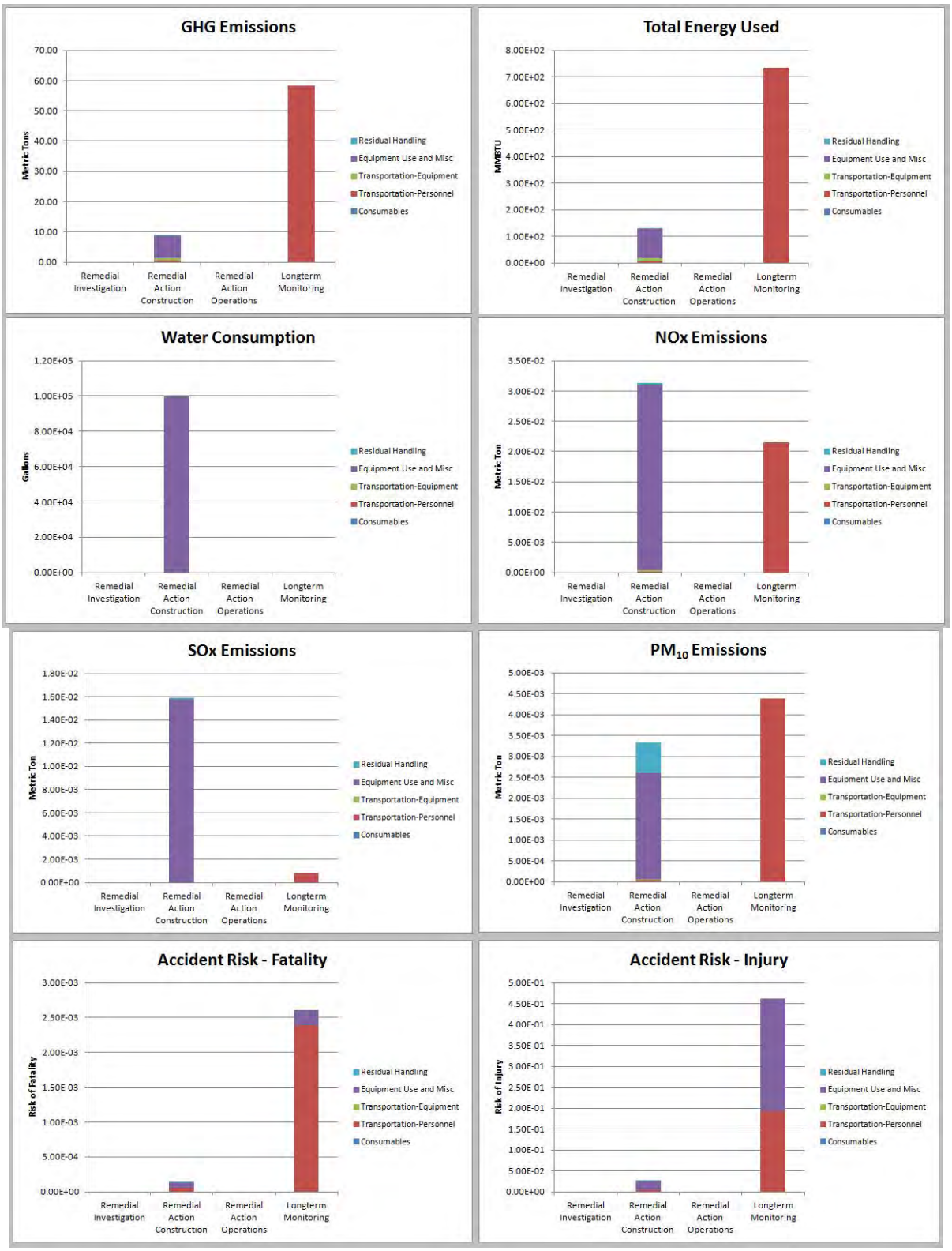

Figure D5: Impact Contributions Breakdown for Mare Island IA F1 Sediment Alternative W3: Institutional Controls, Excavation, and Off-site Disposal

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Appendix E: Cost Summary and Assumptions

Cost Summary and Assumptions

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1. Introduction

This appendix summarizes the methodology and documents the assumptions used in the development of cost estimates for Investigation Area (IA) F1, located within the Former Mare Island Naval Shipyard (Mare Island) in Vallejo, California. The alternatives are developed and evaluated as part of this Feasibility Study (FS) Report. Detailed descriptions of the alternatives can be found in Section 5 of the FS.

Cost estimates are developed as part of an FS to compare remedial alternatives during the remedy selection process, and not to establish project budgets or to negotiate Superfund enforcement settlements. The cost estimate is typically carried over from the FS Report to the Proposed Plan for public comment during remedy selection. The cost estimate in the Record of Decision reflects any changes to the remedial alternative that occurred during the remedy selection process as a result of new information or public comment (U.S. Environmental Protection Agency [EPA], 2000).

Cost is one of the nine National Oil and Hazardous Substances Pollution Contingency Plan (NCP) criteria for CERCLA sites. Cost estimates for FSs are prepared primarily for comparative purposes and are not reliable estimates of the absolute value of an alternative. Therefore, the FS cost estimate should not be used as the sole basis for allocation or planning of financing, or establishing the finance mechanisms. An engineering cost opinion must be prepared at the remedial design stage for a more reliable estimate of construction cost.

2. Cost Estimate Methodology

Total cost estimates are made up of three primary cost components including Remedial Design and Project Management, Capital Costs, and Operations and Maintenance (O&M) Costs. Remedial Design and Project Management costs are estimated as a fixed percentage of the capital costs according to "A Guide to Developing and Documenting Cost Estimates during the Feasibility Study," Exhibit 5-8, Examples of Percentages for Professional/Technical Service Capital Cost (EPA, 2000). The percentages assumed are shown in the table below.

Capital Cost Element	Total Construction Cost of $500,000 to $2,000,000	Total Construction Cost of $2,000,000 to $10,000,000
Project Management	6	5
Remedial Design	12	8
Construction Management	8	6

Capital costs were estimated using a detailed approach that estimates cost on a per-item or per-action basis. Line item costs for unique items or actions were based on professional judgment and knowledge of vendor quotes for similar projects. O&M costs were estimated on an annual basis assuming a 30-year life of the remedy. These costs are necessary to assure the

effectiveness of a response action. Costs for annual and five-year reviews were based on professional judgment and consider the relative anticipated effort required for O&M of each alternative.

The costs presented in this appendix are for comparison purposes only and have an estimated accuracy of +50 percent to -30 percent in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) guidelines for conducting feasibility studies (FS) (U.S. Environmental Protection Agency [EPA], 1988). Many design variables and permitting requirements have not yet been established. As such, contingency of 20 percent is included in the Capital Costs and O&M portions of the estimate to reflect this uncertainty.

Once total costs are calculated, the net present value (NPV) of the alternative is calculated to allow for comparison between alternatives when the costs are expended at different times during the implementation and O&M of each alternative. The NPV represents the amount of money that, if invested in the initial year of the remedial action at a given rate, would provide the funds required to make future payments to cover all costs associated with the remedial action over its planned life. Excel spreadsheets were used to tabulate costs and calculate NPVs in 2013 dollars.

2.1 Net Present Value

The NPV calculation depends on the selection of a discount rate. This FS follows the EPA policy on use of discount rates provided in "A Guide to Developing and Documenting Cost Estimates during the Feasibility Study," (EPA, 2000), and uses the real discount rate revised for 2013, in the Office of Management and Budget (OMB) Circular A-94 (OMB, 2013). The discount rate for a 30-year stream of payments for fiscal year 2013 is 1.1 percent.

2.2 Cost Estimates Breakdowns

Costs are summarized in Table E1. In Tables E2 through E5 of this appendix, breakdowns of estimated costs are presented for:

- Alternative U2: Institutional Controls and Asphalt Cap (Table E2)
- Alternative U3: Institutional Controls, Excavation, and Off-Site Disposal (Table E3)
- Alternative W2: Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland (Table E4)
- Alternative W3: Institutional Controls, Excavation, and Off-Site Disposal (Table E5)

Alternative 1 (No Action) does not have a corresponding breakdown of costs because there are no associated capital or O&M costs, and its NPV is $0. Detailed descriptions of the alternatives are provided in Section 5 of the FS.

2.3 Assumptions

Alternative specific assumptions used in the cost estimate development of each alterative are shown in the box at the top of each table. General assumptions are as follows:

- For each task, a 20 percent contingency was added to the subtotal of capital costs and O&M costs.
- There is no prime contractor markup on construction costs because it is assumed that the construction contractor would contract directly with the Navy.
- For all alternatives, costs associated with required project plans such as a work plan, sampling and analysis plan, or safety plan as well as documentation and/or progress and completion reporting costs are included within the estimates for Remedial Design and Project Management.
- The Navy is exempt under CERCLA from obtaining permits but must comply with the regulatory requirements of normally permitted activities. It is assumed that agencies would verify the intent to comply with these regulations through review of design plans. Therefore, permitting costs are not included separately, and efforts to ensure compliance with permit requirements are assumed to be part of the design.
- A subtotal total cost is provided for each component and a NPV subtotal is provided for O&M and capitol costs. A total cost and total NPV cost is provided for each alternative.
- It is assumed that construction would start in year 0 and that that construction would be completed within year 1 regardless of the selected alternative.
- The 30-year real discount rate from Appendix C of OMB Circular A-94 of 1.1% was applied to future O&M costs. The discount rates are the standard discount rate for use with federal government facilities.
- Periodic costs for annual and five-year reviews were based on professional judgment and consider the relative anticipated effort required for O&M of each alternative.
- O&M costs are estimated for each alternative without assuming any optimization. O&M costs have the potential to be reduced in the future if annual and 5-year reviews of the upland and wetlands area can be completed and reported on together.

3. References

Office of Management and Budget (OMB). 2013. M-13-04. Appendix C. Discount Rate for Cost-Effectiveness, Lease Purchase, and Related Analyses.

U.S. EPA. 1988. "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA." Interim Final. EPA/540G-89/004. October. Available Online at: <http://www.epa.gov/oerrpage/superfund/policy/remedy/pdfs/540g-89004-s.pdf>.

U.S. EPA. 2000. "A Guide to Developing and Documenting Cost Estimates During the Feasibility Study. July. EPA/540/R-00/002. Available on-line at: < http://www.epa.gov/superfund/policy/remedy/pdfs/finaldoc.pdf>

Tables

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Table E1 - Summary Cost

Feasibility Study, IA F1 Mare Island

Alternative Description	Remedial Design and Project Management	Capital Cost (including Off-site Disposal)	30-Year O&M Cost	30-Year O&M NPV Cost	Total Cost (Capital and O&M)	Total NPV Cost (Capital and O&M NPV)
Alternative 1: No Action	$ -	$ -	$ -	$ -	$ -	$ -
Alternative U2: Institutional Controls and Asphalt Capping	$ 107,680	$ 414,150	$ 1,080,000	$ 909,000	$ 1,601,830	$ 1,428,282
Alternative U3: Institutional Controls, Excavation, and Off-site Disposal	$ 164,660	$ 831,300	$ 900,000	$ 756,400	$ 1,895,960	$ 1,745,274
Alternative W2: Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland	$ 525,470	$ 2,021,040	$ 240,000	$ 210,670	$ 2,786,510	$ 2,735,837
Alternative W3: Institutional Controls, Excavation, and Off-site Disposal	$ 408,980	$ 2,088,480	$ 60,000	$ 58,070	$ 2,557,460	$ 2,533,453

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Table E2 - Alternative U2 - Institutional Controls and Asphalt Capping

Feasibility Study, IA F1 Mare Island

Assumptions/Parameters

Capping area of approximately: 13,500 sqft

4" Asphalt Cap

Both sites A75 and A17 in single 3 week mobilization with 2 different set-ups

Costs for annual IC review for land use ICs are included below and apply to the entire site (upland and wetlands areas).

Costs for ICs associated with asphalt cap maintenance are calculated seperately and are included below.

Costs associated with required project plans such as a work plan, sampling and analysis plan, or saftey plan as well as documentation and/or progress and completion reporting costs are included within the estimates for Remedial Design and Project Management.

	Description	Quantity	Measure	Unit Cost	Extended Cost	NPV Extended Cost	Source
Remedial Design and Project Management							
	Professional Labor Management						
	Remedial Design	12%	Total Capital Costs	--	$49,700		EPA FS Guidance 2000
	Project Management	6%	Total Capital Costs	--	$24,850		EPA FS Guidance 2000
	Construction Management	8%	Total Capital Costs	--	$33,130		EPA FS Guidance 2000
				Total Design and Management Costs	**$107,680**	**$107,680**	
Capital Costs							
	LUC RD Plan						
	Plan Preparation	1	EA	$150,000	$150,000		Engineer's Estimate
	Site Capping						
	Site Survey, Before and After Capping	2	EA	$3,000	$6,000		Engineer's Estimate
	Mobilization and Demobilization	1	EA	$20,000	$20,000		Engineer's Estimate
	Site Setup and Controls	2	EA	$15,000	$30,000		Engineer's Estimate
	MMRP implementation	5	Day	$1,500	$7,500		Engineer's Estimate
	Subgrade preparation	13,500	SQFT	$0.75	$10,125		Engineer's Estimate
	Asphalt Capping	13,500	SQFT	$8	$108,000		Engineer's Estimate
	Capping Testing and Report	3	EA	$4,500	$13,500		Engineer's Estimate
				Subtotal Capital Costs	$345,125		
				Contingency (20%)	$69,025		
				Total Capital Costs	**$414,150**		
				Total NPV Capital Costs		**$411,602**	Construction during Year 1
Operations and Maintenance							
	Enforcing Institutional Controls						
	Institutional Control Review (annually, 30 years)	30	EA	$15,000	$450,000		Engineer's Estimate
	Asphalt Cap Maintenance (annually, 30 years)	30	EA	$5,000	$150,000		Engineer's Estimate
				Subtotal	$600,000		
	5-Year Reviews and Reporting						
	5-year Reviews (per event)	6	EA	$50,000	$300,000		Engineer's Estimate

	Subtotal				$300,000		
	Subtotal Operations and Maintenance (Years 1-30)				$900,000		
	Contingency (20%)				$180,000		
	Total Operations and Maintenance Costs				**$1,080,000**		
	Total NPV Operations and Maintenance Costs					**$909,000**	
	Total Cost				**$1,601,830**		
	Total Net Present Value (NPV) Cost (Years 1-30, 1.1% discount rate). Remedial design, project management, and IC Plan assumed in Year 0, capital costs for construction assumed in Year 1.					**$1,428,282**	

Table E3 - Alternative U3 - Institutional Controls, Excavation, and Off-Site Disposal

Feasibility Study, IA F1 Mare Island

Assumptions/Parameters		
Excavate area of approximately:	13,500	sqft
Excavate to depth of:	2.5	ft
Approximate total volume of soil to excavate:	1,250	BCY
Conversion to Tons - 1.2 Tons per CY - Soil	1,500	Tons

Both sites A75 and A17 in single 3 week mobilization with 2 different set-ups

Assume need 20% more fill than excavation to compact

Costs for annual IC review for land use ICs are included below and apply to the entire site (upland and wetlands areas).

Costs associated with required project plans such as a work plan, sampling and analysis plan, or saftey plan as well as documentation and/or progress and completion reporting costs are included within the estimates for Remedial Design and Project Management.

	Description	Quantity	Measure	Unit Cost	Extended Cost	NPV Extended Cost	Source
Remedial Design and Project Management							
	Professional Labor Management						
	Remedial Design	12%	Total Capital Costs	--	$76,000		EPA FS Guidance 2000
	Project Management	6%	Total Capital Costs	--	$38,000		EPA FS Guidance 2000
	Construction Management	8%	Total Capital Costs	--	$50,660		EPA FS Guidance 2000
				Total Design and Management Costs	**$164,660**	**$164,660**	
Capital Costs							
	LUC RD Plan						
	Plan Preparation	1	EA	$150,000	$150,000		
	MEC Avoidance and Safety						
	UXO Technician	40	Day	$900	$36,000		Engineer's Estimate
	Equipment	40	Day	$200	$8,000		Engineer's Estimate
	Site Excavation and Backfill						
	Site Survey, Before and After Excavation	2	EA	$3,000	$6,000		Engineer's Estimate
	Mobilization and Demobilization	1	EA	$20,000	$20,000		Engineer's Estimate
	Site Setup and Controls	2	EA	$15,000	$30,000		Engineer's Estimate
	MMRP implementation	5	Day	$1,500	$7,500		
	Soil Excavation and Stockpiling	1,250	BCY	$50	$62,500		Engineer's Estimate
	Post-excavation Sampling, Metals	70	EA	$45	$3,150		Engineer's Estimate
	Post-excavation Sampling, TPH-dr	10	EA	$60	$600		Engineer's Estimate
	Clean Fill, Including delivery	1,500	Ton	$20	$30,000		Engineer's Estimate
	Fill Characterization Testing	3	EA	$1,000	$3,000		Engineer's Estimate
	Backfill and Compaction	1,500	LCY	$60	$90,000		Engineer's Estimate
	Site Restoration	13,500	SQFT	$6	$81,000		Engineer's Estimate
				LUC Plan, Site Excavation and Backfill Subtotal	**$527,750**		
				Subtotal Capital Costs	$527,750		

				Contingency (20%)	$105,550		
				Total Capital Costs	**$633,300**		
				Total NPV Capital Costs		**$628,368**	
Off-Site Disposal for Non-Hazardous Waste							
	Non-Haz Waste Transportation and disposal - Soil	1,500	LCY	$110	$165,000		Engineer's Estimate
				Contingency (20%)	$33,000		
				Off-site Disposal Subtotal	**$198,000**		
				NPV Off-site Disposal Subtotal		**$195,846**	
Operations and Maintenance							
	Enforcing Institutional Controls						
	Institutional Control Review (annually, 30 years)	30	EA	$15,000	$450,000		Engineer's Estimate
				Subtotal	$450,000		
	5-Year Reviews and Reporting						
	5-year Reviews (per event)	6	EA	$50,000	$300,000		Engineer's Estimate
				Subtotal	$300,000		
				Subtotal Operations and Maintenance (Years 1-30)	$750,000		
				Contingency (20%)	$150,000		
				Total Operations and Maintenance Costs	**$900,000**		
				Total NPV Operations and Maintenance Costs		**$756,400**	
				Total Cost	**$1,895,960**		
	Total Net Present Value (NPV) Cost (Years 1-30, 1.1% discount rate). Remedial design, project management, and IC Plan assumed in Year 0, construction and disposal assumed in Year 1.					**$1,745,274**	

Table E4 - Alternative W2 - Institutional Controls, Excavation, and On-Site Sediment Relocation to Upland

Feasibility Study, IA F1 Mare Island

Assumptions/Parameters		
Approximate area to the north of the slough associated with Outfall 33:	25,750	sqft
Approximate area to be considered from IA K Outfall 33 and associated slough:	12,600	sqft
Total approximate area to be ~~contained~~ considered prior to pre-design sampling:	38,350	sqft
Cell sized 1:1 to excavated volume to be relocated	1	
Depth of sediment to be relocated	2.5	ft
Volume of sediment to be relocated (area * depth)	3550	BCY
Conversion to Tons: 1.4 Tons per CY - Sediment	5,000	Tons
Volume of imported sediment to replace relocated sediment	3,905	LCY
Tons of imported sediment	5,000	Tons

Assume loose cubic yards = 1.2*bulk cubic yards for upland soil

Assume loose cubic yards = 1.1*bulk cubic yards for wetland sediment

Costs for a sitewide LUC and IC Implementation Plan are included in the uplands alternatives: Alternatives U1 and U2.

Costs associated with O&M for sitewide LUC/IC enforcement are included in the uplands alternatives: Alternatives U1 and U2.

Costs for ICs associated with cell maintenance are calculated seperately and are included below.

Assume predesign sampling requires 75 samples

Costs associated with required project plans such as a work plan, sampling and analysis plan, or saftey plan as well as documentation and/or progress and completion reporting costs are included within the estimates for Remedial Design and Project Management.

	Description	Quantity	Measure	Unit Cost	Extended Cost	NPV Extended Cost	Source
Remedial Design and Project Management							
	Professional Labor Management						
	Remedial Design	12%	Total Capital Costs	--	$242,525		EPA FS Guidance 2000
	Project Management	6%	Total Capital Costs	--	$121,262		EPA FS Guidance 2000
	Construction Management	8%	Total Capital Costs	--	$161,683		EPA FS Guidance 2000
				Total Design and Management Costs	**$525,470**	**$525,470**	
Capital Costs							
	Pre-Design Survey						
	Sampling Survey	1	EA	$30,000	$30,000		Engineer's Estimate
	Analysis for metals	75	EA	$60	$4,500		Engineer's Estimate
	Report preparation	1	EA	$15,000	$15,000		Engineer's Estimate
				Pre-design Survey Subtotal	$49,500		
	MEC Avoidance and Safety						
	UXO Technician	20	Day	$900	$18,000		Engineer's Estimate
	Equipment	20	Day	$200	$4,000		Engineer's Estimate
	Biological Monitoring	40	Day	$1,500	$60,000		Engineer's Estimate
	Salt Marsh Harvest Mouse Exclusion Fencing	1	Ea	$35,000	$35,000		Engineer's Estimate
	Sediment Excavation in TTZs						
	Site Survey Before and After Excavation	2	EA	$3,000	$6,000		Engineer's Estimate

	Mobilization and Demobilization	1	EA	$20,000	$20,000		Engineer's Estimate
	Site Setup and Controls	1	EA	$15,000	$15,000		Engineer's Estimate
	Sedimet Excavation and Stockpiling	3550	BCY	$75	$266,250		
	Post-excavation Sampling, Metals	20	EA	$60	$1,200		
	Import Clean Sediment Fill, including delivery	5,000	Tons	$30	$150,000		
	Fill Characterization Testing	1	EA	$1,000	$1,000		
	Backfill to Original Wetlands Elevation	3,905	LCY	$20	$78,100		
	Wetlands Restoration						
	Site Restoration - Grading and Wetland Restoration Planning	1	EA	$300,000	$300,000		
	Harvesting Sod Fragments from Donor Area	38,350	SQFT	$4	$153,400		Engineer's Estimate
	Transplanting Harvested Native Wetland Species (pickleweed)	38,350	SQFT	$4	$153,400		Engineer's Estimate
	Site Excavation and Wetlands Restoration Subtotal				$1,261,350		
	Uplands Containment Cell						
	UXO Technician - MEC Avoidance and Safety in the Upland Area	5	Day	$900	$4,500		Engineer's Estimate
	Equipment - MEC Avoidance and Safety in the Upland Area	5	Day	$200	$1,000		Engineer's Estimate
	Site Survey, Before and After Cell Development and Covering	2	EA	$3,000	$6,000		Engineer's Estimate
	Uplands Excavation and Stockpiling for Containment Cell	3550	BCY	$50	$177,500		Engineer's Estimate
	Sediment Relocation to Uplands Containment Cell	5,000	Tons	$10	$50,000		Engineer's Estimate
	Backfill with Excavated Uplands Soil	4,800	LCY	$20	$96,000		
	Compacting Soil Cover Over Containment Cell	38,350	SQFT	$1	$38,350		Engineer's Estimate
	Onsite Uplands Containment Cell Subtotal				$373,350.00		
	Subtotal Capital Costs				$1,684,200		
	Contingency (20%)				$336,840		
	Total Capital Costs				**$2,021,040**		
	Total NPV Capital Costs					**$1,999,697**	
Operations and Maintenance							
	Enforcing Institutional Controls						
	Institutional Control Review (annually, 30 years)	30	EA	--	--		See Alternative U2 or U3
	Monitoring wetland development (annually, 5 years)	5	EA	$10,000	$50,000		Engineer's Estimate
	Maintain Upland Containment Cell (annually, 30 years)	30	EA	$5,000	$150,000		Engineer's Estimate
	Subtotal - Annual				$200,000		
	5-Year Reviews and Reporting						
	5-year Reviews (per event)	6	EA	--	--		See Alternative U2 or U3
	Subtotal 5-year				--		See Alternative U2 or U3
	Subtotal Operations and Maintenance (Years 1-30)				$200,000		
	Contingency (20%)				$40,000		
	Total Operations and Maintenance Costs				**$240,000**		
	Total NPV Operations and Maintenance Costs					**$210,670**	
	Total Cost				**$2,786,510**		
	Total Net Present Value (NPV) Cost (Years 1-30, 1.1% discount rate). Remedial design, project management, and predesign survery assumed in Year 0, capital costs for construction assumed in Year 1.					**$2,735,837**	

Table E5 - Sediment Alternative W3 - Institutional Controls, Excavation, and Off-site Disposal

Feasibility Study, IA F1 Mare Island

Assumptions/Parameters		
Approximate area north of the slough associated with Outfall 33 from IA K:	25,750	sqft
Approximate area to be considered from IA K Outfall 33 and associated slough:	12,600	sqft
Total approximate area to be excavated prior to pre-design sampling:	38,350	sqft
Excavate to depth of:	2.5	ft
Approximate total volume of sediment to excavate prior to pre-design survey (area * depth)	3550	BCY
Conversion to Tons - 1.4 Tons per CY - Sediment	5,000	Tons
Assume additional sampling with 75 samples		
Assume 10% more fill than excavation to compact		
Costs for a sitewide LUC and IC Implementation Plan are included in the uplands alternatives: Alternatives U1 and U2.		
Costs associated with O&M for sitewide LUC/IC enforcement are included in the uplands alternatives: Alternatives U1 and U2.		
Costs associated with required project plans such as a work plan, sampling and analysis plan, or safety plan as well as documentation and/or progress and completion reporting costs are included within the estimates for Remedial Design and Project Management.		

	Description	Quantity	Measure	Unit Cost	Extended Cost	NPV Extended Cost	Source
Remedial Design and Project Management							
	Professional Labor Management						
	Remedial Design	12%	Total Capital Costs	--	$188,760		EPA FS Guidance 2000
	Project Management	6%	Total Capital Costs	--	$94,380		EPA FS Guidance 2000
	Construction Management	8%	Total Capital Costs	--	$125,840		EPA FS Guidance 2000
				Total Design and Management Costs	**$408,980**	**$408,980**	
Capital Costs							
	Pre-Design Survey						
	Sampling Survey	1	EA	$30,000	$30,000		Engineer's Estimate
	Analysis for metals	75	EA	$60	$4,500		Engineer's Estimate
	Report preparation	1	EA	$15,000	$15,000		Engineer's Estimate
				Pre-design Survey Subtotal	$49,500		
	MEC Avoidance and Safety						
	UXO Technician	20	Day	$900	$18,000		Engineer's Estimate
	Equipment	20	Day	$200	$4,000		Engineer's Estimate
	Biological Monitoring	40	Day	$1,500	$60,000		Engineer's Estimate
	Salt Marsh Harvest Mouse Exclusion Fencing	1	Ea	$35,000	$35,000		Engineer's Estimate
	Site Excavation and Backfill						
	Site Survey, Before and After Excavation	2	EA	$3,000	$6,000		Engineer's Estimate
	Mobilization and Demobilization	1	EA	$20,000	$20,000		Engineer's Estimate
	Site Setup and Controls	1	EA	$15,000	$15,000		Engineer's Estimate
	Sediment Excavation and Stockpiling	3,550	BCY	$75	$266,250		Engineer's Estimate

	Post-excavation Sampling, Metals	20	EA	$60	$1,200		Engineer's Estimate
	Import Clean Sediment Fill, Including delivery	5,000	Ton	$30	$150,000		Engineer's Estimate
	Fill Characterization Testing	1	EA	$1,000	$1,000		Engineer's Estimate
	Backfill and Compaction	3,905	LCY	$20	$78,100		Engineer's Estimate
	Wetlands Restoration						
	Site Restoration - Grading and Wetland Restoration Planning	1	EA	$300,000	$300,000		Engineer's Estimate
	Harvesting sod fragments for wetland development	38,350	SQFT	$4	$153,400		
	Transplanting native wetland species (pickleweed)	38,350	SQFT	$4	$153,400		
	Site Excavation and Wetlands Restoration Subtotal				$1,261,350		
	Subtotal Capital Costs				$1,310,850		
	Contingency (20%)				$262,170		
	Total Capital Costs				**$1,573,020**		
	Total NPV Capital Costs					**$1,556,551**	
	Off-Site Disposal (Non-Hazardous Waste)						
	Transportation and disposal - Sediment	3,905	LCY	$110	$429,550		Engineer's Estimate
	Contingency (20%)				$85,910		
	Off-site Disposal Total				**$515,460**		
	NPV Off-site Disposal Total					**$509,852**	
Operations and Maintenance							
	Enforcing Institutional Controls						
	Institutional Control Review (annually, 30 years)	30	EA	--	--		See Alternative U2 or U3
	Monitoring wetland development (annually, 5 years)	5	EA	$10,000	$50,000		Engineer's Estimate
	Subtotal				$50,000		
	5-Year Reviews and Reporting						
	5-year Reviews (per event)	6	EA	--	--		See Alternative U2 or U3
	Subtotal				--		See Alternative U2 or U3
	Subtotal Operations and Maintenance (Years 1-30)				$50,000		
	Contingency (20%)				$10,000		
	Total Operations and Maintenance Costs				**$60,000**		
	Total NPV Operations and Maintenance Costs					**$58,070**	
	Total Cost				**$2,557,460**		
	Total Net Present Value (NPV) Cost (Years 1-30, 1.1% discount rate). Remedial design, project management, and predesign survey assumed in Year 0, capital costs for construction and disposal assumed in Year 1.					**$2,533,453**	

Appendix F

Responses to Comments from Regulatory Agencies

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Responses to Agency Comments dated November 2014

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Janet Naito, Project Manager – Comments dated November 2014
California Department of Toxic Substances Control (DTSC) and San Francisco Bay Regional Water Quality Control Board (Water Board)
700 Heinz Avenue, Berkeley, CA 94710

DTSC and Water Board General Comments	Navy Responses
General Comment 1: Review the text to insure that it states throughout the document that only shallow groundwater received the exception to drinking water policy from Regional Water Board staff. In addition, unless deeper groundwater has been tested for applicable constituents (e.g., total dissolved solids) and results showed the groundwater does not meet potability criteria (as defined by the EPA and State Water Resources Control Board), deeper groundwater cannot be ruled out as a drinking water source.	**Response to General Comment 1:** As requested, the text has been revised in the locations referenced below to indicate that the Water Board exception is for shallow groundwater. Revised text locations in document: • Table ES-6 • Section 1, Groundwater (pg 1-3) • 2.3.4.1 Groundwater Potability (pg 2-6) • 2.6.5 Final IA F1 RI Report Conclusions and Recommendations (pg 2-21) • 4.3.3.1 Effectiveness (pg 4-6) • Table 7 Revised text locations in ARARs document (Appendix C): • 2.1.1 Groundwater ARARs Conclusions (App C pg 2-1) [changes made for 2 instances] • 2.2.1.1 Federal (App C pg 2-3) [changes made for 2 instances] • 2.2.1.2 State, - Comprehensive Water Quality Control Plan for the San Francisco Bay Region (Basin Plan) (App C pg 2-5) • Table C-2.

General Comment 2: Reference in the text the Regional Water Board staff no further action letters for USTs or other petroleum features that were closed.	**Response to General Comment 2:** Table 1-2 from the Final RI summarizes the UST closures at IA F1 and includes references to the Regional Water Board staff NFA letters. This table is attached to this RTC for ease of reference. UST closure typically included one or more of the following requirements: • Water Board notification for changes in land use from Commercial/Industrial, • No residential land use, • No drinking water use • Any monitoring wells that will no longer be used must be properly destroyed pursuant to requirements of the Solano County Department of Public Works. These requirements have been added to Table 7, Institutional Controls, and the corresponding Executive Summary table, Table ES-6, as a new row in the table identifying UST Requirements.
General Comment 3: Include all abbreviations in the notes of the tables. Some of the tables use abbreviations that are not defined (e.g., Tables ES-1, ES-7, and possibly others)	**Response to General Comment 3:** As requested the tables have been reviewed and revised to include definitions of abbreviations, including the tables in the executive summary. Abbreviation revisions were made to the following Tables, with bold text indicating an addition and strikeout text indicating a deletion: Table 1 • **ERA Ecological Risk Assessment** • **IA F1 Investigation Area F1** Table 2 • **ARAR Applicable or relevant and appropriate**

requirements

- **IA F1 Installation Area F1**
- **RAOs Remedial action objectives**
- ~~GRA General Response Action~~

Table 4

- **ARAR applicable or relevant and appropriate requirements**
- **NCP National Oil and Hazardous Substances Pollution Contingency Plan**

Table 5

- **ARAR applicable or relevant and appropriate requirements**
- **NCP National Oil and Hazardous Substances Pollution Contingency Plan**

Table 6

- **GSR – Green and Sustainable Remediation**
- **MMBtu – million British thermal units**
- **NO_x – nitrogen oxides**
- **PM_{10} – particulate matter 10 microns in diameter or smaller**
- **SOx – sulfur oxides**

Table 7

- **EPC – exposure point concentrations**
- **ERA – Ecological Risk Assessment**
- **GW – groundwater**
- **RI – Remedial Investigation**

Table 8

- **CHHSL California Human Health Screening Level**
- **EPC exposure point concentration**
- **HI Hazard Index**
- **HQ Hazard Quotient**
- **mg/kg milligrams per kilograms**
- **OEHHA Office of Environmental Health Hazard Assessment**
- **RG remedial goal**
- **TRV toxicity reference value**
- **TTZ target treatment zone**
- **yd^3 cubic yard**

Executive Summary Tables:

Table ES-1

- **ERA Ecological Risk Assessment**
- **IA F1 Investigation Area F1**

Table ES-2

- **ARAR Applicable or relevant and appropriate requirements**
- **IA F1 Installation Area F1**
- **RAOs Remedial action objectives**
- **TTZ Target treatment zone**

Table ES-4

- **ARAR applicable or relevant and appropriate requirements**
- **NCP National Oil and Hazardous Substances Pollution**

	Contingency Plan Table ES-5 • **ARAR applicable or relevant and appropriate requirements** • **NCP National Oil and Hazardous Substances Pollution Contingency Plan** Table ES-6 • **EPC – exposure point concentrations** • **ERA – Ecological Risk Assessment** • **GW – groundwater** • **RI – Remedial Investigation** Table ES-7 • **CHHSL California Human Health Screening Level** • **EPC exposure point concentration** • **HI Hazard Index** • **HQ Hazard Quotient** • **mg/kg milligrams per kilograms** • **OEHHA Office of Environmental Health Hazard Assessment** • **RG remedial goal** • **TRV toxicity reference value** • **TTZ target treatment zone** • **yd3 cubic yard**
General Comment 4: Clarify whether site use as "conservation," "recreational," and "regional	**Response to General Comment 4:** The terms as used are related but not identical. Subarea 6 is slated for

park" are the same, particularly with respect to risk assessment and exposure of future users and ecological receptors. The terms seem to be used interchangeably throughout the document.	reuse as a conservation area. A conservation area is a reuse category and is an area designated for protection of its natural resources including ecological receptors. Subarea 7 and part of Subarea 5 are slated for reuse as a regional park. A regional park is another reuse category and is an area designated for regular use by the public. Exposures to anticipated future users in both of these subareas are expected to be typical of recreational users. The recreational user is a receptor in the human health risk model.
General Comment 5: Review the "Reduction in Toxicity, Mobility, or Volume Through Treatment" sections of the report for consistency and content. The discussions are not consistent. For example, destruction of chemicals of concern is mentioned in some sections but not others. Also, Section 6.3.2.4 states that the "overall toxicity and mobility of the contaminant" will be reduced via excavation and disposal. However, removal of soil containing the chemicals simply relocates rather than reduces the toxicity of the chemicals.	**Response to General Comment 5:** In response to this comment the referenced sections have been reviewed for consistency. **6.3.1.4 Reduction in Toxicity, Mobility, or Volume through Treatment** "~~Although~~ Alternative U2 includes asphalt cover over contaminated soil and ICs to improve the permanence of the alternative.~~, it~~ **This alternative** does not include **any** treatment of contaminated soil at Subareas 4 and 5. Therefore, this alternative would not result in the ~~destruction~~ **reduction** of COCs and COECs in soil**,** or reduce the overall toxicity or ~~volume~~ **mobility** of contamination through treatment. ~~and~~ **This alternative** would not meet the statutory preference for treatment options. ~~However, this alternative would reduce the potential for contaminant mobility.~~ The rating for Alternative U2 for the reduction of toxicity, mobility, and volume through treatment is **low**. ~~marginal because, although toxicity and volume are not reduced, mobility is reduced as a result of the capping remedy.~~ " **6.3.2.4 Reduction in Toxicity, Mobility, or Volume through Treatment** Alternative U3 includes removal and disposal of the contaminated surface soil **to an offsite facility**. ~~While t~~**T**his alternative would **not** reduce the overall toxicity, ~~and~~ **volume, or** mobility of ~~the~~ contaminant**s**

from ~~at~~ IA F1 **through treatment**~~, the volume of contamination would transferred off-site rather than reduced by treatment~~. **However, if the disposal facility places the contaminated soil in a lined cell then the mobility of contaminants would be reduced through containment.** This alternative would not meet the statutory preference for **reduction in toxicity, mobility, or volume through** treatment~~options~~. The rating for Alternative U3 for the reduction of toxicity, mobility, or volume through treatment is ~~marginal~~ **low**.~~because the toxicity, mobility, and volume of COCs present at IA F1 is reduced by the alternative but not by treatment.~~

6.4.1.4 Reduction in Toxicity, Mobility, or Volume through Treatment

Alternative W2 does not include treatment of contaminated sediment in Subarea 6. Therefore, this alternative would not result in the destruction of COECs, reduce the overall mobility of metals in sediment, or reduce the overall toxicity or volume of contamination through treatment. **This alternative** ~~and~~ would not meet the statutory preference for treatment options. ~~This alternative would reduce the potential for contaminant mobility if the material is placed in an upland containment cell, though the reduction is not achieved through treatment.~~ The rating for Alternative W2 for the reduction of toxicity, mobility, and volume through treatment is ~~marginal~~**low**.

6.4.2.4 Reduction in Toxicity, Mobility, or Volume through Treatment

Similar to Alternative U3, Alternative W3 includes removal and disposal of the contaminated sediment **to an offsite facility**. ~~While this alternative would reduce the overall toxicity and mobility of the contaminant at IA F1, the volume of contamination would be transferred off-site rather than reduced by treatment.~~ **This alternative would not meet the statutory preference for treatment options.** The rating for Alternative W3 for the reduction of toxicity, mobility, or volume through treatment is **low**. ~~marginal because the toxicity, mobility, and~~

	~~volume of COECs present at Subarea 6 is reduced by the alternative but not by treatment.~~
General Comment 6: Please describe the institutional control format that would be used to prohibit the domestic or other use of groundwater at this Site.	**Response to General Comment 6:** As stated in Appendix C: *"The remedial design document will identify specific implementation actions to ensure compliance with the institutional controls and to specify roles and responsibilities for implementing, monitoring, and enforcing the institutional controls."* The specific format of the institutional controls will be developed in future documents, such as a land-use control remedial design (LUC RD).
General Comment 7: The Navy indicated that it conducts vegetation control (i.e., mowing) quarterly as the reason why there is no habitat around Building A190 for the small mammals represented by the ornate shrew in the Remedial Investigation Report. DTSC accepted the Remedial Investigation Report in its July 5, 2013 letter as long as certain provisions were addressed in the Feasibility Study Report. The Feasibility Study was either to demonstrate how the Navy will ensure that the area around Building A190 does not become habitat in the future or collect additional soil samples to demonstrate that the contamination present will not pose a significant risk to small mammals. The Navy did not collect additional samples and the rationale provided in the Report is not sufficient to demonstrate that the area will not become habitat in the future. For example, text is used such as "It is expected that the industrial character of the area will be maintained ..."	**Response to General Comment 7:** It is the Navy's intention that the responsibility, to continue vegetation control until such time as redevelopment renders it unnecessary, be transferred to the next owner. An IC will be placed in the deed to ensure the area is maintained as an industrial area. The section quoted at the end of the comment continues, and states that ICs to prevent the formation of habitat are evaluated for Subarea 4. To clarify this, the following bold text has been added to this text appearing in the portion of the executive summary discussing Subarea 4 (2nd paragraph on page ES-5 in the Draft FS). "*~~It is expected that t~~**T**he industrial character of the area will be maintained* ***based on site zoning and is consistent with the City of Vallejo's Re-Use Plan,*** *resulting in an incomplete exposure pathway for ecological receptors. ICs are evaluated for Subarea 4* **to prevent the formation of open space or ecological habitat in the industrial portion of ~~Subarea 5~~the subarea,** *to assure ~~that habitat is not created during future industrial redevelopment and~~ that the ecological exposure pathway remains incomplete in this area. Therefore, dioxin-like congeners were eliminated as COECs due to an incomplete exposure*

	pathway." Changes were made to section as stated above.
General Comment 8: Comments on the text, tables, and figures also should be addressed in the Executive Summary.	**Response to General Comment 8:** Noted. Comments will be addressed in the ES as applicable. See above comments for updates to ES tables and text. See Comment 26 for updated ES Figures.
General Comment 9: DTSC and Water Board staff suggest the Navy and regulatory agencies discuss the cost estimates (Appendix E) for Alternatives W2, W3, U2, and U3 (Tables E2-E5) so the regulatory agencies can better understand the assumptions and quantities used. For example, a. What is the conversion factor used for BCY to LCY? b. Why are three Site Setup and Control events included? c. Is the Navy assuming the excavated sediment (3,550 BCY) and the excavated upland soil (3,550 BCY) will both be placed in the excavated cell, as implied by the cost estimate line items ("sediment relocation to uplands cell" and "backfill with excavated uplands soil")? d. Why is the LUC/IC Implementation Plan preparation only included in one of the upland alternative cost estimates? e. What does the institutional control review include for $15,000 per event?	**Response to General Comment 9:** a) As stated in Table E4 in Appendix E, loose cubic yard (LCY) is 1.2*bank cubic yards (BCY) for soil and the conversion for wet sediment is LCY=1.1*BCY. b) For Tables E2 and E3, the quantity of Site Setup and Control events were corrected to **2 events**; one for each AOC (A75 and A17). c) Correct. The upland soil excavated to create the containment cell will be used as cover after the relocated sediment is placed within the cell. d) Cost estimates have been updated to include the capital costs for a LUC/IC Implementation Plan for Alternatives U2 and U3. e) The institutional control review would include the following elements relevant to the annual review: • Planning • Informing the public • Record keeping systems • Administration • Monitoring • Inspection • Enforcement (Source: *Estimating the Cost of Institutional Control*, 2005 Environmental Law Institute and 2005 Resources for the Future)

DTSC and Water Board Specific Comments	
Specific Comment 1: Page ES-10, Northern Area of Subarea 6. The RI Report shows all of the wetlands portion of Subarea 6 needing to be addressed in the Feasibility Study. The Feasibility Study only looks at the Northern Area of Subarea 6. Additional explanation in the text is necessary to support this.	**Response to Specific Comment 1:** The rationale for focusing attention in the FS on the northern portion of Subarea 6 is discussed in Appendix B, and is a best estimate based on the sediment data available at this time. Further evaluation (sample collection) in Subarea 6 is being considered by the Navy, in part in response to comments received from DTSC/HERO-ERAS commenter J. Michael Eichelberger, see below. The results of future sampling may refine the area of remediation, or it may be determined that remediation is not needed. The Executive Summary has been updated within the Subarea 6 section to state, "***Removal of sediment containing elevated metals within the northern area around Outfall 33 would reduce the risk from metals within the subarea.***" The above text was added at the end of Subarea 6 section on page ES-7.
Specific Comment 2: Page ES-12, Subarea 6 Sediment Preliminary RGs, last bullet, and Surface and Subsurface Soil Preliminary RGs for IA F1. Please revise "restrict" to "prohibit". Otherwise it is not clear whether the intent is to say only residential use or prohibit residential use. Make this same correction throughout the document.	**Response to Specific Comment 2:** The Navy prefers to use the word "restrict" for consistency. The following text changes have been made to clarify the intent of the two referenced bullets. As requested, the document has been reviewed for similar language that may have been unclear. *"Establish a legal instrument to restrict* ***the residential*** *use of the property ~~for residential purposes~~."*
Specific Comment 3: Section 1, Soil and Sediment, 1st paragraph: Correct "paint shop is the likely the source…"	**Response to Specific Comment 3:** Agreed. The redundant use of the word "*the*" has been eliminated as requested.

Specific Comment 4:	**Response to Specific Comment 4:**
Section 1, Soil and Sediment, 2nd paragraph: State whether the regulatory agencies concurred with the recommendations of the Remedial Investigation report and if so, reference the regulatory agency letter.	An agency letter accepting the Final RI Report for IA F1 was received by the Navy. The letter is dated July 5, 2013. The letter accepts the RI report with the following provisions, which the Navy believes are substantively addressed within this feasibility study document. The referenced paragraph has been updated as shown below. *"The risk assessments and recommendations in the Final RI Report for IA F1 document that Subareas 1, 2, 3, and 7 and areas outside of the portions of Subareas 4, 5, and 6 described above do not require further evaluation for active remediation in the future use scenario planned for IA F1.* ***California Environmental Protection Agency's Department of Toxic Substances Control (DTSC) accepted the 2012 Final RI Report in its July 5, 2013 letter with provisions that are addressed in this FS Report (DTSC 2013)."*** The following reference to the DTSC letter was added to the Reference Section of the document. ***DTSC. 2013. "DTSC Review of Final Remedial Investigation Report for IA F1." [DTSC Concurrence Letter]. July.*** Agency provisions on RI acceptance are provided for reference below. 1. The entire Investigation Area F1 will be moved into the Feasibility Study for institutional controls. The Remedial Investigation Report indicates areas moving forward to the feasibility study only when there is active remediation required in addition to the institutional controls. 2. The Navy indicated that it conducts vegetation control (i.e., mowing) quarterly as the reason why there is no habitat around Building A190 for the small mammals represented by the ornate shrew in the ecological risk assessment. The Feasibility Study must either demonstrate how the Navy will ensure that this area does not become habitat in the future or the Navy should collected additional soil samples to demonstrate that the

	contamination present will not pose a significant risk to small mammals. 3. The Navy conducted a munitions removal action in the Production Manufacturing Area. This work included the potential for collection of soil samples if suspected hazardous materials contamination was encountered. This may result in additional areas that need to be carried through to the Feasibility Study. 4. Table 1-3 lists the status of PCB Sites being addressed under the oversight of the U.S. Environmental Protection Agency. If a PCB site does not meet the criteria for unrestricted use, it should be carried through to the feasibility study. 5. The Water Board previously provided comments that the Navy indicated will be addressed as part of the Feasibility Study. No changes were made to the FS based on this comment.
Specific Comment 5: Section 1, Groundwater, 2nd paragraph: Revise the text to reflect the Regional Water Board is part of the California Environmental Protection Agency.	**Response to Specific Comment 5:** The first use of the term Water Board in this section has been updated to read ***"****…San Francisco Bay Regional Water Quality Control Board (Water Board),* ***a part of the California Environmental Protection Agency (CalEPA)****…****"***
Specific Comment 6: Section 2.3.3.2: State how thick the unconsolidated natural deposits are in IA F1.	**Response to Specific Comment 6:** The thickness of the unconsolidated natural deposits unit is stated in this Section with the following text, taken from the RI Report (ChaduxTt 2012a). *"This unit [unconsolidated natural deposits unit] generally ranges from 40 to 105 feet in thickness throughout the base; however, it thins westward at IA F1 toward the hilly area (the original island)."*

Specific Comment 7: Section 2.3.3.3: State the depth to bedrock beneath IA F1.	**Response to Specific Comment 7:** The following text has been added to this Section, "*Bedrock at IA F1 consists of steeply dipping, yellowish-brown to light olive-brown interbedded sandstone, siltstone, mudstone, and claystone… Bedrock encountered at IA F1 correlates with bedrock outcrops in the hilly area at the southern end of the peninsula.* ***The depth to bedrock beneath IA F1 is not known. Bedrock has not been encountered during the installation of any boring or well at IA F1.****"* The geology of Mare Island is discussed further in Appendix F of the Final RI. As stated in Appendix F, "The unconsolidated materials on the eastern side of the ridge vary from as little as 5 feet thick near the bedrock ridge to more than 105 feet thick near the southern end of the peninsula." For the western portion of Mare Island, Appendix F states "The total thickness of the lower sand unit is not known because bedrock has not been encountered during installation of any boring or well in the western half of Mare Island."
Specific Comment 8: Section 2.3.4: Clarify whether the intermediate water-bearing zone is present beneath IA F1. Only two hydrogeologic units are mentioned. However, according to other reports prepared by the Navy, three hydrogeologic units are present beneath Mare Island (shallow, intermediate, and deep water-bearing zones) and typically the shallow water-bearing zone is described as consisting of artificial fill and just the upper portion of the unconsolidated natural deposits.	**Response to Specific Comment 8:** The RI did not identify the intermediate water bearing zone beneath IA F1. The text in the referenced section is taken from the Final RI, stating that "*Two hydrogeologic units were identified based on the geologic materials present at the site. These units correspond to the shallow water-bearing zone of Mare Island.*" The hydrology for Mare Island is discussed further in Appendix F of the Final RI, which states that "*Three primary water-bearing zones (referred to as shallow, intermediate, and deep) have been identified at Mare Island... All three primary water-bearing zones have been encountered in deep wells west of the bedrock ridge (near the landfill). However, at other locations on Mare Island, only the shallow water-bearing zone and the shallow weathered bedrock water-bearing zone were encountered in shallower borings and wells.*"

	The following text has been revised for this section: **2.3.4 *Hydrogeology*** ***Three primary water-bearing zones (referred to as shallow, intermediate, and deep) have been identified at Mare Island in deep wells west of the bedrock ridge.*** *At other locations on Mare Island only the shallow water-bearing zones were encountered in shallower borings and wells. Monitoring wells at IA F1 are in the shallow water bearing zone. For this zone, two hydrogeologic units were identified based on the geologic materials present at the site: a primary hydrogeologic unit of artificial fill with underlying silty clay and a second hydrogeologic unit of bedrock and weathered bedrock.* ~~*These units correspond to the shallow water-bearing zone of Mare Island. The primary hydrogeologic unit at IA F1 consists of artificial fill material and, to a lesser degree, the underlying silty clay unit.*~~ *Most of the wells in IA F1 were completed in or across the artificial fill or silty clay units*~~*. The second hydrogeologic unit at IA F1 consists of bedrock and weathered bedrock*~~ *(ChaduxTt 2012a).*
Specific Comment 9: Section 2.3.4.1: Clarify in the text that only data for shallow groundwater were used to evaluate beneficial use. Change "SWRBC" to "SWRCB."	**Response to Specific Comment 9:** Similar to Comment 1, the text has been updated to indicate shallow groundwater. As requested the acronym *"SWRBC"* has been corrected to *"**SWRCB**."*
Specific Comment 10: Section 2.6.3.4, 1st paragraph: Specify the "TPH Area" for each of the four locations identified as having elevated concentrations of TPH.	**Response to Specific Comment 10:** The TPH Areas were added to each location described in this Section as follows (new text in bold). *"TPH was detected at concentrations above comparison criteria in soil at the following locations: 1) near former underground storage tank (UST) A-225* ***(TPH Area 13)****, 2) near former pits excavated during the MEC intrusive investigation* ***(TPH Area 6)*** *(Weston 2002), 3) near excavations for former UST A-190,* ***(TPH Areas 5, 7, and 11)*** *and 4) beneath the southeastern corner of Building A248* ***(TPH Area 8)****.* ***UST sites A-225 and A248 are closed***

	sites. *The regulatory agencies concurred with the Navy's recommendation for no further action at TPH Areas 5, 6, 7, 8, 11, and 13 within Subarea 4 (Water Board 2012)."*
Specific Comment 11: Page 2-19, Section 2.6.4.1, Dioxin-Like Congeners near Building A190 (Subarea 4). The Navy needs to demonstrate not only how they will ensure future industrial redevelopment does not create habitat, but also how the Navy will ensure that habitat does not develop prior to redevelopment.	**Response to Specific Comment 11:** The following bold text has been added to this section in response to this comment "*ICs are evaluated for Subarea 4 to assure that habitat is not created* ***prior to or*** *during future industrial redevelopment."* Periodic mowing and clearing is currently being performed by the Navy for fire prevention, which prevents the formation of habitat prior to transfer. Please see the response to General Comment 7.
Specific Comment 12: Page 3-5, Section 3.3, Two remediation goals are presented for Building A17 surface soil for lead. For the resident 105.6 mg/kg and for the ecological receptor 205 mg/kg. Please clarify which of these two remediation goals will be used for Building A17 surface soil?	**Response to Specific Comment 12:** The modified OEHHA residential CHHSL value for lead of 105.6 mg/kg is used as the remediation goal for Building A17 surface soil. This section has been clarified to: • *"Preliminary RG for lead of 105.6 mg/kg (modified OEHHA residential CHHSL). Recreational receptors are exposed to no more than ½ the residential exposure as stated in the RI (ChaduxTt 2012a). An RG that is protective of ~~the~~ future recreational receptors will also be protective of current commercial/industrial workers and construction workers.* ***This preliminary RG for lead is also protective of the most sensitive vertebrate receptor (western meadowlark) since it is lower than the calculated 205 mg/kg for lead based on an HQ of 1 using the high TRV for risk.*** • ~~*Preliminary RG for lead of 205 mg/kg, which corresponds to an HQ of 1 using the high TRV for risk to the most sensitive vertebrate receptor (western meadowlark).*~~*"*
Specific Comment 13:	**Response to Specific Comment 13:**

Section 3.4, Building A75: Change "treatment" to "removal." The remedial alternatives do not include soil treatment.	The text has been modified to: *"For cost estimating purposes, the FS considered ~~treatment~~* ***remediation by excavation*** *to a depth of 2.5 feet bgs, which results in an estimated soil volume of 1,000 cubic yards for ~~treatment~~* ***removal****."*
Specific Comment 14: Section 4.3.2: Note that if contamination at concentrations greater than cleanup criteria are left in place (capping and relocation alternatives), a soil management plan will be necessary.	**Response to Specific Comment 14:** The following bullet statement was added to the bulleted list for the LUC RD IC implementation and action elements listed in this section: *"~~**management**~~ **All requirements for soil associated with ~~capping and relocation~~ the chosen alternative, ~~if needed~~**"* The above text was revised (page 4-6).
Specific Comment 15: Section 4.4.1: Specify what measures will be taken to prevent impact to groundwater from the chemicals in sediment that is placed in the upland containment cell.	**Response to Specific Comment 15:** Although it would be possible to construct a lined containment cell designed to prevent impact to groundwater from contaminated sediment, the unlined cell currently evaluated in this FS anticipates that the sediment will not require such measures because the cell will be located in the upland industrial area and meet the RAOs for the upland industrial area. This would be confirmed by analytical testing prior to placement of the sediment in the cell. The following changes were made to Section 4.4.1: " *~~Sediments containing COEC contaminants that result in unacceptable ecological risk would be removed and consolidated in the cell.~~* ***Sediments planned for relocation will be tested for suitability prior to placement in the cell.****"*
Specific Comment 16: Section 4.4.3.1: It is not clear why remediation and off-site disposal (without treatment) are discussed. Neither of these are treatment	**Response to Specific Comment 16:** **Section 4.4** discusses all remedial technologies that are considered for the areas requiring active remediation. Treatment technologies are

technologies.	discussed as remedial technologies in **Section 4.4.2**. Removal technologies are discussed as remedial technologies in **Section 4.4.3**. Remedial Technology Discussion Organization: Section 4 Screening of Remedial Technologies and Process Options 4.4 Remedial Technologies for TTZs. 4.4.1 Containment 4.4.2 Treatment 4.4.3 Removal 4.4.4 Summary Remedial Technologies for TTZs Screening Outcomes No changes were made to the document in response to this comment.
Specific Comment 17: **Page 5-3, Section 5.2.1.2, Asphalt Cap for TTZ.** Please revise the discussion to clarify that an asphalt cap must be operated and maintained to ensure its continued effectiveness.	**Response to Specific Comment 17:** The discussion in Section 5.2.1.2 acknowledges "*ongoing maintenance, upgrades, or repairs*" for the cap and that an evaluation would be made as part of the Remedial Design (RD). In addition the section discusses annual inspection and periodic review of the protectiveness of the remedy. In response to this comment the following text change has been made to this section: "*The need for ongoing maintenance, upgrades, or repairs to the ~~existing~~ covers would be assessed in the RD and implemented for this alternative, as necessary.*"
Specific Comment 18: Pages 5-3 and 5-4, Section 5.2.2. The approach for collecting confirmation samples for proposed excavation activities should be discussed in the Report. If the proposed excavation is bound laterally or vertically by previous sampling efforts then that should be clearly described. Alternatively, confirmation sampling approaches should be presented clearly in order to confirm that excavation activities has accurately	**Response to Specific Comment 18:** Detailed discussion of the confirmation sampling approach would be developed as part of the Remedial Action Work Plan development process following remedy selection, and the finalization of the ROD. No change has been made to the document based on this comment.

captured contaminated soil.	
Specific Comment 19: Section 6.2, 2nd paragraph: Regional Water Board staff suggest deleting the paragraph, as it is redundant with the description of the modifying criteria in Section 6.1 on the previous page.	**Response to Specific Comment 19:** As requested this paragraph has been deleted.
Specific Comment 20: Section 6.3.1 a. 2nd bullet: Change "workers that…" to "workers who..." b. Section 6.4.1.5: The text states that "four factors and the GSR results… are assessed below…" c. However, because the text leads the reader to six bullets rather than five, it is confusing.	**Response to Specific Comment 20:** The following changes were made: a. *"Risk to workers ~~that~~* ***who****…"* b. Bullets 1 and 2 both discuss community factors and for clarity have now been combined to one bullet. c. There are now five bullets.
Specific Comment 21: Section 7.2.2: The statement that Alternatives W2 and W3 would not reduce toxicity, mobility, and volume through treatment is not consistent with what the text says in Section 6.4.2.4.	**Response to Specific Comment 21:** The Reduction in Toxicity, Mobility, or Volume through Treatment sections throughout the document have been updated based on other Comments (See Specific Comment 24 below). Alternatives W2 and W3 both rank poor which is consistent with Section 7.2 See Comment 24.
Specific Comment 22: Table 1: a. Note a: Clarify why the parenthetical values in the "Hazard Index" column are shown only as "<1" and do not show the actual value for the segregated highest target organ b. Note b: It is not clear where in the table note b is located. In addition, clarify if Subarea 6 as a "conservation area" (as listed in the table under future land use) is synonymous with "regional park" (as defined in note b).	**Response to Specific Comment 22:** a. The rationale for this summary table is that as long as the hazard index does not exceed one, the risk is acceptable. This approach mirrors the presentation of risk in the RI. However, in response to this comment the hazard index values currently shown as "<1" have been replaced with the decimal values. b. Table note b is not needed and will be deleted. Conservation area (planned future use for the wetlands area) is not synonymous with regional park (planned future use for Subarea 7 and a portion of Subarea 5). Confusion created by note b should be eliminated when the note is deleted.

Specific Comment 23: Table 2: a. Clarify the difference between "preventing" and "limiting" exposure to contaminated soils as listed in the purpose under Alternative U2. b. Include long-term monitoring, maintenance, and reporting in the alternative descriptions. c. Specify the volume of soil to be relocated in Alternative W2.	**Response to Specific Comment 23:** a. The text has been modified as follows for clarity: "*Removes exposure pathways by ~~preventing and limiting exposure to~~* ***shielding and preventing actions that would result in exposure to*** *contaminated soil,* ***capped*** *in the TTZ. Restricts sensitive receptor exposure to soil and groundwater."* b. As requested long-term monitoring, maintenance, and reporting were added to the alternative descriptions in Table 2. c. The volume of sediment (3550 bank cy) to be relocated in Alternative W2 has been specified in Table 2.
Specific Comment 24: Tables 4 and 5: Clarify why Alternatives U2, U3, W2, and W2 are shown as marginal rather than poor for reduction of toxicity, mobility, or volume through treatment. Treatment of soil to reduce/remove chemicals present in soil is not included in any of these alternatives.	**Response to Specific Comment 24:** Alternatives U2, U3, W2, and W3 have all been revised to poor for the reduction of toxicity, mobility, or volume through treatment in Tables 4 and 5 and the document.
Specific Comment 25: Table 5: Clarify why the overall rating of Alternative W3 is the same as Alternative W2. The ratings for 3 of the criteria are the same, but W3 has higher ratings for long-term effectiveness and implementability. Therefore, based on the evaluation, W3 should have a higher overall rating than W2.	**Response to Specific Comment 25:** Agreed. The overall rating for W3 is updated to "Very Good" in Table 5 and the document.
Specific Comment 26: Figure ES-A1: Specify for what the asterisk (*) following "Maximum TPH-dr Concentrations" stands; a definition for it is not included in the notes. In addition, include a definition for "sl," which is used in Note 1 and the "U" and "J" qualifiers in the data table. In addition, clarify if the colored dots represent TPH-dr only. The presentation is confusing because the title of the figure is more general ("TPH Soil Sample Results") and the table presents TPH-mr and TPH-gr results in addition to the TPH-dr data.	**Response to Specific Comment 26:** The asterisk has been removed from Figure ES-A1. A definition for "sl" is included but is shown as "SL." This is corrected to "sl" for both instances. The definition for "U" has been added to the notes section. A definition for "J" can be found in the notes section. The title for Figure ES-A1 has been updated to "TPH-**dr** SOIL SAMPLE RESULTS IN SUBAREA 1." Colored dots have been labeled as TPH-dr in the legend. Data for TPH-gr and TPH-mr

	remain in the table as a reference for the reader.
Specific Comment 27: Figure ES-A2: Clarify what chemical is represented by the colored dots. It is confusing because the title is general and the table presents TPH-dr and TPH-mr results as well.	**Response to Specific Comment 27:** Similar to Response to Comment 26, the title for Figure ES-A2 has been updated to "TPH-**dr** GRAB GROUNDWATER SAMPLE RESULTS IN SUBAREA 4." Colored dots have been labeled as TPH-dr in the legend. Data for TPH-mr remain in the table as a reference for the reader.
Specific Comment 28: Appendix A, Borehole Log, TPH2BSB1: Provide the static water level.	**Response to Specific Comment 28:** A note has been added to the bore log to clarify that groundwater was not encountered.
Specific Comment 29: Appendix B. See comments by James Eichelberger. As additional samples have been considered in the analysis, a figure showing all of the sampling locations should be included in the Appendix.	**Response to Specific Comment 29:** The sample locations referenced in Appendix B are included on FS Figure 7. While a duplicate copy of this figure could be reproduced in the appendix, the Navy suggests that to reduce duplication the following bolded text be added to the introduction paragraph of Appendix B, referring the reader to the FS figure. *"This appendix presents the detailed analysis for the Subarea 6 metals recommended for further analysis in the conclusions of the Mare Island Investigation Area (IA) F1 Remedial Investigation (RI). The appendix initially provides general information and then individually addresses each metal recommended for further investigation in the FS including barium, copper, lead, molybdenum and zinc.* ***This appendix shows figures for specific portions of Subarea 6. The overall site figure for this subarea showing both sample locations and analytical results for barium, copper, lead, molybdenum and zinc is shown on Figure 7 of the FS to which this appendix is attached."***
Specific Comment 30:	**Response to Specific Comment 30:**

Appendix C, Sections 2.1.1 and 2.2.1.2, Table 3-2 (p. 3): Revise the text to reflect that only the shallow groundwater received the Regional Water Board staff concurrence for an exception to drinking water policy. See General Comment 1, above.	Appendix C Section 2.1.1 and 2.2.1.2 have been revised to clarify that the exception applies to shallow groundwater.
Specific Comment 31: Appendix C, Section 2.2.1.1: Confirm that wells were screened in and data was collected from all water-bearing zones to support the conclusion that all groundwater beneath the site is non-potable.	**Response to Specific Comment 31:** Appendix C, Section 2.2.1.1 has been revised to clarify the discussion is for shallow groundwater.
Specific Comment 32: Appendix E, Section 2.3: The assumption that construction will be completed within Year 0 is presented for the cost estimate does not agree with the text of the Draft FS, which states that some alternatives may take up to 18 months to implement (therefore, in Year 1).	**Response to Specific Comment 32:** Costs have been updated to reflect construction completion in Year 1.

J. Michael Eichelberger, Ph.D.
Staff Toxicologist
Ecological Risk Assessment Section (ERAS)
Human and Ecological Risk Office (HERO)
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, CA 95826

HERO/ERAS General Comments by J. Michael Eichelberger

General Comments:	**Response to General Comment 1:**
The report presents results from several lines of investigation conducted at the site that were performed to determine potential hazard from site related Chemicals of Potential Ecological Concern (COPECs) to benthic organisms, marine birds and mammals using bay waters, and birds utilizing tidally inundated mud flats. Although ERAS agrees with the findings of the report that risk of hazard from site sediments is likely *de minimis*, several aspects of the report still require comment. In particular, the potential remediation of 38,400 square feet of sediment near Outfall 33 requires a closer examination. Removal of this much habitat would adversely affect the salt marsh harvest mouse.	The Navy agrees that potential benefits of the removal of sediment in the wetlands area should be balanced against potential adverse effects.

HERO/ERAS Specific Comments by J. Michael Eichelberger

Specific Comment 1:	**Response to Specific Comment 1**
Pdf page 17 of 388, Subarea 4, second paragraph of page. The report states *'however, as stated in the RI, the habitat quality around former Building A190 does not encourage foraging in the area, and results in an incomplete exposure pathway'*. Please provide a sentence that describes the attributes of the habitat around Building A190-1that support the position the habitat does not provide forage.	In response to this comment the following clarifying description taken from the Final RI Report has been added to the referenced paragraph, with new text in bold. "*however, as stated in the RI, the habitat quality around former Building A190 does not encourage foraging in the area.* ***The area consists~~ing~~ of non-native grasses, which are regularly mowed to reduce the risk of fire danger to the buildings. This activity*** *~~and~~ results in an incomplete exposure pathway."* The above changes have been made (page ES-5)

Specific Comment 2	**Response to Specific Comment 2:**
Pdf page 18 of 388, Subarea 5, final paragraph of section. The report states *'In addition, ICs are evaluated for the portion of Subarea 5 planned for future industrial redevelopment to assure that habitat is not created that might result in risk to future ecological receptors by drawing them to the area'* . ERAS does not fully understand how habitat will be created during construction but the bigger question in ERAS' opinion is severing the exposure pathway to ecological receptors from existing habitat (if present) prior to construction. This could become more significant with time if construction is delayed for an indefinite period.	Habitat formation in the planned industrial portion of Subarea 5 is currently prevented by the Navy through mowing to reduce fire risk and maintain the industrial character of the site, as discussed in the FS, and this activity will continue during Navy ownership of the property. ICs will be placed in the deed to ensure the area is maintained as an industrial area. Such ICs are planned for areas where ecological risk is possible, but future land use is planned as industrial. In order to clarify this the statement has been revised as follows: *"In addition, ICs are evaluated t**o prevent the formation of open space or ecological habitat in the industrial portion of Subarea 5,** ~~for the portion of Subarea 5 planned for future industrial redevelopment to assure that habitat is not created that~~ **which** might result in risk to future ecological receptors by drawing them to the area."* Text is revised as shown (pg ES-6).
Specific Comment 3:	**Response to Specific Comment 3:**
Pdf page 20 of 388, Remedial Action Objectives and Preliminary RGs, first paragraph. The Preliminary Remediation Goals (PRGs) in the report are based on back-calculated media concentrations protective of the most sensitive ecological receptor or the Mare Island Ambient Fill Concentration. The Ambient Fill Concentration has been chosen as the PRG if the back-calculated safe media concentration is smaller. Please provide a citation for the report containing the DTSC approval of the Mare Island Ambient Concentrations.	Ambient metal concentrations used in native and fill soils at Mare Island (other than for molybdenum) were calculated using statistical methods summarized in the "Final Compilation of Technical Memoranda on Ambient Analyses of Metals in Soils and Groundwater, Mare Island, California". This document describes the regulatory agreement on the values presented. The document appears in the references section of the FS as "Tetra Tech. 2002. *Final Compilation of Technical Memoranda on Ambient Analyses of Metals in Soils and Groundwater, Mare Island, Vallejo, California*. April 19." The ambient molybdenum dataset was evaluated separately,

	and this document appears in the references section of the FS as "ChaduxTt. 2012b. *Technical Memorandum Ambient Fill Data Set for Molybdenum at Mare Island and Comparison to the Molybdenum Data Set for Sediment at the Non-Tidal Wetland Area of the Installation Restoration Site 17 and Building 503 Area, Former Mare Island Naval Shipyard, Vallejo, California*. September 28."
Specific Comment 4 **Pdf page 66 of 388, Soil and Sediment first paragraph.** The report identifies surface sediment as the media of concern in Subarea 6. The report considered surface sediment to be the 0-2 feet below ground surface (bgs) interval. ERAS typically views surface sediment as the top 6 inches of sediment. Most exposure to benthic invertebrates and the higher trophic levels that feed on this receptor guild is usually from exposure to contaminants in the first six inches of sediment. Any additional sampling that may be proposed to refine TTZ areas for remedial actions should focus on the upper six inches of sediment.	**Response to Specific Comment 4** Comment Noted. Any proposed future sediment sampling at the site will take this preference into account as work is planned.
Specific Comment 5 **Pdf page 88 of 388, Section 2.6.4.1, Upland Habitat (Subareas 1 through 5 and 7), third paragraph.** Please clarify the meaning of the sentence *'Dioxin-like congeners were identified as a COEC for the western meadowlark and were retained as a COEC for plants and invertebrates based on the risk decision for birds and mammals'*.	**Response to Specific Comment 5** This text is taken from the Final RI Report (ChaduxTt 2012a) and describes the conclusions of that report. For more detailed discussion please see the RI report, in particular Appendix J. For clarity the following bold text has been added to the referenced FS text section. "*Dioxin-like congeners were identified as a COEC for the western meadowlark and were retained as a COEC for plants and invertebrates based on the risk decision for birds and mammals.* ***Given the lack of information on the toxicity of dioxin-like congeners to plants and to terrestrial invertebrates, retention of dioxin-like congeners as COECs was evaluated in the RI ERA based on the decisions for higher trophic level organisms.****"*

Specific Comment 6	Response to Specific Comment 6
Pdf page 90 of 388, Section 2.6.4.2, Wetland Habitat (Subarea 6), third paragraph. The report states *'The RI concluded that although barium, copper, lead, molybdenum, and zinc are present at concentrations that may result in unacceptable risk to one or more of the following receptors: plants, benthic macroinvertebrates, SMHM, and other herbivorous mammals, none of these COECs is widespread throughout the wetland habitat (Chadux Tt 2012)'*. It would be very helpful to the readability of this paragraph if an explanation was provided as to how the exposure point concentration is represented. If they are based on single samples at individual locations that should be stated.	The ERA performed in the RI for Subarea 6 (ERA Step 3a) utilized the lower of the 95% upper confidence limit (UCL) of the mean or the subarea maximum as the exposure point concentration, unless a 95% UCL of the Subarea 6 mean could not be calculated because the number of detected results was less than six. Because there were only six shallow samples available in Subarea 6 for most metals, if a metal was not reported as detected in one or more of these samples then the maximum value was used. The ERA used the maximum value for lead (detected in 5 of 6 samples) and for molybdenum (detected in 3 of 6 samples), as well as using the maximum value for zinc because the calculated 95% UCL of the Subarea 6 mean slightly exceeded the maximum detected result. The calculated 95% UCL of the Subarea 6 mean was used for barium and copper as these were each detected in all six of the sediment samples used in the ERA. For clarity the following bold text has been added to the referenced FS text section. "*The RI concluded that although barium, copper, lead, molybdenum, and zinc are present in Subarea 6 at concentrations that may result in unacceptable risk to one or more of the following receptors: plants, benthic macroinvertebrates, SMHM, and other herbivorous mammals; none of these COECs is widespread throughout the wetland habitat.* ***The exposure point concentration used in the ERA for these metals in Subarea 6 was the 95% upper confidence limit (UCL) of the mean for barium and copper, while the maximum value was used for lead, molybdenum, and zinc (Chadux Tt 2012) ."***

Specific Comment 7	Response to Specific Comment 7
Pdf page 92 of 388, Section 2.6.5, Final IA F1 Report Conclusions and Recommendations, Subarea 5. The report states that lead in soil poses unacceptable risk to ecological receptors. The report would be strengthened it if it would include the hazard quotient describing the risk and a description of how that hazard quotient was obtained (i.e., based on a maximum concentration or 95UCL, and the number of samples used to make the exposure point concentration).	The ERA was performed in the RI phase for the uplands subareas as a single unit, and separately for the wetlands subarea. A spatial analysis was subsequently performed for COECs to determine which exceeded risk-based concentrations in which areas of the site. This is best described in the FS in paragraph two of Section 2.6.4.1, which reads: *"Ecological risk was not quantitatively evaluated for individual upland subareas; however, an assessment of the spatial distribution of sample results within each subarea was performed for each COEC that exceeded a risk-based concentration within that subarea. That risk-based concentration for each COEC was the concentration at which, using the high TRV, the hazard quotient equaled 1.0 for the most sensitive vertebrate receptor. This evaluation was used to identify areas of the upland habitat that may require additional evaluation."* Because the lead EPC was not calculated separately for Subarea 5 in the ERA analysis in the RI, no subarea-specific ecological HQ was calculated. In response to this comment the following bold text was added to Section 2.6.5, bullet for Subarea 5. *"**The RI evaluated ecological risk quantitatively for all upland subareas as a single unit, and then the distribution of identified COECs was evaluated spatially.** Based on the **spatial** distribution of the COECs in the upland habitat, lead in soil poses unacceptable risk to ecological receptors in the area around Building A17."*

Specific Comment 8	Response to Specific Comment 8
Pdf page 105 of 388, Section 3.4, Remedial Footprints and Volumes of Contaminated Media, Northern Area of Subarea 6. Figure B2:IA K 'Sampling locations Near Outfall 33' which the figure title apparently indicates, measured metals concentrations in sediment near the outfall. Unfortunately, the figure appears to be a scanned copy that has been inserted into the report. The scanned image is unreadable on the computer and is also unreadable if printed. Given this, ERAS cannot discern the distribution of chemical concentrations. A readable version of the figure needs to be provided for ERAS review. The text should reference Figure 3 'Site Features and Habitat Map' on pdf page 159 of 388 to identify Outfall 33's location. ERAS agrees with the report that further sampling should be conducted to better delineate contamination prior to deciding on sediment removal. ERAS also agrees that focusing on the upper six inches of sediment is sound and also recommends that filtered pore water be collected as well as sediment. The dissolved fraction is the portion available for plant uptake. Sampling of pickleweed would also be recommended to verify the plant uptake model and reduce the uncertainty regarding the dietary dose to the salt marsh harvest mouse. Destruction of habitat occupied by an endangered species should not be taken lightly. Thirty eight thousand four hundred square feet is larger than the home range of the salt marsh harvest mouse (http://www.fws.gov/ecos/ajax/docs/five year review/doc3221.pdf). Loss of habitat may well equal loss of life to members of an endangered species. Validation of the food chain pathway may provide valuable information to reduce this possibility.	As requested a clearer copy of the IA K figure has been obtained for use as Figure B2. As requested, a reference to Figure 3 for the identification of Outfall 33 within Subarea 6 has been added. The Navy notes ERAS' agreement that further assessment and delineation of shallow metals in sediment should be undertaken near Outfall 33 before a final decision on remedial options. The Navy agrees that a better understanding of the bioavailability of metals in the sediment to the salt marsh harvest mouse may reduce or eliminate the area requiring remedial action. The Navy is considering further assessment of metals in shallow sediment in the northern area of Subarea 6 near Outfall 33. For the purpose of evaluating remedial options, should action be needed, the FS will continue to use the remedial footprint and volume shown in the Draft FS, acknowledging that the area may change, or be eliminated entirely.
Specific Comment 9	**Response to Specific Comment 9**
Pdf pages 233 through pdf page 237, Tables 82 through 86. The tables show sample results compared to Mare Island Ambient concentrations, which are all higher than the back-calculated safe sediment concentrations based on the salt marsh harvest mouse. The table shows several sample locations outside the outfalls (i.e., IA F1) where the hazard quotients would exceed one, although the exceedance of a hazard quotient greater than one would not be large. If sampling is conducted to delineate contamination at Outfall 33, ERAS would also recommend validation sampling be conducted at non-outfall locations where the COEC concentration exceeds the Mare Island ambient	Comment noted. As stated in the response to Specific Comment 8 above, the Navy is considering further assessment of metals in shallow sediment in the northern area of Subarea 6. Validation sampling at selected non-outfall sampling locations will be considered as this idea is developed. In addition, improved understanding of the bioavailability of shallow metals to the salt marsh harvest mouse would apply to these limited exceedances

concentration to verify the food chain model. If the validation does not support the assumption of a hazard quotient of one at the no effect level, ERAS would not recommend removing sediment from those locations.	as well as to the area of Outfall 33.
Conclusion Based on the discussion in the report, ERAS believes a closer examination of potential sediment removal to ensure that valuable habitat is not damaged at the expense of removal of marginal contamination or contamination that may not affect the salt marsh harvest mouse at the no effect level. ERAS believes that additional sampling should include pore water and pickleweed. Porewater is the bioavailable fraction of the sediment and is a better estimate of toxicity than is the sediment. Validation by measuring tissue concentration of the salt marsh harvest mouse (pickleweed) will confirm food chain modeling and greatly reduce the uncertainty regarding the modeled exposures. Validation could be conducted at sample locations that exceed the Mare Island ambient concentrations, which are serving as the ecological preliminary remediation goals for site IA F1 and IA K collectively. Clarification of this significant issue would also address any third party concerns regarding the cleanup. A better description of the Subarea 5 justification for no further action should be provided.	**Response** Comment noted. Please see above for specific responses. The reference to Subarea 5 justification for no further action is unclear to us, unless the comment intends to refer to areas outside of Outfall 33 of the wetlands area, currently Subarea 6.

Tami Nakahara
Senior Environmental Scientist (Specialist)
California Department of Fish and Wildlife
Office of Spill Prevention and Response
1700 K Street, Suite 250
Sacramento, CA 95811

CDFW Comments by Tami Nakahara	**Navy Responses**
Specific Comment 1: **Page 5-6, Section 5.3.1.3 Excavation, and On-Site Consolidation for Relocation to Upland Area of Site.** The text states in regards to the relocation of contaminated sediment from the wetlands in Subarea 6 to the uplands portion of IA F1, "The containment cell location would be chosen from one of the subareas slated for future industrial reuse where sensitive use ICs [Institutional Controls] restricting habitat formation will be implemented." Due to the potential for salt marsh harvest mice to utilize upland habitat within 50 feet of salt marsh habitat, CDFW-OSPR requests the location of the containment cell to be greater than 50 feet from salt marsh habitat.	**Response to Specific Comment 1:** Agreed. The following bolded text has been added to this section. *"The containment cell location would be chosen from one of the subareas slated for future industrial reuse where sensitive use ICs restricting habitat formation will be implemented.* ***Due to the potential for salt marsh harvest mice to utilize upland habitat within 50 feet of salt marsh habitat, the location of the containment cell will be selected at a distance greater than 50 feet from salt marsh habitat.****"*
Specific Comment 2: **Appendix C: ARARs.** Please replace the acronym "DFG-OSPR" with "CDFW- OSPR" throughout this appendix to reflect the name change of our department on January 1, 2013.	**Response to Specific Comment 2:** As requested, the text has been reviewed and the acronym *"DFG-OSPR"* replaced with *"**CDFW- OSPR**"*.

Specific Comment 3a:	**Response to Specific Comment 3a:**
The Navy asserts that, *"Cal. Fish & Game Code§§ 3005, 3503 and Cal. Code Regs. Tit. 14 §460 are not applicable because the United States of America has not waived sovereign immunity in the federal Endangered Species Act for these State of California requirements."* These sections were submitted by CDFW-OSPR because they are relevant and appropriate considerations for the remedial activities at the site. We disagree with the Navy's statement that the United States has not waived sovereign immunity for these State of California requirements. The United States of America has waived sovereign immunity and is liable for cleanup and natural resource damages to the same extent as any nongovernmental agency pursuant to section 120(a)(1) of CERCLA, codified at 42 U.S.C. section 9620. The United States District Court for the Central District of California found that the United States has waived sovereign immunity associated with CERCLA compliance; the United States Ninth Circuit Court of Appeals affirmed this opinion on appeal. *United States of America and State of California v. Shell Oil Company (2002): Dist. Ct. opinion 841 F. Supp. 962, Ct of Appeals opinion 294 F.3d 1045.* The Navy's ARARs determination did not provide a legal basis for its assertion that the United States of America has not waived sovereign immunity for these State requirements and without additional information, we are unable to seriously consider the Navy's position. If the Navy would like to provide its legal analysis to support its position with appropriate legal references, CDFW-OSPR will certainly consider it to work towards an amicable resolution to our differences on this issue.	DON has evaluated the potential applicability of all statutory provisions and regulations cited in Cal. Fish and Game Code Sections 3005, 3503, and Cal. Code Regs. Tit. 14 Section 460 and determined that there is no waiver of sovereignty for those requirements under the federal Endangered Species Act (ESA), and that they are, therefore, not "applicable" ARARs. The text of several of our recent proposed ARAR determinations was not clear on this. The DON is referring to the lack of waiver in the ESA rather than CERCLA. In making this assertion, DON does not mean to suggest that there is no waiver of sovereign immunity within CERCLA, or that, accordingly, the Navy would not have to comply with certain State requirements. For example, DON acknowledges that the DON is potentially liable under CERCLA to the same extent as non-governmental entities, as discussed in *Shell Oil Company*, 294 F.3d 1045 (Ninth Cir. 2002). Furthermore, DON acknowledges the need to comply with ARARs per Section 121(d) of CERCLA. We trust this clarification will satisfy any concerns CDFW-OSPR has expressed in its comments with respect to the question of sovereign immunity generally. The document has been updated to add the following language on page 3-4, Section 3.2.1.2 after the second bullet, "***The DON's position is that the United States Congress did not specifically waive sovereign immunity in the Endangered Species Act (ESA) for the subject matter of the Department of Fish and Wildlife statutes or regulations. Therefore, authority does not exist to authorize applicability of the Cal. Fish & Game Code or its implementing regulations. In addition, Section 121(e) of CERCLA exempts on-site CERCLA response actions from permit requirements. Some of the Department of Fish and Wildlife requirements allow otherwise prohibited actions through a permit process. The DON follows the CERCLA process rather than these permitting processes when making CERCLA decisions. The DON***

	has determined that a requirement that protects a species listed as a state endangered, threatened, rare, or fully protected species may be potentially relevant and appropriate. The specific language for making this determination in accordance with CERCLA relevant and appropriate criteria is given below.*"* The above text was added to the ARARs document (Appendix C).
Specific Comment 3b: The Navy asserts that, *"Pursuant to 40 C.F.R.§ 300.400(g)(2) of the NCP* [National Oil and Hazardous Substances Pollution Contingency Plan], *the Navy has determined that these requirements are not 'relevant and appropriate' because they do not address problems or situations sufficiently similar to the circumstances of the release or CERCLA response action and is not well-suited to the site based upon the pertinent provisions of Subsections 300.400(g)(2)(i) and (iv) of the NCP*. These ARARs are relevant and appropriate because they do address problems or situations sufficiently similar to the circumstances of the release or CERCLA response action at the site and are well-suited to the site in light of the potential presence of species and the potential for impacts associated with the project. F&GC section 3005 is intended to protect birds and mammals from take associated with poison and/or contaminants. "Take" can occur if birds or mammals are exposed to lethal levels of contaminants during removal or remedial activities. Avoiding "take" and developing cleanup criteria protective of the environment should be a consideration for the threshold cleanup criteria. This statute is relevant and appropriate to IA F1 and should be included as an ARAR in the FS. California Code of Regulations Title 14 section 460 makes it unlawful to take Fisher, marten, river otter, desert kit fox, and red fox. Although the Navy may not intend to "take" bird's nest or eggs (F&GC section 3503), or a red fox, remedial or construction activities associated with the cleanup may result in "take" for purposes of the F&GC definitions as explained	**Response to Specific Comment 3b:** The language: ~~"*Pursuant to 40 C.F.R.§ 300.400(g)(2) of the NCP* [National Oil and Hazardous Substances Pollution Contingency Plan], *the Navy has determined that these requirements are not 'relevant and appropriate' because they do not address problems or situations sufficiently similar to the circumstances of the release or CERCLA response action and is not well-suited to the site based upon the pertinent provisions of Subsections 300.400(g)(2)(i) and (iv) of the NCP*."~~ will be struck from the document. DON has evaluated the potential applicability of all statutory provisions and regulations cited in Cal. Fish and Game Code Sections 3005, 3503, and Cal. Code Regs. Tit. 14 Section 460 and determined that there is no waiver of sovereignty for those requirements under the ESA, and that they are, therefore, not "applicable" ARARs. The Navy and CDFW-OSPR can agree that the language set forth below should be included in ARAR findings if the DON and the State, through CDFW-OSPR, are able to reach agreement as to cleanup levels (with respect to Cal. Fish & Game Code § 3005) or as to measures to be taken to avoid harm to pertinent species (with respect to Cal. Fish & Game Code §§3503 and Cal. Code Regs. tit. 14 § 460). In addition, the table would be revised to match.

above. Therefore, these statutes are relevant and appropriate to IA F1 and should be included as ARARs in the FS.	(See Callaway/Waters correspondence with CA Dept of Fish & Game Counsel circa Dec 2009, Apr 2010 outlining approach to addressing disagreements between State/federal agencies regarding ARARs in the context of CERCLA.) ***"Cal. Fish & Game Code § 3005*** *It is unlawful to take birds or mammals with any net, pound, cage, trap, set line or wire, or poisonous substance, or to possess birds or mammals so taken, whether taken within or without this state.* *The DON has determined that Cal. Fish & Game Code § 3005(a) is not a state ARAR ~~because~~* ***and*** *it is not applicable or relevant and appropriate* ***because the DON determined that there is no waiver of sovereignty for these requirements under the Endangered Species Act (ESA).*** *The State of California, through DFW-OSPR, asserts that Cal. Fish & Game Code §3005(a) is a state ARAR because it is relevant and appropriate. Whereas, the DON and the State have not agreed upon whether Cal. Fish & Game Code §3005(a) is an ARAR, this FS report documents each party's position on the statute but does not attempt to resolve the issue.* ***However, the DON and the State have previously agreed on harm-avoidance measures for activities on this site, and the DON believes a similar agreement can be reached for the F1 remedial alternatives. ~~However~~Additionally****, the State has determined that the proposed ecological cleanup levels would substantively comply with the State requirement and provide an acceptable level of protectiveness.* ***These harm-avoidance measures and cleanup levels will be documented in the future Remedial Action Work Plan.*** *~~, and the State does not intend to dispute the FS.~~* ***Cal. Fish & Game Code § 3503*** *It is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto.* *The DON has determined that Cal. Fish & Game Code § 3503 is not a*

	state ARAR ~~because~~ ***and*** *it is not applicable or relevant and appropriate* ***because the DON determined that there is no waiver of sovereignty for these requirements under the federal Endangered Species Act (ESA)****. The State of California, through CDFW-OSPR, asserts that Section 3503 is a state ARAR because it is relevant and appropriate. Whereas, the DON and the State have not agreed upon whether Cal. Fish & Game Code § 3503 is an ARAR, this FS Report documents each party's position on the statute but does not attempt to resolve the issue. Nonetheless, the DON agrees that it will undertake measures in order to generally avoid harm to nests and eggs when there is potential that they may be impacted by response action construction.* ***The DON and the State have previously agreed on harm-avoidance measures for activities on this site, and the DON believes a similar agreement can be reached for the F1 remedial alternatives. These harm-avoidance measures would be documented in the future Remedial Action Work Plan.*** ~~*The State will not dispute the selected remedy for failure to identify Cal. Fish & Game Code § 3503 as an ARAR because the State has determined that the mutually agreed measures to generally avoid harm will result in substantive compliance with the state requirement.*~~ ***Cal. Code Regs. Tit. 14, § 460*** *Fisher, marten, river otter, desert kit fox, and red fox may not be taken at any time.* *The DON has determined that Cal. Code Regs. tit. 14 §460 is not a state ARAR ~~because~~* ***and*** *it is not applicable or relevant and appropriate* ***because the DON determined that there is no waiver of sovereignty for these requirements under the federal Endangered Species Act (ESA)****. The State of California, through DFW-OSPR, asserts that Cal. Code Regs. tit. 14 §460 is a state ARAR because it is relevant and appropriate. Whereas, the DON and the State have not agreed upon whether Cal. Code Regs. tit. 14 §460 is an ARAR, this FS Report documents each party's position on the statute but does not attempt to resolve the issue. Nonetheless, the DON agrees that it will*

	undertake measures in order to generally avoid harm to fisher, marten, river otter, desert kit fox, and red fox when there is potential that they may be impacted by response action construction. ***The DON and the State have previously agreed on harm-avoidance measures for activities on this site, and the DON believes a similar agreement can be reached for the F1 remedial alternatives. These harm-avoidance measures would be documented in the future Remedial Action Work Plan.****"* ~~*The State will not dispute the selected remedy for failure to identify Cal. Code Regs. tit. 14 §460 as an ARAR because the State has determined that the mutually agreed upon measures to generally avoid harm will result in substantive compliance with the state requirement.*~~
Specific Comment 3c: The Navy asserts that, *"the purpose of these State requirements is to regulate and set forth conditions for the 'taking' of the species addressed by those requirements. Moreover that purpose is achieved through the regulation of intentional conduct directed at the species as opposed to incidental 'take' (or possession, etc.) of species in the course of lawful activity such as CERCLA remedial action. The focus on intentional conduct is not well-suited to the circumstances at CERCLA sites."* These statutes are not directed solely towards intentional taking of the species. They are resource protection laws to manage the species and take (whether intentional or incident to a lawful activity) of the species in attempt to ensure their continued existence. They are "environmental requirements" since they pertain to protection of the state's natural resources which may occur on site. The Navy believes "take" requires intent and the Navy would not intend to "take", and, therefore, would not be in violation of the provision. However, intent is not required to effectuate a "take" per California F&GC section 86, *Department of Fish and Game v. Anderson-Cottonwood Irrigation District (1992) 8 Cal. App. 4th 1554; 11 Cal Rptr. 2d 222.* CDFW- OSPR disagrees with the Navy's interpretation of the purpose of F&GC provisions and while the Navy may not intend to	**Response to Specific Comment 3c:** The language, "….~~*the purpose of these State requirements is to regulate and set forth conditions for the 'taking' of the species addressed by those requirements. Moreover that purpose is achieved through the regulation of intentional conduct directed at the species as opposed to incidental 'take' (or possession, etc.) of species in the course of lawful activity such as CERCLA remedial action. The focus on intentional conduct is not well-suited to the circumstances at CERCLA sites.*~~*"* will be struck from the document. DON has evaluated the potential applicability of all statutory provisions and regulations cited in Cal. Fish and Game Code Sections 3005, 3503, and Cal. Code Regs. Tit. 14 Section 460 and determined that there is no waiver of sovereignty for those requirements under the federal Endangered Species Act (ESA), and that they are, therefore, not "applicable" ARARs. Whereas, the DON and the State have not agreed upon whether these Cal. Fish & Game Code sections are ARARs, this FS Report documents each party's position on the statutes but does not attempt to resolve the issues. Nonetheless, the DON agrees that it will undertake harm-avoidance measures when there is potential that species under these codes may be impacted by

effectuate a "take" of a species, contaminants remaining on site or remedial actions may result in "take" for purposes of the F&GC definition regardless of intent.	response action construction. The Navy will carefully consider input from the CDFW-OSPR and other agencies when developing and implementing this removal action including taking reasonable steps to prevent takings of California endangered, rare, threatened, fully protected species, or species of special concern (i.e. no hunting, capturing, killing, etc.). The DON and the State have previously agreed on harm-avoidance measures for activities on this site, and the DON believes a similar agreement can be reached for the F1 remedial alternatives. These harm-avoidance measures would be documented in the future Remedial Action Work Plan.

***List of Attachments*:**

Attachment 1 – UST Summary Table 1-2 from the *Final Remedial Investigation Report, Installation Restoration Program Sites Within Investigation Area F1, Former Mare Island Naval Shipyard, Vallejo, California*, ChaduxTt 2012.

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TABLE 1-2: SUMMARY OF UNDERGROUND STORAGE TANKS (UST) AND INVESTIGATIONS AT IA F1
Remedial Investigation Report, Investigation Area F1, Former Mare Island Naval Shipyard, Vallejo, California

UST Number	Tank Content	Status	Closed?	Comments
A-16		Not located	Yes	A suspect vent pipe was identified; however, no tank was found (PRC 1991a) (Sullivan and Tetra Tech 2005). No further action required (Water Board 2009b).
A-64		Not located	Yes	A fuel tank was shown in a 1940's NAD drawing; however, a 1998 investigation found no evidence of a buried tank on the site, and concluded that the tank was removed during prior utility work. No further action required (SSPORTS 1998a) (Sullivan and Tetra Tech 2005).
A-71		Removed	Yes	Former UST A-71 was midway between UST A-71N and UST A-71S. A former gasoline service station was located between former USTs A-71 and A-71S. UST A-71 was removed in January 1993 and subsequent sampling was conducted. The site was found to be low risk and was recommended for closure with no further action (PRC 1992, 1994, 1995b; Tetra Tech and Morrison Knudsen 1998) (Sullivan and Tetra Tech 2005).
A-71N		Removed	Yes	Former UST A-71N was located outside the northern corner of Building A71. The UST was removed in August 1990 and subsequent sampling was conducted. The site was found to be low risk and was recommended for closure with no further action (PRC 1991b; Tetra Tech and Morrison Knudsen 1998; Water Board 2004) (Sullivan and Tetra Tech 2005).
A-71S		Removed	Yes	Former UST A-71S was located outside near the southeastern corner of Building A71. The UST was removed in August 1990 and subsequent soil sampling was conducted (PRC 1991b) (Sullivan and Tetra Tech 2005).
A-71W		Removed	Yes	Tank removed (SSPORTS 1998b) (Sullivan and Tetra Tech 2005).
A-190		Removed	Yes	UST A-190 was removed in 1992 and subsequent soil sampling was conducted. Closeout with no further action was recommended (PRC 1992, 1994; Tetra Tech 2001).
A-190(1), A-190(2), A-190(3), A-190(4)		Removed	Yes	Site of former fuel oil USTs (Site A-190) was recommended for closure as a low risk fuel site (Tetra Tech 2001).
A-191		Removed	Yes	Former UST A-191 was located near the southern corner of Building A20 (west of Building A267). The tank was removed in September 1990 (PRC 1991b; Sullivan and Tetra Tech 2005).

TABLE 1-2: SUMMARY OF UNDERGROUND STORAGE TANKS (UST) AND INVESTIGATIONS AT IA F1
Remedial Investigation Report, Investigation Area F1, Former Mare Island Naval Shipyard, Vallejo, California

UST Number	Tank Content	Status	Closed?	Comments
A-215		No UST	Yes	Investigations in the area around the suspected location of UST A-215 found no indication that a UST was present in this location (PRC 1991a). A suspect vent pipe was associated with a stream line; electromagnetic investigations found no UST (Sullivan and Tetra Tech 2005).
A-221W		Not located	Yes	SSPORTS determined that UST A-221W was likely demolished during building construction, and no further action was recommended (SSPORTS 1999). A suspected tank was identified on drawings; however excavation found only a 2.5-inch steel pipe (Sullivan and Tetra Tech 2005).
A-225	TPH	Removed	Yes	A 200-gallon fuel oil UST was removed from near Building A225 in July 1990. During excavation activities, an oil odor was observed in the soil, and sampling activities were conducted (PRC 1991b). TPH was the only chemical detected at concentrations above comparison criteria (Attachment A, RTCs for Draft RI for IA F1).
	TPH-mr	Removed	Yes	TPH as motor oil was detected at 1,400 mg/kg which exceeds the Mare Island TPH as motor oil comparison criteria for soil but not the Lennar TPH clean-up criteria (Attachment A, RTCs for Draft RI for IA F1).
	TPH-dr	Removed	Yes	TPH-dr was detected at 1,400 mg/kg which exceeds the Mare Island TPH-dr comparison criteria for soil but not the Lennar TPH clean-up criteria (SulTech 2007).
	TPH-dr	Removed	Yes	TPH-dr was detected at 430 µg/L which exceeds the ESL for potable water but not the ESL for non-potable water (SulTech 2007). No additional data will be collected at UST A-225. The UST was closed in January 2011 with a land use control for industrial use only (Water Board 2011).
A-226		Removed	Yes	UST A-226 was removed in 1990. Subsequent sampling was conducted. The site was found to be low risk and was recommended for closure with no further action (PRC 1991b; Tetra Tech and Morrison Knudsen 1998; Water Board 2004)(Sullivan and Tetra Tech 2005).
A-226W		Not located	Yes	A magnetic anomaly at this location was determined to be the metal cover of a concrete vault. No tank was found and the site was recommended for no further action (SSPORTS 1999, Sullivan and Tetra Tech 2005).
A-246E		Removed	Yes	UST A-246E was removed in January 1993, and subsequent sampling was conducted. The site was found to be low risk and was recommended for closure with no further action (PRC 1992, 1994, 1995b; Tetra Tech and Morrison Knudsen 1998; Water Board 2004) (Sullivan and Tetra Tech 2005).

TABLE 1-2: SUMMARY OF UNDERGROUND STORAGE TANKS (UST) AND INVESTIGATIONS AT IA F1
Remedial Investigation Report, Investigation Area F1, Former Mare Island Naval Shipyard, Vallejo, California

UST Number	Tank Content	Status	Closed?	Comments
A-246W		No UST	Yes	The ground-penetrating radar anomaly was determined to be a concrete footer; no tank was found (PRC 1992, 1994) (Sullivan and Tetra Tech 2005).
A-266S		Not located	Yes	A gas station was at this site until Building A266 was constructed in 1946. A previous site search concluded that no tanks were present (SSPORTS 1998a) (Sullivan and Tetra Tech 2005). In August 2011, two borings were advanced in the location where the suspect UST was suspected to be located, and one soil sample and one grab groundwater sample were collected from each boring. Soil and groundwater samples results were below screening criteria, and the Water Board recommended the site for closure with no NFA (Water Board 2012)..
A-267	Diesel	Removed	Yes	Former UST A-267 was located near the southern corner of Building A-267 (Sullivan and Tetra Tech 2005). A steel 500-gallon UST containing diesel and water was removed from Building A-267 or the vicinity in July 1990 (Mare Island NSY 1994, 1995). Analytical results indicate TPH as diesel concentrations in the soil up to 440 mg/kg (PRC 1995a). This UST was approved for closure for petroleum-related waste in 2009 (Water Board 2009a). Further investigation was conducted for UST A-267 in 2007; all detected results were below comparison criteria for TPH and VOCs (Sullivan and Tetra Tech 2007).
A-914(1)		Removed	Yes	UST A-914(1) was removed in July 1990 and subsequent sampling was conducted. The site was found to be low risk and was recommended for closure with no further action (PRC 1991b; Tetra Tech and Morrison Knudsen 1998; Water Board 2004) (Sullivan and Tetra Tech 2005).
A-914(2)		Removed	Yes	UST A-914(2) was removed in July 1990 and subsequent sampling was conducted. The site was found to be low risk and was recommended for closure with no further action (PRC 1991b; Tetra Tech and Morrison Knudsen 1998; Water Board 2004) (Sullivan and Tetra Tech 2005).

TABLE 1-2: SUMMARY OF UNDERGROUND STORAGE TANKS (UST) AND INVESTIGATIONS AT IA F1

Remedial Investigation Report, Investigation Area F1, Former Mare Island Naval Shipyard, Vallejo, California

Notes:

bgs	Below ground surface
BTEX	Benzene, toluene, ethylbenzene, and xylenes
µg/L	Micrograms per liter
E	East
EPA	Environmental Protection Agency
ESL	Environmental screening level
mg/kg	Milligrams per kilogram
N	North
NSY	Naval shipyard
NAD	Naval ammunition depot
PAH	Polycyclic aromatic hydrocarbon
PRC	PRC Environmental Management Inc.
PRG	Preliminary remediation goal
RI	Remedial investigation
RTC	Response to comments
S	South
SSPORTS	Supervisor of Shipbuilding, Conversion, and Repair, Portsmouth, Virginia, Environmental Detachment
TPH	Total petroleum hydrocarbons
TPH-dr	Total petroleum hydrocarbons, diesel range
TPH-dr	Total petroleum hydrocarbons, motor oil range
UST	Underground storage tank
W	West

Reference:

Attachment A, RTCs for Draft RI for IA F1, Mare Island, Vallejo, California.

Mare Island Naval Shipyard (NYS). 1994. "Environmental Baseline Survey and Department of Defense Community Environmental Response Facilitation Act Report." Code 106.4. April 19.

Mare Island NSY. 1995. "Underground Storage Tank Summary Data Report." Revision B. March 10.

PRC Environmental Inc. (PRC). 1991a. "Underground Storage Tank Investigation Summary Report, Mare Island Naval Shipyard, Vallejo, California."

PRC. 1991b. "MINSY Preliminary UST Remedial Investigation Field Work Plan." December 6.

PRC. 1992. "Mare Island Naval Shipyard Underground Storage Tank Closure Plan." April 10.

PRC. 1994. "Final Underground Storage Tank Removal and Preliminary Site Assessment Summary Report, Mare Island Naval Shipyard, Vallejo, California." Volumes I and II. Tanks A-25, H-34, 46, 50, A-58, A-71, A-190, 243-1, 243-2, A-246E, 505, 658, 810, 886, IWTP." December 30.

PRC. 1995a. "Preliminary Assessment, Final Summary Report, Ordnance Sites." September.

PRC. 1995b. "Final Underground Storage Tank Site Investigation Field Work Plan., Mare Island Naval Shipyard, Vallejo, California." December 6.

Notes (continued):

Supervisor of Shipbuilding, Conversion, and Repair, Portsmouth, Virginia, Environmental Detachment, Vallejo (SSPORTS). 1998a. "Site Investigation Report for Suspect Underground Storage Tanks, Mare Island Naval Complex, Former Mare Island Naval Shipyard, Vallejo, California." Part II of III. June 10.

SSPORTS. 1998b. "Removal Summary Report for UST A71W(456)." December 18.

SSPORTS. 1999. "Final Site Investigation Report for Suspect Underground Storage Tanks, Mare Island Naval Complex, Former Mare Island Naval Shipyard, Vallejo, California." Part III of III. January 15.

Sullivan and Tetra Tech. 2005. "Draft Remedial Investigation Report, Installation Restoration Program Sites Within Investigation Area F1, Mare Island, Vallejo, California." February.

Sullivan and Tetra Tech. 2007. "Draft Final Data Summary Report for Underground Storage Tanks A-225 and A-267 Soil and Groundwater Sampling, Investigation Area F1, Former Mare Island Naval Shipyard, Vallejo, California." June.

Tetra Tech and Morrison Knudsen Corporation. 1998. "Draft Site Closure Report UST Sites A-71, A-226, A-246E, A-259, A-914, IWTP, 46/50, 108, 521, 627, and 886." May 29.

Tetra Tech. 2001. "Draft Site Assessment Summary Report for Site A-190, Mare Island, Vallejo, California." March 1.

Tetra Tech. 1998. "Final Technical Memorandum: Estimation of Ambient Concentrations of Polynuclear Aromatic Hydrocarbons in Soil, Mare Island, Vallejo, California." November 25.

Water Board. 2004. "Closure Letter and Site Summary for Six Underground Storage Tanks at the Former Mare Island Naval Shipyard, Vallejo, California." December 22.

Water Board. 2009a. "Closure Letter and Site Summary for UST A-267 (Water Board Case No. 48D9249), Building A-267, Railroad Avenue & Blake Avenue, Former Mare Island Naval Shipyard, Vallejo, California." October 20. Available on-line at: http://geotracker.swrcb.ca.gov/regulators/deliverable_documents/7571262955/UST%20A-267%20Closure%20October%202009.pdf

Water Board. 2009b. "No Further Action for Underground Storage Tank A-16, Building A-16, Blake Avenue & Railroad Avenue, Vallejo, California 94592." October 23.

Water Board. 2011. "No Further Action for UST A-225, Mare Island Naval Shipyard, Vallejo, Solano County, Water Board Case No. 48D9242." January 24.

Water Board. 2012. "No Further Action for UST A266S, Former Mare Island Naval Shipyard, Vallejo, Solano County." May 4.

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Revised Responses to Agency Comments dated April 2015

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Janet Naito, Project Manager – Comments on review of RTCs, letter received by email April 24, 2015
California Department of Toxic Substances Control (DTSC) and San Francisco Bay Regional Water Quality Control Board (Water Board)
700 Heinz Avenue, Berkeley, CA 94710

DTSC and Water Board General Comments	Navy Responses
Original General Comment 4: Clarify whether site use as "conservation," "recreational," and "regional park" are the same, particularly with respect to risk assessment and exposure of future users and ecological receptors. The terms seem to be used interchangeably throughout the document.	**Original Response to General Comment 4:** The terms as used are related but not identical. Subarea 6 is slated for reuse as a conservation area. A conservation area is a reuse category and is an area designated for protection of its natural resources including ecological receptors. Subarea 7 and part of Subarea 5 are slated for reuse as a regional park. A regional park is another reuse category and is an area designated for regular use by the public. Exposures to anticipated future users in both of these subareas are expected to be typical of recreational users. The recreational user is a receptor in the human health risk model. **UPDATED Original Response to General Comment 4:** The terms as used are related but not identical. Subarea 6 is **a wetlands area and is identified** ~~slated for reuse a~~ as a conservation area. A conservation area ~~is a reuse category and~~ is an area designated for protection of its natural resources including ecological receptors. **As a result the only complete exposure pathway is to ecological receptors. Although this area will not be available for recreational purposes a hypothetical recreational user has been evaluated as a conservative measure.** Subarea 7 and part of Subarea 5 are slated for reuse as a regional park. **The**~~A~~ regional park is ~~another reuse category and is an area~~ designated for regular use by the public. Exposures to anticipated future users in both of these subareas are expected to be typical of recreational users. The recreational user is a receptor in the human health risk model.

General Comment 1on Navy RTC	**Response to General Comment 1 on Navy RTCs:**
Page 6, Response to DTSC and Water Board General Comment 4: Please ensure the explanation in the Response to Comments is incorporated into the Feasibility Study Report.	In response to this comment the following changes have been made in the text to define the terms more clearly: The following bolded text was added for "conservation area" on page ES-7: *"~~Subarea 6 contains wetlands and is intended for reuse as a conservation area with an exposure pathway only to recreational users and ecological receptors.~~* ***Subarea 6 consists of wetlands and will remain wetlands. These wetlands have been identified for a conservation area. A conservation area is an area designated for protection of its natural resources including ecological receptors. As a result the only complete exposure pathway is to ecological receptors. Although this area will not be available for recreational purposes a hypothetical recreational user has been evaluated as a conservative measure. …"*** The following bolded text was added for "conservation area" in Conservation Area Section 2.4.3 on page 2-9: *"Subarea 6, consisting of tidal wetland, is identified ~~as~~* ***for*** *a conservation area****.*** *~~in the National Environmental Policy Act Environmental Impact Statement prepared for the transfer and reuse of Mare Island.~~* ***A conservation area is an area designated for protection of its natural resources including ecological receptors.*** *~~Conservation restrictions will be included in a binding real estate instrument that will run with the land.~~"* The following bolded text was added for "regional park" on page ES-5: *"Building A17 is located within the portion of Subarea 5, which is intended in part to be a regional park (Figure ES-4) and may include both ecological and recreational future receptors.* ***A regional park is an area designated for regular recreational use by the public.****"*

	The following bolded text was added for "recreational and regional park area" in Regional Park Section 2.4.2 on page 2-9: *"The southern portion of Subarea 5 and the entirety of Subarea 7 are proposed for reuse as a regional park* ***and is intended for passive recreational uses.*** *~~within Reuse Area 12, which will serve the City of Vallejo and surrounding communities.~~* ***A regional park is an area designated for regular recreational use by the public.*** *~~The regional park in Reuse Area 12 is intended for passive recreational uses and will be managed as part of the extended open space framework for Mare Island.~~"* **<u>Navy Initiated Change:</u>** The clarification that ***"because a conservation area is an area designated for protection of its natural resources the only complete exposure pathway is to ecological receptors. Although this area will not be available for recreational purposes a hypothetical recreational user has been evaluated as a conservative measure"*** has been added to the relevant sections of the FS.

Original General Comment 6:

Please describe the institutional control format that would be used to prohibit the domestic or other use of groundwater at this Site.

General Comment 2 on Navy RTC

Page 8, Response to DTSC and Water Board General Comment 6: California Code of Regulations, Title 22, section 67391.1 prohibits DTSC from approving or concurring with a response action decision document which includes limitations on land use or other institutional controls, unless the limitations or controls are clearly set forth and defined in the response action decision document. Since the Proposed Plan summarizes the information in the Remedial Investigation and Feasibility Study Reports and proposes a recommended cleanup alternative, it would be useful to revise the Feasibility Study to more clearly define the anticipated use restrictions. Suggest revising Section 5.2.1.1, Sensitive Use ICs, Paragraph 2 to state: "Restricted land-use activities for Subareas 3, 4, and 5 would include:"

Original Response to General Comment 6:

As stated in Appendix C: *"The remedial design document will identify specific implementation actions to ensure compliance with the institutional controls and to specify roles and responsibilities for implementing, monitoring, and enforcing the institutional controls."*

The specific format of the institutional controls will be developed in future documents, such as a land-use control remedial design (LUC RD).

Response to General Comment 2 on Navy RTCs:

Section 5.2.1.1 of the FS includes the anticipated restricted land-use activities. The following text in paragraph 2 of Section 5.2.1.1, Sensitive Use ICs was revised as suggested:

*"**It is anticipated that** restricted land-use activities **for Subareas 3, 4, and 5** ~~may~~ **would** include:*

- *Residential use*
- *A hospital for humans*
- *A school for persons under 18 years of age*
- *A day care facility for children*
- ~~*Grazing or agricultural activities of any type*~~
- ~~*Growing vegetables or fruits in native soil for human consumption*~~
- *Formation of open space or ecological habitat specifically within Subarea 4 and the industrial reuse portion of Subarea 5."*

<u>Navy Initiated Change:</u>

The Navy has removed the following restricted land-use activities for consistency with other approved Mare Island documents:

	• Grazing or agricultural activities of any type • Growing vegetables or fruits in native soil for human consumption
Original General Comment 7: The Navy indicated that it conducts vegetation control (i.e., mowing) quarterly as the reason why there is no habitat around Building A190 for the small mammals represented by the ornate shrew in the Remedial Investigation Report. DTSC accepted the Remedial Investigation Report in its July 5, 2013 letter as long as certain provisions were addressed in the Feasibility Study Report. The Feasibility Study was either to demonstrate how the Navy will ensure that the area around Building A190 does not become habitat in the future or collect additional soil samples to demonstrate that the contamination present will not pose a significant risk to small mammals. The Navy did not collect additional samples and the rationale provided in the Report is not sufficient to demonstrate that the area will not become habitat in the future. For example, text is used such as "It is expected that the industrial character of the area will be maintained ..." **General Comment 1 on Navy RTCs** Page 9, Response to DTSC and Water Board General Comment 7: Institutional controls by themselves will not prevent the formation of ecological habitat in the industrial portion of the subarea. Specific measures may need to be implemented after transfer of the property to a new owner	**Original Response to General Comment 7:** It is the Navy's intention that the responsibility to continue vegetation control until such time as redevelopment renders it unnecessary, be transferred to the next owner. An IC will be placed in the deed to ensure the area is maintained as an industrial area. The section quoted at the end of the comment continues, and states that ICs to prevent the formation of habitat are evaluated for Subarea 4. To clarify this, the following bold text has been added to this text appearing in the portion of the executive summary discussing Subarea 4 (2nd paragraph on page ES-5 in the Draft FS). "*~~It is expected that t~~* ***T****he industrial character of the area will be maintained* ***based on site zoning and is consistent with the City of Vallejo's Re-Use Plan,*** *resulting in an incomplete exposure pathway for ecological receptors. ICs are evaluated for Subarea 4* **to prevent the formation of open space or ecological habitat in the industrial portion of ~~Subarea 5~~the subarea,** *to assure ~~that habitat is not created during future industrial redevelopment and~~ that the ecological exposure pathway remains incomplete in this area. Therefore, dioxin-like congeners were eliminated as COECs due to an incomplete exposure pathway.*" Changes were made to section as stated above. **Response to General Comment 1 on Navy RTCs** Comment noted.

and prior to development. The institutional controls will need to incorporate those measures.	

DTSC and Water Board Response to Navy RTCs	
Original Specific Comment 1 Page ES-10, Northern Area of Subarea 6. The RI Report shows all of the wetlands portion of Subarea 6 needing to be addressed in the Feasibility Study. The Feasibility Study only looks at the Northern Area of Subarea 6. Additional explanation in the text is necessary to support this. **Specific Comment 1 on Navy RTC:** Water Board Response to Navy RTC for Specific Comment 1, Page ES-10, Northern Area of Subarea 6: While the text the Navy added is sufficient to make it clear that its focus is the northern portion of the subarea, the response does not provide additional explanation for focusing only on this area. The Navy states it is considering further evaluation (sample collection) of Subarea 6. However, no information is given regarding how the Navy will decide to do (or not do) this further evaluation.	**Original Response to Specific Comment 1** The rationale for focusing attention in the FS on the northern portion of Subarea 6 is discussed in Appendix B, and is a best estimate based on the sediment data available at this time. Further evaluation (sample collection) in Subarea 6 is being considered by the Navy, in part in response to comments received from DTSC/HERO-ERAS commenter J. Michael Eichelberger, see below. The results of future sampling may refine the area of remediation, or it may be determined that remediation is not needed. The Executive Summary has been updated within the Subarea 6 section to state, "***Removal of sediment containing elevated metals within the northern area around Outfall 33 would reduce the risk from metals within the subarea.***" The above text was added at the end of Subarea 6 section on page ES-7. **Response to Specific Comment 1 on Navy RTCs:** As stated previously, the rationale for focusing attention in the FS on the northern portion of Subarea 6 is discussed in Appendix B, and is a best estimate based on the sediment data available at this time. For example although there are a limited number of samples across Subarea 6 the samples were targeted in the locations most likely to contain impacts from upland runoff. Appendix B evaluates spatial patterns in the data available for risk drivers in Subarea 6. The appendix also discusses background data for risk drivers, including for molybdenum, which was not evaluated against background in the RI Report. To clarify, the Navy was considering additional sampling at two phases:

	now and at the Remedial Design (RD). The Navy and the DTSC agree that additional sampling now for bioavailability is unwarranted for the site because the IA F1 ecological risk was based on Mare Island specific bioaccumulation factors instead of literature values. The Navy continues to envision that sampling to refine the area of remediation will be conducted as part of the RD phase and the details of criteria used for sampling will be included in the RD Work Plan. During the development of this future Work Plan, regulators and the Water Board would have opportunities to review and comment on the sampling plan. The results of future sampling to delineate the metals impacts in the Northern area are intended to refine the area of remediation. The results of this delineation sampling are not anticipated to affect the choice of remedy at the site. The Executive Summary has been updated within the Subarea 6 section to state, "***Removal of sediment containing elevated metals within the northern area around Outfall 33 would reduce the risk from metals within the entire subarea 6.***" The above text was added at the end of Subarea 6 section on page ES-7.
Original Specific Comment 2 Page ES-12, Subarea 6 Sediment Preliminary RGs, last bullet, and Surface and Subsurface Soil Preliminary RGs for IA F1. Please revise "restrict" to "prohibit". Otherwise it is not clear whether the intent is to say only residential use or prohibit residential use. Make this same correction throughout the document. **Specific Comment 2 on Navy RTC:** Water Board Response to Navy RTC for Specific Comment 2, Page ES-12, Subarea 6 Sediment Preliminary RGs, last bullet, and Surface and Subsurface Soil Preliminary RGs for IA F1: The modification made to the sentence in response to the comment does not clarify the Navy's	**Original Response to Specific Comment 2** The Navy prefers to use the word "restrict" for consistency. The following text changes have been made to clarify the intent of the two referenced bullets. As requested, the document has been reviewed for similar language that may have been unclear. *"Establish a legal instrument to restrict **the residential** use of the property ~~for residential purposes~~."* **Response to Specific Comment 2 on Navy RTCs:** In response to the comment, the following text changes have been made to clarify the intent of the two referenced bullets. The document has been reviewed for similar language that may have been unclear. *"Establish a legal instrument to ~~restrict~~ **prevent** the residential use of*

intent. If the Navy will not use "prohibit" in the sentence, the sentence needs to be re-written. "Restricting the residential use" of a property may not be interpreted as preventing, disallowing, or prohibiting residential use by the reader.	*the property* ***unless and until it is suitable for such use****."*
Original Specific Comment 7: Section 2.3.3.3: State the depth to bedrock beneath IA F1. **Specific Comment 3 on Navy RTC** Page 15, Response to DTSC and Water Board Specific Comment 7, Section 2.3.3.3: The text appears contradictory, as it states that "Bedrock encountered at IA F1 correlates with bedrock outcrops in the hilly area ..." but the sentence following the next states that "Bedrock has not been encountered during the installation of any boring or well at IA F1." Were there other historical activities beside boring or drilling that encountered bedrock but did not note depths?	**Original Response to Specific Comment 7:** The following text has been added to this Section, *"Bedrock at IA F1 consists of steeply dipping, yellowish-brown to light olive-brown interbedded sandstone, siltstone, mudstone, and claystone… Bedrock encountered at IA F1 correlates with bedrock outcrops in the hilly area at the southern end of the peninsula. The depth to bedrock beneath IA F1 is not known. Bedrock has not been encountered during the installation of any boring or well at IA F1."* The geology of Mare Island is discussed further in Appendix F of the Final RI. As stated in Appendix F, "The unconsolidated materials on the eastern side of the ridge vary from as little as 5 feet thick near the bedrock ridge to more than 105 feet thick near the southern end of the peninsula." For the western portion of Mare Island, Appendix F states "The total thickness of the lower sand unit is not known because bedrock has not been encountered during installation of any boring or well in the western half of Mare Island." **Response to Specific Comment 3 on Navy RTCs** The comment is correct, and the response dated January 21, 2015 was in error. Bedrock has been reported in both borings and wells at IA F1 (Chadux Tt 2012a). As stated in the Final RI (Appendix K), *"The depth to the bedrock varies from 0 to 3 feet below ground surface (bgs) in the western portion of IA F1 to more than 35 feet bgs in the eastern portion of the site (see Figures 1-5 through 1-7 in the RI report)."* Therefore the following correction has been made to the text in Section 2.3.3.3:

	"Bedrock at IA F1 consists of steeply dipping, yellowish-brown to light olive-brown interbedded sandstone, siltstone, mudstone, and claystone… Bedrock encountered at IA F1 correlates with bedrock outcrops in the hilly area at the southern end of the peninsula. The depth to bedrock reported in borings at IA F1 ***varies from 0 to 3 feet below ground surface (bgs) in the western portion of IA F1 to more than 35 feet bgs in the eastern portion of the site (ChaduxTt 2012a).*** *~~Bedrock has not been encountered during the installation of any boring or well at IA F1.~~"*
Original Specific Comment 14 Section 4.3.2: Note that if contamination at concentrations greater than cleanup criteria are left in place (capping and relocation alternatives), a soil management plan will be necessary. **Specific Comment 4 on Navy RTC:** Water Board Response to Navy RTC for Specific Comment 14, Section 4.3.2, LUCs Implementation and Oversight: It is not clear that the text the Navy added sufficiently includes a contingency for a soil management plan. Water Board staff suggest the bullet more clearly state that a soil management plan will be prepared if concentrations greater than cleanup standards are left in place.	**Original Response to Specific Comment 14** The following bullet statement was added to the bulleted list for the LUC RD IC implementation and action elements listed in this section: *"~~management~~ All requirements for soil associated with ~~capping and relocation~~ the chosen alternative, ~~if needed~~"* The above text was revised (page 4-6). **Response to Specific Comment 4 on Navy RTCs:** The need for a soil management plan or other applicable requirements would be determined in the development of the LUC RD document based on the selected alternative for the Site. The Navy suggest that the bullet statement be left as follows: *"All requirements for soil associated with the chosen alternative"*

Original Specific Comment 23: Table 2: a. Clarify the difference between "preventing" and "limiting" exposure to contaminated soils as listed in the purpose under Alternative U2. b. Include long-term monitoring, maintenance, and reporting in the alternative descriptions. c. Specify the volume of soil to be relocated in Alternative W2. **Comment 5 on Navy RTC:** Water Board Response to Navy RTC for Specific Comment 23, Table 2, a: The modification to the sentence does not clarify the intent. The Navy replaced "limiting" with "shielding." The Navy needs to define "shielding" and clarify how it is different from "preventing."	**Original Response to Specific Comment 23:** a. The text has been modified as follows for clarity: "*Removes exposure pathways by ~~preventing and limiting exposure to~~* ***shielding and preventing actions that would result in exposure to*** *contaminated soil,* ***capped*** *in the TTZ. Restricts sensitive receptor exposure to soil and groundwater."* b. As requested long-term monitoring, maintenance, and reporting were added to the alternative descriptions in Table 2. c. The volume of sediment (3550 bank cy) to be relocated in Alternative W2 has been specified in Table 2. **Response to Comment 5 on Navy RTCs:** a. Shielding is the mechanism by which asphalt capping prevents exposure, while LUCs "prevent" actions such as cap disturbance that would compromise the effectiveness of the cap. The text has been simplified as follows for clarity: "*Removes exposure pathways by* ***physically shielding receptors from exposure to*** *contaminated soil,* ***capped*** *in the TTZ.* ***A beneficial use exception for shallow groundwater was received for the site****."*
	<u>Navy Initiated Change:</u> In coordination with the Water Board the Navy has removed groundwater ICs from this document for all subareas of this site. The site has an exception to drinking water policy (formerly called a Beneficial Use Exception). While all the change pages from the text are not listed in these RRTCs the updated summary Table 7 (Institutional Controls) is attached here for reference.

Janet Naito, Project Manager – Comments on review of RTCs, received by email April 24, 2015	
HERO/ERAS General Comments by J. Michael Eichelberger	
Original General Comments: The report presents results from several lines of investigation conducted at the site that were performed to determine potential hazard from site related Chemicals of Potential Ecological Concern (COPECs) to benthic organisms, marine birds and mammals using bay waters, and birds utilizing tidally inundated mud flats. Although ERAS agrees with the findings of the report that risk of hazard from site sediments is likely *de minimis*, several aspects of the report still require comment. In particular, the potential remediation of 38,400 square feet of sediment near Outfall 33 requires a closer examination. Removal of this much habitat would adversely affect the salt marsh harvest mouse. **ERAS Response to General Comment 1 on Navy RTCs:** Comment noted.	**Original Response to General Comment 1:** The Navy agrees that potential benefits of the removal of sediment in the wetlands area should be balanced against potential adverse effects. **Response to ERAS Response to Navy RTC for General Comment 1 on Navy RTCs:** Comment noted.
HERO/ERAS Specific Comments by J. Michael Eichelberger	
Original Specific Comment 1: **Pdf page 17 of 388, Subarea 4, second paragraph of page.** The report states *'however, as stated in the RI, the habitat quality around former Building A190 does not encourage foraging in the area, and results in an incomplete exposure pathway'*. Please provide a sentence that describes the attributes of the habitat around Building A190-1that support the position the habitat does not provide forage. **ERAS Response to Specific Comment 1 on Navy RTCs:** ERAS would not agree that mowing eliminated exposure pathways. The response would be better written as 'reduces potential exposure'.	**Original Response to Specific Comment 1** In response to this comment the following clarifying description taken from the Final RI Report has been added to the referenced paragraph, with new text in bold. "*however, as stated in the RI, the habitat quality around former Building A190 does not encourage foraging in the area.* ***The area consists of non-native grasses, which are regularly mowed to reduce the risk of fire danger to the buildings. This activity*** ~~*and*~~ *results in an incomplete exposure pathway."* The above changes have been made (page ES-5) **Response to ERAS Response to Navy RTC for Specific Comment 1**

	The following changes have been made with new text in bold (page ES-5) *"however, as stated in the RI, the habitat quality around former Building A190 does not encourage foraging in the area.* ***The area consists of non-native grasses, which are regularly mowed to reduce the risk of fire danger to the buildings. This activity*** *~~results in an incomplete exposure pathway~~* ***reduces the potential exposure to ecological receptors****."*
Original Specific Comment 2 **Pdf page 18 of 388, Subarea 5, final paragraph of section.** The report states *'In addition, ICs are evaluated for the portion of Subarea 5 planned for future industrial redevelopment to assure that habitat is not created that might result in risk to future ecological receptors by drawing them to the area'* . ERAS does not fully understand how habitat will be created during construction but the bigger question in ERAS' opinion is severing the exposure pathway to ecological receptors from existing habitat (if present) prior to construction. This could become more significant with time if construction is delayed for an indefinite period. **ERAS Response to Specific Comment 2 on Navy RTCs:** As in Specific Comment 1, 'reduce' would be a better word than 'prevent'.	**Original Response to Specific Comment 2:** Habitat formation in the planned industrial portion of Subarea 5 is currently prevented by the Navy through mowing to reduce fire risk and maintain the industrial character of the site, as discussed in the FS, and this activity will continue during Navy ownership of the property. ICs will be placed in the deed to ensure the area is maintained as an industrial area. Such ICs are planned for areas where ecological risk is possible, but future land use is planned as industrial. In order to clarify this the statement has been revised as follows: *"In addition, ICs are evaluated t****o prevent the formation of open space or ecological habitat in the industrial portion of Subarea 5,*** *~~for the portion of Subarea 5 planned for future industrial redevelopment to assure that habitat is not created that~~* ***which*** *might result in risk to future ecological receptors by drawing them to the area."* Text is revised as shown (pg ES-6). **Response to ERAS Response to Navy RTC for Specific Comment 2** The following changes have been made to page ES-6 as shown below: *"In addition, ICs are evaluated to ~~prevent~~* ***limit*** *the formation*

	of open space or ecological habitat in the industrial portion of Subarea 5, ***and reduce*** *~~for the portion of Subarea 5 planned for future industrial redevelopment to assure that habitat is not created that might result in~~ risk to future ecological receptors ~~by drawing them to the area~~."*
Original Specific Comment 3: **Pdf page 20 of 388, Remedial Action Objectives and Preliminary RGs, first paragraph.** The Preliminary Remediation Goals (PRGs) in the report are based on back-calculated media concentrations protective of the most sensitive ecological receptor or the Mare Island Ambient Fill Concentration. The Ambient Fill Concentration has been chosen as the PRG if the back-calculated safe media concentration is smaller. Please provide a citation for the report containing the DTSC approval of the Mare Island Ambient Concentrations.	**Original Response to Specific Comment 3:** Ambient metal concentrations used in native and fill soils at Mare Island (other than for molybdenum) were calculated using statistical methods summarized in the "Final Compilation of Technical Memoranda on Ambient Analyses of Metals in Soils and Groundwater, Mare Island, California". This document describes the regulatory agreement on the values presented. The document appears in the references section of the FS as "Tetra Tech. 2002. *Final Compilation of Technical Memoranda on Ambient Analyses of Metals in Soils and Groundwater, Mare Island, Vallejo, California*. April 19." The ambient molybdenum dataset was evaluated separately, and this document appears in the references section of the FS as "ChaduxTt. 2012b. *Technical Memorandum Ambient Fill Data Set for Molybdenum at Mare Island and Comparison to the Molybdenum Data Set for Sediment at the Non-Tidal Wetland Area of the Installation Restoration Site 17 and Building 503 Area, Former Mare Island Naval Shipyard, Vallejo, California*. September 28."
ERAS Response to Specific Comment 3 on Navy RTCs: Comment accepted.	**Response to ERAS Response to Navy RTC for Specific Comment 3** Comment noted.

Original Specific Comment 4	Original Response to Specific Comment 4
Pdf page 66 of 388, Soil and Sediment first paragraph. The report identifies surface sediment as the media of concern in Subarea 6. The report considered surface sediment to be the 0-2 feet below ground surface (bgs) interval. ERAS typically views surface sediment as the top 6 inches of sediment. Most exposure to benthic invertebrates and the higher trophic levels that feed on this receptor guild is usually from exposure to contaminants in the first six inches of sediment. Any additional sampling that may be proposed to refine TTZ areas for remedial actions should focus on the upper six inches of sediment. **ERAS Response to Specific Comment 4 on Navy RTCs:** Response to comment noted.	Comment Noted. Any proposed future sediment sampling at the site will take this preference into account as work is planned. **Response to ERAS Response to Navy RTC for Specific Comment 4** Comment noted.
Original Specific Comment 5	**Original Response to Specific Comment 5**
Pdf page 88 of 388, Section 2.6.4.1, Upland Habitat (Subareas 1 through 5 and 7), third paragraph. Please clarify the meaning of the sentence *'Dioxin-like congeners were identified as a COEC for the western meadowlark and were retained as a COEC for plants and invertebrates based on the risk decision for birds and mammals'*. **ERAS Response to Specific Comment 5 on Navy RTCs:** The comment is accepted although retaining dioxins as COECS for plants and invertebrates is not necessary in ERAS' opinion.	This text is taken from the Final RI Report (ChaduxTt 2012a) and describes the conclusions of that report. For more detailed discussion please see the RI report, in particular Appendix J. For clarity the following bold text has been added to the referenced FS text section. "*Dioxin-like congeners were identified as a COEC for the western meadowlark and were retained as a COEC for plants and invertebrates based on the risk decision for birds and mammals.* ***Given the lack of information on the toxicity of dioxin-like congeners to plants and to terrestrial invertebrates, retention of dioxin-like congeners as COECs was evaluated in the RI ERA based on the decisions for higher trophic level organisms.***" **Response to ERAS Response to Navy RTC for Specific Comment 5** Comment noted.

Original Specific Comment 6	Original Response to Specific Comment 6
Pdf page 90 of 388, Section 2.6.4.2, Wetland Habitat (Subarea 6), third paragraph. The report states *'The RI concluded that although barium, copper, lead, molybdenum, and zinc are present at concentrations that may result in unacceptable risk to one or more of the following receptors: plants, benthic macroinvertebrates, SMHM, and other herbivorous mammals, none of these COECs is widespread throughout the wetland habitat (Chadux Tt 2012)'.* It would be very helpful to the readability of this paragraph if an explanation was provided as to how the exposure point concentration is represented. If they are based on single samples at individual locations that should be stated.	The ERA performed in the RI for Subarea 6 (ERA Step 3a) utilized the lower of the 95% upper confidence limit (UCL) of the mean or the subarea maximum as the exposure point concentration, unless a 95% UCL of the Subarea 6 mean could not be calculated because the number of detected results was less than six. Because there were only six shallow samples available in Subarea 6 for most metals, if a metal was not reported as detected in one or more of these samples then the maximum value was used. The ERA used the maximum value for lead (detected in 5 of 6 samples) and for molybdenum (detected in 3 of 6 samples), as well as using the maximum value for zinc because the calculated 95% UCL of the Subarea 6 mean slightly exceeded the maximum detected result. The calculated 95% UCL of the Subarea 6 mean was used for barium and copper as these were each detected in all six of the sediment samples used in the ERA. For clarity the following bold text has been added to the referenced FS text section. "*The RI concluded that although barium, copper, lead, molybdenum, and zinc are present in Subarea 6 at concentrations that may result in unacceptable risk to one or more of the following receptors: plants, benthic macroinvertebrates, SMHM, and other herbivorous mammals; none of these COECs is widespread throughout the wetland habitat.* ***The exposure point concentration used in the ERA for these metals in Subarea 6 was the 95% upper confidence limit (UCL) of the mean for barium and copper, while the maximum value was used for lead, molybdenum, and zinc (Chadux Tt 2012) ."***

ERAS Response to Specific Comment 6 on Navy RTCs: Comment accepted, however ERAS does not understand the portion of the response that states '... if a metal was not reported as detected in one or more of these samples than the maximum value was used'.	**Response to ERAS Response to Navy RTC for Specific Comment 6** Comment noted. A simpler way to say it is that the maximum detection was used as the EPC if there were not enough reported detections to calculate the 95 percent UCL of the mean to use as the EPC.
Original Specific Comment 7 **Pdf page 92 of 388, Section 2.6.5, Final IA F1 Report Conclusions and Recommendations, Subarea 5.** The report states that lead in soil poses unacceptable risk to ecological receptors. The report would be strengthened it if it would include the hazard quotient describing the risk and a description of how that hazard quotient was obtained (i.e., based on a maximum concentration or 95UCL, and the number of samples used to make the exposure point concentration).	**Original Response to Specific Comment 7** The ERA was performed in the RI phase for the uplands subareas as a single unit, and separately for the wetlands subarea. A spatial analysis was subsequently performed for COECs to determine which exceeded risk-based concentrations in which areas of the site. This is best described in the FS in paragraph two of Section 2.6.4.1, which reads: *"Ecological risk was not quantitatively evaluated for individual upland subareas; however, an assessment of the spatial distribution of sample results within each subarea was performed for each COEC that exceeded a risk-based concentration within that subarea. That risk-based concentration for each COEC was the concentration at which, using the high TRV, the hazard quotient equaled 1.0 for the most sensitive vertebrate receptor. This evaluation was used to identify areas of the upland habitat that may require additional evaluation."* Because the lead EPC was not calculated separately for Subarea 5 in the ERA analysis in the RI, no subarea-specific

	ecological HQ was calculated. In response to this comment the following bold text was added to Section 2.6.5, bullet for Subarea 5. *"**The RI evaluated ecological risk quantitatively for all upland subareas as a single unit, and then the distribution of identified COECs was evaluated spatially.** Based on the **spatial** distribution of the COECs in the upland habitat, lead in soil poses unacceptable risk to ecological receptors in the area around Building A17."*
ERAS Response to Specific Comment 7 on Navy RTCs: Comment accepted.	**Response to ERAS Response to Navy RTC for Specific Comment 7** Comment noted.
Original Specific Comment 8 **Pdf page 105 of 388, Section 3.4, Remedial Footprints and Volumes of Contaminated Media, Northern Area of Subarea 6.** Figure B2:IA K 'Sampling locations Near Outfall 33' which the figure title apparently indicates, measured metals concentrations in sediment near the outfall. Unfortunately, the figure appears to be a scanned copy that has been inserted into the report. The scanned image is unreadable on the computer and is also unreadable if printed. Given this, ERAS cannot discern the distribution of chemical concentrations. A readable version of the figure needs to be provided for ERAS review. The text should reference Figure 3 'Site Features and Habitat Map' on pdf page 159 of 388 to identify Outfall 33's location. ERAS agrees with the report that further sampling should be conducted to better delineate contamination prior to deciding on sediment removal. ERAS also agrees that focusing on the upper six inches of sediment is sound and also recommends that filtered pore water be collected as well as sediment. The dissolved fraction is the portion available for plant uptake. Sampling of pickleweed would also be	**Original Response to Specific Comment 8** As requested a clearer copy of the IA K figure has been obtained for use as Figure B2. As requested, a reference to Figure 3 for the identification of Outfall 33 within Subarea 6 has been added. The Navy notes ERAS' agreement that further assessment and delineation of shallow metals in sediment should be undertaken near Outfall 33 before a final decision on remedial options. The Navy agrees that a better understanding of the bioavailability of metals in the sediment to the salt marsh harvest mouse may reduce or eliminate the area requiring remedial action. The Navy is considering further assessment of metals in shallow sediment in the northern area of Subarea 6 near Outfall 33. For the purpose of evaluating remedial options,

recommended to verify the plant uptake model and reduce the uncertainty regarding the dietary dose to the salt marsh harvest mouse. Destruction of habitat occupied by an endangered species should not be taken lightly. Thirty eight thousand four hundred square feet is larger than the home range of the salt marsh harvest mouse (http://www.fws.gov/ecos/ajax/docs/five year review/doc3221.pdf). Loss of habitat may well equal loss of life to members of an endangered species. Validation of the food chain pathway may provide valuable information to reduce this possibility.	should action be needed, the FS will continue to use the remedial footprint and volume shown in the Draft FS, acknowledging that the area may change, or be eliminated entirely.
ERAS Response to Specific Comment 8 on Navy RTCs: Comment noted.	**Response to ERAS Response to Navy RTC for Specific Comment 8** Comment noted with the elaboration that the IA F1 ecological risk was based on Mare Island specific bioaccumulation factors instead of literature values. For this reason the Navy and the DTSC agree that additional sampling for bioavailability is unwarranted for the site. The Navy envisions that sampling to refine the area of remediation will be conducted as part of the Remedial Design (RD) phase and the details of criteria used for sampling will be included in the RD Work Plan.
Original Specific Comment 9	**Original Response to Specific Comment 9**
Pdf pages 233 through pdf page 237, Tables 82 through 86. The tables show sample results compared to Mare Island Ambient concentrations, which are all higher than the back-calculated safe sediment concentrations based on the salt marsh harvest mouse. The table shows several sample locations outside the outfalls (i.e., IA F1) where the hazard quotients would exceed one, although the exceedance of a hazard quotient greater than one would not be large. If sampling is conducted to delineate contamination at Outfall 33, ERAS would also recommend validation sampling be conducted at non-outfall locations where the COEC concentration exceeds the Mare Island ambient concentration to verify the food chain model. If the validation does not support the assumption of a hazard quotient of one at the no	Comment noted. As stated in the response to Specific Comment 8 above, the Navy is considering further assessment of metals in shallow sediment in the northern area of Subarea 6. Validation sampling at selected non-outfall sampling locations will be considered as this idea is developed. In addition, improved understanding of the bioavailability of shallow metals to the salt marsh harvest mouse would apply to these limited exceedances as well as to the area of Outfall 33.

effect level, ERAS would not recommend removing sediment from those locations.	
ERAS Response to Specific Comment 9 on Navy RTCs: Comment noted.	**Response to ERAS Response to Navy RTC for Specific Comment 9** Comment noted, and as noted above the IA F1 ecological risk was based on Mare Island specific bioaccumulation factors instead of literature values. For this reason the Navy and the DTSC agree that additional sampling for bioavailability is unwarranted for the site. The following bold text update has been made to the third paragraph of the original response to Specific Comment 8 below. "Comment noted. As stated in the response to Specific Comment 8 above, the Navy is considering further assessment of metals in shallow sediment in the northern area of Subarea 6. Validation sampling at selected non-outfall sampling locations will be considered as this idea is developed.~~ In addition, improved understanding of the bioavailability of shallow metals to the salt marsh harvest mouse would apply to these limited exceedances as well as to the area of Outfall 33.~~"
Original Conclusion Based on the discussion in the report, ERAS believes a closer examination of potential sediment removal to ensure that valuable habitat is not damaged at the expense of removal of marginal contamination or contamination that may not affect the salt marsh harvest mouse at the no effect level. ERAS believes that additional sampling should include pore water and pickleweed. Porewater is the bioavailable fraction of the sediment and is a better estimate of toxicity than is the sediment. Validation by measuring tissue concentration of the salt marsh harvest mouse (pickleweed) will confirm food chain modeling and greatly reduce the uncertainty regarding the modeled exposures. Validation could be conducted at sample locations that exceed the Mare Island ambient concentrations, which are	**Original Response** Comment noted. Please see above for specific responses. The reference to Subarea 5 justification for no further action is unclear to us, unless the comment intends to refer to areas outside of Outfall 33 of the wetlands area, currently Subarea 6.

serving as the ecological preliminary remediation goals for site IA F1 and IA K collectively. Clarification of this significant issue would also address any third party concerns regarding the cleanup. A better description of the Subarea 5 justification for no further action should be provided.	
ERAS Response to Conclusion on Navy RTCs: Comment noted. Disregard the final sentence.	**Response to ERAS Response to Navy RTC for Conclusion** Comment noted.

Tami Nakahara, received by email April 24, 2015
Senior Environmental Scientist (Specialist)
California Department of Fish and Wildlife
Office of Spill Prevention and Response
1700 K Street, Suite 250
Sacramento, CA 95811

CDFW-OSPR Comments	Navy Responses
Original Specific Comment 3a: The Navy asserts that, *"Cal. Fish & Game Code§§ 3005, 3503 and Cal. Code Regs. Tit. 14 §460 are not applicable because the United States of America has not waived sovereign immunity in the federal Endangered Species Act for these State of California requirements."* These sections were submitted by CDFW-OSPR because they are relevant and appropriate considerations for the remedial activities at the site. We disagree with the Navy's statement that the United States has not waived sovereign immunity for these State of California requirements. The United States of America has waived sovereign immunity and is liable for cleanup and natural resource damages to the same extent as any nongovernmental agency pursuant to section 120(a)(1) of CERCLA, codified at 42 U.S.C. section 9620. The United States District Court for the Central District of California found that the United States has waived sovereign immunity associated with CERCLA compliance; the United States Ninth Circuit Court of Appeals affirmed this opinion on appeal. *United States of America and State of California v. Shell Oil Company (2002): Dist. Ct. opinion 841 F. Supp. 962, Ct of Appeals opinion 294 F.3d 1045.* The Navy's ARARs determination did not provide a legal basis for its assertion that the United States of America has not waived sovereign immunity for these State requirements and without additional information, we are unable to seriously consider the Navy's position. If the Navy would like to provide its legal analysis to support its position with appropriate legal references, CDFW-OSPR will certainly consider it to work towards an amicable resolution to our differences on this issue.	**Original Response to Specific Comment 3a:** DON has evaluated the potential applicability of all statutory provisions and regulations cited in Cal. Fish and Game Code Sections 3005, 3503, and Cal. Code Regs. Tit. 14 Section 460 and determined that there is no waiver of sovereignty for those requirements under the federal Endangered Species Act (ESA), and that they are, therefore, not "applicable" ARARs. The text of several of our recent proposed ARAR determinations was not clear on this. The DON is referring to the lack of waiver in the ESA rather than CERCLA. In making this assertion, DON does not mean to suggest that there is no waiver of sovereign immunity within CERCLA, or that, accordingly, the Navy would not have to comply with certain State requirements. For example, DON acknowledges that the DON is potentially liable under CERCLA to the same extent as non-governmental entities, as discussed in *Shell Oil Company*, 294 F.3d 1045 (Ninth Cir. 2002). Furthermore, DON acknowledges the need to comply with ARARs per Section 121(d) of CERCLA. We trust this clarification will satisfy any concerns CDFW-OSPR has expressed in its comments with respect to the question of sovereign immunity generally. The document has been updated to add the following language on page 3-4, Section 3.2.1.2 after the second bullet, "***The DON's position is that the United States Congress did not specifically waive sovereign immunity in the Endangered Species Act (ESA) for the subject matter of the Department of Fish and***

Wildlife statutes or regulations. Therefore, authority does not exist to authorize applicability of the Cal. Fish & Game Code or its implementing regulations. In addition, Section 121(e) of CERCLA exempts on-site CERCLA response actions from permit requirements. Some of the Department of Fish and Wildlife requirements allow otherwise prohibited actions through a permit process. The DON follows the CERCLA process rather than these permitting processes when making CERCLA decisions. The DON has determined that a requirement that protects a species listed as a state endangered, threatened, rare, or fully protected species may be potentially relevant and appropriate. The specific language for making this determination in accordance with CERCLA relevant and appropriate criteria is given below."

The above text was added to the ARARs document (Appendix C).

CDFW-OSPR Response to Specific Comment 3a on Navy RTCs:

The Navy responded, *"DON has evaluated the potential applicability of all statutory provisions and regulations cited in Cal. Fish and Game Code Sections 3005, 3503, and* Cal. *Code* Regs. *Tit. 14 Section 460 and determined that there is no waiver of sovereignty for those requirements under the federal Endangered Species Act (ESA), and that they are, therefore, not "applicable" ARARs. The text of several of our recent proposed ARAR determinations* was *not clear on this. The DON* is *referring to the lack of waiver in the ESA rather than CERCLA. In making this* assertion, *DON does not mean to suggest that there* is *no waiver of sovereign immunity within CERCLA, or that, accordingly, the Navy would not have to comply with certain State requirements. For example, DON acknowledges that the DON is potentially liable under CERCLA to the same extent* as *non-governmental entities,* as *discussed in Shell Oil Company, 294 F. 3d 1045 (Ninth Cir. 2002). Furthermore, DON*

Response to CDFW-OSPR Response to Navy RTCs for Specific Comment 3a

The "waiver of sovereign immunity" language used in the ARARs determination is relevant for the following reason. The Navy makes its determination of whether a potential ARAR is "applicable" or "relevant and appropriate" based on whether a waiver of sovereign immunity exists. By default the federal government has sovereign immunity, and sovereign immunity must be waived by an act of Congress in order for the federal government to be subject to laws and regulations. A waiver of sovereign immunity is required in order for state regulations be "applicable". No such waiver exists for the cited Cal. Fish and Game Code sections, and the ESA waiver of sovereign immunity enacted by Congress does not extend to encompass the cited California regulations. The issue of sovereign immunity is further discussed in the Callaway/Waters correspondence with CA

acknowledges the need to comply with ARARs per Section 121(d) of CERCLA." CDFW-OSPR does not believe that the waiver of sovereignty for the requirements under the Federal ESA is relevant to this CERCLA remedial action. We appreciate Navy's acknowledgement of the need to comply with ARARs per Section 121(d) of CERCLA.

The Navy further responded that the document has been updated to add the following language, ***"Some of the Department of Fish and Wildlife requirements allow otherwise prohibited actions through a permit process ... "*** Please revise the proposed language as follows: ***"Some of the Department of Fish and Wildlife authority may allow take through a permit process, however substantive compliance of the take provision must occur through full mitigation for any authorized incidental take or take avoidance measures. The DON follows the CERCLA process when making CERCLA decisions. The DON has determined that a requirement that protects a species listed as state endangered, threatened, rare or fully protected may be potentially relevant and appropriate ... "***

Dept of Fish & Game Counsel circa Dec 2009, Apr 2010 that was presented previously.

The DON acknowledges that the Department of Fish and Wildlife has the authority to allow incidental take of special status species through the issuance of permits for some types of projects, but this procedural authority does not exist under CERCLA. Consequently, the Navy does not accept the proposed revisions as written, but agrees in principle with the measures needed to substantially comply with these state ARARs. The following changes have been made to page 3-4, Section 3.2.1.2 as shown below:

"The DON's position is that the United States Congress did not specifically waive sovereign immunity in the Endangered Species Act (ESA) for the subject matter of the Department of Fish and Wildlife statutes or regulations. Therefore, authority does not exist to authorize applicability of the Cal. Fish & Game Code or its implementing regulations. However, the DON has determined that a requirement that protects state listed endangered, threatened, or fully protected species and state listed rare plants may be potentially relevant and appropriate if those species use the site.

Some of the Department of Fish and Wildlife requirements may allow incidental take as defined by Federal regulation through a permitting process. Section 121(e) of CERCLA exempts on-site CERCLA response actions from permit requirements, but the DON will comply with the substantive requirements of the regulations by coordinating with biological resource trustees to determine appropriate measures to avoid incidental take as defined by Federal regulation, implementing those take avoidance measures during field work, and providing appropriate mitigation for any incidental take that cannot be avoided."

The above text was added to the ARARs document (Appendix C).

Original Specific Comment 3b:

The Navy asserts that, *"Pursuant to 40 C.F.R.§ 300.400(g)(2) of the NCP* [National Oil and Hazardous Substances Pollution Contingency Plan], *the Navy has determined that these requirements are not 'relevant and appropriate' because they do not address problems or situations sufficiently similar to the circumstances of the release or CERCLA response action and is not well-suited to the site based upon the pertinent provisions of Subsections 300.400(g)(2)(i) and (iv) of the NCP*. These ARARs are relevant and appropriate because they do address problems or situations sufficiently similar to the circumstances of the release or CERCLA response action at the site and are well-suited to the site in light of the potential presence of species and the potential for impacts associated with the project. F&GC section 3005 is intended to protect birds and mammals from take associated with poison and/or contaminants. "Take" can occur if birds or mammals are exposed to lethal levels of contaminants during removal or remedial activities. Avoiding "take" and developing cleanup criteria protective of the environment should be a consideration for the threshold cleanup criteria. This statute is relevant and appropriate to IA F1 and should be included as an ARAR in the FS.

California Code of Regulations Title 14 section 460 makes it unlawful to take Fisher, marten, river otter, desert kit fox, and red fox. Although the Navy may not intend to "take" bird's nest or eggs (F&GC section 3503), or a red fox, remedial or construction activities associated with the cleanup may result in "take" for purposes of the F&GC definitions as explained above. Therefore, these statutes are relevant and appropriate to IA F1 and should be included as ARARs in the FS.

Original Response to Specific Comment 3b:

The language:

~~*"Pursuant to 40 C.F.R.§ 300.400(g)(2) of the NCP* [National Oil and Hazardous Substances Pollution Contingency Plan], *the Navy has determined that these requirements are not 'relevant and appropriate' because they do not address problems or situations sufficiently similar to the circumstances of the release or CERCLA response action and is not well-suited to the site based upon the pertinent provisions of Subsections 300.400(g)(2)(i) and (iv) of the NCP."*~~

will be struck from the document. DON has evaluated the potential applicability of all statutory provisions and regulations cited in Cal. Fish and Game Code Sections 3005, 3503, and Cal. Code Regs. Tit. 14 Section 460 and determined that there is no waiver of sovereignty for those requirements under the ESA, and that they are, therefore, not "applicable" ARARs.

The Navy and CDFW-OSPR can agree that the language set forth below should be included in ARAR findings if the DON and the State, through CDFW-OSPR, are able to reach agreement as to cleanup levels (with respect to Cal. Fish & Game Code § 3005) or as to measures to be taken to avoid harm to pertinent species (with respect to Cal. Fish & Game Code §§3503 and Cal. Code Regs. tit. 14 § 460).

In addition, the table would be revised to match.

(See Callaway/Waters correspondence with CA Dept of Fish & Game Counsel circa Dec 2009, Apr 2010 outlining approach to addressing disagreements between State/federal agencies regarding ARARs in the context of CERCLA.)

"Cal. Fish & Game Code § 3005

It is unlawful to take birds or mammals with any net, pound, cage, trap, set line or wire, or poisonous substance, or to possess birds or mammals so taken, whether taken within or without this state.

	The DON has determined that Cal. Fish & Game Code § 3005(a) is not a state ARAR ~~because~~ ***and*** *it is not applicable or relevant and appropriate* ***because the DON determined that there is no waiver of sovereignty for these requirements under the Endangered Species Act (ESA).*** *The State of California, through DFW-OSPR, asserts that Cal. Fish & Game Code §3005(a) is a state ARAR because it is relevant and appropriate. Whereas, the DON and the State have not agreed upon whether Cal. Fish & Game Code §3005(a) is an ARAR, this FS report documents each party's position on the statute but does not attempt to resolve the issue.* ***However, the DON and the State have previously agreed on harm-avoidance measures for activities on this site, and the DON believes a similar agreement can be reached for the F1 remedial alternatives. ~~However~~Additionally****, the State has determined that the proposed ecological cleanup levels would substantively comply with the State requirement and provide an acceptable level of protectiveness.* ***These harm-avoidance measures and cleanup levels will be documented in the future Remedial Action Work Plan.*** *~~, and the State does not intend to dispute the FS.~~* ***Cal. Fish & Game Code § 3503*** *It is unlawful to take, possess, or needlessly destroy the nest or eggs of any bird, except as otherwise provided by this code or any regulation made pursuant thereto.* *The DON has determined that Cal. Fish & Game Code § 3503 is not a state ARAR ~~because~~* ***and*** *it is not applicable or relevant and appropriate* ***because the DON determined that there is no waiver of sovereignty for these requirements under the federal Endangered Species Act (ESA)****. The State of California, through CDFW-OSPR, asserts that Section 3503 is a state ARAR because it is relevant and appropriate. Whereas, the DON and the State have not agreed upon whether Cal. Fish & Game Code § 3503 is an ARAR, this FS Report documents each party's position on the statute but does not attempt to resolve the issue. Nonetheless, the DON agrees that it will undertake*

	measures in order to generally avoid harm to nests and eggs when there is potential that they may be impacted by response action construction. ***The DON and the State have previously agreed on harm-avoidance measures for activities on this site, and the DON believes a similar agreement can be reached for the F1 remedial alternatives. These harm-avoidance measures would be documented in the future Remedial Action Work Plan.*** ~~*The State will not dispute the selected remedy for failure to identify Cal. Fish & Game Code § 3503 as an ARAR because the State has determined that the mutually agreed measures to generally avoid harm will result in substantive compliance with the state requirement.*~~ ***Cal. Code Regs. Tit. 14, § 460*** *Fisher, marten, river otter, desert kit fox, and red fox may not be taken at any time.* *The DON has determined that Cal. Code Regs. tit. 14 §460 is not a state ARAR* ~~*because*~~ ***and*** *it is not applicable or relevant and appropriate* ***because the DON determined that there is no waiver of sovereignty for these requirements under the federal Endangered Species Act (ESA)****. The State of California, through DFW-OSPR, asserts that Cal. Code Regs. tit. 14 §460 is a state ARAR because it is relevant and appropriate. Whereas, the DON and the State have not agreed upon whether Cal. Code Regs. tit. 14 §460 is an ARAR, this FS Report documents each party's position on the statute but does not attempt to resolve the issue. Nonetheless, the DON agrees that it will undertake measures in order to generally avoid harm to fisher, marten, river otter, desert kit fox, and red fox when there is potential that they may be impacted by response action construction.* ***The DON and the State have previously agreed on harm-avoidance measures for activities on this site, and the DON believes a similar agreement can be reached for the F1 remedial alternatives. These harm-avoidance measures would be documented in the future Remedial Action Work Plan.****"* ~~*The State will not dispute the selected remedy for failure to identify Cal. Code Regs. tit. 14 §460 as an ARAR because*~~

	~~*the State has determined that the mutually agreed upon measures to generally avoid harm will result in substantive compliance with the state requirement.*~~
CDFW-OSPR Response to Specific Comment 3b on Navy RTCs: The Navy responded, *"DON has evaluated the potential applicability of all statutory provisions and regulations cited in Cal. Fish and Game Code Sections 3005, 3503, and Cal. Code Regs. Tit. 14 Section 460 and determined that there is no waiver of sovereignty for those requirements under the* ESA, *and that they are, therefore, not "applicable" ARARs."* CDFW-OSPR does not believe that the waiver of sovereignty for the requirements under the Federal ESA is relevant to this CERCLA remedial action. We appreciate Navy's acknowledgement of the need to comply with ARARs per Section 121(d) of CERCLA.	**Response to CDFW-OSPR Response to Navy RTCs for Specific Comment 3b** Comment noted. Please refer to response to Specific Comment 3a.
Original Specific Comment 3c: The Navy asserts that, *"the purpose of these State requirements is to regulate and set forth conditions for the 'taking' of the species addressed by those requirements. Moreover that purpose is achieved through the regulation of intentional conduct directed at the species as opposed to incidental 'take' (or possession, etc.) of species in the course of lawful activity such as CERCLA remedial action. The focus on intentional conduct is not well-suited to the circumstances at CERCLA sites."* These statutes are not directed solely towards intentional taking of the species. They are resource protection laws to manage the species and take (whether intentional or incident to a lawful activity) of the species in attempt to ensure their continued existence. They are "environmental requirements" since they pertain to protection of the state's natural resources which may occur on site. The Navy believes "take" requires intent and the Navy would not intend to "take", and, therefore, would not be in violation of the provision. However, intent is not required to effectuate a "take" per California F&GC section 86, *Department of Fish and Game v. Anderson-Cottonwood Irrigation District (1992) 8 Cal. App. 4th 1554; 11 Cal Rptr.*	**Original Response to Specific Comment 3c:** The language, "….~~*the purpose of these State requirements is to regulate and set forth conditions for the 'taking' of the species addressed by those requirements. Moreover that purpose is achieved through the regulation of intentional conduct directed at the species as opposed to incidental 'take' (or possession, etc.) of species in the course of lawful activity such as CERCLA remedial action. The focus on intentional conduct is not well-suited to the circumstances at CERCLA sites.*~~" will be struck from the document. DON has evaluated the potential applicability of all statutory provisions and regulations cited in Cal. Fish and Game Code Sections 3005, 3503, and Cal. Code Regs. Tit. 14 Section 460 and determined that there is no waiver of sovereignty for those requirements under the federal Endangered Species Act (ESA), and that they are, therefore, not "applicable" ARARs. Whereas, the DON and the State have not agreed upon whether these Cal. Fish & Game Code sections are ARARs, this FS Report documents each party's position on the statutes but does not attempt to resolve the issues. Nonetheless, the

2d 222. CDFW- OSPR disagrees with the Navy's interpretation of the purpose of F&GC provisions and while the Navy may not intend to effectuate a "take" of a species, contaminants remaining on site or remedial actions may result in "take" for purposes of the F&GC definition regardless of intent.	DON agrees that it will undertake harm-avoidance measures when there is potential that species under these codes may be impacted by response action construction. The Navy will carefully consider input from the CDFW-OSPR and other agencies when developing and implementing this removal action including taking reasonable steps to prevent takings of California endangered, rare, threatened, fully protected species, or species of special concern (i.e. no hunting, capturing, killing, etc.). The DON and the State have previously agreed on harm-avoidance measures for activities on this site, and the DON believes a similar agreement can be reached for the F1 remedial alternatives. These harm-avoidance measures would be documented in the future Remedial Action Work Plan.
CDFW-OSPR Response to Specific Comment 3c on Navy RTCs: The Navy responded, *"DON has evaluated the potential applicability of all statutory provisions and regulations cited in Cal. Fish and Game Code Sections 3005, 3503, and Cal. Code Regs. Tit, 14 Section 460 and determined that there is no waiver of sovereignty for those requirements under the federal Endangered Species Act (ESA), and that they are, therefore, not "applicable" ARARs."* CDFW-OSPR does not believe that the waiver of sovereignty for the requirements under the Federal ESA is relevant to this CERCLA remedial action. We appreciate Navy's acknowledgement of the need to comply with ARARs per Section 121(d) of CERCLA.	**Response to CDFW-OSPR Response to Navy RTCs for Specific Comment 3c** See response to CDFW-OSPR Response to Navy RTCs for Specific Comment 3a

Table 7. Institutional Controls

Subarea	Receptors Considered in HHRA and ERA	Sensitive Uses	Contaminants Driving Site Decisions	Is Unrestricted Reuse Feasible?	Restrictions to Protect Future Receptors	Are ICs Protective of Future Use?
Upland Areas						
Subarea 1 Future Use: Mixed Industrial	**Human Receptors** • Hypothetical Resident, Industrial/Commercial Worker and Construction Worker • Beneficial use exception for shallow groundwater received. **Eco Receptors** • Plants, Invertebrates, Birds, Mammals	**Groundwater Use** • Beneficial use exception for shallow groundwater received. **Land Uses** Examples of Sensitive Land Uses may include: • Residential use • A hospital for humans • A school for persons under 18 years of age • A day care facility for children • Formation of open space or ecological habitat (Subarea 4 and future industrial reuse portions of Subarea 5)	**Soil** – None **Groundwater –** Residual Impacts	**Yes - Soil.** Surface and subsurface soil do not pose an unacceptable risk to sensitive or ecological receptors. **No - GW.** Beneficial use exception for shallow groundwater received.	NFA appropriate for surface and subsurface soil.	**Yes**
Subarea 2 Future Use: Mixed Industrial			**Soil** – None **Groundwater –** Residual Impacts	**Yes - Soil.** Surface and subsurface soil do not pose an unacceptable risk to sensitive or ecological receptors. **No - GW.** Beneficial use exception for shallow groundwater received.	NFA appropriate for surface and subsurface soil.	**Yes**
Subarea 3 Future Use: Mixed Industrial			**Lead** exceeds modified residential CHHSL. Carcinogenic risk to a hypothetical future resident is 1E-4 driven by vinyl chloride in soil and groundwater (nonpotable).	**No.** EPC for lead exceeds the modified residential CHHSL in Subarea 3. Carcinogenic risk to a hypothetical future resident is 1E-4 driven by vinyl chloride in soil and groundwater (nonpotable). Beneficial use exception for shallow groundwater received.	ICs to restrict sensitive land uses at Subarea 3.	**Yes**
Subarea 4 Future Use: Mixed Industrial			**Lead** near Building A75 exceeds modified industrial and residential CHHSL. Carcinogenic risk to a hypothetical future resident is 2E-5 driven by dioxins and benzo(a)pyrene in soil.	**No.** EPC for lead in Subarea 4 exceeds the modified residential CHHSL, and a hotspot near Building A75 exceeds the industrial CHHSL for lead. Carcinogenic risk to a hypothetical future resident is 2E-5 driven by dioxins and benzo(a)pyrene in soil. Beneficial use exception for shallow groundwater received.	ICs to restrict sensitive land. Further action needed to meet future land use at Subarea 4.	**Partially.** Outside TTZ, yes. Active remediation evaluated for TTZ.
Subarea 5 Future Use: Mixed Industrial and Regional Park			**Lead** near Building A17 exceeds modified industrial and residential CHHSL. **Lead** near Building A17 poses a potential risk to future ecological receptors.[1]	**No.** EPC for lead for Subarea 5 exceeds the modified residential CHHSL, but not the modified industrial CHHSL. Residential exposure parameters for lead are conservative relative to recreational exposure parameters. Lead near Building A17 poses a potential risk to future ecological receptors. Beneficial use exception for shallow groundwater received.	ICs to restrict sensitive land. Further action needed to meet future land uses at Subarea 5.	**Partially.** Outside TTZ, yes. Active remediation evaluated for TTZ.
Subarea 7 Future Use: Mixed Industrial			**Soil** – None **Groundwater –** Residual Impacts	**Yes - Soil.** Surface and subsurface soil do not pose an unacceptable risk to sensitive or ecological receptors. **No - GW**. Beneficial use exception for shallow groundwater received.	NFA appropriate for surface and subsurface soil.	**Yes**

Table 7. Institutional Controls

Subarea	Receptors Considered in HHRA and ERA	Sensitive Uses	Contaminants Driving Site Decisions	Is Unrestricted Reuse Feasible?	Restrictions to Protect Future Receptors	Are ICs Protective of Future Use?
Wetland Areas						
Subarea 6 Future Use: Conservation Area	**Human Receptor** • Recreational Receptor • Beneficial use exception for shallow groundwater received **Eco Receptors** • Plants, Invertebrates, Birds, Mammals, Individual SMHM	See above	**Barium, Copper, Lead and Zinc** based on potential risk to ecological receptors.[2]	**No**. Unacceptable risk exists to ecological receptors. Residential reuse incompatible with wetlands. Beneficial use exception for shallow groundwater received	ICs to restrict sensitive land uses. Further action needed based on potential ecological risk at Subarea 6.	**Partially.** Outside TTZ, yes. Active remediation evaluated for TTZ.
Sites with USTs and Other Petroleum Features at IA F1	UST closure letters for IA F1: Water Board. 2004. "Closure Letter and Site Summary for Six Underground Storage Tanks at the Former Mare Island Naval Shipyard, Vallejo, California." December 22. Water Board. 2011a. "No Further Action for UST A-225, Mare Island Naval Shipyard, Vallejo, Solano County, Water Board Case No. 48D9242." January 24. Water Board. 2012. "No Further Action for UST A266S, Former Mare Island Naval Shipyard, Vallejo, Solano County." May 4.					

1. Most sensitive ecological receptor is Western Meadowlark
2. Most sensitive ecological receptor is SMHM

CHHSL – California Human Health Screening Level
EPC – exposure point concentrations
ERA – Ecological Risk Assessment
GW – groundwater
HHRA – Human Health Risk Assessment
ICs – institutional controls
NFA – no further action
RI – Remedial Investigation
SMHM – salt marsh harvest mouse
TTZ – target treatment zone
UST – underground storage tank

Revised Response to Agency Comment dated August 2015

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Tami Nakahara, received by email August 18, 2015
Senior Environmental Scientist (Specialist)
California Department of Fish and Wildlife
Office of Spill Prevention and Response
1700 K Street, Suite 250
Sacramento, CA 95811

CDFW-OSPR Comments	**Navy Responses**
Specific Comment 1: *Second Response to Specific Comments #3a, 3b, and 3c. Appendix C: ARARs, page 3-7, Section 3.2.1.2 State ARARs, Subsection Cal. Fish* & *Game Code* [F&GC] *§§ 3005, 3503 and Cal. Code Regs. Tit. 14 §460.* CDFW-OSPR's position has not changed and we continue to believe that the waiver of sovereignty for the requirements under the Federal Endangered Species Act is not relevant to this CERCLA remedial action (Nakahara, 2015). We appreciate Navy's acknowledgement of the need to comply with ARARs per Section 121(d) of CERCLA. CDFW-OSPR again requests the cited F&GC sections be included in the FS for IA F1 as *"relevant and appropriate"* requirements. The following language should also be included in the document as previously requested: *"Some of the Department of Fish and Wildlife authority may allow take through* a *permit process, however substantive compliance. of the take provision must occur through full mitigation for any authorized incidental take or take avoidance measures. The DON follows the CERCLA process when making CERCLA decisions. The DON* has *determined that* a *requirement that protects* a *species listed* as *state endangered, threatened, rare or fully protected may be potentially relevant and appropriate ... "* (Nakahara, 2015).	**Response to Specific Comment 1:** The Navy and CDFW counsel are initiating discussions to resolve this issue related to ARARs. The resolution will be included in the ROD. Acknowledgement of the CDFW position has been added to the text of Section 3.2.1.2 of Appendix C.

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